
ISCN-GULF Charter Report

www.uni.lu/sustainability
Table A3, Principle 3:
Integration of facilities, research, education, and outreach as a "living laboratory" for sustainability

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Social integration
Engagement of staff and students

The second round of the SCCS course held during the summer semester 2010/2011. Three new courses launched in the domain of sustainable development: "Social enterprise and social innovation", "Global environmental change in the Anthropocene" and "Global reporting initiative".

Research projects on sustainable facilities and operations

- reducing carbon-based emissions
- integrate all actions, research projects and teaching activities related to sustainability

Uni.lu Strategic Action Plan
Caring on the development of the Uni.lu Strategic action plan
Oversight of research on sustainability at Ph.D. and Master level
Fields:
- Engineering
- Geography
- Political Sciences

Commitments and resources for campus sustainability

The Cell is a dedicated organizational structure of the university, depending directly from the rectorate.

The Cell is a member of the ICSN-GULF network

The Cell’s budget: 75,000 Euro
50% Head
50% Secretary
On average 3 students working each under a contract of time 10 hours per week

The Cell’s budget: 70,000 Euro
50% Head
50% Secretary
On average 2 students working each under a contract of time 10 hours per week

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This biennial report on sustainable development at the University of Luxembourg in the years 2013 and 2014 is the third report that focusses on work coordinated or implemented by the Cell for Sustainable Development. The Cell’s mission was to integrate University activities relating to research, teaching, learning, operations, facilities management, social cohesion and outreach. This report was prepared by Francesca Vescovini and Ariane König for the University of Luxembourg Cell for Sustainable Development in collaboration with the central administration, engaged faculty, and students (see acknowledgements).

Starting in 2015, activities of the Cell for Sustainable Development have been reorganized, in order to place more emphasis on research contributing to developing the University’s new priority research area on ‘sustainable development’. Most activities of the Cell relating to administration and operations will be moved to the central administration. There will be further sustainability reports for the University of Luxembourg in years to come, they will however likely differ in form, content, and production process. Continued reporting is deemed important, as this process is considered a part of a social learning process of a university that strives to contribute towards more balance between the pursuit of improved quality of life, environmental quality and wealth creation in society.

Instead of the Cell for Sustainable Development, a virtual platform for Transformative Science for Sustainability and a first research project on ‘Future challenges at the water-food-energy nexus’ will be established in 2016. This will allow to further develop internationally oriented research in sustainability science that was started under the auspices of the Cell (see Figures 4.1.1. and 4.1.2. on page 17). The strategic decision of the rectorate to strengthen these research activities offers great opportunities to further increase the international reputation in this field of knowledge that is so central to shaping our common future.
HIGHLIGHTS 2013 – 2015

Operations and management:

• The completion and progressive implementation of the ‘Sustainable Transport Strategy’ in close collaboration with the Research Unit for ‘Engineering Sciences’ and the central administration.

• The organization of student award programmes for initiatives to improve sustainability on campus and in student housing.

• The creation of a Luxembourg chapter of OIKOS an internationally leading student association dedicated to fostering sustainable development and associated practices.

Teaching, learning and research:

• The launch of a unique trans-disciplinary study programme, the Certificate in Sustainable Development and Social Innovation, that is the only programme open to students of all levels and disciplines and to professionals. The study programme has the goal of serving as platform for societal social learning processes for sustainability.

• Research on social learning processes underpinning sustainable development that also provides the conceptual framework for the study programme embedded in the International Sustainable Campus Network a platform for collaboration of leading universities. A book and a special issue in a high impact journal were published as a result of this work.

Social cohesion and outreach:

• Ariane König, the head of Sustainable Development was appointed as a member of the National Council of Sustainable Development of the Luxembourg Government where she led a project on scenarios for the future of education in the face of sustainability challenges.

• Invitations to chair and give keynote speeches at international conferences.
NEW HORIZONS – 2015 AND BEYOND

In January 2015 Prof. Rainer Klump assumed the office of the University President. A key priority is the greater visibility and integration of the University in the society of Luxembourg. At the same time there is a new preference for clear structural separation of activities relating to research and teaching and the central administration. The more administrative tasks relating to campus operations, facilities and planning, and reporting will be embedded in the core of the central administrations tasks. From an organisational learning point of view, the full integration in the core mission and activities of the university presents a great opportunity for deeper organisational learning. 2015 is also the year of the move of the central administration to the new campus in in Esch-Belval. This presents a break with past ways of managing facilities, as on this new and largest campus the Fonds Belval is in charge of the infrastructure.

Gaining an enriched understanding and repertoire of action on complex social-ecological problems is essential for sustainability. The Luxembourg research community includes internationally leading experts in salient disciplinary fields of knowledge, including geography, sociology, educational sciences, welfare and environmental economics, political economy, social enterprise and innovation, impact finance, environmental law, engineering and the environmental sciences. Interdisciplinary research programmes, such as on cross-border governance, are a unique strength in Luxembourg.

For a better understanding of the complex social-ecological systems with stocks and flows of materials and energy, and with interdependently developing social structures and practices, new forms of integrative science are emerging. Examples include the fields of human-ecology and transition studies. These draw on theory and methods from natural, social and engineering sciences as well as the humanities. For enhancing Luxembourg’s adaptive capacity and resilience to change, it will be necessary to build capacity in such integrative fields of scientific research.

Furthermore, new forms of social coordination are required that are effective in translating theory and empirical research findings for the development of coping mechanisms that are effective in reality, while allowing room for the essential trial and error.

In order that conceptions of sustainability science that have emerged from all past integrative activities of the Cell for Sustainable Development can have greater traction in practice, we have committed to building a virtual platform for network and capacity building for transformative science for sustainability in Luxembourg. In association there will be a first research project to anticipate potential future challenges at the water-food-energy nexus with key stakeholders in government, private enterprise and civil society. This project will be embedded in the Faculty of Language and Literature, Humanities, Arts and Education. It will be developed in close collaboration with the other two faculties and the Luxembourg Institute for Science and Technology.
The persistent lack of action in response to growing evidence that our industrial metabolism exceeds the planet’s biophysical carrying capacity and thereby threatens our life support system is causing increasing concern across the globe. The existential problems of civilization in the 21st century are complex, as they involve interactions between society and culture, the techno-sphere and the environment. Sustainability can be considered an emergent property of a societal negotiation that takes into account the planet’s biophysical carrying capacity. Traditional disciplinary fields of ‘normal’ science can only play a limited role in resolving such complex problems. “Sustainability science” has been conceived as a new branch of science that connects across disciplinary silos in the natural and social sciences by adopting a systems perspective and a futures-oriented approach. Transformative science for sustainability aims to actively change human-environment interaction and involves recognition of complexity, contingency, contra-dictions, uncertainty, and ignorance. This requires rethinking how new actionable knowledge is co-created in collaborative processes, which will often be place-based. With their combined mission of research, teaching and engagement, universities can play a leading role in establishing such social learning processes.

The University of Luxembourg (UL) is Luxembourg’s first and only university. Unique attributes of Luxembourg and the university that played a role in shaping first activities in the area of sustainable development at the university level are listed in Box 0.1. Luxembourg is a small country with short paths to high-level decision-makers and politicians. University President Rolf Tarrach is highly appreciated as key enabler for building sustainable development in activities across the faculties and practice at the University over the last seven years. Another requisite for success was the ability to draw on the university’s own internal funds for establishing the Cell. A further helpful facet is that a priority for the tri-lingual University is international cooperation promoting an open culture and cross-cultural sensitivity.

That is also key for collaboration and reflection in diverse groups for the creation of actionable knowledge for sustainability.

The University Cell for Sustainable Development was created in 2009, in accord with the board of governors in response to the need for more integrative activities. It included the position of Head of Sustainable Development, and secretarial assistance. The Cell first coordinated the development of the UL’s first Action Plan on Sustainable Development 2010-2013 in a participatory process with faculty, students, the administration, and external stakeholders. The Action Plan’s overarching goal is “to engage students, staff and interested civil society in experiential learning about how to reduce environmental impacts and enhance social cohesion and build capacity to develop and implement solutions by drawing on...”

“Sustainability sounds to many ears like a hollow word, the meaning of which has been drained from over-use. Since the 2008 financial crisis it is less of a priority in EU politics. Over the past years, however, I personally came to the conviction that it presents one of the most pressing problems in current affairs. Science, too, has to acknowledge this and has to change.”

Rolf Tarrach
President of the University of Luxembourg, 2005-2015
different disciplines." International cooperation has always informed work on sustainability: The Head of Sustainability, Dr Ariane König, coordinated the development process of the UL’s first Strategic Action Plan at the same time as acting as lead-author for the Charter of the International Sustainable Campus Network (ISCN). After 21 of the world’s leading Universities (including Harvard, MIT, Tongji, INSEAD, ETH Zürich, Oxford and Cambridge) signed the Charter in 2010, the University of Luxembourg followed suit.

Regular reporting the Cell’s goals, ambitions and progress achieved on sustainable development is a part of the university’s commitment as signatory of the Charter. This report summarises the main activities that integrate research, teaching and practice across at least two faculties under the auspices of the Cell. The highlights on page 2 summarize the main achievements over the last three years, and they are elaborated upon in more detail in the following pages of this report. These achievements include the completion and implementation of a sustainable transport strategy in collaboration with the research unit of engineering sciences and the central administration, the organisation of student award programmes; the launch of the Certificate in Sustainability and Social Innovation, a unique study programme that serves as a platform for social learning for sustainability in Luxembourg, and associated research. The Cell was invited to present this work at leading international conferences. This and the prior two reports clearly demonstrate that all activities mapped out that the UL’s first action plan on sustainable development have now been completed.

As an explicit commitment to the government, sustainability was, for the first time, mentioned as an overarching priority for the entire university in the 3rd Four Year Plan of the UL (2014-2017). The plan points to ISCN membership, mentions activities of the Cell for Sustainable Development, as well as highlights sustainable development as a priority mentioned by all three faculties. Apart from requiring approval of the university’s board of governors, this plan is subject to accord by the Luxembourg government. It presents the basis for the contractual agreement on public funding between the university and the state over a period of four years. Art. 3(4) of this four-year contract highlights sustainable development as one of four topics that require development of a joint ten-year strategy with the other public research bodies in Luxembourg by 2016.

Box 0.1. Unique attributes of Luxembourg and its university that contribute to shaping research and education in sustainability science

**Luxembourg**

- Luxembourg is a seat of major EU institutions (Part of EU Parliament and Commission, EUROSTAT, Court of Auditors, European Court of Justice) the international community presents a pool of highly professional cross-culturally sensitive contributors and participants.
- The small size of Luxembourg and its government present short paths to decision-makers.

**The University of Luxembourg**

- Created by law in 2003 as Luxembourg’s first and only university.
- The mission statement is ‘An international university serving its country’.
- The government provides a sizable budget to the University: 128.70 million € in 2013.
- A research oriented university with 3 faculties offering 46 Bologna study programmes at the Bachelor and Masters level in natural science, social science and humanities, law and economics and finance. Connection of research and teaching is a stated priority.
- Article 3 in the founding law prescribes inter-disciplinarity, the close connection of research and teaching, international cooperation and multi-lingualism as some of the main organizing principles.
- International: Obligatory semester abroad for all Bachelors, tri-lingual (study programmes and administration in English, German and French), staff and students from over 100 different countries, under 50% Luxembourg students. In 2014, the university had signed 274 international agreements worldwide.
- Small: Seeking to cap at 7000 students to remain personable.
- Sustainability is endorsed at the highest level: the president signed the International Sustainable Campus Network Charter 2010 (UL Head of Sustainability was lead-author of the Charter and plays a leading role in this network).

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"It has been an honor to work with Ariane König over the past half decade linking my interest in the learning sciences with her work on sustainability science. As co-chairs of an International Sustainable Campus Network (ISCN) working group we brought together universities across five continents to actively share best practices and research on responses to sustainability challenges in higher education. Ariane König had the wisdom to consider in deep and sustained ways broader changes in organizing student learning and university research in parallel. This work resulted in a guest edited volume of Current Opinion in Environmental Sustainability (COSUST) on new conceptions of learning for solving complex problems. König’s efforts will have lasting impact on diverse academic disciplines and her work features the University of Luxembourg at the forefront of this movement."

"My research focuses on the effects of global warming, particularly ice mass change in Greenland and changes in the global water cycle. I teach a couple of classes within the Global Environmental Change course, An Introduction to Systems Science, the Carbon Cycle, and the Ozone Hole. I was motivated to teach in this program because I feel that it is important that students learn to think critically about the data analysis that leads to conclusions regarding climate change."

"My main contribution to the Certificate is on the management ‘science and society’ issues and on the applications of mathematics to policy problems. For me the Certificate is very important because it encourages the exploration of scientific knowledge in a critical and self-reflective spirit. In this it is unique among courses dealing with science, and so it is a great initiative in education, for scientists as well as for citizens."

"As a Ph.D. candidate in engineering design, I really enjoy being involved in the Certificate by facilitating a workshop on design thinking and a peer group project. Working with highly motivated course participants not only enriched my research by providing insights from practice and inspirations, but also helped me to further understand thriving group work with diverse backgrounds. The numerous ideas and initiatives that came out of the courses, prove that they are a fruitful ground to drive social learning, individual engagement and sustainable progression."

"As Social Investor and Venture Philanthropist, I am dedicated to mobilizing capital, market forces and entrepreneurship for greater social and environmental impact. I teach how to develop concepts for social enterprise using the business canvas model, and I supervise a peer group on responsible finance. The certificate opens the minds and hearts of potential change-makers, providing the tools and alternatives for social innovation to create systemic change for a more sustainable future."

"Since the beginning of 2015 LIST has consolidated its RDI activities in the field of water management into a "Water Security and Safety" Research Unit. As a Unit Leader, I have the honor to coordinate a team of 55 people who focus on the sustainable management of this precious resource. If sustainable use of it is the goal, technological development to reach it is not only the mean. Participating in teaching gave me the opportunity to put my professional actions into a truly interdisciplinary perspective while sharing my views with motivated people on how water can be more efficiently managed when looking at different scales of governance, by creating possibilities for individual action and diverse points of view. Teaching in this course became over the years a refreshing and vital activity."
ACKNOWLEDGEMENTS

First and foremost I would like to thank the highly motivated team of students who have chosen to work for the Cell under student contracts: Anikó Knopp, Kathan Wafita, Marcela Trevisinho Infante, Franklin Feyeh Bahfon, and Tea Sikharulidze.

Furthermore, without the close and fruitful collaboration with colleagues from the administration, including the administrative director Alfred Funk and his team; Pierre Fagot, Head of the Service des Infrastructures et de la Logistique, and his colleagues Thierry Richard, Sébastien Schreiber, and Jérôme Bajon as well as Thomas Barra and Virginie Laye from the Belval Office, any strategy, recommended actions or efforts to connect research, education and facilities would have remained theoretical.

Team teaching with colleagues from our and other Universities, public research institutes and practice is so enriching, we learn so fast, we never manage to teach the same course twice! It is thanks to these colleagues that the Certificate has frequently been called an inspirational study programme that fosters ‘out-of-the-box’ thinking. These interactions offer a constant source of new ideas, courses of action, and positive energy to persevere on the more tricky issues.

I am also grateful for the open and constructive work environment at the University of Luxembourg ensured in past years by Rolf Tarrach, President of the University of Luxembourg and Christian Schulz, Head of the Research Unit ‘Identités, Politiques, Sociétés, Espaces’, who always gave their full support for my very active engagement at the university, in Luxembourg, and internationally.

Without Danielle Schwirtz-Lejeune who acts as social hub for all who work with the University of Luxembourg Cell for Sustainable Development and who also provided invaluable practical and moral support at all times, only a fraction of the achievements reported here might have been realized.

Author of this report: Ariane König, Head of the Cell for Sustainable Development

Photographer: Michel Brumat
1. FACILITIES, OPERATIONS AND PLANNING

Goal of the 2010-2013 Action Plan

Our goals centre on improving the planning, management, construction and refurbishment of buildings and campus in view of achieving greater resource-efficiency, and engaging our campus community in joint learning about efficiency and sufficiency in the use of natural resources, energy and reducing waste.

Energy saving

Energy saving is deemed important by the ‘Service des Infrastructures et de la Logistique’ (SIL). Extension of motion controlled lighting in public areas and pro-active work on further optimizing the heating and ventilation control system across all three old campuses Limpertsberg, Kirchberg and Walferdange contributed to achieve energy savings in 2014 compared to 2013 in spite of growing staff and student numbers (Figure 1.1, 1.2, 1.3). Since 2014, the university procures ‘green energy’ from two energy providers. On the Belval campus the electricity purchased from the provider Sudstroum is derived exclusively from wind and hydro-energy. Heating comes from a gas and wood pellet combustion plant coupled to a district heating system.

Sustainable Transport

The UL’s sustainable transport strategy has been developed and implemented in an ongoing participatory process that was started in 2010 and led by the University of Luxembourg’s Cell for Sustainable Development (see Figure 1.4.). The process relied on close consultation with the UL President, and with participation of representatives of the administration, the faculties and students, including experts on transport from engineering and geography and spatial planning. Research and regular transport surveys of staff and students by François Sprumont and Prof. Francesco Viti of the Research Engineering Unit are underpinning the continued development of the transport policy and its implementation. The questionnaire was developed in coordination with the Verkéiersverbond and run in 2012 with over 300 responses and in 2014 with over 500 responses.

The strategy has six interdependent pillars to promote the use of public transport and low impact modes and to reduce trips to the UL in individually occupied motor vehicles (Figure 1.4). In 2013, the Cell together with the Administrative director launched the subsidized public transport M Pass, 148 staff took advantage of this offer, in 2014 the number of participating staff was well over 300. In May 2013 the Cell and faculty conducting transport-related research organized an open workshop on a UL transport policy with key internal stakeholders. In consequence, a dedicated UL transport group with representatives from across the university that is jointly coordinated by the Cell and the Belval office has been set up. In 2014, the UL transport working group catalogued room for improvement in public transport to the campuses. The group also developed a proposal for a ‘needs-based’ parking management scheme in a participatory process in a co-design workshop, in collaboration with participants from CRP Henri Tudor, CEPS, Luxinnovation, FNR, PRO-SUD. The Belval office implemented an Intercampus shuttle with Sales Lentz, and a car sharing platform with Carzoo in September 2015. RUES and the Cell and the SIL have implemented a University car fleet for car sharing with City Mov’ and a web-based platform that provides information and access to all transport choices an with an in-built learning system to allow the progressive optimization of all transport-related services. This platform was developed by RUES (see section 2.2. on research for more details).

The move to Belval brings a unique opportunity to invite staff and students to develop attitudes and new habits for commuting choices by fostering implementation of measures that make these options as attractive as possible. Adequate connection of the new site to public transport complemented with shuttles to strategic nodal transport points in Luxembourg is seen as important to the smooth functioning of the university, and quality of life for staff and students, in particular during the years of the move. The Belval office and the SIL have now become key strategic partners and will take over these activities from 2016 onwards.

Challenges and opportunities ahead

Facilities management and organization of the SIL will change profoundly. The Fonds Belval, a public organization in charge of building public buildings and infrastructure in Belval, is in charge of the infrastructure. An agreement has been signed on the division of roles in operating the buildings. Opportunities include the new campus buildings, with their coherent energy concept that limits building technology services to a minimum, restricts heating to the winter, offers no air conditioning, implements CO₂ sensor activated ventilation, and controls all lighting by motion-sensor. Challenges include establishing a good connection between users and the new facility managers, who have a steep learning curve ahead on how a research university functions. It will be key to develop approaches to communicate, and to make visible the building information on energy and water use as basis for a social learning process in the built environment. Post occupancy building commissioning processes and constant monitoring of building performance with respect to stated energy efficiency and water use goals will be central to success.

Re-use, reduce, recycle – towards improved waste management approaches

In 2013 there were two student award programmes. One invited teams to improve sustainability practices in student residences and the other focussed on improving waste sorting on campus. These helped to engage students and establish projects with impact (see Figure 1.4.). The results were presented to the SIL and several facets were implemented, both in student residences and on campus.

The University chooses catering firms and negotiates offers with a view to sustainable consumption with offers promoting regional produce and organically grown foods. It offers a wide choice of eco labels and fair trade products during meetings, in vending machines and at students’ canteens. Best practices are established among cleaning staff and in the choice of cleaning products, and environmental standards for procurement and ITC equipment are respected. Only recycled paper is used.

Sustainable procurement:

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Figure 1.5. Award Ceremony of the Re-use, reduce, recycle award scheme hosted by the Municipality of Esch on 9 July 2013.
Sponsor, Jury and Organisers: Xavier Poos, Ville D’Esch; Marco Quaino, SIL; Sébastien Schreiber, SIL; Jérôme Bajon, SIL; Marcela Infante Trevinho, CELL; Ariane König, CELL.
Award winning Students: Mika Tahiana, Laura Roof, Glawdys Nouboussi Ganmegne, Franklin Feyeh Bayfon, Jose Miguel Lopez Becerra, Tom Bümanis, Marwane El Kharbili, Dongo Jr Koffi Evêque

Figure 1.1. Staff and students 2007–2014

Figure 1.2. Total annual energy use on campus

Figure 1.3. Total annual on campus energy use per person (Staff and students)

Figure 1.4. The UL sustainable transport policy with six interdependent pillars to promote the use of public transport and low impact commuting modes and to reduce trips to the UL in individually occupied motor vehicles. University activities under each of these pillars are addressed in a detailed document on the UL transport policy on the website www.uni.lu/sustainability.

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2. **TEACHING, LEARNING AND RESEARCH**

**Goal**
One central goal of the Cell for Sustainable Development relates to building capacity within and beyond the campus community to better understand and act upon complex issues with interdependent environmental and social facets. Achieving this goal requires issue-centred research, teaching, and learning which draws on diverse disciplines, connects with practice, and relies on new participatory methods to find local solutions reconciling trade-offs and conflicts of interest.

**2.1 TEACHING AND LEARNING**

**Open Courses**
The open courses initiative was developed by the Cell in collaboration with the Vice President for academic affairs in 2012 in the interest of creating opportunities for students getting acquainted with diverse disciplines. The UL offers access to university courses of general interest from a wide range of disciplines to all students and the general public. The number of Open Courses on offer has stabilized at 82, most of which are offered by the faculty of humanities, arts and educational sciences. 42 students and 142 guest auditors were enrolled in the winter semester of 2014. The UL is also planning to progressively extend the range of degree programmes in which students have the option to take open courses that count towards their degrees.

**Certificate in Sustainable Development and Social Innovation**
The Certificate, launched in September 2013, is the university’s first part-time programme open to Bachelor-, Master-, Ph.D.-students and professionals. In 2013 and 2014 we enrolled about 30 participants and had a total of about 50 applicants each year. The programme’s main stated goal is to serve as a platform for societal debate, social learning and network development to foster systemic transformation for sustainability in Luxembourg. The structure of the programme allows for the design of an individual learning path (Figure 2.1.1). Learning outcomes are listed in Box 2.1. The Certificate’s overarching goal is to provide a better understanding of and a repertoire of action on the complex challenges that societies, organizations and individuals face as we approach the limits of the biophysical carrying capacity of our planet. Sustainability and Social Innovation are inseparable: active involvement of both citizens and science is necessary for guiding and monitoring the innovations that promise to protect or improve our lifestyles. The study programme offers tools for social learning to tap into the collective intelligence of stakeholders and experts. Issues such as energy, water and food production, waste and recycling, sustainable housing and transport are covered by academics and practitioners from Luxembourg and abroad. For example, in 2013, 2014, and 2015 we conducted co-design workshops facilitated by Dr Kilian Genicke, researcher in RUES FSTC and Jan Glas from LuxInnovation in close collaboration with the SIL (Figure 2.1.2). An associated public lectures series with prestigious international speakers is organized each semester. The academic publisher Routledge has agreed a contract to develop a text book based on our main Core course, which will also serve as a basis to establish a new Routledge Web Resource Repository on ‘Sustainability Science’, further enhancing the visibility of the UL internationally.

**Peer group projects as part of the Certificate**
Peer group projects on complex transition problems in Luxembourg form another central aspect in the programme providing opportunities for engagement in collective problem-based scientific inquiry in small diverse groups with guidance from experts and stakeholders. This kind of transformative learning process assumes that knowledge is constructed for action, and that learning can be mediated by practice. For an overview on peer group projects see Figure 2.1.1, Table 2.1, and Figure 2.1.3. with snapshots of action by the peer group on sustainability transition in the Luxembourg municipality of Beckerich. Such experiential learning opportunities equip participants for making better informed decisions and, if diversity is managed successfully, also for making more reflexive judgments for effective action. Learning is not only based on personal experience, but learners, including teachers need to be challenged by the experiences and perceptions of others in a dialectical manner. In order to embrace complexity, contingency, contradictions, and ignorance we need to draw on diverse rationalities and contested behaviours. Transformative learning is considered as a life-long iterative process, doors to which may be opened through engagement in projects that integrate education, research and civic engagement. Thus in the Certificate, contributors and participants are seen as members in a diverse learning community who engage with each other to shed light on multiple facets of complex problems, actively exchanging and learning from each other in a social learning process.

**The IPSE doctoral school interdisciplinary strand on sustainability**
The interdisciplinary strand on sustainability is built on conceptions of research and learning developed in the Certificate (see above) and is established in co-lead with Prof. Robert Krueger, visiting professor from Worcester Polytechnic Institute. One seminar for example equips doctoral researchers for the Practice of Critical interdisciplinarity, developed with Dr Jerome Ravetz, Associate Fellow, Oxford University, to better understand merits and limitations of specific disciplined research approaches, and theory and methods by juxta-position of diverse disciplinary fields of knowledge.
The Certificate requires 20 points of the European Credit Transfer System (ECTS) that can be collected by completing core courses, peer group projects and auxiliary courses. One ECTS point corresponds to a work load of about 1 hour, or a lecture of 45 minutes. Participation in the two core courses (6 ECTS each) and at least one semester of a peer group project (4 ECTS) is required. A second semester of a peer group project can be optionally replaced by completing an auxiliary course (4 ECTS). At the time of writing, two auxiliary courses ‘Global Environmental Change in the Anthropocene (GECA) and on ‘Sustainability Reporting’ had been established following the guidance of the Global Reporting Initiative (GRI). Individual learning paths can thus be more practice oriented by enrolling in two semesters of peer group project (recommended), or focussing more on the scientific knowledge base (GECA), or practical knowledge on developing organizational reports. The programme is designed to be compatible with a full-time job or study programme. Students have a choice of options. They can enroll to obtain the Certificate as second qualification in parallel to pursuing their main degree whilst at the University. Alternatively they can take individual courses as optional courses that count towards their main degree.

**Box 2.1. Main Learning Outcomes of the Certificate in Sustainability and Social Innovation**

- To apply systems thinking to understand the complexity of society, environment and their interactions.
- To respect the conflicting perspectives on an issue that are held by diverse experts and stakeholders, stemming from diversity in experience, values and world views.
- To recognize uncertainties and tensions arising from the gulf between local and global perspectives and modes of inquiry.
- Skills in negotiation: respect, listening, giving and taking to find mutually acceptable solutions to complex problems.
- An appreciation of alternative forms of social organization and enterprise for achieving a sustainable economic exchange system.
- To develop ‘citizen science’ approaches and techniques for creatively integrating the social and scientific emphases of the two phases of the course.
- To engage science and scientists productively in social learning processes with diverse groups of stakeholders for concerted action on local issues of environment and sustainability.

2.2 RESEARCH

Research on conceptual developments for sustainability science led to the insight that for a consolidated and comprehensive strategy that for sustainability research in Luxembourg it makes sense to distinguish between:

i) discipline-based research with salient strands in the natural, social and engineering sciences, and humanities;

ii) integrative research for an enriched understanding of complex social-ecological systems;

iii) and transformative research the aim of which is the transformation of human-environment interactions.

Combining research in engineering science and practice working with the team of Prof. Francesco Viti, started with the joint launch of regular staff surveys to monitor transport choices. Figure 2.2.1 shows there is no significant change in transport choices between 2012 and 2014, inspite of the implementation of the M-Pass subsidy (see section 1.). The next staff survey in 2016 will reveal whether the move to Belval by a large fraction of staff has caused significant behavioural changes in relation to the use of private cars, public transport and low impact modes. This collaboration evolved thanks to shared interests, and the UL transport strategy got wings, as Prof. Viti’s team developed a new concept of a personalized travel assistant. The travel assistant is now being implemented and provides information on all means to get to all campuses. In future, the system will learn from documentation of travel choices by individuals. Over time the system will not only advise users on the optimization of transport implementation measures at the UL (shuttle, car sharing, public transport), but also provide improved real time advice for traveling. The system will learn about the daily commuting practices of each person from home to work, shopping, leisure, sport or other activities and the preferred transport mode. The GO2 uni.lu web-portal is depicted in Figure 2.2.2.(a), Figure 2.2.2.(b) offers a scheme of its main functions.

This study was concluded and presented in May 2013. At the university, the study served as a basis for continued work on local indicators of sustainability transitions for the municipality of Beckerich.

A case study on developing indicators for local transition to a low carbon economy in the cross-border area Alzette-Belval was developed by the Cell for Sustainable Development for the OECD LEED Programme in collaboration with colleagues from STATEC and EUROSTAT.

Research on living laboratories established by Universities across the globe resulted in the publication of a book with 12 case studies of living laboratories being built in leading universities across four continents (Figure 2.2.2). Living laboratories are established as institutional frameworks for social learning processes for sustainability. They will mediate local choices by diverse stakeholders of global technological options and best practices, and further adapt these to local circumstances. They are designed to link research, education and practice and to integrate knowledge across disciplines to develop more socially robust approaches and local agreement on concerted action for improving sustainability. Directing attention to what enables and what constrains learning in communities of multiple and very diverse stakeholders in such laboratories can contribute to the development of an integrated understanding of factors influencing the chance of success (or failure), and the institutional arrangements, norms and values that accompany it.

Research on sustainability science as social learning process that focuses on how universities engage in the transformation for sustainability by offering new forms of learning opportunities, has led to the publication of a special issue in the Journal Current Opinion in Environmental Sustainability (IF=3.1) in October 2015. The special issue features ten case papers from five continents, including a paper on the Luxembourg Certificate and its evaluation scheme. A related paper presented at the Conference on Sustainability Science by the International Alliance of Research Universities in October 2014 in Copenhagen (Figure 2.2.3), is being published in a special issue with highlights from this conference (König, A., Dyball, R., Davila, F. (2016). The Solutions Journal, in press).
Figure 2.2.1. Results of transport surveys from 2012 and 2014

Figure 2.2.2. Functions of GO uni.lu: Towards a learning transport system

Figure 2.2.3. Book on living laboratories

As Chair of a Working Group of the International Sustainable Campus Network, Dr. Ariane König was editor of the ISCN’s first published book (in November 2013) with twelve case studies from five continents.

Prof. Steve Rayner, Oxford University, UK, states:

“This book’s case studies from North America, Europe and Asia highlight an enormous, but as yet untapped, potential for achieving social and technological change in cities worldwide. The authors show how university campuses around the world can be “living laboratories” to investigate and demonstrate the practicality of “regenerative sustainability”, which looks beyond environmental damage control to a vision of urban development that actually improves environmental quality and human welfare. If these ideas catch on, they could literally change the world.”
The goals of the Cell for Sustainable Development include developing participatory workshops and projects on environmental and social issues with engagement from local government, industry and organized civil society to provide input to local, national and regional policy making.

A group of five UL students founded a chapter of the international student association oikos, which was started in St Gallen, Switzerland, in 1987. The stated goal is to equip students as change agents for sustainability (Figure 3.1). Today, oikos international is a large international student community with chapters on five continents and a vibrant network of alumni and practitioners. The Luxembourg chapter has organized several awareness raising events, including ‘Fair Trade Breakfasts’ and a conference; it had also taken on the running of the student award programme ‘the Green Student Residence Award’ and ‘the Recycling Award’ in 2013. At the international level, Oikos Luxembourg (chapter in accession) has participated in conferences and workshops on transformative science and education in St. Gallen and Copenhagen. The chapter represented the University of Luxembourg in delegate meetings and established lasting relationships with engaged students from universities around the world.

Strengthening ties to government, in 2013 the Head of the Cell, Dr Ariane König, was nominated a member of the Conseil Supérieur Développement Durable, where she coordinates a project on scenarios for education in Luxembourg in 2030. On July 17 2015 the project was presented to the three government Ministers Claude Meisch, Carole Dieschbourg and François Bausch at their request. The project is now in its final roll out phase with a dedicated website, and a video (Figure 3.2). Dr König was also the lead-author of a recent opinion by the Conseil Supérieur about the governments progress report on the implementation of the national plan for sustainable development. In 2013 Dr König was also invited to join the national ‘Groupe de Réflexion Indicateurs Développement Durable’ under the auspices of the Ministry for Sustainable Development and Infrastructures that was charged with identifying a subset of 20-30 sustainability indicators from 418 proposed measures for tracking sustainability development at the national level. In 2013, she was for a second time a member of jury of the 123 GO Social enterprise development award programme. In November 2014, she was nominated as a Board member of the newly founded social enterprise TIIME. The Cell also was part of an expert panel for the auditing of the POST sustainability report that meets international standards of the Global Reporting Initiative, in 2014 and 2015. In 2013 and 2014 the Cell’s Certificate in Sustainability and Social Innovation was submitted in candidature of the Luxembourg Green Business Award; and was awarded the 2nd place for projects by public authorities in both years. As part of the Certificate we closely collaborate with several social enterprises in Luxembourg, including the two renewable energy citizen cooperatives EquiEnerCoop in Junglinster and Transition Minette.

International visibility of the UL in matters of sustainability was further enhanced as chair of a Working Group of the International Sustainable Campus Network (ISCN) Conference hosted by the National University of Singapore in 2013 and by Harvard University and the Massachusetts Institute of Technology in 2014. As a consequence of presentations of the book project and the Certificate at these prestigious venues, Dr König was invited chair of all sessions on Education in Sustainability at the Sustainability Science Congress organized by the International Alliance of Research Universities (IARU) in Copenhagen with 800 participants. She was also the key note speaker at the International Symposium on Sustainable Campus Creation at Hokkaido University in Japan, with over 200 Asian participants (Figure 3.3). These international activities contributing to the visibility of the UL will doubtlessly continue in the future as the Routledge book is published and new initiatives on ‘Transformative Science for Sustainability’ are being built.
Figure 3.1. oikos Luxembourg: Founding members
Upper row from left to right: Aniko Knopp, Marcela Trevino, Laura Roof, Aline Schalz, Thiaba Fall; lower row from left to right: Franklin Bahfon Feyeh, Mika Taks, Jan Doerr

Figure 3.2. CSDD project Scenarios for Education in 2030 in the face of sustainability challenges ADD: http://www.csdd.public.lu/fr/scenarios/index.html

Figure 3.3. Contributors to the International Symposium on the Creation of Sustainable Campuses 2014 at the University of Hokkaido, Japan
Prof. Takashi Mikami (Vice president, Hokkaido University); Prof. Hiroshi Yoshimi (Dean of Faculty of Economics, Hokkaido University); Mr. Noriaki Ikushima (Vice mayor, City of Sapporo); Dr Ariane König (Head of the Cell for Sustainable Development, University of Luxembourg); Prof. Kazuhiro Ueta (Faculty of Economics, Kyoto University); Associate Prof. Takao Ozasa (Faculty of Engineering, Hokkaido University); Mr. Masayuki Moti (Ministry of Education, Culture, Sports, Science and Technology of Japan); Associate Prof. Takeo Ozawa (Faculty of Engineering, Hokkaido University); Three members of the delegation from Ubon Ratchathani Rajabhat University, Thailand; Mr Takashi Yokoyama (Project manager, Office for a Sustainable Campus, Hokkaido University); Dr Maki Ikegami (Coordinator, Office for a Sustainable Campus, Hokkaido University)
4. OUTLOOK: BUILDING TRANSFORMATIVE SCIENCE FOR SUSTAINABILITY IN LUXEMBOURG

A new approach to structuring a research process, transformative sustainability science is emerging, in which researchers, civil society, private enterprise, and governments collaborate with the goal of transforming how society and environment interact. These new forms of science will be required to implement sustainability-related goals and measures emerging from recent political agreements, such as the United Nations Sustainable Development Goals, the EU Agenda 2030, and resolutions taken at the 21st Conference of the Parties (COP 21). The Luxembourg “Klima Pakt” is already starting to fundamentally change how the national and local governments work together to improve adaptive governance. But the joint engagement of civil society and research in developing an improved understanding and repertoire of action, warrants more formal support. This is also important in view of the potentially beneficial systemic changes that require a more profound reframing of current ways of thinking and doing. Capacity-building for transformative sustainability science is still to be implemented in Luxembourg, in spite of its being crucial for building society’s coping mechanisms in response to accelerating global change.

WHAT RESEARCH DO WE NEED IN LUXEMBOURG IN THE FACE OF ACCELERATING GLOBAL CHANGE?

In Luxembourg, salient disciplinary research and teaching to describe specific sustainability challenges in particular systems is established, and the development of key interdisciplinary research areas including on transport/mobility, health economics, ecological economics and Green ICT is well underway. There is however relatively little research that combines natural science and engineering with critical perspectives from social sciences and humanities on the functioning of our society. This is however required in order to better understand and act upon complex social-ecological systems with stocks and flows of materials and energy that are developing interdependently with social structures and practices.

Transformative sustainability science seeks to draw on problem-solving as well as critical research perspectives, and involves recognition of complexity, contingency, contradictions, uncertainty, and ignorance. Developing a shared language and an understanding of problems, progress, theory, methods and potential actions across disciplinary fields in natural science and social science, together with policy, and practice, requires collaboration for an extended period of time, and is only likely to happen within institutional frameworks which promote such relationship building.

WHAT WE WANT TO DO

Research Building on recent insights from sustainability science, we will establish a first research project, combining a systems approach and participatory scenario building with regional integration. This project will first focus on future challenges and interdependencies at the water-food nexus in the catchment area of the Alzette (with focus on the sandstone area around Luxembourg city). This research will be co-produced in collaboration with scientists, policy-makers, enterprises, and organized civil society. Overarching research questions include: ‘How can today’s relatively independent activities of research, planning, observation, assessment and decision-support be better integrated into systems for adaptive management and social learning?’ And ‘How can the future be scanned in a creative, rigorous and policy relevant manner that reflects the normative character of sustainability and incorporates different perspectives?’

Outreach We propose to develop a virtual platform for sustainability science as an arena for research, teaching and learning, which plays an active role in transforming relations between society, environment, economy and technology. The Platform will be developed as a nodal point for capacity building in a growing network of existing disciplinary public research teams, government units, private firms and organized civil society, who are interested in engaging in transformative sustainability science. For this purpose, the virtual platform will focus on building structures and activities for capacity building for engaging diverse sectors of society in such research, teaching and learning (see Box 4.1).

To arrive at an integrated and/or transformative understanding of social and environmental facets of sustainability challenges, commonly used approaches include stock-flow modelling in a systems perspective, such as in human-ecology; citizen science for participatory monitoring projects for creating shared environmental knowledge and awareness, and the establishment of living laboratories. These approaches usually require regional integration and result in place-based knowledge. Scenario planning methods have the potential to enrich our understanding of future drivers of change, contradictions, and areas of ignorance. These methods taken together are considered key to fostering Luxembourg’s resilience and adaptive capacity. They will also point out areas where citizens, public authorities and firms may want to assume new responsibilities in the face of accelerating global change.

By working with faculty engaged in our research project, we will also aim to leverage our research for systematically increasing the offer of relevant learning opportunities at all higher education levels in Luxembourg (Bachelor, Masters, Ph.D. and professional education, and for the Certificate in Sustainability and Social Innovation). A mid-term goal is the establishment of an Executive Training Programme to equip graduates for engagement in sustainability science projects. The long-term goal is to establish networks, processes and sources for the acquisition of third party funding for transformative science for sustainability in Luxembourg.
**BOX 4.1. Core Elements of a Luxembourg virtual Platform for Sustainability Science**

- A steering group with representatives of all faculties of the University and the Ministry for Sustainable Development and Infrastructures
- An advisory board with national stakeholders, including for example representatives from selected Ministries, the Luxembourg Institutes for Science and Technology, and for Socio-Economic Research (LIST and LISER), the private sector (e.g. Inspiring More Sustainability (IMS) a.s.b.l., and civil society (e.g. the Centre for Ecological Learning in Luxembourg a.s.b.l., Natur & Ëmwelt))
- A knowledge centre that offers an overview on relevant expertise, projects, and funding opportunities in Luxembourg
- An international network of experts and mentors to advise all researchers on building integrative or transformative science projects, and who also play a role in regular evaluation of the Centre already recruited from ISCN and IARU
- A resource repository with teaching materials for capacity building for engagement in transformative science projects
- SALIENT ISSUES Workshops, biennial, to co-create transformative science research projects in collaborative processes with stakeholders from civil society, government, and firms
- Prototype funding- and contractual solutions for long-term (6-10 year) collaborative sustainability science research projects
- A doctoral training unit
The three tables below summaries UL sustainable development goals, initiatives and results in the years 2012, 2013 and 2014 for each of the three principles of the ISCN-GULF CHARTER, respectively.
Principle 1: To demonstrate respect for nature and society, sustainability considerations should be an integral part of planning, construction, renovation, and operation of buildings on campus.

A sustainable campus infrastructure is governed by respect for natural resources and social responsibility, and embraces the principle of a low carbon economy. Concrete goals embodied in individual buildings can include minimizing environmental impacts (such as energy and water consumption or waste), furthering equal access and optimizing the integration of built and natural environment. To ensure buildings on campus can meet these goals in the long term, and in a flexible manner, useful processes include participatory planning (integrating end-users such as faculty, staff, and students) and life-cycle costing (taking into account future cost-savings from sustainable construction).

<table>
<thead>
<tr>
<th>Topics</th>
<th>Goals and Initiatives</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority topics</td>
<td>Objectives and targets (for reporting year, for the following year, and / or planned for the following and beyond)</td>
<td>Performance 2012</td>
</tr>
<tr>
<td>Facilities</td>
<td>Key Initiatives</td>
<td>The organization of the Green Student Residence Award has been accompanied by the Recycling Design Award</td>
</tr>
<tr>
<td>Student residencies</td>
<td>Improving the environmental footprint and the quality of student residencies.</td>
<td>Organization of awareness rising programs and award on sustainability programs</td>
</tr>
<tr>
<td>Resource use</td>
<td>Direct &amp; indirect energy use</td>
<td>Electricity-saving measures: • Led lamps and light detectors used for lighting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gas and district heating: • The heating is shut down in July and August (depending on the outside temperature)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The heating chart is yearly adopted for the distribution of heat</td>
</tr>
<tr>
<td></td>
<td>Green energy use</td>
<td>Purchase of green energy</td>
</tr>
<tr>
<td>Waste resort</td>
<td>Waste</td>
<td>Sorting chemical and biological waste separated</td>
</tr>
<tr>
<td></td>
<td>Printing</td>
<td>Exclusive use of recycled paper</td>
</tr>
</tbody>
</table>
**Table A, Principle 2:**

**Campus wide Master planning and target setting**

**Principle 2:** To ensure long-term sustainable campus development, campus-wide master planning and target-setting should include environmental and social goals.

Sustainable campus development needs to rely on forward-looking planning processes that consider the campus as a whole, and not just individual buildings. These processes can include comprehensive master planning with goals for impact management (for example, limiting use of land and other natural resources and protecting ecosystems), responsible operation (for example encouraging environmentally compatible transport modes and efficiently managing urban flows), and social integration (ensuring user diversity, creating indoor and outdoor spaces for social exchange and shared learning, and supporting ease of access to commerce and services).

Such integrated planning can profit from including users and neighbors, and can be strengthened by organization-wide target setting (for example greenhouse gas emission goals).

<table>
<thead>
<tr>
<th>Topics</th>
<th>Goals and Initiatives</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Priority topics (with units of measurement)</strong></td>
<td><strong>Objectives and targets (for reporting year, for the following year, and/or beyond)</strong></td>
<td><strong>Key Initiatives (in reporting year, and/or planned for the following and beyond)</strong></td>
</tr>
<tr>
<td><strong>Institution-wide carbon targets and related achievements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct and indirect emissions</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Master planning</strong></td>
<td>Beginning of the construction of the data processing centre and the “House of Innovation”</td>
<td>Celebration of the 10th Anniversary of Uni.lu, setting the goals for the future challenges</td>
</tr>
</tbody>
</table>
| **Transport** | By the end of 2014:  
• A 10% decrease of the people driving alone to work  
• Increase the proportion of public transport user of 10%  
• Increase the part of low-impact mode user to 5% | Approval by the Board of education to subsidize the M-pass for public transport by 30% | Transport subsidy: over 200 M-passes issued for staff | • Transport subsidy: over 300 M-passes issued for staff  
• New transport survey on transport behaviours |  |
| **Food** | The Government programme on Development Cooperation promotes public spending on Fair Trade products | Fair Trade coffee and juice are offered during meetings  
Fair Trade products are available at vending machines | Fair Trade coffee and juice are offered during meetings  
Fair Trade products are available at vending machines | Fair Trade coffee and juice are offered during meetings  
Fair Trade products are available at vending machines  
Fair Trade products are available at vending machine and in the canteen |  |
| **Social Inclusion** | **Gender issue**  
• Initiative to support equality among genders and stop sexual harassment  
• Maintaining of planned efforts to increase the number of women among academic staff | **Initiatives against women and man violence and stop sexual harassment days** | **December 2012:** Students in undergraduate and continuing education: 3188 women; 3100 male Academic staff: 23.6% | **December 2013:** Students in undergraduate and continuing education: 3146 women; 3083 male Academic staff: 26% | **December 2014:** Students in undergraduate and continuing education: 3187 women; 3100 male Academic staff: 26% |
| **Multilingualism** |  |  |  |  |  |
Principle 3:

To align the organization’s core mission with sustainable development, facilities, research, and education should be linked to create a “living laboratory” for sustainability. On a sustainable campus, the built environment, operational systems, research, scholarship, and education are linked as a “living laboratory” for sustainability: Users (such as students, faculty, and staff) have access to research, teaching, and learning opportunities on connections between environmental, social, and economic issues. Campus sustainability programs have concrete goals and can bring together campus residents with external partners, such as industry, government, or organized civil society. Beyond exploring a sustainable future in general, such programs can address issues pertinent to research and higher education (such as environmental impacts of research facilities, participatory teaching, or research that transcends disciplines). Institutional commitments (such as a sustainability policy) and dedicated resources (such as a person or team in the administration focused on this task) contribute to success.

### Table A3, Principle 3: Integration of facilities, research, education, and outreach as a “living laboratory” for sustainability

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Priority topics</strong> (with units of measurement)</td>
<td>Objectives and targets (for the following year, and/or beyond)</td>
<td>Key Initiatives (for reporting year, and/or planned for the following and beyond)</td>
</tr>
<tr>
<td><strong>Social integration</strong></td>
<td><strong>Engagement of staff and students</strong></td>
<td><strong>Launch of the “Certificate for Sustainable Development and Social Innovation” comprehensive of previous courses and introducing peer group projects as part of the learning activity</strong></td>
</tr>
<tr>
<td>Social integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Research projects on sustainable facilities and operations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commitments and resources for campus sustainability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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