D2.5: Guidelines for IPMVP Protocol

Submission date: 11th May 2026

DOCUMENT SUMMARY INFORMATION

Grant Agreement No	**101167104**	**Acronym**	**EasyPro**
Full Title	**Easy Procurement of Energy Performance Contracts**		
Start Date	**01/07/2024**	**Duration**	**36 months**
Call topic	**LIFE-2023-CET-PDA**		
Type of action	**LIFE-PJG**		
Deliverable	D2.5: Guidelines for IPMVP Protocol		
Work Package	WP2 – Design of the EasyPro Solution		
Type	R	**Dissemination Level**	PU
Lead Beneficiary	Codema		
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DOCUMENT HISTORY

Version	Date	Changes	Contributor(s)
0.1	29/11/2025	Initial draft	Joe Hayden
0.2	29/04/2026	Final draft	Joe Hayden
0.3	30/04/2026	Final draft	Conor Murphy
0.3	10/05/2026	Quality review	Krishna Kumar
1.0	11/05/2026	Final version and submission	Luciano De Tommasi

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PROJECT PARTNERS

Partner	Country	Short name
UNIVERSITY COLLEGE CORK - NATIONAL UNIVERSITY OF IRELAND, CORK	IE	UCC-IERC
CITY OF DUBLIN ENERGY MANAGEMENT AGENCY LIMITED	IE	CODEMA
CARR COMMUNICATIONS LIMITED	IE	CARR
NOEL LAWLER GREEN ENERGY SOLUTIONS LIMITED	IE	LAWLER

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation / acronym	**Definition**
BMS	Building Management System
CDD	Cooling Degree Days
EEMs	Energy Efficiency Measures
EPC	Energy Performance Contracting
ESCOs	Energy Service Companies
HDD	Heating Degree Days
IPMVP	International Performance Measurement and Verification Protocol
M&V	Measurement and Verification
PV	Photo-Voltaic
WP	Work Package

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Executive Summary

Measurement and Verification (M&V) is a critical component of Energy Performance Contracting (EPC), as it provides the mechanism through which energy and cost savings are quantified, validated, and linked to contractual performance. In EPC projects, where payments to Energy Service Companies (ESCOs) are directly tied to achieved savings, a robust, transparent, and consistent M&V framework is essential to ensure credibility, reduce risk, and support effective project delivery.

The International Performance Measurement and Verification Protocol (IPMVP) is the most widely recognised standard for M&V and is commonly applied across Europe. It provides a structured methodology for establishing energy baselines, measuring performance, and verifying savings under a range of project conditions. However, while IPMVP offers flexibility, its application can introduce complexity and additional cost, particularly where extensive monitoring infrastructure is required. This can act as a barrier to EPC uptake, especially in projects of smaller scale or where standardised solutions are sought.

This deliverable addresses this challenge by developing practical, standardised, and cost-effective guidelines for the application of IPMVP within the EasyPro framework. The objective is to ensure that energy and cost savings can be robustly and accurately measured, while avoiding disproportionate expenditure on monitoring equipment and data collection systems.

The deliverable provides:

- A simplified interpretation of IPMVP principles, tailored to the requirements of EasyPro projects
- Standardised M&V approaches for common energy efficiency measures and EPC project types
- A structured framework for selecting appropriate M&V options, based on project characteristics, data availability, and required accuracy
- Guidance on cost-effective monitoring and data collection, prioritising the use of existing infrastructure and proportionality
- A standard M&V Plan template for bidders, ensuring consistency and comparability across tender submissions
- Examples of the application of IPMVP Options A, B, and C

The guidelines emphasise the use of Option C (Whole Facility) as the default approach for multi-measure EPC projects, supported by Options A and B for specific measures where appropriate. Option D (calibrated simulation) is recommended only in cases where other approaches are not feasible.

By standardising M&V approaches and providing clear guidance to bidders, this deliverable contributes to:

- Improved comparability of tender submissions
- Reduced transaction costs for both ESCOs and contracting authorities
- Enhanced transparency and trust between contracting parties
- Reduced performance and financial risk, supporting project bankability
- Greater scalability and replicability of EPC projects across the public sector

Within the EasyPro framework, this deliverable forms part of an integrated toolkit that includes baseline definition (D2.1), calculation methodologies (D2.3), and risk assessment protocols (D2.6). Together, these

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elements ensure that projected energy savings are translated into measurable, verifiable, and contractually enforceable outcomes.

In conclusion, the guidelines presented in this deliverable provide a robust yet practical foundation for the implementation of M&V in EPC projects. By balancing methodological rigour with cost-effectiveness, they support the wider objective of enabling the efficient deployment of EPC as a key mechanism for achieving energy efficiency and decarbonisation in the Irish university sector and beyond.

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1 Introduction

1.1 Context

Energy Performance Contracting (EPC) is a contractual mechanism in which the implementation of energy efficiency and decarbonisation measures is linked to guaranteed energy and/or cost savings. Within this framework, the accurate quantification and verification of savings is critical, as it underpins contractual payments, risk allocation, and overall project viability.

In EPC projects, energy savings are not directly measurable and must be determined through comparison with a defined baseline. This introduces inherent uncertainty, as actual energy consumption is influenced by a range of factors beyond the control of the contractor, including weather conditions, occupancy patterns, operational practices, and user behaviour. Variations in these parameters can significantly affect the realised savings and, if not properly accounted for, may lead to discrepancies between expected and verified performance.

Measurement and Verification (M&V) provides a structured approach to address these challenges by defining how energy savings are calculated, measured, and validated over the project lifecycle. A robust M&V framework ensures that savings are assessed in a transparent, consistent, and credible manner, thereby reducing uncertainty and enabling fair comparison between baseline and post-implementation performance. This is particularly important in EPC projects, where payments to Energy Service Companies (ESCOs) are directly linked to the achievement of guaranteed savings.

The International Performance Measurement and Verification Protocol (IPMVP) is the most widely recognised M&V framework internationally and is commonly applied across Europe. It provides standardised methodologies for establishing baselines, selecting measurement boundaries, and calculating savings under different project conditions. The adoption of IPMVP ensures consistency with best practice and supports the development of a transparent and bankable EPC market.

However, the application of IPMVP can introduce complexity, particularly in projects involving multiple energy efficiency measures or where extensive monitoring infrastructure is required. Overly complex M&V approaches may increase project costs, extend implementation timelines, and act as a barrier to participation for ESCOs, particularly in smaller or standardised projects. There is therefore a need to balance methodological robustness with practicality and cost-effectiveness.

Within the EasyPro project, this challenge is particularly relevant. The project aims to facilitate the large-scale deployment of EPCs in the Irish university sector by developing standardised templates, methodologies, and procurement frameworks that reduce administrative and technical barriers. In this context, the development of simplified and standardised M&V guidelines is essential to ensure that energy savings can be measured reliably without imposing disproportionate costs on project developers or contracting authorities.

1.2 Objective of the Deliverable

The objective of this deliverable is to provide clear, practical, and standardised guidelines for the application of the IPMVP framework within EPC projects developed under the EasyPro initiative.

Specifically, the deliverable aims to:

- Provide a simplified interpretation of IPMVP principles tailored to the EasyPro context

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- Establish standardised Measurement and Verification approaches for common project types and energy efficiency measures
- Support bidders in selecting appropriate M&V methodologies based on project characteristics
- Ensure that M&V approaches are robust, transparent, and aligned with contractual requirements
- Minimise the cost and complexity associated with monitoring and data collection
- Enhance comparability of tender submissions through consistent M&V practices

By achieving these objectives, the deliverable contributes to reducing technical and financial barriers to EPC implementation, while maintaining the integrity and credibility of energy savings verification.

1.3 Scope of Application

The guidelines presented in this deliverable apply to EPC and Energy Supply Contracting (ESC) projects developed within the EasyPro framework, with a primary focus on EPC projects where performance guarantees are directly linked to verified energy savings.

The scope includes:

- Typical energy efficiency measures implemented in university buildings, such as:
  - Lighting upgrades
  - HVAC system improvements
  - Heat pump installations
  - Building Management System (BMS) optimisation
  - Renewable energy systems (e.g. solar PV)
- Both single-measure projects and multi-measure EPC bundles involving interactions between systems
- All stages of the M&V process, including:
  - Baseline definition
  - Measurement boundary selection
  - Data collection and monitoring
  - Adjustment for external variables
  - Reporting and verification

The primary target audience for this deliverable includes:

- Energy Service Companies (ESCOs) preparing tender submissions
- Contracting authorities (universities and public bodies) procuring EPC services
- Technical advisors and consultants involved in EPC project development

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1.4 Link to Other EasyPro Deliverables

This deliverable forms part of a broader suite of tools developed under Work Package 2 (WP2) to support the design and implementation of EPC projects within the EasyPro framework.

It is closely linked to the following deliverables:

- **D2.1 – Building Energy Assessments & Documentation to Support Tendering Process**
  Provides the technical baseline data, asset information, and project documentation required to define the reference conditions against which energy savings are measured.
- **D2.3 – Calculation Methodology Template and Guidelines**
  Defines the standardised approach for calculating energy, cost, and CO_2 savings across different energy efficiency measures, ensuring consistency and comparability of tender submissions.
- **D2.6 – Standardised Risk Assessment Protocols**
  Identifies and categorises risks associated with EPC projects, including those related to performance uncertainty and data quality, which are directly influenced by the robustness of the M&V approach.

Within this framework, the present deliverable provides the **verification layer**, ensuring that calculated and projected savings are translated into measurable and contractually enforceable outcomes.

Together, these deliverables establish a comprehensive and integrated toolkit that supports the development of transparent, standardised, and scalable EPC solutions within the Irish market.

1.5 Structure of the Deliverable

The remainder of this deliverable is structured as follows:

- **Section 2** outlines the role of Measurement and Verification in EPC projects and its relationship with risk and contractual performance.
- **Section 3** provides an overview of the IPMVP framework, including the different M&V options and their applicability.
- **Section 4** introduces standardised M&V approaches tailored to the EasyPro project, including recommended options for common energy efficiency measures.
- **Section 5** presents guidelines for selecting appropriate M&V options based on project characteristics, including a decision-making framework.
- **Section 6** discusses cost-effective monitoring and data collection strategies to ensure proportionality between M&V effort and project scale.
- **Section 7** defines the requirements for M&V plans to be submitted by bidders as part of the tendering process.
- **Section 8** describes how M&V is integrated into EPC contracts and procurement processes.
- **Section 9** summarises the key findings and conclusions of the deliverable.

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2 Role of Measurement & Verification in EPC

2.1 Function of Measurement & Verification in EPC Projects

Measurement and Verification (M&V) is a central component of Energy Performance Contracting (EPC), as it provides the mechanism through which energy savings are quantified and validated. Unlike conventional construction or service contracts, EPC agreements are performance-based, meaning that payments to the Energy Service Company (ESCO) are directly linked to the achievement of agreed energy and/or cost savings.

Within this context, M&V performs several critical functions:

- **Baseline comparison:** Establishes a reference point against which post-implementation performance is assessed
- **Savings quantification:** Calculates the difference between baseline and actual energy consumption
- **Performance validation:** Confirms whether guaranteed savings have been achieved
- **Financial settlement:** Supports payment mechanisms linked to verified savings
- **Transparency and accountability:** Ensures that both contracting parties have a clear and agreed methodology for assessing performance

A robust M&V framework therefore underpins the credibility of EPC projects and is essential for ensuring that contractual obligations are met in a fair and transparent manner.

2.2 Sources of Uncertainty in Energy Savings

Energy savings in EPC projects are influenced by a range of variables that introduce uncertainty into performance assessment. These factors must be carefully considered within the M&V framework to ensure that savings are accurately determined.

Key sources of uncertainty include:

- **Weather conditions:** Variations in heating and cooling demand due to changes in temperature and climatic conditions
- **Occupancy patterns:** Changes in building usage, including occupancy levels, operating hours, and space utilisation
- **User behaviour:** Variability in how occupants interact with building systems (e.g. thermostat settings, lighting usage)
- **Operational practices:** Differences in system operation, maintenance regimes, and control strategies
- **Equipment performance:** Degradation over time or deviations from expected performance levels

These uncertainties mean that simple before-and-after comparisons are insufficient. Instead, M&V methodologies must include mechanisms for adjusting baseline conditions and normalising results to ensure a fair comparison between expected and actual performance.

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2.3 Relationship Between M&V and Risk Allocation

M&V plays a fundamental role in the allocation and management of risk within EPC contracts. As identified in the EasyPro risk assessment framework, uncertainty in energy savings is a key contributor to both technical and financial risk.

In EPC projects:

- The **ESCO typically assumes performance risk**, meaning it is responsible for achieving the guaranteed level of savings
- The **building owner retains certain external risks**, such as changes in occupancy or operational conditions

A clearly defined M&V approach helps to:

- **Reduce ambiguity:** By establishing agreed rules for calculating savings
- **Support fair risk allocation:** By distinguishing between controllable and uncontrollable factors
- **Prevent disputes:** By providing a transparent and agreed methodology
- **Enhance bankability:** By giving confidence to financial institutions that savings are measurable and enforceable

If M&V is poorly defined or inconsistently applied, disputes may arise regarding the level of savings achieved, potentially undermining the financial viability of the project. Conversely, a well-structured M&V framework reduces uncertainty and supports effective collaboration between contracting parties.

2.4 M&V Across the Project Lifecycle

M&V is not a single activity but a continuous process that spans the entire EPC project lifecycle. Its role evolves across different project phases, as illustrated in Table 2.1 below.

Table 2.1 – Role of M&V Across EPC Project Phases

Project Phase	Role of M&V	Key Activities
Pre-contract (Development & Tendering)	Define methodology and baseline	- Establish baseline energy consumption- Select IPMVP option- Define measurement boundaries
Implementation (Design & Construction)	Prepare measurement systems	- Install meters (if required)- Configure data collection systems- Finalise M&V plan

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Operation (Performance Period)	Verify savings	- Monitor energy consumption- Apply adjustments (weather, occupancy)- Calculate savings
Reporting & Settlement	Validate performance	- Prepare M&V reports- Compare savings against guarantees- Support financial payments

2.5 Integration with Baseline Definition and Adjustments

A key element of M&V is the establishment of a reliable baseline, which represents the energy consumption that would have occurred in the absence of the implemented measures. The baseline is typically derived from historical energy data and may be adjusted to account for relevant variables such as weather and occupancy.

The relationship between baseline and measured consumption can be expressed conceptually as:

Verified Savings = Adjusted Baseline Consumption – Measured Post-Implementation Consumption

To ensure accuracy, the M&V process must:

- Clearly define the baseline period and data sources
- Identify relevant adjustment variables (e.g. heating degree days, occupancy levels)
- Apply appropriate adjustment methods (e.g. regression analysis)
- Maintain consistency between baseline assumptions and post-implementation conditions

The baseline methodology must be transparent and agreed by all parties at the contract stage, as it forms the foundation for all subsequent savings calculations.

2.6 Importance of M&V for Market Confidence

Beyond its technical role, M&V is a key enabler of market confidence in EPC. Reliable verification of savings:

- Provides assurance to **building owners** that expected benefits are realised
- Reduces perceived risk for **ESCOs**, enabling more competitive bids
- Supports **financial institutions** in assessing project bankability
- Facilitates **standardisation and scalability** of EPC across multiple projects

Within the EasyPro framework, the standardisation of M&V approaches is particularly important, as it ensures consistency across projects and reduces transaction costs associated with procurement and evaluation.

By providing clear and practical guidance on the application of IPMVP, this deliverable aims to strengthen the role of M&V as a foundation for transparent, efficient, and scalable EPC implementation.

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3 Overview of the IPMVP Framework

3.1 Introduction to IPMVP

The International Performance Measurement and Verification Protocol (IPMVP) is the most widely recognised framework for the measurement and verification of energy savings in energy efficiency projects. It provides a structured and standardised approach for quantifying energy savings resulting from the implementation of Energy efficiency measures (EEMs).

IPMVP is widely applied across Europe and internationally in EPC projects, as it ensures that savings are:

- **Transparent**, with clearly defined methodologies
- **Consistent**, enabling comparison across projects
- **Credible**, supporting contractual enforcement and financial investment

Within the EasyPro framework, IPMVP is adopted as the reference methodology for M&V to ensure alignment with international best practice and to support the development of a robust and bankable EPC market.

3.2 Core Principles of IPMVP

The IPMVP framework is based on a number of fundamental principles that guide the development and implementation of M&V plans (Table 3.1).

Table 3.1 – Core Principles of IPMVP

Principle	Description	Relevance to EasyPro
Accuracy	Savings estimates should be as close as reasonably possible to actual values	Ensures reliability of EPC guarantees
Completeness	All relevant energy effects should be included	Avoids under- or over-estimation of savings
Conservatism	Where uncertainty exists, assumptions should not overstate savings	Protects contracting authorities
Consistency	Methods should be applied consistently over time	Enables fair comparison across reporting periods
Transparency	All assumptions and methodologies must be clearly documented	Reduces disputes and improves trust

These principles underpin all IPMVP methodologies and must be reflected in the M&V plans submitted by bidders.

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3.3 IPMVP Options for Measurement and Verification

IPMVP defines four standard approaches (Options A–D) for measuring and verifying energy savings. Each option differs in terms of complexity, cost, accuracy, and applicability.

3.3.1 Option A – Retrofit Isolation: Key Parameter Measurement

Option A involves measuring key performance parameters of the affected system while estimating other variables.

Key characteristics:

- Partial measurement approach
- Use of engineering estimates for some parameters
- Lower implementation cost

Typical applications:

- Lighting upgrades
- Simple equipment replacements

Advantages:

- Cost-effective
- Simple to implement

Limitations:

- Potentially lower accuracy due to reliance on assumptions
- Requires justification of estimated parameters

3.3.2 Option B – Retrofit Isolation: All Parameter Measurement

Option B involves direct measurement of all relevant parameters affecting energy use within the system boundary.

Key characteristics:

- Full measurement approach
- High level of detail and accuracy
- Requires installation of metering equipment

Typical applications:

- HVAC system upgrades
- Pumps and motors
- Heat pump systems

Advantages:

- High accuracy

- Reduced reliance on assumptions

Limitations:

- Higher cost due to monitoring requirements
- Increased complexity

3.3.3 Option C – Whole Facility

Option C evaluates energy savings at the level of the entire facility using utility meter data.

Key characteristics:

- Uses whole-building energy consumption
- Relies on historical baseline data
- Applies statistical methods (e.g. regression analysis) to account for external variables

Typical applications:

- Multi-measure EPC projects
- Whole-building retrofits

Advantages:

- Captures interaction between multiple measures
- Lower cost if existing utility data is available

Limitations:

- Less precise attribution of savings to individual measures
- Requires high-quality baseline data

3.3.4 Option D – Calibrated Simulation

Option D uses calibrated energy models to estimate energy savings.

Key characteristics:

- Simulation-based approach
- Calibration using measured data
- Suitable where measurement is difficult

Typical applications:

- New buildings
- Complex retrofit projects
- Projects with limited historical data

Advantages:

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- Can model complex systems and interactions
- Useful where direct measurement is not feasible

Limitations:

- High cost and technical complexity
- Requires specialised expertise

3.4 Comparison of IPMVP Options

The selection of an appropriate IPMVP option involves balancing accuracy, cost, and complexity (Table 3.2).

Table 3.2 – Comparison of IPMVP Options

Option	Measurement Scope	Accuracy	Cost	Complexity	Typical Use
A	Key parameters	Medium	Low	Low	Simple retrofits
B	All parameters	High	Medium–High	Medium	Technical systems
C	Whole facility	Medium	Low–Medium	Medium	EPC bundles
D	Simulation	High	High	High	New buildings / no baseline data

3.5 Selection Logic for IPMVP Options

The choice of IPMVP option depends on several factors, including:

- Project scale
- Complexity of measures
- Interaction between systems
- Availability of data
- Required level of accuracy

The appropriate selection logic for IPMVP option is illustrated in Figure 3.1.

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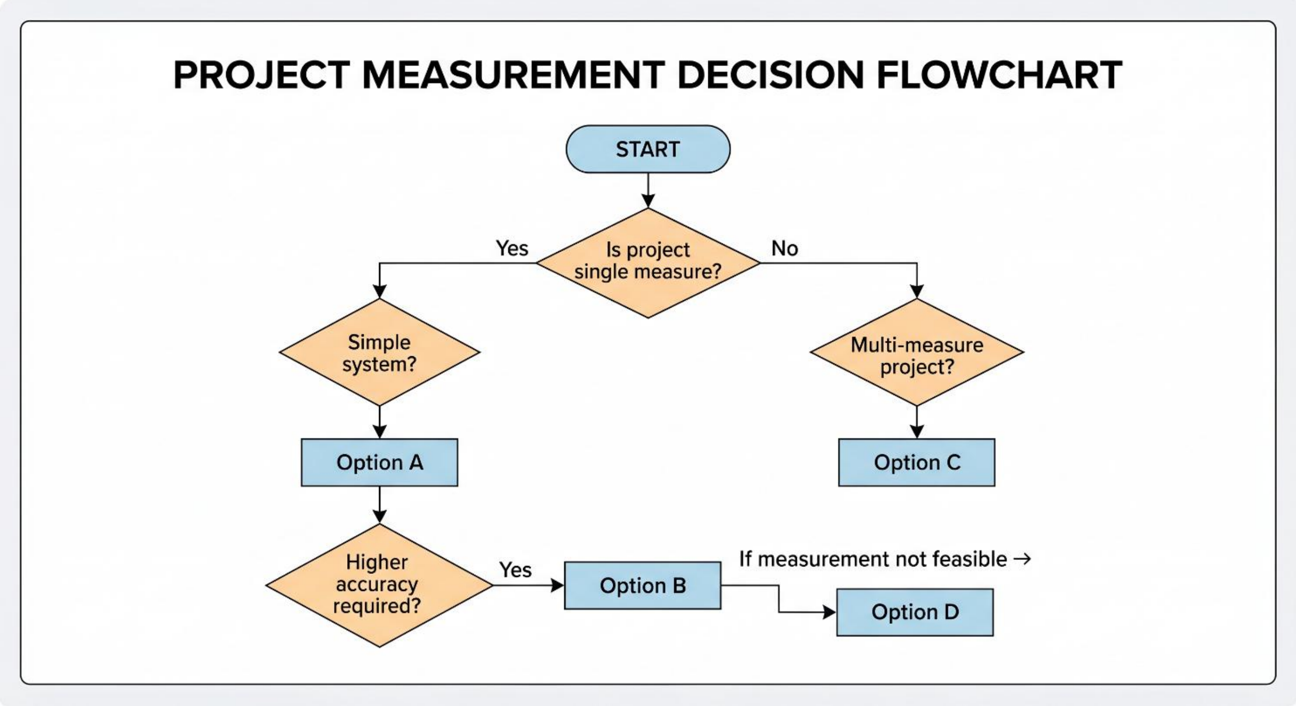
Figure 3.1 – IPMVP Option Selection Logic



3.6 Applicability within the EasyPro Framework

Within the EasyPro project, the application of IPMVP must be adapted to ensure:

- **Consistency across tender submissions**
- **Cost-effective implementation**
- **Alignment with project scale and complexity**

In practice:

- **Option C** is expected to be the default approach for EPC project bundles
- **Options A and B** are suitable for specific, isolated measures
- **Option D** should be used only where justified due to its complexity and cost

The following section builds on this overview by defining **standardised M&V approaches tailored to EasyPro projects**, ensuring that IPMVP is applied in a practical and proportionate manner.

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4 Standardised M&V Approaches for EasyPro

4.1 Rationale for Standardisation

The application of IPMVP allows flexibility in the selection of measurement and verification approaches. While this flexibility is beneficial in accommodating a wide range of project types, it can also lead to significant variability in how M&V is implemented across different EPC proposals.

In the context of the EasyPro project, such variability presents several challenges:

- **Reduced comparability of bids**, making evaluation more complex
- **Increased transaction costs** for both bidders and contracting authorities
- **Inconsistent levels of accuracy and robustness** in savings verification
- **Potential over-specification of monitoring systems**, leading to unnecessary costs

To address these challenges, this deliverable establishes **standardised M&V approaches** aligned with IPMVP principles but adapted to the specific needs of EasyPro projects.

The objectives of standardisation are to:

- Ensure **consistency across tender submissions**
- Reduce **complexity and cost of M&V implementation**
- Provide **clear guidance to bidders** on acceptable methodologies
- Improve **transparency and fairness in bid evaluation**
- Support the **scalability and replication** of EPC projects

4.2 Standard Approach by Project Type

Based on the characteristics of typical EPC projects within the EasyPro framework, recommended IPMVP options are defined for common project types and energy efficiency measures (Table 4.1).

Table 4.1 – Recommended M&V Approaches by Measure Type

Measure Type	Typical Scope	Recommended IPMVP Option	Measurement Approach	Rationale
Lighting upgrades	Replacement of fixtures, LEDs	Option A	Spot measurement / operating hours	Low variability, predictable savings
Pumps and motors	Circulation pumps, VSDs	Option B	Power and runtime measurement	Performance depends on load and control

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HVAC systems	AHUs, chillers, ventilation	Option B / C	Full parameter measurement	Complex systems with variable operation
Heat pump systems	Space heating / DHW	Option B / C	Metered energy input + system performance	Influenced by weather and demand
BMS optimisation	Controls and scheduling	Option C	Whole-building analysis	System-wide impact, difficult to isolate
Solar PV	On-site generation	Option B	Metered electricity generation	Direct and measurable output
Whole-building retrofit	Multi-measure EPC bundle	Option C	Utility data + regression	Captures interaction between measures

4.3 Default M&V Approach for EasyPro Projects

To ensure consistency across projects, the following default approach is defined:

- **Option C (Whole Facility)** shall be considered the **default M&V approach for EPC project bundles**, particularly where multiple measures are implemented across a building or campus.

This approach is preferred because:

- It captures the **combined effect of multiple measures**, including interaction effects
- It reduces the need for extensive sub-metering
- It aligns with the availability of **utility billing data**
- It provides a **cost-effective and scalable solution**

However, Option C requires:

- A reliable and well-defined baseline
- Appropriate adjustment methods (e.g. weather normalisation)
- Consistent data collection and reporting

4.4 Use of Retrofit Isolation Approaches (Options A and B)

While Option C is the default for EPC bundles, **Options A and B** remain appropriate in specific cases.

Option A (Key Parameter Measurement) should be used where:

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- The measure is **simple and well-defined**
- Savings can be reliably estimated using limited measurement
- Variability is low

Typical examples:

- Lighting upgrades
- Fixed equipment replacements

Option B (All Parameter Measurement) should be used where:

- The system performance is **complex or variable**
- High accuracy is required
- Savings cannot be reliably estimated using assumptions

Typical examples:

- HVAC systems
- Heat pumps
- Pumps and motors

In these cases, Option B provides greater accuracy but must be applied proportionately to avoid excessive monitoring costs.

4.5 Application of Option D (Simulation)

Option D should be used only in specific circumstances where other options are not feasible.

Appropriate use cases:

- Lack of reliable baseline data
- Complex systems with significant interactions
- Projects involving major structural or operational changes

Limitations:

- High cost and complexity
- Requires specialist modelling expertise
- Increased uncertainty if not properly calibrated

As a result, **Option D should not be used as a default approach** and must be clearly justified by bidders.

Bidders proposing the use of IPMVP Option D (Simulation) shall provide a clear and evidence-based justification demonstrating why alternative IPMVP options are not suitable. Acceptable justifications may include addressing the use cases previously listed in this section, as well as:

- Facilities with highly complex or integrated energy systems where isolation of individual measures is impractical

- Projects involving substantial changes in occupancy patterns, operating schedules, production processes, or building configuration
- Situations where direct measurement would require disproportionate cost, disruption, or metering infrastructure
- Projects where calibrated simulation modelling is necessary to separate the impact of multiple interacting energy efficiency measures

Where Option D is proposed, bidders shall also demonstrate:

- The suitability and validation approach of the simulation model
- The qualifications and relevant experience of the modelling personnel
- The proposed calibration methodology and accuracy criteria
- The assumptions, input data sources, and uncertainty management approach

The contracting authority should reserve the right to reject the use of Option D where the justification provided is insufficient or where a simpler and more robust M&V option could reasonably be applied.

4.6 Standard M&V Routes for Common Measures

To further simplify implementation, standard M&V routes are defined for commonly implemented measures (Table 4.2).

Table 4.2 – Standard M&V Routes

Measure	Baseline Approach	Measurement Method	Adjustment Required
Lighting	Installed connected load and assumed operating hours	Spot measurement or sampling of fixtures and operating hours	Minor adjustments for operating schedule or occupancy where applicable
Pumps	Baseline flow, head, and operating profile	Continuous metering of power and flow	Adjustments for flow, demand, or system operating conditions
HVAC	Historical energy consumption under baseline conditions	Sub-metered or system-level energy monitoring	Weather normalization (and occupancy where relevant)
Heat pumps	Baseline heating demand or historical thermal energy use	Electricity consumption via dedicated metering	Weather (degree days) and occupancy or setpoint changes
BMS	Whole-building baseline consumption from utility/main meters	Utility or main meter data	Weather, occupancy, and operational usage patterns

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PV	Simulated or modelled generation potential	Metered PV output	Not applicable for simple metered reporting; performance analysis requires weather and system-loss normalisation.

4.7 Treatment of Interactive Effects

In multi-measure EPC projects, energy efficiency measures may interact with one another. For example:

- Lighting upgrades may reduce internal heat gains, affecting heating demand
- HVAC improvements may alter ventilation and cooling loads
- BMS optimisation may influence multiple systems simultaneously

These interactions can affect the overall energy performance and must be accounted for in the M&V approach.

Within the EasyPro framework:

- **Option C is preferred** where interaction effects are significant
- Where Options A or B are used, **interactions must be explicitly considered**
- Bidders must clearly state how interactions are addressed in their M&V plans

4.8 Flexibility and Justification for Alternative Approaches

While standardisation is essential, flexibility is allowed where justified.

Bidders may propose alternative M&V approaches provided that:

- The approach is **consistent with IPMVP principles**
- It provides **equal or greater accuracy and transparency**
- It does not introduce **unnecessary cost or complexity**
- A clear **technical justification** is provided

Any deviations from the recommended approaches will be evaluated as part of the tender assessment process.

4.9 Summary of Standardised Approach

The EasyPro standardised M&V framework can be summarised as follows:

- **Option C as default** for EPC bundles
- **Options A and B for specific measures**, depending on complexity
- **Option D only where necessary** and justified
- Emphasis on **cost-effectiveness and proportionality**

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- Requirement for **clear documentation and transparency**

This structured approach ensures that M&V remains both **robust and practical**, supporting the successful implementation of EPC projects while minimising unnecessary barriers to market participation.

5 Guidelines for Selecting M&V Options

5.1 Purpose of M&V Option Selection

The selection of an appropriate Measurement and Verification (M&V) approach is a key step in the design of an EPC project. While Section 4 defines standardised approaches for common project types, this section provides a structured framework to guide bidders in selecting the most appropriate IPMVP option for their specific project.

The objective is to ensure that the selected M&V approach is:

- **Technically appropriate** for the project characteristics
- **Sufficiently accurate** to support contractual guarantees
- **Cost-effective**, avoiding unnecessary monitoring or complexity
- **Consistent with EasyPro standardisation requirements**

A well-chosen M&V option ensures reliable savings verification while maintaining proportionality between the cost of measurement and the value of the project.

5.2 Key Selection Criteria

The selection of an IPMVP option should be based on a structured assessment of the key criteria included in Table 5.1.

Table 5.1 – Key Criteria for Selecting M&V Options

Criterion	Description	Implication for M&V Selection
Project scale	Size and value of the project	Larger projects justify more robust M&V approaches
Complexity of measures	Technical complexity and variability	More complex systems require more detailed measurement
Interaction between measures	Degree to which systems influence each other	High interaction favours whole-building approaches (Option C)

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Data availability	Availability of historical and real-time data	Limited data may require simplified or simulated approaches
Required accuracy	Level of precision required for guarantees	Higher guarantees require more robust M&V
Cost constraints	Budget for monitoring and verification	M&V cost should be proportionate to project value (usually between 1% and 10% of annual verified savings)

5.3 Selection Based on Project Characteristics

The guidance in Table 5.2 below provides a practical mapping between project characteristics and recommended M&V options.

Table 5.2 – Recommended M&V Options by Project Characteristics

Project Type	Characteristics	Recommended Option
Simple, single measure	Low complexity, predictable savings	Option A
Single technical system	Moderate complexity, variable performance	Option B
Multi-measure EPC	Multiple interacting systems	Option C
Complex or data-limited project	High complexity or limited baseline data	Option D

5.4 Cost vs Accuracy Considerations

A key principle in M&V design is achieving an appropriate balance between cost and accuracy (Table 5.3).

Overly complex M&V approaches can:

- Increase capital and operational costs
- Reduce project attractiveness
- Create unnecessary administrative burden

Conversely, overly simplified approaches may:

- Reduce accuracy

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- Increase risk of disputes
- Undermine confidence in savings

Table 5.3 – Cost vs Accuracy Trade-Off

Option	Accuracy	Monitoring Cost	Recommended Use
A	Medium	Low	Simple, predictable measures
B	High	Medium–High	Technical systems requiring precision
C	Medium	Low–Medium	Whole-building EPC projects
D	High	High	Complex or data-constrained projects

As a general rule:

The cost of M&V should not be disproportionate to the value of the energy savings being verified.

5.5 Decision Framework for Selecting M&V Options

To support consistent decision-making, bidders should follow a structured selection process (Figure 5.1).

Figure 5.1 – M&V Option Selection Framework

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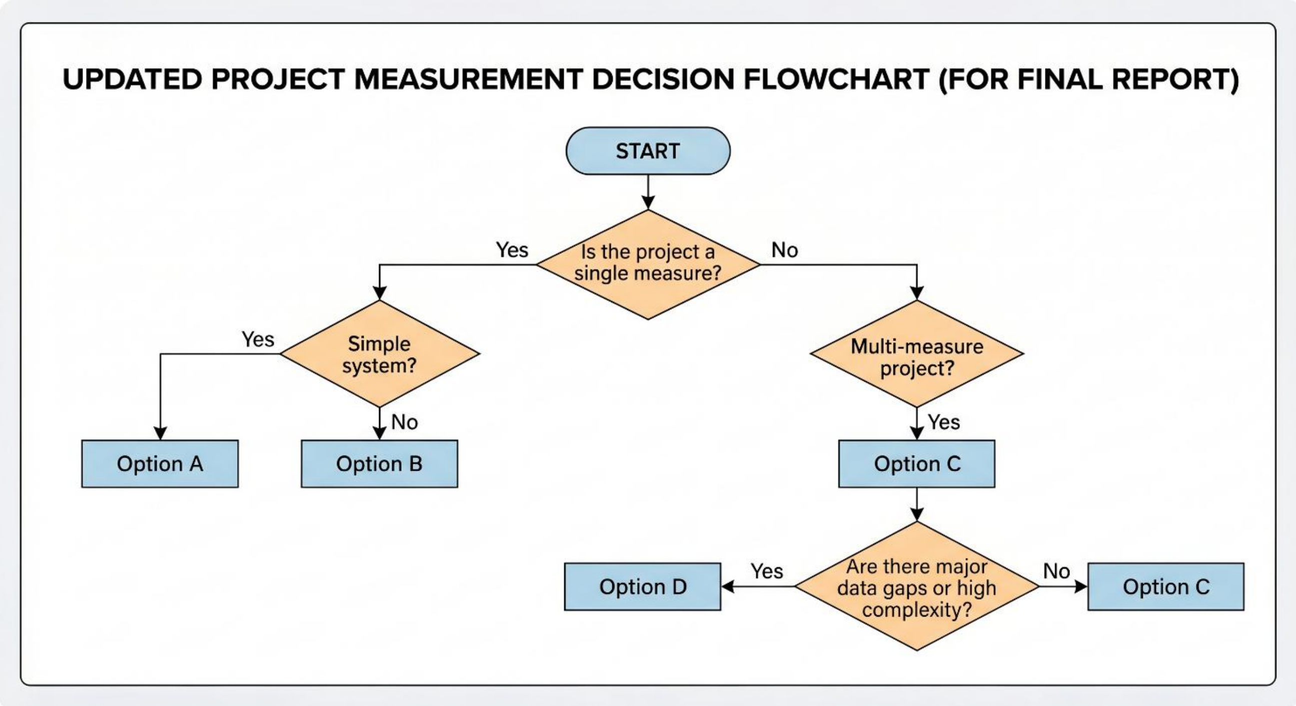

5.6 Data Availability and Quality

The availability and quality of data play a critical role in determining the appropriate M&V approach.

Key considerations:

- Availability of **historical energy consumption data**
- Presence of **utility meters or sub-metering**
- Access to **Building Management System (BMS) data**
- Reliability and completeness of datasets

Guidance:

- Where **reliable utility data is available**, Option C is preferred
- Where **system-level data is required**, Option B may be necessary
- Where **data is limited or incomplete**, Option A or Option D may be considered

Poor data quality increases uncertainty and may require more conservative assumptions, in line with IPMVP principles.

5.7 Treatment of Adjustment Variables

Adjustment variables are essential for ensuring that savings calculations reflect comparable conditions between the baseline and reporting periods.

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Common adjustment variables:

- Weather (HDDs / CDDs)
- Occupancy levels
- Operating hours
- Production or usage levels (where applicable)

Guidance:

- Projects with **significant external variability** should favour Option C or B
- Adjustment methods must be **clearly defined and justified**
- Data used for adjustments must be **reliable and verifiable**

5.8 Acceptable Deviations from Standard Approaches

While Section 4 defines standardised M&V approaches, bidders may propose alternative methodologies where justified.

Conditions for deviation:

- The proposed approach must comply with **IPMVP principles**
- It must provide **equal or improved accuracy and transparency**
- It must remain **cost-effective and proportionate**
- A clear **technical justification** must be provided

Examples of acceptable deviations include:

- Use of Option B instead of Option C for high-value systems
- Use of Option D where baseline data is insufficient
- Hybrid approaches combining multiple IPMVP options

All deviations will be assessed as part of the tender evaluation process.

5.9 Summary of Selection Guidelines

The selection of an M&V option within the EasyPro framework should follow these key principles:

- Align with **standardised approaches** defined in Section 4
- Ensure **proportionality between cost and accuracy**
- Consider **project complexity and interaction effects**
- Use **available data effectively**
- Apply **adjustments consistently and transparently**
- Provide **clear justification for any deviations**

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By following these guidelines, bidders can develop M&V approaches that are robust, transparent, and aligned with EasyPro objectives, while maintaining flexibility to address project-specific requirements.

6 Cost-Effective Monitoring and Data Collection

6.1 Purpose and Principles

Measurement and Verification (M&V) requires the collection and analysis of energy data to quantify savings. However, the level of monitoring required can vary significantly depending on the selected IPMVP option, project complexity, and required level of accuracy.

A key objective of the EasyPro framework is to ensure that M&V approaches are **cost-effective and proportionate**, avoiding unnecessary expenditure on metering infrastructure and data collection systems. Excessive monitoring requirements can:

- Increase capital costs
- Extend project implementation timelines
- Reduce the financial attractiveness of EPC projects
- Create unnecessary operational and administrative burden

To address this, the following principles shall guide monitoring and data collection:

- **Proportionality:** The cost of monitoring should be proportionate to the value of the energy savings
- **Simplicity:** Monitoring systems should be as simple as possible while maintaining required accuracy
- **Use of existing data:** Existing meters and systems should be prioritised
- **Fit-for-purpose measurement:** Only parameters that materially affect savings should be measured

6.2 Hierarchy of Data Sources

To minimise costs, data collection should follow a hierarchy that prioritises existing and low-cost sources before introducing new monitoring infrastructure (Table 6.1).

Table 6.1 – Hierarchy of Data Sources

Level	Data Source	Description	Typical Use
Level 1	Utility meters	Electricity, gas, and other utility bills	Whole-building analysis (Option C)
Level 2	Building Management System (BMS)	Existing control and monitoring systems	HVAC performance, runtime data

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Level 3	Existing sub-metering	Installed system-level meters	Pumps, lighting circuits
Level 4	Temporary measurement	Short-term monitoring or spot measurements	Option A verification
Level 5	New permanent metering	Installation of new meters and sensors	Option B or complex systems

Guidance:

- Levels 1–3 should be used wherever possible
- Levels 4–5 should only be used where required to achieve sufficient accuracy

6.3 Guidance on Metering Requirements

The selection of metering infrastructure should be based on the specific needs of the M&V approach and the characteristics of the project.

6.3.1 When New Metering is Required

New metering may be justified where:

- The selected IPMVP option requires **direct measurement of system performance** (e.g. Option B)
- Existing data is **insufficient or unreliable**
- The system has **high variability or operational complexity**
- The value of savings justifies additional monitoring investment

6.3.2 When New Metering is Not Required

New metering should generally be avoided where:

- Utility data provides sufficient accuracy (Option C)
- Savings can be estimated using **engineering calculations and spot measurements** (Option A)
- Existing BMS or sub-metering systems provide adequate data
- The cost of additional metering would be disproportionate to the value of savings

6.4 Monitoring Requirements by M&V Option

Each IPMVP option has different monitoring requirements, which should be considered when designing the M&V approach (Table 6.2).

Table 6.2 – Monitoring Requirements by IPMVP Option

Option	Monitoring Requirement	Cost Implication	Guidance
A	Key parameter measurement	Low	Use spot measurements and estimates
B	Full parameter measurement	Medium–High	Install meters only where necessary
C	Utility data + adjustments	Low–Medium	Prefer existing data sources
D	Model calibration data	High	Use only where justified

6.5 Use of Building Management Systems (BMS)

Building Management Systems (BMS) represent a valuable source of data for M&V and should be utilised wherever possible.

Advantages of using BMS data:

- Already installed in many buildings
- Provides real-time operational data
- Reduces need for additional sensors
- Supports ongoing performance monitoring

Limitations:

- Data quality and reliability may vary
- May not cover all systems or parameters
- Requires validation and calibration

Guidance:

- BMS data should be used where it meets accuracy requirements
- Data quality should be assessed before use
- Supplementary measurement may be required where gaps exist

6.6 Practical Examples of Cost-Effective Monitoring

6.6.1 Lighting Upgrade (Option A)

- Measure sample wattage of existing and new fixtures
- Use standard operating hours
- No continuous metering required

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Outcome:
Low-cost, simple verification approach with sufficient accuracy

6.6.2 Heat Pump Installation (Option B / C)

- Use electricity meter to measure input energy
- Estimate output using performance characteristics (e.g. COP)
- Adjust for weather using degree days

Outcome:
Balanced approach combining measurement and adjustment

6.6.3 Whole-Building EPC (Option C)

- Use utility billing data
- Apply regression analysis for weather and occupancy
- No additional metering required in most cases

Outcome:
Cost-effective approach capturing full project impact

6.7 Data Quality and Validation

The reliability of M&V results depends on the quality of the data used.

Key data quality requirements:

- Accuracy of measurements
- Completeness of datasets
- Consistency over time
- Traceability and transparency

Data validation measures:

- Cross-checking with multiple data sources
- Identifying anomalies and outliers
- Ensuring consistent data formats
- Documenting assumptions and corrections

Poor data quality can lead to:

- Incorrect savings calculations
- Increased uncertainty

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- Disputes between contracting parties

6.8 Data Collection Frequency and Reporting

Data collection frequency should be aligned with the needs of the M&V approach (Table 6.3).

Table 6.3 – Recommended Data Collection Frequency

Data Type	Frequency	Application
Utility data	Monthly	Option C
BMS data	Daily / hourly	HVAC systems
Spot measurements	One-off / periodic	Option A
System performance data	Continuous	Option B

Guidance:

- Higher frequency data is not always necessary
- Data resolution should match the level of analysis required
- Over-collection of data should be avoided

6.9 Summary of Cost-Effective Monitoring Approach

The EasyPro approach to monitoring and data collection can be summarised as follows:

- Prioritise **existing data sources** (utility meters, BMS, sub-metering)
- Avoid unnecessary installation of new metering infrastructure
- Apply **simplified approaches** where appropriate
- Ensure **data quality and reliability**
- Maintain **proportionality between monitoring cost and project value**

By following these principles, M&V can be implemented in a manner that is both **robust and economically efficient**, supporting the wider objective of scaling EPC deployment without introducing unnecessary barriers.

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7 M&V Plan Requirements for Bidders

7.1 Purpose of the M&V Plan

As part of the tender submission, bidders shall provide a detailed Measurement and Verification (M&V) Plan describing how energy savings will be measured, calculated, and reported throughout the EPC contract period.

The M&V Plan is a critical document that:

- Defines the **methodology for verifying energy savings**
- Demonstrates the bidder's **technical approach and capability**
- Provides the basis for **contractual performance guarantees**
- Supports **transparent and consistent evaluation of bids**

A clear and well-structured M&V Plan ensures that both the contracting authority and the Energy Service Company (ESCO) have a shared understanding of how performance will be assessed.

7.2 General Requirements

The M&V Plan submitted by bidders shall:

- Be consistent with the **IPMVP framework**
- Align with the **standardised approaches defined in Sections 4–6**
- Be **proportionate to project scale and complexity**
- Clearly define all **assumptions, methodologies, and data sources**
- Be sufficiently detailed to allow **independent review and validation**

The level of detail should reflect the complexity of the project, with more complex projects requiring more comprehensive M&V plans.

7.3 Mandatory Components of the M&V Plan

Each M&V Plan shall include, at a minimum, the components included in Table 7.1 below.

Table 7.1 – Mandatory Components of the M&V Plan

Section	Description	Key Requirements
Project Description	Overview of project scope and measures	Buildings, systems, and EEMs included

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Selected IPMVP Option	Chosen M&V methodology	Option A, B, C, or D with justification
Measurement Boundary	Definition of systems included in M&V	Clear inclusion/exclusion of systems
Baseline Definition	Method for establishing baseline consumption	Data sources, period, adjustments
Data Collection Plan	Method and frequency of data collection	Meters, BMS, utility data
Adjustment Methodology	Approach to normalising data	Weather, occupancy, operational changes
Savings Calculation Method	Formula and approach used	Transparent and consistent method
Reporting Procedures	Format and frequency of reporting	Monthly, quarterly, annual
Roles and Responsibilities	Allocation of M&V responsibilities	ESCO vs contracting authority
Quality Assurance	Data validation and verification procedures	Checks, audits, error handling

7.4 Baseline Definition Requirements

The baseline is a fundamental component of the M&V Plan and must be clearly defined.

Requirements:

- Use **representative historical data** (typically 12–36 months)
- Clearly define:
  - Energy consumption
  - Systems included
  - Operating conditions
- Apply **normalisation for relevant variables**, such as:
  - Weather (e.g. degree days)
  - Occupancy
  - Operating hours

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The baseline methodology must be:

- Transparent
- Reproducible
- Consistent with the approach defined in tender documentation

7.5 Measurement Boundary Definition

The M&V Plan must clearly define the **measurement boundary**, specifying which systems and energy uses are included in the savings calculation (Table 7.2).

Table 7.2 – Example Measurement Boundary Definition

System	Included in M&V	Notes
Lighting	Yes	Full building scope
HVAC	Yes	Main systems only
Plug loads	No	Excluded from scope
Renewable generation	Yes	PV included

Guidance:

- Boundaries must align with the selected IPMVP option
- Any exclusions must be clearly justified
- Boundaries must remain consistent throughout the contract

7.6 Data Collection and Monitoring Plan

Bidders must describe how data will be collected, including:

- Data sources (utility meters, BMS, sub-metering)
- Measurement methods
- Data collection frequency
- Data storage and management

An example of data collection plan is illustrated in Table 7.3 below.

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Table 7.3 – Example Data Collection Plan

Parameter	Source	Method	Frequency
Electricity consumption	Utility meter	Billing data	Monthly
HVAC runtime	BMS	System logs	Daily
Temperature	Weather station	External data	Daily

Guidance:

- Prioritise **existing data sources**
- Avoid unnecessary new metering
- Ensure data quality and reliability

7.7 Adjustment Methodology

The M&V Plan must define how external variables will be accounted for to ensure a fair comparison between baseline and reporting periods.

Common adjustment factors:

- Weather (heating and cooling degree days)
- Occupancy levels
- Operating hours

Requirements:

- Adjustment variables must be **clearly defined and justified**
- Methods must be **consistent and transparent**
- Data used for adjustments must be **reliable and verifiable**

7.8 Savings Calculation Methodology

The M&V Plan must clearly define how savings will be calculated.

At a minimum, the following should be included:

- Calculation formula
- Units of measurement (kWh, €, CO_2)
- Treatment of uncertainties
- Approach to aggregation (for multi-measure projects)

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General calculation approach:

Savings are determined as:

Verified Savings = Adjusted Baseline Consumption – Measured Post-Implementation Consumption

The methodology must be:

- Consistent with IPMVP principles
- Transparent and reproducible
- Suitable for independent verification

7.9 Reporting Requirements

Bidders must define how M&V results will be reported. Reporting requirements are summarized in Table 7.4 below.

Table 7.4 – Reporting Requirements

Requirement	Description
Frequency	Monthly, quarterly, or annual
Format	Standardised report
Content	Energy use, savings, adjustments, assumptions
Verification	Internal or independent review

Guidance:

- Reporting frequency should align with contract requirements
- Reports must be clear and accessible to non-technical stakeholders
- All assumptions and adjustments must be documented

7.10 Roles and Responsibilities

The M&V Plan must clearly define the roles and responsibilities of all parties (Table 7.5).

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Table 7.5 – Roles and Responsibilities

Party	Responsibility
ESCO	Data collection, analysis, reporting
Contracting Authority	Data access, validation, oversight
Third Party (if applicable)	Independent verification

Clear allocation of responsibilities is essential to avoid disputes and ensure smooth implementation.

7.11 Quality Assurance and Verification

To ensure reliability, the M&V Plan must include procedures for:

- Data validation
- Error detection and correction
- Handling missing data
- Periodic review of methodology
- **Guidance:**
- Use cross-checks between data sources
- Identify and investigate anomalies
- Maintain audit trails for all data and calculations

7.12 Standard Template Requirement

To ensure consistency across bids:

- Bidders shall use the **standard M&V Plan template**
- Any deviations must be clearly identified and justified
- The structure of the template must be maintained

This approach ensures:

- Consistency across submissions
- Easier evaluation by contracting authorities
- Reduced administrative burden

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7.13 Evaluation of M&V Plans

M&V Plans will be evaluated as part of the tender process. Suggested evaluation criteria are summarized in Table 7.6 below.

Table 7.6 – Evaluation Criteria for M&V Plans

Criterion	Description	Weighting
Robustness	Accuracy and reliability of methodology	30%
Cost-effectiveness	Proportionality of monitoring approach	20%
Clarity	Transparency and documentation	15%
Compliance	Alignment with IPMVP and EasyPro guidelines	20%
Practicality	Feasibility of implementation	15%

A simple scoring methodology could use a 0–5 scale for each criterion:

0 = Unacceptable / non-compliant
1 = Poor
2 = Significant weaknesses
3 = Satisfactory
4 = Good
5 = Excellent / fully meets best practice

The weighted score for each criterion can then be calculated as:

Weighted Score = (Criterion Score ÷ 5) × Weighting

The overall score for an M&V Plan can be calculated by adding the weighted scores for all individual criteria.

For consistency across contracting authorities, guidance should encourage evaluators to define indicative characteristics for each scoring band. For example, an "Excellent" robustness score may require clearly justified baseline methods, appropriate treatment of independent variables, uncertainty assessment, and transparent calculation procedures, whereas a "Satisfactory" score may reflect a generally acceptable methodology with limited supporting justification.

Contracting authorities may also wish to introduce minimum thresholds for critical criteria. For example, tenders scoring below a defined minimum for Robustness or Compliance could be deemed technically non-compliant regardless of total aggregate score.

7.14 Summary

The M&V Plan is a critical component of EPC tender submissions and must:

- Clearly define the methodology for measuring and verifying savings
- Be aligned with IPMVP and EasyPro guidelines

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- Be proportionate, transparent, and robust
- Provide sufficient detail to support evaluation and contract implementation

By standardising M&V Plan requirements, the EasyPro framework ensures consistency, reduces uncertainty, and supports the successful delivery of EPC projects.

8 Integration with Tendering and Contracts

8.1 Role of M&V in EPC Contracts

Measurement and Verification (M&V) is a core component of Energy Performance Contracting (EPC), as it directly underpins the contractual relationship between the contracting authority and the Energy Service Company (ESCO). In EPC agreements, payments are typically linked to the achievement of guaranteed energy savings, making the M&V methodology a critical contractual element.

Within this context, M&V:

- Defines how **energy savings are calculated and verified**
- Determines whether **performance guarantees are met**
- Forms the basis for **financial payments and adjustments**
- Provides a mechanism for **resolving discrepancies or disputes**

A clearly defined M&V framework ensures that both parties have a shared understanding of how performance will be assessed, reducing ambiguity and strengthening contractual enforceability.

8.2 Integration with Tender Documentation

To ensure consistency and transparency, M&V requirements must be clearly embedded within the tender documentation issued to bidders.

Key elements to be included in tender documents:

- **Reference to IPMVP** as the required M&V framework
- **Standardised M&V approaches** (as defined in Sections 4–6)
- Requirement for submission of a **detailed M&V Plan** (Section 7)
- Definition of **baseline methodology** and available data
- Specification of **reporting requirements and frequency**
- Identification of **acceptable adjustment variables**

By clearly defining these elements at the tender stage, contracting authorities can:

- Ensure **consistency across bids**
- Reduce the risk of **misinterpretation or ambiguity**

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- Facilitate **efficient evaluation of proposals**
- Minimise the need for post-tender clarification

8.3 Alignment with Performance Guarantees

The M&V methodology must be directly aligned with the performance guarantees specified in the EPC contract.

Key considerations:

- The definition of **guaranteed savings** must be consistent with the M&V approach
- The **baseline and adjustment methodology** must be agreed at contract stage
- The method for calculating **shortfalls or excess savings** must be clearly defined
- The **units of performance** (e.g. kWh, €, CO_2) must be consistent across all documents

Example:

If savings are guaranteed in energy terms (kWh), the M&V methodology must ensure accurate measurement of energy consumption. If guarantees are financial (€), energy savings must be translated using agreed tariffs.

Clear alignment between M&V and performance guarantees ensures that contractual obligations are measurable, enforceable, and transparent.

8.4 Payment Mechanisms and Financial Settlement

M&V plays a central role in determining financial payments under EPC contracts.

Typical payment structures include:

- **Guaranteed savings model:**
  The ESCO guarantees a minimum level of savings; any shortfall is compensated
- **Shared savings model:**
  Savings are shared between the ESCO and the contracting authority
- **First-out model:**
  The ESCO recovers investment costs from realised savings

In all cases, M&V determines:

- The **level of verified savings**
- Whether **guarantees are met or exceeded**
- The **financial value of savings**
- Any **adjustments or penalties**

A robust and transparent M&V framework is therefore essential to ensure fair and accurate financial settlement.

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8.5 Risk Allocation and M&V

As outlined in previous EasyPro deliverables, EPC projects involve a range of risks related to performance, data quality, and external factors.

M&V plays a key role in managing these risks by:

- Clearly defining how **savings are measured and adjusted**
- Distinguishing between **controllable and uncontrollable variables**
- Reducing uncertainty in **performance assessment**
- Supporting **fair allocation of risk between parties**

Examples:

- **Weather risk:** Managed through baseline adjustment (e.g. degree days)
- **Occupancy risk:** Addressed through agreed adjustment mechanisms
- **Operational risk:** Managed through clear measurement boundaries

A well-defined M&V framework ensures that risks are allocated to the party best able to manage them, reducing the likelihood of disputes.

8.6 Dispute Prevention and Resolution

Disputes in EPC projects often arise from disagreements regarding achieved energy savings. A clear and transparent M&V methodology is one of the most effective tools for preventing such disputes.

Key elements for dispute prevention:

- Clearly defined **baseline and adjustment rules**
- Transparent **calculation methodology**
- Agreed **measurement boundaries**
- Consistent **data sources and reporting formats**
- **Dispute resolution mechanisms may include:**
- Independent verification by a third party
- Review of data and calculations
- Application of agreed contractual procedures

By embedding these elements in both the M&V Plan and the EPC contract, the likelihood of disputes can be significantly reduced.

8.7 Reporting and Contractual Compliance

Regular reporting is essential to demonstrate compliance with contractual obligations.

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Reporting requirements should include:

- Verified energy consumption and savings
- Applied adjustments and assumptions
- Comparison with guaranteed performance levels
- Explanation of any deviations

Reports must be:

- Clear and transparent
- Consistent with the agreed M&V methodology
- Accessible to both technical and non-technical stakeholders

Regular reporting supports ongoing performance monitoring and ensures that both parties remain aligned throughout the contract period.

8.8 Standardisation within EasyPro Procurement

Within the EasyPro framework, the integration of M&V into tendering and contracts is based on the principle of standardisation.

Key standardisation measures include:

- Use of **standard M&V Plan templates**
- Defined **default IPMVP approaches**
- Consistent **baseline and adjustment methodologies**
- Standardised **reporting formats**

This approach ensures:

- Reduced transaction costs
- Improved comparability of bids
- Faster procurement processes
- Increased confidence among ESCOs and contracting authorities

Standardisation also supports the replication and scaling of EPC projects across multiple institutions.

8.9 Summary

The integration of Measurement and Verification into tendering and contractual processes is essential for the successful implementation of EPC projects.

Key principles include:

- M&V must be **clearly defined at the tender stage**

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- It must be **fully aligned with performance guarantees and payment mechanisms**
- It should support **fair risk allocation and dispute prevention**
- It must be **transparent, standardised, and practical**

By embedding M&V requirements into both procurement and contract structures, the EasyPro framework ensures that energy savings are measurable, verifiable, and contractually enforceable, thereby supporting the delivery of reliable and scalable EPC projects.

9 Conclusions

Measurement and Verification (M&V) is a fundamental component of Energy Performance Contracting (EPC), as it provides the mechanism through which energy savings are quantified, validated, and linked to contractual performance. The application of a robust and transparent M&V framework is therefore essential to ensure the credibility, bankability, and successful delivery of EPC projects.

The International Performance Measurement and Verification Protocol (IPMVP) offers a well-established and widely accepted methodology for M&V. However, its effective implementation requires careful adaptation to project scale, complexity, and context. Without such adaptation, there is a risk that M&V approaches may become overly complex or costly, potentially acting as a barrier to EPC uptake.

This deliverable addresses this challenge by providing **practical, standardised, and cost-effective guidelines** for the application of IPMVP within the EasyPro framework. The guidance developed achieves a balance between methodological robustness and practical implementation, ensuring that energy savings can be measured accurately without imposing disproportionate requirements on project developers or contracting authorities.

The key contributions of this deliverable can be summarised as follows:

- Establishment of a **clear and simplified interpretation of IPMVP principles** tailored to EasyPro projects
- Definition of **standardised M&V approaches** for common energy efficiency measures and project types
- Development of a **structured framework for selecting appropriate M&V options**, based on project characteristics and data availability
- Provision of guidance on **cost-effective monitoring and data collection**, prioritising existing infrastructure and proportionality
- Specification of **standard M&V Plan requirements for bidders**, ensuring consistency and comparability of tender submissions
- Integration of M&V into **procurement and contractual structures**, supporting performance guarantees, payment mechanisms, and risk allocation

Together, these elements form a coherent and practical M&V framework that supports the broader objectives of the EasyPro project.

From a market perspective, the standardisation of M&V approaches is expected to deliver several key benefits:

- **Reduced transaction costs** for both ESCOs and contracting authorities

- **Improved comparability of bids**, facilitating more efficient procurement processes
- **Enhanced transparency and trust** between contracting parties
- **Reduced performance and financial risk**, supporting project bankability
- **Increased scalability and replicability** of EPC projects across the public sector

By simplifying the application of IPMVP while maintaining alignment with international best practice, this deliverable removes a key barrier to EPC implementation and contributes to the development of a more accessible and efficient ESCO market in Ireland.

Within the EasyPro framework, M&V acts as the **verification layer** that connects baseline definition (D2.1), savings calculation methodologies (D2.3), and risk assessment (D2.6), ensuring that projected benefits are translated into measurable and contractually enforceable outcomes.

In conclusion, the guidelines presented in this deliverable provide a robust yet practical foundation for the implementation of M&V in EPC projects. By enabling accurate, transparent, and cost-effective verification of energy savings, they support the successful deployment of EPC as a key mechanism for achieving energy efficiency and decarbonisation objectives within the Irish university sector and beyond.

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