

EHITUSTEADUSKOND
KESKKONNATEHNIKA INSTITUUT
TEADUS- JA ARENDUSTEGEVUSE AASTAARUANNE 2012

1. Instituudi struktuur.

Keskkonnatehnika instituut, Department of Environmental Engineering

Instituudi direktor Enn Loigu

- Keskkonnakaitse aluste õppetool, Chair of Environmental Protection , Enn Loigu
- Kütte ja ventilatsiooni õppetool, Chair of Heating and Ventilation, Teet-Andrus Kõiv
- Veetehnika Õppetool, Chair of Water Engineering, Karin Pachel
- Veekvaliteedi teadus- ja katselaboratoorium, Laboratory of Water Quality, (Maila Hannus)

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

(NB! Punktid 2.1.-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

The main scientific research projects were

„Hydrochemical monitoring of rivers in North Estonia“ is an annual project supported by the Ministry of Environment. Monitoring is carried out in 17 stations and 23 chemical parameters are analysed by TUT specialists. According to the state monitoring programme for rivers adopted by the Ministry of Environment and Monitoring Council 63 river stations were examined in 2012. An overview on the ecological status and quality classes of rivers that belong to the whole state monitoring system was compiled. Samples from 94% of the stations correspond to good or very good overall ecological status.

During the recent years, water quality according to the summary estimation of physical-chemical parameters has not decreased. In 2012 the most problematic parameter was total

nitrogen (N_{tot}), as 29% of the stations were not corresponding to good ecological status on the bases of the N_{tot} content in the water sample.

The main results for the year 2012 indicate, that the river water is mainly in good state.

Poor ecological state (due to too high N_{tot}) was found in rivers Seljajõgi, Jänijõgi, Alastvere main ditch. In the mouth of River Vääna the content of P_{tot} was too high, Oxygen conditions are better than in 2011 in all rivers except Alastvere main ditch.

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 colleagues in Latin America on the bases of distributing knowledge about the green technologies and energy production. In February 2012 Prof Arvo Iital and PhD student Marija Klõga participated in project meeting and Capacity-building Seminar in Bolivia with a presentation on climate change related issues in Estonia. Later on, in August 2012 project partners from Latin America visited Tallinn and the 3-rd International Capacity-building Seminar was held in the premises of the Estonian Ministry of the Environment.

The final survey report about the research, innovation and training needs in Estonia and Estonian TT strategy were ready and sent to the partners. Collection and analyses of information from the partners about questionnaires' content was accomplished until the end of the year 2012.

The project **BALTIC COMPASS** „Policy and Investments for sustainable solutions in agricultural production in the Baltic Sea Region“: focused on the limitation of pollution loads from agricultural activities to the aquatic environment. Second edition of the guidebook of harmonized agricultural nutrient runoff assessment methods was published. A list of recommendations was produced based on the outcome of the workshop on the use of automatic water quality devices in April 17th 2012. A study to select rational methods for use of phosphorus-filters in a small agricultural stream and design of the filters was finalised. TUT participated in the project conference in Copenhagen and in the final conference in Tallinn, 11-12 December. TUT also participated at WP5 meeting in Warsaw to discuss the quality of data, monitoring methods and risk areas. Profesor A. Iital presented and discussed the project results with stakeholders in Jämeda on 3rd December. TUT participated in a Baltic

Compass meeting in Warsaw to discuss prolongation of the activities and possible submission of a BONUS application.

SUBMARINER „Sustainable Uses of Baltic Marine Resources“: was giving new ideas for improving the Baltic Sea environment and economies through innovative approaches to the sustainable use of marine resources. For example the quality and specific features of reed as bioenergy resource. The TUT was responsible to compile the compendium, the section of “Reed harvesting and possible use”. The proper inventory of Reed areas and its possible uses in BSR were assessed. The compendium was finalised at the end of September 2012 in two versions (short version and long version). Results were presented at International Conference “Reed as Renewable Resource” 14th-16th February 2013 in Greifswald, Germany.

PROMITHEAS -4 „ Knowledge transfer and research needs for preparing mitigation/adaptation policy portfolio“. The project aim is the Development and evaluation of mitigation/adaptation (M/A) policy portfolios and prioritization of research needs and gaps for twelve (12) countries: Albania, Armenia, Azerbaijan, Bulgaria, Estonia, Kazakhstan, Moldova, Romania, Russian Federation, Serbia, Turkey and Ukraine. National report („Research gaps and needs associated with M/A policy data“) and Special Edition of Climate Change “Overview of the Mitigation/Adaptation Policy Instruments in Estonia) were prepared in 2012. TUT participated in the board meeting in Belgrade in April 2012, where the Special Edition was disseminated among partners. National reports, prepared in 2011 and 2012, totally three reports, were disseminated among potential stakeholders in Estonia. Nine months training, including both e-classes and real training on two workshops were provided within the project. As a result, the model LEAP was applied and a draft “Development and assessment of Mitigation / Adaptation Climate Change policy portfolios for Estonia” for three scenarios was prepared. The project coordinator is assoc. Prof. Alvina Reihan. Project is financed by Seventh Framework **Programme** (FP7).

Assessment of possible changes of Estonian climate and environmental status on the basis of dynamical modeling of atmosphere, ocean and river runoff (EstKliima). The project is aimed to investigate possible climate changes by the end of twenty-first century and the responses of Estonian sea areas, coasts and river runoff to the projected climate changes. The complex approach is used - dynamical modeling of atmosphere, sea areas and river runoff forced by different climate scenarios downscaled with regional climate models. Assessment of possible

effects of climate changes is based on simulation results with atmosphere, coupled circulation and ecosystem, wave and river runoff models. Consolidated Hydro- and Chemical database was created for 14 rivers (7 parameters). Long-term Pollution load (7 parameters separately) for monitored and unmonitored rivers was calculated. The initial estimation of trends in load has been carried out. TUT participated in two working meetings. Project participants are: Alvina Reihan, Kristjan Piirimäe (researcher) and Rain Elken (PhD student). Project is financed by ARHIMEDES foundation.

Monitoring of surface water quality in Ojamaa (assessing the environmental impacts by the activities of the enterprise Viru Chemistry Group), monitoring of the hydrochemical quality of North Estonian Rivers was continued (Order by the Ministry of Environment),

Development of ecological flow estimation methods for regulated, salmon and the rest rivers in Estonia (Order of the Ministry of Environment). The guidance on measuring the water level before and below (after) the river dam is compiled. Three different calculation methods were proposed, however, the final decision of the applicability of these methods will be done in 2013, in spring. Project responsible contractor is Prof. Enn Loigu, executors are Alvina Reihan and Rain Elken.

Hydromorphological state of important natural and heavily modified waterbodies was studied and methodology for such investigations will be elaborated.. LMIN 12191, Oluliste looduslike ning inimtegevuse tulemusena rikutud (tugevasti muudetud või tehislake) vooluveekogude hüdro-morfoloogilise seisundi uurimine ning hüdro-morfoloogilise seisundi hindamise meetodika väljatöötamine" (28.11.2012 – 30.11.2013)

Chair of Heating and Ventilation

The most important project in 2012 was “Minimisation of the heating costs in large apartment houses by awareness rising of the inhabitants, change of their behaviour and measuring individual heating costs.” The main task was to determine the optimal ratio of the steady and changing heating costs using the device called allocator as well as calculation of the factors related to the location of the apartments and analyses of heating from the neighbouring flats.

A questionnaire on the changes in the habits of using thermostatic valves in the individual apartments was conducted. Simulation models of indoor climate and energy consumption were made for all investigated 6 buildings. A big attention was paid to so called heating from

neighbouring flats and the influence of the latter to the temperature. For example, in a renovated building the indoor temperature will not fall under 18°C even in wintertime and when the heating is switched off, in case the temperature in the neighbouring flats is 21 °C. AS a result of this study it was recommended to use the share of changing costs only up to 30% and the share of heating costs that are distributed between the flats according to the square metres, to be not less than 70%. The leader of this study was professor Teet-Andrus Kõiv and the following PhD students: Martin Thalfeldt, Anti Hamburg, Allan Hani, and Master students Jevgeni Fadejev, Imre Hõrak, Marek Karja took part in the work.

A new project financed by **ARCHIMEDES** foundation and involving the Health protection institute from Tartu University was started for analysing the **ventilation** in 8 dwelling houses before and after installing suitable ventilation techniques. In 2012 the junior staff was trained for conducting air quality measurements and Tartu University started the analyses of moulds in the air samples. First stage of investigation of the room-based air handling units (AU) was accomplished. Ventilation solutions based on heat exhaust air heat pumps in newly built apartment houses was studied.

INTERREG project **ENEF** „Central Baltic Cooperation in Energy Efficiency and Feasibility in Urban Planning“ was continued from the year 2011. 2012 the main activities was performing example audits in dwelling houses, schools and other public buildings. On the bases of those a guideline for energy audits for Estonia was started.

KredEx started and supported a new study concerning the post review of the actual efficiency of refurbishing works that they have financed. The support scheme has included different conditions and financing levels depending on the expected economy in heating costs. The study aims to check if the expected efficiency has been achieved.

Chair of Water Engineering

The biggest project **SUSBIO** “Sustainable utilization of waste and industrial non-core materials” is financed by Interreg Programme and it is performed in partnership with Turku University of Applied Sciences (leading partner). TUT is responsible for data collection of biodegradable waste, which may be utilized in biogas production. The collected data is systemised and the biogas potential estimated. The laboratory experiments are going on to

find the best substrates and their compositions for biogas production. The main substrates used in laboratory experiments are wastewater sludge, food industry wastes together with glycerol. Possible use of solid residues from biogas production in agriculture and the corresponding regularity is investigated.

KOIVA-GAUJA river basin transboundary joint management by Estonia and Latvia was also led by the personnel from the Water Engineering chair mainly. Monthly study tours for 3 days were organised to bring water samples from monitoring stations in the river Koiva Gauja (both Estonian and Latvian parts of the river). The samples were sent to Tallinn by cargo bus and immediately analysed in the Tallinn Technical University, Environmental Engineering Institute, Laboratory of Water Quality: Several conferences and expert workshops were organised and attended in Tartu, Pärnu, Võru and Riga.

Samples during 12 field trips are taken, runoff is measured, data collected and organised in a one xls database. Chemical analysis, incl QA, in laboratory is done. According to program, during the field trips 13 monitoring points (13 profiles in 9 rivers, on some rivers 2-3 profiles). 13 samples were taken and 8 measurements to identify runoff were done. In each sample (13) 22 parameters were analysed. Rivers and profiles are following: Pededze-Kivioja, Pededze -Möldre (background), Kuura (background), Vaidava (outlet from Lake Murati), Kolga, Pähni (background), Peetri-Leppura, Pärlijõgi, Mustjõgi-Taheva, Pedeli-Valga, Pedeli-Koorküla, Vaidava-Kuutsi. Additionally for the impact identification of 3 wastewater outlets Hargla, Mõniste, Saru is monitored 3 times according to plan, which is: to monitor wastewater outlets and rivers before and after wastewater outlets (River Mustajõe, Hargla and Muhkametsa). 13 parameters were analysed. Results of monitoring in time-period between January 2012 and December 2012 are reviewed and treated into database. Assessment of the hydrochemical quality status and objectives of the rivers on Estonian side is drafted. According to the investigations and data analysis, Koiva basin watercourses are in a very good or good status.

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Studies on the Lake Harju were supported by the Tallinn Board of Environment Protection as well as studies on the stormwater monitoring in Tallinn.

„Stormwater monitoring in Tallinn“: 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. This will enable to plan suitable measures for improving the state of the sea. Monitoring was carried out in 6 sampling stations 6 times per year with different weather conditions.

According to the governmental wastewater regulation, the content of suspended solids and oil products are limited in stormwater. These parameters concerning oil products did not exceed the allowed concentrations but the parameters concerning suspended solids were higher than allowed in the samples taken from the stations (collector outlets) named „Saare tee“ and „Russaka“. Nitrogen content was higher in the stations „Russalka“ and „Ülemiste polder“, this has been the case in the previous years as well. The sample from the station „Rocca al Mare“ taken on 29 May, was outstanding due to very high content of organic matter, phosphorus and nitrogen, while the content of soluble oxygen was low. Salmonella was present in the samples taken on 29 May, 21 August and 23 October (in „Rocca al Mare“): Salmonella contamination was also observed in the samples from „Mustjõe“ on 29 May and in the sample from „Lauluväljak“ on 21 August. 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 „Saare tee“, „Rocca al Mare“ and „Lauluväljak“ 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“ and in some cases also at „Lauluväljak“.

„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 (on 31 July and 30 October during the summer low tide and autumn high tide). Unstable parameters were determined in 17 different stations *in situ (in the field)*. Suspended solids, BOD₇, COD_(Mn), NH₄⁺, N_{tot}, P_{tot} and chlorides were determined *in vitro. (in the laboratory)*.

On the basis of the limits of the ecological water quality classes for flowing surface water bodies according to the values of the physico-chemical general conditions during the whole year 2012, the mouth of stream Soone is in a good ecological state according to BOD and NH₄⁺, but in a poor state according to N_{tot} and P_{tot}. The stream Kadaka in Astangu is in a very good state according to BOD, N_{tot} and NH₄⁺, but in a poor state according to P_{tot}. The stream

Harku in its lower part is in a very good state according to BOD; in a good ecological state according to N_{tot} and NH_4^+ , and in a very poor state according to P_{tot} . The stream Tiskre oja close to its start from the lake is in a good state according to N_{tot} and in a poor state according to BOD, P_{tot} and NH_4^+ .

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.

2.2 Uurimisgrupi kuni 5 olulisemat publikatsiooni läinud aastal.

* Sööt, M., Voll, H. Kõiv, T.-A. (2012) Utilisation of Oil-Shale Retort Gas. Oil-Shale, 29(3), 248-267.

*Pachel, K., Klõga, M. Iital, A. (2012). Scenarios for reduction of nutrient load from point sources in Estonia. Hydrology Research, 43(4), 374-382

*Reihan, A., Kriauciuniene, J., Meilutyte-Barauskiene, D., Kolcova, T.(2012). Temporal variation of spring flood in rivers of the Baltic states. Hydrology Research, 43(4) , 301-314.

2.3 Loetelu struktuuriüksuse töötajate rahvusvahelistest tunnustustest.

Emerald Publishers – 2012 Outstanding Paper Award.2:

Voronova, V.; Moora, H.; Loigu, E. (2011). Environmental assessment and sustainable management options of leachate and landfill gas treatment in Estonian municipal waste landfills. Management of Environmental Quality: An International Journal, 22(6), 787 - 802.

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

Prof Teet-Andrus Kõiv – a member of the World Society of Sustainable Technologies from 9 January 2013.

2.5 Aruandeaasta tähtsamad T&A finantseerimise allikad.

Tähtsamad finantseerimise allikad on EL Raamprogramm (Eesti Läti Partnerlusprogramm, INTERREG IVA; Archimedes) ning siseriiklikud lepingud (Keskkonnaministeerium, KredEx, Tallinna Linnavalitsus).

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

- Valgetähe orden EV Presidendilt (Professor Enn Loigu)
- Ehitusteaduskonna parim õppejõud 2012 aastal– dotsent Alvina Reihan

Hinnang tegevusele – **hea**.

2.7 Instituudi teadus- ja arendustegevuse teemade ja projektide nimetused (*Eesti Teadusinfosüsteemi, edaspidi ETIS, andmetel*)

- Haridus- ja Teadusministeerium
 - sihtfinantseeritavad teemad:
T172, Vedeliku ja konstruktsiooni koostoime mehaanika , Kõiv Teet-Andrus (2008 – 2013)
 - baasfinantseerimise toetusfondist rahastatud projektid (sh TTÜ tippkeskused):
 - riiklikud programmid:
 - Teiste ministeeriumide poolt rahastatavad riiklikud programmid:
 - Uuriija-professori rahastamine:
 - SA Eesti Teadusfond/Eesti Teadusagentuur
 - grandid:
 - ühisgrandid välisriigiga:
 - järel doktorite grandid (SA ETF ja Mobilitas):
MJD107, Voll Hendrik, Investigation of Grey Water Irrigation and Energy Demand for Greenroofs (1.01.2011- 31.12.2013), väljaspool TTÜ-d - Portland State University
 - tippteadlase grandid (Mobilitas):
 - Ettevõtluse Arendamise SA
 - eeluuringud:
 - arendustoetused:
 - SA Archimedesega sõlmitud lepingud
 - infrastruktuur (nn „mini-infra“, „asutuse infra“):
 - Eesti tippkeskused:
 - riiklikud programmid:

AR12045, Keskkonnatehnoloogia, Efektiivsete ja paindlike õhupuhastus- ja ventilatsioonitehnoloogiate kompleksne arendamine hoonete energiatõhususe tõstmiseks, Teet-Andrus Kõiv (1.04.2012 - 31.03.2014)

AR12094A, KESTA, Eesti kliima ja keskkonnaseisundi võimalike muutuste hindamine atmosfääri-, mere- ja jõgede äravoolu dünaamiliste mudelite tulemuste põhjal (EstKliima), Alvina Reihan (1.01.2012 - 31.12.2014)

– muud T&A lepingud:
Doktorikool:

DAR9085, Ehituse ja keskkonnatehnika doktorikool, Kõiv Teet-Andrus (1.10.2009 - 30.09.2014)

- SA Keskkonnainvesteeringute Keskusega sõlmitud lepingud:

- Siseriiklikud lepingud:

Lep10046, Reoveesette ja teiste biolagunevate jäätmete koos- ja eraldikäitlemine anaeroobse kääritamise teel Eestis ja digestaadile jäätmelõpu kriteeriumist lähtuvalt soovituslike kasutuskriteeriumide väljatöötamine, Loigu Enn (26.04.2010 -28.02.2012)

Lep11032, Ojamaa kaevandusala ettevõtte pinnavee eneseseire 2011, Loigu Enn (25.04.2011 - 10.01.2012)

Lep12024, Ojamaa kaevandusala pinnavee seire, Loigu Enn (8.12.2011 - 10.01.2014)

Lep12034, Tallinna sademevee seire, Pachel Karin (20.02.2012 - 15.02.2014)

Lep12035, Harku järve vee kvaliteet, Pachel Karin (20.02.2012 - 15.12.2014)

Lep12040, Kütteenõudlikkuse vähendamine korterelamutes läbi tarbijate teadlikkuse tõstmise ja käitumisharjumuste muutmise, tuginedes individuaalse küttekulu mõõtmisele, Kõiv, Teet-Andrus (17.02.2012 - 30.09.2012)

Lep12153, Hoonete keskkonnamõju arvestamine, nn. „roheline märk“, Voll, Hendri (1.09.2012 - 31.12.2012)

Lep12168, Rekonstrueeritud korterelamute sisekliima ja energiatarbe seire ja analüüs ning nende vastavus standarditele ja energiaaudititele, Kõiv Teet-Andrus (26.10.2012 - 31.03.2014)

LMIN11013, Põhja-Eesti jõgede hüdrokeemiline seire 2011.a, Loigu Enn (21.02.2011 - 1.02.2012)

LMIN11123, Piiriveekogude loodusliku ja inimtekkelise koormuse arvutamine Eesti territooriumilt, Loigu Enn (20.12.2011,30.11.2012)

LMIN12038, Põhja-Eesti jõgede hüdrokeemiline seire 2012.a., Loigu Enn (28.02.2012-1.02.2013)

LMIN12069, Sanitaarvooluhulgad ja paisutamine, Loigu Enn (11.04.2012 - 1.07.2013)

- EL Raamprogrammi projektid:

VFP493, Teadmiste edasiandmise ja teadustöö vajadus kliima muutustega kohanemiseks-leevendamiseks vajaliku poliitika portfelli ettevalmistamiseks - PROMITHEAS-4, Reihan Alvina (1.01.2011 - 31.12.2013)

VFP536, OPEN HOUSE "EL ühtse hoonete kvaliteedi hindamise meetodika välja töötamine", Voll Hendrik (12.12.2011 - 12.06.2013)

- Välisriiklikud lepingud:

VA540, OPEN HOUSE "EL ühtse hoonete kvaliteedi hindamise meetodika väljatöötamine", Voll Hendrik (1.12.2011 - 1.06.2012)

VA542, OPEN HOUSE "EL ühtse hoonete kvaliteedi hindamise meetodika väljatöötamine", Voll Hendrik (12.12.2011 - 12.06.2012)

VE574, Kraavifiltrite projekti teine etapp: Filtrite paigaldus ja hooldus Linnamäel, Loigu Enn (1.07.2012 - 28.02.2014)

VEU497, CELA Kliimamuutuste tehnoloogiate siirde keskused Euroopas ja Ladina Ameerikas, Loigu Enn (1.01.2011 - 31.12.2013)

VIR425, Läänemere piirkonna 2007-2013 programmi projekt COHIBA - Ohtlike ainete kontroll Läänemere regioonis (Control of hazardous substances in the Baltic Sea region), Loigu Enn (25.10.2008 - 24.01.2012)

VIR454, Baltic COMPASS - Poliitika ja investeeringud jätkusuutlikeks lahendusteks Läänemere regiooni põllumajandustootmises (INTERREG IVA), Loigu Enn (17.09.2009 - 16.12.2012)

VIR459, Jäätmete ja tootmise kõrvalproduktide säästlik utiliseerimine, Loigu Enn (1.05.2010 - 30.04.2013)

VIR470, SUBMARINER Läänemere ressursside jätkusuutlik kasutamine, Loigu Enn (1.09.2010 - 1.09.2013)

VIR488, Kesk-Balti regiooni koostöö energiaefektiivsuse ja jätkusuutlikkuse tagamiseks linnaplaneerimises (ENEF), Kõiv Teet-Andrus (1.01.2011 - 31.12.2013)

VIR522, GAUJA-KOIVA Piiriülese Gauja/Koiva vesikonna parema ühise haldamise tegevused, Loigu Enn (1.07.2011 - 30.06.2013)

Euroopa Komisjoni õppe-arendusprogrammid

VY531, Doktoriõppe programmi väljatöötamine taastuenergeetika ja keskkonnatehnoloogia valdkonnas, CREDO, Iital, Arvo, 15.10.2010, 14.10.2013

2.8 Struktuuriüksuse töötajate poolt avaldatud eelretsenseeritavad teaduspublikatsioonid (*ETIS klassifikaatori alusel 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 4.1 ja 5.1*).

1.1

Voll, H.; Seinre, E. (2012). A Method of Optimizing Fenestration Design for Daylighting to Reduce Heating and Cooling Loads in Offices. *Journal of Civil Engineering and Management*, 50 - 60. [ilmumas]

Eriksson, A.K., Ulén, B., Berzina, L., Iital, A., Jansons, V., Sileika, A.S. and Toomsoo, A. (2012). Phosphorus in agricultural soils around the Baltic Sea – comparison of laboratory methods as indices for phosphorus leaching to waters. *Soil Use and Management*, xx - xx. [ilmumas]

Pachel, K.; Klõga, M.; Iital, A. (2012). Scenarios for reduction of nutrient load from point sources in Estonia. *Hydrology Research*, 43(4), 374 - 382.

Kaljonen, M., Varjopuro, R., Gielczewski, M., Iital, A. (2012). Seeking policy-relevant knowledge: a comparative study of the contextualisation of participatory scenarios for the Narew River and Lake Peipsi. *Environmental Science and Policy*, 15(1), 72 - 81.

Reihan, A.; Kriauciuniene, J.; Meilutyte-Barauskiene, D.; Kolcova, T. (2012). Temporal variation of spring flood in rivers of the Baltic states. *Hydrology Research*, 43(4), 301 - 314.

Sööt, M.; Voll, H.; Kõiv, T.-A. (2012). Utilization of Oil Shale Retort Gas. *Oil Shale*, 29(3), 248 - 267.

Kriauciuniene, J.; Meilutyte-Barauskiene, D.; Reihan, A.; Koltsova, T.; Lizuma, L.; Sarauskiene, D. (2012). Variability in temperature, precipitation and river discharge in the Baltic States. *Boreal Environment Research*, 17(2), 150 - 162.

1.2

Voll, H.; Seinre, E.; Sööt, M. (2012). Analysis of Heating Energy of Ventilation and Underground Heat Exchanger in North European Passive Houses. *International Journal of Energy and Environment*, 6(1), 92 - 100.

Hani, A.; Koiv, T.-A. (2012). Energy consumption monitoring analysis for residential, educational and public buildings. *Smart Grid and Renewable Energy*, 3(3), 231 - 238.

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2.9 Struktuuriüksuses kaitstud doktoriväitekirjade loetelu *(NB! struktuuriüksus lisab struktuuriüksuse töötaja juhendamisel mujal kaitstud doktoriväitekirjade loetelu)*

Allan Hani, keskkonnatehnika instituut

Teema: *Investigation of Energy Efficiency in Buildings and HVAC Systems* (Hoonete ja nende tehnosüsteemide energeetilise efektiivsuse uurimine)

Juhendaja: prof Teet-Andrus Kõiv

Kaitses: 30.10.2012

Omistatud kraad: filosoofiadoktor (ehitus ja keskkonnatehnika)

Dmitri Loginov, keskkonnatehnika instituut

Teema: *Autonomous Design Systems (ADS) in HVAC field. Synergetics-Based Approach*
(Autonoomsed masinprojekteerimissüsteemid (ADS) kütte- ja ventilatsioonivaldkonnas.
Sünergeetikapõhine lähenemine)

Juhendaja: prof Kaido Hääl

Kaitses: 21.12.2012

Omistatud kraad: filosoofiadoktor (ehitus ja keskkonnatehnika)

2.10 Struktuuriüksuses järeldoktorina T&A-s osalenud isikute loetelu (*ETIS-e kaudu esitatud taotluste alusel*)

2.11 Struktuuriüksuses loodud tööstusomandi loetelu

1. Struktuuriüksuse infrastruktuuri uuendamise loetelu (*summa eurodes*)

PV007302, Tõmbekapp, 20.01.2012 (4 158,75)

PV007303, Tõmbekapp, 20.01.2012 (4 158,75)

PV007304, Tõmbekapp, 20.01.2012 (4 158,75)

PV007305, Tõmbekapp, 20.01.2012 (4 158,75)

PV007306, Laborimööbel, 20.01.2012 (31 537,56)

PV007316, Osakeste analüsaator-aerosooli, 22.02.2012 (9 700,00)

PV007325, Toitainete sisalduse määramise, 2.03.2012 (36 562,28)

PV007400, Jõe veekvaliteedi seiresüsteem, 22.06.2012 (48 300,00)

PV007523, Maasoojuspumba mõõtesüsteem, 21.12.2012 (25 000,00)

PV007527, Soojusarvestid PolluStat-E, 31.12.2012 (10 597,00)