

IEA EBC Annex 94:

Validation and verification of in-situ building energy
performance measurement techniques

Report

Working Meeting #1

October 1-3, 2025

-

Vienna, Austria



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1. Participants

48 Participants, from nine countries, joined this first working meeting.

Country	Name	Organisation	In Person/Online
ES	AITOR ERCORECA GONZALEZ	University of the Basque Country	Online
BE	Alexander Ulrix	KU Leuven	In person
NL	Andrea Joseph Thaddeus	-	Online
ES	Arregi Goikolea, Beñat	-	Online
FR	Baptiste Poirier	-	Online
ES	CATALINA GIRALDO SOTO	University of the Basque Country	Online
NL	Christian Struck	Saxion	In person
AT	Christoph Rohminger	AEE INTEC	In person
UK	Cliff Elwell	UCL Energy Institute	In person
UK	David Allinson	Loughborough University	In person
UK	David Glew	Leeds Beckett University	In person
UK	David Johnston	Leeds Beckett University	In person
UK	Frances Hollick	University College London	In person
UK	Grant Henshaw	University of Salford	In person
NZ	Griffin Cherrill	-	Online
UK	Hardy, Adam	Leeds Beckett University	Online
UK	Harrison, Michael	DESNZ	Online
FR	ILLY Hervé	CSTB	Online
AT	Iva Kovacic	TU Wien	In person
DE	Johannes Pernpeintner	DLR	In person
ES	JOSE ALBERTO DIAZ ANGULO	-	Online
UK	Joshua Cooper	Hildebrand	In person
ES	Juan Mari Hidalgo	EHU	Online
FR	Julien Waeytens	Univ Gustave Eiffel	Online
DK	Justinas Smertinas	Technical University of Denmark (DTU)	In person
BE	Katia Ritossa	KU Leuven	In person
BE	Liesja Van Gelder	BCCA	In person
UK	Lior Carno	-	Online
ES	Lopez Villamor, Iñigo	-	Online
UK	Lubo Jankovic	Univerity of Salford	Online
ES	LUIS YELAMOS MARTIN	-	Online
ES	María José Jiménez	-	Online
UK	Mark Collett	Leeds Beckett University	In person
UK	Matt Goodridge	Kestrix	Online
UK	Matt Li	Loughborough University	In person
DK	Matthias Van Hove	DTU / Ghent University	In person
ES	Myriam Humbert	Cerema	In person
AT	Oliver Englund	TU Wien	In person

FR	RAVELONARIVO Mirado	-	Online
AT	Rene Kurzbauer	TU Wien	In person
UK	Richard Fitton	University of Salford	In person
NL	Rob Meester	Saxion	In person
UK	roger hitchin	-	Online
UK	Sam Stamp	University College London	In person
FR	Sarah Juricic	CSTB	In person
FR	Simon Rouchier	Université Savoie Mont Blanc (USMB)	In person
UK	Tom Fenton	-	Online
AT	Yusuf Alaidy	TU Wien	In person

2. Agenda

Wednesday October 1, 2025

- 12.00 Arrival and coffee
- 12.30 Welcome and Keynote speaker
- 13.00 Annex 94 update and presentations of work relevant to the annex
- 15.00 Coffee break
- 17.00 End of day 1 wrap up

Thursday October 2, 2025

- 08:30 Arrival and coffee
- 09.00 Aim of today and thoughts on publishing
- 09.30 ST3: Verification and validation
- 10:30 Coffee break
- 11.00 ST2: Extending HTC measurement
- 12.00 ST4: Performance diagnostics
- 13.00 Lunch and photographs
- 14.30 ST1: Applications and their requirements
- 15.30 ST5: Data collection and curation
- 16:30 Wrap up of day 2 and laboratory tour
- 18.30 City tour and evening meal

Friday October 3, 2025

- 08:30 Arrival and coffee
- 09.00 Aim of today
- 09.15 ST2-4: breakouts for planning who does what by when
- 10:30 ST 1-5: feedback and next steps
- 11.30 Dynastee and symposium
- 11:45 Thanks and details of the next meeting
- 12.00 Finish

3. Day 1 October 1, 2025

Welcome and keynote speaker

Oliver Englhardt, Rene Kurzbauer, and Yousef Al Aidy welcomed us to TU Wein and told us about the work of their research group.

Annex 94 update and presentations of work relevant to the annex

David Allinson gave an update on IEA EBC Annex 94: the ExCo has approved our working phase and we now have three years to deliver this paradigm shift.

Participants presented past research work relevant to Annex 71. Details can be seen on the Annex 71 website.

Order	Presenter	Company/Institution	Title	In-Person/Online
1	Roger Hitchin	-	Sizing heating for intermittent heating	Online
2	Myriam HUMBERT	CEREMA	In-situ energy performance measurement : a reflection by Stakeholders on most appropriate tools	In-Person
3	Simon Rouchier & Sarah Juricic	LOCIE, CSTB, CEA LITEN	Measuring the thermal performance of the building envelope during occupancy	In-Person
4	Michael Harrison	DESNZ	SMETER implementation policy development	Online
5	David Alinson	LBORO	New evidence framework for reliable in-use measurement of HTC	In-Person
6	Fances Hollick	UCL	GHG SMETER	In-Person
7	Johannes Pernpeintner	DLR	Acoustic leak detection and lock-in thermography	In-Person
8	Vicente Orts Mercadillo	Vector Labs	Printed Heat Flux Sensors for Building U-Value Measurement	In-Person

4. Day 2 October 2, 2025

Sub-task 3: Verification and validation

Subtask 3 advanced its validation framework, glossary, and method description templates. Actions from Vienna include completing prose drafts of validation literature by December 2025, defining a 'Benchmark' framework for ground truth testing, and enhancing communication with stakeholders through social media. Collaboration with ST2 and ST4 supports consistent documentation across methods and diagnostic processes.

Sub-task 2: extending HTC measurement

- 1) Work Package (WP) coordinators were established:
 - WP2.1 – David Johnston (Leeds Beckett University)
 - WP2.2 – Jason Zhang (Arizona State University)
 - WP2.3 – Lubo Jankovic (University of Salford)
 - WP2.4 – Carlos Jiménez-Bescós (University of Westminster)
 - WP2.5 – Kami Rakhshanbabanari (Loughborough University)
- 2) A comprehensive table of data requirements has been created to support the investigation of different aspects impacting the Heat Transfer Coefficient (HTC) characterisation.
- 3) The preliminary Common Exercise 0 has been launched on the example of the SMETER dataset with the goal of onboarding all participants, familiarising them with statistical models and data processing, and setting the environment for more complex calculations.
- 4) A review of existing HTC assessment methods (both dedicated and in-use) has been completed to establish a shared knowledge base and identify gaps in the current state of the art.
 - K. Ritosa, M. Collet, S. Juricic, G. Henshaw, M. Li, S. Roels, and R. Fitton, "Review of methods for assessing the measured Heat Transfer Coefficient (HTC)," under review in Building and Environment.

Sub-task 4: performance diagnostics

Subtask 4 concentrates on diagnosing discrepancies between measured and expected HTC values. The Vienna session focused on the development of a diagnostic process tool (flowchart and MVP), a state of the art review paper, and plans for field validation via round robin testing. The process will provide practitioners with structured guidance to identify causes of performance gaps and to select appropriate diagnostic methods. Collaboration continues with ST1 and ST3 to integrate user feedback and survey insights.

Sub-task 1: applications and their requirements

Subtask 1 focuses on mapping related projects, developing shared terminology, and conducting stakeholder surveys to identify how measured HTC and energy performance data are used across sectors. The Vienna meeting confirmed ongoing survey deployment, with analysis planned for 2026. Outputs include white papers, datasets, and journal publications summarising engagement outcomes and pathways to policy impact.

Sub-task 5: Data collection and curation

Subtask 5 will focus on the development of the data platform, covering data architecture,

repository management, interoperability, and integration with the Annex 94 Dataverse platform.

3. Day 3 October 3, 2025

Sub-task 1: applications and their requirements

Activity	Description	Outcome	Year	Responsible (+team)	Actions
Mapping related projects and interact with them (Annex 88, IEA ES Task 43, ...)	Identification of other projects that overlap with the scope of this Annex.	One pager	1	ST1 leaders	Complete by November 14
(Non-) technical vocabulary	A schedule of applicable terms to the annex along with definitions suitable to communicating to non-technical audiences.	White paper	1	Jamie Corson, Chris Ricketts	Provide feedback on draft
Stakeholder survey (with ST3 and 4)	Delivery of an online survey to determine current use cases of HTC measurements and measured energy performance in general.	Dataset	1	Survey team (ST1, ST3 & ST4 leaders)	Everyone to send around*
In depth interviews/meetings/workshops	Following on from the data collected from the stakeholder survey the findings will be discussed and validated with key stakeholders.	White paper	2	National champions	
Impact report	Identify what needs to be done for the Annex to have impact in real life (aka impact plan)	Report	2	Richard Jack, Cliff Elwell	
Form advisory panel	Form a group of stakeholders to give advice related to outcomes of the annex	Report	2	ST1 leaders	
Stakeholder survey results	A write up of the findings from the stakeholder survey and in-depth interviews.	Journal Paper	3	Survey team	
Pathways to impact	Providing pathways to impact for the work of the annex, including conferences, presentations to external groups, policy makers etc	Report/Paper	3	All	

Sub-task 2: extending HTC measurement

1) Common Exercise 0

During the meeting, the CE was further refined with clear goals separating into:

- CE0.1 – Creates a reproducible baseline and serves as a common reference point for comparing results on the SMETER cases and for guiding subsequent methodological development.
- CE0.2 – Participants can use any data preprocessing and estimation method, with the aim of exploring the causes of deviation between the calculated HTC. This includes the impact of assumptions in data processing and physical assumptions incorporated in models, impact of period and averaging times, impact of additional qualitative data/information on the examined dwellings, and other.

The general aim of this exercise is to pinpoint the constraints of existing methods, propose solutions and open the door for advancement in HTC estimation models through the following Common Exercises.

- ST2 leaders will create a formal Common Exercise document with instructions by mid-October.
- Participants from all subtasks will participate in their own capacity.

2) Other Common Exercises

Representatives from KU Leuven presented the planned dedicated experimental campaign at the ConstrucThor testing facility. The campaign will comprise Coheating and different heating phases: simultaneous heating of all units, heating one unit at a time, as well as intermittent schedules and setpoints. This will primarily serve the intent of characterising party-wall heat loss in WP1. The campaign will run in the winter 2025/2026.

- KU Leuven plans to present the Common Exercise 0 at the next meeting.
- Other institutions will join the common effort to populate the Dataverse data sharing platform through which we will identify other work-package-related potential case studies.

3) Collaborative work

- Since the common exercises require a reliable and organised collection of estimates and methodologies, a collaboration with ST3 will be established to produce modular templates suitable for ST2 needs.
- Meeting between ST2 and ST3 representatives in October. The data collection for Common Exercises will be facilitated through collaboration with ST5, the owner of the Dataverse repository.
- ST2 and ST5 will collaborate on identifying useful datasets.
- Idea of setting up a common GitHub for sharing Rstudio and Python codes.
- Simon Rouchier will support the coordination of WP2.3 (Time as a variable in HTC assessment) and Justinas Smertinas of WP2.5 (Innovation hub).
- The work of ST2 will continue through monthly meetings for the whole group and task-oriented working meetings within individuals researching the same topic.

Sub-task 3: Verification and validation

Glossary:

- **J. Corson** and **H. Illy** to add examples and incorporate feedback from participants
- Ensure useful to stakeholders/HTC users

Method description template:

- Think about how to distribute and make clear which sections are optional
- **K. Ritosa** & **J. Smertinas** to fill it in, **M. Collett** to ask Saint-Gobain Research to fill it in as well

Validation literature review:

- **Authors** to have prose drafts of their sections by mid-December

Validation using 'ground truth':

- 'Ground truth' => 'Benchmark'
- **M. van Hove** to lead on setting out a draft document on this to be shared with the Annex prior to a ST3 seminar in January

Impact:

- **S. Juricic** and **F. Hollick** to coordinate with other subtask leads and **Hildebrand** on social media strategy

Online meetings:

- Poll on January ST3 seminar date to be circulated by **S. Juricic** and **F. Hollick**



Links

Template: [Method descriptions](#)

Glossary: [IEA-Annex94-Glossary](#)

Sub-task 4: performance diagnostics

Activities & Technical Focus

- **State-of-the-Art Review:** A comprehensive review of existing diagnostic methods (e.g., U-value measurement, leakage detection, air permeability, thermal bridging) is underway. The review catalogues what contributes to HTC discrepancies and will be updated at the end of the annex to include new tools and approaches.
- **Diagnostic Process Development:** The core deliverable is a flowchart or wizard-style diagnostic process, inspired by medical diagnostics, that guides users through stages such as initial assessment (e.g., EPC or baseline data), triage (e.g., HTC measurement), and identification of key issues (thermal performance, moisture/IAQ, overheating, system performance).
- **Field Validation:** Planned round robin testing will apply the diagnostic process in real buildings, ideally alongside HTC measurements, to validate and refine the framework.
- **Stakeholder Engagement:** A survey was initiated to understand who would use diagnostics and how services should be packaged. Progress has slowed, and greater participation is needed. The survey results are expected to inform a future publication and support tool development.

Breakout Session Highlights

- **State-of-the-Art Paper:** Led by Grant Henshaw, with contributions from team members and PhD students. Will include a summary table comparing diagnostic methods by time, cost, and

accuracy. Volunteers were confirmed, including Juan Mari Hidalgo (EHU), especially for air tightness and ventilation sections. Draft completion is targeted for spring 2026.

- Diagnostic Process Tool: Group discussion emphasized developing a minimum viable product (MVP) for the diagnostic tool, to be user-tested before wider rollout. The tool
- should guide users through diagnostics, highlight uncertainties, and adapt as more data is provided. Accessibility, international adaptability, and integration with national data sources (e.g., EPCs) were key design goals.
- Revised Survey Focus: The team decided to pause the consumer/user survey in favor of user testing the diagnostic tool. Once the tool matures, the survey may resume to capture user experience and adoption potential.
- Collaboration & Next Steps: Agreement to use a shared online repository (e.g., SharePoint) for document coordination. Next actions: refine the diagnostic flowchart, build and test the MVP, and complete the state-of-the-art paper draft.

Dynastee and symposium

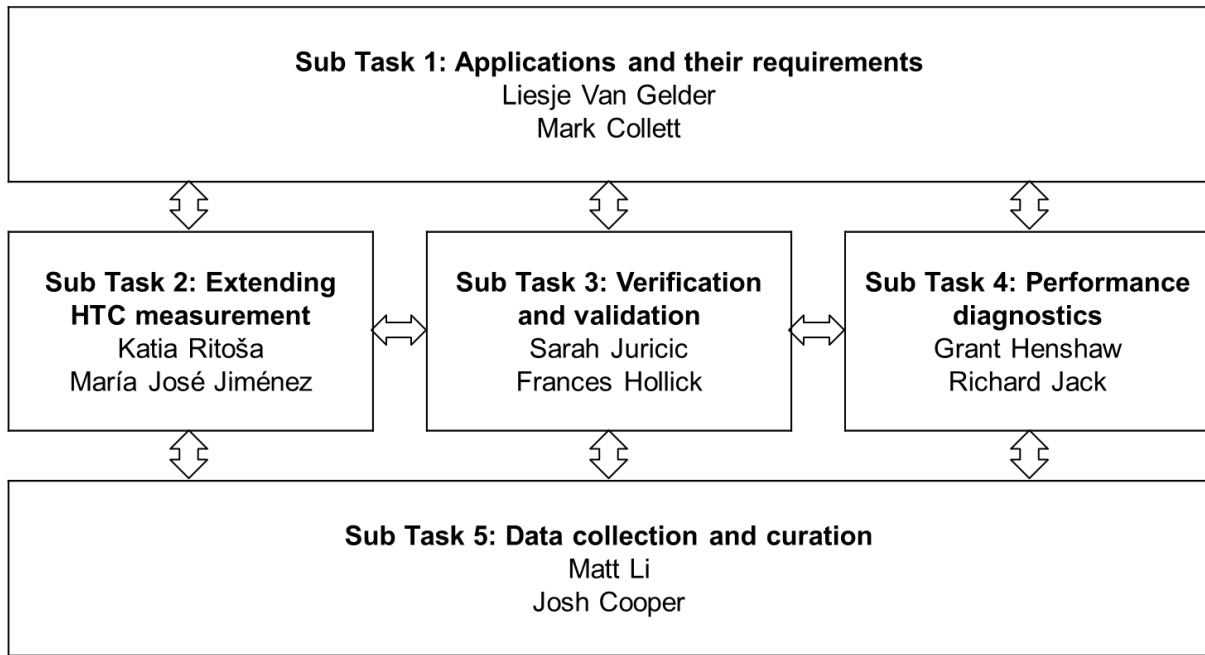
Richard Fitton presented the DYNASTEE Centre of Excellence. DYNASTEE is the Network for DYNAMIC Analysis Simulation and Testing of Energy and Environmental performance of buildings. Formed in 2005, DYNASTEE's roots go back to 1985 and PASSYS 1. DYNASTEE organise an annual summer school that is very relevant to Annex 94 – next one in 2026. A symposium in collaboration with CIEMAT is planned for Autumn 2026 in Madrid with a focus on in-situ HTC measurement and analysis – inviting industry and academics to come together with governmental organization. All Annex 94 ST leaders are invited to share work in progress through the newsletter in June

Next meeting and closing remarks

Meetings for Annex 94 are planned in Paris in April 2026, then Madrid in September/October 2026. We aim to promote wider engagement events alongside these meetings, for example we are currently exploring a workshop with the wider French sector alongside the Paris meeting, and a symposium in collaboration with the European DYNASTEE network alongside the Madrid meeting. Between these main meeting, each sub-task is organising online meetings focussed on specific tasks and outputs.

Extra special thanks to our brilliant hosts for the wonderful hospitality:

- Oliver Enghardt, Rene Kurzbauer, and Yousef Al Aidy and all the team at TU Wien!



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