

MINUTES**1ST EXPERT MEETING****OSLO, NORWAY, MARCH 14-15, 2016****NORWEGIAN INSTITUTE OF WOOD TECHNOLOGY, FORSKNINGSVEIEN 3B, 0373 OSLO, NORWAY****ATTENDANCE**

Participants present in person:	Participants present online:
Henrik Knudsen, Danish Building Research Institute, Aalborg University (HK)	Carmina Bocanegra-Yanez, Strathclyde University, UK (CB)
Carsten Rode, Technical University of Denmark (CR) - Operating Agent	Christopher Just Johnston, Technical University of Denmark (CJ)
Dimitrios Kraniotis, Norwegian Institute of Wood Technology (DK)	Jiping Zhu, Health Canada (JZ)
Gabriel Rojas-Kopeinig, Universität Innsbruck, Austria (GR)	
Jakub Kolarik, Technical University of Denmark (JK)	
Jan Tywoniak, Czech Technical University in Prague (JT)	
Jos v. Schijndel, TU Eindhoven, The Netherlands (JS)	
Kristine Nore, Norwegian Institute of Wood Technology (KN)	
Karin Kompatscher, TU Eindhoven, The Netherlands (KK)	
Marc Abadie, Université La Rochelle, France (MA)	
Pawel Wargocki, Technical University of Denmark (PW) only 14.3.	
Jensen Zhang, Syracuse University, USA (JZ)	
Menghao Quin, Nanjing University, China (MQ)	
John Grunewald, TU Dresden, Germany (JG)	
Guangyu Cao, NTNU, Norway (GC)	
Jelle Laverge, Ghent University, Belgium (JL)	
Alice Saad, Saint Gobain, France (AS)	
Fengna Chen, IBR Shenzhen, China (FC)	
Li Wang, The University of Tokyo, Japan (LW)	
Mike Davies, University College London, UK (MD)	
Morten Sejleskog, SINTEF, Norway (MS)	
Targo Kalamees, Tallinn University of Technology, Estonia (TG)	
Thomas Thiis, Norwegian University of Life Sciences (TT)	
Tormod Aurlien, Norwegian University of Life Sciences (TT)	
Valerie Goletto, Saint Gobain, France (VG)	

AGENDA

March 14:

- 8:15 - 9:45 Subtask leader meeting (with co-subtask leaders)
- 10:00 – 17:30 All meeting activity will be for all Annex participants in plenary
 - 10:00 – 10:10 Welcome to Treteknisk by Managing Director Hilde Tellesbø
 - 10:10 – 10:20 Meeting opening and brief on Annex status (Chair: Carsten Rode)
 - 10:20 - 12:15 Subtask 1 (Chair: Marc Abadie w. Pawel Wargocki)
 - 12:15 – 13:00 Lunch together with the participants of the Norwegian EU-network
“Sustainable energy solutions in the built environment”.
 - 13:00 – 15:00 Subtask 2 (Chair: Menghao Qin w. Jensen Zhang)
 - 15:00 – 15:30 Coffee break
 - 15:30 – 17:30 Subtask 3 (Chair: John Grunewald w. Jensen Zhang)
- 18:30 - Common Dinner at Aker Brygge (www.onda.no)

March 15:

- 8:30 - 15:30 Plenary meeting continues
 - 8:30 – 10:30 Subtask 5 (Chair: Jelle Laverge w. Kristine Nore)
 - 10:30 – 11:00 Coffee break
 - 11:00 – 12:00 Subtask 4 (Chair: Jakub Kolarik)
 - 12:00 – 12:45 Lunch
 - 12:45 - 13:45 Subtask 4 – continuation
 - 13:45 – 14:00 Refreshment
 - 14:00 – 15:30 Various issues regarding project and activity planning and administration (Chair: Carsten Rode)
- 15:45 – 16:30 Subtask leader meeting

March 16:

- 9:00 - 13:00 Site visit
 - 9:00 – 9:45 Departure in minibus from the hotels
 - 9:45 – 10:15 Visit the student housing in 8 floor CLT houses built in 2013-14, the highest CLT buildings at that time, with many interesting experiences of energy use, deformation, sound, comfort and more
 - 10:15 – 11:00 Visit the test houses of NMBU and Treteknisk at Sørås-feltet, the test houses which will be used in WP 5 in A68. Previous and future research will be presented.
 - 11:00 – 11:45 Modern rehab of the oldest university building with low-energy ambitions, Urbygningen.
 - 11:45 – 12:30 Lunch at Økonomikantina
 - 12:30 – 13:00 Travel back to Oslo

ACTION ITEMS FROM THE CURRENT MEETING

No.	Responsibility	Action Item	Deadline
8	All STL	Define one or more Common Exercises for participants to work with within their subtask	Before Syracuse meeting
9	All STL's and all	State of the art reports related to the subtasks	For Syracuse meeting
10	All	Contribute with free papers presenting own research of relevance for the Annex and its subtasks	For Syracuse meeting
11	OA	Present the project at Clima 2016, Aalborg, DK, May 2016	May 2016
12	MA + OA	Present the project and conduct a workshop on metrics at Indoor Air 2016, Gent, B, July 2016	July 2016
13	All STL's	Present the project and conduct a workshop at ASHRAE IAQ 2016, Alexandria, VA, USA, September 2016	Sept. 2016
14	JZ + OA	Organize CHAMPS workshop and 2 nd working Phase Annex meeting in Syracuse, NY, USA	Sept. 2016
15	OA	Final revision of Annex text as per the EBC ExCo's request	Over summer 2016

ACTION ITEMS FROM PREVIOUS MEETINGS

No.	Responsibility	Action Item	Deadline
1	OA, STL-1, STL-5	Modification of Annex text to reflect measurements conducted in ST5 and the fact that no measurements will be conducted in ST4	27/9/2015
2	OA	Correction of table summarizing ST lead and co-lead	27/9/2015
3	All STL	Collect RID forms and upload to Sharepoint	1/11/2015
4	OA	Correct RID form – Staff months->man-months	ASAP
5	All	Upload signed national letters of participation	30/9/2015
6	OA	Upload graphical file with EBC logo	ASAP
7	All STLs	Revision of ST description in Annex text.	27/9/2015

LIST OF APPENDICES

No.	Appendix
A	Workshop agenda
B	ST1 status review presentation
C	ST2 status review presentation
D	ST3 status review presentation

E	ST4 status review presentation
F	ST5 status review presentation
G	Presentation by Henrik Knudsen, SBi, Denmark

LIST OF ACRONYMS

AI	Action Item
ASAP	As Soon As Possible (in connection to AI)
BEPS	Building Energy Performance Simulation
ExCo	EBC Executive Committee
IAQ	Indoor Air Quality
OA	Operating Agent
RID	Research Item Description
ST	Subtask
STL	Subtask Leader

1. STL meeting

The subtask leader meeting was held prior to the plenary Annex meeting.

Situation and work progress in subtasks was reviewed.

ST1

- A paper for Indoor Air 2016 has been submitted
- 1st draft of the ST1 report was prepared by MA and should be discussed at the 1st expert meeting
- It was discussed that ST1 should be learning from previous work and come with crude indicators
- Attempts on similar tasks are currently taken in the USA, Berkeley
- Target pollutants should be specified with some rationale
- High ambitions are set, and may not be easy to live up to. A review process may be needed.
- It was discussed that it can be a challenge to use data from the past to estimate the situation in future buildings

ST2

- Subtask 2 will have a new title: *Pollutant loads in residential buildings*
- Literature review is ongoing
- Journal paper on the effect of moisture on VOC emissions is under preparation
- Relevant measurements are ongoing in a few places.
- Interest to consider also particles
- There is a need to clarify what we promise, and what we wish.
- 2 new partners – Shanghai Univ. (prof. Wan) and Shenzhen Institute of Building Research – measurements in small climate chambers. Already Nanjing and Tsinghua Universities are contributing.

- Contributors to the subtask now are four Chinese institutions, Univ. La Rochelle (F), FIB (D), DTU (DK), and Syracuse Univ. (US)

ST3

- Commitments for participation in the Subtask are on its way, e.g. from TU Eindhoven.
- Presentation of current background regarding available tools. JG and JZ have made a document that gives an overview of what is going on in the field of modelling.
- Decision must be taken what is the gap that should be bridged – increasing quality of models, common exercises, eliminating sources of errors.
- We don't do software development per se within the Annex
- Sorption models should result from Subtask 2.

ST4

- First draft of "Stakeholder survey" was distributed to all participants, comments provided by GR, should be considered as a common exercise – will be discussed at the meeting
- Review of "written knowledge" – international part (ASHRAE, EN ISO Standards etc.) will be summarized by DTU, review of national materials regarding design strategies should be provided by Annex participants. A template for input is on Sharepoint.
- Approach should be influenced by Subtask 1, but also with input from other Subtasks.
- Subtask co-leader has been missing so far.

ST5

- Questionnaire to collect information about research facilities was distributed. Who has which facilities for test and case studies (what, where and how).
- Currently four responses have been obtained, but more should come.

Further discussion included details regarding 2nd expert meeting in Syracuse:

- Thursday, Sept. 8: Start with CHASMPs meeting until 15:00, followed by STL meeting in the evening
- Friday, Sept. 9 – 2nd expert meeting (including parallel ST meetings)
- Saturday, Sept. 10, morning. Continuation and closure of the expert meeting.

Future meetings: Germany (Dresden) and China expressed interest in organizing

The principle of openness about the work, documents exchanged and presentations was discussed. In principle we would like to have everything as "open access" as possible, but as companies fortunately are joining the project, they may require confidentiality about certain exchanges, and we may have to adjust procedures accordingly to facilitate such confidentiality. OA informed that Saint-Gobain will be officially member of the Annex 68.

A wish was expressed that the Sharepoint should be able to support version handling (CR will check – versioning has since then been enabled).

2. Start of the meeting and welcome

The meeting started with welcome from the Norwegian Institute of Wood Technology's director Hilde Tellesbø.

3. Review of agenda and general status

CAR briefly introduced the agenda and informed about the general status of the Annex (Appendix A).

4. Approval of minutes

N/A

5. Subtask 1 - Defining the Metrics

MA presented current status in ST1 with focus on Objectives, First results, Working method and Schedule. The presentation is attached (Appendix B). Main points are:

- There are many pollutants. Five main ones could be PM (2.5 & 10), formaldehyde, benzene, NO₂, PAH. There is an issue about how to aggregate the view upon pollutants, to define an index and metrics for the rest of the work in the Annex.
- An index is proposed as the ratio between the observed value of a certain pollutant and its limit chronic or acute value. Even, suggestions were presented on how pollutant indices could be balance against energy performance indices.
- A draft report from Subtask 1 is planned to be prepared for presentation in conjunction with the Indoor Air Conference, and a list of contents for the report has been made. The report could be completed after summer 2016. Subtask 1 will then have completed its primary function in the Annex but will remain as a partly open / dormant activity for the whole project duration, while further knowledge may be gathered.

Further points from the discussion:

- High IAQ should be kept without increasing ventilation (to save energy).
- Source control should be better than increasing ventilation – how does it changes IAQ design strategy (link to ST4).
- In Denmark, humidity and mould have been more decisive than chemistry for necessary ventilation rates. More interest to vary the ventilation rate over the day. Also in Denmark: low energy buildings are well ventilated, mechanically, and have less IAQ problems.
- But some low energy buildings are based on natural ventilation and may face problems
- Need to distinguish between new and existing buildings.
- Source control rather than ventilation to achieve high IAQ shifts the focus of the metrics, e.g. dry air becomes an issue with high ventilation rates. Look to acceptable bounds for humidity.
- Standard conditions for T and RH should be defined.
- There is a link between humidity and emissions.
- Pollutants can vary over the year
- Characteristic of Low Energy Buildings has to be given.

- What are the IAQ problems related to Low Energy dwellings in comparison to normal dwellings (non-low energy) – tighter control is needed, there is higher sensitivity to IAQ problems.
- Focus should be on metrics that can be directly used in ST3 and ST4, but it is not clear how.
- Renovated buildings are an important issue!
- Different pollutants in residential than in commercial buildings. We don't have much information regarding pollutants from residential buildings.
- In the US, there is talk about 5 key pollutants – out of a gross list of 10 pollutants. ASHRAE's EHC Committee has looked to a dose-response model (Corsi).
- DALY (Disability Adjusted Life Years) can be linked to example pollutants.
- Suggestion to look at aggregated parameters, e.g. TVOC
- A word of caution was expressed about synergistic effects. But generally we know only very little about such.
- There are thermal effects.
- There are also ozone interactions to consider, and it will be necessary to separate between primary and secondary emissions.
- Inhabitants' cleaning habits are important.
- More knowledge may be accrued during the three years duration of the project.

6. Subtask 2 - Pollutant Loads in Residential Buildings

MQ presented the current status in ST2. His presentation is attached (Appendix C). Main points are:

1. Laboratory measurements source/sink models (small scale)
2. Room models (big scale)
3. Full scale climate chamber tests
4. Pollutant loads

Contributors seem to be from: Nanjing, Shanghai, Shenzhen, Tsinghua, DTU, La Rochelle, FIB, Syracuse.

For 2016, the plan comprises: Literature survey with collection of existing emission data (from the above mentioned contributors), Emission and adsorption test of some typical building material (Database update), Emission mechanism studies of composite material, and study/gather information about combined effects of temperature and humidity.

Further activities for 2017 -18 shall be: Measurements and tests of emission/sorption (for details see Appendix C) and model improvement. Reporting will be in 2019.

MQ also reported on activities on the CCHH project (China Children Healthy Home) in Shanghai (Prof. Huang), where conditions in 10 different Chinese cities from north to south are investigated regarding asthma in children based on an idea by prof. Sundell. Some 2,000-15,000 children involved pr. city. PM2.5, T/RH/CO2 measurements. Bacteria, dust and urine inspections. Inspections during four characteristic seasons.

- Chambers from different institutes can be used.

- P+ building in Changzhou Expo Park, China, can be used as a case study with different ventilation and air cleaning systems. It is a combination building with offices and residences.
- A review of materials used in China is currently ongoing – material emission database.
- The French Pandora database is a good starting point.
- Shenzhen IBR also has database
- Preliminary study: what type of materials do people have at home – building materials are the main source of emissions.
- Guidelines and labelling schemes exist all over the world.
- Plan for the project for 2016 shall comprise emission and absorption tests; emission mechanism studies; combined effects of temperature and humidity.
- Test methods, incl. the IAQ monitors is an interesting/relevant field to study and follow.

- An additional presentation was given by FC (Shenzhen IBR) – modelling pollution from decorations (including software development to be used by professionals for process control). Formaldehyde used to define to define standard rates of emissions.
- Process control regarding materials and building design from pre-assessment to entire process control.
- An engineering case as an office building with various ventilation paradigms has studied concentration level vs. time during construction and when from moving in to the building. Test methods include an IAQ monitor.

- CJ (who is currently a visitor with Jiping Zhang at Tsinghua Univ. in China) will be dealing with integration of IAQ modelling and BEPS (can be used in ST3 and ST4), and this will be used in an optimization process for ventilation volumes.

Further information and comments given:

- BUMA is a collection of database (password protected) of indoor pollution sources.
- Project EFFECT measures emissions from consumer products
- Cleaning products are dominant pollutants in office buildings, where limonene is a dominant contributor.
- TUD considers combined T & RH effects on pollutants and have started a database, but it is a big task.
- Our project should be restricted to building products rather than also comprising consumer products.

7. Subtask 3 - Modelling - review, gap analysis and categorization

JG presented current status in ST3. His presentation is attached (Appendix D).

- There are many tools already, we should rather focus on their quality
- 15 tools are represented in www.EnEff-stadt.info/design-tools/
- There is insufficient coordination among modelling tools which has led to overlaps, lack of coupling and quality issues.

- Examples of: EN tool platform and “history of building energy modelling” (1960-2010)
- Modelica – there are suitable libraries, but a lot of overlap among the different libraries, now unification of libraries under Annex 60.
- Analysis tools for energy: TRNSYS/BLAST/DOE/MATLAB/Simulink/Modelica/EnergyPlus w. DesignBuilder
- For IAQ, there are several (possibly)
- ST3 will focus on characterization of IAQ modelling tools
- Work plan and milestones – ST3 modelling description
- From an Annex 68 perspective, JG suggests to start with the EnTool platform. It requires systematization and identification of gaps and potentials, standards, validation and calibration.

Work plan is:

- Start looking to validation cases
- Framework should comprise CHAMPS (Combined Heat Air Moisture & Pollutant Simulation)
- It should be supported by databases
- Similarity approaches should be adapted as possible
- Validation cases should be decomposed so errors can be identified
- Outcome should be a new generation of validated tools with datasets and cases
- A first step is to register tools that are available. What kind of tools are they – what does it take for other teams to use the tools without too long learning curves?

OA requested clear activation of contributors.

Points from discussion:

- JZ: Make a protocol with which people can contribute with the tools as they are used to (Yuguo Li and Peter V. Nielsen did that in the past for CFD).
- Should lead to a guideline performing relevant simulations. ... and a common database
- New software needs not be brought forwards
- Focus should be on “building scale” – components exist, but there is a lack of a “BESTEST” solution.
- Study impact of “key technologies” for low energy dwellings on IAQ – to be able to refer to ST4&5.
- Start modelling known, simple problems (top down approach) for common exercises. Take the real case and do the modelling. Simple cases could come from Subtask 5. It might be difficult with real homes, but OK for test cells.
- Quantification of uncertainties is needed. Simplification - single zone etc. should be considered.
- Where are the links to ST1 and ST2?
- Definition of common exercise – first results by September?
- Also others may have input, e.g. NIST and NRC

Three cases:

1. A simple room, can we model it full scale? (Possibly do this until September)
2. A well-monitored research building
3. Field studies (communication with ST 5 is important)

Use experience from previous IEA Annexes’ common exercises (e.g. Annex 41 – where spreads were surprisingly large).

Themes for Common Exercises could be VOC's, SVOC's (difficult), PM, and perhaps CO2 and tracer gases – but some degree of sorption effects should also be relevant/included.

JG & JZ will develop guidelines for dealing with tools

8. Subtask 5 - (presented before ST4)

JL presented the current status in ST5. His presentation is attached (Appendix F).

- Information about available facilities will be collected in a web-based questionnaire.
- Suggestions for common exercises were presented:
 - o One room. Could be a stainless steel chamber with STEP exposures
 - o A test house with material emissions and possible inter-room connections.
 - o Inhabited building

We must clarify which phenomena we want to trace. Possibly test ventilation paradigms in building. Combinations with T and humidity are interesting. Challenge with S-VOC's. Clarify possible interaction/overlap with Subtask 2, which was subsequently negotiated.

Themes would be Sorption/SVOC/Particles/Microbiology/Secondary reactions/Inter-room connections/T-gradients/Indoor-outdoor interactions/energy.

- For field test, reporting should comprise
 - o Measuring protocol
 - o Analysis

JL has sent an invitation to Annex participants with a request to report about their test facilities: <http://goo.gl/forms/DO8MkazCG5>. (The questionnaire will be updated). It was remarked that Google forms are not accessible in China.

- Some references for test sites were given already:
 - o DK: WEEE - Wood Energy Emission Experience (2012-14)
 - o DK: HOME – Holistic Monitoring of indoor Environment, with room in room. Will run cycles of humidity ad study influence on VOC emissions.
 - o MD: UCL has cooperated with Tsinghua Univ combing low energy with IAQ studies, including humidity and CO2. Occupant dstudies. Now moving to ex-olympic site (London)
 - o JT: CVUT has two room operated indepedently with possibility to measure VOC. Has PIV equipment. Ref to Andreas Wagner, Karlsruhe. Contact with passive house builder.
 - o Saint-Gobain R&D Centre. Has two rooms/chambers, each 12 m2 where VOC, RH, T, ACH are measured to test products and systems in 1-3 month tests.
 - o Multikomfort house in Beaucouze (house from 2011 now privately owned). French HQE standard. Use non-poluting materials or passively cleaning products. AQ ssampling, VOC, T, RH, Radon.
 - o Saint-Gobain can identify other houses

Other discussion was mostly related to the whole concept of the ST5.

9. Subtask 4 - Strategies for Design and Control of Buildings

JK presented the current status in ST4. His presentation is attached (Appendix E).

Base questions:

- IAQ theme: How much do we need to ventilate?
- Systems-theme: How do we design the hardware?

General overview/plan follows a subdivision into four sub-subtasks:

- 4.1 State of the art review
- 4.2 Investigation – possible design strategies
- 4.3 Investigation – possible operation strategies
- 4.4 Annex 68 Guide

HK presented results from previous surveys of low energy houses conducted in Denmark (Appendix G). Highly energy efficient homes have been studied in Denmark. Satisfaction with IAQ generally very good (93% satisfied). Possibly an issue with over-heating. Small issues with noise and dry air. There could be a need to model/analyze homes with DCV and . Commissioning and checks are needed. Possibly an issue with filters not being checked/maintained in private homes.

CB has made a literature review on design strategies in the UK where there is a prescriptive requirement to have adequate ventilation. Background ventilation and exhaust fans are typical.

GR spoke about cascade ventilation, and gave link to a guide on www.phi-ibk.at/luftfuehrung/ and <http://www.komfortlüftung.at/>

Points from the discussion:

- Active contact to the stakeholders should be kept during whole ST4.
- Designers will never use advanced simulation tools (or even co-simulation solutions) – the influence must be made on standardization and legislators instead of on practitioners.
- Who is the target audience for the Annex 68 Guide? Should it provide tools to evaluate innovative ventilation systems?
- Our scope is residential buildings, but designers will not use design tools for such!
- But there may be cases where simulated results are needed, and legislators also need information
- Ask the practitioners: “where are the problems”?
- Cases analysed in Activity 4.2 could be used as a structure for the guide, feedback from stakeholders is needed.
- How to select-define cases for 4.2? Each country should define “typical dwelling” and design exercise will be conducted for such typical dwellings (approach applied in Health Vent project)?

To do's:

- Define when and what we can get from other ST's

- Define deliverables
- Involve stakeholders
- Define common exercise: What every country, what is a typical dwelling? Typologies: detached/multistory. New or existing/renovated. With or without mechanical ventilation.

10. Planning and administration

Issues pertaining to planning and administration were mostly dealt with at the beginning of the meeting.

It was reminded that the share point has the address https://share.dtu.dk/sites/IEA-EBC-Annex68_71200/SitePages/Home.aspx. Put files here (papers and presentations) using the name convention: Report A68-T#-CC-YY-#- III – Name.ppt or Presentation A68-T#-CC-YY-#- III – Name.ppt, where CC is country, YY I year, # is serial number, III is institution acronym, and Name is author name.

It was informed that NTNU (by GC) would most likely take subtask co-leadership of Subtask 4.

A few countries (D and A) have an issue with not having been able to get a signature both from their own institution and their country's ExCo representative about their participation. Canada will possibly join the Annex.

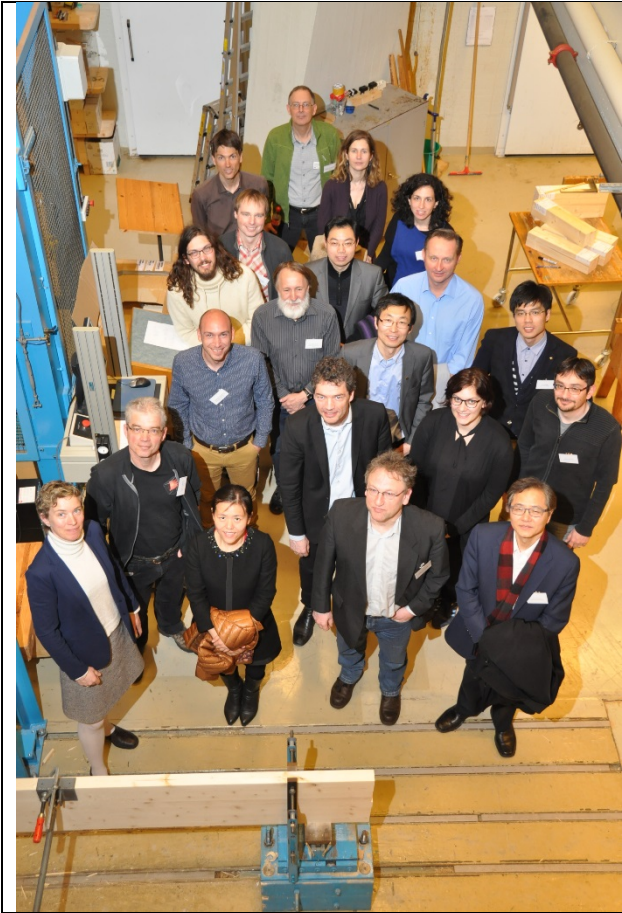
Next working meeting will be hosted by Syracuse University, Syracuse, NY, USA on the dates 8-10 September. Most of the day (until 3 pm) on the Sept. 8 will be dedicated to an (open) CHAMPS workshop. Sept. 10 (Saturday) will only be until noon.

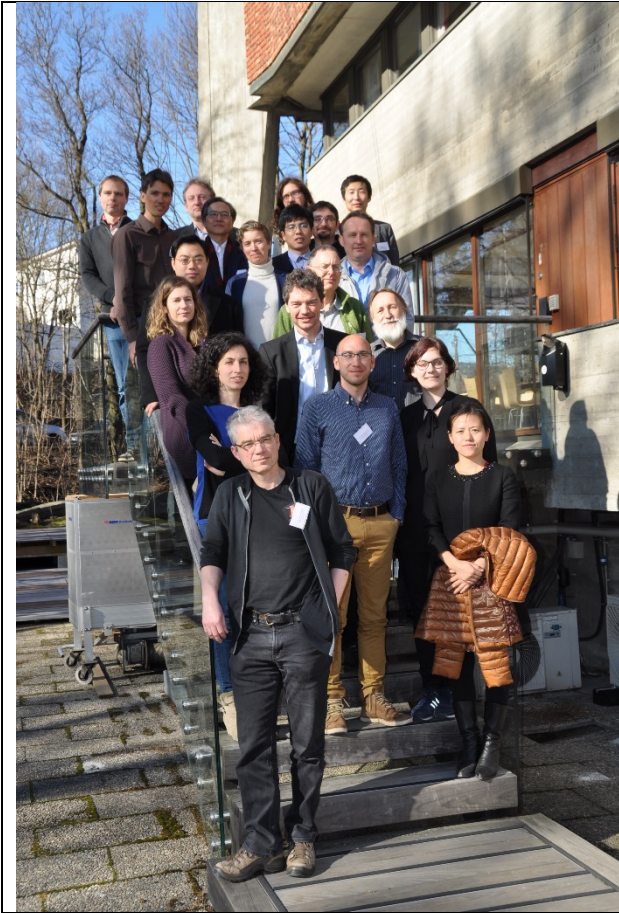
Subsequent meetings will be in Dresden (D), China and the UK (tentatively agreed)

Meetings should be 2½ day meetings in addition to subtask leader meetings (before/after working meeting) and possibilities for stakeholder involvement and/or technical visits. Meetings should have both common & parallel sessions, and should cover Administration, Subtask work items, Common Exercises, Reports and "Free papers".

11. Technical visits

A visit to the laboratories of the Norwegian Institute of Wood Technology, Treteknisk, was organized in conjunction with the lunch break on Tuesday March 15.





A visit to the field test site of the Norwegian University of Life Sciences, NMBU, was organized on Wednesday, March 16. Thomas Thiis guided us on a visit that comprised:

- A visit to an 8 story student dormitory, which was made as a wooden structure
- Outdoor field test buildings with chamber-in-chamber test of log walled rooms
- A visit to one of the historic buildings of NMBU which was under current renovation

