THE UNIVERSITY of EDINBURGH
Estates Department

Estates Design Guideline No. 5

Metering (Energy & Utilities)

Important Comment on Estates Design Guidelines, Assets & Standards

These Design Guidelines, Assets and Standards and the associated suite of documents have been produced in order to furnish external design consultants and contractors with guidance on required University standards for inclusion within their proposed project design.

These guidelines are to be used as supplementary information during project design stage, and as such, detail the minimum standards expected from the University Estates Department.

Please note, these guidelines do not absolve the project design team including, sub-consultants and sub-contractors of their legal and contractual obligations under, design liability, statutory regulations and health and safety legislation.

EDG No. 5 - Metering (Energy & Utilities) - Approval Procedure	
Estates Design Guidelines (Assets & Standards) No. 5 Metering (Energy & Utilities) Leads: Controls Systems Manager and Energy Manager	Name Signed Off Date
Estates Design Guidelines (Assets & Standards) No. 5 Metering (Energy & Utilities) – equality check Lead: Building Services Group Manager	Name Signed Off Date
Estates Design Guidelines (Assets & Standards) No. 5 Metering (Energy & Utilities) – check and approval Lead: Director of Estates Operations	Name Signed Off Date
Estates Design Guidelines (Assets & Standards) No. 5 Metering (Energy & Utilities) – approval by EMG	Name Signed Off Date
Estates Design Guidelines (Assets & Standards) No. 5 Metering (Energy & Utilities) – approval by Estates Committee	Name Signed Off Date
Estates Design Guidelines (Assets & Standards) No. 5 Metering (Energy & Utilities) – future review Lead: Controls Team and Energy Team	Name Signed Off Date

Version Control for Estates Design Guidelines (Assets & Standards) No. 5 Metering (Energy & Utilities)

Version	Date	Nature of Revision	Author	Approved by	Signed
1.0	January 2019				
1.0	January 2020	General updates			

Contents

1.0 Introduction

The UoE Design Guidelines (as a whole), have been developed for employees of the UoE, Design Teams, Architects, Engineers, Project Managers, external consultants and contractors. This documentation has been developed to enable Design Teams and Contractors to have a broad understanding of the principles that the University of Edinburgh will require to be adopted for any future developments.

The guide is primarily designed to be used in conjunction with Royal Institute of British Architects (RIBA) stages. The actual extent and scope of the design guide to be incorporated for any future development will be based upon the specific projects requirements.

The UoE Design Guidelines aim to discuss strategic matters and does not provide an exhaustive treatment of statutory or best practice design and compliance requirements; its primary purpose is to establish a starting point for design briefs, support the consultation process and outline existing assets and standards. It is the responsibility of Design Team readers/duty holders to ensure subsequent designs are complete, compliant and able to meet the final approved brief when measured in use.

1.1 Important Notice – Essential Prior Reading

It is essential for readers of this document to first refer to the Guide No1 – entitled *"Estates Design Guidelines (Assets & Standards) Introduction and Application"* – which serves to provide the Principles and overview with vital information and context that apply to all projects.

1.2 Purpose of the University of Edinburgh Estates Design Guidelines (Assets and Standards) – UoE Design Guidelines

The purpose of the Estates Guidelines is to act as a briefing document to give designers an overview of the minimum design requirements, constraints and challenges presented by the University of Edinburgh's particular needs. It applies to all new-build, refurbishment, minor works and change of use projects, including property leased by the University, controlling quality in the production of designs, specifications and the subsequent performance of buildings, developed to a consistently high standard and ensuring continuity throughout the University Estate.

The University of Edinburgh encourages innovation, however, all project Design Teams should ensure that their proposed projects have end user considerations and ease of maintenance at its core.

The use of the University of Edinburgh Estates Guidelines, Assets and Standards will not take the place of, or remove, any of the professional responsibility from Design Teams and Contractors to fully comply with the requirements within this document. Given the complex, diverse and growing estate, not all eventualities can be fully defined within this document.

Should any projects deviate from these guidelines, a technical submittal outlining the deviation, reason why and impact to the University maintenance strategy should be prepared and forwarded to the nominated University project representative for liaison with the Building Services Group (BSG).

A review of this deviation shall be carried out by the BSG; a final decision on the deviation shall be communicated to the appropriate design/construction team.

1.3 Interpretation of UoE Estates Design Guidelines, Assets and Standards

The Estates Design Guidelines, Assets and Standards are required to be issued with all project contractual documentation in order to inform project design and construction teams of expected standards to ensure quality continuity across its Estate.

Glossary of Terms:

1.3.1 Enforced Requirements

The use of the word(s) ‘shall’, ‘are required’, ‘is required’ ‘must’ or ‘will’ denotes a requirement that is non- negotiable and shall be used as the basis for designs, technical submissions and/or activities. If such a statement conflicts with a statutory obligation then a technical submittal shall be issued to the University project representative for liaison with the BSG for their final decision regarding compliance with the documentation.

1.3.2 Requirements Needing Confirmation

The use of the word ‘may’ denotes a negotiable requirement or indication of a solution, where innovation and further calculation, design and discussion may be required to arrive at an optimised solution.

1.3.3 Quality

The Design Guide aims to arrive at the University of Edinburgh’s highest design aspirations and standards. It may be that, at the University of Edinburgh’s sole discretion, solutions are value managed and then value engineered during subsequent design iterations. Design Teams and Contractors are encouraged to consider where value management and subsequent value engineering may result in an improved financial performance should funding constraints occur. All mechanical and electrical value management and value engineering exercises carried out shall be forwarded to the BSG for review.

1.3.4 Assets and standards

The Design Guidelines endeavours to set out Assets and Standards that will maximise the benefits realisation for the UoE to achieve its strategic objectives and maximise value for money. This will involve coordinated and optimised planning in conjunction with Procurement, robust asset selection with particular reference to existing legacy assets and standards on the University Estate, for reasons of utilisation and continuity of maintenance, replacement of parts, renewal and ultimate disposal.

1.3.5 Currency of Third Party Documents

Where superseded standards and regulatory documents are referred to in the text, the reader shall apply current revisions and amendments to their project. Should there be any ambiguity, the BSG should be contacted for clarity.

1.3.6 Proof

Where the word ‘proof’ is used, e.g. ‘proof is required’, a written report or installation certificate must be produced for approval depending on context.

1.4 Review Design Data Process (RDD)

All proposed designs shall be submitted to the Project Manager and respect Estates Teams and Building Services Group for review and comments, the response will be categorised as follows:

A. Design Team to acknowledge comments and continue to develop the design to the next stage.

B. Design Team to acknowledge comments and update the design in accordance with comments and resubmit for consideration before proceeding to the next stage.

C. Design Team to acknowledge comments and completely review and update the design in accordance to the agreed design principles and resubmit for consideration before proceeding to the next stage.

In addition to the above, the UoE may request specific technical submission to support the RDD and may include the request setting out with proof, e.g. calculations, drawings, etc.

The purpose of the RDD is to ensure designs meet the strategic requirements of the UoE and do not compromise the future operations and maintenance provision. The obligations owed by external architects, consultants and contractors to UoE and their liabilities to UoE is not in any way diminished or otherwise reduced by the RDD.

1.5 The Obligations Owed

By external Design Teams, consultants and contractors to University of Edinburgh and their liabilities to University of Edinburgh is not in any way diminished or otherwise reduced by the approval process. University of Edinburgh is not taking over the roles and duties of the external Design Teams, consultants and contractors who will remain legally responsible for the design and/or works carried out by them or on behalf of their staff, agents, sub- consultants and/or sub-contractors.

1.6 Version Control and Updates

The Estates Design Guidelines, Assets and Standards will be updated annually. The anticipated date of issue being January each calendar year. This is subject to change.

The version number will, using 2018 as an example, move from 2018 V1.0 at the end of January to 2019 V1.0 for the following year. The picture or colour of front cover of each new version will be changed to simplify referencing.

Any new or amended content is highlighted in yellow so readers can easily identify changes from previous versions. If there are no further revisions, a guidance note will accompany the issue.

1.7 Purpose of UoE Design Guideline No. 5

The purpose of this document is to set out the guidelines and standards that apply to UoE Estate and its design requirement for Metering (Energy & Utilities) as set out by the Energy Team and Controls Systems Team. This document will apply to new build and refurbishments in existing buildings. In some cases, this standard exceeds the Building Regulation requirements, as it represents good practice in the Higher Education sector.

This document applies to all buildings managed or owned by the UoE. In tenanted buildings any proposed changes to any part of a building which will affect the Metering (Energy & Utilities) systems must first receive permission from the Energy Team and Controls Systems Team and the Landlord of the property or nominated agent and be written in the respective lease.

This document indicates the University's generic Metering (Energy & Utilities) systems Client Requirements. Consultants must also refer to specific project requirements identified by the University's Project Leader. They must fully integrate any new design into the University's Automated Meter Reading (AMR) and automated Monitoring and Targeting (aM&T) systems.

The Building (Scotland) Regulations set out to ensure that new buildings and works achieve the objectives of the Building (Scotland) Act 2003 in terms of health, safety, welfare, convenience, conservation of fuel and power and sustainable development. The purpose of this guide is to specify the standard that is required by the UoE.

The Energy Team and Controls Systems Team must be consulted at the appropriate time within the design process, initially when the form and function of the building has been established and a schedule of accommodation and adjacencies has been completed.

This UoE Design Guideline No. 5 is for designers, engineers, specifiers, installers and commissioning and maintenance engineers of Metering (Energy &Utilities) for UoE Estates from the Developed Design Stage (RIBA Stage 3) to when the building is in use (RIBA Stage 7.) It aims to:

- Align the requirements of the Technical Standards (Scotland) Regulations/Building Regulations, CIBSE Guide H Building Controls Systems, CIBSE TM39 and the University. There is potential conflict between these as the Technical Handbook/Building Regulations are generic and often prescriptive whilst Building Control Systems encourages creative solutions relative to actual use and management
- Align the requirements of Energy Efficiency in Buildings (CIBSE Guide F) and the University as Energy Efficiency in Buildings seeks to inform a very diverse audience and aims to be pertinent to many groups involved in buildings besides building services engineers, including building developers/financiers, specifiers, architects, surveyors, letting agents, energy managers and consultants and building owners/operators
- Provide an indication of non-prescriptive preferred solutions and appropriate standards. The content is not a statement of requirements or intended to replace existing British or European technical standards or national guidance; reference to these will still be necessary.

Metering per se does not save energy. It is the actions taken, as a result of installing and monitoring meters that can achieve quantifiable energy savings. It is essential that meters are selected and installed correctly, to provide the information for the monitoring and targeting process that is a key part of energy management.

The Scottish Building Standards Technical Handbook: Non-Domestic – Energy (Section 6) Chapter 10 recognises the valuable role of metering and therefore includes suggestions for sub-metering non-domestic buildings based on CIBSE TM39. These regulations seek to ensure that building designers include appropriate metering at the design stage, to enable building owners and operators to have a clear way of establishing where, when and how energy is being consumed.

Although the capital cost of individual meters has reduced in recent years, the cost of installing direct metering throughout a large building can still be significant. However, it is not always necessary to install large amounts of direct metering to establish end-use energy consumption, in this respect it is essential that the Design Team liaise and consult with the Energy Team and Controls Systems Team, to optimise the cost of metering against practicality, the value of the information gained and future energy savings.

If due to the nature of the project, certain aspects of Metering (Energy & Utilities) are not covered within these guidelines and standards, the relevant codes of practices, British Standards and building regulations are to be applied and followed, subject to timely consultation with the Energy Team and Controls Systems Team.

For any general and specific queries, further advice can be obtained from the Energy Team and Controls Systems Team. In the event that documents referred to within this document have been superseded, then most recent versions are to be referred to.

Consultants and contractors must obtain approval in writing for any variation from these requirements.

Reference is made to the nominated field equipment list attached at Appendix 1.

Before incorporating these client requirements in, e.g. tender documentation, etc., please always check with the UoE project manager or the Energy Team and Controls Systems Team that you have current issue of both these client requirements and the field equipment list.

Please always approach directly the Energy and Controls Systems Teams to discuss any point of clarification or possible improvement and to obtain further copies of the client requirements.

Energy and Controls Teams
Estates Department – Estates Operations
9 Infirmary Street
Edinburgh
EH1 1NP

General Enquires – 0131 650 9157

2.0 Legislation and Best Practice Standards for Reference

The University will comply with all relevant legislation and regulations relating to the design and structure of the building. Academic, administrative buildings and all residential property are subject to the requirements of the Technical Standards (Scotland) Regulations/Building Regulations Section 6, CIBSE Guide F: Energy Efficiency in Buildings, CIBSE Technical Memorandum (TM39) Building Energy Metering, etc.

These standards allow detailed professional knowledge and judgement to be applied in order to develop a final design solution, which will satisfy projects that are more complicated.

3.0 Design Consultation and Notification Process for Projects

The University of Edinburgh Energy and Controls Systems Teams must be consulted and invited by the Project Manager and Design Teams to comment on the Metering (Energy & Utilities) aspects of a project and design proposals at an early stage and throughout the Plan of Work stages. The Energy and Controls Systems Teams or other competent persons acting under the Energy and Controls Systems Teams and authorised to do so, must approve the proposed Metering (Energy & Utilities) at appropriate stages of the design and construction.

If any building or part of a building undergoes a change of use that might affect the Metering (Energy & Utilities) Systems wider metering strategy, it is essential that the Energy and Controls Systems Teams are fully consulted with, to ensure that the Metering (Energy & Utilities) proposals are reviewed and to confirm that they remain appropriate to deliver the Metering Strategy and overall building use philosophies.

The selection of appropriate options at design stage, through consultation with key stakeholders, i.e. Architect, Consulting Engineer, M&E Engineers and the UoE Energy and Controls Systems Teams, may serve to mitigate unacceptable functional risks to users or unacceptable on-going cost and managerial issues. Addressing issues at a late stage is likely to cause conflict, delay, additional expense or management burden and have a negative impact on environmental conditions and operation of the building. The Controls and Energy Teams must be privy to a clear understanding of how the building and facilities are to be used and operated, in order to develop optimum applications and flexibility in operation. The project must provide the flexibility for future proofing of metering facilities and ensure that all anticipated installations and connection points are duly made.

Early and comprehensive consultation with the Energy and Controls Systems Teams is key to achieving good cost-effective Metering (Energy & Utilities) Systems standards compliant with relevant legislation. The Energy and Controls Systems Teams and other relevant persons shall be consulted on a regular basis throughout in an open, transparent manner. Effective consultation should ensure that the potential negative effects are mitigated and improvements can be considered for inclusion. Consultation should not cause any delay and is likely to reduce cost.

Refer to Appendices No.4: Metering Process and No.5 RIBA Stage Requirements for consultation points.

4.0 Introduction and Objectives

UoE Sustainability and Energy strategies articulate the following aims:

- To achieve the Zero by 2040 carbon target in our Climate Strategy
- To create a campus which supports UoE's academic, research and enterprise activities in a sustainable way
- To enable, empower and support all UoE communities to address our environmental sustainability impacts
- To provide the education, advancement, dissemination and application of sustainable development
- To maximise the wider impact of UoE's environmental sustainability activities at local, regional, national and international level through collaboration, partnership and communications
- To become a leader across the HE sector in terms of environmental sustainability.

The implementation of comprehensive energy and water metering across the campus will help to achieve these aims by:

- Helping the Estates Department to manage the Estate to reduce utility consumption and associated carbon emissions and make buildings more comfortable to work in
- Providing visibility of energy and water consumption that is being used across campus to facilitate culture change within the UoE community
- To allow academics and students to use the Estate as a living lab for sustainability research by providing appropriate data.

This Metering Design Guideline No. 5 has therefore been prepared to provide a structure for improving metering across the University Estate to achieve these aims.

4.1 Objectives of Metering

The following objectives for metering at UoE have been identified:

- Ensure system efficiency
- Ensure systems operating correctly
- Collect data for reporting, including carbon reporting, regulatory compliance and baselining
- Financial management
- Inform design and investment decisions
- Inform infrastructure management
- Improve visibility/usability of energy data.

5.0 Measurement Hierarchy

The primary objective of the metering system is to allow utility input into each building to be accounted for. Each building must have its own electricity, heat/cool and/or gas and/or steam and water meters that are connected to the site Automated Meter Reading (AMR) system located in the Estates Energy Office.

The University operates a number of energy centres including extensive CHP generation facilities with private distribution networks. Additional metering will be required where buildings are to be connected to the University networks. AMR will be deployed at appropriate points throughout the network to monitor generation, optimum operation, standing losses and utility delivery, creating appropriate checks and balances to allow ongoing validation of the data being generated. For projects involving CHP generation and networks, full consultation and approval is required with the Energy Team and Controls Systems Team and Building Services Group. A metering hierarchy should be provided based on a series of tiers with various metering points being required in each tier. For projects including Solar PV metering to be provided at inverter level and main output. Metering strategies shall not design in virtual meters to calculate energy and utility usage.

In addition to the normal metering provision:

- Where a building is under consideration for Capacity Markets and Demand Side Response, the associated metering must be compliant to industry standard relevant specifications
- Renewable generation – suitable metering to allow application for feed-in tariffs and incentives schemes
- Renewable heat – suitable metering to allow application for the Renewable Heat Incentive (RHI) Scheme or any future replacement of the RHI.

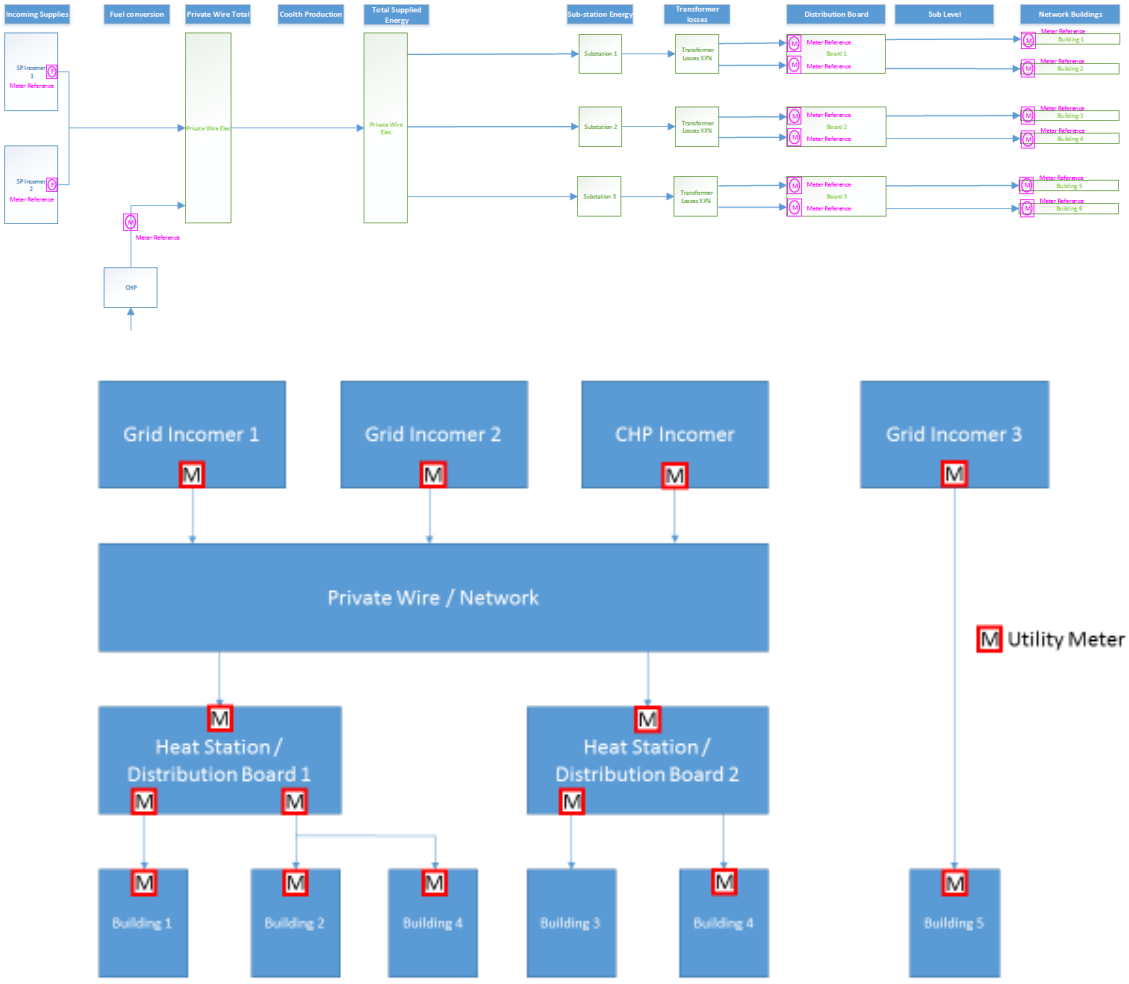
The metering topology within buildings and campuses shall be designed in a hierarchy to provide suitable and sufficient measurement and validation in the form of mass balance. As a minimum, sufficient metering shall be allowed to incorporate separation of monitoring of individual buildings utility consumption, without the use of inter meter calculations. Where sub-metering is used for analysis of consumption across different zones, then each sub-circuit will require a separate metering arrangement with respect to specific usage in addition to the main meter.

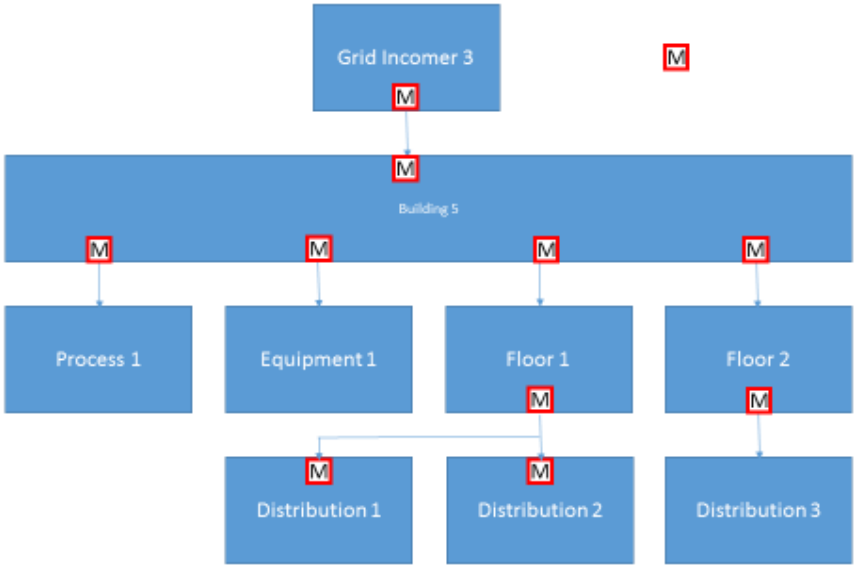
The proposed metering topology and hierarchy will be subject to consultation and approval by the Energy Team and Controls Systems Team. The measurement hierarchy defines how energy meters shall be set up and reported. It is critical that “meter trees” showing the exact hierarchy within each site and building are developed to facilitate the understanding of the services structure, and for example, avoid double counting of energy or under-reporting of energy.

Note – there are cases when the requirement to have a meter will also dictate the services infrastructure, e.g. tenants, catering outlets, etc.

5.1 Metering Schematics – Examples

Note the examples provide suggestions for meter hierarchies and present a range of options, which can be tailored for individual projects.





5.1.1 Site Level Metering

The definition of a site would normally be a building or cluster of buildings, which has its own address and building number.

The following link is available via a University login:
https://www.ed.ac.uk/estates/buildings-information/buildings-by-building-number

The metering installation will be capable of capturing and recording consumption data at half hourly intervals.

The Design Team shall provide a table of predicted design loads to be used in the metering verification and check process.

5.1.2 Building Level Metering

Where the incoming utility meters supply multiple buildings within a site, each building must be fitted with AMR connected meters for each utility consumed. Where a site consists of a single building, then site level and building level metering are one and the same. The primary objective of the University metering strategy is to provide building level metering across the entire portfolio.

5.1.3 Zone Level Sub-Metering

Zone level sub-metering refers to the installation of sub-meters for monitoring energy and utility consumption of specific areas of a building, e.g. tenanted areas, retail, laboratory, etc. It is recognised by the University that, whilst the provision of zone Level energy metering would provide some benefits, the cost of installing a full sub-metering system could be prohibitively expensive. The extent of zone level sub metering must be established as early in the design process as possible, through consultation with the Energy and Controls Systems Teams. It is recommended that zone level metering only be fitted to specific tenanted or specific use areas within buildings.

When new buildings are commissioned, sufficient sub-metering shall be installed to be able to monitor energy usage at a level appropriate to the building's use. This may be by building floor or functional area. Zone level metering should not be installed on a widespread basis across the building unless there is a specific reason for doing so. Other requirements, such as financial accountability, may impact on the design of the metering.

5.1.4 Service Level Sub-Metering

Service level sub-meter differs from zone level sub-metering in that it monitors energy consumption from specific items of plant (e.g. lighting, pumps, air handling units and chillers.) Service level sub-metering can include gas, electric, heat, cool, steam and water as appropriate.

All new buildings shall have full service level sub-metering in accordance with CIBSE TM39, subject to consultation on practicality, effectiveness and approval by the Energy Team and Controls Systems Team. It is also a requirement of the Building Regulations that service level metering be installed when carrying out major refurbishments and changes to plant. An example of the requirements would be heat meters on all main circuits within the plant room for larger projects. Lighting and small power should be separately sub-metered where appropriate.

For energy centres or major low carbon or renewable technology installations sufficient metering to be provided to allow a proper understanding of the efficiency of the technology to be provided, including thermal storage where part of the installation.

Service level sub-metering is required to validate the impacts of operational, controls and equipment changes made as part of any energy savings campaigns.

6.0 Metering Requirements

Meters measuring consumption for any given building may be a mix of utility supplier meters (fiscal meters) and UoE managed meters.

The meters shall be connected to the existing site Automated Meter Reading (AMR) system by a Modbus connection, either as part of a single communications loop or by a pulse collector on the same loop. Pulse meters are only permitted for gas and water. The Modbus gateway (referred to as the "gateway") will transmit the data to the site system via the University IT network. Where there is not a gateway close to the meter installation, a new gateway will be required. The University Energy Team and Controls Systems Team must be consulted during project design and at the earliest practical time to consider the metering requirements.

The gateways will be supplied, installed and commissioned by the contractor with liaison with the Energy Team and Controls Systems Team. The gateways will be specified to the contractor by the Energy Team and Controls Systems Team, who will also agree the location it is to be installed. Typically this gateway shall be installed adjacent to the main BEMS control panel and the meters wired back with final terminations made at the meters and gateway by the BEMS contractor. The gateway should be positioned for ease of working and housed in a suitable enclosure.

A communication network schematic must be produced by the installing contractor, indicating the relative positions of all meters and their associated sensors on the network. This schematic is to include the meter references and names provided by the Energy Team on the commissioning version of the metering schedule.

All meters shall be installed and commissioned complete with a label identifying its use. The Energy Team will advise the meter number to be included on the meter label based on the metering schedule provided by the project team. An initial meter schedule is to be provided at RIBA Stage 3 / 4 for review by the Energy team. The meter schedule is to be included with the metering requirements in any tender documents / specifications issued.

The gateway power supply, including final connection, is part of the electrical package. A labelled, fused 230V spur, with indication, shall be provided by the electrical contractor fed from a distribution board. Power shall not be derived from the BEMS panel.

The gateway network point is part of the IT package. A double network point should be fitted to allow for a commissioning device connection. The IT points should be positioned so that a standard patch lead, 2m max, can be plugged in.

The Energy Team will arrange with Information Services for the new gateway to be commissioned on the BEMS VLAN.

6.1 Metering Process and RIBA Stages

A flow chart showing the metering process and roles and responsibilities is provided in Appendix No.4.

A Check List for RIBA stage requirements is provided in Appendix No.5, based on the metering process.

6.2 Fiscal Meters – General

In general, the Energy Team must be consulted in respect of the utility meter, providers, operators and administrators, to ensure the correct University arrangements are in place.

The University Energy Office must be contacted for any works which involve a main fiscal meter for electricity, natural gas or water. This is to ensure the correct supplier forms are completed for disconnections, new connections and addition of supplies to our utility contracts.

If any works require a temporary disconnection of an electricity supply a Letter of Authority can be provided from the Energy Office which will enable the contractor to contact the electricity supplier directly to organise these works.

The contact details for the energy office are: -

The University of Edinburgh
Estates Department
9-11 Infirmary Street
Edinburgh, EH1 1NP

David A Jack
Energy and Utilities Operations Manager
Tel: 01316509536
Mob: 07920468146
E-Mail: d.a.jack@ed.ac.uk

The calibration and upkeep of Fiscal meters is normally the legal responsibility of the meter operating company. For UoE projects, the following ancillary requirements must be followed:

- Fiscal electric meters should be ordered to come with a set of auxiliary outputs for connection to the University AMR. In addition, a separate check meter must be installed, selected from Appendix No 1 and connected to the AMR. Connection to the AMR should be by the BEMS contractor
- Fiscal water meters will only be connected to the licensed providers AMR system. In addition, a check meter must be installed inside the building which must be accessible and easily readable and its final location is to be agreed with the Energy and Controls Systems Teams. The check meter must be selected from Appendix No 1. Connection to the AMR should be by the BEMS contractor
- Fiscal gas meters should be ordered to come with an intrinsically safe interface unit “chatterbox” pulse output splitter, supplied and installed by the meter administrator. The “chatterbox” must have sufficient outputs to provide signals to the shipper, network and University AMR, all to be agreed with the Energy and Controls Systems Teams. Connection to the University AMR should be by the BEMS contractor.

6.3 UoE Meters and AMR

In general, the University AMR reads Modbus electric and heat/cool meters and pulses for water, gas and steam. For list of approved AMR meters, see Appendix No 1. Any variation must be approved in writing by the Energy and Controls Systems Teams.

6.3.1 Measurement Devices

It is required that the specifications shown below be applied as appropriate whenever a new meter is installed. This applies to any new buildings that are commissioned, to refurbishment projects, and to replacement meters that are installed.

All meter displays shall be located so that they can be easily read, from left to right, with displays fully visible, readable from floor level, and orientated horizontally.

Meters shall be sized appropriate to the application, so that the AMR can depict reasonable daily profile graphs of the utility being measured. The meter should have sufficient display digits to avoid “going round the clock” in less than 4 years.

6.3.2 Gas Meters

Fiscal Meters

All incoming gas supplies should be fitted with fiscal meters in accordance with the current Code of Practice for Gas Meter Asset Managers.

Gas Sub-Meters

Where a gas supply services more than one building, or building services function, gas sub-metering should be installed in order to accurately apportion the gas usage.

For example, if an incoming gas supply serves heating boilers, domestic hot water calorifiers and catering, then all of the three functions should be fitted with sub-meters.

Gas Meters – General Requirements (applies to both main and sub-meters)

All gas meters should comply with the requirements of BS 6400 and should be fitted with pulse outputs. Connection to the pulse signal should be via an intrinsically safe interface unit (e.g. a Chatterbox) where necessary.

Any gas meter having a flow greater than 40 cubic metres per hour, should be fitted with a pressure and temperature correction device designed in accordance with BS-EN 12405. Where gas sub-meters are operating within elevated pressure systems a pressure and temperature correction device designed in accordance with BS-EN 12405 will also be fitted.

Where these devices are fitted, outputs will be provided for both converted and unconverted units of volume. The University AMR should receive both the converted and unconverted volume signals for checking and audit purposes.

6.3.3 Electricity Meters

Fiscal Meters

All electricity supply point meters should provide a Pulse Output, which should be accessible via Customer Access Terminals (CAT box.) These should be used to allow the direct connection of the meter to the site AMR system and should be additional to any AMR connections required by the utility supply company. In addition, a separate check meter must be installed, selected from Appendix No 1 and connected to the AMR. Connection to the AMR should be by the BEMS contractor.

The pulse outputs should be suitably scaled to provide adequate resolution relative to the size of the supply (this will normally be 1 pulse per kWh or 1 pulse per 10 kWh.)

Site Electric Meters and Sub-meters

Electrical meters will normally be supplied and set up as part of switchboards provided by the electrical contractor in accordance with Electrical Engineering Services Guidelines No 6 requirements.

As a typical guide for CHP generation and networks, please consider the following:

- At HV level import/export AMR meters to record at the fiscal incomers and HV input to transformers.

At the CHP Energy Centre, the following meters to be included:

- CHP output at generator on to the network
- CHP panel parasitic loads
- CHP/Energy Centre supplies (mechanical control panels, lighting circuits)
- Import/export meter on supply to/from private wire.

At substation level, LV metering of the incoming supply to each bus bar and all outgoing ways. If any outgoing ways supply more than one building, additional meters will be required at either the outgoing supply or incomer for each building. All new building level switchboards shall have incoming and outgoing supplies metered. For meter types, see Appendix No 1.

Modbus communication wiring shall be incorporated within the panel, with provision for “in” and “out” field cables in a dedicated section for connection to the University AMR. The internal wiring shall include any spare sections. Meters shall be capable of being replaced without a need for a shutdown.

Current transformers must be matched to the meters and the correct meter factors used. Current transformers should be installed the correct way round with respect to supply and load operation.

Electricity Meters - General Requirements

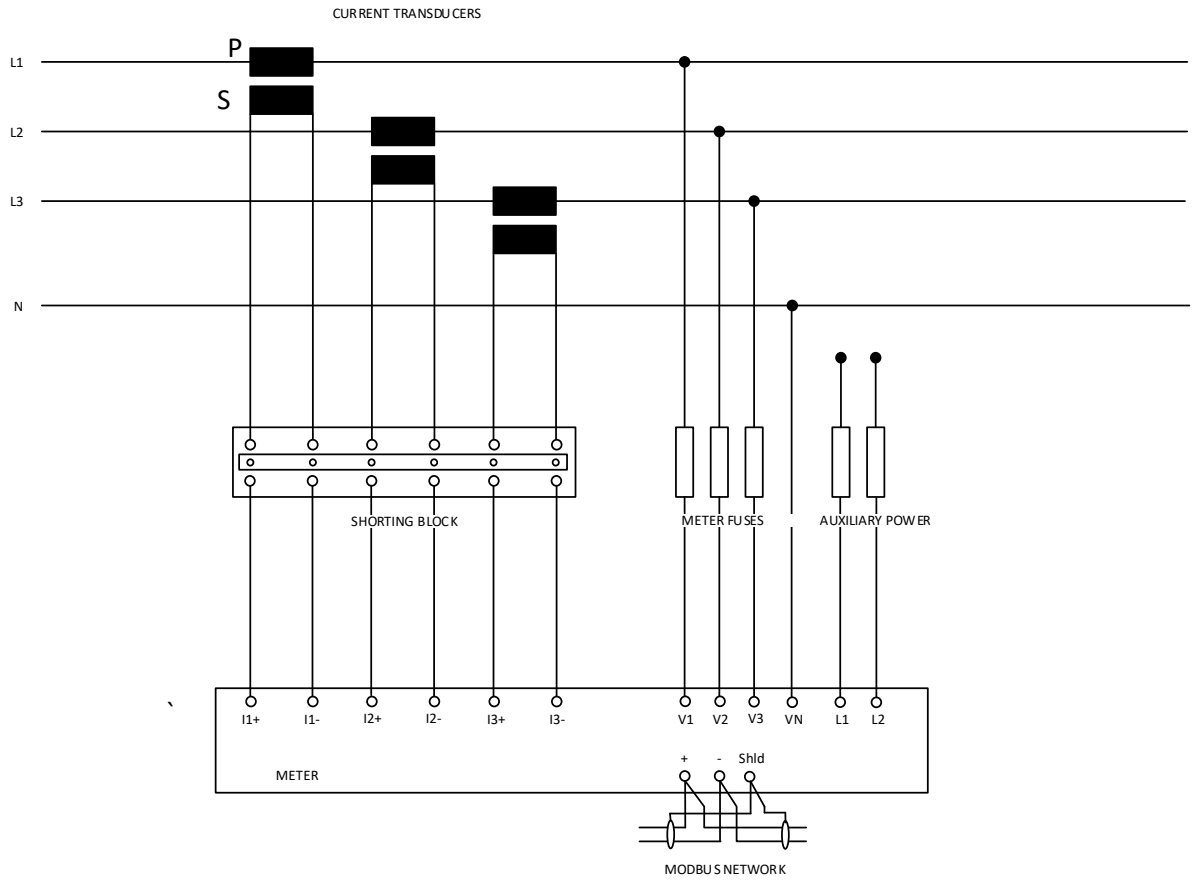
The following table details the requirements of the electricity meters:

No.	Requirements
1.	CTs and voltage connections for each phase to be provided with meter and calibrated as a single unit at the switchgear panel manufacturer's works. Installation to be in accordance with metering and CT manufacturer's recommendations. All meters will be connected to low voltage supplies using current transformers and direct voltage connections. CT ratios to be recorded on the panel diagrams and provided to the client
2.	Meters to be installed in accordance with manufacturer recommendations
3.	AMR interface requirements – Modbus RTU communications protocol to be employed. Meters are to be configured as Modbus slave. Units within a location are to be daisy chained in accordance with RS485 standards using compliant cabling with correct terminations

No.	Requirements
4.	Electrical connections to meters are to be made via interposing terminal rails comprising appropriately rated fuse disconnect terminals for voltages and shorting links for CT connections, to facilitate safe replacement of meters
5.	Electrical switch boards shall be fitted with suitable fuses, shrouds, links and means of isolation so that meters can be replaced without having to power down the board or essential supplies. Spare ways to include the same and CTs installed. Shorting links must be fitted to CTs on spare ways and must be left in the closed position if a meter is not installed
6.	All meters not mounted in electrical switchboards shall be mounted in easily accessible positions, out-with hazardous areas, at heights where they can be clearly read from ground level without the use of ladders or access equipment and follow requirements as detailed in Item 5 above
7.	Electricity meters on generator circuits must have an auxiliary supply from the normally live circuit

Electricity Meters – Typical Wiring

The diagram below indicates the typical wiring expected for the current and voltage transformers. Note that these should be brought back to a terminal rail block. The meter to be connected to the other side of the terminal rail block.



6.4 Water Metering

6.4.1 Fiscal Meters

All incoming water mains must be fitted with water meters, by the water supply company, i.e. Scottish Water, unless the property is exempt from volumetric water charges.

Where these are fitted with AMR it must still be possible to take a manual meter reading without the need to remove the auto-reader head.

Water meters must be installed in straight pipework to ensure accurate operation in full accordance with manufacturers' recommendations.

- In addition, a check meter must be installed inside the building which must be accessible and easily readable and its final location is to be agreed with the Energy and Controls Systems Teams. The check meter must be selected from Appendix No 1. Connection to the AMR should be by the BEMS contractor.

6.4.2 Sub-Meters – Water

Where feasible (for example in new buildings and during major refurbishments) sub-metering should be installed on all major consumers of water.

For example, water sub-meters must be installed on commercial kitchens, process water and tenant areas, etc.

All water sub-meters should be capable of being fitted with a manufacturer provided volt-free pulse output module. Where these are fitted it must still be possible to take a manual meter reading without the need to remove the auto-reader head.

Appropriate valves must be installed to allow easy meter replacement.

6.5 Heat Metering (principles also apply to cooling meters)

Heat meters to be Modbus type.

Heat meters will be installed at the following points of a heat network scheme:

- Output from each source of heat or cooling, e.g. boilers, chillers, CHP, heat pumps, etc
- Waste heat plant
- Input to heat or cooling network
- Input to heat or cooling point of connection of each building
- Sub-meters where appropriate.

Buildings which have their own boilers shall have heat meters fitted where the boiler capacity exceeds 100kW.

Buildings which have their own chillers shall have cooling meters fitted where the chiller capacity exceeds 30kW.

Note that where existing campus wide CHP systems have the facilities for monitoring heat/cooling meters by both the BEMS and the AMR, then this should be provided on all subsequent buildings.

This may require additional communications cards to be provided with the meter, and additional wiring, or use of signal splitters. The type of communications cards required by the BMS will depend on the local BMS system and so will need to be confirmed. If in doubt, seek guidance from the University Energy and Controls Systems Teams.

Heat meters must be installed in accordance with the manufacturer's instructions. For example:

- In straight pipework to ensure accurate operation, the manufacturer will generally specify how many 'pipe diameters' of straight pipe should be allowed before and after the meter. This must be included and be specified on the design drawings and checked at the commissioning stage
- Meters should be installed in clean systems as dirty systems reduce accuracy, reliability and can ultimately lead to blockages
- Check additive/coolant % mix for heat and cooling meters in a thermal-fluid mix environment and compatibility with flowmeter
- Appropriate valves must be installed to allow easy flowmeter replacement
- Flow meter and temperature probes to be installed in accessible locations to allow for maintenance.

6.6 Meter Commissioning

The contractor will work with the University Energy team to commission the system. The responsibilities are as follows:

Task	Responsibility
Site verify correct connection of meter and reading accuracy and supply certificate	Contractor
Verify connection to Gateway and commission meter onto AMR system	Contractor with input from UoE
Metering verification and check against predicated design load, with agreed reference and recorded on meter schedule.	Contractor

Where the project includes over 50 meters, the project will provide a specialist meter commissioning engineer to set up the meters on the metering system. This will be Elcomponent unless an alternative automatic meter reading system has been agreed by the Energy Team.

Elcomponent Ltd
Unit 5 Southmill Trading Centre
Bishop's Stortford
Herts
CM23 3DY

Telephone: 01279 503173
FAX: 01279 654441
E-mail:catrina@elcomponent.co.uk.
https://www.elcomponent.co.uk/

If less than 50 meters, the Energy Team will commission the meters.

6.6.1 Commissioning Process

The commissioning process will be as follows:

- The project completes the project section of the Meter Schedule (Appendix 2) and provides to the Energy Team at least 10 weeks prior to handover
- Where Specialist Meter Commissioning Engineer is appointed, the Energy Team will complete and return the Meter Schedule for the project to pass onto the Specialist Meter Commissioning Engineer
- The project provides date(s) for meter commissioning when all meters will be installed and functional and gateway(s) and data ports will be in place and commissioned to the Metering VLAN
- Meter setup and commissioning carried out as per schedule and required documentation provided to Energy Team
- Meters commissioned on to AMR system by Specialist Meter Commissioning Engineer / Energy Team including updating Master Meter list and New Meter Form
- Any issues to be resolved by Contractor and Specialist Meter Commissioning Engineer / Energy Team before acceptance of the metering equipment

6.6.2 Equipment Communications Requirements

The gateway and data requirements are covered in Section 6.0.
The following requirements apply to the meters:

- Meters set up for correct recording parameters and compatibility with the AMR system. This includes settings as follows:

Parameter	**Setting**
Address	As per meter schedule
Baud Rate	9600
Parity	None
Stop Bits (if available)	1
Display	Display to switch off after 1 minute or similar where possible

6.7 Meter Calibration - General

All new meters will be supplied with a certificate of calibration. Where auxiliary equipment is required then calibration certificates will also be required for that equipment. Appropriate information will be recorded on the metering schedule to allow as installed site verification of metering. If required, specialist sub contractors will be utilised to provide “as installed” calibration and verification of metering.
The contractor will work with the University Energy team to ensure appropriate calibration records for meters on the system. Re-calibration periods and requirements will also be considered when metering is being selected.
Early consultation with the Energy Team will allow any additional operational or legislative calibration requirements to be considered in the design, installation and commissioning of the metering system.

7.0 Appendices

7.1 Appendix No. 1: Metering Field Devices

Item	Range/Spec No	Manufacturer
Electricity Meters	Meters should meet the requirements of the Measuring Instruments Directive (MID 2004/22/EC) where used for tenant billing as advised in the schedule of metering equipment and should have a tamper proof seal. Meters to be Schneider PM5111 or equal and approved by the Energy Team. The PM5111 is MID compliant and has Modbus connection as standard. Where there is extensive sub-metering Digi-Ware or other similar systems can be considered.	Schneider
Water Meters	The range of available meters and applications is large. Meters should be selected suitable for the application, taking into account anticipated consumption, horizontal/vertical pipework, WRAS, pipework material, fluid temperature and pressure, etc. Meter must come with appropriate replaceable pulsing unit. Meter must be able to be read from normal floor level, with display facing outwards.	
Heat Meters	Preferred meter is Kamstrup 603 with Modbus card. To be supplied with appropriate matched temperature sensors and pockets. Length of sensor cable needs to be considered. Options are required for display to be remote from flow meter. Meter must be able to be read from normal floor level, with display facing outwards. Flow meter to be Kamstrup Ultraflow and supplied with the heat meter calculator.	Kamstrup
Chilled Water Meters	Preferred meter is Kamstrup 603 as above. Alternatives may need to be considered when glycol is present – contact Energy and Controls Systems Teams for advice.	Kamstrup
Gas Meters	The range of available meters and applications is large. Meters should be selected suitable for the application, taking into account anticipated consumption, horizontal/vertical pipework, pipework material, temperature and pressure, etc. Meter must come with appropriate replaceable pulsing unit. Meter must be able to be read from normal floor level, with display facing outwards. High volume or elevated pressure meters should be supplied with pressure and temperature correction equipment.	

Alternatives to the above list of preferred equipment may be acceptable if approved by the Energy Team and Controls Systems Team prior to commencement of the contract.

7.2 Appendix No 2: Metering Schedule

Completed by Project Team						**Completed by Energy Team**				
Building Number	**Building Name**	**Meter Type / Model**	**Meter Contract reference**	**CT Ratio / Flow Meter Size**	**Benchmark (Annual kWh)**	**Metering System Reference**	**Metering System Name**	**Modbus Address**	**New / Existing Gateway**	**MPC**
Examples:										
0001	*Old College*	*Electricity / Schneider PM5111*	*Main Incomer No.1*	*2500/5*	*1,500,000*	*0001NE001M*	*Old College Main Incomer 1*	*02*	*New – Old College Plant Room*	*12*
2705	*SCRM*	*Heat / Kamstrup 603*	*Boiler No.2 Heat Meter*	*DN80*	*500,000*	*2705NH003S*	*SCRM Boiler 2 Heat*	*103*	*Existing – SCRM Plant room*	*6*

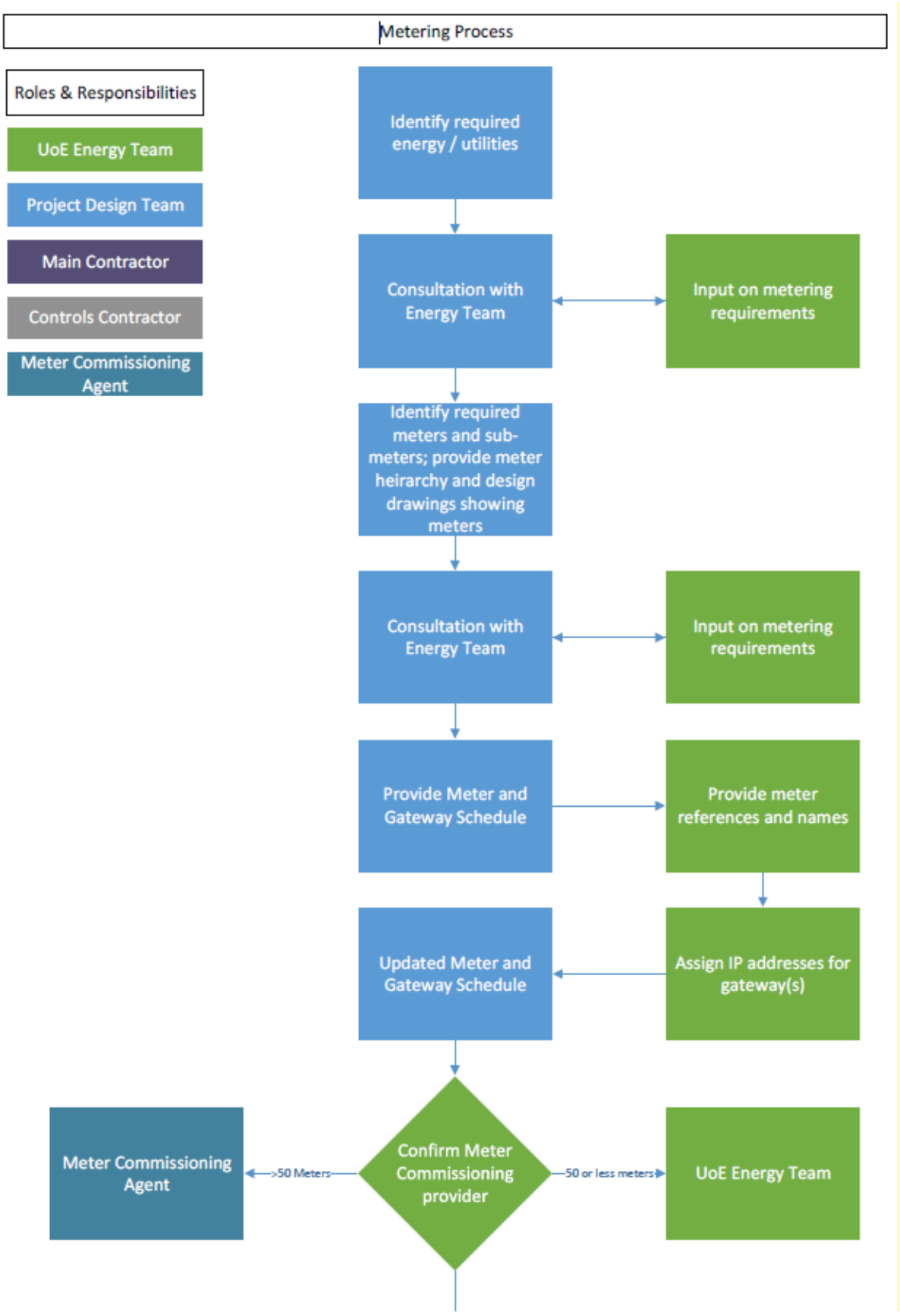
7.3 Appendix No 3: Competent Person at Handover Checklist

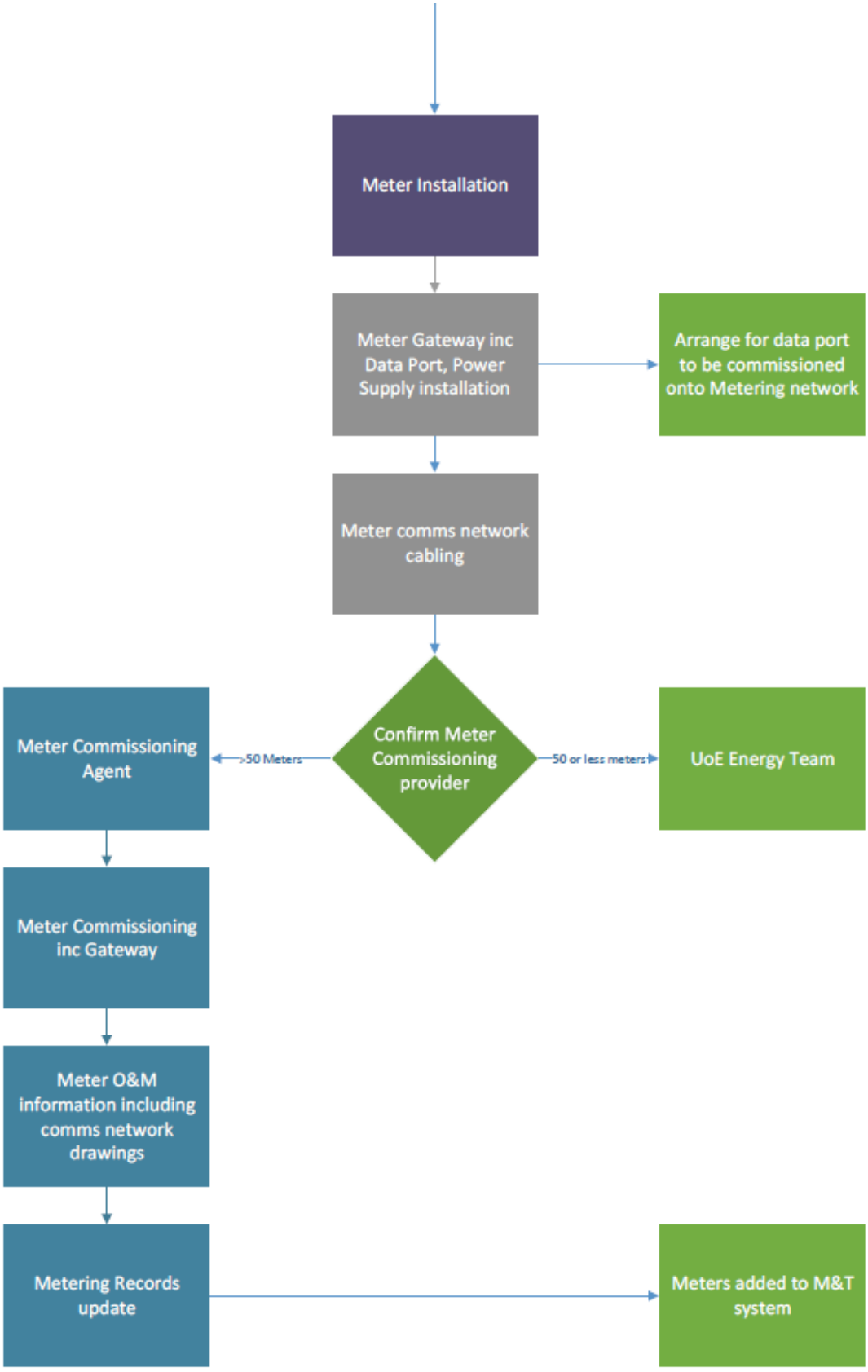
The issue of the Practical Completion Certificate will be in accordance with the Conditions of Contract and the decision of the Project Manager.

Check List	**Yes**	**No**	**N/A**
Has the metering been commissioned for the project and has the test certificate been issued? (Please note this applies to new systems, new zones for existing buildings or the re-commissioning of existing systems)			
➢ Design Certificate – to be signed by the designer			
➢ Installation Certificate – to be signed by the installer			
➢ Commissioning Certificate – to be signed by the commissioning engineer			
➢ Acceptance Certificate – to be signed by the project manager (on behalf of UoE)			
Have the schematic diagrams been installed within the plant room area?			
Have the metering strategy drawings and description been submitted together with a copy of the marked up plan showing commissioning record for metering installation?			
	Yes	**No**	**N/A**
Have all elements of the metering systems within the scope of the project been subjected to an inspection by a competent person and fully demonstrated?			
Have commissioning certificates been provided for specialist equipment for metering (energy and utilities) been provided were necessary?			
Have the metering (energy and utilities) operation and maintenance (O&M) manuals been supplied, does it contain all required information and are arrangements in place to revise these as built?			
Have all meter recorded initial readings:			

Signed – Project Manager:	Date:
Signed – Metering Team:	Date:

7.4 Appendix No 4: Metering Process




Meter Installation
Meter Gateway inc Data Port, Power Supply installation
Arrange for data port to be commissioned onto Metering network
Meter comms network cabling
Confirm Meter Commissioning provider
>50 Meters
50 or less meters
Meter Commissioning Agent
UoE Energy Team
Meter Commissioning inc Gateway
Meter O&M information including comms network drawings
Metering Records update
Meters added to M&T system

7.5 Appendix No 5: RIBA Stage requirements

For responsibilities refer to meter process flow chart in Appendix No. 4

RIBA Stage	Check List	Yes	No	N/A
0	N/A			
1	Identify required energy / utilities (UoE Project Manager and Development Engineers)			
2	Consultation with Energy Team			
3	Consultation with Energy Team			
4	Identify required meters and sub-meters; provide meter heirarchy and design drawings showing meters Provide Meter and Gateway Schedule			
5	Meter Installation Meter Gateway, data port and power supply installation Meter comms network cabling Meter commissioning			
6	Meter O&M information including comms network drawings Metering Records update			
7	N/A			
	Signed – Project Manager:	Date:		
	Signed – Metering Team:	Date:		

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