Minutes of the 1st preparation phase expert meeting in IEA EBC Annex 68

Copenhagen, March 19-20, 2015

Meeting place:
Technical University of Denmark, Kgs. Lyngby (Copenhagen), Denmark

Agenda

1. Welcome. Introduction to the workshop and presentation of its purpose.
2. Presentation of Annex text in its current state
    - Scope and objectives
    - Subtasks
    - Deliverables

    Presentation of history of coming to this state of the text:
    Workshops with CHAMPS community (Combined Heat, Air, Moisture & Pollutants Simulation), Annex preparation Workshop in Shenzhen, ASHRAE, Comments from the AIVC, Comments from the IEA EBC ExCo
3. Walk and talk on DTU Campus
    - While walking, make acquaintances and discuss Annex text
    - Visit to DTU Civil Engineering laboratories: Outdoor field test site (Nordvej), Civil engineering laboratories (Building 118 & 119), Indoor climate chambers and labs.
4. Short presentations of areas of interest/contributions from the participants covering
    - Actual research / results / key-findings
    - Relevant case studies
    - Views on gaps of knowledge to fill. Plans for contributions to the Annex.
    - Indication of subtask interest
5. Project organization
    - Subtask content and leadership
    - Subtask contributions
    - Web-page
    - Repository for documents and data
6. Funding and commitment
    - Management structure
    - Form of work
    - Research Item Descriptions – per partner
    - Industry / stakeholder involvement
    - Letter of national participation
    - Funding
7. Need for revision of Annex text?
    - Formation of working group
    - Work plan - not least for the next half year
8. Deliverables and outreach activities
    - List of Deliverables
    - Newsletter
    - Public seminars/technical days
    - Conferences
9. Contact to other groups and activities
    - AIVC
    - ASHRAE
    - Other IEA EBC Annexes
    - National / regional projects and contacts
10. Next meetings

Participants

See the list of participants in **Appendix A**.

1. **Welcome. Introduction to the workshop and presentation of its purpose.**
Carsten bid welcome and introduced the purpose of the meeting as primarily being to discuss the Annex text and some topics for revisions requested by the IEA EBC Executive Committee (ExCo). In addition, with the participants in the meeting, we should hear about their related activities and how they fit with the Annex proposal – also with a view to possible funding.
The ExCo had requested the following updates of the Annex text:
(a) Revise the scope to limit the topics to be studied
(b) Update the title to reflect the revised scope
(c) Explain more clearly how the underlying IAQ targets will be derived
(d) Explain how the work will advance the scientific basis for energy efficiency calculation methods to support policy implementations for low energy buildings
(e) Clearly state the anticipated deliverables for the intended target audiences

2. **Presentation of Annex text in its current state**
- Scope and objectives/Subtasks/Deliverables
- Presentation of history of coming to this state of the text

Carsten introduced the Annex description in its most recent edition: the one that was presented to the ExCo at its meeting in November 2014 (with a few immediate updates following from some of the easy comments by the ExCo).

The division into Subtasks is as follows:

ST1 - Defining the metrics
ST2 - Pollutant loads in buildings
ST3 - Modelling
ST4 - Strategies for design and operation
ST5 - Field measurements and case studies

Short editions of the content of each subtask with possible subdivision and statements about activities, stakeholders and deliverables were given in the slides, which can be found on the Sharepoint site for the project (text also in **Appendix B** of these minutes).

Carsten continued referring input given at the Annex preparation workshop (Shenzen, July 2014), the results of the Technology Readiness Assessment, references to the AIVC, where it was arranged that all ventilation-related IEA EBC Annexes should exchange information about their activities. These are IEA Annex 5 (AIVC), 59, 60, 61, 66, 67, 69. A phone meeting had been held on 27 Feb. 2015 between representatives of (most of) these projects.
In addition to the requests for annex text revision given by the ExCo, a few more specific suggestions had been given to Carsten by ExCo member and head of the AIVC, Peter Wouters:
- Develop an IAQ based relation to correction factors for energy
- Follow the development of sensor and logging technologies and control strategies.

We have been invited to have a session about our Annex in conjunction with the AIVC conference in Madrid, September 23-24, 2015. It was agreed to accept this invitation and to aim for a one hour session. It was also decided to aim for having the next Annex meeting in conjunction with the AIVC conference and to try get a Spanish participant on board in the project.

3. Walk and talk on DTU Campus
   - While walking, make acquaintances and discuss Annex text
   - Visit to DTU Civil Engineering laboratories: Outdoor field test site (Nordvej), Civil engineering laboratories (Building 118 & 119), Indoor climate chambers and labs.

   Walk and visit to the laboratories of DTU Civil Engineering was carried out according to the plan of the agenda.

4. Short presentations of areas of interest/contributions from the participants covering
   - Actual research / results / key-findings
   - Relevant case studies
   - Views on gaps of knowledge to fill. Plans for contributions to the Annex.
   - Indication of subtask interest

   The presentations are summarized in **Appendix C** by means of listing of the topics brought forward by the presenters. Presentations will be put on the Sharepoint server. The order of the presentations was arbitrary/a tour around the table.

   The presentations were given in the afternoon of Thursday March 19, and continued with a few presentations in the morning of Friday March 20.

Friday 20 March

5. Project organization
   - Subtask content and leadership
     The following subtasks will be in the project (with indication of Subtask leadership/co-leadership). The content is further described in **Appendix B** of these minutes.
     ST1 - Defining the metrics
       STL: Marc Abadie, Université La Rochelle, France /
       Co-STL: Pawel Wargocki, Technical University of Denmark, Denmark
     ST2 - Pollutant loads in buildings
       STL: Menghao Qin, Nanjing University, China (supported by Xudong Yang, Tsinghua University, China)
       Co-STL: Jensen Zhang, Syracuse University, USA
     ST3 – Modelling
       STL: John Grunewald, Germany
       Co-STL: Jensen Zhang, Syracuse University, USA
     ST4 - Strategies for design and operation
       STL: Jakub Kolarik, Technical University of Denmark, Denmark (supported by Rune Korsholm Andersen, DTU and Henrik N. Knudsen, SBi)
       Co-STL: Gilles Rusaouën, CETHIL, Insa de Lyon, France
     ST5 - Field measurements and case studies
       STL: Wei Pan, The University of Hong Kong, Hong Kong / China
       Co-STL: Sweden or Norway (TBD)

Subtask contributions

Country / institution	ST1	ST2	ST3	ST4	ST5
Austria					
Universität Innsbruck			x	x	(x)
Brazil (observing country)					
Pontifícia Universidade Católica do Paraná					
Canada					
Concordia University					
China					
Nanjing University		**X**		x	x
Tsinghua University		**X**		x	x
The University of Hong Kong	x				**X**
Czech Republic					
TU Liberec		X	x	x	
Technical University of Kosice					x
Denmark					
Technical University of Denmark, DTU	**x**	x	x	**X**	x
Danish Building Research Institute, SBi			x	**X**	x
Danish Technological Institute, TI				x	
Niras A/S	x			x	
Exhausto A/S				x	
VELUX A/S					
France					
Université La Rochelle	**X**	x	x		x
CEHTIL, Insa Lyon			x	**X**	
LOCIE, Université de Savoie		x			x
Germany					
Fraunhofer IBP		x	x		x
TU Dresden			**X**		
RWTH			x		
Japan					
The University of Tokyo			x		x
The Netherlands					
TU Eindhoven			x		
Norway					
Norwegian Institute of Wood Technology			x		**x**
Norges miljø- og biovitenskapelige universitet, NMBU					x
Portugal					
Faculdade de Eng. da Univ. do Porto					
Sweden					
SP, Sveriges Tekniska Forskningsinstitut					
IVL Swedish Environmental Research Institute			x		x
USA					
Syracuse University		**x**	**x**		
Missouri University					
Environmental and Occupational Health Sciences Institute, Rutgers					

- Web-page
  The following domain has been reserved for the project homepage: IEA-EBC-Annex68.org

Repository for documents and data
Presentations and papers should be uploaded the Sharepoint server: share.dtu.dk/sites/IEA-EBC-Annex68_71200/.

Documents should be uploaded as pdf-files. Name your documents according to the template: A68-T#-country code-yy-# (T# = Subtask no.), e.g.: A68-T2-DK-15-1
Access to the Sharepoint server will be granted by the Operating Agent (or the person he assigns to do it), and will be offered to partners of the project.

Documents, which are available on the Sharepoint, should be regarded as being made available in confidence only for the information of other project participants, and thus cannot be disseminated to recipients from outside of the project, nor can they be used or copied by others without the consent of the original author. This way, it should be possible within the project to upload also results which may have only a provisional nature, e.g. for discussion, and retaining the possibility for later publishing in scientific journals.

6. Funding and commitment
- Management structure
  Each subtask will be led by a Subtask leader supported by a Co-Subtask leader. The Operating Agent together with the Subtask Leaders and co-Subtask Leaders constitute the project's Management team. The management team may arrange extra planning meetings in conjunction with the regular bi-annual expert meetings, and the management team may also be in additional contact with one another, e.g. by on-line meetings.

- Main country contact
  Each country will have a nominated country contact through whom formal issues with the partners of that country will be coordinated. The country contact will also support contact with and dissemination to stakeholders from their country. However, most scientific information should be available through the Sharepoint of the project, and will thus be disseminated that way with direct possibility for all partners to access and upload results and information.

  The following country contacts have been nominated by (by country, institution):
  - Austria, Universität Innsbruck
  - Brazil, Pontifícia Universidade Católica do Paraná
  - Canada, Concordia University
  - China, Nanjing University
  - Czech Republic, TU Liberec
  - Denmark, Technical University of Denmark, DTU
  - France, Université La Rochelle
  - Germany, Fraunhofer IBP
  - Japan, The University of Tokyo
  - The Netherlands, TU Eindhoven
  - Norway, Norwegian Institute of Wood Technology
  - Portugal, Faculdade de Eng. da Univ. do Porto
  - Sweden, SP, Sveriges Tekniska Forskningsinstitut
  - USA, Syracuse University

- Form of work

  The following Gantt-chart gives an overview of the course of the subtasks:

	2015		2016		2017		2018		2019	
Preparation Phase	x	x								
ST1			x	x						
ST2			x	x	x	X	x	X		
ST3			x	x	x	X	x	X		
ST4			x	x	x	X	x	X		
ST5			x	x	x	X	x	X		
Reporting									x	X

The subtask leadership teams (STLs and co-STLs) should decide on a proper form of work for their subtasks. Crucial is to have some continuing activity between the bi-annual expert meetings. Subtasks must have clear deliverables. Common exercises, tool development, data collection and general harvesting of results and experiences from relevant complementary projects should be arranged and aligned such that participants actively work between the meetings with progression towards the agreed goals and final project deliverables. Involvement of local stakeholders is highly welcomed and should be encouraged. Likewise, workshops and seminars at relevant conferences are good to make awareness and make associations with relevant activities.

A participant is committed to offer 3 months of labour for each year of the project. Funding for this activity has to be obtained individually by each participant – typically in their own nation, but joint funding, e.g. in the form of EU/Horizon 2020 projects should certainly also be possible.

General characteristics of the subtasks:
- ST1 *Defining the metrics* has to be defined within the first year of the project.
- ST2-4. These subtasks should have an international approach, be coordinated, may work with common exercises gather and further develop experiences from previous assessments, take tools from other annexes, e.g. IEA EBC Annex 60, and investigate how we can further use and develop them in the Annex 68 context.
- ST5 *Field measurements and case studies*. These cases could be managed locally, but we should have a proper set of cases that represent the various conditions amongst the participating countries.

Deliverables were discussed, not least in relation to ST4, that should lead to some form of "guidebook" touching upon design, cost, prototype methodologies. Costs should also be remembered when defining the metrics in Subtask 1.

- Research Item Descriptions – per partner
  A Research Item Description form had been developed before the meeting and participants had been asked to fill it in with their interests and expertises – possibly with more than one form per participant. However, only few participants had done that. This is to be followed up.

- Industry / stakeholder involvement
  It is very important to get stakeholders involved on board –
  1) universities may take the leadership, but it could also be done by an industrial partner.
  2) highlight benefits for companies, help to save energy, show to the public that the company is involved
  3) also get authorities, e.g. legislators, on board to discuss and influence policies when relevant
  4) organize regular meetings, to keep companies updated - companies are not that much interested in publications
  5) make workshops to get interaction to promote better what we do – locally, to attract companies,

6) organize internationally based seminars

A remark was given that stakeholders from industry would have only limited own resources to go into the project with, e.g. for traveling, conferences etc. They would have to either obtain funding from projects like also the academic participants, or the project should be organized such that local participation in conjunction with expert meetings and representation at conferences would be maximized and by employing other means of dissemination and involvement.

- Letter of national participation
  Every participant should work towards having a letter of national participation signed within the preparation year of the Annex.

- Funding
  It will be needed that every participant secures funding to fulfil the requirements of being a project member. The requirements are:
  - Minimum time commitment – 3 months of labour per year
  - Time and funds to attend 2 meetings each year
  Some countries indicated their situation – and some are in progress of attracting the funding and aligning complementary projects.
  It was suggested that good/successful proposals to attract funding could be share with other members

7. Need for revision of Annex text?
   - Formation of working group
     Inputs for the pending Annex text revision should be organized on a subtask level.

   - Work plan - not least for the next half year
     The Annex text should be revised within a month or so, so it could be delivered to the ExCo in ample time, six weeks before its next meeting (June 17-18)

   Hints for Annex text revision:
   - The title should emphasize what kind of buildings the project has in its scope: low energy residential buildings.
   - The text should be written in such a way that it makes a proper balance between IAQ and energy efficiency. And energy conservation means need not only be in respect to ventilation.
   - Note the possible energy expenditure which is associated with improving air quality (more specific field of energy savings). Be more specific with respect to what energy savings we deal with.
   - Include also materials as an important topic.
   - Also outdoor air (conditions) should be considered, maybe rather consider only outdoor sources.
   - Heating and cooling systems are not specifically addressed in the Annex.

   Carsten highlighted the necessity that the scope of the Annex should rather be more focused than widened up.

   Some indications had been uttered, also at this meeting, that the problems the project wants to address have already been solved. I.e. low energy buildings are by some perceived as generally being characterized by having good indoor environments. Thus it was decided to vote by hand-raising if the idea of making the project should be continued. The poll resulted in a unanimous “yes” to continue.

Title:
Suggestions for a revised title were discussed. The discussion was concluded with the title:
Indoor air quality design and control in low energy residential buildings

8. Deliverables and outreach activities
   - List of Deliverables
     It was agreed that all participants should consider the deliverables and give their comments/suggestions within a month.

   - Newsletter
     We should deliver a status report and updates to the EBC web-site and annual reports every half year. In addition, we should deliver an Annex summary report a brochure and contribution to the EBC slide show. Every participant is encouraged to contribute to such deliverables by providing ideas, pieces of text, and not last visual material.

   - Public seminars/technical days
     Seminars for stakeholders, invite also other participants to join the seminars.

   - Conferences
     We should as Annex68 make ourselves visible at conferences.

     We have an invitation to have a workshop about Annex 68 at the AIVC Conference September 23-24, 2015 in Madrid
     . Some representatives from Annex 68 should be there, e.g. from all the Subtasks. No written publications (papers) shall be made, and the session should be for 1 hour. Work plan can be presented, short presentations and mainly with a purpose to get feedback from conference attendees.

     Other conferences and meetings:

     ASHRAE 2016 IAQ conference
     Environmental Health Committee – ASHRAE. The committee will be informed about Annex 68 by Jensen Zhang.
     TC 4.10 Indoor Environmental Modelling Committee - ASHRAE
     CHAMPS workshop – May 2015 – official invitation will be sent (will include a short session on Annex 68, e.g. half hour)
     ExCo meeting – report should be sent in the beginning of May

9. Contact to other groups and activities
   - AIVC
   - ASHRAE
   - Other IEA EBC Annexes
   - National / regional projects and contacts

10. Next meetings
    Whenever possible the next meetings should be arranged in conjunction with relevant other meetings/conferences. Thus it will be sought to have the fall 2015 meeting in adjacency to the AIVC conference in Madrid.

Appendix A

List of participants

Name	Company / institution	E-mail
Carsten Rode	Technical University of Denmark	car@byg.dtu.dk
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Karel Frana	Technical University of Liberec	karel.frana@tul.cz
Shinsuke Kato	The University of Tokyo	kato@iis.u-tokyo.ac.jp
Henrik N. Knudsen	Danish Building Research Institute	hnk@sbi.aau.dk
Sarka Langer	IVL Swedish Environmental Research Institute Ltd.	sarka.langer@ivl.se
Jakub Kolarik	Technical University of Denmark	jakol@byg.dtu.dk
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Bjarne Olesen	Technical University of Denmark	bwo@byg.dtu.dk
Marek Kušnír	Technical University of Košice	
František Vranay	Technical University of Košice	
Rune Korsholm Andersen	Technical University of Denmark	rva@byg.dtu.dk
Jiri Sedlak	VUT Brno	sedlak.j@fce.vutbr.cz
Part-of-day participation		
Sayana Tsutsima	Technical University of Denmark	
Gabriel Bekö	Technical University of Denmark	
Charles Weschler	Environmental and Occupational Health Sciences Institute, Rutgers	
Henning Grønbæk	Exhausto A/S	

Ruut Peuhkuri	Technical University of Denmark	
Skype/Adobe Connect participation		
Jensen	Syracuse University	jszhang@syr.edu
Xudong Yang	Tsinghua University	xyang@tsinghua.edu.cn
Excused		
Linda Hägerhed Engman	SP Technical Research Institute of Sweden	Linda.HagerhedEngman@sp.se
Jürgen Frick	Material Testing Institute – MPA, University of Stuttgart	Juergen.Frick@mpa.uni-stuttgart.de
Peter Foldbjerg	Velux A/S	peter.foldbjerg@velux.com
Francis Allard	Université La Rochelle	francis.allard@univ-lr.fr

Appendix B

Short editions of the content of each subtask with possible subdivision and statements about activities, stakeholders and deliverables.
This edition is the one that was valid during the days of the 1st expert meeting. It is to be amended within a month after the meeting.

ST1 - Defining the metrics
Lack of a quantitative measure of the IEQ benefit in comparison with the energy saving and greenhouse gas emission reduction benefit. Correlations between IEQ and productivity and health care related costs will be reviewed. Enable proper consideration of both energy and IEQ benefit in building design and operation

Activity:
T1.1 Literature surveys, gather input from stakeholders and seminars

Deliverable:
D1.1 A set of performance metrics will be defined and reported from this study.

ST2 - Pollutant loads in buildings
Collection and provision of new data about properties for transport, retention and emission of chemical substances in new and recycled materials under the influence of heat and moisture transfer.

Activities:
T2.1 Literature survey to gather relevant data and existing knowledge on pollutant loads in buildings, including models
T2.2 Laboratory testing and model setup to provide examples of new types of data which shall be beneficial to improve knowledge on combined effects that must be taken into consideration.

Interested parties:
Manufacturers of building materials and inventory products regarding testing and development of products that have minimal emission properties or which can absorb indoor pollutants and/or function as air cleaners

Deliverables:
D2.1 Mechanistic emission source and sink models to estimate pollution loads under realistic environmental conditions.
D2.2 A database of material's storage and transport properties for use in the models
D2.3 A database of pollution loads in existing buildings.

ST3 – Modelling
Collection and development of knowledge regarding whole building analysis tools and methods to predict the hygrothermal conditions, absorption and transport of humidity and chemical substances, and energy consumption within whole buildings.
Focus on methods to predict the emission and absorption of chemical compounds from materials under realistic in-use conditions regarding the CHAMPS-exposure in buildings.
This will predominantly be carried out by building upon existing BES tools and rests from e.g. IEA EBC Annex 60.

Activities:

T3.1 Literature survey and provision of knowledge about contemporary modelling capabilities in whole building energy and hygrothermal analysis in combination with air flow and emission models. Development of a paradigm for work with models such that they can be used as optimisation tools for good building energy performance under high IEQ conditions. Identification of gaps in current modelling capabilities.

T3.2 Development of new procedures that will be needed to model the interaction between energy efficient operation and high IEQ.

Stakeholders involved:
Building designers and companies involved in building design tool development may contribute to the subtask

Deliverables:

D3.1 A modelling framework and design tool such as a Virtual Design Studio for integrated and coordinated design of low energy and high IEQ buildings

ST4 - Strategies for design and operation

To devise optimal control strategies for the operation of buildings, not least with regards to ventilation requirement and ventilation mode (e.g. intermittent vs. continuous), such that the building energy performance, and user comfort and health conditions can be optimal

Activities:

T4.1 Modelling of possible strategies for operation on residential buildings

T4.2 Development of new procedures to model the interaction between energy efficient operation and high IEQ.

Stakeholders involved:
Cooperation is anticipated with building designers and with companies that provide ventilation systems and controls

Deliverables:

D4.1 A guidebook will be developed on operational strategies for optimal energy performance and good IEQ in residential buildings

ST5 - Field measurements and case studies

This subtask is to carry out field tests and analysis of certified green residential buildings that can be used to test and verify the findings of the other subtasks. Several sites/climates will be proposed, and the field tests will include buildings which are declared as “green”.
The field tests will focus on testing and demonstrating in practice, which low energy operational strategies can be used that will provide amenable indoor environments.

Activities:

5.1 Examples of residential buildings from different geographical regions, and which are either new buildings or existing (possibly retrofitted) buildings will be chosen for investigation. It shall be possible in the chosen buildings to interact with the relevant operational parameters, e.g. for ventilation control, and to monitor the relevant performance parameters for energy consumption and indoor environment.

5.2 Analysis and dissemination of the result collected in T5.1

Stakeholders involved:
Industry partners from the previous subtasks and with building owners.
Engineers and building owners/operators from the studied buildings.

Deliverables:
D5.1 Report demonstrating and analyzing residential green buildings which achieve optimal energy and IEQ conditions under various climatic situations.

Appendix C

Summaries of short presentations of areas of interest/contributions from the meeting participants, covering:

- Actual research / results / key-findings
- Relevant case studies
- Views on gaps of knowledge to fill
- Plans for contributions to the Annex
- Indication of subtask interest

(apologies for the staccato form, as the citation have at times!)

Combined presentation given by **Thomas Witterseh, Danish Technological Institute** and **Henrik N. Knudsen, Danish Building Research Institute / Aalborg University**.

TW:

Center for building examination, 200 people in DTI, 90% time spent on commercial tasks. DTI makes 1000 building examinations per year.

Themes of typical building investigations: PCB, asbestos, mould, moisture, air quality.

- Danish Indoor Climate abelling programme for low emitting materials

HNK:

Develop research based knowledge. Research projects on IEQ & Energy.

Energy retrofit – Indoor Climate before and after retrofit, 87% recommend retrofitting the house

New low energy building – (new energy classes); overall satisfaction with low energy houses - 93% recommend, good indoor climate, low energy costs. 75 % have ventilation system. But there are complaints about the noise.

High ventilation rates improve air quality. Old houses have trouble with low ventilation rates, challenging energy consumption.

User-friendly installations and handover procedures are important. Expectations should be reconciled (so occupants do not get disappointed after the 1st day).

Energy retrofitting improves indoor climate but you have to consider the house as whole system, not sufficient just to replace windows, otherwise you may end up with worse indoor climate.

Statements:

"Renovation is complicated"

"Houses are complicated today"

"Keep it simple and user friendly!"

Project: UserTEC – how people use energy and how they behave with respect to indoor climate. Focus n the triangle: Energy - indoor climate - user behaviour

Gaps of knowledge:

- Perception and health, questionnaires + measurements (perception and measurements). Physical condition vs. user perception.
- Use data we have, analyze them more in depth (e.g. questionnaires),
- We have a lot of data, databases are not well organized

Contributions to Subtask 5

C. Rode:	Where is the optimum for energy savings vs. indoor air quality?
HNK:	It is a question: where does it come from, the general recommendation of an air change rate of ACH=0.5 /h. Energy savings – still good indoor climate, but higher initial costs. Installation of sensors, sensors can contribute significantly to energy savings, not only by reducing the ventilation rate. DCV may be room based.

H. Grønbæk Reducing ventilation rates *may* be problematic. Have the ventilation where the users are.
What is a challenge, and should be a focus area, is refurbishment.

G. Rojas: Problem with dryness in winter. Level of ACH is a compromise between CO_2 level and humidity, 4 L/s person enough to supply fresh air.
Reference to *HealthVent* project.
Regarding pollution and building products/source control. OK in the beginning, but how to consider what eople bring in subsequently?

Shinsuke Kato (University of Tokyo) –
Contaminant control within the house
2 types of stakeholders/sponsors:
1) Air cleaner producers e.g. Daikin, Panasonic, Mitsubishi (portable devices, sink control, not source control, reduced ventilation rate, air cleaning method – passive method-building materials adsorb pollutants itself, active method – portable air cleaner).
2) House builders.

No actual response fro the stakeholders yet, contacts hvse just been made. stakeholders

Coupling of multi-zone network model with CFD. Issues:
- Calculation of mass flow rates (Chen)
- Modelling paradigm with “Concentration response factors”.
- Distribution with CFD.

How will portable air cleaners decrease contaminant concentration? Concept of “Concentration storage”
What is the most suitable position of air cleaners, with regards to supply and exhaust openings? Predict how air cleaners can decrease pollutants.
Measurements with tracer gas.

Interest in Subtask 3 and 5

Marc Abadie, Université de La Rochelle, LaSIE
A. Flows, energy and environment (Air, Rational use of energy, urban micro climate and building interactions).
Research activities – modelling of ventilation, sources such as pollutants’ transfer from the ground – radon, materials’ emissions and reactivity, air cleaning, systems/materials’ impact on IAQ for prioritization of indoor air pollutants.
Small and full-scale experiments.
Resources: emission of VOC, material properties, environmental chamber, modular IEQ house 110m^2 – modular, PT-RMS, Particle counters.
BES modelling with TRNSYS, Modellica, HAM Tools.
B. Database – Pandora (542 pollutant sources), 8171 pollutant emissions rates (7980 gaseous pollutants, particulate matter 191).
IAQ French campaign in dwellings (chemical, physical, biological).
Look at the link between outdoor and indoor air.
Reactivity models in sorption/diffusion mass transfer models (RH dependent).
Zonal models for airflow and gas/particle distribution in rooms and ventilation systems.
Transient simulation results for Toluene.

Gaps:
- What are the target pollutants?
- How to aggregate multiple indices.
- Outdoor air pollutant data for IAQ dynamic realistic simulations.
- Representative schedules of occupant activities.

- Database of material properties for IAQ modelling.

Interest in Subtasks 1, 2, and 3

German contributions (presented by John Grunewald)
John Grunewald, TU Dresden
TU Dresden does modelling, laboratory and field tests.
CHAMPS, CHAMPS-BES, with implementation of VOC storage and transport.
Air flows in constructions with VOC infiltration/exfiltration.
VOC/material combinations -> which partition coefficients to use.
Single chambers and dual chambers – diffusion and partition coefficients, evaluation of the data could be another challenge.
Optimum between air flow and damage in construction due to the moisture.
Delphin 6 (2015).
Energy related effects of VOC emissions at building scale – whole building, multizone.
MANDRAD

Measurements in Munich, **FIW/Andreas Holm (by JG)**
Hygrothermal properties emission and storage.

Christoph van Treeck, RWTH Aachen (by JG)
Mainly CFD simulations
CFD with pollutants => Simplified models

Florian Antretter, Munich Research Institute (by JG)
Modelling, WUFI software, Model verification strategy.
Material properties and VOC properties, WUFI software.
Huge testing facilities (Fraunhofer IBP).
Coupling HAM and CFD could be a problem, long time, high performance computers.
Test facilities in test field and chambers.

A German contribution is also by **Jürgen Frick, Stuttgart University**
Jürgen Frick was not present at the meeting, and his inputs were not covered by the presentation given by John Grunewald. However, Jürgen Frick has sent a PowerPoint presentation, which is uploaded on the Sharepoint server.

Jakub Kolarik, DTU
Photocatalytic air purifiers – does not work for bio-effluents, so they are good for non-occupied rooms, but mot when people are present, so occupants are important
Photocatalytic cement based paint. Require light in UV range. We still need the right material.
CO_2 sensors versus MOS VOC sensors. CO_2 and VOC sensors may suggest different controls for opening/closing of vents and windows. How are the relations and offsets? Research is needed on how to sensibly use VOC-sensors and investigate potential risk of over-ventilation.
New types of sensors are interesting.

Interest in Subtasks 2, 3, 4

Sarka Langer, IVL, Swedish Environmental Research Institute
IVL does consulting (40%) and research (60%) "on everything that is sustainable"
Sustainable buildings.
SMIL: Strategy of Methodology for assessment of Indoor Air Quality in Low energy buildings.
Indoor air chemistry.

Formation of photochemical smog.
Ventilation.
Evaluation of materials.
Case study: Schools - pupils vs. Ozone.

Marek Kusnir, Technical University of Kosice
Have focus on energy.
Field laboratory in the city center of Kosice, step changes in building renovation
Effective use of renewable energy sources
Heat pumps. Micro-capillary systems
Relation to Annex 68: improved air quality, active building

Henning Grønbæk, Exhausto A/S
Aiming for optimal ways of control of ventilation. Pressure control system
Adaptive system – control with VOC sensors.
Work with Rune Andersen DTU on occupant behaviour.
Variations between apartments and also over time.
Contribution: modelling of occupant control of ACH in residential buildings, opening windows plus mechanical systems.
"Good if control with VOC sensors is possible".
"In total we are over-ventilating".

Rune Korsholm Andersen, DTU Civil Engineering
Works with occupant related issues, and in that relation, studies temperature and CO_2 distributions.
Contribution to Annex 68 on modelling of occupant controlled HVAC systems.

Chinese contributions, presented by Menghao Qin, Nanjing University also on behalf of Tsinghua University, and Shenzhen IBR.
The Chinese universities, in comparison to many other project partners, have a particular interest in conditions for hot and humid climates.

MQ, Nanjing University: International centre for green building and urban living environment (cooperation with other universities).
Multiple scales of research – micro (e.g. porous materials) – meso (hygrothermal issues) – macro (urban microclimates).
Establish database of materials used in China
Moisture buffer value (MBV). "Chinese materials are different". Interest in MBV of phase change materials.
Simple but accurate models (challenge). IAQ modelling. CHAMPS simulations.
Test building under construction (w. Michael Pelken) – passive strategies for high IEQ and low energy consumption

MQ presents on behalf of Xudong Yang, Tshingua University
Develop reliable VOC design and simulation tools which are applicable for real buildings.
Long-term continuous measurements of formaldehyde in a house.
Emissions in real buildings are different from what can be deduced based on constant conditions in the laboratory.
Combined effect on emissions of temperature and humidity lacking, but is important.
IAQ simulation tool software – under development.

China's interests are in Subtasks 2, 4 and 5

Representatives from Norway

Dimitrios Kraniotis, Treteknisk

Interest in latent heat – moisture in drying/absorption phase – heat absorbed or released.
Hygrothermal mass – materials with large moisture capacity.
Hygroscopic structures – to maximize potential related to this phenomenon.
Treteknisk would like to see moisture as a resource rather than as a pollutant.

Tormod Aurlien, NMBU

Extensive use of massive wood – also for tall buildings.
Explore buffer capacity of wood.
Experiment with modules: Untreated massive wood vs. with non-hygroscopic (plastic) surface -equal moisture supplied to both modules at the same time.
Simulation does not equal to reality (WUFI software).

Kristine Nore, Treteknisk

Projects of relevance:

- HOME = Holistic Monitoring of indoor environment
- WOOD2NEW
- HYGROMASS (H2020 application submitted)

Works also with: Architecture. Windows with switchable mirrors. Intelligent control.
Implementation of the neglected energy carrier: hygrothermal mass in buildings, simulation and operation.

Interest in Subtasks 3 and 5

Karel Frana, Technical University of Liberec

Three topics of relevance:

- Gas pollutant propagation in a room – experimental data validate simulation output. Measurements followed up by CFD-calculations (with combustion)
- Indoor comfort conditions – thermo-camera, PIV measurements, flow visualization by laser. Near-window applications.
- HVAC systems, practical applications – innovation of heat exchangers, improve energy efficiency of ventilation system.

Gaps: experimental data, materials' research (subtask 2).
Absorption of the building materials (subtask 2 and 3).
Database of particle pollutants, behaviour of particle pollutants (subtask 4).

Interest in Subtasks 2, 3 and 4

Friday 20 March – Continuation of individual presentations of interests and possible contributions:

Wei Pan, The University of Hong Kong, HKU

Climatic zone considerations: (Yesterday's discussions were focused on conditions for temperature climate zones: Hong Kong conditions are different with a hot and humid climate, and that should also be considered. Hong Kong is also different by being dominated by high rise buildings, and a high density of buildings.

The Civil Engineering Department of HKU is involved in the following ongoing initiatives:

- A low carbon- initiative which is carried out in cooperation with consultants and contractors.
- A zero–carbon partnerships, which includes a social as well as a political context.
- Cases with public houses as well as private office buildings.

Wei completed his presentation by highlighting that metrics definition is very important for the project – which variable are we focusing upon?

Gabriel Rojas, Innsbruck University

Topics of activity:

- Refurbishment
- Hygrothermal analysis
- Indoor air quality
- School project and flats, which are passive houses.
- Cascade ventilation.
- Humidity buffering and analysis with CONTAM.
- Has tried to model VOC, but not easy to get realistic output.
- Ventilation rate vs. low humidity in winter.

Opinions:

- VOC's are not a problem if source control is carried out. Bio-effluents and humidity are more important. It has to be designed as a proper balance between not having problems with bio-effluents and avoiding low humidity (in winter).
- VOC's cannot be used to define how much ACH we need

Facilities:

- Innsbruck University has two PASSYS cells.
- The group also work with a PT-RMS.

Project: Low_vent.com

Open questions/Inputs to project:

- Consideration of emissions from building products decrease with time, influence of T and RH can cause a fluctuation, chemistry – but may not be so important in the big picture.
- Link between measurements and real world (furniture/occupants activity), e.g. problems of kitchen
- Link between concentration in room and concentration at human nose depending on ventilation – local versus bulk values for pollutants and humidity.

Comment from Glenn Morrison: Materials' VOC can be controlled, but peoples' influence and SVOCs could be an issue.

Christopher Just Johnston, DTU and Niras A/S

"People don't want it" (ducted ventilation systems in residential buildings)
"We don't know how to do it". So:

- "How to convince our costumers"
- "What are the good and elegant technical solutions"?
- "It should convince legislators"

Interest in Subtasks 1 and 4.1

Contributions from Lyon and Chambéry (presented by Gilles Rousaouën)

Gilles Rusaouën, CETHIL, Insa de Lyon

Building physics group.
Adapted simplified models:

- Regulation
- City model: MERUBBI

Thermal transfer, complex thermal systems, thermal behaviour
LBM simulations indoor
Moisture transfer models: HUMIBATEX/MOB-AIR/HAM

Interest in optimization rather than knowing the physics better.
IAQ has more unknowns than what is the case for the thermal conditions of buildings.

LOCIE, Université Savoie Mont Blanc

Indoor air quality. Has project on indoor air treatment/air cleaners in residential buildings.