EHITUSTEADUSKONNA KESKKONNATEHNIKA INSTITUUDI TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2013

1. **Instituudi struktuur**

Instituudi direktor Enn Loigu

- Keskkonnakaitse aluste õppetool, Chair of Environmental Protection, Enn Loigu
- Kütte ja ventilatsiooni õppetool, Chair of Heating and Ventilation, Hendrik Voll
- Veetehnika Õppetool, Chair of Water Engineering, Karin Pachel
- Veekvaliteedi teadus- ja katselaboratoorium, Laboratory of Water Quality, Kati Roosalu

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

(NB! Punktid 21.-2.6 täidab struktuuriüksus!)

2.1. Struktuuriüksuse koosseisu kuuluvate uurimisgruppide teadustöö kirjeldus (2.1.1) ja tähtsamad teadustulemused (2.1.2) inglise keeles

Chair of Environmental Protection

Under the project **CELA** („Network of Climate Change Technology Transfer Centres in Europe and Latin America“) the teaching staff of the university exchanged experiences with their colleauges in Latin America on the bases of distributing knowledge about the technology transfer on climate change. In March 2013 Prof Arvo Iital and PhD student Marija Klõga participated in project meeting and Capacity-building Seminar in Lima, Peru with a presentation on Technologies for Adaptation and Management of Water Resources. Later on, in August 2013 they participated in the project conference held in Guatemala and had a presentation on „Technology driven measures for coping with climate change in water systems“. J. Lebedeva and M. Klõga participated at a conference on climate change held in University of Life Sciences, Tartu in September. In November Klõga and Iital participated at a project final conference in Hamburg.

The final version of the CELA transnational recommendation report has been finalised, published and delivered to the project partners, stakeholders and participants of the project final conference.

Publications:

Tallinn University of Technology, 2013. CELA Transnational Recommendation report. Climate change technology transfer across higher education institutes in Latin America and Europe, 63 pp.

SUBMARINER „Sustainable Uses of Baltic Marine Resources“: was giving new ideas for improving the Baltic Sea environment and economies through innovative approaches and

sustainable use of marine resources.. It includes common reed as bioenergy resource as well as a material for construction and thatching.. *In 2013 TUT was responsible for compilinga of the Submariner vision 2013 and the roadmap for future use of reed A report: "*Pilot case study: Common Reed in Haapsalu and Matsalu Bay area" was produced.
The results of the study on reed areas and biomass in the BSR were presented at International Conference "Reed as Renewable Resource" 14th-16th February 2013 in Greifswald, Germany attended by prof Iital and V. Voronova In March Prof A. Iital took part in seminar on "Ecosystem services" held in Berlin, Germany. In May V. Voronova presented the final project report in Lolland, Denmark. In September Prof Iital and Voronova took part in project meeting in Copenhagen, Denmark. And In September Iital and Voronova participated in the final project conference on "Using marine resources", that was held in Gdansk, Poland.
Publications:
Iital, A. and Voronova, V., 2013. Pilot case study: Common Reed in Haapsalu and Matsalu Bay area. Submariner report, TUT, Baltic Sea Region Programme, 10 pp.

PROMITHEAS -4 „ Knowledge transfer and research needs for preparing mitigation/adaptation policy portfolio". *"Development and assessment of Mitigation / Adaptation Climate Change policy portfolios for Estonia" for three scenarios was prepared*. National workshop was organized in Tallinn, 8 May 2013. Outputs of the project are available on PROMITHEAS-4 as well as on TUT Environmental engineering department homepages. The project was successfully completed in December 2013. In 2013 the International combined with the Final conference of the project was held in Athens, Greece in October. The project coordinator is assoc. Prof. Alvina Reihan. Project is financed by Seventh Framework Programme (FP7).

The Project „Assessment of possible changes of Estonian climate and environmental status on the basis of dynamical modeling of atmosphere, ocean and river runoff (EstKliima)" under KESTA programme is continued project that will be finished in 2014. Project is finansed by ARHIMEDES foundation. In the 2013 pollution load to the Baltic Sea of selected parameters were estimated for the long-term period of 1992-2011. Trends were positive in most cases, however not significant for all sites. Phosphorus loads were modelled for three different scenarious under a climate change conditions. Modelled results showed phosphorus load increase up to 15-20%.
TUT participated in two working meetings. Project participants are: **Alvina Reihan**, Kristjan Piirimäe (researcher) and Rain Elken (PhD student).

The project „Development of ecological flow estimation methods for regulated, salmon and the rest rivers in Estonia (Order of the Ministry of Environment)" was complited in 2013 May. Three environmental calculation methods were proposed. Project responsible contractor is Prof. Enn Loigu, executors are **Alvina Reihan** and Rain Elken.

Chair of Heating and Ventilation

KESTA (Development of efficient technologies for air exchange and ventilation necessary for the increase of energy efficiency of buildings).

This is a continuous project that will end in 2014. During the 2013 efficiency of ventilation systems in residential buildings was analyzed. The impact of ventilation solutions for air quality was measured and analyzed. Besides considerable research attention was given for the investigation of room air handling unit and exhaust air ventilation systems with heat pumps. Also the apartment and centralized ventilation system in renovation ventilation of apartment buildings has been analyzed.

MJD 107 (Investigation of Grey Water Irrigation and Energy Demand for Greenroofs).
This is Postdoctoral Research Grant that ended in 2013. The project had two objectives. Firstly to analyze the passive cooling potential of greenroofs. Secondly to prove the evaporative cooling potential of greenroofs irrigated by grey water. The results of the passive cooling potential study showed that the green roof configurations functioned as additional insulation layer at night and reduced the night time cooling at roof surface. Both the lab tests and simulation results indicated that the overall cooling demand increased. Evaporative cooling study concluded that greywater irrigation compared to potable water irrigation reduced the thermal resistance by about 30%.

INTERREG project ENEF (Central Baltic Cooperation in Energy Efficiency and Feasibility in Urban Planning)
The project ended in 2013. As an outcome Handbook on Building Renovation in Central Baltic Region was Published. Also in 2013 an International Conference and Exhibition "Energy efficiency strategies for buildings and urban areas" was organized at Tallinn University of Technology. The conference gathered about 200 national and international guests. In the conference the project results gathered in the published handbook were presented. Also the student exhibition passive cooling strategies took place with seven participating student teams from Estonia, Latvia, Finland and Sweden.
Besides three major research projects described above researchers from the Chair of Heating and Ventilation were involved with multiple smaller scale national projects.

Chair of Water Engineering

The INTERREG project **SUSBIO** "Sustainable utilization of waste and industrial non-core materials" was completed. The SUSBIO project aimed to develop tools for added sustainability of the food value chain in order to reduce the total environmental load on the Baltic Rim area. The project is in line with the EU waste framework directive (2008/98/EC9) and was performed in partnership with Turku University of Applied Sciences (leading partner). TUT participated in project as responsible partner for WP2 and WP4. Met goals:

Data of biodegradable waste quantities was collected and the waste treatment investigated. Estimation of the qualities and quantities of biodegradable waste in Estonia and its potential for biogas production have been done. Separate collection of municipal solid waste in Tallinn, changes in collection system waste composition have been analysed The database model for evaluation of biogas production perspectives in Estonia was created and preliminary optimisation method for biomaterial utilization for biofuel was carried out. The anaerobic digestion process has been analyzed using the specially made and also purchased (AMPTS II) laboratory equipment. Screening experimental methods were examined and from available experimental methods, the bio-methane potential (BMP) tests are those that have been most successful, mainly thanks to their easy set up and conduction as well as the useful information obtainable from them. The tests were conducted either with pure substrates or a mixture of two substrates in order to investigate also the effect that the combination of different organic wastes have on the digestion process (co-digestion).The research for optimal parameters in biogas production applying single and multistep procedures was carried out. The investigation of opportunities to utilize the solid residues from biogas production in agriculture and the corresponding regularity were investigated. The technical manual of biogas production was drafted. The substrates used in laboratory experiments were sludge from wastewater treatment plant, glycerol, food processing industry wastes
The final report of project (of the part, in which TUT was responsible) was drafted.

Gauja/Koiva

Results of monitoring in time-period between October 2011 and December 2012 are reviewed and treated into database. Assessment of the hydrochemical quality status and objectives of the rivers on Estonian side is finished. According to the investigations and data analysis, Koiva basin watercourses are in a very good or good status. Final Report on assessment of the quality status of the transboundary water bodies (coastal, lakes, rivers) in Gauja/Koiva river basin district in English is drafted. Existing Estonian and Latvian rivers water quality objectives according to the chemical parameters and limit values were revised and harmonised objectives for the transboundary water bodies in the Gauja/Koiva river basin district is provided. Brochures on water use and water quality in Gauja/Koiva river basin district are commented and revised as well printed brochures were disseminated. Several conferences and expert workshops were attended in Riga, Pärnu and Sigulda.

Tallinn stormwater monitoring

The goal of the study was to monitor and assess the flow rate and quality of stormwater, for measuring the extent and trends of pollution, the load of pollutants falling into the sea in timeperiod between 2012 and 2014. This will enable to plan suitable measures for improving the state of the sea. Monitoring is carried out in 6 sampling stations 6 times per year with different weather conditions. The water quality in Mustoja cannot be considered good due to very high anthropogenic load /impact in the drainage area. Higher content of phosphorus was evident in samples from several collectors throughout the whole monitoring period. The analyses of the diurnal fluctuations of the loads indicated, that the highest loads were those in

the outlets of „Russalka“; „Ülemiste“, „Mustjõe“. Previous years reports are available on Tallinn City webpage http://www.tallinn.ee/est/Veemajandus-Tallinna-linnas.

Monitoring the Lake Harku

According to the initial task, samples were taken and flow rate measurements done 5 times per year during the monitoring period. Unstable parameters were determined in 17 different stations in situ (in the field). Suspended solids, BOD7, COD_{Mn}, NH_4+, N_{tot}, P_{tot} and chlorides were determined in vitro (in the laboratory).According to the calculated pollution loads, it is evident, that (as it was expected) the biggest pollution load into the lake originates from the spring high tide, and the lowest pollution load during summer and the most highly polluted point is the mouth of the stream Harku. Water quality in the catchment of the Lake Harku and lake itself is moderate. Previous years reports are available on Tallinn City webpage http://www.tallinn.ee/est/Veemajandus-Tallinna-linnas.

2.2 Uurimisgrupi kuni 5 olulisemat publikatsiooni läinud aastal

1.1.

Thalfeldt, M.; Pikas, E.; Kurnitski, J.; Voll, H. (2013). Facade design principles for nearly zero energy buildings in a cold climate. Energy and Buildings, 67, 309 - 321.

Eriksson, A.K, Ulen, B., Berzina, L., Iital, A., Jansons, V., Sileika, A.S., Toomsoo, A. (2013). Phosphorus in agricultural soils around the Baltic Sea – comparision of laboratory methods as indeces for phosphorus leaching to waters. Soil Use Management, 29(1), 5-14

1.2.

Koiv, T.-A.; Mikola, A.; Toode, A. (2013). DHW design flow rates and consumption profiles in educational, office buildings and shopping centres. Smart Grid and Renewable Energy, 4(3), 287 - 296.

Kuusik, A., Kuusik, A. Pachel, K. Loigu, E., Sokk, O. (2013). Generalised Integration of Solid Waste Treatment Practices to Enchance Methane Productivity, Generate Suspension Fertiliser and Upgrade Biogas. European Scientific Journal, 9 (36), 14-30

Maharjan, B., Pachel, K., Loigu, E. (2013). Urban Stormwater quality and quantity in the city of Tallinn. European Scientific journal, 3, 305-314

Voronova, V., Piirimäe,. K., Virve, M. (2013). Assessment of the Pay Aas You Throw system into current waste management in Estonia. Management of Environmental Quality: An International Journal, 24(5), 667-682

2.3 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustustest

Teet-Andrus Kõiv – REHVA (Federation of European Heating, Ventilation and Air-conditioning Association) Professional Award for energy efficiency of buildings.

Hendrik Voll - REHVA Fellow - in recognition of the outstanding services to REHVA and the work for the improvements of energy efficiency and the indoor environment of buildings

2.4. Loetelu struktuuriüksuste töötajatest, kes on välisakadeemiate või muude oluliste T&A –ga seotud välisorgansatsioonide liikmed

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2.5. Aruandeaasta tähtsamad T&A finantseerimise allikad

Tähtsamad finantseerimise allikad on EL 7. Raamprogramm, INTERREG, ARCHIMEDES, ning siseriiklikud lepingud (Keskkonnaministeerium, Tallinna Linnavalitsus, KredEx jt.)

2.6. Soovi korral lisada aruandeaastal saadud T&A-ga seotud tunnustusi (v.a. punktis 2.3. toodud tunnustused), ülevaate teaduskorralduslikust tegevusest, teadlasmobiilsusest ning anda hinnang oma teadustulemustele

Hinnang tegevusele – **hea**.