

VIABLE SOLUTIONS FOR SMART SUSTAINABLE CITIES

JUNE 2017



**UNIVERSITIES AND MUNICIPALITIES
WORK TOGETHER AT EUROPEAN
SUSTAINABLE SOLUTIONS FOR EXISTING
AND NEW CITY ENVIRONMENTS**



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THE FUTURE OF HUMANKIND DEPENDS TO A GREAT EXTENT ON WHETHER WE WILL BE ABLE TO BOOST THE SUSTAINABLE DEVELOPMENT OF CITIES.

SMART SUSTAINABLE CITIES & HIGHER EDUCATION

Our cities are the key challenge in realising a sustainable earth. Enormous geographical, demographical and environmental changes will take place in urban environments in the coming decades.

Text: Erlijn Eweg [1] | Photo: Mirel Mašić

Since the beginning of the 21st Century the majority of the world population lives in an urban environment; every day there are thousands more people living in cities than the day before. The rate of urbanisation is increasing rapidly and the age structure of the urban population is shifting towards more elderly people. Environmental pressures are increasing especially in these urban areas. These developments challenge us to develop integrated sustainable solutions for economic, social and environmental problems. The future of humankind depends to a great extent on whether we will be able to boost the sustainable development of cities.

Awareness of this sense of urgency was the reason for HU University of Applied Sciences Utrecht to start the Centre of Expertise Smart Sustainable Cities in 2014. This is a public-private partnership. Its rationale is that viable solutions are to be found in cooperation between Higher Education Institutes, enterprises and local government. The need for a transition towards more sustainable cities requires a reinforcement of academic programmes educating future professionals. We must enable today's students to develop viable solutions for creating Smart Sustainable Cities of the future. The knowledge and expertise of Higher Education Institutes on societal challenges will improve the quality of these possible solutions. The cooperation between universities and municipalities will have a great impact on the local and regional level in society.

The need for these solutions is underlined by the European Commission: "Higher education is at the heart of Europe's ambition to become a smart, sustainable and inclusive economy: it plays a crucial role in individual and societal advancement; and, with its impact on innovation and research, it provides the highly skilled human capital that knowledge-based economies need to generate growth and prosperity." [2].

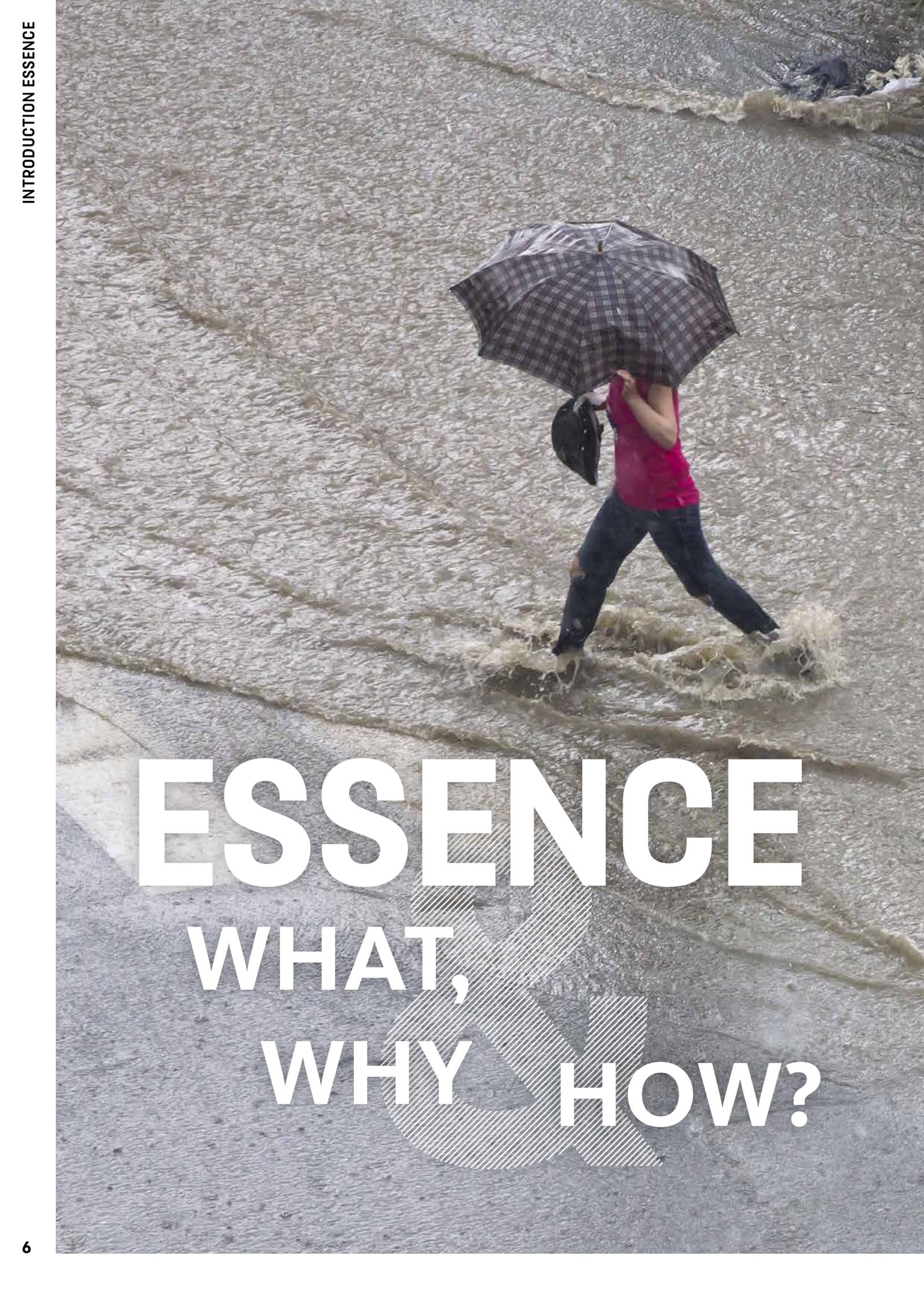
Cooperation between universities and municipalities will result in local changes. The complexity of today's challenges urges regions to learn from one another's approaches, and as well urges universities to learn to work together on societal challenges. We will strive to cooperate on an international and interdisciplinary level, universities together with municipalities and companies. Sustainability just does not stop at the border.

Exchanging knowledge and expertise through international cooperation is very inspiring. This publication offers you insights into the ways universities and municipalities work together to realise Smart Sustainable Cities. It contains a selection of practical examples from the international project European Sustainable Solutions for Existing and New City Environments (ESSENCE). A number of people involved in ESSENCE share their experiences and views, seen from different perspectives, depending on their role in the project and their national background. Many people cooperated and worked hard to make this beautiful example of international cooperation possible. We are grateful to all of them.

I hope and expect this publication will inspire and inform you about the state of the art of higher education and sustainable cities, and the knowledge, skills and experiences needed to realise such cities. We hope that some of it will be useful in future joint cooperation to meet the grand challenges of this era.

1 Drs. Erlijn Eweg
Project manager
ESSENCE Centre
of Expertise Smart
Sustainable Cities, HU
University of Applied
Sciences Utrecht.

2 Communication from
the commission to the
European Parliament,
the council, the
European economic
and social committee
and the regions -
Brussels 11.7.2013 COM
499 final.



ESSENCE

WHAT,
WHY & HOW?

In ESSENCE five European Higher Education Institutions and three municipalities worked together to train future professionals to overcome the complex challenges of achieving smart sustainable cities. Students worked on behalf of the three local governments on useful solutions to sustainability issues in the urban environment. New teaching methods were applied, such as blended learning and creative solution searching methods.

Text: Erlijn Eweg | Photo: iStockphoto | Infographics: GoatCode

The needs of urban societies urged five European Higher Education Institutions from the Consortium on Applied Research and Professional Education (CARPE) (in Utrecht, València, Turku, Manchester and Hamburg) to start the strategic partnership project ESSENCE in Erasmus+, the European Programme for Education and Training. With the Centre of Expertise Smart Sustainable Cities at HU University of Applied Sciences Utrecht in the lead, a proposal was developed, based on an integrated approach to achieving sustainable cities. For this a strong involvement of municipal governments was needed and therefore three regional governments (Utrecht, Alcoy and Turku) were invited to participate. The role of municipal governments is crucial in setting a vision for sustainable cities; this vision was established in 2012 in the United Nations Conference on Sustainable Development (UNCSD), also known as Rio 2012 or Rio+20 [1]. A shared vision on sustainable cities of Higher Education Institutions and regional authorities is the basis of ESSENCE.

The purpose of ESSENCE is to promote the development of sustainable cities in international cooperation. An interdisciplinary teaching programme with a number of staff training sessions has been developed in ESSENCE. Students worked on behalf of three local governments on useful solutions to sustainability issues in the urban environment. New teaching methods are applied, such as blended learning and creative solution searching methods. These didactic approaches match the European Modernisation Agenda for Higher Education Institutions. Special attention was paid to entrepreneurship and the encouragement of developing startups. The main goal of ESSENCE is that future professionals in Europe will be trained and highly skilled to overcome the complex challenges in achieving sustainable cities. With this project, ESSENCE set a remarkable example for the rest of Europe, leading to reinforced competitiveness of involved regions and supporting regional innovation.

PROJECT TARGETS AND TOPICS

ESSENCE contributes to the following European objectives as described in the Erasmus programme:

- The improvement of competences regarding the contribution to a sustainable society. To foster quality improvements, innovation excellence and internationalisation at Higher Education Institutions, through transnational mobility and cooperation.
- To enhance the international dimension of education and training and to promote diversity and intercultural awareness in the European Union.

ESSENCE is structured around three topics:

- *Environment and climate change.* Sustainable solutions are needed for existing and new city environments, with synergies between policy and practice and inter-institutional cooperation. ESSENCE accelerated the design, development and uptake of viable solutions for sustainable cities by enhancing cooperation between higher education and regional authorities, such as municipalities and incubators. Successful approaches are communicated and reinforced with an international Sustainable City competition and Startup competition for students.
- *Interregional dimension and cooperation.* A collaborative approach is needed in 'the triple helix' relationships between business communities, government organisations and knowledge institutions [2]. This demands active participation of young people in society and inter-regional cooperation between Higher Education Institutions and municipalities. ESSENCE developed an international course programme on creating sustainable cities, involving higher education and regional authorities. Parts of the programme are disseminated as open course ware to be used in other regions. This sets an example for and has a broad impact on the creation of sustainable cities throughout Europe.

1 Art. 136 RIO 20+ decisions.

2 www.theneweconomy.com/technology/utrechts-competitive-edge-is-taking-its-economy-to-new-heights.

- *New innovative curricula, educational methods and development of training courses.*
Innovative approaches are needed for learning pathways in higher education by open educational resources, quality of education, cross-disciplinary co-operation, transversal skills and flexible pathways, leading to the necessary 21st century skills of the current generation of students. ESSENCE exchanged, investigated and tested best practices of innovative teaching approaches, blended learning, distance learning, flipped classroom, webinars and ICT methods. It implemented the best practices in the international course on creating sustainable cities.

TARGET GROUPS AND PROJECT PARTNERS

The target groups of ESSENCE are:

- Students, trainees, and apprentices in Higher Education Institutions;
- Researchers and teaching staff in Higher Education Institutions;
- Experts, specialists, professionals, incubator facilities and Small and Medium Enterprises (SMEs);
- Officials and decision makers (municipalities);
- Any person or organisation interested in the outcomes of the project.

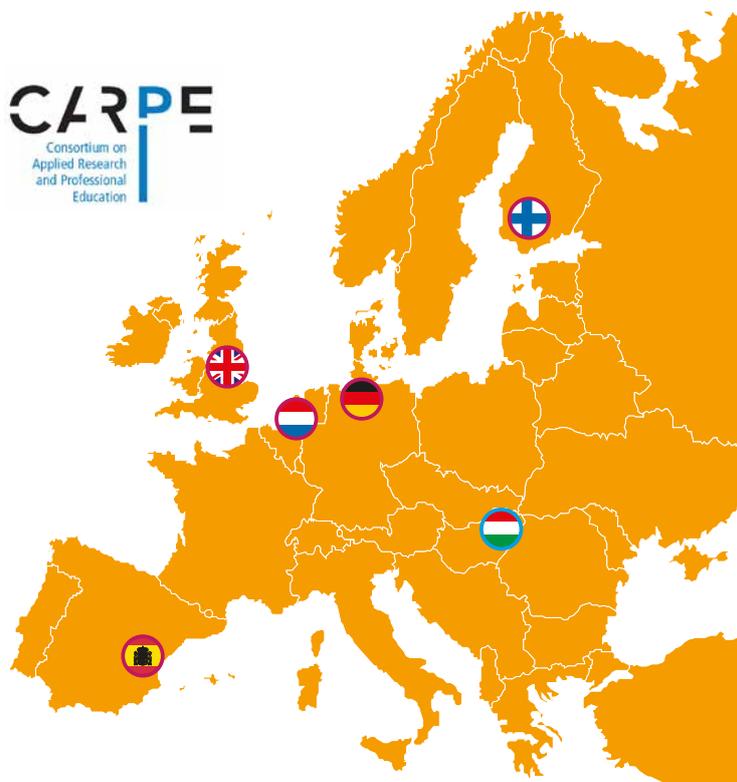
The project partners in ESSENCE are five Higher Education Institutions and three municipalities:

- Turku University of Applied Sciences (TUAS), Finland;
- Manchester Metropolitan University (MMU), United Kingdom;
- HU University of Applied Sciences Utrecht (HU UAS Utrecht), the Netherlands;
- Hamburg University of Applied Sciences (HAW), Germany;
- Universitat Politècnica de València (UPV), Spain;
- Municipality of Turku, Finland;
- Municipality of Utrecht, the Netherlands;
- Municipality of Alcoy, Spain.

The five Higher Education Institutions are partners in the Consortium on Applied Research and Professional Education (CARPE), first of this kind in the field of Applied Sciences in Europe. CARPE aims at connecting education and research with their regions of residence in order to increase the social and economic value of the knowledge they create.

PROJECT ORGANISATION AND QUALITY ASSURANCE

The key players in the project were the teaching staff and project leaders from the five Higher Education Institutions, too many to mention all personally, and the three municipalities. The project board was under the direction of: prof. dr. Ivo Opstelten, prof. dr. Johan Versendaal and prof. ir. Remko van der Lugt, all from HU University of Applied Sciences Utrecht. Projectmanagement was done by drs. Erlijn Eweg and ir. Lenneke Kok. A steering group monitored and tracked the quality assurance and was formed by representatives of each institute: Javier Orozco Messana PhD (UPV), dr. Martijn Rietbergen (HU UAS Utrecht), prof. dr. Tobias Held (HAW), MSc Harri Lappalainen (TUAS) and Claire Baird (MMU). The municipalities were represented by MSc Janne Rinne (Turku), Jan Bloemheugel (Utrecht) and dr. Alexandre Martines I Joan (Alcoy).



FULL MEMBERS

-  Turku University of Applied Sciences (TUAS)
-  Manchester Metropolitan University (MMU)
-  University of Applied Sciences Utrecht (HU UAS Utrecht)
-  Hamburg University of Applied Sciences (HAW)
-  Universitat Politècnica de València (UPV)

ASSOCIATE MEMBER

-  University of Debrecen (UD)

MAIN ACTIVITIES

The ESSENCE project started in 2014; the duration of the project was three years. In the first year we discussed the challenges for developing sustainable cities in detail and set up an outline for a joint course. Teaching staff were trained in the use of innovative teaching approaches and the development of the electronic learning environment. In Alcoy a conference on blended learning was organised. In Utrecht the infrastructure for an Open Learning Environment was built in order to make the (digital) learning materials available for reuse.

In the second year, learning material for a course programme of one semester was completed. We developed this learning material in international staff teams. In Manchester, a boot camp on entrepreneurship was organised, where part of the learning material was tried out in a pilot. The bootcamp ended up in an international Startup competition for students. In Turku we trained an international group of teaching staff in using creative solution searching methodologies and we organised a conference on creative solution searching order to realise a smart sustainable city.

In the third year, we tried out the joint course programme of one semester in Utrecht, in a blended learning format. After that we organised an intensive learning programme of three weeks on smart sustainable cities in Utrecht, Alcoy/València and Turku in April 2017. Students from the Netherlands, Finland, Spain, United Kingdom and Germany attended the courses. The students worked on assignments

of the three municipalities Alcoy, Manchester and Utrecht and were challenged to send in their results to an international student Sustainable City competition. This is a yearly competition, organised by the Dutch association of professors on Urban Energy (Nationaal Lectoren Platform Urban Energy). For this competition, student teams develop action plans which contribute to the transition towards smart sustainable cities and compete for the Transition Zero Award. This year, with the cooperation of the students of various ESSENCE teams, inspiring ideas were submitted by twelve student teams. The final conference Smart Sustainable Cities – Viable Solutions took place in Utrecht in June 2017, with pitches of the nominated teams and the announcement of the Transition Zero Award winning team.

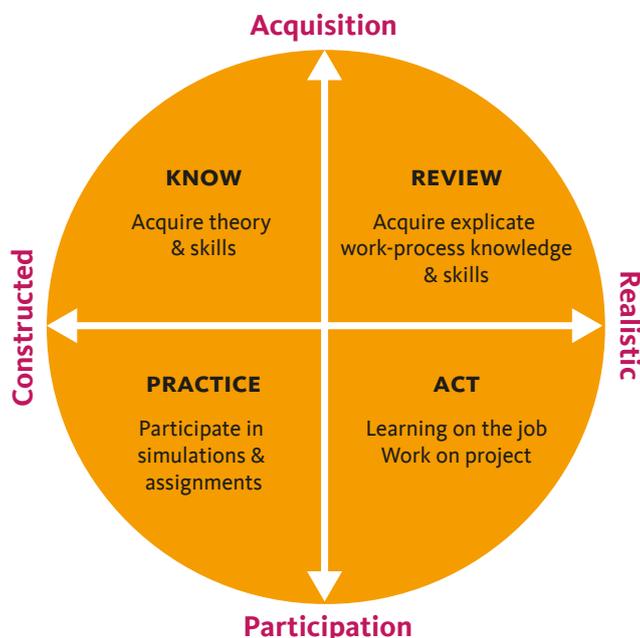
INNOVATIVE APPROACHES ON BLENDED LEARNING AND CREATIVITY

The universities partnering in CARPE needed a common learning space, where learning material could be shared and developed. In ESSENCE such an Electronical Learning Environment (ELE) is developed in Moodle, based on design principles suitable for an international context. Moodle is chosen because two of the partners were experienced Moodle users already, and because it is an open source environment dedicated to education.

The digital infrastructure in ESSENCE is developed according to extended co-design principles and based on a short co-design process. This included formative evaluations and the involvement with regard to the architecture of educational experts, ICT experts, co-design experts, teaching staff and students. The aim was to have an educational, logical and physical architecture for a competency-based, blended and international learning environment. Development under architecture was necessary. A physical and logical architecture was developed by the expert team of HU UAS Utrecht. The result was a working learning environment, based on the educational approach to learn by patterns [3]. The teaching staff developed the learning material with relevant patterns, always using the four pillars:

- Knowledge and instruction (Know)
- Reflective practice (Practice)
- On the job learning (Act)
- Assignments, simulations & collaborations (Review)

The use of this quadrant model proved to be valuable for the teachers to develop the learning environment. In this model students acquire 21st century skills by distinguishing four different quadrants on two dimensions. On the x-axis we find the simulated reality as 'constructed' and the real live working environment as 'realistic'; on the



Quadrant model

y-axis we find the patterns with an active learning attitude as 'participation' and a more consuming learning attitude as 'acquisition'. From this, in the ESSENCE learning environment four patterns were distinguished. All the learning processes were structured around: 'know', 'practice', 'act' and 'review'. The teaching staff involved in ESSENCE did apply this model for the first time.

Nowadays the learning environment is online and in use. The course developers did develop their learning material online in the ELE and the students use the ELE during their courses.

INNOVATIVE APPROACHES ON TEACHING STAFF

The first training activity was about the use and possibilities of blended learning and the use of the ELE. It was an intensive programme for teaching staff, organised in València, laying the fundamentals for all further activities and results.

In Turku another intensive programme for the international group of teaching staff was offered. The thematic focus of this programme was on creative approaches to find solutions to sustainable challenges in urban environment: creative solution searching approaches. The teaching staff members practised working with the platform, and learned about creative methodologies to find solutions to sustainable challenges in urban environments. Both staff training sessions were important to share ideas and to reach a common understanding of the main targets and approaches in ESSENCE.

COURSE MATERIAL ON SMART SUSTAINABLE CITIES

Starting with the Tuning methodology [4] a course outline was evolved for a course of one

3 Zitter, I. and A. Hoeve (2012). Hybrid Learning Environments: Merging Learning and Work Processes to Facilitate Knowledge Integration and Transitions. OECD Education Working Papers, No. 81, OECD Publishing.

4 www.unideusto.org/tuningeu/tuning-methodology.html. Tuning Educational Structures in Europe, Life Long Learning programme. University of Groningen/University of Deusto.



Field research during Intensive program



Final presentation course SSC

semester on smart sustainable cities. The course was meant for students with a technical profile at advanced bachelor level. For each course module a coordinator was found to organise the international development of their module. The course material was empowered by blended learning, i.e. digital education in combination with vocational and coached education.

In several meetings the blended learning approach was discussed, as well as how to operate and organise the course. A model was developed and agreed on: the framework of blended learning was a good base for what we planned and worked out well. The result was real international education with teaching staff of all universities in different roles: as coaches, as experts and as guest lecturers. Interesting for all universities was the discussion about comparing the grading rules. It turned out to be a real challenge to organise a joint programme with a governance structure acceptable for all the participating universities.

The developed course material consists of six modules on smart sustainable cities: an introductory course, a methodology course, a module on social design, a module on physical transition, a module on entrepreneurship and the city project as a connecting thread. Three weeks of fieldwork on location (in Utrecht, Alcoy or Turku) were part of the city project.

BOOTCAMP ON ENTREPRENEURSHIP

During one week “bootcamp” in Manchester there was a first try-out of the learning material on entrepreneurship with students from Spain, Germany, the Netherlands, the United Kingdom and Finland. With the input from the entrepreneurial course module, and support from local SMEs, the bootcamp ended up in a Transnational Startup competition. The experience with the bootcamp was used to develop and revise the learning material. It was suggested to organise comparable bootcamps for CARPE partners in the future, with the help of Erasmus exchange programmes, as the bootcamp worked out very well and was a great experience for the participants.

DISSEMINATING THE KNOWLEDGE

To share the knowledge and experiences in ESSENCE, three events were organised – all of them with over a hundred visitors, apart from the directly involved partners. Subjects were Blended Learning, Creative Solutions and Smart Sustainable Cities. The first event took place in Alcoy on ‘Sustainability in cities – a necessary challenge: learning with Blended Learning’. The event was strongly related to the former staff training in València.

The second event took place in Turku and was about creative and innovative learning approaches. The conference was titled ‘Smart Sustainable Cities Excursion to Skanssi area – developing the area by using creative solution searching tools’. International staff who attended the staff training on creative solution searching had a direct role in the programme, in order to practice what they learned during the training, by coaching the groups and reuse the materials and input of the staff training. The location of the event was the Skanssi Shopping Centre, the same area about which the city project from the municipality of Turku was defined for the student course on Smart Sustainable Cities.

The third and last event took place in Utrecht: a conference on ‘Smart Sustainable Cities and viable solutions’. Reflecting, talking and discussing about how we can work together to keep our cities livable and sustainable: municipalities, enterprises and universities. We invited keynote speakers of international reputation, showed inspiring examples of best practices to develop smart sustainable cities and all the participating countries in ESSENCE shared their vision. Knowledge and experience sharing about ESSENCE also took place during several meetings, presentations, publications and of course via the website www.essence.hu.nl

STUDENT COURSE ON SMART SUSTAINABLE CITIES

The course Smart Sustainable Cities was offered in Utrecht and was promoted by TUAS, HU UAS Utrecht, HAW, MMU and UPV. The course extended of 30 European Credits (ECTS), all with focus on sustainable cities. The students learned how to understand a sustainable city and how to find creative

solutions to realise sustainable cities. In its purest and most distilled form the imperatives of sustainability are summed up by just three words: 'People, Planet, Profit' [5].

It is easy to recognise this concept of the three P's in the course on smart sustainable cities – regarding to physical transition, social design and entrepreneurship. In the practice of sustainability the three P's are widely known, and almost universally agreed upon. Sustainability will be growing if we are able to simultaneously maximise all benefit to People, Planet and Profit. This concerns a benefit to the environment, to everyone inhabiting the earth and a financial and long-term viability: all these ingredients are needed to create a sustainable future. During one semester the students explored sustainable cities and learned about them. But almost as important was their international experience: living and working in another country with another culture. Friendships were born and mutual respect and understanding towards other cultures did grow.

INTENSIVE PROGRAMME ON SUSTAINABLE CITIES

An intensive programme on sustainable cities was offered simultaneously in Finland, Spain and the Netherlands with the developed learning material as a baseline. The intensive programme was meant to prepare the students for the international student Sustainable City competition, in order to participate in the international Sustainable City competition – the Transition Zero Award. Again the municipalities designed the challenge based on real needs and were the connecting thread in the intensive programme.

RESULTS OF ESSENCE AND SPIN-OFF

Partners did benefit from the international cooperation by learning about different methods and approaches. They came up with ideas to discuss subjects within all university staff – not limited to the staff involved directly in the project. The development of joint courses enhanced education by discussions, for example face-to-face discussion, with international staff. The cooperation was being experienced as a good basis for exchanging different teaching methodologies and developing a common joint curriculum. A stronger focus on international comparison as leading strategy could strengthen international cooperation for all universities. The project finally enabled core staff of universities to get to know each other well; this will be important for cooperation in the long run.

In 2016 the ESSENCE project did win the Orange Carpet Award, a prestigious award by Nuffic – the Dutch National Agency on Erasmus+, on best practises for international education in Higher Education.

AN INTENSIVE PROGRAMME ON SUSTAINABLE CITIES WAS OFFERED SIMULTANEOUSLY IN FINLAND, SPAIN AND THE NETHERLANDS WITH THE DEVELOPED LEARNING MATERIAL AS A BASELINE.

The participating universities make use of the developed learning materials, although not all of them in a 30 ECTS programme. TUAS already uses the materials in separate modules and courses in the Faculty of Technology, Environment and Business (TEB) and in international courses. HU UAS Utrecht will proceed with the 30 credit point course as an international minor programme in Utrecht. Both UPV and MMU will implement a smaller part of the developed material in existing courses. MMU will investigate the usability for extracurricular sustainability activities available to students, such as energy awareness training sessions. HAW had a participation of students from seven departments and three faculties in the pilot course in Utrecht in April-May 2017. Therefore HAW is considering to investigate the possibility to integrate the whole course in the curriculum, or to use single modules.

Apart from all the experiences and lessons learned in this project, ESSENCE did lead to new bilateral international agreements on exchange between universities. Even the European project CIMULACT [6] did benefit from ESSENCE. CIMULACT is a project on citizen and multi-actor consultation on Horizon 2020. It aims to give concrete and unique input to the research and innovation agenda of the European Union, based on visions from citizens in thirty European countries. The students in the course on sustainable cities did meet in a vision workshop where they expressed their dreams for a sustainable and desirable future.

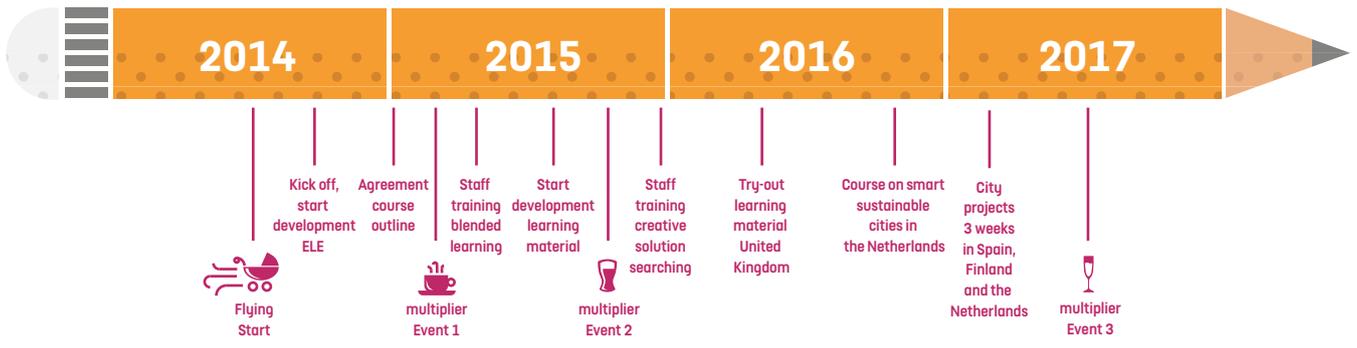
The ELE as developed in ESSENCE will still be in use during upcoming activities. A new proposal on digital skills is developed by HU UAS Utrecht together with the partners, using this digital platform as an e-learning environment. An interesting spin-off of ESSENCE is SAUNAC [7]. This project is lead by TUAS and stands for 'Sustainable Alliances of Urban Networks in Asiatic Cities'. The same European universities of applied sciences are involved and working together with six Vietnamese universities in this project in order to develop a similar course as was done in ESSENCE, finally aiming to realise sustainable cities together. Here again the development of the learning material, staff trainings and coping with real live challenges on sustainability are the heart of the project and the digital platform will be used and hosted in Vietnam.

5 Elkington, J. (1997). *Cannibals with Forks: The Triple Bottom Line in 21st Century Businesses*. New Society Publishers, Gabriola Is., BC.

6 www.cimulact.eu 2015.

7 www.saunac.eu 2016.

Sketching Future Cities



597 Total ESSENCE participants



- Municipalities
- Students
- Teaching staff
- Universities
- Visitors event

ESSENCE brings the right people together

People with:

- Knowledge
- Human resources
- Motivation

Lots of learning



104 students took courses

Bootcamp: 22 Students

Course SSC: 32 Students

Intensive program SSC: 50 Students

4 Different subjects

88 People



Blended Learning

156 People



Creative Solution Searching

282 People



Sustainable Cities

15 People



Bootcamp Entrepreneurship



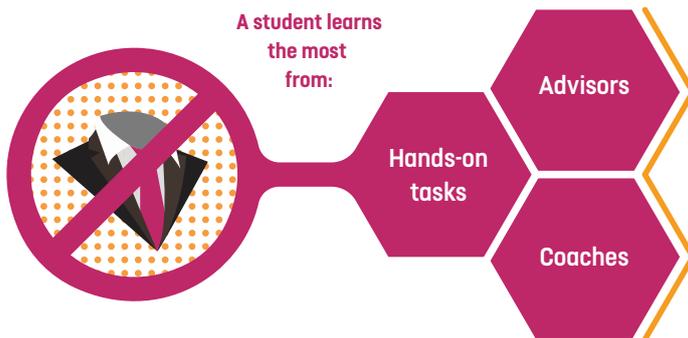
54 staff members trained

Blended learning: 22 Staff members

Creative approaches & coaching: 16 Staff members

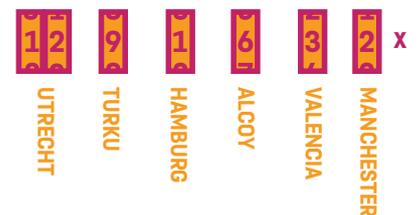
Creative approaches: 16 Staff members

No traditional teaching here



Event counter

How many times did the participating cities host an activity?



Developing learning materials

TOGETHER



HENNA KNUUTILA is a senior lecturer and project manager at Turku University of Applied Sciences in Finland. She was strongly involved in ESSENCE and played an important role developing learning materials concerning the cooperation within municipalities in the joint course Smart Sustainable Cities, together with the international teachers team.

Henna Knuutila explains: “It was a challenge to develop a common international curriculum.

ESSENCE was a quite complicated project and we all learned a lot from developing it. It is interesting to notice the differences between teaching in different countries and how they think about learning. In Finland and the Netherlands we have a more flexible curriculum than the other participating countries have, which makes it a real challenge to make everything match.”

“In Turku University we strongly believe in a flexible curriculum. According to us, students learn the most in practical situations, and

not from the lectures. The different countries also have very different views on the role of the teacher. The teacher’s role in Turku University is a coaching one, helping students in the right direction to find the ways to learn most, instead of being an expert in everything. I was inspired by the other countries, for example about how you do assessments in Utrecht, with the help of a matrix.”

LEARNING METHODS

“The contents of the learning material are important of course, but I was more interested in the learning methods. We took part both in the methodology development and in the practical work of applying it to a real life situation. Other universities participated in courses as well and added learning material like videolectures.”

TURKU SMART SUSTAINABLE CITIES COURSE

“We managed to embed the Smart Sustainable Cities course into our curriculum at Turku University! I really think we all have to do that. We updated the course material to our own learning environment. Our own students and thirteen Erasmus students from other countries are now participating in this course. They work on the different challenges given by city of the Turku. In the

meantime students of Turku follow an intensive programme in València or Utrecht.”

“ESSENCE WAS A VERY GOOD PROJECT FOR US TO LEARN FROM. NOW IT HAS BECOME MUCH EASIER TO CONTACT MY COLLEAGUES FROM OTHER UNIVERSITIES.”

“For example having to deal with various definitions of the concept of ‘shared spaces’ in the Skanssi District project offered students a very useful learning experience. Because working life is like that! Many facts that seem self-evident in your own country are not self-evident anymore when you work in an international group. If there happens to be a conceptual misunderstanding, you have to rethink the whole issue again. For a moment, everybody was confused. Students learned not to get angry in this kind of situation, but just drink a coffee and carry on.”

“ESSENCE was a very good project for us to learn from. Now it has become much easier to contact my colleagues from other universities. We are a good team now, which will make it easier to cooperate in future activities.”



The **BLENDED** learning environment



DR. ILYA ZITTER is associate professor Designing learning environments in vocational education at HU University of Applied Sciences Utrecht. She has trained and coached the international team of educators of the Smart Sustainable Cities course on the didactic concept of blended learning environments and how to apply this in the course.

Ilya Zitter explains: “The one-week course in València was extremely well organised in a very solid way. The educators were really good and all parties were enthusiastic also after the course was concluded. Quite an achievement for a huge and complicated project like this one, with so many cultural differences to overcome.”

BLENDED CITY

“We decided to relate the definition of blended learning in this course directly to the definition of smart sustainable cities. The underlying idea for us was: if you want to educate students towards being able to work in a smart sustainable city, their learning environment should also be smart and sustainable! It should not be a traditional learning

environment. Therefore the design principle we developed for ESSENCE is based on the definition of a smart sustainable city. It goes as follows: ‘Design a smart learning environment to foster a learning climate where people will want to learn and work, buzzing with entrepreneurial and social activities and where all participants will use technologies, materials and expertise to learn from each other’.”

CULTURAL DIFFERENCES

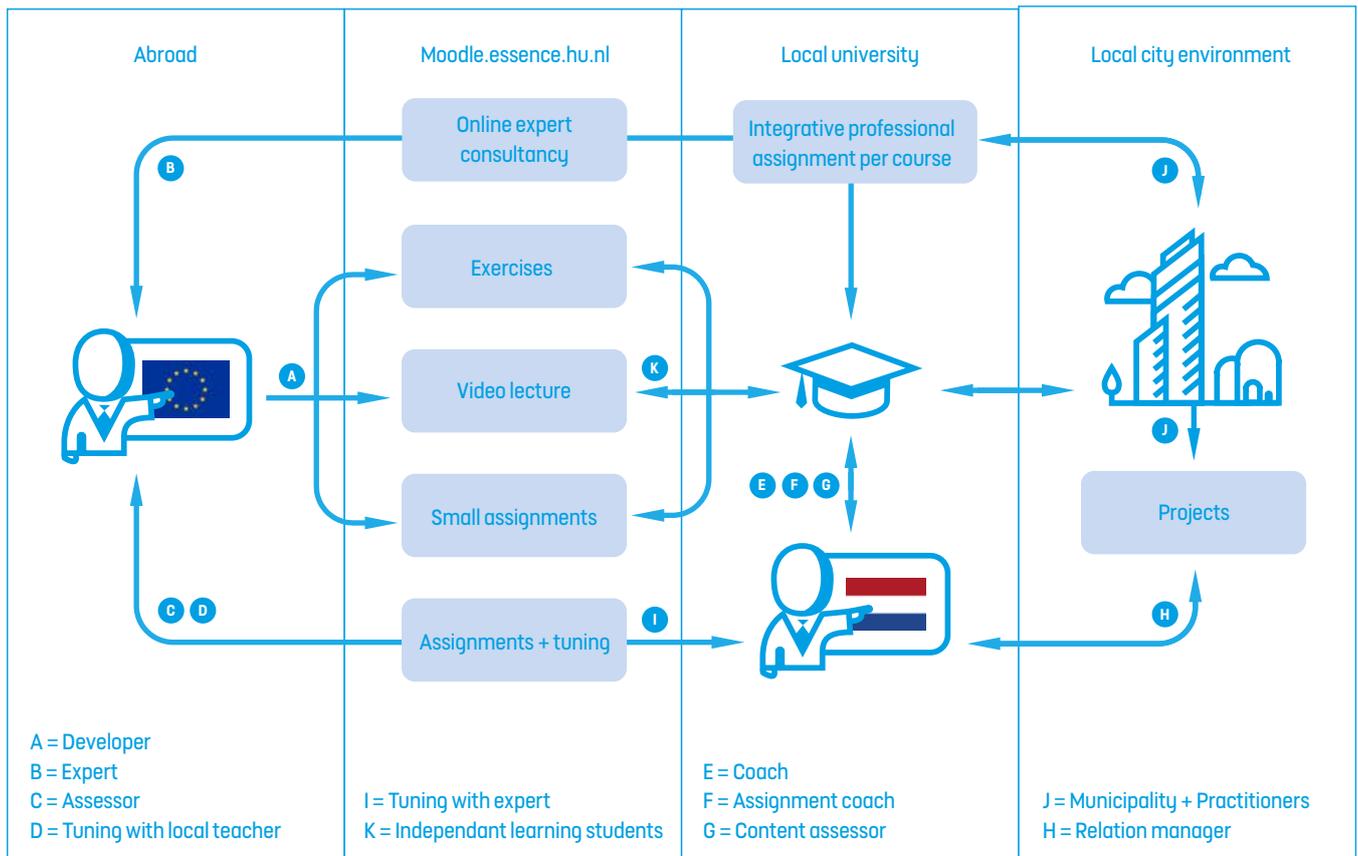
“It has been a real challenge to find common ground for the didactic concept, as the cultural differences between the ESSENCE partners

are considerable. Perspectives and opinions vary not just on an educational level, because of the different educational systems in the participating countries. They diverge on the disciplinary level as well: experts from various disciplines had to design a didactic concept together. The professional environment and practice also differ in every country. So the development of this didactic concept involved much boundary crossing. In order to be able to cope with all the cultural and disciplinary differences we decided to use the concept of the smart sustainable city itself as the main didactic tool.”



FEMKE VAN DEN HEUVEL

ESSENCE blended learning environment



SETH CARNILL

ACTING IN THE REAL WORLD

“In order to become a professional who is able to work on smart sustainable cities you need a variety of learning experiences. Therefore we developed a rich, online Moodle learning environment for the students and teachers. The Moodle environment has been based on four educational principles: ‘know’, ‘practice’, ‘act’ and ‘review’ and reflects on the dynamics of a smart sustainable city.”

“The online sharing of knowledge and experiences from different locations was very satisfactory. Acting in the ‘real world’, with real clients and real local authorities proves to be much more complicated, as well as reviewing these actions. The Moodle learning environment has a lot of possibilities for this. These options can be used even on a higher level. It is up to us to develop this in the future. But the way the blended learning environment is used also depends on a couple of other factors. Like the ideas of the client, the local and cultural situation, how much space students are given by their educators and personal variations in each project group.”

“Each participating country has specific strong items to add to the course. By trying to reach compromises on all levels we risk losing some of these strong items that every participating country brings. Instead of aiming at a uniform learning environment in all participating countries, it might be an option to emphasize the various strong items even more. That makes cooperation most valuable.”

Teaching on **ENTREPRENEURSHIP**



CLAIRE PATTISON is one of the main developers of the module on Entrepreneurship and a guest lecturer on this subject in the joint course Smart Sustainable Cities. She works as a project manager and enterprise fellow at Manchester Metropolitan University.

Claire Pattison explains: “In ESSENCE special attention is being paid to entrepreneurship. During a bootcamp in Manchester students were encouraged to develop startups. The shared vision on sustainable cities between Higher Education Institutes and regional authorities is essential in ESSENCE. To realise this vision young professionals are trained to be able to contribute to achieving sustainable cities. Achieving a ‘smart’ and ‘sustainable’ city demands innovative contributions from the public and private sectors and the social economy. New forms of entrepreneurship and innovation are needed. The overall aim is to improve the level of skills in students for employability and new business creation in a sustainability context.”

SOLVING COMPLEX PROBLEMS

“We use the Moodle platform in Manchester as well. But with respect to the ESSENCE course we had to pay special attention to learning materials designed to be used face to face in a classroom. These materials are skill-based, which is a bit trickier in the online environment of the course Smart Sustainable Cities. You can’t really understand it unless you see somebody try; you have to see it face to face, people practicing it, and then you can do coaching around it. Together with the partners we developed it into a very thorough course.”

“Sustainability is a key topic in Manchester, but the concept of the smart sustainable city is a bit new for us. For example how can you solve complex problems like the lack of infrastructure for bikes in the United Kingdom? We used the example of the city of Utrecht in the course, with its



MIREL MAŠIĆ



MIREL MASIC

fantastic infrastructure, amazing facilities and high level of safety for cyclists.”

RAISING A MARKETING CAMPAIGN

“In Manchester I worked on a great marketing campaign, and introduced it to an educational project to learn how to promote a new product. It was about a sort of spray meant for cyclists. You put it on your clothes and your back, so you reflect in the dark while cycling. It lasts about a week, then it wears off. Students had not heard of this product before. We looked at it from a UK perspective, where there are a lot of bike accidents. It is about more people cycling and about cycling safety. Instead of surviving a crash, wouldn't it be better to avoid crashes? We looked at the campaign and analysed it. The students also looked at their own products they developed and learned how to raise a marketing

“IT IS A PITY THAT I WAS NOT INVOLVED IN THE WHOLE ESSENCE PROJECT, BUT ONLY A PART OF IT. I WOULD LIKE TO TEACH AGAIN IN SEPTEMBER!”

campaign on that. This way we raise awareness about entrepreneurship.”

“The course programme was really intense, with a mix of taught stuff, lots of self-directed learning and doing tasks. In Manchester we ran the ESSENCE one-week bootcamp. The ideas students came up with were really interesting. For example one team came up with an app to stop printing receipts from shops; the app would store them all in one place. An interesting idea to get rid of the paper. We were impressed by the level of the students.”

UTRECHT MUNICIPALITY as a client



JAN BLOEMHEUVEL is manager European subsidies on Mobility, Environment and Urban Development at the municipality of Utrecht. As such, he is client for a number of student projects of the ESSENCE international course Smart Sustainable Cities and the Intensive programmes. In addition he represents the city of Utrecht in the Transnational Meetings of ESSENCE.

Jan Bloemheugel explains: “The municipality of Utrecht decided to participate in ESSENCE a couple of years ago, because working on a smart sustainable city is urgent and our goal. Therefore we take part in a great number of national and international projects in this field. Being involved in the ESSENCE student projects is useful for us, because it means we are faced with new ideas. Students come up with fresh views, which can be really useful and inspiring for us as a local government. The solutions students present are sometimes very different from ours. Or we wonder: well, that is quite a

good solution and we have thought of this before, so why didn't we proceed on this solution?”

WASTE MOBILE PHONES, TABLETS AND COMPUTERS

“One of the interesting ideas on the transition towards a more circular economy is a plan to increase resource efficiency by encouraging people to hand in their old mobile phones, computers and tablets. It seems people are reluctant to take these devices to the waste collection unit for recycling or reuse. This might be due to the fact that there are data on these devices. But students did



"IT WAS NICE TO SEE THAT THE OTHER MUNICIPALITIES STRUGGLE WITH SUSTAINABILITY SOLUTIONS AS WELL AND VALUED THE FRESH VIEW OF THE STUDENTS."

some market research and found out people often prefer to keep their disused mobile phones, computers and tablets as spares in case of an emergency, when their current device suddenly goes out of order or gets lost. After this discovery they came up with

an interesting solution: people who hand in their waste phone, tablet or computer receive a membership card which gives them the right to borrow a replacement device, until the moment they have their phone or computer repaired or buy a new one. This idea really deserves further investigation in order to find out whether we can apply it in Utrecht."

PROVIDING 'REAL' PROBLEMS

"As a local government we also like to contribute to the education of future generations by providing 'real' problems to solve. Being confronted with 'real' problems offers a very

important learning experience; I wish I could have had that option during my own studies. We take our role as a client seriously, which means that we are available for students during the course and as a start we gave a couple of presentations on the city's challenges concerning sustainability and the green energy. We linked each project to one of our experts who coached the students. The municipality of Utrecht really appeals to international students as an innovative city with regard to sustainability, we noticed. That means the ESSENCE project is also good publicity for the city of Utrecht."



International RESULTS



JAVIER OROZCO MESSANA from Polytechnic University of Valencia was involved from the start of ESSENCE and played an important role in the development of the international joint course Smart Sustainable Cities. He was in charge of the course module Physical Transition and a member of the steering group.

Javier Orozco Messana explains: “The Smart Sustainable Cities course has a wide variety of subjects, both technical and non-technical. One of the goals of the course is obtaining more experience in 21st century skills like group work, collaboration with professionals from other disciplines and being able to solve real problems. That part of the course was very satisfactory for the students from València who took part in the course. By working in an interesting environment on real situations they were able to enlarge their work opportunities for the future. One of the research methods the students used was interviewing people about traffic and mobility in the streets of Alcoy. We do not feature that kind

of activity usually, so this was rather innovative for the Spanish students.”

“On the other hand, technical competencies are basic for training engineering students at the Polytechnic University of Valencia and this was an issue for our students. But I must admit that developing their social involvement is a key need for the proposed minor programme. Therefore the multidisciplinary character of the course is enriching for all students. Having to deal with different approaches and abilities, and having to work together and discuss things are very useful for them.”

“WHAT MORE CAN YOU WISH FOR THE OUTCOME OF A SMART SUSTAINABLE CITIES STUDENT PROJECT?”

ENTHUSIASTIC CLIENT

“The outcome of the Alcoy project about reducing CO₂ emissions caused by traffic was in general very satisfactory. The only student from Spain who took part in the Alcoy project played an important role because she was in touch with the client, the local government. The local government of Alcoy is so enthusiastic about the results of the project that it has decided to hire her, in order to

implement part of ideas suggested in the plan. What more can you wish for as the outcome of a smart sustainable cities student project?”

“The blended learning materials and environment were very successful in my opinion and I strongly support that approach. In València we have been working with the open access tool Moodle for over five years now and we develop all our courses in that platform. For some students coming from other universities the e-learning environment was very new.”

“The joint Smart Sustainable Cities course we developed is a minor-bachelor program, but we have the ambition to develop it into a master program in the future. We do not have minors in Spain, so at present the only option for our students is to take the course as a postgraduate course. It is interesting for them as an option to obtain an additional degree.”

“According to me, ESSENCE was successful especially from two points of view. We have been able to work together with the different universities involved in the project on a multidisciplinary blended learning approach. And we have been able to prepare the basis for a joint curriculum much needed for the development of future cities.”

STUDENT EXPERIENCES



STEFAN RÄTHER and **LENNART PUSCH** from the Hamburg University of Applied Sciences attended the ESSENCE course Smart Sustainable Cities (September 2016 - February 2017). Stefan Räther is a student in Industrial Business Administration; Lennart Pusch studies Automotive Engineering. They both participated in the Alcoy traffic project.

Stefan Räther explains: “Spending time in Alcoy to help with solving the CO₂ problem as a result of the dense traffic was an enriching experience. Being present in person really makes a difference. It changes your perception when you can see and feel the problem. That is very different from just reading about it, or hearing about other people’s experiences with regard to the problem. It was a challenge to identify the problems and to understand the inhabitants. We noticed how hard it is not to use a car in Alcoy. The challenge was to make it more attractive for the inhabitants of the city to walk, so they will use their cars less often than they do now.”

“We really felt like being consultants working on a project for our client, the local government”, Stefan Räther continues. “We elaborated some ideas the residents can use in a simple way, for example the idea of walking distance maps of the city. The city of Utrecht was our source of inspiration for this idea. By using a walking distance map of the Utrecht city centre you can actually judge by yourself how far a destination is when you walk instead of going there by car or public transport. There are circles on the map that indicate: this is a five-minute walk, this is a ten-minute walk, this is a fifteen-minute walk. People in Alcoy often suppose: oh, that is much too far to walk! We wanted them to be aware that their destinations are often much nearer than they think.”

BLENDLED LEARNING EXPERIENCES

What are the experiences of the two students with regard to the approach of creative solution searching and the blended learning concept? Stefan Räther: “The methods we learned are very useful. The ways of analysing a problem and using different tools in a creative way helped us. The blended learning environment is useful to shorten distances, but sometimes I



had the feeling these technological possibilities were not facilitating us, but detaining us from the main problem that had to be solved. For example, we had to do a great number of assignments which were about reflecting on each others’ work, giving comments and helping each other. Of course it is important to reflect, but I found the ratio somewhat unbalanced. We wanted to focus more on the project.”

“We have a similar e-learning platform in Hamburg, on which



FEMKE VAN DEN HEUVEL

"THE METHODS WE LEARNED ARE VERY USEFUL. THE WAYS OF ANALYZING A PROBLEM AND USING DIFFERENT TOOLS IN A CREATIVE WAY HELPED US."

teachers upload and students download learning material", Lennart Pusch adds. "It is helpful that you can do more than that in the Moodle platform. I especially liked the communication part. But I am not sure how useful it is to reflect on the work of other students so often. Not all students gave serious feedback, nor were their comments discussed afterwards."

LEARNING ATMOSPHERE
"I liked the atmosphere of learning, because everybody could choose a

topic for themselves and was really eager to dive into it", Lennart Pusch explains. "It was interesting to have different approaches to learning from all over Europe. The fact that the teachers in Utrecht are very informal in their attitude towards the students was new to me. They would just hang out and talk to you. In Germany teachers are much more distant and we call them only by their last name. I liked it the Dutch way, but I have to admit that students might work a bit harder when there is more distance."



International

RELATIONS



MARTIJN RIETBERGEN is a member of the Research Group New Energy in the City at HU University of Applied Sciences Utrecht. He has been coordinator of the course Smart Sustainable Cities from September 2016 to February 2017 and the Intensive programme in Utrecht in April 2017. During the ESSENCE project he participated in the steering group on quality assurance.

Martijn Rietbergen explains: “The impact of the ESSENCE project is gigantic in my opinion. Teachers have been trained in several subjects with regard to the People-Planet-Profit concept. They have been trained in using the blended learning environment Moodle and they co-designed the course together with international partners. We learned a lot about the differences between the educational systems in several countries and how teachers teach and think.”

STEPPINGSTONE

“The course Smart Sustainable Cities is considered to be a growth model. Schools participating in the programme have added course material to the Moodle platform. It can be used as a basis to develop

more courses. Sustainability is the stepping stone for developing new projects with regard to the People-Planet-Profit concept. The teaching staff used the quadrant model about learning environments and learning processes developed by Ilya Zitter. We all applied the model for the first time and it proved to be valuable for the teachers. It also proved to be really useful in the course to emphasize the fact that we need to explore the concept of smart sustainable cities from different perspectives, not just from a technical point of view. At the moment, we are making use of all this experience and knowledge while developing a similar course in Vietnam, with six Vietnamese universities about sustainable Asiatic cities.”

SHARED SPACES

“In the course Smart Sustainable Cities I coached the Turku city project. In the beginning the students worked in Utrecht on the project. Via Skype they were coached by the Finnish partner on the real live situation. We learned that it is good to be keen on possible conceptual misunderstandings due to different backgrounds. For example, the Turku project was focused around the concept of ‘shared spaces’. But not until the students arrived in Turku did we discover that the definition of ‘shared spaces’ we used was not the same as the one used by the Finnish. ‘Shared spaces’ is about spaces being

used by different flows of traffic at the same moment, for example cyclists and pedestrians using the same track. It is also used for spaces being used by several groups at different moments, for example a school building used as a public gym in the evening hours. The different interpretations of the concept caused some confusion and influenced the results of the project. A very useful experience for the ESSENCE training team: always be aware of miscommunications.”

"I AM SURE A LOT OF LONG TERM INTERNATIONAL RELATIONS HAVE DEVELOPED BY WORKING TOGETHER AS A GROUP SO INTENSIVELY FOR A COUPLE OF MONTHS."

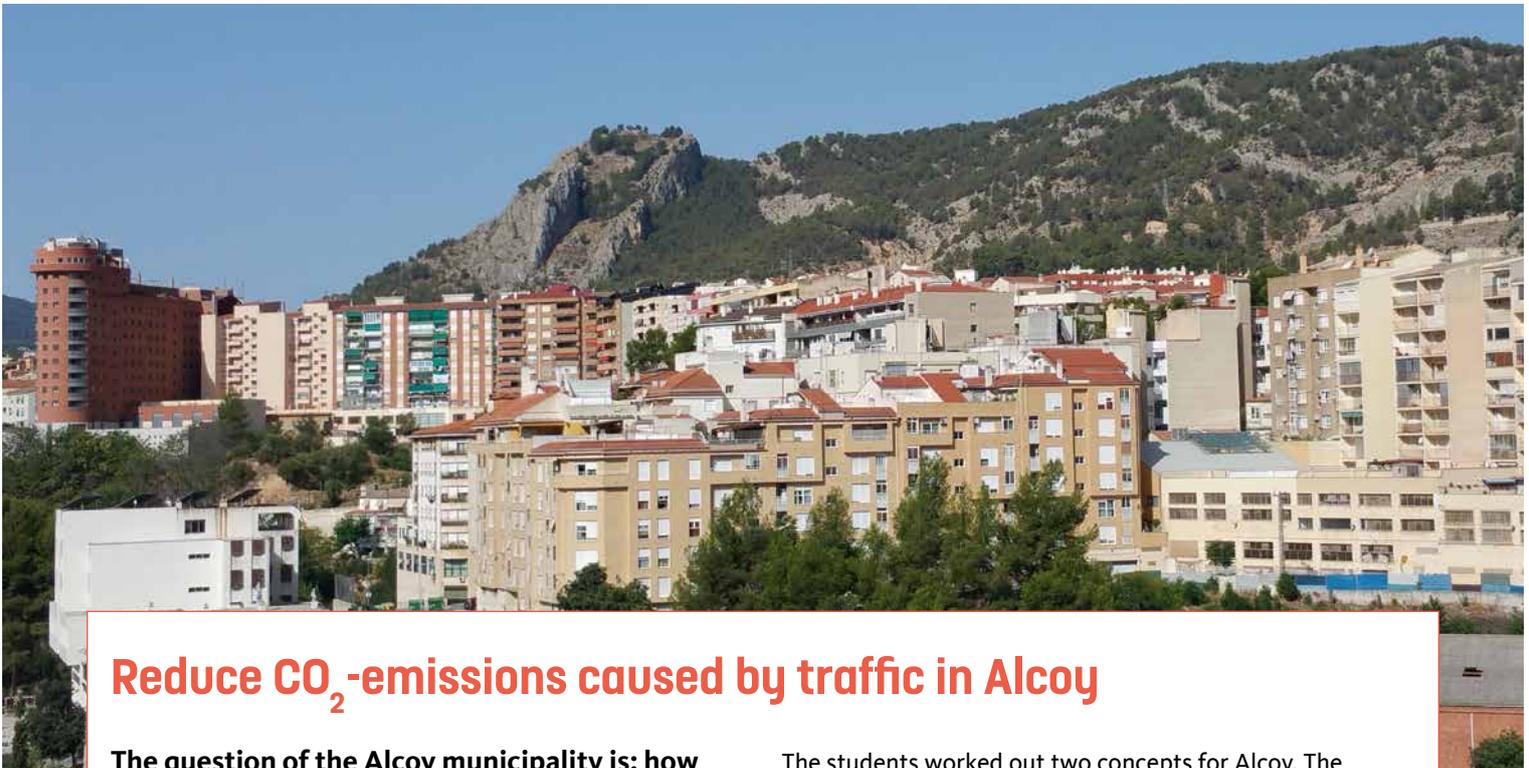
COMMUNITY

“It was really great to be a teacher in this course. You see a fine new community develop right in front of your eyes. The students were really shy when they first entered the classroom, but after one semester they left with a lot of self-confidence and with a big suitcase of knowledge, experience, ideas and new contacts. I am sure a lot of long-term international relations have developed by working together as a group so intensively for a couple of months.”

CITY PROJECTS

in Turku, Alcoy and Utrecht

What was the outcome of the city projects students performed for the local governments in Alcoy, Turku and Utrecht, during the international course Smart Sustainable Cities of September 2016? We give a short impression of the results and also indicate the other issues students tried to tackle in the three cities during the short intensive courses in 2017.



Reduce CO₂-emissions caused by traffic in Alcoy

The question of the Alcoy municipality is: how can a substantial reduction of CO₂ emissions in the city of Alcoy be obtained?

In order to transform the south-eastern Spanish city of Alcoy (community of València, about 60.000 inhabitants) into a more sustainable city, its tremendous car traffic pressure should be reduced. The city is located in the valley of a mountainous area. It has lots of narrow and unidirectional streets, which make cycling difficult. The car is dominant in the city and people do not want to live without it. Doing research in the streets of Alcoy and interviewing people helped the students a lot to understand the needs and problems around mobility. These insights were necessary to be able to contribute to finding solutions.

The students worked out two concepts for Alcoy. The first concept is developed for the local university. It is an action plan which should help to raise awareness among the students and staff, and it shows alternatives for a more sustainable way of living. The second concept is about changing the infrastructure of Alcoy. Proposals are for example changing streets from unidirectional to bidirectional, by adding lanes for bikes and changing existing bus routes. E-scooters and bike sharing are part of the concept as well. Walking and carpooling are promoted as inexpensive solutions. A more expensive idea is a bike escalator to make biking more attractive in the hilly city; you only have to cycle downhill. The local government is enthusiastic about the variety of ideas in the plan and considers the possibilities for implementation.



ONE OF THE MOST CONSPICUOUS PROPOSALS OF THE STUDENTS IS THE 'MAN CAVE'.

Turku: The Skanssi project about sharing spaces

The question of Turku municipality is: how can empty spaces be used as an opportunity to create a smart sustainable (business) environment within the Skanssi area in Turku?

Skanssi is a new smart city district near the city of Turku (about 180.000 inhabitants). It should be developed into a living oasis that will increase the population of the Turku area and decrease the CO₂ emission per habitant. The construction of the first phase of the residential area started in 2011, and a new shopping mall has already been realised in the district.

The students designed a shared spaces concept that would fit the Skanssi area. They wrote proposals for utilising the unoccupied spaces within the Skanssi mall as an opportunity

to organise events which strengthen the Skanssi community and attract people to the Skanssi shopping centre. Ideas ranged from a lunch disco in the shopping mall, using school buildings more efficiently after school hours (gym, repair cafe, theatre, childcare, kids parties) to creating spaces for co-working in the public buildings.

One of the most conspicuous proposals of the students is the 'man cave'. The man cave is meant as "a male retreat, for male visitors where they will have a place where they can do whatever they like, without any meddling from females". The man cave concept is based on three main sections: a bar focused on beer and crafts, a relaxing corner and a laser game hall. During a meeting with the marketing promotions manager it became clear that there is a need for a place just for men in the mall.

Fossil Fuel Free Utrecht

The question of Utrecht municipality is: how can the Tuindorp-Oost district of the city of Utrecht be transformed into a fossil fuel free neighbourhood by 2030?

Related to the goal of the European Union to reduce greenhouse gas emissions by at least 80 per cent until 2050, compared to 1990, the municipality of Utrecht (about 343.000 residents) has decided to go a step further and become climate neutral by 2030. The municipality of Utrecht wants to switch to a fossil fuel free energy supply as soon as possible. All gas heating facilities must be replaced by electric appliances or other fossil fuel free devices.

The students of the Smart Sustainable City course recommend the municipality to insulate all buildings in Tuindorp-Oost before taking further measures. According to them, with a proper insulation it will be possible to cut down the yearly heat loss of the houses up to 90 per cent. The students proved that it is technically possible to make Tuindorp-Oost a fossil fuel free neighbourhood, with the use of insulation, solar energy and electrical heating water systems; although the period until 2030 will probably be too short and investment costs will be too high to reach this goal. In addition, the students developed several approaches on how to get the locals involved and accept the challenge to upgrade their houses.

Circular Economy in Utrecht

The question of Utrecht municipality, department of Environment and Mobility is: develop innovative concepts towards speeding up the process of circular economy in the construction sector in Utrecht.

A circular economy is a system in which resource input and waste, emission and energy leakage are minimised by slowing, closing and narrowing material and energy loops. There are quite a lot of stakeholders involved who all need to be satisfied. The identified stakeholders in the construction sector (like architects, contractors, homeowners, project developers, transport companies, recycle companies) are all seen as necessary and they all need to be on board in order to achieve a circular economy in Utrecht.

In order to boost the process of circular economy in the construction sector in Utrecht it is important to answer the “what-is-in-it-for-me”-question and create accepted social norms on circular economy, according to the students.

The supply chain integration can help to create alignment and coordination within a supply chain, often with the use of shared management information systems. Integration of the supply chain is necessary for any of the suggested concepts to succeed. This is a must for Utrecht in order to accelerate the transition towards a circular economy with all the identified stakeholders. A possible way to do so is to clarify the benefits for each stakeholder, to generate circular social norms in Utrecht and to try to combine knowledge from all the stakeholders involved to realise a circular Utrecht.



IN ORDER TO SPEED UP THE PROCESS OF CIRCULAR ECONOMY IN THE CONSTRUCTION SECTOR IN UTRECHT IT IS IMPORTANT TO ANSWER THE WHAT-IS-IN-IT-FOR-ME-QUESTION.



Net Zero Energy Housing in Utrecht

The question of Utrecht municipality is: which steps need to be taken to renovate houses built in the 1930s, 1960s and 1990s into Net Zero Energy houses?

The municipality of Utrecht is working hard to become climate neutral by 2030. The problem the municipality faces is that home owners do not yet take measures to get to Net Zero Energy houses. Reasons are, among other things, that they are not able to collect all the right information in one place and they are not sure about the benefits Net Zero Energy would have for them.

In the Smart Sustainable Cities course, students created a concept to accelerate renovation through three routes (physical-technical, social and business) that enhance each other in reaching the sustainability goals. The

physical-technical route consists of three step-by-step plans designed for home owners to use for renovating their homes towards Net Zero Energy houses. These plans show the optimal actions for home owners to take during renovations. The step-by-step plans are made for three different house types: a 1930s, a 1960s and a 1990s house. It shows the possibilities to implement all electric housing, district heating and solar boilers as alternative housing concepts.

The social route focuses on motivating home owners and on the distribution of the step-by-step plans to home owners. The business route is indicated by the students as very important for the strategy. Their idea is to set up a platform aiming at introducing the step-by-step plan to help contractors develop their own Net Zero Energy renovation concepts and providing collaboration possibilities between different companies.

Other city projects

Apart from the five projects described above, students worked on solving a number of other issues concerning sustainability in the three cities during the short intensive courses in ESSENCE:

Turku:

- How to promote and present resource wisdom solutions in the new campus?
- How to develop the new Visitor Centre in Kupittaa area as a platform for innovations?
- What are the students' needs in mobility services, now and in the future?
- What kind of service models could be developed to reduce the need of owning a private car?
- How to promote biking in the city of Turku?
- How to reinforce smart city ferries and water transport as part of the Turku Region Traffic System?

Valencia and Alcoy:

- How to realise a sustainable refurbishment of a row of houses at the border of Font Roja Natural Park, with reinforcement of rural activities and sustainable tourism?
- Realise a plan for the island of Tabarca, including the refurbishment of an old lighthouse under Net Zero Energy Building principles, in order to serve as an innovation centre for academic and demonstration activities related to sustainability.
- Find nature-based solutions for the area Casino del America in the region of València, using the traditional gardens, including vertical ecosystems for graywater.

Utrecht:

- Develop a strategy with multiple concepts for circular potential of Waste Electrical and Electronic Equipment (WEEE), including the social and business opportunities of these designs.
- Design a business-to-consumers technical and financial step-by-step plan to make a specific house built in the 1960s energy neutral.
- Map the business value of one or more districts in Utrecht for Net Zero Energy Houses or fossil free districts.

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Text:

Mariek Hilhorst Tekstredactie en Productiebegeleiding, Amsterdam
Erlin Eweg, Centre of Expertise Smart Sustainable Cities of HU University of Applied Sciences Utrecht

Final editing:

Lenneke Kok, HU University of Applied Sciences Utrecht
Susan Baines, Manchester Metropolitan University

Design:

Martine Hermsen Graphic Design, Amsterdam

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Guido van Theelen (GoatCode), Haelen

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Centre of Expertise Smart Sustainable Cities (HU UAS Utrecht)
Padualaan 99, 3584 CH Utrecht
The Netherlands

E Smartsustainablecities@hu.nl
W www.smartsustainablecities.hu.nl
W www.essence.hu.nl

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ESSENCE APPLIED INNOVATIVE TEACHING AND LEARNING METHODS TO SET A VISION FOR SUSTAINABLE CITIES.



HIGHER EDUCATION PARTNERS



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