Investor Confidence Project

Project Developer and Quality Assurance Assessor Training:

Street Lighting

22nd November 2018

Presenters:

Luís Castanheira, ICP Europe Technical Director

Bethan Phillips, ICP Europe Technical Team

Welcome!

Your Presenters

- 20 years in Sustainable Energy
- Energaia – Energy Management Agency
- Porto Polytechnic Engineering School
- EU Commission Expert
- CMVP and IPMVP Technical Committee Member
- Energy auditor, BREEAM, EPBD building energy assessor

Luis Castanheira
ICP Europe Technical Director

Your Presenters

- 15+ years in low energy building design and sustainable energy solutions
- Principal consultant at Verco
- Building services engineering, mechanical engineer
- CMVP accredited, ISO 50001 lead auditor
- Energy audits, feasibility studies (CHP, district heating, etc), sustainability assessments

Bethan Phillips

ICP Europe Technical Team

European Commission Disclaimer

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 754056.

Agenda

- Housekeeping
- Strategic approach
- What is the Investor Confidence Project?
- Roles and responsibilities
- Process and tools available
- ICP Stages – requirements
- Worked examples
- Application process

This webinar will be recorded

Housekeeping

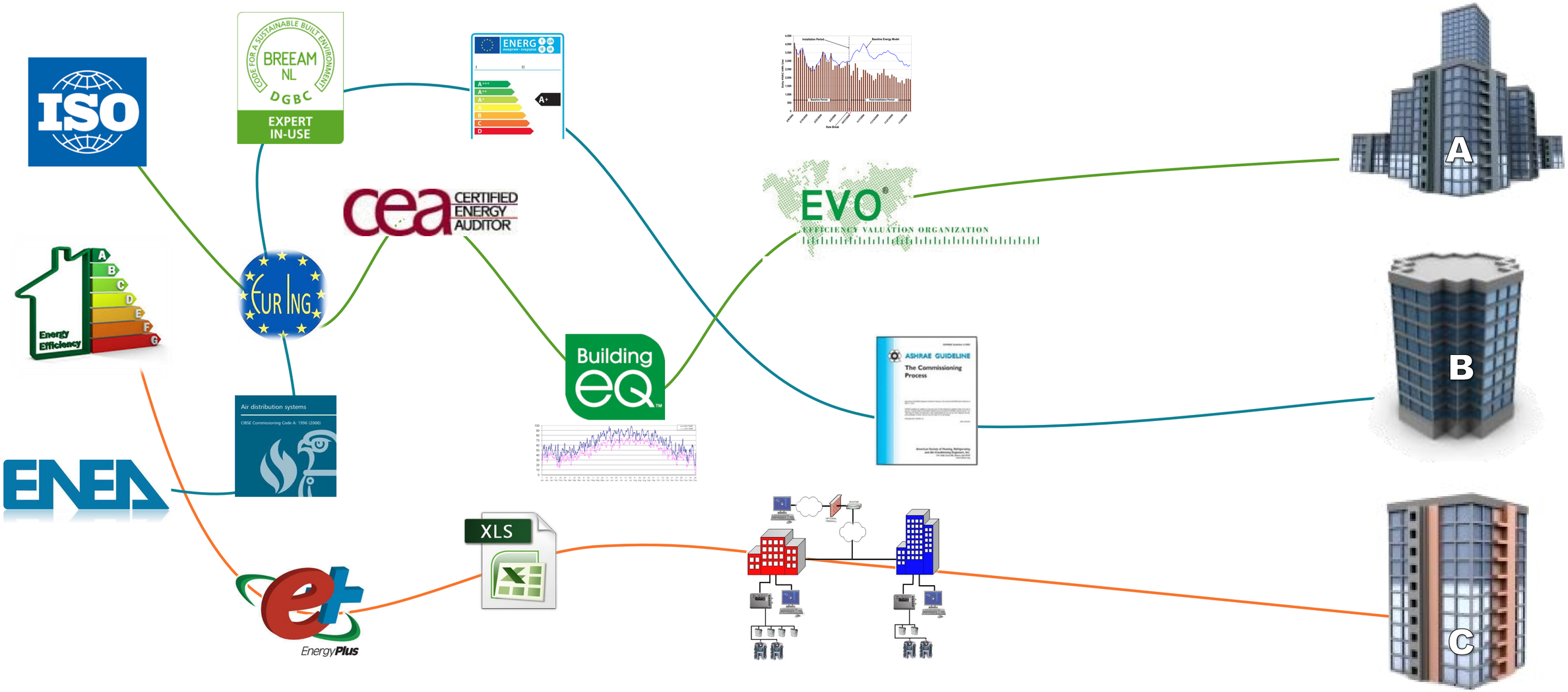
- You are all muted by default to minimize background noise, but we want your participation!
- You can ask questions either using the chat box on the gotowebinar control panel anytime
- We will stop at the end of each section for QA
- We will use a poll facility to assess comprehension and guide interaction
- At the end we will have an open QA session
- We will get back to you if there is any question we cannot answer in the course of this session
- This is part of the process towards becoming a member of the network and should take a maximum of 2 hours + QA
- We ask that attendees be present for the full training session in order to be eligible to take the QAA test and apply for the networks
- Attendees of the training will have two attempts to pass the test, then they must retake the course

Strategic Approach

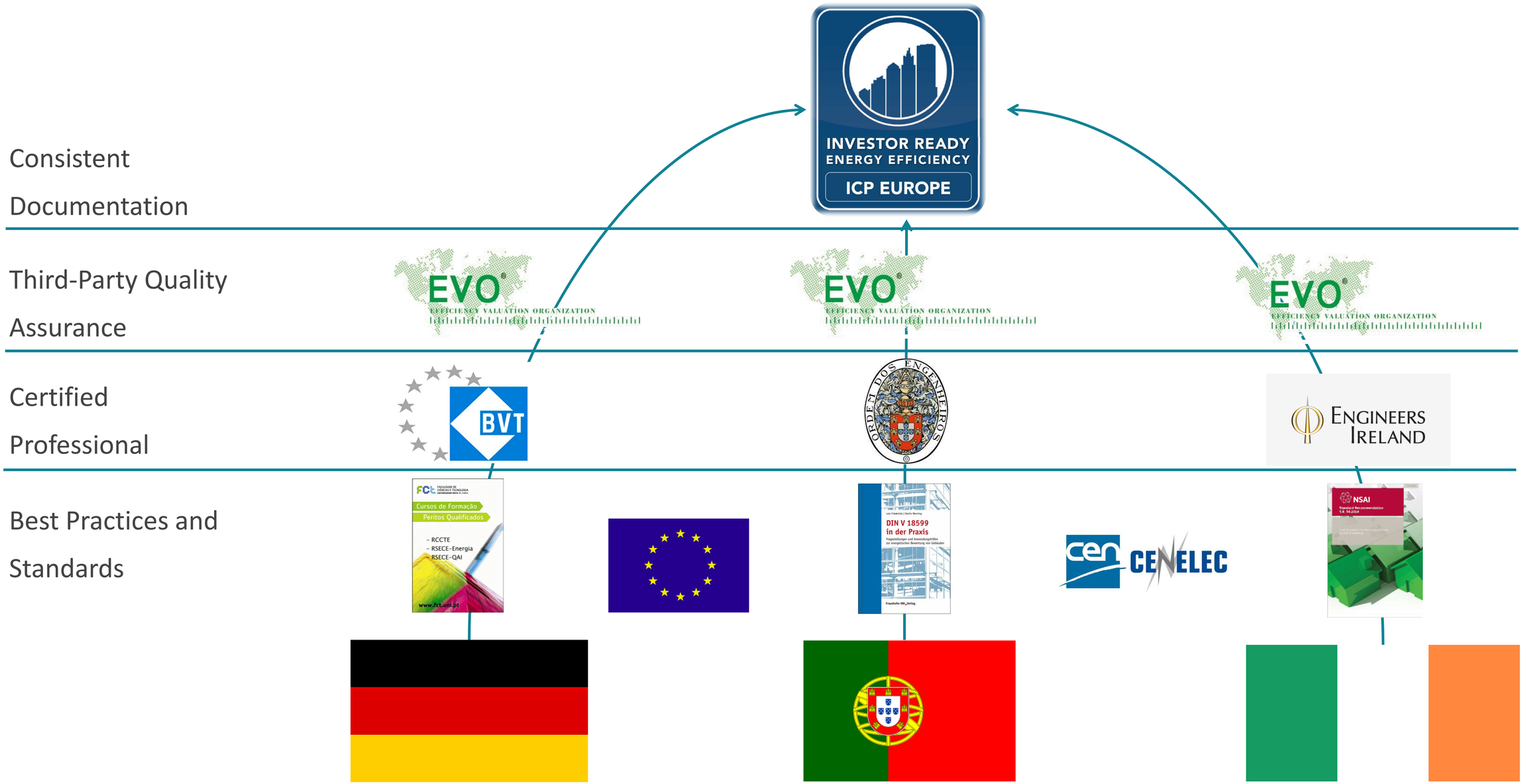
- All participants are knowledgeable and experienced professionals
- This training is only the beginning of a longer journey
- ICP Project Developers and Quality Assurance Assessors are crucial agents for the success of our scheme and the transformation of the Energy Efficiency market

What is the Investor Confidence Project?

Lack of Standardisation = Greater Risk



Investor Ready Energy Efficiency Project



Ensures transparency, consistency and trust-worthiness through **best practice and independent verification.**

An international framework for reducing owner and investor risk, lowering due diligence costs, increasing certainty of savings achievement and enabling aggregation.

Procedures

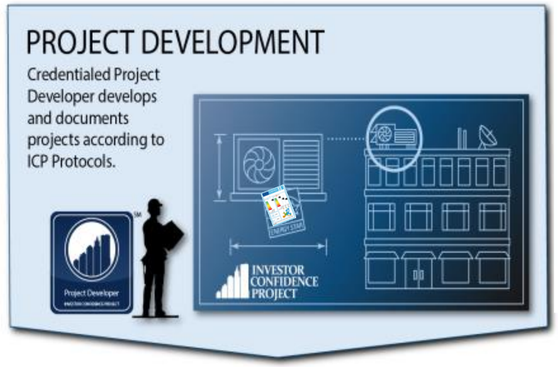
- Best Practice Workflow
- Standard Industry Practices

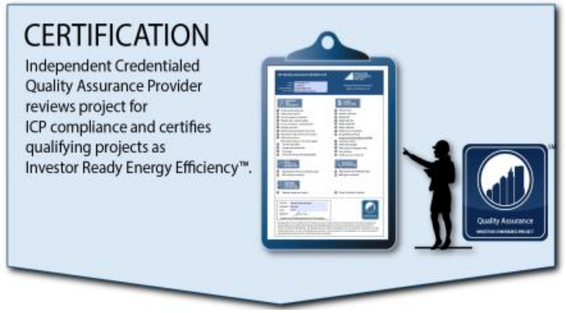
Documentation

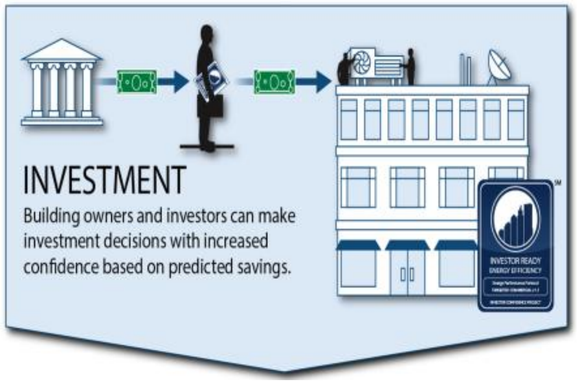
- Standard Documentation Package
- Itemized Outputs Required

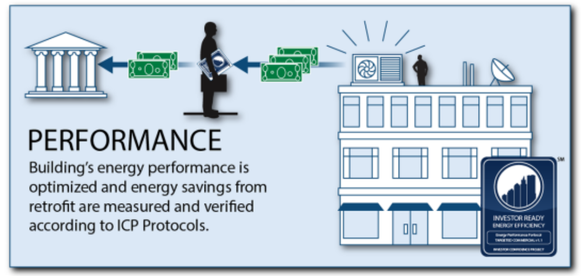
The IREE™ Certification is delivered prior to investment decision

INVESTOR READY ENERGY EFFICIENCY℠
Energy Performance Protocol
LARGE MULTIFAMILY v1.0a
INVESTOR CONFIDENCE PROJECT



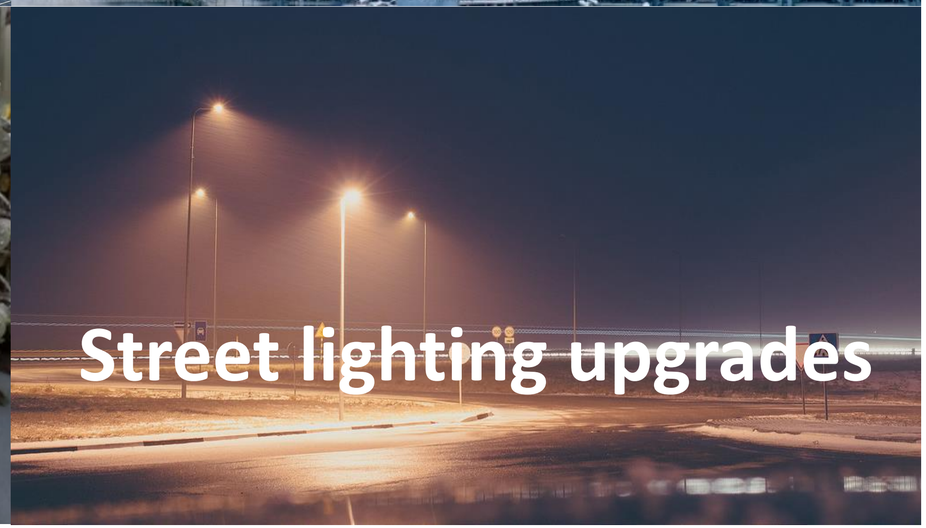






Development Period | **Underwriting Period** | **Invest** | **Performance Period**

What project types is IREE™ designed for?



Street Lighting

One Protocol

Single protocol for all types of street lighting energy efficiency projects

Street Lighting: European Context

- 60-90m street lights across Europe
- 75% more than 25 years old
- Approximate annual energy cost €3bn
- Energy saving potential from LED of 50-75% or €1.9bn

Important FACTS to remember

- Any EE project that follows state of the market origination processes already does "everything ICP requires" **– ICP is an overarching standardizing layer to the process**
- ICP supports best practices standards, tools or engineering methodologies already in the market place
- ICP is flexible and adaptable to different project complexity and investment levels
- There is nothing like ICP in the global market – relevance of the Performance Period for persistence of savings

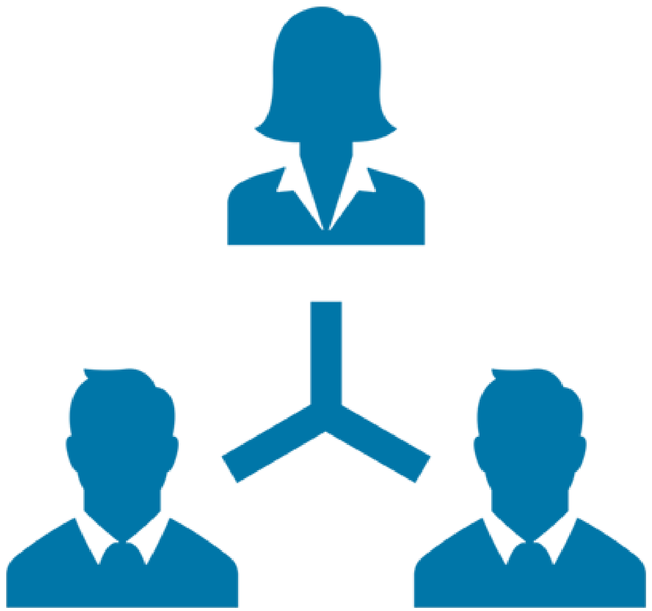
Roles and Responsibilities

ICP Project Developer

- Complete training
- Meet qualification and experience requirements,
- Quick and easy process to join the network
- Insurance must meet needs of project owner (reviewed by QAA on per project basis)

Third Party

- Someone who may be indirectly involved with, but is not a principal party to, an arrangement, contract, deal, or transaction
- ICP requires third-parties for:
  - Measurement and Verification (third party oversight is required as a minimum)
  - Quality Assurance



ICP Quality Assurance

- Energy efficiency investors lack expertise
- Multiple investors separately evaluating a project = time and money wasted
- QA Assessor
  - Independent
  - Represent the investor’s interests
  - Ensures project conforms to ICP protocols
  - Can also be an ICP Project Developer

Quality Assurance ‘Specialists’

- Spreadsheet calculations
- Implementation costs / investment criteria
- Commissioning (OPV)
- Measurement and verification

Project Developer Responsibilities

- Represents project owner’s interests
- Components clearly identified and organised
- Available to QA Assessor and others as appropriate
- Develop and assemble documentation **(investment)** package:
  - Submit all documentation required by protocol
  - Ensure calculations are fully transparent, and all assumptions documented and explained

QA Assessor Responsibilities

- Ensure project was developed in accordance with the *most appropriate approach taken from the ICP Protocol*
- Validate that all necessary *documentation* is provided and complete
- Check methodologies, assumptions, and results *(technical review)*
- Complete the ICP Checklist
- Issue the IREE™ certification

ICP QA Checklist Qualifier

"By signing the ICP QA checklist, the ICP Quality Assurance Assessor attests to having reviewed the project development documentation and finds that the project is consistent with the ICP Protocol as deemed applicable to the project based upon the data that are available. *This Quality Assurance review and signature does not constitute a guarantee of energy savings performance, nor does it signify that the reviewer is taking professional responsibility for the required documents and engineering produced by the credentialed Project Developer.*"

Project Team Communication

- Involve QAA early on in project development
- Maintain professional perspective and independence
- Collaborative approach
- Ask for clarifications

Process and tools available

Project Development Tasks

STAGE	Develop Baseline	Savings Calculations / Investment Package	Design, Construction & Verification	Operations, Maintenance & Monitoring	Measurement & Verification
PROJECT TASKS	Select a baselining approach	Develop initial savings estimates	Appoint an Operational Performance Verification Resource	Select and document ongoing management regime e.g. periodic inspection/aM&T	Develop an IPMVP based M&V plan
	Collect asset information, plans, drawings and utility asset registers	Establish preliminary cost estimates	Develop OPV plan	Develop OM&M plan	Appoint an M&V professional
	Work with the M&V specialist to define the measurement boundary	Ascertain preferred financial analysis metrics	Where appropriate, make provisions for the development and implementation of training	Where appropriate, make provisions for the development and implementation of operator training	Provide the M&V Plan, input data sets, assumptions and calculation to all parties
	Establish the baseline period	Develop a set of recommended ECMs	Make provisions for updating systems manual (if one already exists)	Make provisions for updating operator's manual (if one already exists)	Option A/B: Collect post-retrofit energy / performance data
	Collect hourly electricity consumption data, independent data, utility rate schedule, historical energy use data and independent variable data	Develop a project inventory for the proposed ECMs	If no systems manual exists, at minimum provide full inventory of installed equipment	Make provisions for the development and execution of instructions to notify affected stakeholders	Option A/B: Performance data analysis
	Define the project boundary	Estimate the total annual operational hours	Where appropriate, make provisions for a simple OPV report		Option A/B: Verified savings calculations
	Develop a project inventory	Calculate and document the estimated annual performance period energy consumption			Option C: Post-utility data
	Calculate estimated operational hours, power consumption and hence baseline energy consumption	Develop detailed energy savings calculations			Option C: Identify / quantify non-routine adjustments
	Cross-check the baseline energy consumption using spot measurements	Develop final investment package for ECMs			Option C: Regression based analysis
	Calendarise independent variable data	Prepare final report summarising ECMs			Develop a deemed savings plan
	Develop the baseline energy consumption model and test accuracy				
	Establish peak demand and pricing (where it is in effect)				
	Chart average daily demand (where demand charges or time-of-using pricing is in effect)				

Key	
	All approaches
	Measurement based approach
	Deemed savings approach

Quality Assurance Tasks

STAGE	Develop Baseline	Savings Calculations / Investment Package	Design, Construction & Verification	Operations, Maintenance & Monitoring	Measurement & Verification
QUALITY ASSURANCE TASKS	Review and approve selected baseline period	Review and approve credentials of individual responsible for energy model/savings calculations	Review and approve credentials of individual responsible for OPV	Review and approve OM&M plan, setting out procedures	If using a measurement based approach: Review and approve M&V plan
	Review and approve electricity data and rates, significant variable data and energy baseline	Review and approve credentials of individual responsible for designing the lighting system	Review and approve OPV plan	Review and approve selected ongoing management regime	Review and approve credentials of individual responsible for M&V
	Review and approve energy consumption model	Review and approve energy savings calculations, including supporting data	Review and approve systems manual/full inventory	Review and approve operator's manual (if one exists)	Review and approve the deemed savings plan
	Review and approve regression model when used	Review and approve annual operational hours and total annual post-retrofit energy consumption calculations	Review and approve training (interview system operators)	Review and approve training (interview system operators)	
		Review and approve project inventory			
		Review and approve investment package			
		Review and approve ECM report including final energy cost savings and pricing for each measure			

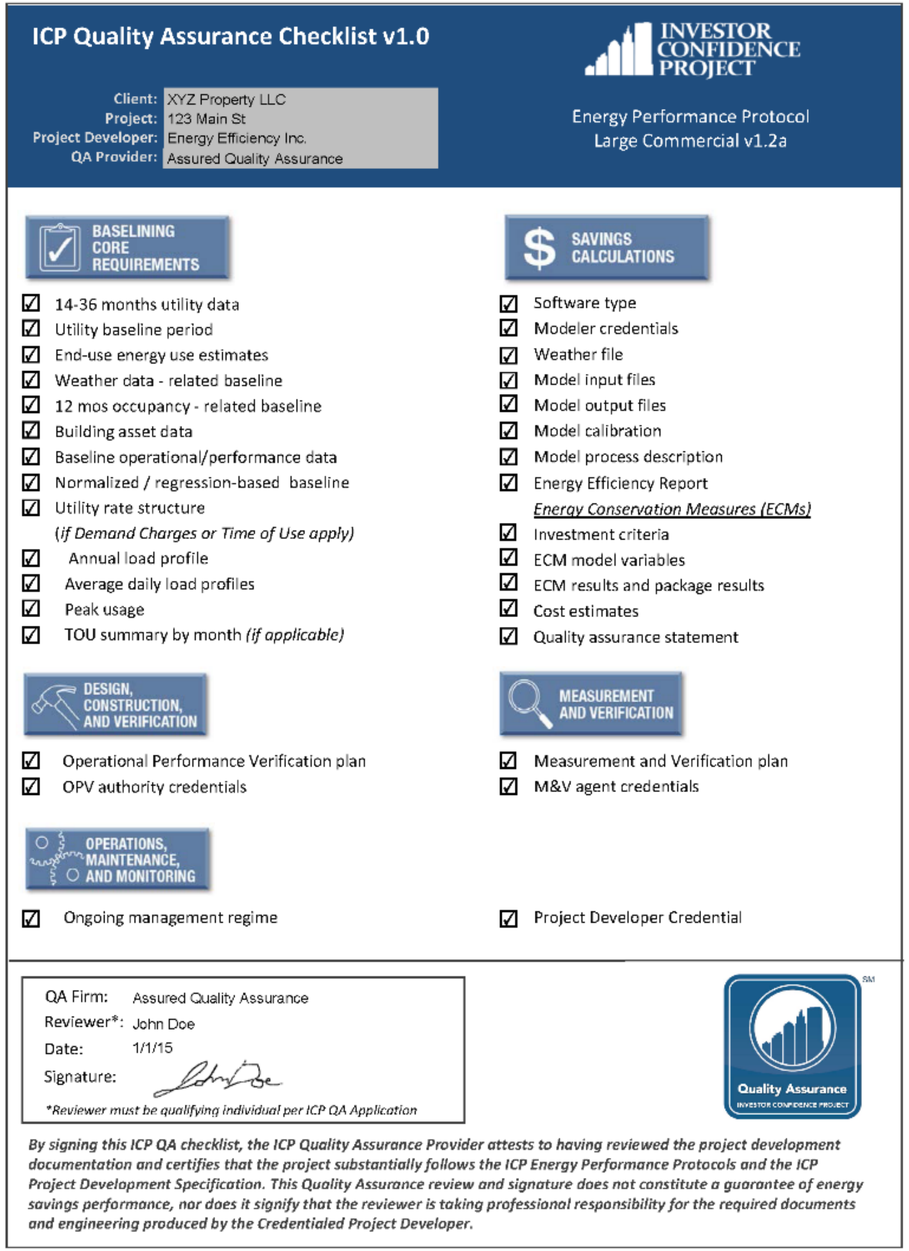
Key	
	All approaches
	Measurement based approach
	Deemed savings approach

Project Acceptance

- Descriptions of deficiencies and issues
  - Documentation requirements
  - Methodologies, assumptions, and results
- Reasonableness
  - Document how items were resolved, or why they were left open
- Complete and sign the QA Checklist
- Project certified as IREE™

Quality Assurance Tools

- ICP QA Checklist
- ICP PD Specification
- Project Registry



ICP Quality Assurance Checklist v1.0

INVESTOR CONFIDENCE PROJECT

Energy Performance Protocol
Large Commercial v1.2a

Client:	XYZ Property LLC
Project:	123 Main St
Project Developer:	Energy Efficiency Inc.
QA Provider:	Assured Quality Assurance

BASELINING CORE REQUIREMENTS

- ☑ 14-36 months utility data
- ☑ Utility baseline period
- ☑ End-use energy use estimates
- ☑ Weather data - related baseline
- ☑ 12 mos occupancy - related baseline
- ☑ Building asset data
- ☑ Baseline operational/performance data
- ☑ Normalized / regression-based baseline
- ☑ Utility rate structure *(if Demand Charges or Time of Use apply)*
  - ☑ Annual load profile
  - ☑ Average daily load profiles
  - ☑ Peak usage
  - ☑ TOU summary by month *(if applicable)*

SAVINGS CALCULATIONS

- ☑ Software type
- ☑ Modeler credentials
- ☑ Weather file
- ☑ Model input files
- ☑ Model output files
- ☑ Model calibration
- ☑ Model process description
- ☑ Energy Efficiency Report

Energy Conservation Measures (ECMs)

- ☑ Investment criteria
- ☑ ECM model variables
- ☑ ECM results and package results
- ☑ Cost estimates
- ☑ Quality assurance statement

DESIGN, CONSTRUCTION, AND VERIFICATION

- ☑ Operational Performance Verification plan
- ☑ OPV authority credentials

MEASUREMENT AND VERIFICATION

- ☑ Measurement and Verification plan
- ☑ M&V agent credentials

OPERATIONS, MAINTENANCE, AND MONITORING

- ☑ Ongoing management regime

- ☑ Project Developer Credential

QA Firm:	Assured Quality Assurance
Reviewer*:	John Doe
Date:	1/1/15
Signature:	John Doe

**Reviewer must be qualifying individual per ICP QA Application*

Quality Assurance
INVESTOR CONFIDENCE PROJECT

By signing this ICP QA checklist, the ICP Quality Assurance Provider attests to having reviewed the project development documentation and certifies that the project substantially follows the ICP Energy Performance Protocols and the ICP Project Development Specification. This Quality Assurance review and signature does not constitute a guarantee of energy savings performance, nor does it signify that the reviewer is taking professional responsibility for the required documents and engineering produced by the Credentialed Project Developer.

ICP Quality Assurance Checklists

- Specific to the protocol (one checklists)
- Focuses on underwriting phase
- Required components and documentation
  - Baselining
  - Savings Calculations
  - OPV
  - OM&M
  - M&V

ICP Project Development Specification

- Supplements protocol
- More detailed guidance on requirements in protocol
- Additional resources
- Linked to protocol sections

ICP Project Registry

Project Name *

Protocol *

Large Commercial

Protocol Version # *

Project Description *

Quality Assurance Provider *

QA Reviewer Name *

QA Reviewer Email *

Project Developer *

QA Reviewer Phone #

Project Developer ICP Credentialed?

Yes

QA Reviewer ICP Credentialed?

Yes

Building Owner Organization/Name *

Questions and polls

ICP Stages - Requirements

1. **Baseline Development**
2. Savings Calculations
3. Design, Construction & Verification
4. Operations Maintenance & Monitoring
5. Measurement & Verification

Baseline Development

Protocol Approach and Documentation

Street Lighting Protocol

Measurement-Based Approach

- Direct monitoring of energy consumption
- IPMVP compliant
- Preferred approach: more robust

Deemed Savings Approach

- Estimations of consumption based on reliable asset information
- No requirement for when to use it, but generally when:
  - Billing based on deemed savings approach, and/or
  - No energy monitoring system installed

Street Lighting Project Development Specification

Baseline Development

Procedure	Measurement-based	Deemed Savings
Normalised baseline (energy consumption equation)	Maybe	-
Electricity consumption data	✓	-
System asset, operational, performance data	✓	✓
Retrofit isolation baseline	Maybe	-
Load shapes (when interval data available)	✓	-
Project Inventory	-	✓
Estimated annual baseline energy consumption	-	✓

Where relevant to the ECMs

All approaches: System Asset, Operational, Performance Data

- Collect system asset, operational, and performance data
  - Drawings, equipment inventories, surveys, monitoring or measurements etc.
  - System performance tracking
  - Analysis of ECMs
  - ECM implementation
  - ECM performance tracking

- Provide a summary of activities and processes

Deemed savings approach: Estimated baseline calculation

- Define project boundary
- Develop project inventory for fixtures and fittings undergoing replacement
  - Include fixtures which are not operational
  - Power consumption from manufacturer’s data, national reference documents or on-site measurement (preferred option).
- Calculate estimated total annual operational hours
  - Account for effects such as local sunrise/sunset times and weather effects
  - Nationally recognised approach, or use on-site measurement (preferred)
- Calculate estimated power consumption by fitting type and operating hours

Deemed savings approach: Estimated baseline calculation

- Estimated annual baseline energy consumption = ∑ power consumption x operating hours *(for each equipment category)*
- Cross-check with spot measurements (sampling) and/or comparing with national databases (e.g. inventory and charge code)
- Deviation >10%: written justification required
- Document all assumption, calculations, measurements

Measurement-based approach: Data Collection

PDS section 4.2.1
Street Lighting PDS section 1.2

- Collect historical energy use and cost data
  - Define measurement boundary/project boundary
  - At least one full energy-use cycle (for most street lighting systems this will be one year)
  - Electricity, renewable energy and any other resources consumed
  - Calendarise if necessary
  - Energy end-use breakdowns to create boundaries and reality checks associated with energy savings estimates

EN16247-1 Energy Audits – General requirements
ISO 50002 Energy Audits – Requirements with guidance for use

Measurement-based approach: Regression-based model

- Develop an energy-use equation
  - Achieve an appropriate goodness of fit of energy data variability to independent variables
  - Perform regression analysis
    - Initial check on R-squared – in some cases it may be hard to achieve a high R-squared value
  - Model should be evaluated on the basis of predicted savings: must be greater than twice the standard error of the baseline value
  - Uncertainty analysis not required, but recommended
  - Proprietary tools may be available

IPMVP: Statistics and Uncertainty for IPMVP 2014 (section 1)

Measurement-based approach: Energy end-use consumption/Weather

- Estimate or measure end-use energy use
  - Calibrate baseline energy model
  - Calibrate energy savings estimates
- Where relevant to ECMs, collect independent variables data corresponding to the baseline period (e.g. traffic)
  - At least one full energy-use cycle (for most street lighting systems this will be one year)
- Other independent variables
  - e.g. number of burn outs,
  - changes to illuminance levels etc.

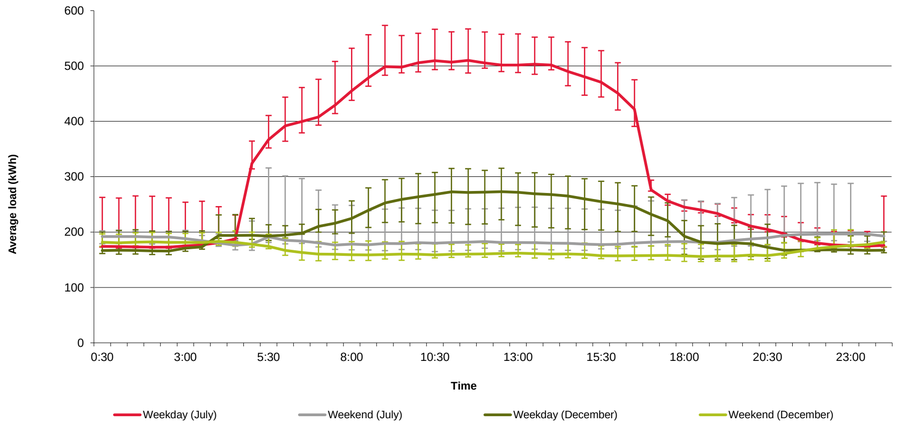
Measurement-based approach: Retrofit isolation baseline

- ECM specific baseline
  - IPMVP Option A or B M&V approach
  - Same approach as whole-system baseline development
  - Define measurement boundary
    - Specific piece of equipment
    - End-use
  - Define
    - Constant / variable load
    - Constant / variable schedule

IPMVP Core Concepts 2016
Section 5.1

All approaches: Load Profiles

- If demand charges/time of use pricing are in effect:
  - Determine impact on monetary savings
  - Annual load profile showing monthly consumption and peak demand
  - Average daily load profiles - use 15-minute interval data (if available), to develop profiles for all four seasons
  - Time of Use summaries by month (if applicable)



Documentation

Baseline approach	Documentation
Both	Statement of basis for the baselining approach selected
Measurement-based	Baseline period (start and end dates)
Measurement-based	Energy data
Deemed Savings	Project inventory
Deemed Savings	Details of power consumptions of relevant equipment
Deemed Savings	Calculations relating to baseline energy consumption
Both	Access to all asset, operational and performance data
Both	Utility rate structure
If applicable:	
Measurement-based	Operational hours, weather and traffic data (if relevant to project)
Both	Interval data; sub-metered data; load profiles; monthly peak demand

Questions and polls

1. Baseline Development

2. Savings Calculations

3. Design, Construction & Verification

4. Operations Maintenance & Monitoring

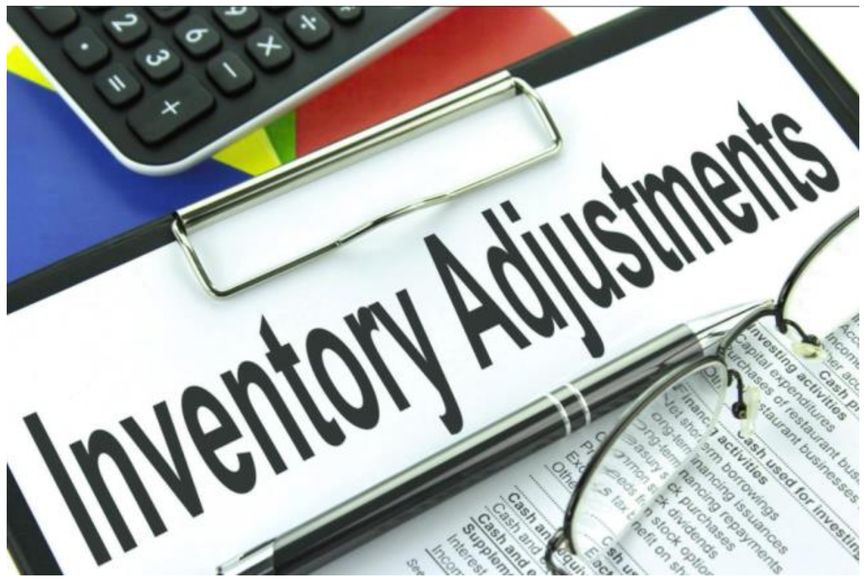
5. Measurement & Verification

Savings Calculations

Procedure	Measurement-based	Deemed Savings
ECM descriptions	✓	✓
ECM savings calcs – models/spreadsheets	✓	✓
Investment criteria	✓	✓
Fixed prices for each ECM	✓	✓
Investment package	✓	✓
Reporting	✓	✓

Deemed savings approach

- Repeat baselining process for proposed ECMs:
  - Project inventory including number of items and estimated power consumption
  - Estimate total annual operational hours for each piece of equipment
  - Calculate and document annual performance period energy consumption



ECM Descriptions; Cost Estimates

- ECM descriptions
  - Present condition, proposed measure
- Cost estimates
  - At the feasibility stage, direct quotes or past experience can be used
  - Final investment package must be based on contracted price
  - Must include:
    - Construction feasibility review
    - Labour and materials
    - Line items for professional fees, engineering, commissioning, construction management, permitting, M&V, overhead and profit, contingency
- Long term financial analysis is optional
- Where design work is required, the design must be carried out by an individual with either:
    - Nationally/Internationally recognised professional qualification in lighting engineering, or membership of a professional body in the field of lighting design, or
    - At least three years’ experience in designing street lighting systems, documented in the form of a CV outlining relevant project experience.

Typical street lighting ECMs; Ancillary Equipment

- Unpredictable loads are not permitted under the protocol, an example of which would be an EV Charging point

Energy use	Equipment
Typical Street Lighting Equipment	Controls including timing and dimming
	Sensors including presence detection and light level detection
	Central management system (CMS) and associated communications modules
	Ballasts or drivers
	Lighting fixtures
	Power supply including cable losses
Typical Ancillary Equipment	WiFi hotspots
	Mobile phone cell sites
	Low power wireless networks
	Public information systems
	Sensors (e.g. pollution monitoring
	Other non-lighting-related ancillary load

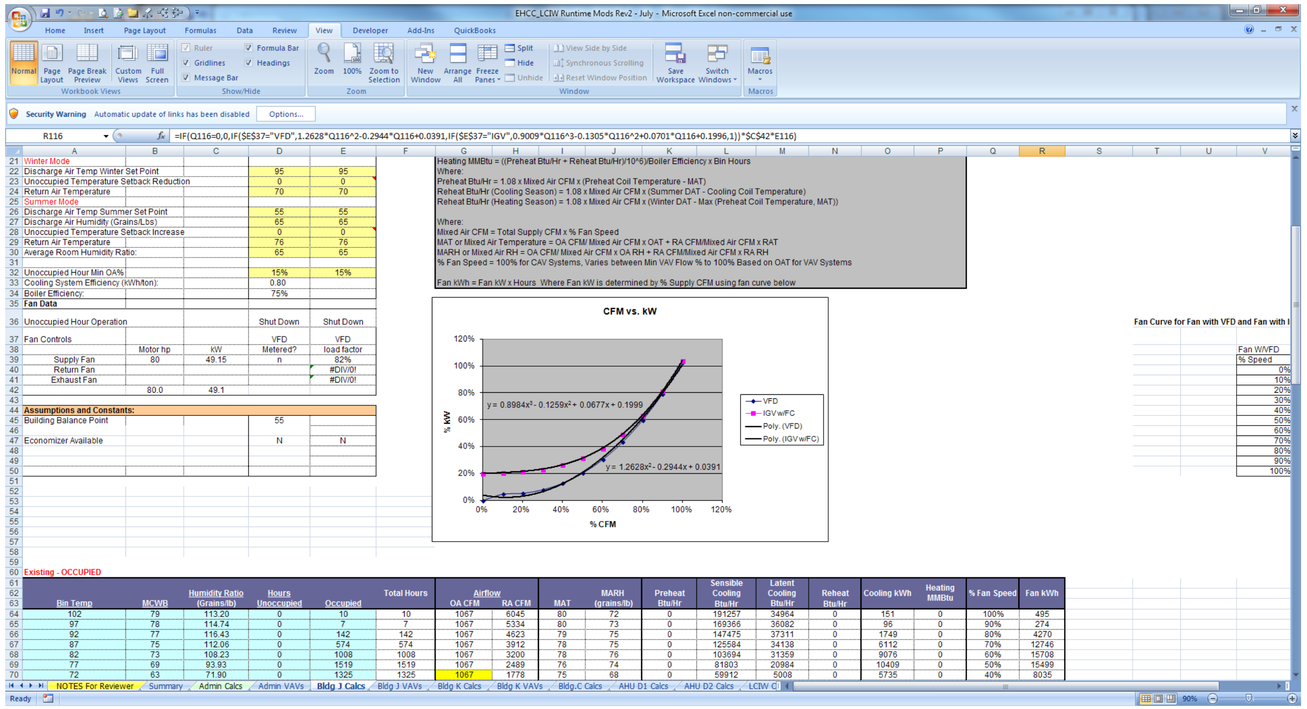
Investment Criteria

- Programmes and projects have individual criteria
  - ICP does not specify investment criteria to be used
  - Job of PD is to ascertain and inform preferred financial metrics
    - Implementation costs
    - Estimated savings
    - Available incentives
    - Effective useful life
    - Escalation rates
    - Interest rates
    - Discount rates
    - Cost of capital
    - Lease terms
    - Other appropriate financial inputs

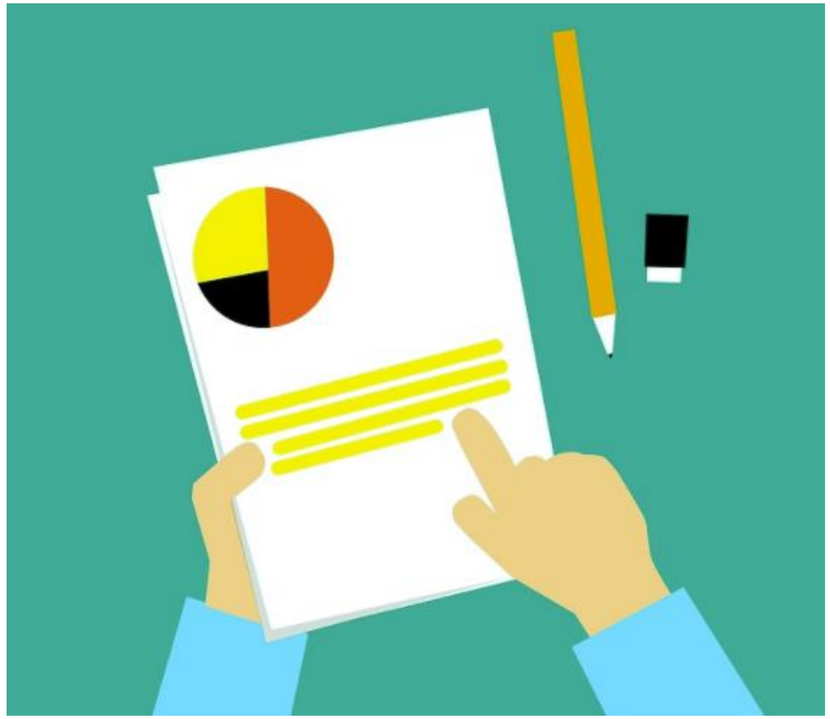
Savings Calculations

Spreadsheets and tools

- Analysis methods
  - Spreadsheet-based
  - Regressions analysis
  - Proprietary tools
- Assumptions and inputs
  - Documented
  - Never embedded
  - Reasonable



Report



- Summary report: industry-accepted format
  - Results
  - Methods used
  - Data
  - Pricing for each ECM and package of ECMs
  - Predicted energy savings: energy consumption, % volume, cost savings

EN 16247-1 Energy audits – Part 1
Section 5.6

Documentation

Protocol	Documentation
Both	Energy modeller/consultant qualifications
Both	System designer qualifications
Both	Where proprietary or third-party software has been used: input files; output files; calculation descriptions
Both	Where open-book calculations have been used: calculation process description, workbooks, calculation tools
Both	Basis for ECM costs
Both	Summary report – including annual predicted energy savings by fuel type
Deemed Savings	Project inventory: all equipment within the project boundary
Deemed Savings	Calculations relating to: annual operational hours; total annual baseline energy consumption

Questions and polls

1. Baseline Development
2. Savings Calculations
3. **Design, Construction & Verification**
4. Operations Maintenance & Monitoring
5. Measurement & Verification

Design, Construction & Verification

Procedure	Protocol
Appoint an Operational Performance Verification (OPV) resource	✓
Operational Performance Verification (OPV) plan	✓
Operational Performance Verification (OPV) report	Maybe
Training	Maybe
Update Systems manual/full Inventory of the installed equipment	✓

Where appropriate to the nature of the ECMs/scale of the project

Operational Performance Verification

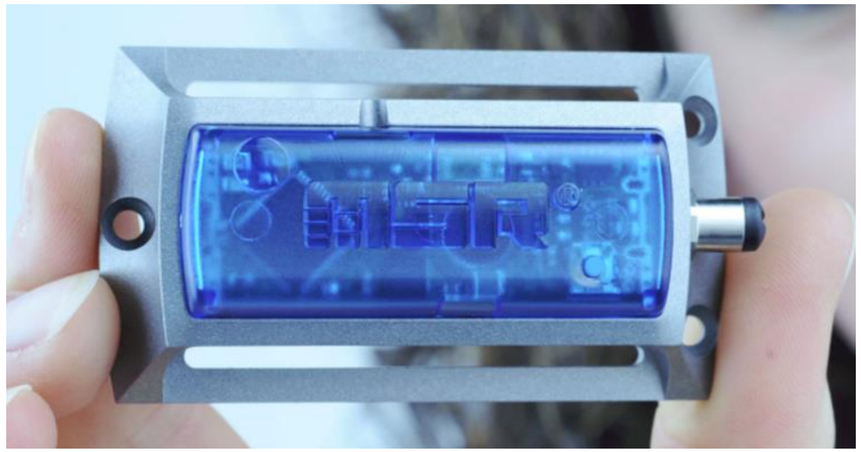
- OPV approaches

Deemed savings approaches
Well-known ECMs, predictable or low savings

- *Visual inspection* - verify the physical installation of the ECM

- *Spot measurements* - measure key energy-use parameters for ECMs or a sample of ECMs
- *Targeted functional performance testing* - test functionality and proper control
- *Trending and data logging* - setup trends or install data logging equipment and analyse data, and/or review control logic

ECMs with greater savings/uncertainty



Operational Performance Verification

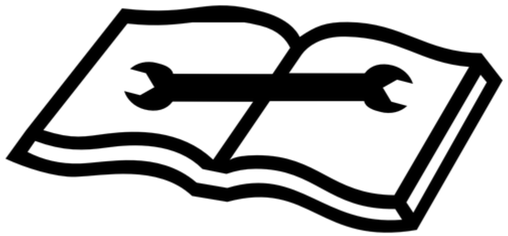
- OPV effort
  - Consultation with energy auditors
  - Monitoring of designs, submittals and project changes
  - Inspections of implemented changes
  - Means of reporting deviations from design
  - Help the client / PD team *fully install the measure properly* and then re-verify its performance; or
  - Work with the PD team to *revise the ECM savings estimates* using the actual post-installation data and associated inputs.

Operational Performance Verification

- OPV plan
  - Developed preconstruction
  - Verification activities: design review, etc…
  - Systems involved; roles and responsibilities
  - Target energy budget
  - Description of OPV report (where appropriate to nature/scale of project)
  - Provisions to:
    - Develop training plan for operators (ECM descriptions, target performance, etc.) (where appropriate to nature/scale of project)
    - Update Systems Manual, or
    - If no Systems Manual exists, provide a full inventory of the installed equipment, as a minimum

Systems Manual –update if one exists

- Systems manual
  - System design and construction (owner’s project requirements, current system requirements, basis of design, construction/project record documents)
  - Operational requirements
  - Maintenance requirements and procedures
  - Commissioning process report: OPV plan, testing reports, issue and resolution logs
  - Training



Documentation

Approach	Documentation
Both	Qualifications of the OPV provider
Both	OPV Plan

Questions and polls

1. Baseline Development
2. Savings Calculations
3. Design, Construction & Verification
4. Operations Maintenance & Monitoring
5. Measurement & Verification

Operations, Maintenance & Monitoring

Procedure	Protocol
OM&M plan (ongoing management regime)	✓
Training on OM&M procedures	Maybe
Update Operators manual (if one exists)	Maybe

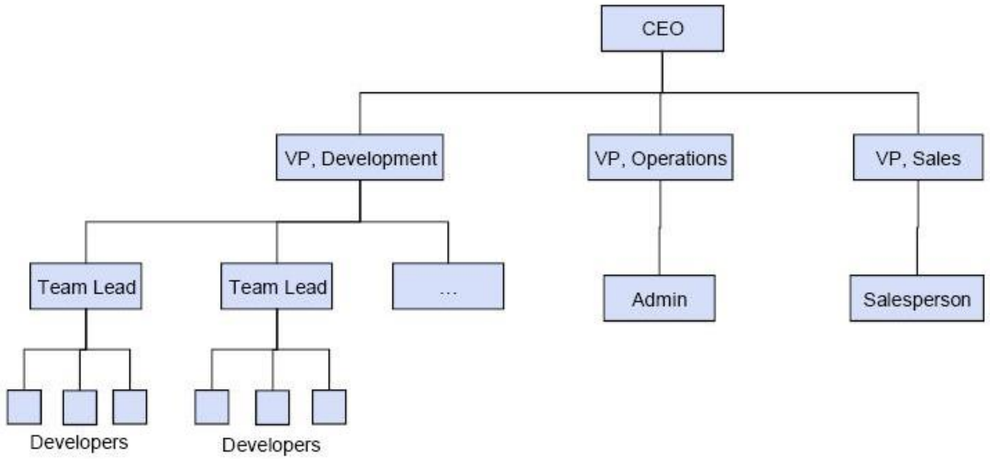
Where appropriate to the nature of the ECMs

OM&M Plan

- OM&M procedures
  - Continuous improvement and monitoring
  - Tracking, analyzing, diagnosing issues
  - Resolving issues
  - Maintain production levels
- Methods include:
  - Periodic inspections
  - Remote management and monitoring systems

OM&M Plan

- OM&M Plan: framework for ongoing management regime
  - Process and intent
    - Manual or automated tools or processes to use
  - Resources and established roles / responsibilities
    - Organisational chart
    - Technical qualifications for O&M
  - Provisions to:
    - Use approved installers (where national certification schemes exist)
    - Develop training plan for operators (ECM descriptions, target performance, issue resolution, etc.)(where appropriate to nature/scale of project)
    - Update Operator’s Manual
    - Develop instructions to notify stakeholders of implemented ECMs



Operator’s Manual – update if one exists

- Operator’s Manual
  - Often combined with Systems Manual
  - Photographs
  - Reduced-size as-built drawings and schematics
  - List of major equipment
  - Invoices for major equipment purchases and repairs
  - Equipment locations
  - Control system logic
  - O&M instructions
  - Training materials

Documentation

Approach	Documentation
Both	OM&M Plan (ongoing management regime)
Both	Organisational chart

Questions and polls

1. Baseline Development
2. Savings Calculations
3. Design, Construction & Verification
4. Operations Maintenance & Monitoring
5. **Measurement & Verification**

Measurement & Verification

Procedure	Measurement-based	Deemed Savings
Appoint an M&V resource	✓	
M&V Plan	✓	
Whole facility (Option C)	✓	
Retrofit isolation – all parameters (Option B)	✓	
Retrofit isolation – key parameters (Option A)	✓	
Deemed Savings Plan		✓
Collection of energy data	✓	✓
Verified calculations and report	✓	✓

Deemed savings approach: Pre-construction

- Post-retrofit verification
  - Check asset information for each piece of installed equipment consistent with pre-retrofit assumptions
    - Power consumption
    - Operating hours
  - Not compliant with IPMVP
  - Does not need to be carried out by a qualified M&V professional

Deemed savings approach: Pre-construction

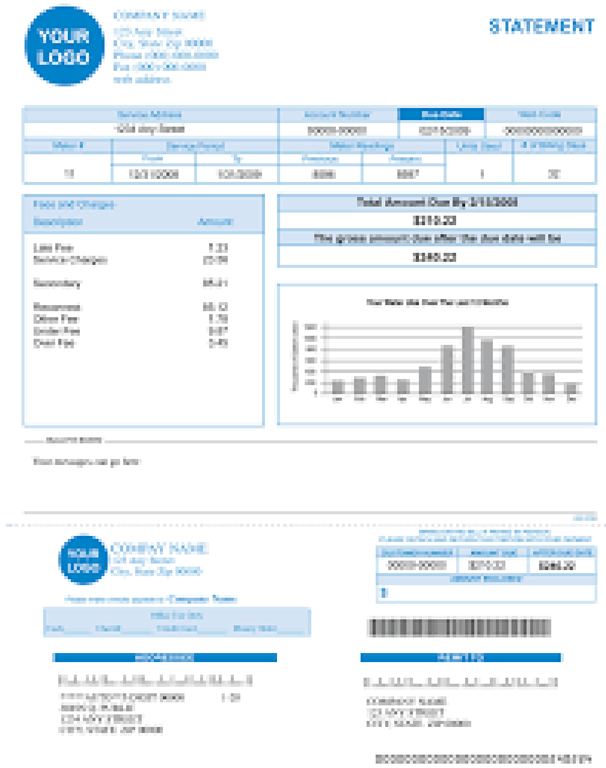
- Deemed Savings Plan
  - Develop pre-retrofit
  - Verify asset information
  - Define project boundary
  - Documentation of the planned process for establishing the deemed energy savings:
    - Collect estimated annual baseline energy consumption
    - Collect estimated post-upgrade energy consumption

Deemed savings approach: Performance period effects

Measurement-based approach: Option C

- Whole Facility
  - Option C: Utility bill analysis
  - Savings estimates > 10% system energy use
  - Energy use equation/regression analysis
  - Routine and non-routine adjustments
  - Statistical evaluation
    - R2 > 0.75
    - CV[RMSE] < 15%
    - T-stat > 2.0

IPMVP Core Concepts 2016



Measurement-based approach: Option A and B

- Retrofit Isolation
  - Option A: Key parameter measurement
  - Option B: All parameter measurement

IPMVP Core Concepts 2016

  - Specific to each ECM
  - Develop measurement boundaries
  - Estimated parameters

Measurement-based approach: Process

- Follow IPMVP M&V process

1. Document baseline
2. Plan and coordinate M&V activities

Pre-retrofit

3. Verify operations
4. Gather data
5. Verify savings
6. Report results

Post-retrofit

Measurement-based approach: M&V Application – Pre-construction

Section 7.1
IPMVP Core Concepts 2016

- M&V Plan
  - Compliant with IPMVP
  - Select appropriate Option(s)
  - Define:
    - Routine and non-routine adjustments
    - Measurement boundary
    - Measurement period
  - Meter locations, accuracy
  - Collect baseline and post-construction data
  - Option A: estimated parameters

Measurement-based approach: Performance period effects

Documentation

Approach	Documentation
Measurement-based	Qualifications of the M&V provider
Measurement-based	M&V Plan
Measurement-based	Routine and non-routine adjustments
Deemed Savings	Deemed Savings Plan
Both	Pre-retrofit collected data (baseline period)

Questions and polls

Worked Examples

Example 1: Retrofit of LED luminaires

- Discrete measure
  - Simple to estimate savings
- Measurement/project boundary to be drawn around number of luminaires in system
- IPMVP Option A or B/Deemed Savings approach likely to be most appropriate
- A sampling approach can be adopted, provided a representative sample is selected
- Only the baseline associated with the luminaires needs to be developed (if other energy uses)

Example 2: Major street lighting upgrade

- ECMs consist of luminaire retrofit, installation of a new Central Management System and replacement of most ‘at-risk’ street lighting columns.
- Billing based on metered data
- Measurement boundary should include all energy using components – i.e. include the entire system.
- IPMVP Option C approach likely to be most suitable

Application Process

Application timeline

- Straightforward process!
- A link to the PD and QAA applications will be sent to attendees of today's training
- We ask that attendees be present for/watch the full training session in order to be eligible to take the PD/QAA test and apply for the networks
- A link to test for QAA applications will also be sent
- Applications must be submitted within two weeks
- We will contact you if we require additional information or clarifications on your submission
- Once our review is complete, we will notify you to confirm your official status as a member of the ICP PD/QAA network

Project Developer requirements

- List of individuals who will oversee ICP projects and their credentials - option 1 (**professional engineer**) or option 2 (**engineering/science degree plus additional certification**) – describe relevance of qualification
- Sign **Declaration of Honour** confirming **PD experience** across 5 ICP stages:
  - Baselining
  - Savings calculations
  - Design, Construction and OPV
  - Operations, Maintenance and Monitoring
  - Measurement and Verification
- **Acknowledge** ICP T&Cs and to information being correct
- **Company** logo and brief details
- Insurance on a per project basis

QA Assessor requirements

- List of individuals who will oversee ICP projects and their credentials - option 1 (**professional engineer**) or option 2 (**engineering/science degree plus additional certification**) – describe relevance of qualification
- Sign **Declaration of Honour** confirming **QA experience** across 5 ICP stages:
  - Baselining
  - Savings calculations
  - Design, Construction and OPV
  - Operations, Maintenance and Monitoring
  - Measurement and Verification
- **Acknowledge** ICP T&Cs and to information being correct
- **Company** logo and brief details
- **Take QAA test – online, 40 questions, 30 mins**
- Insurance on a per project basis

Questions and polls

Pilot Projects

ICP Europe Network Members

Thank You

Investor Confidence Project

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