

TTÜ EHITUSTEADUSKOND
EHITISTE PROJEKTEERIMISE INSTITUUT
TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2013

1. Struktuur

Ehitiste projekteerimise instituut, Department of Structural Design
direktor professor Jarek Kurnitski

Struktuuriüksuse koosseisu kuuluvad järgmised õppetoolid ja laboratoorium:

- Ehitusfüüsika ja arhitektuuri õppetool - Chair of Building Physics and Architecture (kuni30. juuni 2013) juhataja professor Targo Kalamees
Ehitusfüüsika ja energiatõhususe õppetool - Chair of Building Physics and Energy Efficiency (**alates 01. juuli 2013**) juhataja professor Targo Kalamees
- Ehituskonstruksioonide õppetool - Chair of Structural Engineering
õppetoolihoidja dotsent IvarTalvik
- Ehituskonstruksioonide teadus- ja katselaboratoorium - Laboratory of Structures
juhataja Elmar-Jaan Just

2. Instituudi teadus- ja arendustegevuse (edaspidi T&A) iseloomustus

2.1 struktuuriüksuse koosseisu kuuluvad uurimisgrupid

Uurimisgrupi nimetus (*eesti ja inglise keeles*) ja juhi nimi

- uurimisgrupi teadustöö kirjeldus (*inglise keeles*)
- uurimisgrupi aruandeaastal saadud tähtsamad teadustulemused (*inglise keeles*)
- uurimisgrupi kuni 5 olulisemat publikatsiooni aruandeaastal

Liginullenergiahoonete uurimisgrupp – Nearly Zero Energy nZEB Research Group, juht professor Jarek Kurnitski

Nearly Zero Energy nZEB Research Group was established 01.04.2012 at Tallinn University of Technology (TUT). The group has a web page www.nzeb.ee. This multi- and interdisciplinary nZEB research group represents a strong networking effort within TUT among four different disciplines: Energy performance of buildings, Building Service Systems, Building Physics and Construction Economics and Management. With active involvement of two other professors this research group consist of about 10 persons. Professor Targo Kalamees (Building Physics) has actively been involved in the research of nZEB group, especially the research of airtightness and infiltration. Adjunct professor Hendrik Voll (HVAC-technology, co-funded by the grant) has been involved in one core topic of the group, fenestration design principles for nZEB office buildings in a cold climate.

In 2013 five PhD students have worked in the group:

- Mikk Maivel works with low temperature radiator (and floor heating) systems with the aim to find optimal heating solutions with minimal systems losses for nZEB buildings;
- Martin Thalfeldt is conducting building simulation in order to find optimal fenestration solutions and design regarding daylight, heating and cooling energy as well electric lighting;

- Ergo Pikas works with cost optimality and other economic aspects related to high performance solutions needed for nZEB. With his help, the fenestration analyses can show not only novel technical solutions to control energy use but also cost optimal solutions;
- Jevgeni Fadejev is focused on energy pile and ground source heat pump modeling questions and performance analyses in a whole building simulation environment;
- Erkki Seinre is working with quantification of environmental and economic impacts for main categories relevant for building labeling schemes and sustainability assessment.

The research has been generally been focused on technical solutions for nZEB most urgently needed in Estonia, which may be condensed as follows:

- new heating and ventilation solutions suitable for specific operation conditions in nZEB;
- new external wall assembly solutions studied with computational analyses and climate chamber tests;
- office building solar shading and façade analyses will use energy simulations and measurements at TUT technological facility;
- energy simulations combined with economic and cost optimal analyses.

From autumn 2013 we have been capable for laboratory research: two facilities, nZEB technological research facility and climate chambers for controlled laboratory experiments are completed, and first studies are already ongoing.

The main research outcomes and publications have been following:

- low temperature radiator heating systems – detailed dynamic modeling in order to quantify system losses in low energy buildings, continues with floor heating systems and heat performance optimization with radiator system;
- fenestration design principles in a cold climate for office buildings with the focus on daylight, heating and cooling energy and lighting electricity, façade energy performance and cost optimality of solutions have been published and the work continues with external shading control principles;
- development and validation of simplified energy performance compliance assessment method based on specific heat loss correlation and used in Estonian regulation;
- quantification of environmental and economic impacts for main categories of building labeling schemes in Estonian context.

Input to European harmonization:

- preparation of European nZEB technical definition for uniformed national implementation of EPBD – REHVA nZEB definition 2013 (Chairing the REHVA nZEB task force and cooperation with CEN);
- comparative analyses of Estonian and Nordic building codes regarding energy performance minimum requirements;
- publishing one of the first technical oriented nZEB book (Springer, about 180 pages) dealing with definitions and early stage design principles.

Input to national regulation:

- contribution to preparation of the Estonian regulation on minimum energy performance requirements and calculation methodology (revision of the minimum requirements, governmental act VV No 68:2012 and a new act of calculation methodology MKM No 63:2012);
- guide for low energy and nearly zero energy buildings – technical solutions for scoping and conceptual design stage (about 100 pages for construction clients, architects, contractors and other decision makers, printed book March 2013).

In 2013, being the first full year of the research group, we have published 6 peer reviewed journal articles, 2 books, 1 editing of European REHVA report, and 7 conference and technical articles.

Some selected publications:

- E. Seinre, J. Kurnitski, H. Voll, Quantification of environmental and economic impacts for main categories of building labeling schemes, *Energy and Buildings* 70 (2014) 145–158, <http://dx.doi.org/10.1016/j.enbuild.2013.11.048>;
- M. Maivel, J. Kurnitski. Low Temperature Radiator Heating Distribution and Emission Efficiency in Residential Buildings, *Energy and Buildings* 69 (2014) 224–236, <http://dx.doi.org/10.1016/j.enbuild.2013.10.030>;
- Thalfeldt, M., Pikas, E., Kurnitski, J., Voll, H. Facade design principles for nearly zero energy buildings in a cold climate, *Energy and Buildings*, 2013, Volume 67, 309–321, DOI: <http://dx.doi.org/doi:10.1016/j.enbuild.2013.08.027>;
- Jarek Kurnitski (editor), *Cost Optimal and Nearly Zero-Energy Buildings (nZEB) Definitions, Calculation Principles and Case Studies*. Springer-Verlag London 2013;
- Jarek Kurnitski (editor), *REHVA nZEB technical definition and system boundaries for nearly zero energy buildings, 2013 revision for uniformed national implementation of EPBD recast prepared in cooperation with European standardization organization CEN*. REHVA, Federation of European Heating, Ventilation and Air-Conditioning Associations, Report No 4, REHVA 2013.

2.2 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest

Lennusadama vesilennukite angaaride taastamise eest saadud Euroopa kõrgeim tunnustus kultuuripärandi hoidmisel ja taastamisel :

EU Prize for Cultural Heritage / Europa Nostra Awards 2013

Category 1 – Conservation

Tallinn Seaplane Harbour, Estonia

Lennusadama projekteerisid arhitektibüroo KOKO arhitektid ja teised projektipartnerid (TTÜ professor Karl Õiger, PhD Heiki Onton jt)

2.3 Loetelu struktuuriüksuse töötajatest, kes on välisakadeemiate või muude oluliste T&A-ga seotud välisorganisatsioonide liikmed.

Targo Kalamees: CIB-International Council for Building Research Studies and Documentation – W40- Heat and-Moisture Transfer in Buildings, member of commission;

-International Society of Indoor Air Quality and Climate, member.

Jarek Kurnitski: Vice-President of the REHVA (Federation of European Heating and Air-Conditioning Associations), since April 18, 2012;

- Chairman of the REHVA (Federation of European Heating and Air-Conditioning Associations) Task Force on Nearly Zero Energy Buildings, 2010-2013;

- Co-Chair of the REHVA Technology and Research Committee (TRC) since 2012;

- member of the editorial board of *Energy and Buildings* (an international scientific journal);

- member of the editorial board of the *REHVA European HVAC Journal*;

- member of the board of the Finnish Heat Pump Association SULPU 2012-2013;

- Vice-chairman of The Finnish Association of HVAC Societies SuLVI, 2010-2013;

- member in CEN TC228 Heating Systems in Buildings WG4 Calculation methods and system performance and evaluation, 2014-2015;
- member in CEN TC371 Project Committee – Energy Performance of Buildings project group WG1 EPBD Standards group, 2012-2015;
- Expert in CEN TC156 Ventilation for Buildings WG21 Revision of calculation standards EN15241, 15242 and 15243, 2013-2015.

Aldur Parts: International Association of Bridge and Structural Engineering (IABSE), member.

Ivar Talvik: CEN/TC 250/SC 2 Eurocode 2: Design of concrete structures, expert.

Alar Just: International Association of Bridge and Structural Engineering (IABSE), member:

- Rahvusvahelise ekspertgrupi Fire Safe Use of Wood, member;
- CEN/TC 250/SC 5 Eurocode 5, member.

Valdek Kulbach: Rakenteiden Mekaniikan Seura RY, member.

Vello Otsmaa: CEN/TC 250/SC 2 Eurocode 2: Design of concrete structures, expert,

Valdo Jaaniso: International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), member.

Johannes Pello: International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), member.

Väino Voltri : CIB-International Council for Building Research Studies and Documentation -W23 - Wall Structures, member of commission.

Karl Õiger: Honorary Doctor of Science in Technology (Tampere University of Technology since 18.05.2012).

2.4 Soovi korral esitatakse aruandeaastal saadud T&A-ga seotud tunnustused (va punktis 2.3 toodud tunnustused), ülevaade teaduskorralduslikust tegevusest, teadlasmobiilsusest ning hinnang oma teadustulemustele

Aruandeaastal saadud muud T&A-ga seotud tunnustused

Arhitektuuri sihtkapitali aastapreemia:

professor Karl Õiger`le – elutööpreemia.

Mahuka teadustöö eest ehitusinseneria valdkonnas, selle rakendamise eest ehitus- ja restaureerimispraktikasse ning panuse eest inseneride koolitusel. 3200 eurot.

Eesti Arhitektide Liit andis 14.02.2013 oma üldkogu piduliku tseremoonia raames esmakordselt üle aasta parima inseneri tiitli - selle pälvis üksmeelselt professor Karl Õiger suurepärase ja südamega tehtud töö eest vesilennukite angaaride renoveerimisel.

Eesti Betooniühing kuulutas konkursi „Aasta betoonehitis 2012“ võitjaks Tallinna Lennusadama vesilennukite angaari betoonkonstruktsioonide rekonstrueerimise. Konkursi peaauphind omistati konstruktoritele Karl Õigerile ja Heiki Ontonile.

Eesti Betooniühingu üliõpilaspreamia saajad olid:

- Margus Riimann magistritöö „ Eksperimentaalsed uuringud impregneeritud tekstiilarmatuuriga I-tala põikjõukindluse määramiseks“ eest. Töö juhendajad professor Karl Õiger ja M.Eng Christian Kulas.
- Martin Minin magistritöö „ Energia- ja õhupaneeli õhusüsteemi energiatõhusus ja projekteerimisjuhised“ eest. Töö juhendaja professor Jarek Kurnitski.

3. veebruar 2014