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SHORT FORM CONTRACT FOR THE SUPPLY OF GOODS AND/OR SERVICES

I. Cover Letter

LOUGHBOROUGH UNIVERSITY ENTERPRISES LIMITED
Rutland Building
Finance Office
Loughborough
LE11 3TU
Attn: [redacted]
By email to: [redacted]

Date: Friday, 28th July 2023
Our ref: PS23085

Dea[redacted]

Following your tender/proposal for the supply of PS23085 Gathering Evidence To Improve Airtightness in the UK Housing Stock to Department for Energy, Security and Net Zero, we are pleased confirm our intention to award this Contract to you.

The attached Order Form, contract Conditions and the Annexes set out the terms of the Contract between Department for Energy, Security and Net Zero and Loughborough University Enterprises Limited for the provision of the Deliverables set out in the Order Form. We thank you for your co-operation to date and look forward to forging a successful working relationship resulting in a smooth and successful Delivery of the Deliverables. Please confirm your acceptance of this Contract by signing and returning the Order Form to Alan Bird at the following email address: Professionalservices@uksbs.co.uk within **7** days from the date of the Order Form. No other form of acknowledgement will be accepted. Please remember to include the reference number(s) above in any future communications relating to this Contract.

We will then arrange for the Order Form to be countersigned which will create a binding contract between us/You should arrange for the Order Form to be countersigned which will create a binding contract between us.

Yours faithfully,

[redacted]

UK Shared Business Services Ltd

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II. Order Form

1. Contract Reference	PS23085	
2. Buyer	Department for Energy Security and Net Zero	
3. Supplier	**LOUGHBOROUGH UNIVERSITY ENTERPRISES LIMITED**	
4. The Contract	This Contract between the Buyer and the Supplier is for the supply of Deliverables. The Supplier shall supply the Deliverables described below on the terms set out in this Order Form and the attached contract conditions ("**Conditions**") and Annexes. Unless the context otherwise requires, capitalised expressions used in this Order Form have the same meanings as in the Conditions. In the event of any conflict between this Order Form and the Conditions, this Order Form shall prevail.	
5. Deliverables	**Goods**	None
	Services	Description: as set out Annex 2 – **Specification**. To be performed at ***the Supplier's premises.*** Date(s) of Delivery: As set out in Annex 2 – Specification.
6. Specification	The specification of the Deliverables is as set out in Annex 2 – **Specification**	
7. Start Date	Monday, 31st July 2023	
8. Expiry Date	31st January 2024	
9. Extension Period	Not applicable	
10. Optional Intellectual Property Rights ("IPR") Clauses	Not applicable	
11. Charges	The Charges for the Deliverables shall be as set out in Annex 3 – **Charges**	
12. Payment	Payment of undisputed invoices will be made within 30 days of receipt of invoice, which must be submitted promptly by the Supplier.	

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	All invoices must be sent, quoting a valid Purchase Order Number (PO Number), to: [redacted] **BEIS c/o UK SBS, Queensway House, West Precinct, Billingham, TS23 2NF**. Within **10** Working Days of receipt of your countersigned copy of this Order Form, we will send you a unique PO Number. You must be in receipt of a valid PO Number before submitting an invoice. To avoid delay in payment it is important that the invoice is compliant and that it includes a valid PO Number, item number (if applicable) and the details (name, email, and telephone number) of your Buyer contact (i.e. Buyer Authorised Representative). Non-compliant invoices may be sent back to you, which may lead to a delay in payment. Payments will be made by BACS to **TBC.** If you have a query regarding an outstanding payment please contact our Accounts Payable team either by email to [redacted] or by [redacted] etween 09:00 and 17:00 Monday to Friday .
13. Data Protection Liability Cap	In accordance with clause 12.5 of the Conditions, the Supplier's total aggregate liability under clause 14.7(e) of the Conditions is no more than the Data Protection Liability Cap, being of ***£500,000*.**
14. Progress Meetings and Progress Reports	• The Supplier shall attend progress meetings with the Buyer every month • The Supplier shall provide the Buyer with progress reports every month
15. Buyer Authorised Representative(s)	For general liaison your contact will continue to be or, in their absence,
16. Supplier Authorised Representative(s)	For general liaison your contact will continue to be or, in their absence, [redacted]

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17. Address for notices	**Buyer:** **Department for Energy, Security and Net Zero,** 1 Victoria Street, London, SW1H 0ET Attention: [redacted] Email: [redacted] **Supplier:** **LOUGHBOROUGH UNIVERSITY ENTERPRISES LIMITED,** Rutland Building, Finance Office, Loughborough, LE11 3TU Attention: [redacted] Email: [redacted]
18. Key Staff	**Key Staff Role:** / **Key Staff Name:** / **Staff Contact Details:** Project Manager [redacted] Leader Leader [redacted]
19. Procedures and Policies	For the purposes of the Contract the: The Buyer's security / data security requirements are. https://www.gov.uk/government/publications/security-policy-framework/hmg-security-policy-framework
20. Special Terms	***N/A***
21. Incorporated /terms	The following documents are incorporated into the Contract. If there is any conflict, the following order of precedence applies: a) The cover letter from the Buyer to the Supplier dated **TBC** (if used) b) This Order Form c) Any Special Terms (see **row 20 (Special Terms)** in this Order Form) d) The following Annexes in equal order of precedence: i. Annex 1 – Processing Personal Data ii. Annex 2 – Specification iii. Annex 3 – **Charges**

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	e) Annex 4 – Supplier **Tender**

[redacted]

III. Annex 1 – Processing Personal Data

A. Part A - Authorised Processing Template

Contract:	**PS23085 Gathering Evidence To Improve Airtightness in the UK Housing Stock**
Date:	Monday, 31st July 2023
Description of authorised processing	**Details**
Identity of Controller and Processor for each category of Personal Data	N/A
Subject matter of the processing	N/A
Duration of the processing	N/A
Nature and purposes of the processing	N/A
Type of Personal Data	N/a
Categories of Data Subject	N/A
Plan for return and destruction of the data once the processing is complete UNLESS requirement under law to preserve that type of data	N/A
Locations at which the Supplier and/or its Subcontractors process Personal Data under this Contract	N/A

Protective Measures that the Supplier and, where applicable, its Subcontractors have implemented to protect Personal Data processed under this Contract against a breach of security (insofar as that breach of security relates to data) or a Personal Data Breach	N/A

IV. Annex 2 – Specification

1 Introduction

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The Heat and Buildings Strategy states that "…the journey to Net Zero buildings starts with better energy performance." Heat loss due to poor airtightness of buildings is understood to be a problem in some homes, however we don't know how serious the problem is or in how many homes. Research is therefore needed to better understand the baseline airtightness of the UK housing stock to inform future retrofit policies that aim to tackle heat loss, overheating and energy performance by improving airtightness. This work will ultimately look to quantify the emissions saving potential by first understanding the airtightness of the existing stock and then targeting retrofit policies appropriately.

This research will support policy work by addressing three clear knowledge gaps:

- Gather quantitative as-built evidence of the airtightness of the UK housing stock to understand the baseline and to improve targeting of retrofit and overheating policies.
- Gather evidence to support an update to the "n/20" rule of thumb that is used in the Standard Assessment Procedure (SAP) to link airtightness to infiltration, the model that assesses compliance with building regulations.
- Gather qualitative in-use evidence of construction and operational practices relating to airtightness such that better energy efficiency of buildings can be targeted through airtightness measures, both in new construction, retrofit of the existing stock and subsequent operation of any dwelling.

This research will be conducted in two phases – Phase 1 (this procurement) will carry out a literature review, and identification and analysis of existing data on the airtightness of the existing stock. Phase 1 will also provide a list of recommendations on which field surveys to be completed in Phase 2 (to be procured later) will be based.

Current typical advice on draught proofing focuses on straightforward measures such as sealing gaps around windows and doors. The ongoing DESNZ project, Demonstration of Energy Efficiency Potential (DEEP), provides detailed insight from a small sample of case studies on the impacts of increased airtightness as a retrofit measure. This project will specifically address evidence gaps between these extremes with the aim of supporting the development of improved airtightness policy for the whole existing building stock.

2 Aims & Objectives

The aims of the project are to:

- gather evidence of the baseline airtightness of the UK housing stock so as to be able to better target retrofit policy;
- gather evidence to support an update to the "n/20" rule of thumb used in the SAP calculation that links airtightness to infiltration and is known to be unreliable; and
- to understand better the construction and operational practices and risks that relate to airtightness.

The Objectives for Phase 1 are:

1) Review what the current literature says about the airtightness, infiltration and ventilation of the existing UK housing stock and identify the gaps in the evidence base.
2) Identify what studies have been done to date and what data are currently available regarding the airtightness of the UK housing stock, broken down by building characteristics such as type/age/construction type/listed status etc.
3) Define what the n/20 rule used in SAP is, how it is currently used, what are its limitations and suggest proposals for a methodology to change/improve it.
4) Understand what is known about construction practices and risks relating to airtightness in the UK housing stock and whether there are typical failure points

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during the construction process which lead to poor airtightness or increase the risk of overheating.

5) Provide recommendations and suggest aims, objectives and methodology for Phase 2 to inform survey design which will:
   a. achieve a reliable overview of the baseline airtightness of the UK housing stock taking into consideration the Devolved Administrations.
   b. update the SAP methodology for estimating infiltration rates;
   c. understand construction and operational practices relating to airtightness and ventilation in UK homes.

   The recommendations are expected to include the type of tests that should be carried out, the number of houses that should be tested, typical costs of tests and time to carry out tests, likely team/resources required, approach to interviews etc.

3 Background to the requirements

Airtightness is important for minimising heat loss through uncontrolled air exchanges between the inside and outside of a building and good airtightness plays a crucial role in achieving low energy houses. Infiltration should not be relied upon as a means of ventilating a building. Adequate ventilation must be provided to an airtight space to mitigate overheating and prevent moisture build up which could otherwise lead to damp and mould problems.

The project will address three clear knowledge gaps as follows:

1) Understandthebaselineairtightnessoftheukhousingstocktoinform retrofitpolicies.

There is very little research on the actual airtightness of existing homes in the UK stock. Whilst all new homes have an airtightness test at completion, this is not reflective of general infiltration in the older stock. We know that unintended heat loss due to poor airtightness is a huge problem in some homes, however we don't know how many. Having this knowledge gap limits our ability to make useful energy efficiency improvements at a national scale – given that infiltration can be such a dominant factor in the heat loss of a building, being unsure about the airtightness of the stock can lead to uncertainty around the effectiveness of other energy efficiency measures or the accuracy of modelling. Evidence arising from the ongoing DEEP case studies also suggests that the underlying airtightness impacts the benefit from non-airtightness retrofits, like underfloor insulation. It is therefore important to understand the airtightness of the existing stock to be able to target airtightness retrofit policies appropriately and proportionately. Identifying generic building architypes or building components will also enable targeted interventions.

The literature review and data analysis carried out in this phase of the work will be used to inform and scope out a large-scale national survey of a stratified sample of homes that will take place in a future Phase 2. The survey will aim to understand the state of airtightness in the stock and the potential for airtightness improvements. We also wish to understand how the airtightness of UK homes compares to those of other European countries.

2) Gatherevidencetosupportanupdatetothemethodologyusedfor estimatingtheinfiltrationratesinSAP

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The ‘divide-by-20’ rule of thumb is currently used in the SAP 10 calculation as a simple infiltration-air leakage ratio to estimate the infiltration rate from the air permeability result of a pressurisation test. It is known that this ratio is likely to be unreliable for some homes (underestimating the air change rate in some and overestimating in others) and it was identified in Recommendation 19 of Etude’s SAP 11 Scoping Study completed for BEIS in 2021 that the assumptions on infiltration and ventilation (including the n/20 rule) should be reviewed and revalidated or revised in future improved versions of SAP. An inaccurate estimate of the infiltration rate used in the SAP calculation will contribute to an inaccurate estimate of the heat loss from a home which in turn contributes to the performance gap (the difference between designed and as-built energy performance of a building). SAP 11 is looking to address the issue with the n/20 rule of thumb to some degree by looking at potential options such as the CIBSE Guide A methodology, but this airtightness project is intended to go further.

Measurement of the infiltration of every home requiring a SAP calculation directly with a gas tracer test is impractical as it is expensive and time consuming. An update to the n/20 rule to estimate the infiltration from the air permeability result (from a more affordable and practical pressurisation test) that goes further than the options considered in SAP 11 is therefore required. This Phase of the project will propose what tests need to be carried out, the conditions under which those tests should take place (e.g. weather) and define how many homes should be surveyed in order to represent the entire stock and gather enough data to reliably update the calculation. Phase 2 will gather and process this data.

Incorporating airtightness accurately into SAP will be of crucial benefit to policy given that policy schemes are currently based on EPCs/SAP. Understanding the baseline airtightness in the stock and being able to accurately model it in SAP will help target policies effectively as airtightness changes resulting from intervention/ retrofit can be accurately quantified.

3) Constructionandoperationalpracticesrelatingtoairtightness– understandinghowtheseaffectenergyefficiencyandwhattheymeanfor overheating.

The Future Homes Standard (FHS) proposes an air permeability target of 5 $m^3/hr.m^2$ for new builds. Going beyond such levels of airtightness would require a fundamental shift in both construction and operational practices, as well as a greater understanding and awareness of the risks.

Construction - In practice, there is currently no sole responsibility or ownership of airtightness by a single trade during the construction process and it is known that airtightness test results can be manipulated and therefore be misleading (e.g., windows edges can be taped over to improve a test result). Phase 1 literature review will look to understand what is known about construction practices relating to airtightness in the UK housing stock and whether there are typical failure points during the construction process which lead to poor airtightness. Suggestions should be made for investigating further in site surveys or interviews in Phase 2.

Research into whether airtightness could be used as a proxy for ‘build quality’ could help inform policies aiming to increase the quality of construction. It is anticipated that defining ‘build quality’ and identifying any relationship to measured data/airtightness test results will be an objective of Phase 2, however the literature review of this phase should bear this objective in mind.

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Operation - it is unknown whether people are aware of how to ventilate their properties sufficiently and appropriately or operate and maintain mechanical ventilation systems, and if they do have this knowledge, whether they act upon it. It is also unclear how airtightness measures perform over time or whether there is deterioration, especially in new build properties. In addition, a review of mechanical ventilation systems that have already been installed and identifying where there are problems or lessons learned from commissioning could help ensure optimal use of these systems in homes. It is anticipated that this will primarily be investigated as part of interviews and site surveys in Phase 2, however the literature review in this phase should bear this objective in mind and present findings/recommendations that will help scope Phase 2.

Overheating – Inadequate ventilation alongside (poorly fitted?) energy efficiency measures can lead to condensation, mould and other unintended consequences. It can also exacerbate the risks associated with a warming climate, including poor indoor air quality and overheating. Currently, measures installed under current Government schemes must be carried out by a Trustmark registered and Publicly Available Standards (PAS) 2030 certified installer in accordance with PAS 2035 to ensure the risks of poor-quality installations are minimised.

The risk of overheating and poor indoor air quality will be increasingly important in a warming climate, however, evidence gaps are common in this area. Research is needed to: address evidence gaps in the overheating space; understand how airtightness and ventilation retrofit policies will perform in the future with a warming climate; and to inform new and existing retrofit policies to ensure that the existing housing stock is appropriately retrofitted to adapt to a warming climate whilst delivering Net Zero by 2050. There is a need to understand the thermal performance of a building in respect of its ability to retain heat in the winter or maintain comfortable conditions in the summer. Infiltration should not be relied upon as a means of ventilating a building, but if it is and infiltration is to be addressed, the consequences of doing so need to be understood.

An understanding of the baseline airtightness of the stock, as well as an understanding of the year-round ventilation properties of buildings will help lay the ground for future research to address these social/behavioural research issues and identify the pros/cons/barriers of going further than the target set in the FHS. If better airtightness were to be targeted, sufficient ventilation must be provided to avoid moisture build up which could lead to mould issues, and appropriate advice must be given to occupants to help them manage the risks.

Links to other areas

The findings from this work will be useful to the Hydrogen Heating policy team who are looking to understand the airtightness of the UK housing stock and how this depends upon the building/construction type and specific ventilation features installed in homes. The Hydrogen team will combine findings from this work with wider evidence being gathered by the Hydrogen Heating programme on the relationship between airtightness and the accumulation characteristics of hydrogen gas in the event of a leak in homes with different ventilation features.

4 Requirements

ResearchQuestions

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The contractor is expected to use the following research questions as a guide to help meet the above objectives and to address the evidence gaps listed in the background section:

- What is the n/20 rule and how is it used?
- What are the limitations with the n/20 rule?
- How should the SAP methodology for estimating infiltration rates should be changed/improved?
- What data needs to be collected to support/validate a change/improvement to the way SAP calculates airtightness? E.g. types of tests, numbers of houses that need to be tested, building survey data, costs of tests, time taken to conduct tests, conditions under which tests should be taken etc.
- What is the typical airtightness of different house types in the UK?
- How does the airtightness of UK houses compare to that of houses from other European countries?
- How does airtightness differ by house type/age/construction type/listed status etc?
- What are the typical airtightness failure points by house type/age/construction type etc?
- How could typical failures in airtightness be addressed by retrofit?
- What is the potential impact (£ and Carbon savings) of improving airtightness across the UK housing stock? Consider different airtightness retrofit measures.
- Is there a relationship between airtightness and build quality?
- What are the typical points of failure in the construction process that can lead to poor airtightness?
- How do people typically ventilate their buildings?
- Do people ventilate their buildings sufficiently or appropriately? Do they know how to?
- What construction and operational practices in relation to airtightness and ventilation need to be considered in the scenario of a warming climate if overheating is to be mitigated?
- What might a field study look like in terms of aims/ objectives, method, costs and impact to gather the necessary data?

Methodology

Literature review to address research questions:

- Review existing literature to establish what is currently known about airtightness, infiltration and ventilation of the existing UK housing stock, both as a whole at a national level and in specific case studies – it is believed that many existing airtightness studies are limited to small samples of specific building types. By reviewing existing literature, this work will seek to understand airtightness on a larger scale in different building types. The successful bidder will be supplied with existing/unpublished reports from from ongoing government research on airtightness to avoid duplication of effort and to build on existing knowledge – this literature review is expected to not replicate previous BEIS funded work, but go further.
- Review literature and data on airtightness in the UK, other European countries, and countries with a similar climate to the UK to draw comparisons.
- Review literature to identify practices and principles relating to airtightness that contribute to the performance gap, both relating to construction and occupation.
- Review literature to understand how “build quality” is characterised across literature, with focus on whether airtightness is related to build quality.

Data analysis to supplement literature review in answering research questions:

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- Identify what existing data sources are available on the airtightness of the UK housing stock to understand if information can be gathered without the use of, or prior to, field trials taking place. Given the requirement for all new builds to have an airtightness test, bidders will be expected to provide details of how they intend to identify data sources that are representative of the whole stock, not just skewed towards new build.
- Arrange access where possible to existing qualitative and quantitative data sources. Carry out analysis to obtain information without the need for a field trial. We expect bidders to be able to obtain insights into construction and operational practices applicable to the whole stock, even if the requirement for airtightness tests is biased towards newer houses.
- Explore existing data to understand if independent repeat airtightness tests can be conducted to inform our understanding of degradation over time and to understand and quantify the prevalence of gaming.

Survey scoping:

- Comment on how far Phase 1 is able to go in achieving the objectives and answering the research questions, and make suggestions on where further work will need to be done in Phase 2 alongside the field trials to meet the objectives.
- Suggest a nationally representative sample of domestic building archetypes that should be surveyed to meet the objectives and answer the research questions including, but not limited to: attachment type (detached, semi-detached, terrace and flats), construction type (solid or cavity walls etc.), different ages and geographic regions, window type (e.g. sash windows), etc. This information will be used to define the size and cost of the full building survey that will take place in Phase 2.
- Suggest the types of tests and how many would need to be carried out to fulfil the research objectives.
- Suggest typical costs for these tests, how long they take to carry out and the resources required to complete the proposed field tests.

Inputs

It is intended that this research builds on previous government research that considers airithgtness, including the DEEP project and SAP 11 project. We will provide the successful bidder with documentation from the ongoing SAP 11 project and unpublished research from the DEEP study.

In relation to airtightness, the DEEP project specification required the following of that project:

“Objective 8: To characterise the technical and practical barriers to solid wall building retrofit.

BEIS requires information on the airtightness of solid wall dwellings to understand energy consumption and the likelihood of retrofit not achieving its predicted performance…

A sample of solid wall dwellings should be tested to quantify airtightness and characterise air movement behaviour, including determining unintentional air leakage pathways. The size of this sample should be sufficient to provide confidence in measurements, and such measurements should enable the characterisation of the various air movement phenomena that are observed, and their relationship with the building fabric.”

A review of natural ventilation in dwellings in relation to airtightness calculations in SAP has been conducted in the SAP 11 project.

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Outputs
DESNZ will receive the following reports:

- Literature Review detailing what current literature says about airtightness, infiltration and ventilation of the UK housing stock, including details of relevant studies and research.
- Synthesis report identifying existing sources of data about airtightness in the UK housing stock and presenting the results of analysis of those sources.
- Report commenting on how well Phase 1 is able to achieve the objectives and answer the research questions, and recommend where further work could be done in Phase 2 alongside the field trials.
- List of Recommendations to help prepare for the Phase 2 field study and interviews such that an understanding of the baseline airtightness of the UK housing stock will be obtained and an understanding of how construction and operational practices and risks relate to airtightness. This may be provided in the form of a series of options for how Phase 2 may be carried out. This should include details on how to obtain a nationally representative stratified sample of homes so that the SAP methodology for estimating infiltration rates can be reliably updated. Recommendations will likely include, but are not limited to:
    - Sample size and sampling methodology
    - List of archetypes
    - Tests to be conducted e.g., Blower Door, Pulse, Gas Tracer tests, thermal imaging etc. and conditions under which tests should be carried out
    - Building survey data to be collected
    - Estimates of typical costs, time and resources

The appointed contractor will be responsible for the day-to-day management of the project and hence responsible for achieving the project objectives.

Regular progress meetings will be held at least bi-weekly between the contractor and the DESNZ Project Manager, with weekly email correspondence as a minimum. These meetings will be a chance to discuss progress against objectives, identify potential risks/opportunities and put in place actions such that risks are mitigated in a timely manner and avoid becoming issues. The contractor will be required to maintain a risk register and Risks, Assumptions, Issues and Dependencies (RAID) log which will be shared with the DESNZ PM and risks / issues will be escalated to the SRO as appropriate.

As this work will be completed in two phases, all IP arising from Phase 1 must be made available to DESNZ to share with bidders and contractor appointed for future phases of the work – see Clause 10 of the Short Form contract.

The contractor will be required to nominate a named individual to act as the main point of contact for the project. The contractor will be asked to provide details of their project and organisational structure such that any issues with performance can be escalated appropriately by the Department to the appropriate level on the Contractor side.

5 Timescales

The bidder will be required to submit appropriate work packages and gantt chart for completing the work.

We will ask for a preliminary findings report approximately half way through the project – we expect this to be sufficiently well progressed to enable early stage scoping and budgeting for Phase 2.

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The project is expected to last 6 months with indicative timeline as follows:

Contract signed/kick-off meeting – July 2023
Preliminary findings/recommendations – September 2023
Draft Final report – November 2023
Final report – January 2024

Payment Milestones may be aligned with key dates and/or deliverables.

TermsandConditions

Bidders are to note that any requested modifications to the Contracting Authority Terms and Conditions on the grounds of statutory and legal matters only, shall be raised as a formal clarification during the permitted clarification period.

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V. Annex 3 – Charges