



**Roskilde
University**

Learning for a sustainable future

Schools at University for Climate and Energy

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Learning for a sustainable future



Schools at University for Climate and Energy

The SAUCE Publishable Report



Schools @ University for Climate and Energy (SAUCE)



SAUCE Publishable report

Schools at University for Climate and Energy - SAUCE is supported by the European programme Intelligent Energy Europe. This programme aims to promote energy efficiency and renewable energy sources. It helps all of us to produce and use energy in more intelligent ways and to increase the use of renewables.

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“Our biggest challenge in this new century is to take an idea that seems abstract – sustainable development – and turn it into a daily reality for all the world’s people”

Kofi Anan – former UN Secretary General

Preface

Creative energy education by universities to face the challenges of a sustainable future

Education has a key role to play in sustainable development. The United Nations have therefore declared the period 2005-2014 the World Decade of “Education for Sustainable Development” with the aim of anchoring the concept of sustainable development at all levels and across all fields of education.

But a sustainable lifestyle cannot be prescribed top-down, as part of a centralised approach to policy. Sustainable development is a process of societal change that affects everyone and must be lived by everyone. This applies to citizens, to social institutions and to politics. To ensure that society develops in a sustainable way, education must prepare people to become engaged and involved citizens. The holistic approach of ESD helps us find practical answers to the demands for changing awareness and values, development of skills and competences, and the need for changes in behaviours.

In the interdisciplinary, interactive SAUCE programme, seven European universities demonstrate in exemplary fashion that universities can provide excellent out-of-school learning environments. These can make an important contribution to the practical dissemination of the ESD approach and to enabling young people to grow into responsible actors for climate protection and the transition to a sustainable energy system.

SAUCE is an exciting project that uses unusual and creative methods to enthuse schoolchildren and their teachers for energy efficient behaviour and climate protection in their everyday life at school and at home. From the perspective of educational policy SAUCE presents a model European educational project that is robust and worthy of replication, and which, we honestly hope, will encourage other European universities to join the concerted effort required.

Prof. Dr. Gerhard de Haan, Chair of the German national commission for implementing the “UN Decade for Education for Sustainable Development 2005-2014”



1 Introduction: The Project Origin

The “Schools at University for Climate and Energy – SAUCE“ project was conceived and designed in 2007 against a background of growing public concern raised by the 2006 publication of the “Stern Report” on the economic costs of climate change and the publication of the Intergovernmental Panel on Climate Change Fourth Report (IPCC 2007). The public debates and policy programmes prompted by these reports reflected the urgent need for transition to a low-carbon economy. However, halting progress in international negotiations and in national legislation also showed that there was still much to do to design and execute the transition. Public debate as well as policy review further showed that a Green New Deal, and a shift to sustainable behaviours, required people of all ages to develop an understanding of energy issues and to actively support the transition process.

As public debate intensified, the demand for expert advice from energy policy researchers has also grown – from government, the media and also, if to a lesser extent, from education professionals. It was against this background that members of the REFORM group, an international group of energy policy experts, drew inspiration from a pilot project on energy education developed by researchers at the Freie Universität Berlin’s Environmental Policy Research Centre (FFU). On the occasion of the 20th anniversary of the Chernobyl nuclear disaster, the FFU had organized the first Children’s University for Climate and Energy, with a view to building a bridge between university research and schools, to share knowledge and skills applicable to the everyday themes of climate protection and energy. The praise for this pilot project from participating teachers and pupils and its interdisciplinary approach motivated these energy experts to break new ground and try themselves at supporting the transition process in a for them novel way, at the community and individual level and collaborate in an original and ultimately very rewarding project.

In the SAUCE project, academics from seven universities in Austria, Denmark, Germany, Latvia, the Netherlands and the United Kingdom, in partnership with the Berlin Energy Agency, set out to develop a model for the education of a new, young target group. They invited schools into their universities, introducing the children to the academy as a place for critical reflection,

learning and research, and thereby opening up universities as hubs for networks of actors in energy education. The programme they developed together shows how the full range of disciplines, from natural sciences to the arts, contributes to awareness and understanding of energy and climate issues. They combined these disciplines in the programmes, providing a variety of experiential approaches to learning and teaching, designed to spark the children’s interest and laying the groundwork for their engagement in a sustainable future. SAUCE partners have been able to explore these approaches across a number of institutional contexts for education that vary in the extent to which they accommodate the interdisciplinarity and community engagement on which a successful, just transition to a low carbon economy depends. Over the course of three years’ intense shared experience, the SAUCE concept developed into a fully-fledged European programme, in which more than 19,000 children have participated and which has met with steadily growing interest from teachers, local educators and political decision makers.

Since the beginning of the SAUCE programme, the debate over the Green New Deal and green skills has to some extent matured. A broader acceptance of the science of climate change as well as the tragedy of the Fukushima nuclear accident, have brought home the need to accelerate the transition to a low-carbon energy system based on renewable energy sources and increased energy efficiency. The final rounds of the SAUCE programme took place while events were unfolding in Fukushima, and were warmly welcomed by teachers seeking support and inspiration in addressing these vital questions with the schoolchildren, in order to find a constructive way of preparing pupils to engage with these issues themselves.

This provides a favourable context for further development and delivery of the SAUCE programme, in new ways and new places throughout Europe. This report is written with this aim in mind.

Project full name	
SAUCE - Schools at University for Climate and Energy	
Key Action:	Energy education
Project coordinator:	Prof. Dr. Miranda Schreurs PD Dr. Lutz Mez Freie Universität Berlin, Environmental Policy Research Centre, Germany
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Project's Partners:	<ol style="list-style-type: none"> 1. Freie Universität Berlin, Environmental Policy Research Centre, Germany 2. London Metropolitan University, Faculty of Social Sciences and Humanities (FSSH), United Kingdom 3. University of Twente, Center for Clean Technology and Environmental Policy, The Netherlands 4. University of Latvia, Environmental Management Department, Latvia 5. Vienna University of Technology, Institute of Power Systems and Energy Economics, Energy Economics Group, Austria 6. Aalborg University, Department of Development and Planning, Denmark 7. Berlin Energy Agency, Germany 8. Roskilde University, Department for Environmental, Social and Spatial Change, Denmark
Project's website:	www.schools-at-university.eu
Benefits:	Development of resources and networks for energy and climate change education in teaching practice
Keywords:	University programme for schoolchildren, interdisciplinary and interactive energy education, transfer of energy education tools into schools
Duration:	01/09/2008 – 31/08/2011
Budget:	EUR 1,355,452 (EU contribution: 75%)
Contract number:	IEE/07/816
Achieved results:	The project published the SAUCE handbook and the SAUCE resources guide for European universities interested in carrying out SAUCE programmes. The booklets present lessons learnt from the programme development and networking experience and give guidance on how to organize a SAUCE programme.

2 Summary: Schools at University for Climate and Energy – SAUCE

In the SAUCE project, the participating European universities and the Berlin Energy Agency developed an interactive and interdisciplinary educational programme for primary and early secondary education (pupils aged 10-13). The project's aims were to raise children's awareness of the core topics of climate change and sustainable energy use, and to inspire in them a lasting interest in climate and energy issues that would stimulate behavioural changes. Each university invited up to 2,500 pupils to attend a five-day on-campus programme, offered once (or twice) a year. Programme contributors were recruited from among university researchers and local actors and organisations involved in energy and environmental education. The SAUCE programmes initiated cooperation and exchange between researchers and non-formal educational actors, combining scientific competence with proven experience in effective energy education. In this context, the host universities proved to be the perfect place for out-of-school learning where the complex subjects of climate and energy could be made more easily accessible to schoolchildren.

The programme also included induction and training for teachers, in order to help integrate energy and climate change issues into regular teaching and to disseminate best-practice examples of teaching materials and information sources. Continuing contacts with teachers were fostered, and the inclusion of non-formal energy education experts in the project supported regional, national and international networking between different educational actors. This also supported a multi-disciplinary approach to teaching that reflected the full range of subjects covered at schools, and allowed the project team to address and attract a large circle of teachers including those teaching non-scientific subjects.

Furthermore, SAUCE brings together local actors from the academy, policy, the voluntary sector, economy and schools, with universities acting as a hub for development of networks of actors in energy education. Universities are well-suited to take on this role. Their institutional status and their positive reputation serve as a door-opener to many, making it easier to win partners, and thereby raising their profile.

In the three year project period, 25 SAUCE programmes were held at seven European Universities in six

European countries. The SAUCE universities were successful in increasing attendance by teachers and schools over the duration of the programme, reaching a total of more than 18,500 pupils and 1,300 teachers from 400 schools. Participants attended one or more of the 1,100 SAUCE programme sessions which provided a total of 38,400 places.

Surveys among teachers indicated that they are motivated to teach the SAUCE subjects at school and apply the materials and ideas presented in their own teaching. SAUCE has initiated energy saving activities at the schools and inspired activities with external partners whose visibility among educators had been increased by the SAUCE networking effort. Finally, the majority of SAUCE partner universities raised political and financial support for the continuation of SAUCE in 2012 and beyond.

SAUCE dissemination was planned to establish SAUCE at further European universities. To this end, the project published the SAUCE Handbook and the SAUCE Resources Guide for European universities interested in carrying out SAUCE programmes. These booklets present lessons learnt from the programme development and networking experience and give guidance on how to organize a SAUCE programme.

Background – why SAUCE?

SAUCE is a response to substantial deficits in knowledge and teaching about energy and climate topics – two key themes in education for sustainable development (ESD) – in primary and early secondary education. Research has shown that despite the political importance of climate change, schools have given little attention to its causes and effects or concrete solutions in their curricula or in teaching practice, and what there is often depends on the personal initiative of individual teachers. This is partly due to the nature of the subjects themselves: energy research and technology, energy policy aims and strategies, and research on climate change and its global effects are all subject to constant change which are not easily followed or understood by lay persons. And since curriculum development and the publication of school textbooks is a slow and cumbersome process, it would not be realistic or fair to expect that the newest developments could be included in them. Thus, in most countries, teachers who do take up these topics must often resort to non-traditional teaching materials, and their own initiative to keep up to date with new developments. The SAUCE programmes are designed to supplement the regular curriculum and to help teachers to integrate climate and energy into the school schedule.



The European policy context

The objectives of the SAUCE project thus feed into several international discourses and strategies with relevance for energy and climate education. First and foremost, it supports the “Europe 2020” agenda adopted by the European Council in June 2010 with its flagship initiatives for sustainable growth and resource efficiency and the smart growth agenda for new skills and jobs. The SAUCE project’s objectives of motivating children and teachers to save energy are obviously in line with the agenda’s climate change and energy goals. The SAUCE programme activities also pay attention to awareness raising, to expanding general knowledge about energy systems, about the environmental, economic, and social effects of modern consumption patterns, and about the political decisions and underlying policy processes.

Secondly, by addressing schoolchildren, teachers, researchers and educators and involving them in learning and communication processes at an out-of-school place for non-formal learning, the project also works toward the goals of the Lifelong Learning Programme of the European Union. Under the discourse on lifelong learning processes, these places have been identified as important elements in an educational setting aiming to equip children, students and professionals with the skills and capabilities they need to cope with present and future challenges.

Thirdly, parallels in goals may also be found in the European Access Agenda, as SAUCE Programmes provide underrepresented groups access to university and make a valuable contribution to reaching children who lack contact with higher education. Finally, more recent European initiatives such as the programme supporting Mobilisation and Mutual Learning Action Plans (MML) under the European Framework 7 Science in Society programme of the European Commission.



3 SAUCE Project Objectives and Partners

This section briefly presents the project's objectives, the partners' home institutions, and the educational systems, outlining the conditions SAUCE partners were faced with when starting to implement SAUCE.

3.1 SAUCE project objectives

Specific objectives:

- a) to develop the SAUCE programme as an interactive and interdisciplinary educational tool for pupils aged 10-13, which sensitises them and raises their awareness of the core topics of climate change and sustainable energy use, and shows them ways in which they as individuals can contribute to climate protection by intelligent energy and mobility behaviour;
- b) to support the development of networks between different educational actors at the regional, national and EU level, and thus promote cooperation and exchange between European educators and non-formal educational actors;
- c) to promote dissemination of existing and successful energy education tools to primary and secondary schools and individual teachers and support teachers in taking up energy and climate change issues at school; Projects like SAUCE that explicitly intend to provide low-threshold, easily accessible tools for teachers
- d) to disseminate SAUCE systematically and broadly as a regular programme at European universities beyond the universities participating in the action.

Strategic objectives:

- a) To raise pupils' awareness of intelligent energy and mobility behaviours and to strengthen their problem-solving competences in the face of the challenges arising from climate change and energy issues. Furthermore, the European character of the SAUCE programme will broaden the pupils' horizons regarding the international dimension of climate protection and intelligent energy use.
- b) A further anticipated impact is that the SAUCE educational tool will become an established feature of the educational landscape in European university towns. As a consequence, universities will acquire the didactical qualities of an out-of-school-place for teaching. Pedagogical experience shows that programmes run at locations outside the usual school campus substantially boost pupils' ability to learn effectively
- c) Strengthening and expanding the educational networks will disseminate the use of extra-curricular educational tools on intelligent energy use and climate change issues throughout European member states. Providing key actors in the education reform process with practical examples will also support integration of these topics into the regular curriculum where this has not yet happened.
- d) A further objective is to support efforts to raise pupils' interest in the potential contribution of some 'green' sciences and developing green technologies to solving climate change and renewable energy issues.
- e) To make the universities more familiar and attractive to non-traditional groups of potential students, thus meeting goals of the access agenda.

3.2 SAUCE project partners

The consortium of SAUCE project partners was formed primarily by members of the REFORM Group, an international group of energy policy experts and researchers. These experts and their university institutes had been connected through common research projects, international policy counselling and academic exchange since the early 1990s. Following an interdisciplinary research approach, their focus was on the analysis of international energy market reforms and environmental regulation.

In 2007, the Environmental Policy Research Centre of Freie Universität Berlin (FFU), a core member of the REFORM group, presented the SAUCE project idea to the group. The idea was derived from a pilot project – the first “Schoolchildren’s University for Climate and Energy” – initiated by FFU in 2006 on the occasion of the 20th anniversary of the Chernobyl nuclear accident. The positive response to the first programme in Berlin, from teachers and pupils alike, inspired several members of the REFORM Group to bring the idea to a wider audience in Europe. They finally convinced the leadership of seven universities in six European countries to adopt and further develop the model.

The eighth partner in the project, Berlin Energy Agency (BEA) was closely connected to local and international energy efficiency networks and had successfully developed energy communication activities addressing enterprises and consumers — and among the latter group also the younger generation. Berlin Energy Agency had initiated the SAUCE project idea together with FFU. During the project, BEA served as advisor to the SAUCE partner universities, and in cooperation with FFU developed the SAUCE programme at Freie Universität Berlin.



3.2.1 Aalborg University, Department of Planning

Aalborg University is located in the rural Northern part of Denmark. The University offers education and research within the fields of natural sciences, social sciences, humanities, technical and health sciences. Since Aalborg University was first established in 1974, all university programmes have been based on a unique model of teaching and learning: the problem-based, project-organized model also referred to as “PBL - The Aalborg Model”. The PBL - Aalborg Model, has become both nationally and internationally recognised as an advanced and efficient learning model and a trademark for Aalborg University. Thus, UNESCO has placed its only Danish Chair in PBL at Aalborg University at the Department of Planning.

The PBL-Aalborg Model gives the students the possibility for independent learning to achieve knowledge and skills at a high academic level. The learning model helps the students learn how to analyze problems, how to work result-oriented and, finally, how to successfully work within a team.

The field of the **Department of Planning** includes development and planning in a broad sense, and thereby it reaches from the social science aspects of development (technological, environmental, international and administrative aspects) to physical planning, sector planning, land management, and to technical subjects such as road engineering, road safety, surveying and mapping. The department is part of the Faculty of Engineering and Science.

The Sustainable Energy Planning Research Group in the Department of Planning works with an interdisciplinary approach to Sustainable Energy Planning. Energy planning in general is the main research subject. The focus is placed on technical and geographical aspects, such as on energy system analysis as well as on economic and institutional aspects i.e. feasibility studies and public regulation in the light of technological change.

Since the 1970s, the group has played an active part in the Danish energy planning process. The researchers of the group have regularly contributed to the formulation of Danish energy policy and its implementation at both local and national levels.

3.2.2 Freie Universität Berlin, Environmental Policy Research Centre (FFU)

Freie Universität Berlin is a full-spectrum university, comprising twelve departments and three central institutes that together offer more than 160 different academic programs in a broad range of disciplines in natural and social sciences. It is one of the three large universities in Berlin and is situated in a residential area in Berlin's south-western-most district.

The **Environmental Policy Research Centre (FFU)** at the Department of Political and Social Sciences is an international team of social science researchers and students who research, study, and provide policy advice related to environmental and sustainable energy politics and policies. The FFU community is engaged in academic as well as more policy-oriented research. Furthermore, the FFU offers one of the broadest social science educational programmes on energy and the environment for undergraduate and graduate students in Europe. Approximately 30 researchers, staff, and student assistants as well as an additional 100 Master- and Ph.D. students work and study in an international and multi-lingual environment. Members of the scientific staff organising and participating in the SAUCE programme had a professional orientation in energy and environmental policy analysis, social science didactics and communication.

Berlin is with 4.4 million inhabitants one of Germany's largest metropolitan areas. Since the re-unification of the city, Berlin's economic basis has shifted away from a largely industrial towards an increasingly service oriented economy. Furthermore, the economic transformation of former East Germany has also left its mark in the city which is confronted with steady, above average unemployment. The population is constituted by a diverse mixture of Germans from various regions as well as representatives from all parts of Europe, particularly from Southern and Eastern Europe, and beyond. Despite these challenges, Berlin provides over a well-maintained public infrastructure and a rich cultural and community life.

Part of this community life is a large semi-voluntary sector comprised of social and environmental organisations and associations and some research institutions, part of which have been active on the local as well as national level. Some are publicly funded, but most of them are financed by private and/or business supporters and/or receive public funding on a project, i.e. short-term basis. Their activities have, increasingly so, focussed on children as target groups and have been presented at out-of-school

learning places. These places had increasingly been met by the interest of Berlin schools, particularly of primary schools with a more flexible curriculum than secondary level schools.

The school system in Germany is primarily public, the share of private schools (confessional and non-confessional) in Germany amounted to about 15% in 2007. It is organised and administered autonomously at Länder level. Berlin, which under the German federal system has Länder status, is one of the few German Länder where primary schools usually cover years 1 to 6 and only a minority of secondary schools also cover years 5 and 6. Education policy of recent years has been shaped by a number of challenges, among them the search for an adequate response to negative outcomes in science competences in the early PISA studies, or the challenges arising from demographic and fiscal changes. As a consequence, Berlin's school system has been going through various reform phases leading to major restructuring at both primary and secondary level teaching in recent years. This has posed considerable demands on teachers, which have been epitomised by above average openings and high fluctuation rates. School principals usually have little fiscal freedom, but the Berlin government has supported numerous pilot projects. Teachers are usually university graduates (grade school teachers usually graduated from pedagogy schools with stronger didactic foci) and are appointed as teachers after a two years student teacher period and a state exam.

3.2.3 Berlin Energy Agency

The **Berliner Energy Agency** is a modern energy service company located in Berlin. As part of our three business divisions Consulting, Contracting and International Know-how Transfer we develop and realize innovative projects that reduce high energy costs as well as CO₂ emissions. While rooted in Berlin the BEA launches activities in regional, national and international markets.

On the initiative of the Berlin House of Representatives the Berliner Energieagentur was founded in 1992 especially due to looming effects of the climate change and a decreasing access to fossil natural resources. Therefore, facing today's environmental challenges the BEA aims at contributing to a more efficient use of energy. The federal state of Berlin, the Vattenfall Europe Wärme AG, the GASAG Berliner Gaswerke Aktiengesellschaft and the KfW Bankengruppe hold an equal share of 25% of the BEA. As a public-private-partnership the BEA fulfils a public mandate – nevertheless, all means and methods of doing business are committed to the premise of efficiency. Converging economics and ecology is our daily mission.

3.2.4 London Metropolitan University

London Met is a university of 30,000 students organized in six faculties: the Faculties of Social Sciences and Humanities (FSSH, host to SAUCE UK); Architecture and Spatial Design (ASD); Sir John Cass Faculty of Art, Media and Design (The Cass); Computing; Law, Governance and International Relations; Life Sciences, and London Metropolitan Business School. It is a 'post-92' university, derived in 2002 from a merger of two former polytechnics. It is located on two campuses, one in North London (Islington) and one in the City (Aldgate).

FSSH is home to a range of applied research activities that reflect its inner-city context, mission and opportunities. This research includes work on spatial planning and housing, human rights and social justice, working lives and policy studies in education, as well as digital media. ASD hosts the Low Energy Architecture Research Unit (LEARN), the Business School hosts the Cities Institute with its focus on sustainable cities and the Centre for International Business and Sustainability. Research in Life Sciences includes work on health research and policy, as well as brain chemistry and human nutrition, both of which contribute to an understanding of the relation between health, well-being and learning performance, and the Cass has a special focus on sustainability in design and production of artworks, jewellery and furniture. The University's main research and teaching focus is on humanities and social sciences (which, incidentally, has made it particularly vulnerable to the Government's withdrawal of all state funding from teaching of humanities and social sciences).

At the level of campus management, the University has engaged actively and successfully with energy management and was awarded the Carbon Trust Standard in March 2011 for reducing carbon emissions by 12 percent over the three-year period 2009-11. The University's Estates Department has been an active and effective supporter of the SAUCE programmes.

In the UK, ten to thirteen year-olds bridge two key stages across late primary and early secondary education, with Key Stage 2 running from 7-11 years and Key Stage 3 from 11-14. At the outset of the SAUCE programme, the primary curriculum had just been revised to focus on skills and competences, providing a favourable context

for SAUCE. These are taught across the National Curriculum subjects. Schools must also promote children's spiritual, moral, social and cultural development across all subject areas. General skills for young people as well as the skills needed for a low carbon economy were addressed directly in the revised curriculum. Given its emphasis on novel pedagogic approaches, the SAUCE programme presented an opportunity to match the development of required, or desirable, skills to the learning context (e.g., in the community, or volunteering, or working in small teams) in which these skills are to be acquired.

The activities of individual teachers in UK schools may be thought of as 'nested' in multiple layers of policy and governance: globally in the UNESCO Decade of Education for Sustainable Development; regionally in EU policy support (e.g. Intelligent Energy Europe) and nationally in the inter-departmental curriculum strategy (Department of Children, Schools and Families, Department of Environment, Food and Rural Affairs and Department of Energy and Climate Change). In 1998, the Government set up a review body to address all aspects of ESD in the UK, in the context of a lifelong learning approach, including sustainability requirements for different educational key stages and age groups as well as education for global citizenship, energy and climate change.

These policies also led to formation of organisations at local authority level which became partners of SAUCE, including the London Sustainable Schools Forum, which has re-emerged in altered form after its parent body, the Government Office for London, was abolished in 2010, and Islington Sustainability in Schools (ISIS) which, until its closure in 2010, was one of London's leading local authority initiatives supporting ESD and climate and energy education in particular.

The UK SAUCE programme was, therefore, rooted at the outset in a supportive and active national, regional and local policy framework with strong partners, although this did mean there was some crowding of the institutional space, resulting in some competition for teachers' and schools' time for the SAUCE programme. What the UK lacks, though, is experience with 'Kids' Universities', setting it apart from some of the SAUCE partner countries and underlining differences in context and the need for a country-specific approach.

3.2.5 University of Latvia

The **University of Latvia** is located in Riga, the capital of Latvia. The University with its 17,000 students, 13 faculties and more than 20 research institutes is one of the largest comprehensive and leading research universities in the Baltic States. The University offers more than 150 state-accredited academic and professional study programmes. Research is conducted in over 50 research fields which represent four main areas - the humanities, natural and social sciences, as well as education sciences. The university pays great attention to the development of international collaboration and has at present signed more than 500 agreements with 326 institutions in 31 European countries within the ERASMUS programme.

The Environmental Management Department of the university (former Institute of Environmental Science and Management) has many years of experience in the implementation of academic studies, research and has had a number of projects in environmental management and policy. The department has run the academic master programme in Environmental Management since 1993 and the professional master programme in Environmental Resources Management since 2005. Over the past 10 years, the department has introduced a series of projects in EU programmes and holds the UNESCO Chair in Sustainable Coastal Development. The implemented projects focus on environmental management and policy in municipalities, geographic information systems for environmental management, sustainable development indicators in coastal areas, climate change and environment-friendly behaviour.

Latvia's economic policy aims at developing a knowledge-based economy capable of sustainable economic growth and respect for the environment. Key sectors attracting global investors include manufacturing, forestry and woodworking, metal processing and engineering, textiles, chemicals and pharmaceuticals, logistics and transit, construction. Until the middle of 2008, Latvia had the fastest developing economy in Europe, but the global financial crisis severely affected the Latvian economy. Riga, the capital of Latvia, with 703 581 inhabitants, is the largest city of the Baltic States. Riga accounts for about half of the total industrial output of Latvia, focusing on the financial sector,

public utilities, food and beverages, printing and publishing. The first nine years of basic education in Latvia are compulsory; grade 1-4 elementary school and grade 5-9 five years primary school. According to the Education Law, the National Education Standards provide the strategic goals and main tasks of compulsory curricula and syllabus. In 2006 there were 974 general education day schools. Around 5.4% of schools were elementary (grades 1-4), 48.6% primary/basic schools (grades 1-9) and the rest were combined secondary (grades 1-12) schools. The number of school-age children used to be fairly constant at about 226 000 annually with around 26,760 teachers but has decreased significantly due to low birth rates at the end of 1990's. Teachers in Latvia are trained at five higher education institutions. The most common is a professional bachelor's degree of 4 years, which provides a teaching qualification for a specific level of education (pre-school, primary, secondary) and, for secondary school teachers, a specific subject area. Elementary school teachers are qualified to teach all subjects. The second route of teacher training requires two stages – a bachelor's degree (3 years) in Education Sciences, plus an additional two years of study in a second-level professional programme of studies to qualify as a teacher in a specific level of education and/or subject area.



3.2.6 Roskilde University

Roskilde University was founded in 1972 with the objective of providing research and education at the highest level in the fields of technical science, natural science, social sciences and humanities. Roskilde University has since its foundation been leading among European universities and has in many ways broken with traditional ways of approaching both teaching and research.

Study programmes at the university have a long tradition for project-oriented project work in which students are trained at identifying problems in the society and develop appropriate solutions under supervision of high quality researchers. Another important feature of the university is the emphasis on interdisciplinary in the study programmes as well as in the research. Research at the university is traditionally framed in a close dialogue with the surrounding society; locally, regionally and internationally.

Roskilde University is organised in six departments:

- > Department of Communication, Business and Information Technologies
- > Department of Culture and Identity
- > Department of Environmental, Social and Spatial Change
- > Department of Science, Systems and Models
- > Department of Psychology and Educational Studies
- > Department of Society and Globalisation

There are no faculties at the university and researchers are encouraged to collaborate across disciplines and across the traditional boundaries between natural science, social science and humanities. Roskilde University has approximately 700 researchers employed and 9,500 students enrolled and it is the fifth largest university in Denmark.

Roskilde University is located in the city of Roskilde in Region Zealand. Distance to the capital city of Copenhagen is 35 km which can be covered by 25 minutes train travel. The University is located in a single campus where all facilities are available within walking distance.

UNIVERSITY OF TWENTE.



3.2.7 University of Twente, Twente Centre for Studies in Technology and Sustainable Development (CSTM)

The **Center for Studies in Technology and Sustainable Development (CSTM)** is a research institute of the **University of Twente**, a university for technical and social sciences. Teaching and research is organised in six departments, four technology focused and two social science focused departments. CSTM conducts high quality academic research into the governance of sustainable development and environmental quality. CSTM has an international team of social science researchers and students who research, study, and provide policy advice related to sustainable energy, water and climate change politics and policies. CSTM offers an international master program on Environmental and Energy Management and an International Ph.D. program on Governance of Sustainable Development. Approximately 50 researchers, staff, student assistants and Ph.D. students work and study in an international and multi-lingual environment. Members of the scientific staff organising and participating in the SAUCE program had a professional orientation in sustainable energy (both technology and social science oriented).

The University of Twente is located in the rural Eastern part of the country. It is a high tech island in a predominantly rural region with only a few urban centres where the majority of the population of the region lives. Despite the relative smallness of the country, distance is an issue, meaning that travelling is predominantly local.

The pedagogy of Dutch primary education draws on the idea of primary education as support of the overall cognitive and emotional development of young children, of social, cultural and physical skills and of children's creativity. The curriculum addressing this core idea fulfils three functions:

- a) Support of the individual development of children;
- b) Transfer of basic societal and cultural values; and
- c) Preparation of being able to participate as independent citizen in society

3.2.8 Vienna University of Technology, Energy Economics Group (EEG)

The programs drawing on these ambitions are offered by a dense infrastructure of primary schools in the Netherlands, with different religious and/or cultural orientations. In the Netherlands freedom of religion and freedom of education are respected and have given way to primary schools with all kind of religious orientations or non-religious, public schools. Schools are funded by public money.

Nature and environment education of children is offered by so-called nature and environment teams predominantly municipally or provincially organised. These organisations provide for nature and environment programs for primary schools. The pedagogy behind the offered programs is to engage children (but also adults) in nature, nature protection and the environment.

Engagement in this sense means:

- > Humans know and respect the crucial function of the natural environment for the overall wellbeing of society;
- > Are able to balance ecological, private and societal values in decision making;
- > Are willing to take full personal responsibility for the quality of the natural environment now and later;
- > Are able to integrate these responsibilities in daily life and routines.

The **Energy Economics Group** (EEG) is within the Institute for Energy Systems and Electric Drives at Vienna University of Technology. The core areas of research of EEG are:

- > Dissemination and integration strategies for renewable and new energy systems
- > Energy modelling, forecasting and analysis of energy policy strategies
- > Global and local environmental aspects
- > Sustainable energy systems and climate change

EEG, employing a permanent scientific staff of about 25 people with expertise across all disciplines necessary to assess the impact of energy policy initiatives at the European level, has managed and carried out many international and national research projects funded by the European Commission, national governments, public and private clients.

EEG has many national and international co-operations and has been coordinating several EU-projects in the topical area of renewable energy. Besides, contributions have been given to many other research and consultation projects on European level as a core partner in the field of renewable energy with its keen expertise in the area of energy modelling and energy policy strategies as well as grid integration and sustainable bio-energy use in particular. EEG is at the forefront of discussion on energy policy instruments for the enhanced deployment of renewable energies at the European level as well as at global scale. It substantially contributed to the assessment of the effectiveness and efficiency of support schemes for renewable energies either by conducting ex-post or ex-ante evaluations.

To realise a successful SAUCE programme, an expert in youth pedagogic assists the energy economists of EEG. Vienna is a metropolitan area with more than two million inhabitants, including the surrounding suburban areas. In the Austrian educational system, schoolchildren aged 10 to 13 attend the first two years of secondary schools, where they are confronted with first academic questions. The system is central and decentralised at the same time, depending on the type of school. While schools usually have to adhere to a highly hierarchic decision structure, there is sufficient leeway for personal input by teachers, public officials or nongovernmental educators. If people are personally motivated and willing to get involved in non-formal projects, they can effectively provide access to the schools and teachers.



4 Implementing SAUCE

4.1 What is a SAUCE programme?

Schools at University for Climate and Energy – SAUCE – refers to the concept of taking groups of children, together with their teachers, into universities for workshops, lectures and activities revolving around the topics of energy and climate change. This idea is based on the successful “children’s university” model, where professors and other academics use the above-mentioned formats to communicate relevant issues from science and social research in a form appropriate for children, usually as after school activities. The first “children’s universities” were organised in 2002 and have since become a common feature at many European universities. In 2011, more than 200 European universities offered activities for children, typically

for 7 to 14-year-olds. Many of these universities, among them the SAUCE consortium, joined to form the European Children’s Universities Network, founded in 2008, to actively promote the adoption of children’s universities within the European Union.

SAUCE programmes offer between 20 and 60 activities over a one-week period. Each school class usually attends one programme day and may enrol in up to three activities offered on that day.

Particular characteristics of SAUCE programmes

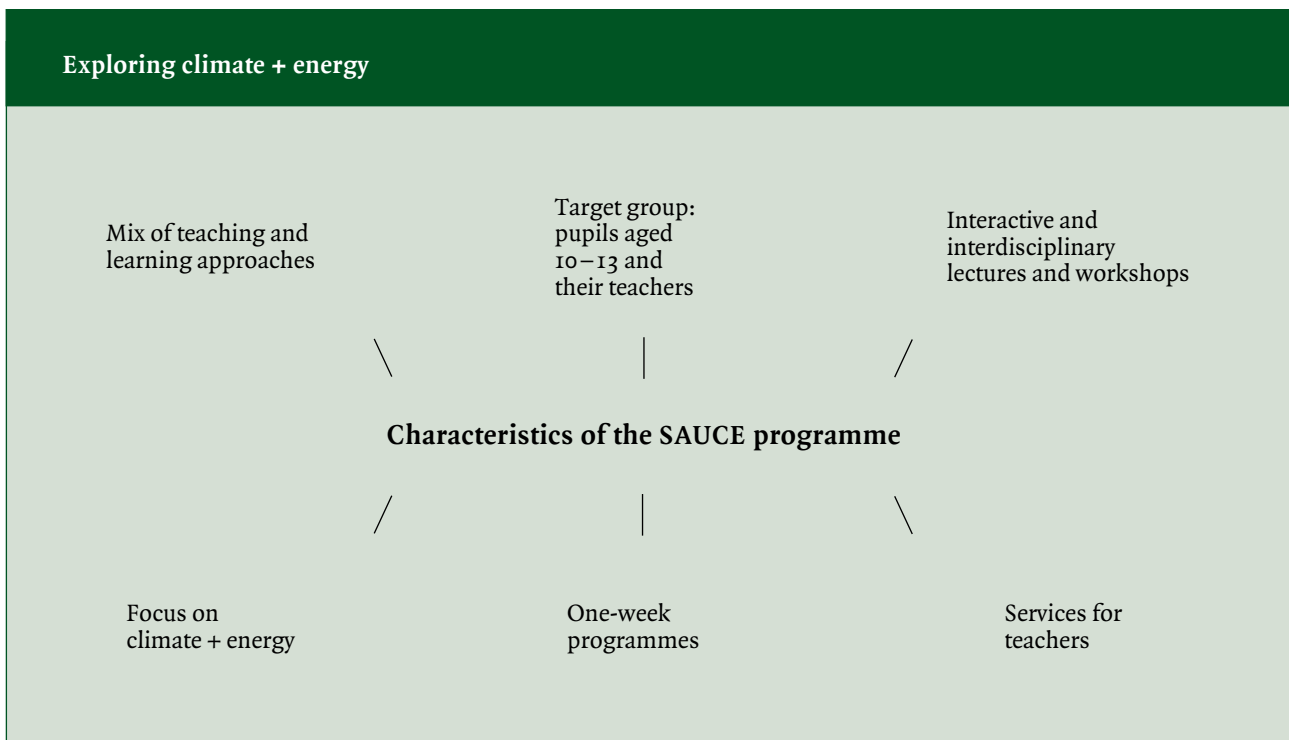
- **Topical focus:** SAUCE programmes put their focus specifically on energy and climate topics. Expanding upon the purpose of science communication in its pure sense, SAUCE programmes actively promote knowledge about energy issues and climate

change and, at the same time, intend to introduce visitors to initiatives and options for energy efficient behaviour in everyday situations (cf. chapter 5).

- > **Core target groups:** SAUCE programmes address schoolchildren aged ten to thirteen years. The programmes are offered as out-of-school learning activities, and reach children from families with academic and non-academic backgrounds alike. The second important target group are the children’s teachers. SAUCE programmes intend to support and motivate teachers to teach SAUCE topics at school on a regular basis (cf chapter 6).

- > **Cooperation with external partners:** SAUCE programmes are presented by members of the universities’ academia, but also by external partners of diverse backgrounds, often with expertise in energy education for children (cf. chapter 7).

- > **Teaching approaches:** The approaches taken to teaching in the SAUCE programmes harness the interdisciplinary nature of the core topics of energy use and climate change. Bringing in the expertise and viewpoints from different disciplines allows for traditional as well as unconventional approaches to the topics and teaching. Irrespective of the particular topical focus, involving the children emotionally, and relating the subject matter to their own personal experiences and everyday lives is the overall objective (cf. chapter 5).



4.2 The target audience

SAUCE programmes target 10 to 13-year-old school-children, because when the project started, educational syllabuses or teaching materials for this age group were rare. Moreover, children of this age (in terms of developmental psychology) are mature enough to understand environmental issues. Most have already been exposed to the general problems of energy and climate change, are eager to learn, and more open-minded than older children tend to be. Therefore, this age group is both easy to reach, and rewarding to teach. Though in principle the SAUCE format may easily be adapted to address older or younger pupils as well.

When assessing the “sustainability skills” of 10- to 13-year-olds, a number of factors have to be kept in mind. Developmental psychology, especially the works of Jean Piaget (1896 – 1980), has a lot to say about the way children at this age perceive the world. Most undergo a qualitative change in ways of thinking between the ages of 11 and 15, i.e. from concrete operational to formal operational thinking, and begin to develop autonomous moral convictions. This change allows children to start thinking in more abstract terms, and thus begin to understand complex problems and explanations, as well as moral implications. According to these findings, the complex topics of energy use and climate change may very well be taught to and discussed with the SAUCE target group.

Possible conclusions from developmental psychology have also been of interest to studies on environmental didactics carried out in the course of the implementation of the United Nations Decade of Education for Sustainable Development (ESD) 2005-2014 (e.g. Haan 2009). One aim has been to define and orchestrate the concept of “scientific literacy” for teaching sustainability skills. In this context, the concept of “scientific literacy” implies relating natural sciences to social, ethical and political aspects, and linking these to people’s everyday lives and personal behaviour. One important component in this process is to acquire “key competences”, which put “soft skills” such as social, compassionate, and organisational competences on an equal footing with traditional analytical and cognitive competences (Haan 2008). These ideas have since become a basis for the international discourse on education for sustainable development.

The didactic considerations taken in the course of the SAUCE project reflect the influence of this debate and its findings. The interdisciplinary approach of SAUCE and its main objective – relating scientific facts or explanations to environmental and societal effects, and contemplating behavioural solutions open to children in their everyday experience – are well-aligned with key aspects of ESD. Scientific, analytical, and research skills, and factual knowledge are indispensable tools for understanding energy use and climate change. Applied to a specific context and put into perspectives that are relevant and immediately accessible for children, a deeper understanding of science and social processes may be conveyed than in their isolated study.

However, learning, understanding and internalising occur in stages within a process over time. Therefore, SAUCE programmes’ activities, with their singular event-like character, may not be expected to achieve this in and of themselves. Nevertheless, among educators they are regarded as very helpful and supportive. Their character, educational effects and potential have been analysed in the context of recent surveys on out-of-school learning places. According to common definition, out-of-school learning places, which school classes attend with their teachers in a day’s programme, include: museums, nature resorts, environmental centres, utility facilities such as water works or power stations and – universities. Here local experts, not teachers, present the given subjects on guided tours or in workshop-type activities. Therefore, education at these out-of-school places is regarded as part of non-formal learning. The advantage of these learning situations is that they are dissociated from classroom teaching and related pressures or anxieties. They offer opportunities for experiential learning and novelty, fun, and excitement. And while these opportunities will not accomplish complete learning cycles, they have been identified as proven components of successful learning, which can effectively supplement classroom teaching.

The role out-of-school places may take in teaching environmental skills and topics has been met with great interest from environmental educators. This is reflected by the increasing number of places and institutions which have been established addressing children in general, but, more specifically, school classes, in several European countries. These places have become increasingly important for transferring and integrating up-to-date research results and specialised knowledge into school education. Furthermore, they are regarded as having very positive effects on the children’s readiness to learn. Sufficiently staffed and financed, they provide equipment and materials otherwise unavailable at schools, benefiting a large cross-section of schoolchildren. Therefore, out-of-school places supplement teaching of topics which

the average teacher will usually not cover for lack of competent and up-to-date knowledge and time, but which are important with respect to sustainability skills, in meeting technical and social challenges of the immediate future. Universities, with their facilities and their research expertise, have been identified as particularly effective, reliable and professional out-of-school learning places.

Haan, Gerhard de: Gestaltungskompetenz als Kompetenzkonzept für Bildung für nachhaltige Entwicklung. In: Bormann, Inka/ Haan, Gerhard de (Hrsg.): Kompetenzen der Bildung für nachhaltige Entwicklung. Operationalisierung, Messung, Rahmenbedingungen, Befunde. VS Verlag, Wiesbaden 2008. S. 23–43.

Cf Daugavpils University, Latvia (et al.), 2008: Analysis of existing intergration of out-of-school learning places into school education, WP2 Report of INSPIRE: Inspire school education by non-formal learning under the “Lifelong Learning Programme” of the European Union.



4.3 Developing the SAUCE format

A first reference for the SAUCE development task was the pilot programme “Schüleruniversität Klima und Energie” at Freie Universität Berlin of March 2006. This programme was a single, week-long event that included numerous contributions from energy education experts and researchers recruited from outside the university. It predominantly offered lecture-format events for 200 and more pupils and included some workshops for smaller groups of children. Thus, the pilot programme already had employed the basic features of the SAUCE programmes, such as the integration of external educators, its topical focus and choosing school classes as target group.

After assessing the pilot programme’s experience contributed by the Berlin team (Freie Universität Berlin and Berlin Energy Agency), it was the SAUCE consortium members’ task to transfer this pilot model to their specific contexts. These were shaped by a variety of factors:

- the universities’ specific research fields,
- their regions and present energy education network structures,
- the thematic focus for the programme favoured by the individual SAUCE teams, and
- the financial and other resources available.

And while the exchange about the pilot programme experience, and later on also about the SAUCE partners’ own experience did help very much, each partner had to start with a baseline review of opportunities and constraints provided by their own particular context. For some, this showed a need to direct efforts to their universities internally, to prepare the ground for these to open their doors to this young and unconventional target group. Others needed to direct efforts externally, in order to convince the targeted schools and teachers of the benefits of attending the programmes as a valuable ‘out-of-school’ contribution to their teaching. Often, of course, they had to do both. And they needed to find their specific programme partners from the pool of potential lecturers and define a programme structure which would best match their local conditions.

4.3.1 Finding local programme partners

SAUCE programmes are shaped by the wide variety of potential partners with many different academic and also non-academic backgrounds, such as researchers or students in the fields of earth sciences, physics, energy policy, or (renewable) energy technology, experts or activists in environmental education, architects, planners and engineers, teachers and teenage schoolchildren, artists, actors and musicians, or writers. They all can contribute different expertise, ideas and educational approaches and thus shape a lively and interdisciplinary SAUCE programme. The extent to which external partners may be integrated in the programmes, in part, also depends on the availability of funds. But, the partners also contribute to the SAUCE programmes’ goals: by disseminating the SAUCE project activities and experience to their specific circles/networks, thereby improving local networking, or, in the case of cooperations, by sharing costs and effort. Thus, a double dividend may be expected from the involvement of many different partners.

Consequently, the SAUCE partners had to start with a baseline review of local conditions and possibilities which included two steps:

First, they needed to determine which capabilities were available in-house by researching relevant projects at their university. This activity helped to develop an interdepartmental, scientific in-house SAUCE network. Concentrating on in-house capacities and knowledge will guarantee the quality of programme content and introduce schoolchildren to the university and its scientists. Relying on in-house research is easier to organise because the technical resources and equipment such as laboratories are at hand. But it can be demanding for the lecturers, who may not have experience teaching younger children. For example, university staff often underestimates the importance of appropriate language and breaks during the lesson. A general challenge was posed by the fact that researchers’ participation in SAUCE programmes does not qualify in the present academic system of assessment and was not readily promoted by the universities’ leaderships. However, once they were convinced university researchers usually did not require the financial resources that external experts usually expect. And since SAUCE is all about the university experience, the SAUCE universities regarded it as pivotal to engage experts from within university in the programmes, and the children enjoyed the fascination emanating from “real” scientists and professors.

Second, the majority of partners created a SAUCE environmental education network by establishing ties to the local community

SAUCE awarded official recognition as “Project of the UN Decade of Education for Sustainable Development 2005-2014”

The United Nations Decade of Education for Sustainable Development 2005-2014 (DESD), for which UNESCO is the lead agency, seeks to embed the principles, values and practices of sustainable development into all aspects of education and learning, in order to address the social, economic, cultural and environmental issues we face in the 21st century.

Implementation of the DESD vision is governed by designated national UNESCO Commissions and follows a common strategy with several key initiatives. The national UNESCO Commissions, for instance, have established communication and information platforms, discussion forums and/or regional centres. These activities are to facilitate exchange of educators and other stakeholders and enhance capacity building in order to integrate the goals of DESD in national and local education programmes and policies (UNESCO 2007). In two SAUCE project partners' countries, Austria and Germany, the national UNESCO Commissions, additionally single out exemplary projects for awards to increase their visibility. To receive the award, the projects have to be positively reviewed by an expert panel and must meet several criteria, covering aspects such as goals, target groups, range of thematic focus, international cooperation and institutional continuity.



The Vienna SAUCE team at the award ceremony in Austria.

The German national UNESCO Commission awarded official recognition to the Berlin SAUCE project as „Project of the UN Decade for Education for Sustainable Development 2005-2014“ in 2009 and, renewing the recognition, again in 2011. In 2010, the SAUCE project partner in Vienna, Austria received the award, as well. The two countries' UNESCO Commissions particularly praised the project for its close cooperation between schools and university as well as its international character.

and external education and climate experts - an important aspect of the SAUCE approach. They found that using proven methods from external educators in an academic setting can add great diversity and improve the SAUCE programme's didactic quality. Cooperation between these external climate and energy educators and scientists for programme elements, if at all feasible, needs to be carefully thought-out and requires some organisational effort. The extent to which the SAUCE partners utilized internal and external experts in their programmes varied. Altogether there were 6 and up to 54 different partners who contributed to the programmes over the three-year project period. Those universities situated in large metropolitan areas can usually take advantage of a wide range of local educators and networks that fit the programme's approach. In rural areas, not as many experienced partners may be available. Most of the programme contributions with a non-university origin are held in schools or out-of-school places on a regular basis. Nevertheless, these workshops had to be fundamentally reorganised and others were tailor-made to meet the "Climate and Energy" focus (cf. Ch. 6).

SAUCE partners were supported in their endeavours by initial input from two formal cooperation partners, the Independent Institute of Environmental Issues (UfU e.V.) in Berlin and the energy education section of the Austrian Wind Energy Association (IG Windkraft) in Vienna. These two partners provided the SAUCE consortium as a whole with advice on didactics and outreach to schools. Furthermore, the international exchange among the SAUCE partners about their ideas and experience gave additional impulses for the local search for suitable programme partners, as the project progressed. Ultimately, the energy researchers at the SAUCE universities found different ways to access and build their specific network of programme partners:

- The SAUCE programme at Freie Universität Berlin profited from the expertise of the SAUCE project partner Berlin Energy Agency with established ties to numerous local energy experts and educators. The cooperation partner Ufu e.V. was a steady programme partner. Throughout the project the SAUCE team kept up steady communication with local voluntary organisations involved in energy education and with related public authorities.
- The SAUCE team at Vienna University of Applied Technology was joined by an environmental education expert, who provided and maintained the link to local external partners and contributed his pedagogical competences. The programmes also profited from the expertise of IG Windkraft. Moreover, the universities academic network was utilised, e.g. by cooperating with the University of Salzburg.
- The Twente University SAUCE team linked up with the local environment and nature group of the Municipality of Enschede, who supported the local SAUCE team to find its way in the local community. From there the local network developed stepwise, and toward the end of the project included several local actors and organisations, for example, the Museum of Technology in Hengelo.
- London Metropolitan University found a prominent partner in the Government Office for London for the London Sustainable Schools Forum and entered a formal cooperation with a local public organisation, the Islington Environmental Learning Partnership IELP, later renamed Islington Sustainability in Schools ISIS, until its closure in 2010, one of London's leading local authority initiatives supporting ESD and climate and energy education in particular.
- At AAU, the concept of children's university was not known at the start of the SAUCE project. To realise a successful SAUCE programme, the SAUCE team therefore established an advisory group consisting of science teachers from local schools, an educational consultant from three primary schools in Mariagerfjord Municipality, and a pedagogical consultant of science teaching from the school administration in Aalborg Municipality.
- Roskilde University, after relying on in-house resources for the first programme, linked up with a Danish energy education project called Green Kids.
- The SAUCE partner at University of Latvia resorted to the faculties' resources and its own expertise in environmental and energy education for programme development as well as established co-operation with experts of the Institute of Solid State Physics, the scientific institute of University of Latvia, and the Institute of Physical Energetics – a leading institution in energy research.established co-operation with experts of the Institute of Solid State Physics, the scientific institute of University of Latvia, and the Institute of Physical Energetics – a leading institution in energy research.

4.3.2 Determining the programme structure

The final programme composition was also determined by the programme structure chosen. SAUCE partners developed two basic formats which were implemented with local variations:

- > An “open-campus” format, which allows participating schools to book individual lectures or workshops. This has the advantage that it also accommodates school classes unable to stay for a full day’s programme. However, this format requires easy access to the site and good public transport. Furthermore, the total number of classes that can be accommodated is higher, which makes it suitable for metropolitan regions with potentially higher demand.
- > A “closed-cycle” programme over the equivalent of a school day, usually with a plenary opening event (e.g., a science demonstration), followed by smaller, parallel workshops and

finishing off with another plenary event or feedback session. The daily schedules may be repeated every day of the programme week or composed of different elements, thus covering a wider range of topics.

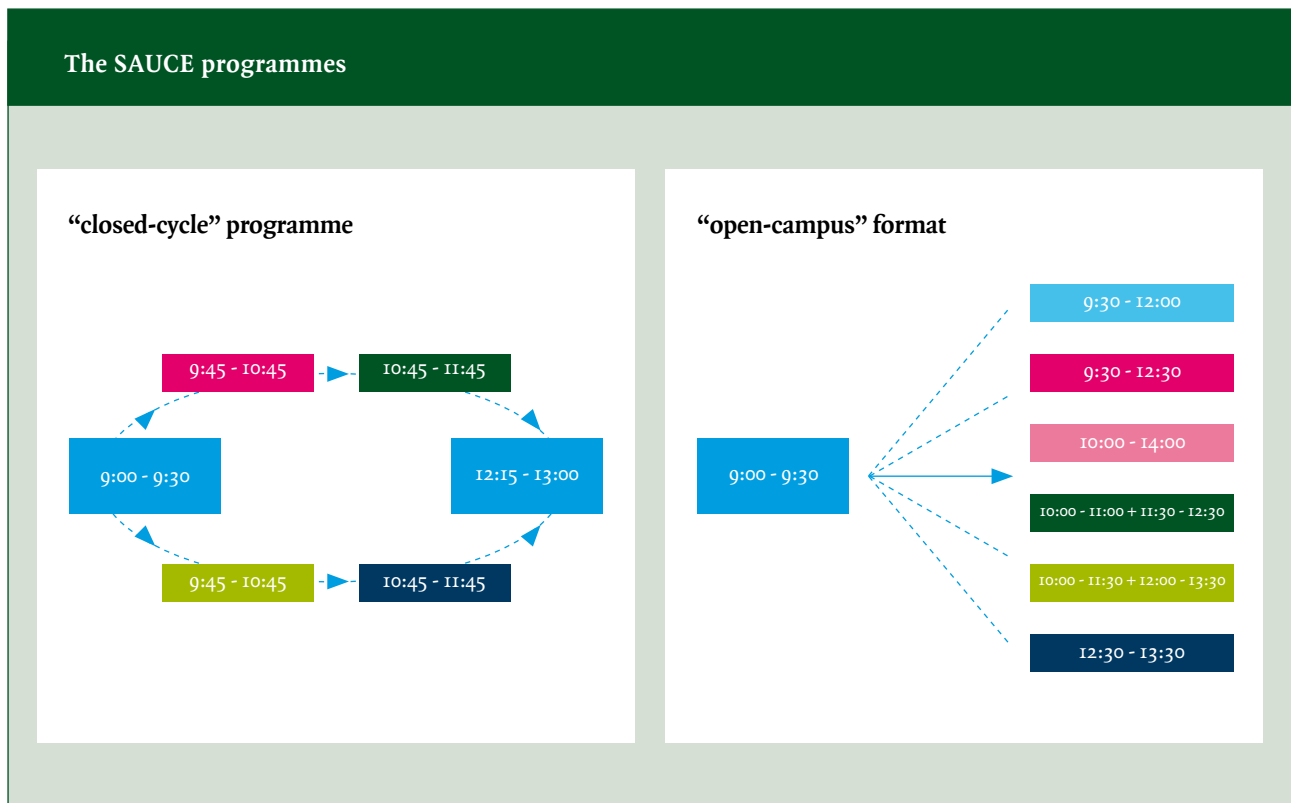
While the Berlin pilot programme had used the “open-campus” format, the majority of the SAUCE partners found that their local conditions did not match this structure and thus developed alternatives. The geographical context – rural or urban – and the cost and time of travel to the event directly influenced the programme structure, as did the number of schoolchildren intended to be reached. The choice of format was above all guided by what best encouraged teachers to participate in the SAUCE programme. In practice, individual elements from the “closed-cycle” programme, e.g. introductory lectures, were adapted to the “open-campus” format as an additional offer and “closed-cycle” programmes occasionally included “open-cycle” programme elements, such as field trips to be booked as single events.

In practice, the 25 SAUCE programmes scheduled between 20 and up to 80 events which were structured largely in parallel sessions. This way, the programmes provided 1,000 to 2,500 places for the schoolchildren in workshops, lectures or other activities during a one-week programme period.



4.3.3 The local SAUCE programmes

The following accounts briefly describe the programme format and programme partners, as well as the thematic focus of the programmes at the SAUCE universities. More details on the teaching approaches are given in Chapter 5.





4.3.3.1 Aalborg

The Aalborg SAUCE programme followed the closed-cycle format. Some schools had to travel more than 100 km to Aalborg University. Teachers would not want to travel such a long distance to participate in only one workshop. Therefore, in order to establish a successful programme, it was necessary to give two workshops to each class plus an opening arrangement. Offering the workshops to classes with between 17 and 29 pupils also fitted well with Danish Public School pedagogical tradition of “hands on” teaching with learning in small groups.

The programmes focussed on how the intelligent uses of energy and the use of renewable energy among other effects may prevent harmful climate changes. They were run by faculty members and students from Aalborg University and experts from two local NGO.

Workshop topics included:

- > Climate changes – consequences and solutions
- > Wind turns into current – how does a wind mill work?
- > How to use solar energy to make electricity and heat
- > Energy and everyday life
- > Funny experiments with energy.
- > When the sea runs high – on utilization of wave energy.
- > Coke for your mobile – bio-batteries.
- > Water – a scanty resource.
- > Light for the village schools of Mali.
- > Fuel cells
- > Plus-energy houses.
- > A guided tour through the energy laboratory.
- > How to build a “green” house.
- > The energy system of the future.
- > The climate effects of products.
- > Environment and recycling in Africa.



4.3.3.2 Berlin

The Berlin SAUCE programme used the “open-campus” format. Each of the altogether five SAUCE programmes offered between 36 and 51 workshops and interactive lectures which held places for 1,600 to 2,600 schoolchildren per programme week. Usually, the individual events lasted one to one-and-a-half hours, but several events lasted for three or more hours. Each school class could participate in a maximum of one workshop and one lecture. Larger events were open to all classes (such as film shows). Furthermore, on four programme days, open introductory lecture sessions were offered.

The programme was predominantly composed of offers by external partners from a wide spectrum of institutions and backgrounds, such as environmental organisations, other research institutes, public and semi-private education institutions, freelance educators and artists, and theatre companies. But also university members contributed to the programme, notably researchers and students of the meteorological institute, the department of physics and the political science department—as well as colleagues running the universities’ energy management system.

From the beginning, the topics covered were abundant, but the diversity of the programmes teaching approaches increased over the project period in step with increasing the number of programme partners. They included among others:

- > experimental workshops and participatory lectures on renewable energy technologies and climate change phenomena;
- > sessions in which the children were dealing with energy consumption and related behavioural aspects, e.g. during the “climate breakfast”, or turned into “energy saving detectives”;
- > role games to explore global perspectives or visions for the future, e.g. in international climate change negotiations and urban planning sessions;
- > slideshow accounts given by young people of their projects – be it a journey to the Arctic or around the world in a solar car or a solar building contest;
- > recycling art workshop and creative writing;
- > visits to the meteorological institute’s weather station and the botanical gardens as part of workshops;
- > “energy” tours guiding the schoolchildren through heating rooms and on solar rooftops;
- > the pedal powered film show, which was powered by the school children on electricity producing bicycles;
- > science demonstration shows, theatre, game shows and film presentations added entertainment and fun to the programme;
- > video conference line between Berlin and Vienna – a highlight: in a cross-border game, a pair of scales symbolically balancing the earth’s climate had to be brought to the right tipping point by the input of energy saving ideas from Viennese and Berlin schoolchildren.



All programmes started with an introduction to the University and to the aims and content of the day, followed by a plenary lecture. SAUCE 1 experimented with lectures by a range of experts but later programmes opened with a Climate Science Demonstration Lecture to help pupils understand the relationship between solids, liquids and gases, important to understanding the impact of climate change. This was spectacular and engaging, drew on laboratory resources not available in school, and supported STEM. In programmes 1-3, pupils were then divided into two large workshop groups, one engaging in a competition to find practical ways of reducing the home carbon footprint and the other starting with a presentation on youth expeditions to the Arctic, followed by mime exercises addressing the impact of climate change on wildlife, ice melt, sea level rise etc.

For all five programmes, in the afternoon pupils could attend two workshops geared to experiential learning and kinetic engagement. Workshops included:

- > making food and learning about their origins and carbon footprints or, exploring the footprint of components of the Kinder Egg (aluminium foil, cocoa and the plastic toy inside)

4.3.3.3 London

- > capoeira dancing, trying the dance moves, but also hearing about the impact of climate change on the rainforest and indigenous peoples
- > making jewellery or accessories from waste products, to sensitise pupils to the value of what we throw away, and to how art can highlight this
- > three workshops with team competitions to (1) build model low carbon houses, using cardboard boxes, insulation materials and solar cells; (2) build model wind turbines and test their efficiency in a wind tunnel (3) assemble a model hydrogen cell car and test its energy efficiency
- > 'indoor gardening', learning about wormeries, composting and passive irrigation,
- > writing lyrics and painting logos, and hearing the lyrics performed
- > an exercise in visioning the future and designing ways to make it more energy efficient and sustainable.

The workshops were all designed to allow some hands-on work, and each pupil attended one that involved team-work. They were also designed to show that every child, and every subject, can contribute to climate and energy solutions. In response to evaluation, in the final two programmes, the second morning session was dropped and the afternoon workshops were extended. This worked better, although there was a trade-off against number of pupils involved. At the end of each programme, all pupils and teachers gathered for a plenary feedback session.

The UK programme was multidisciplinary, aiming to give pupils confidence that every individual and subject can make a contribution, and also to interest them in less familiar disciplines, particularly STEM.



4.3.3.4 Riga

The Riga SAUCE programme used the “closed-cycle” format which includes four activities offered every day of the programme week for all of the participating school classes. The thematic focus of the Riga SAUCE programme was on introducing the pupils to the basic components of the climate problem, and showing a few examples of how problems can be solved by technological solutions in production and change of individual and societal consumption patterns.

Each of the altogether three SAUCE programmes offered between 60 and 80 one-hour workshops (from 10 a.m. until 2 p.m.) which held places for about 500 schoolchildren per programme week. Workshops were planned for school classes of 25 to 40 pupils, as larger groups would not be in accordance with teacher expectations and reduce the possibilities for interactivity.

Programme 1 was held on the premises of the Institute of Solid State Physics and consisted of a common introduction followed by four workshops. Workshops were run by the department members, doctoral students who were concurrently members of environmental NGOs, and the Institute researchers. The Institute offered its laboratories and other facilities, providing “scientific setting” for the SAUCE activities.

Programme 2 and 3 took place at the Faculty of Economics and Management and consisted of a common key note address followed by four workshops. The composition of workshops was changed: two activities were modified, and two completely new activities were introduced. Workshops were run by the department members, researchers of the Institute of Astronomy of UL and the Institute of The Solid State Physics.

All three programmes consisted of four different activities with varying format (workshop, lecture and demonstration, simulation-board game and a quiz).

The issues covered were:

- > Sun and Energy — how can we use it better?
- > Hydrogen — future energy source for transportation vehicles
- > Carbon and ecological footprint
- > Boreal forests and climate change
- > Hydrogen technologies and future energy sources
- > Sun and wind energy utilization: technologies and practice
- > Solar storms echoes the Earth
- > Energy consumption and environment-friendly behaviour



4.3.3.5 Roskilde

Roskilde University experimented with two different SAUCE programmes. The first two programmes consisted of auditorium and classroom lectures and experiments. The feed-back from the teachers was mainly positive, but some suggested putting more emphasis on hands-on activities. This led to a revision of the programme structure, and the design of a renewable energy city, at which most of the third programme teaching took place.

The SAUCE programme was primarily organised by staff from the METRIK research group (Environment, Transport and Climate) at the Department of Environmental, Social and Spatial Change. The SAUCE programme presenters were mainly university members with a research background in environmental planning, focussing on issues such as renewable energy systems and energy saving, water planning, transport and biogas technologies, environmental politics and legislation.

Most of the schools attending the two first SAUCE programmes came from the local area around Roskilde, whereas the third programme also included a number of schools from the larger Copenhagen area.

Programmes 1 and 2

Each day of the “closed-cycle” programme began with an introduction to climate problems as a basis to understand the themes in subsequent sessions, followed by two thematic sessions in which the pupils were given the opportunity to dig deeper into a specific topic related to climate and energy. These sessions varied and they covered a wide range of topics such as renewable energy sources, energy savings, climate change, transport, housing etc. The workshops employed a “learning by doing” approach, meaning that the pupils were actively involved in discussions and problem-oriented assignments. The day ended with a joint activity led by a performance group that involved the children in policy negotiations on climate change mitigation.

Programme 3

The third programme was primarily carried out in a small renewable energy city, which had been specially created for the SAUCE programme. The city had small houses, electric cars, wind turbines, solar panels, photovoltaic cells, a combined heat and power plant, and other renewable energy devices.

The structure of the beginning of the day was similar to programmes 1 and 2. After the introduction pupils were divided into two groups. Each group was given an introduction to renewable energy followed by a group exercise in which the pupils were asked to create a prototype of a novel renewable energy device. They had to reflect upon advantages and disadvantages (technical, economical, political and social) associated with their prototype. During all sessions pupils were able to try out or experience different renewable energy devices within the renewable energy city. The programme ended with a sum-up lecture and a quiz about what they had learnt during the day.



4.3.3.6 Twente

The Twente SAUCE programmes used the “closed-cycle” format. They offered between 9 and 36 interactive lectures, workshops and excursions, with 450 to 2300 places. In the programme week the pupils had the opportunity to:

- > watch documentaries or participate in lectures about energy saving and renewable energy sources, or climate change and adaptation
- > investigate wood-fuel distillation at the university lab
- > discuss technical, social, environmental and global aspects of energy generation, consumption and energy conservation with climate experts,
- > enjoy the climate breakfast at a local eco-farm
- > attend guided tours of Twente’s waste incineration facility and the water cleaning facility (with energy production) of the local water board

Furthermore, workshops for smaller groups of 50 pupils were offered, providing an opportunity to experiment with solar, hydro, biomass and wind energy technologies. For instance, the Solar Car Team showed pupils the function, development, and potential of today’s solar cars.

Moreover, in the Climate Game pupils became European, Asian and American political actors and learnt about the difficulties of international energy and climate negotiations and policies.

The larger programmes also offered entertainment. Every day a funny professor, together with his housekeeper, ended the program by ‘proving’ that he was the ‘brightest’ energy professor in the world.

Leading experts from the CSTM and the University of Twente, together with non-governmental environmental education organisations, developed and performed the programme.



4.3.3.7 Vienna

The Vienna SAUCE programme used the “closed-cycle” format. Each of the three SAUCE programmes offered between 39 and 50 activities fitting in 1,000 pupils per programme week. Thus, approx. 40 school classes from various schools were able to take part in the one-day-programme (9 a.m. until 1 p.m.) in the course of the week. SAUCE venues encompassed the Vienna University of Technology main building, the surrounding premises of the faculties involved, as well as several local sites, amongst them “Technisches Museum Wien”, “Planetarium Wien”, a hydro power station and a biomass CHP-plant.

The main topics covered were: climate change issues, renewable energy, solar energy and technology, mobility, food production, consumer powers, ecological footprint, and the pursuit of personal happiness. We expanded the variance of the programme for our second and third run by adding three new workshops on ‘happiness’, ‘food production’, and ‘a society without oil’.

Each day began with a welcome lecture for all pupils, to introduce the subject. Afterwards the pupils split up into several groups and attended various workshops and lectures on energy use, renewable energy and climate change. The day ended with a playful reflection on experiences gained. As a highlight of the programme, a pair of scales symbolically balancing the earth’s climate showed its sensitiveness to pupils and participating teachers.

The workshop format was the format favoured by teachers much more so than the lecture format, hence workshops dominated the programmes. Although mainly based on educational actors from NGO’s, there were also university staff involved in SAUCE. The inputs ranged from the best insulation for houses to a critical view on society. Other institutes involved from Vienna University of Technology, besides EEG, included Research Center of Transportation, Planning and Traffic Engineering, Institute for Energy Systems and Thermodynamics, Central Institute for Meteorology and Geodynamics, and Institute of Building, Construction and Technology. Furthermore, the Department of Political Science from University of Salzburg offered courses.

4.4 Programme delivery

Once the programme content had been developed and potential presenters recruited, the SAUCE programmes needed to be organised and delivered. This included several steps:

- > review the financial sources for programme costs (remuneration of presenters and helpers, printing costs) and possibly to engage in additional fund raising,
- > determine the programme schedule,
- > publish programme information in print and/or on the website, and invite schools,
- > arrange for facilities needed at the university,
- > organise participant enrollment,
- > recruit helpers and delegate programme delivery tasks,
- > make contract arrangements and issue payments to presenters and helper team.

Many of these tasks, in principle, were not new to SAUCE university researchers who had previously been involved in the organisation of international conferences or other events for larger audiences. However, schools were a non-familiar addressee for the majority of the SAUCE consortium members, and programme advertising often required additional research into the local school systems' communications structures. Also, having to host an audience of children and teachers, unfamiliar to university contexts, did demand some learning by the SAUCE teams and subsequent adjustments of the programmes' logistics. Particularly, the actual delivery of the larger, but also smaller, SAUCE programmes at times required excessive organisational efforts and personal commitment of the SAUCE teams, especially just before the start of the programme week. Additional logistical effort was required for universities in rural areas, which were situated far away from the schools and did not provide adequate public transport, as was the case at Twente and Aalborg. Organisational quality ultimately depended upon financial resources available for staff and other costs, such as special technical equipment or – as some universities did with very positive effects on communication with and among participants – for food and drinks to host the children during breaks. Depending on the

size of the programme, SAUCE programme helper teams were comprised of up to 12 people on one programme day. If the needed hours and costs were not planned into the budgets, voluntary hours by core team members and improvisation were required, or, in the long run, the organisational quality would suffer. The chances to acquire additional funding from private or public sponsors, however, had been negatively influenced by the onset of the economic crisis in 2008. Therefore, only two programme partners were able to significantly expand their SAUCE programmes by adding further contributions from external partners, as these usually implied reimbursements that had to be paid.

Generally, the university campus proved to be a very suitable if not perfect location for the SAUCE programmes. The facilities were usually diverse, spacious and well-equipped, and the technical support was well in place. Nevertheless, to fully take advantage of these facilities the core teams had to become acquainted not only with the scope of the tasks but also with the individual colleagues putting these facilities to work. Therefore, the first programme run often showed features of a trial run and usually organisation ran more smoothly and efficiently with every year to follow. This did have very positive effects on the overall perception of programme quality by teachers over time, as the monitoring revealed. Thus, continuity of organisational staff has been identified as an important factor for success.

A summary of conclusions and tips from the SAUCE partners' experience has been published in the **SAUCE Handbook and in the SAUCE Resources Guide**. Both publications are available in English, Danish, German, Italian, and Polish print editions and can be downloaded from the project website: www.schools-at-university.eu



SAUCE universities as out-of-school learning places and hubs for a vibrant local network for teaching energy and climate issues

After three years and three, sometimes five, programme runs, SAUCE has become known in the local educational networks in the SAUCE partner countries as the “Kinderuniversiteit over klimaatverandering en duurzame energie” (Twente), as “SKUB” (Aalborg), or as “Schüleruni schools@university Klima + Energie” (Berlin and Vienna). In Latvia, some schools which had participated at SAUCE programme in both 2010 and 2011 came to regard themselves as ‘permanent’ partners and expressed the wish to continue co-operation on a regular annual basis, suggested keeping the format of the ‘university for children’ and including further environment and sustainability topics.

The SAUCE programmes have been established as well-balanced and high quality out-of-school learning opportunities. For many teachers the visit to SAUCE has become a regular out-of-school activity. Between 20 and 50% of the teachers visited more than one SAUCE programme with their classes. Altogether, three consecutive cohorts of 10 to 13-year-olds have visited the SAUCE programmes, and the teachers of the next generation are just waiting to enrol their classes in upcoming programmes.



Participants and programme presenters alike valued the wide spectrum of presentations in SAUCE, which were the product of opening up the programmes to the university academics as well as to non-formal educators and non-academic stakeholders from the local communities. These educators and partners brought in different perspectives and disciplines, including the arts and humanities, increasing the diversity and quality of approaches and methods used in the programmes. This had the further benefit of linking teachers and schools with non-formal educators as well as with the university, and helped in the effective evolution and expansion of the energy education network.

4.5 Monitoring and evaluation

Monitoring and evaluation activities were carried out with every SAUCE programme delivery, mainly serving to improve content and quality of the programmes as well as organisation of local delivery. The evaluation drew on the perception of the participating pupils, teachers and lecturers and all others who were involved in the local SAUCE programmes. Furthermore, surveys were done, albeit in a less comprehensive way, to assess the impact of the SAUCE programmes at schools, and thus glean results that might help to assess the impact of the SAUCE project as a whole. With the SAUCE project's resources, these surveys could not be orchestrated to meet scientific standards but rather have an anecdotal character, reporting activities of individual teachers and schools, and may not be amenable to generalisation.

Written and oral survey of participants was the consortium's method of evaluation. The consortium members used single page combined open and closed questionnaires, supplemented by unstructured interviews, SWOT analysis (Twente and Vienna), discussion with pupils and teachers (Aalborg and Berlin) and feedback from intermediary institutions and from pupils' letters (London). CSTM at University of Twente, the SAUCE partner leading the evaluation task in the consortium, made suggestions for questions to the consortium members who processed them into locally specified questionnaires. Additionally, a master thesis research project at the political science institute of Freie Universität Berlin aimed to assess the effects on environmental knowledge and environmental consciousness of schoolchildren who had participated in the SAUCE programmes on the basis of guided interviews.

4.6 Achievements

The SAUCE partners developed a SAUCE programme format which is adaptable to conditions at different European universities:

The SAUCE project has succeeded in developing the SAUCE programme format to be flexible and adaptable to many different contexts. These contexts are determined by the mix of research expertise at the partners' universities, the educational systems, and the specific approaches and the understanding of 'environmental education' which all may be different depending on the university, region or country concerned. A decisive factor is the interdisciplinary character of the programme and the unorthodox cross-disciplinary approach to programme development. This allowed inclusion of many different disciplines and opened the programme to a large group of potential contributors.

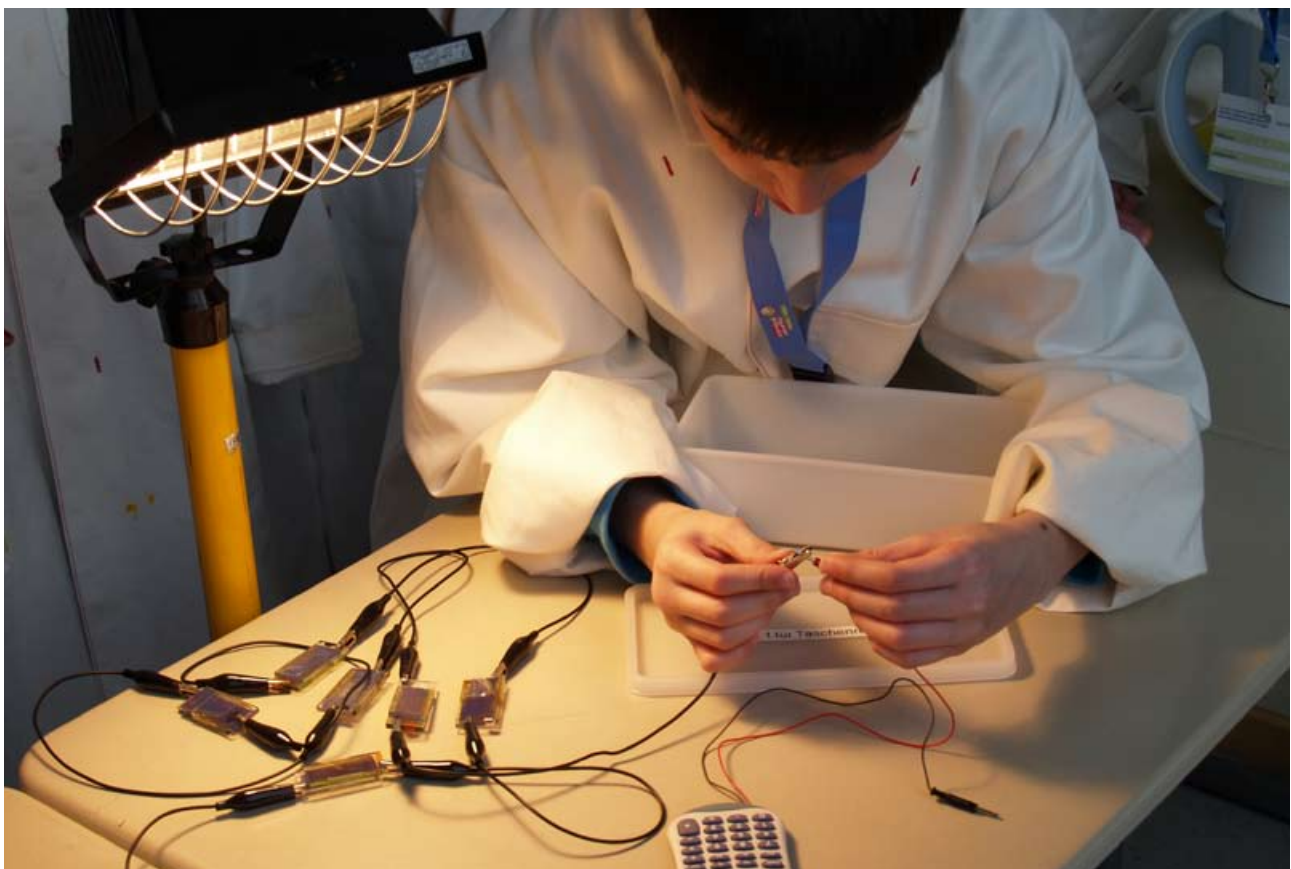
In practice, the SAUCE format was adapted to comply with conditions in large metropolitan areas with well established and abundance of non-formal educational and cultural institutions and organisations as well as to conditions in rural areas which might have much less to offer in this respect. The SAUCE model has been adapted by universities with research expertise in technology and engineering and by universities with an academic focus on the humanities or social sciences. Whatever the individual university's academic profile, there were experts to be found on one or more aspects of climate and energy at all of them. Finally, by taking account of the curriculum and the capacities of teachers and schoolchildren of the target age group, the programme format has been adapted to the partners' specific educational systems.

Scope and size of the SAUCE programmes exceeded the objectives

The SAUCE programmes developed over the three-year project period exceeded the SAUCE partners' initial expectations or plans. The scope of the content matter covered by the programmes expanded considerably as a much larger thematic variety was presented in the different workshops and lectures. Furthermore, the programmes placed an emphasis on activities for small groups. This was consequently reflected in the scale of the SAUCE programmes. The project aimed to present 25-30 hours of activity per programme. In fact, the SAUCE partners developed much longer programmes. Four fifths of the SAUCE programmes carried out exceeded the set goal and included from 40 and up to over 100 hours of activity. In total, the SAUCE partners offered 1340 hours of activity for schoolchildren and their teachers in the three year period.

The SAUCE programmes reached more than 18,500 school children from 400 schools

From 2009 until 2011, the SAUCE partner universities opened their campus for a total of 25 SAUCE programmes. Each university offered a minimum of three, usually annual, programmes. The London and the Berlin partner universities delivered five SAUCE programmes each. These programmes were attended by more than 18,500 schoolchildren who usually participated in two or more events during a programme day. The universities provided a total of 38,400 seats in workshops, lectures, guided tours or excursions for the children. The children were accompanied by 1,300 teachers from more than 400 different schools.





5 **Head, Heart, and Hands: The SAUCE Approach to Communicating Climate Change and Energy**

The SAUCE programme's thematic focus is on the closely intertwined topics of energy use and climate change. The interdisciplinary nature of these core themes implies that SAUCE programmes can address energy issues not only from their ecological and scientific, but also from social, socio-political, local, national and global perspectives. At the same time, the programmes touch upon a large variety of subjects taught in the regular school curriculum: natural sciences, earth sciences, mathematics, social and cultural studies. And, as the SAUCE programmes have demonstrated, energy and climate change can also be made a topic in subjects such as language skills, creative arts and even physical exercise.

The common objective of the SAUCE programmes' activities is to make children aware of the role energy

plays in their own lives, in their everyday needs and activities – that is, in relation to their clothing, nutrition, mobility, hobbies, or to architecture and product design – and to engage the children in creatively developing energy efficient and environmentally friendly solutions that each of them can follow in their everyday lives, at school or at home.

When first starting to develop the SAUCE programmes, the university academics and researchers were confronted with the core question of which methods are most appropriate for teaching these complex and often abstract issues of energy and climate change in a university context:

- How can we make young people think about their attitudes to energy, in terms of their personal everyday lives as well as in terms of policy?

- > How can we make people interested in what is often perceived as a „boring“ topic, and one that is often presented in a negative context – frequently covered by the media only in the context of natural disasters and catastrophes?
- > How can we make people feel responsible for the future, without them feeling patronised?
- > Last but not least, how can we achieve all of the above in just one day’s programme event at the university, which the individual schoolchild will attend?

All these questions show that the SAUCE teams had to engage in the search for, and acquiring expertise on, well-trying (but possibly new) approaches to successfully communicating scientific facts, social processes, and attitudes to children. In this search they were supported by their programme partners and by the exchange within the SAUCE consortium. And, based on the results of their monitoring activities over the three year project period, the SAUCE teams continuously adapted, expanded and improved the programme structure, contents and approaches. In cooperation with the lecturers and presenters the project teams have developed workshops which steadily became more practice oriented and consequently more relevant to the pupils. The programmes also included lectures with opportunities for substantial, active participation by the children. While teachers tended to prefer workshop formats, the lecture format can work well, e.g. at the beginning of the programme. It brings home both the role of the academy in researching the issues and providing solutions, but can also make a lasting impression on schoolchildren by virtue of the size and style of the university’s lecture theatre. This implied that the teams all spent time on instructing presenters, to support them improve their skills in addressing the children in the right way.

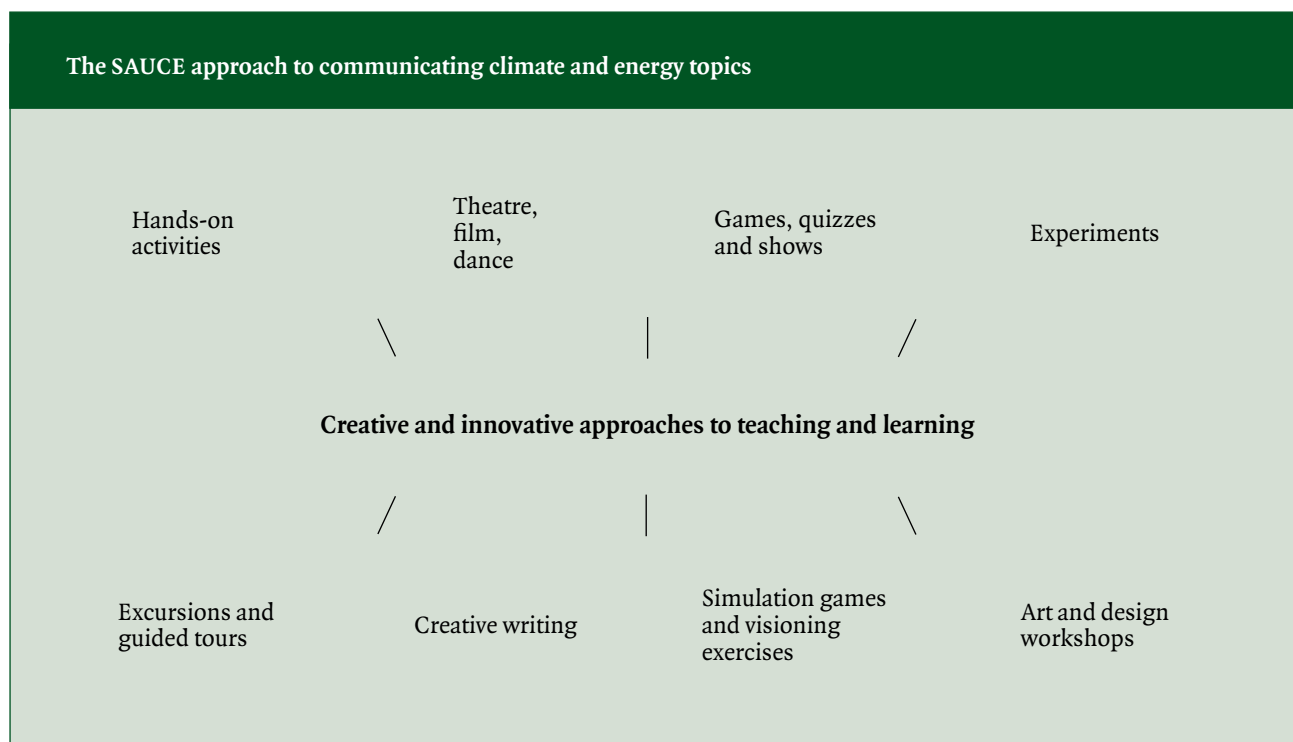
In this process, the SAUCE teams followed the basic principle that rich experiential learning outside the regular classroom is a proven component of successful learning, which has also been identified as a key to environmental, and hence energy and climate, learning. They also followed the conviction that fascination or pure fun holds the potential to give the children a chance to learn important information in a way that will stick with them.

All SAUCE programmes combine teaching of facts and contextual knowledge with practical, hands-on activities or activities which in another way fascinate and involve the children personally. Through direct, and often hands-on, experience children are given the opportunity to appreciate the key issues for themselves, using all five senses and investigating potential solutions and opportunities for action. The universities involved in the project in cooperation with their programme partners have implemented this head-heart-and-hands approach for the SAUCE programme events in many different workshops and lectures, of which several were tailor-made for SAUCE. The result is a variety of programmes which together provide a rich reservoir of programme elements and approaches to teaching the topics of energy and climate, including:

- > Science experiments to demonstrate chemical and physical process behind climate change, or to demonstrate renewable energy technologies
- > Workshops on production (‘growing’) and consumption of food, paper, models of renewable energy alternatives that include hands-on activities and teamwork, encouraging active involvement of the children while they take in the facts.
- > Guided tours to laboratories or university facilities which are combined with a “research” question, e.g. how can I draw energy from waves or what does it take to heat and cool (large) buildings?
- > Lecture formats have been developed which integrate quizzes and games, film sequences, and/or (demonstration or participatory) experiments.
- > Simulation games and city planning workshops on international climate change negotiations, the city of the future, or sustainable architecture, that explore children’s capacity to engage in debate, and help them develop citizenship skills.
- > With external partners, excursions to production sites and farms that illustrate relevant subjects such as recycling or organic farming.
- > Finally, the arts were harnessed to fascinate the children and release their creativity, including dance, mime, music, theatre and artistic shows, clownery, or making craft products (sculptures, jewellery) using waste materials.

Some SAUCE programmes primarily drew on the predominantly scientific-technical expertise of the host universities and therefore had a stronger technical focus. But like the other programmes they have also committed explicitly to the inclusion of aspects of the arts and humanities in promoting awareness and understanding of the issues. Over the project period, most partners experimented

with different approaches and programme partners and, learning from the exchange and experience in the SAUCE consortium, expanded their programmes' portfolio. To improve the balance between the three learning foci - "head", "heart" and "hands"- in the SAUCE programmes, some partners added more workshops and others added entertainment. All changes improved the local programmes, as reflected by the evaluation results.



SAUCE developed tailor-made, transferable activities which have been adopted by other education programmes

The SAUCE project promoted development of new workshops specially designed for the programmes, in particular by the universities' researchers but also by many of the external partners, who tailored some existing activities to the demands of SAUCE, or developed new ones in partnership with the host universities. For many of these workshops, an integrated art and science approach was used. Altogether, more than half of the workshops were developed specifically for SAUCE. Several of these have been adapted to other educational contexts and programmes, by formal and non-formal educators and by schools, locally and internationally.

For example:

- > Taking up an idea of the SAUCE team, the Meteorological Institute at the Freie Universität Berlin developed an activity which combines the standard tour of the institute's weather station with a workshop analysing climate change phenomena and reflecting with the children on activities to reduce greenhouse gas emissions. This activity has since been integrated in the portfolio of the University's Earth Lab and has been offered at the FU Kinderuni (the children's university programme the university offers independently of the SAUCE project) and on public science days.
- > The activity using creative writing techniques to help think and learn about climate change and protection of natural resources, developed for the Berlin SAUCE programme, was adopted by the Berlin programme for the implementation of education for sustainable development in its teacher training sessions and has since spread to several schools in Berlin.
- > In Twente, an energy game for children was developed in a cooperation of the University of Twente with Hengelo Museum. It has become part of the Museum's pedagogic programme.
- > The Berlin Hermann-Nohl-School, a bi-lingual primary school (German-Italian), linked its regular attendance at the SAUCE programmes with activities carried out as part of an international exchange under the European Comenius programme. Through this exchange both the topics and the interdisciplinary teaching approach of the SAUCE
- > Another example is reported from London. The wind turbine and hydrogen cell car workshops developed by Arcola Energy in collaboration with the London SAUCE programme will be presented in Abu Dhabi in November 2011 as part of a Science Fair, with ten 45-minute sessions per day delivered for local pupils, a further international 'result' for SAUCE.



5.1 Workshop examples

Learning about renewable energies

When the surf's up: Ocean waves as the power stations of the future

Experimental workshop

How can we turn the energy of ocean waves into consumable electricity – and how much energy will be made available as a result? Using the university's ocean wave laboratory we discover how much energy is contained within an ocean wave, and how this energy might be used.

Duration: One hour

Educators: University lecturers (PhD students) and engineers of the Institute of Civil Engineering, Aalborg University

Method: By experiencing energy in the university's ocean wave laboratory.

Introduction

Standing directly in front of the laboratory's wave generator, a young PhD student provides an introduction to this session by addressing the following questions: what is energy? How much energy is contained in wood, coal or chocolate? How much energy is contained in an ocean wave, and can we generate waves artificially to use them systematically for energy generation?

Hands-on activity

The lecturer explains how water power can be converted into energy and why water power is categorised as a regenerative energy source. Following this brief introduction, the children imitate the typical up-and-down movements of waves by pretending to be waves themselves. After this theoretical and physical "warm-up", the children are taken on a guided tour of the laboratory.

The lecturer explains how the energy of a wave can be measured, and what parameters are used in measuring this energy. He/she asks the children to undertake such

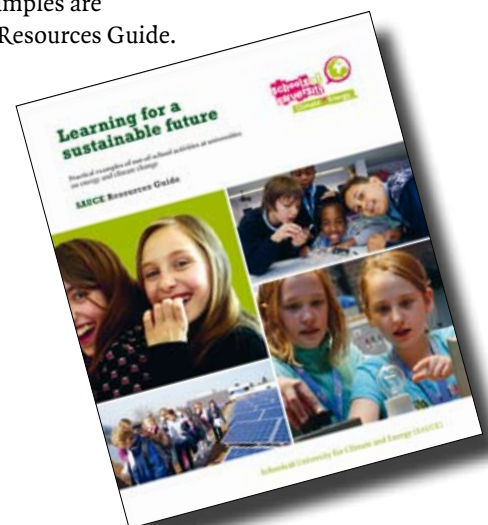


measurements themselves. The children enter the tank wearing waders and measure the water level. After the wave generator is switched on, they measure the height of the waves, also noting the length of the pauses between each wave. The complete data is entered into a specially designed form and collectively evaluated.

Objective

The objective of this workshop is to demonstrate how a wave power station works and how the energy of ocean waves can be used to generate electricity. From the measurements they take - in addition to their experience in the tank -, the children learn that the use of wave power is a realistic and exciting form of energy generation, one that is both renewable and sustainable.

Further practical examples are given in the SAUCE Resources Guide.





Sustainable consumption and lifestyle

Show me your feet! The ecological footprint

Hands-on workshop

Did you know that your lifestyle and energy consumption can be measured in terms of an “ecological footprint”? You can calculate an ecological footprint using data on energy consumption in your school or home. What information can you glean from this? We compare the ecological footprints of several cities and regions in Latvia with those of other cities and countries; and together we try to find ways to reduce the footprints of children’s homes and schools by changing behaviour and thus contributing to climate protection.

Duration: One-and-a-half hours

Educators: Scientists of the Department of Economy and Management, University of Latvia.

Method: Interactive acquisition of knowledge on the concept of the ecological footprint, with quiz elements.

Introduction

By conducting a fun quiz, the lecturer explains what exactly is meant by the term “ecological footprint”. It involves a method which allows for the calculation of the amount of space on earth that would be necessary to support a certain lifestyle and standard of living for every individual, including the volumes necessary for the production of food and clothing, and for energy generation. The resulting “carbon footprint” can then be used to demonstrate the differences in the consumption of raw materials and energy (i.e., the various “footprints”) that exist between countries and/or regions.

Hands-on activity

Prior to this activity, children and teachers are asked to gather information about the energy consumption (electricity, gas, water) of their school and homes, and to bring this data with them. Following the



introductory session, the children feed the data into a computer. The ecological footprint of their school is calculated; thereafter, the children learn how to transmit this data to their own personal consumption. During the workshop they calculate the ecological footprint of their families and friends.

Discussion

On the basis of the results produced, the children discuss the concept of the “ecological footprint”, as well as solutions for reducing the footprints of their homes and school. What feasible alternatives are there, in terms of a climate-friendly and resource-conserving nutrition or mobility? What can each individual do to protect the environment?

Reflection

The children discuss the question of how they can make their families and friends aware of the concept of “ecological footprints”, and how they can persuade them to adopt a more climate-friendly way of life.

Objective

The objective of this workshop is to give children an introduction to the basis for calculating an ecological footprint, allowing them to determine if and to what extent their lifestyle is sustainable, and to find out how they can improve this through changes in their day-to-day behaviour – those which include modest initiatives regarding nutrition, mobility and consumption.

5.2 The impact on schoolchildren

The findings on the SAUCE programmes' impact on the participating schoolchildren, depicted in this section were derived from questionnaires and interviews with a very small cross-section of the children who participated (app. 10%) and from statements by their teachers. Additionally, results from a master thesis project have been included. These results therefore must be understood as tentative.

The schoolchildren appreciate the university environment

- > Irrespective of the individual programme activities the schoolchildren attended, running SAUCE in the University introduced pupils to what was, for them, an impressive learning environment, including the scale of the buildings, a large auditorium, a large open space for breaks and some events, sometimes even gym and dance studios, and, of course, science lab facilities lacking in primary schools. Thus, the university as an out-of-school place for learning clearly added value to teaching children on the theme of climate and energy, even, when addressing children aged 10-13 years.
- > For about half of the schoolchildren, the SAUCE program was the first contact to a university. They usually were, as were all other children, proud to have been at a university and outside of their local neighbourhood. The SAUCE project's give-aways (lanyards, student IDs), but even more so the things produced at some of the workshops (e.g. PV cells, sculptures), to take home worked well to keep this new and special experience alive and visible beyond the programme day and carry it into the children's schools.

The children like the SAUCE programme content and approaches

- > In general, the children received the programmes very well. Particularly regarding the hands-on activities challenging the children's creativity or investigative curiosity, their reactions were very positive. Furthermore, they appreciated to be addressed by "real" professors, professionals

or artists, and to be taken seriously by them. The children proved to have huge absorptive capacity which showed in the evaluation directly after the classes and, if carried through, also in group talks sometime after the event. Most pupils indicated to have clearly benefited from attending the programme and remember the programme as a positive experience.

- > The children were reported to have been motivated through attending the SAUCE programmes to further engage in the topics. They have a sense that they can make a contribution, and in the final get-together at the end of each programme day, show great enthusiasm for making a difference, 'changing the world'. Pupils report making efforts to change energy behaviours at school and at home after the programme. When offered the opportunity by their teachers, they have enthusiastically participated in energy saving activities and other energy projects at the schools.
- > Further evaluation results indicate that the SAUCE programmes made the pupils confident about the future, because they saw that experts and university researchers seriously work on solutions to the problems. Thus, SAUCE counteracts predominating media reports on current or future catastrophic events, which the children are usually confronted with.

The SAUCE programmes seem to effect learning on an emotional level

The master thesis presented by Bianca Adami, member of the SAUCE team at Freie Universität Berlin, provides some interesting insights into the learning effects on pupils which events like the SAUCE programmes might have. For her investigation, she interviewed ten pupils from two different schools using open interview techniques. The aim was to identify long- or mid-term effects on the children's environmental knowledge, consciousness and willingness to act. The children had participated in the workshop "climate breakfast" and were interviewed five months after the SAUCE programme week. In the meantime, the topic had not been taken up again at the two schools. The investigations results showed

- > That the issues of climate change and energy as such are known to the children because they are part of the common discourse at school and in the media.
- > But that the children upon being asked by the interviewer were not able to explain or recollect the basic facts or terms about climate change (greenhouse effect, CO₂, etc) which

had been presented to the children in the course of the event. Thus, their abstract factual knowledge had not been expanded by the visit.

- > That they did have a clear opinion and even intention with respect to personal activities with regard to food choices and the environmental qualities of regional, seasonal and organically grown food. This had even motivated some of the children to try to change their families' food shopping habits.
- > That after the emotional level had been touched in the interview, the children were able to explain some context-related facts about climate change and energy, such as the interrelation between long transportation routes and high CO₂-emissions.

- > And, in conclusion, that increasing the level of environmental knowledge did not prove to be a precondition for increasing the level of environmental consciousness.

Thus, the effects of participating in the SAUCE programme workshop may be identified primarily on the emotional level, which had been influenced by the event. The abstract factual knowledge was not improved, but when linked to the emotional level related facts were recalled. In conclusion, the children's preference for participatory formats with experiments and other hands-on activities that engaged them at an emotional level is complementary to these results. In contrast, the transfer or "teaching" of pure facts in and of itself is boring to them, and if it retains an incidental and isolated character hardly improves their factual knowledge.





6 Reaching Out to teachers and schools

6.1 What SAUCE offers the teachers

Teachers are the key link to keeping the programme's message alive in the minds of pupils after the SAUCE programmes by adapting and transferring the content and methods of the SAUCE programmes to their schools. Therefore, SAUCE placed special emphasis on reaching teachers, along with their classes. Of course, both were addressed by the SAUCE programmes – by the presenters, the hard facts to be discovered, the stories told, the teaching approaches chosen, and indirectly, by the reactions, contributions, and often enthusiastic and creative responses of the children. This experience which definitely produced positive impacts, as the project's monitoring has indicated, was supplemented by several activities directly addressing teachers. While the SAUCE universities all pursued different strategies,

combining different elements for this task, the guiding principle for choosing and shaping these activities has been to provide low-threshold, easily accessible tools for teachers to motivate their own and continued activities.

One important element was to establish and maintain steady communication with the teachers before, after and in between the programmes. Not all school systems are equally open to out-of-school activities, and in some cases, considerable effort was needed to reach and attract teachers who are subjected to increasingly demanding work schedules. Once established, this exchange allowed us to adapt and improve the programme content over time. Since the bulk of communication was only possible on a one-to-one basis, the endeavour was very time consuming, but nonetheless productive.

A second element was to acquire professional advice from local education experts, such as the project's official cooperation partner

UfU e.V. (Independent Institute for Environmental Issues). The local SAUCE partners found different ways of getting the needed advice, sometimes in exchanges on a case by case basis, sometimes by founding local SAUCE governance groups or steering committees. This helped to meet the challenge that at the partner universities, except for the Latvian partner, the SAUCE programme teams had not had professional contact or exchange with the primary or secondary education sector before.

A third element was to offer preparatory information meetings along with each programme delivery to give teachers some insight into the programme and its topics, and to make teaching resources available to them. In this forum university academics may provide state-of-the-art research reviews. Education experts, ideally those who also present at the SAUCE programme, make very good partners for demonstrating well-tested teaching resources. They can provide practical advice and valuable insights from a personal perspective. But also all other energy education experts and organisations were invited to attend the meetings to facilitate a direct exchange with the teachers. The feasibility of implementing these meetings turned out to be very much shaped by the local school systems and educational traditions. These influenced the teachers' motivation or capability to participate in additional activities that naturally had to be scheduled outside their regular teaching hours. Several factors influencing the teachers' response were identified:

- > The teachers' workload: Many teachers are confronted with a workload that leaves little or no room for additional obligations or extra personal engagement. In countries such as the Netherlands or Denmark, primary school teachers hardly have time for extra activities. So, many of the teachers attending the SAUCE programme were newcomers to the topics for their teaching. This is different in other countries, e.g. Germany, where primary school teachers have much more room for own topic choices and therefore usually look out for opportunities to supplement and expand their own teaching programmes.
- > The established system of continuing professional training of teachers: The SAUCE offers were more easily welcomed in systems where teachers are

encouraged and sometimes even obliged to participate in a minimum number of training programmes of their choice and which are offered by public professional institutions but also organisations from the voluntary and private sector.

- > The educational system for teachers: Teachers with university educations are much more easily motivated to attend continued training programmes at university than teachers who were trained at pedagogy schools operating entirely separated from the university system.
- > Incentives: If participating teachers were given first choice of places in the coming SAUCE programme, this motivated many of them to take the effort and time involved with attending the preparatory meeting.

The SAUCE partners' experiences in Germany, Austria, and Latvia, proved that afternoon information and training sessions attract interested teachers. In Denmark, the Netherlands and the United Kingdom, teachers were not receptive to informational meetings or continued training classes at universities. In these cases, the SAUCE partners distributed teaching materials and supplementary information to the teachers during the SAUCE programme itself.

In most cases, it was the SAUCE partners' experience that a lot of effort was required to raise the attention of teachers, because, initially, the universities were newcomers to the institutional contexts teachers refer to. And usually, traditional PR does not reach the special target group of teachers, thus other communication channels needed to be found. Furthermore, this task required careful timing with regard to the schools' planning and schedules. However, over the course of time, as the SAUCE programmes became known for their good performance, the local networks and, not to be underestimated, word-of-mouth recommendations contributed to attracting teachers to the SAUCE programmes and raised their sustained interest in the topics.

6.2 The impact on teachers and schools

As no full-fledged or in any way systematic survey of the participating teachers was done under the project, findings on the impact on teachers and schools are not amenable to generalisation. Therefore, no quantitative data may be derived from the results. Nevertheless, the SAUCE programmes' evaluation and several interviews partners led with teachers indicate that the programmes, their content, topics and approaches, are very much appreciated by the teachers and, indeed, have positive effects with the teachers and at the schools. The following findings may be derived from the surveys:

Teachers personally appreciate what SAUCE offers to them

- > In several countries, particularly in Denmark, the Netherlands and Latvia, but also in the other partner countries, the teachers indicated that they never could have been so efficient in teaching such difficult themes as climate change and renewable energy technology as the SAUCE programmes were in one lecture or one day. Therefore, in this way the SAUCE programmes clearly have added value over the regular primary school classroom teaching. This holds true particularly for those countries where regular teaching at schools hardly allows to cover the themes of climate change, energy efficiency or renewable energy.
- > All programs have been designed by university staff members or other experts on climate and energy. The overall high quality content of the lectures was clearly noticed by the teachers and very well received by both children and teachers at all locations. Only incidentally the intellectual level of the event was perceived as too demanding for the children.
- > Throughout the partner countries, teachers indicated in interviews and conversations that the programme had also influenced their own thinking and knowledge about the topics of energy and climate change.

- > The positive perception of the programmes by teachers is substantiated by another result: As the SAUCE project progressed, mouth-to-mouth propaganda among teachers became an important factor for recruiting participants.

Teachers are motivated by the programmes to teach the SAUCE subjects at school

- > In all SAUCE countries, between 50% and 80% of the teachers surveyed indicated that they intended to follow up on the themes of energy and climate change in their regular classes. One survey from Berlin showed that 14% of the teachers planned to organise specific events at their schools as a consequence of their participation in SAUCE.
- > Surveys among teachers indicated that the majority had already taught SAUCE subjects before. This is not surprising, because teachers interested in teaching these subjects predictably tend to look out for opportunities like the SAUCE programmes more so than the average teacher might. Nevertheless, the SAUCE programmes are also important for these teachers. Several personal interviews indicated that teachers look out for and need support through projects like the SAUCE programmes, e.g. to motivate the children and, often, to counter-balance the de-motivating response from heads of school or colleagues with regard to teaching energy efficiency or many environmental topics, which, apparently still poses a serious problem for teachers.
- > As some SAUCE partners (Latvia, United Kingdom) were cooperating with schools involved in other green networks, and with these networks themselves (UK-Islington Sustainability in Schools, Eco-Schools), it is difficult to isolate the direct effects of the SAUCE programme, but positive changes in schools' energy management in their buildings correlate with attendance at SAUCE, and a number of teachers have indicated how SAUCE also fits with and supports aspects of the curriculum (e.g. the UK 'Eight Doorways' approach, water and energy, global citizenship).
- > In summary, the findings clearly indicate that teachers are supported and inspired by the SAUCE programme and are motivated to continue and even expand their teaching on energy topics. The teachers, thus, act as important disseminators at their schools.

Teachers apply the materials and ideas presented at the SAUCE programmes in their own teaching.

- > The materials presented during the SAUCE programmes or at the information meetings have very often been used by the teachers in class, often for several of their classes. Several teachers have reported to have adapted experiments and approaches from the SAUCE programmes for their own teaching. And they have been used in the context of a large variety of subjects. Some have been passed on to colleagues, too. When asked, teachers pointed out the well-tested and ready-to-use quality of the teaching materials as one important factor for successful adoption.
- > Sculptures, experimental objects or written resolutions pupils had created during the SAUCE programmes were displayed at their schools in exhibitions or during public demonstration days. Often the children and teachers put in extra hours to sum up the results and their experiences for poster presentations to pass on the message to fellow schoolchildren.



The SAUCE programmes have inspired activities with external partners at the schools

- > Individual SAUCE programme partners were invited to schools for additional activities. For example, the SAUCE team at University of Twente developed relationships with several schools in the regions that were interested in special programs for children. In Zwolle, researchers cooperate with a highschool and offered special science programmes for the youngest pupils.
- > In another example from Berlin, candidate political science teachers from Freie Universität Berlin repeated their SAUCE role game on climate change negotiations at a primary school. One teacher reported that her school worked together with the Potsdam Institute for Climate Impact Research

Beside to the SAUCE programme's quality as such, continuous and reliable communication with the teachers is the most important factor for successfully reaching teachers and schools in the SAUCE topics. Additionally, inviting teachers and educators to preparatory information meetings clearly have a positive and supportive effect on networking among teachers, energy education experts and the respective universities. The continuity of the programme over successive years proved to be an important factor for reaching and engaging teachers.

The success of these meetings and requests by teachers participating in the SAUCE programmes are evidence of the engaged teachers' need and demand for teaching materials on energy (efficiency) for successive school levels. In some countries, e.g. in Germany, the situation has improved over the project period. Several public institutions and non-formal educators have meanwhile published high quality teaching materials. But generally, teachers still need more support in finding adequate materials, and ways to create time and space for applying them in classroom teaching.



The SAUCE programmes have initiated energy saving activities at schools

One important focus of SAUCE is energy efficiency, including behaviour change and low carbon technologies that offer everyone everyday opportunities to save energy. Sometimes this inspired immediate action by the participating schoolchildren and their teachers to save energy. For example:

- > After attending the SAUCE programme in 2011 at University of Twente, the Dutch primary school from Enschede, IBS Eschmarke decided to seek professional support to reduce the school's energy consumption. A company specialising in energy efficient solutions was commissioned to refurbish the school's heating and ventilation system. The refurbishment went hand in hand with further teaching of sustainability topics at the school.
- > At the Berlin elementary school Schule am Friedrichshain, after they visited at the SAUCE programme in 2010, the schoolchildren together with their natural science teacher developed an energy saving project: they measured room temperatures at the school throughout the heating period. The results were communicated to the school's janitor/caretaker who was then able to readjust the heating system and to set it to a lower temperature.
- > At another Berlin school, Waldschule Gerdes, the 25 children and their teacher, who had participated in the SAUCE programme's workshop on recycled paper, persuaded their whole school to join the German-wide "Initiative 2000plus" and commit to switching all paper used at the school to 100% recycled paper. The SAUCE workshop had motivated the children and pointed out to them what they could immediately do at their school, including how they could find reliable recycling paper suppliers
- > The evaluation reports by children attending the London programme showed that pupils had initiated energy-saving activities both at home and at school on their return.





7 University as a hub for the local energy education network

It was essential to the implementation of the SAUCE project that SAUCE partners fostered networking activities. In order to develop a SAUCE programme structure best suited to the regional needs and potential, it was necessary to contact programme contributors from within and outside of the universities, consult non-formal educators, teachers and schools, and, if possible, involve politicians and acquire sponsors. Some programme contributions required seeking options for cooperation between scientists and/or educators to implement the interdisciplinary approach. With every new SAUCE programme developed, the SAUCE teams' knowledge of the regional energy education activities and potentials grew, as did their experience and competence with regard to quality and potential of different educational approaches. Consequently, as time progressed, the SAUCE universities themselves

were often regarded as a source of support for energy education, not only by the teachers but also other energy education actors.

Several activities may be identified as having positively influenced the networking process: first, public relations activities, and, second, establishing and, if possible, institutionalising cooperation with local environmental actors, political decision makers, and university faculties and leadership. As a result, the universities' SAUCE teams acquired attributes of what might be called "regional energy education networkers". However, in terms of time and effort, these tasks turned out to be the most demanding

7.1 Public outreach activities

Public relations activities were usually carried out in close cooperation with the SAUCE partners' PR professionals. That included press releases, review articles and interviews. The activities primarily served to make the SAUCE programmes and project activities known in the region, i.e. among the general public, but also among educators and politicians, and thus provide project visibility. The local media's response to press releases varied. Generally, SAUCE universities in smaller towns generated more news reporting than those in large metropolitan areas, where competition for a news slot is high.

Furthermore, PR activities were also important for communications about the SAUCE project within the universities, to colleagues at other faculties and, last but not least, to the university administration. Press releases or news reports in campus magazines have all contributed to raising the administrations' awareness and, in several cases, securing their active support for SAUCE projects.

New media were also utilised: the Austrian SAUCE team produced two video clips about the SAUCE project, in cooperation with the PR Department at the Vienna University of Technology. The first one is an amusing overview on SAUCE in Vienna. The second focusses on content, giving some insight into what SAUCE means and how it works.



7.2 Establishing cooperation structures

The second important part of the networking activities was to maintain continuous communication and cooperation with members of the universities and external educators. The partner universities' SAUCE teams each chose a slightly different emphasis when establishing the respective cooperation structures. SAUCE programme development clearly profited from networking activities and the intensive exchange emanating from it. Keeping these cooperations alive proved to be an important factor for maintaining and improving SAUCE programme quality.

- > At some universities, the SAUCE teams established forums or steering groups that met regularly to develop the programmes and related activities. These often included representatives from the local community, including organisations involved in environmental and energy education—as was the case at the Universities of Aalborg and Twente.
- > Furthermore, at several universities, the SAUCE teams initiated close cooperations among university researchers involved as presenters in the programmes, thus improving internal visibility and support for the SAUCE project. (as was the case at the Universities of Aalborg and Twente, and at Roskilde and Latvia Universities.)
- > In Latvia, the SAUCE team worked through its existing ties to the eco-school network.
- > The London SAUCE partner entered a formal cooperation with the local government-sponsored institution for environmental education.
- > SAUCE teams in Germany and Austria established contacts, and in several cases, formal cooperations between various partners of the governmental and non-governmental education networks, and maintained them throughout the project period. Instituting additional groups was deemed unnecessary, as ample communication structures among actors involved in energy education already existed.

7.3 The impact of networking

SAUCE was successful in involved university researchers in the SAUCE programmes

As a result of the intensive networking and communication activities within the university, SAUCE teams succeeded in building productive working relationships, with as many as six different faculties and their researchers, that lasted throughout the three-year project period. In the course of this cooperation, university colleagues designed and redesigned a set of workshops and activities which have steadily become more practice-oriented, and consequently more relevant to the children. To make this possible, each one of the researchers involved invested many hours and personal effort, which usually was not financially rewarded. Given the current academic assessment system based on criteria such as scientific publications, graduate and under-graduate teaching and testing, or total of solicited research funds, the researchers' voluntary, "non-academic" engagement in projects like SAUCE can in no way be taken for granted.

SAUCE increased cooperation and awareness within the universities

Organizing SAUCE programmes improved communication and exchange among different faculties and among the researchers and students at several of the partner universities, bringing the faculties and disciplines closer together. Being involved in the SAUCE programmes raised the faculties' members' awareness of how climate and energy issues can be approached, from an educational but also personal perspective. Furthermore, the faculties involved in the SAUCE programmes all profited from the public attention raised by the SAUCE programmes as their own visibility internal and external to university was raised, too.

SAUCE networking made academic expertise available to the local network for energy education

SAUCE networking activities, and the competence gained during the course of developing SAUCE programmes have benefited the local energy and environmental education networks. At several partner universities, SAUCE team members or researchers have established working relationships with educators or institutions active in local energy education. For instance, at Twente University, the SAUCE team has established ongoing

collaboration with the local organisation offering regular energy and environment programmes for primary schools. The focus and content of the activities is open, but it has been decided that the SAUCE team will offer programme activities whenever suitable. One of the Austrian SAUCE team experts was invited to organise an "energy school camp" held in early 2011. Researchers from Freie Universität Berlin were invited to participate in expert panels and teacher-training seminars on energy and environmental education methods, and to advise on curriculum development for a newly founded "sustainable school" in Berlin. And the Aalborg team designed a full-fledged energy-efficiency school programme for Aalborg Kommune (cf. Success Story No. 5).

SAUCE networking increased visibility of SAUCE among education actors

Another consequence was that through cooperation with external partners, SAUCE projects' local and national visibility increased. Cooperation partners used their communication networks to propagate SAUCE and the universities' activities thus as acted as intermediaries and multipliers. Over time, networking activity helped to establish the positive reputation of SAUCE among energy educators beyond the local regions' boundaries, as reflected by numerous articles published in education magazines, e.g. in Denmark, the Netherlands and Germany..

SAUCE networking made innovative energy education actors locally visible

The SAUCE programmes and the related networking activities served to make the programme contributors, their organisations, projects, and approaches better-known among actors involved in energy education and among political decision makers. Voluntary organisations and in particular, individuals offering innovative out-of-school activities without professional support structures, all profited from their association with the university run SAUCE programmes, and expanded their visibility radius.

SAUCE networking raised financial support by public or private funds for the SAUCE programmes

The networking activities allowed the SAUCE partners to expand the scope and size of the programmes by acquiring additional financial support and/or voluntary programme contributions from several external partners. These partners included environmental organisations, local municipal governments and, in the case of Austria, even federal ministries. But it also included large private sponsors, such as Deutsche Telekom, a major sponsor of the Berlin programme, or enterprises such as local stores which sponsored prizes or snacks. In other instances, the responses from potential sponsors and supporters did not meet the SAUCE teams' expectations. In some partner countries, this must be attributed to the financial situation and difficulties resulting from policy changes that reduced spending on education in the aftermath of the financial crisis of 2008. Nevertheless, in many cases, the relations that were established could be maintained and made to bear fruit for the project beyond the project period (cf. Success Story No. 8).

Profiting from European networks: SAUCE initiated the Aalborg Kommune energy efficiency programme for schools

The Aalborg Kommune energy efficiency programme for schools is certainly one of the most far-reaching achievements of the SAUCE project and a good example of effective European networking. To implement the SAUCE project, the Aalborg University SAUCE team (AAU) created a local network group consisting of educational consultants, representatives from the municipal school administration, and science teachers, who all were highly interested in expanding their cooperation with the university.

AAU initiated a cooperation project to support teaching and implement energy efficient behaviour at the local schools. In this project, AAU worked with the commune's health and sustainability administration, the school administration, two electricity companies and three schools. Throughout 2009, this group developed and tested science teaching methods and ways of organising and motivating energy conservation in schools and everyday life. Convinced by the project's results, the local administration decided to introduce incentives allowing schools to profit from savings achieved, if saving targets were met. Since the programme's official start in the 2011 school year, all schools have been obliged to reduce energy consumption by 2% annually.



AAU also developed an energy saving handbook for schools, a compilation of good practices and activities, collected from different schools in Denmark and Germany. Aalborg Kommune has used the handbook to train housekeepers at all 50 schools in Aalborg and recommends that heads of schools refer to it for routine organisation of everyday tasks at their schools. Meanwhile, the neighbouring municipality of Rebild has adopted the handbook (available at www.skub.aau.dk).

The local network not only profited from AAU's engagement, but also from the network of IEE projects which provided access to the European Euronet 50/50 project: at the beginning of the energy saving project, AAU researchers were able to have a face-to-face exchange with Euronet 50/50 partners, who disseminate models for energy conservation activities at schools. This contact was made possible through the Euronet 50/50 partner and SAUCE subcontractor, UfU e.V. from Berlin.



8 Dissemination of SAUCE to other European universities

A main goal of the SAUCE project has been to pave the ground for adoption of the SAUCE programme model by other universities, in the SAUCE partner countries as well as other member states of the European Union. Toward this goal, SAUCE partners utilized their national and international academic networks and presented the project at national and international conferences, on the occasion of research exchange meetings with colleagues in European member states but also beyond. Interest was shown particularly from the United States and Commonwealth States and but also from Japan and Russia. The UK programme coordinator was invited by UNESCO to a meeting in the Caribbean to describe the SAUCE programme with a view to it being replicated there, including in EU Overseas Territories.

To facilitate dissemination during and beyond the SAUCE action, project partners compiled the SAUCE handbook with the essentials from SAUCE partner's experience in developing and organising successful SAUCE programmes. A second publication, the SAUCE Resources Guide, depicts the didactic approaches and topical composition followed in the SAUCE workshops, lectures and other programme activities. The publications address universities but also societal and political stakeholders in energy education and are available in five European languages.

During the project, SAUCE partners addressed individual university researchers, institutes or university's children's programmes to bring forward the SAUCE model to them. The general conditions at the academy which partners had to face in this effort did hold some challenges. In several partner countries (notably Austria, Germany, Latvia, United Kingdom), academics or universities as a whole have been exposed to manifold pressures arising from reforms and

financial pressures, causing an increase in teaching and administrative workload for academic staff. Furthermore, quite generally, activities under projects like SAUCE do not qualify in the system of academic assessment. Consequently, many, particularly younger, researchers were found hesitant to take on the responsibilities entailed with organising SAUCE programmes at their university. Therefore, while the programme idea as such usually was welcomed, it was the exception that the universities addressed actually adopted the idea. Nevertheless, the SAUCE project did make some important headway with a view to visibility and recognition. The serious interest has been raised by several universities to carry out variants of SAUCE programmes and, increasingly so in the final year of the project, educators and political stakeholders involved in environmental education have recognised the innovative character and educational potentials inherent on the SAUCE programme model. This has materialised in invitations brought forward to SAUCE partners to provide expert input to the drafting of education strategies or in the addition of university programmes for schools to the list of education activities to be supported under the 2011 tender of the German federal government's national climate initiative.

Several lessons for future dissemination of the SAUCE project can be derived from partner's experience: Interestingly, university institutes and researchers who already ran well established outreach programmes addressing children as well as schools, usually did not conceive of any added value from adopting the topics or establishing additional contacts to schools through a SAUCE programme. By contrast, universities or faculties which were in the process of establishing new science programmes for children were very much more ready for exchange and adopting elements of the SAUCE approach because they were looking for inspiration. Also universities with well-established and financially settled structures for the organisation of children's universities were interested, possibly, because they have the thematic flexibility and do not rely on the personal engagement of individual researchers as science labs often do. But in the European context, these professionalized units (e.g. the "Kinderbüro" of Innsbruck University in Austria) still are an exception. Finally, the involvement of external partners who can contribute educational expertise and/or financial support seemed to facilitate adoption of the SAUCE programmes.



SAUCE project meeting at Aalborg University, Denmark



9 Achievements of the action and lessons learnt

SAUCE was developed as an innovative programme model offering energy and climate education to schools

The SAUCE project has successfully developed a model programme for energy and climate education, which universities offer as an out-of-school learning event for schoolchildren and their teachers. In the three years of SAUCE, its special contribution has become clear. The idea of inviting children to the university has become quite common these days, but offering them a one-week programme with a variety of lectures, workshops and excursions is different, as is offering an integrated, focussed programme on climate and energy. As energy experts, SAUCE teams managed to develop and offer a programme for children which proved popular with them and their schools.

Thanks to the interdisciplinary approach followed in the project, SAUCE covers a wide variety of themes and approaches which have attracted teachers from many different subject specialisms (natural sciences, geography, arts, language, ethics, and others) and supported the integration of energy issues into their teaching at school.

From an educational perspective, the SAUCE project highlights the potential of problem-based learning for a novel approach to science and technology communication: in SAUCE, scientific facts, problems and skills are not taught in isolation, but in the context of practical challenges, and in collaboration with other disciplines that can help with solutions in raising awareness and changing behaviours. Thus, SAUCE in many ways goes beyond what is offered by projects and educational offers promoting Science, Technology, Engineering and Mathematics (STEM) and the public understanding of science. This is important on an individual level



SAUCE programmes were held at other European universities

Practical dissemination of the SAUCE project initiated the integration of elements of the SAUCE programme in the delivery of science programmes for schools at other universities in the partner countries.

One programme was held in Deventer in the Netherlands in early 2011. It was developed in a cooperation project of the SAUCE team from University of Twente with the teacher's university in Deventer, and SABUKI, a science café for children. This two-day event attracted 900 children and included a SAUCE lecture on climate protection and renewable energy which was offered nine times during the programme.

In Austria, SAUCE programmes were held in Innsbruck, Salzburg and Krems thanks to the financial and programme support of the Vienna SAUCE team. A two-day SAUCE programme in Innsbruck included more than 350 participants, and the other two, smaller programmes received very positive feedback, for organisation as well as content.

as it makes it easier for the children to internalise or understand what they are being taught by providing room for emotional associations to form. It is also important on a political or policy level, as this difference from STEM programmes is what led to the positive evaluation of the SAUCE project as Project of the UN Decade for Education for Sustainable Development in Germany, where most STEM motivated programmes offered by universities are not eligible for this recognition

In SAUCE, the intention is to transfer knowledge about the challenges of climate change and energy issues but simultaneously to demonstrate positive options for sustainable energy behaviours and technologies. By involving the children in hands-on-activities, by posing exciting practical challenges, and by linking the issues to the children's everyday behaviour, the topics and the related disciplines appeal to them. They are immediately ready to learn, to absorb the lessons, and are even ready to take action in their everyday environments. Thus, the SAUCE programmes are geared to initiate a first, but important, step to successful learning by stimulating interest and a qualified optimism that we can solve at least some of the problems. It has been the experience of SAUCE that addressing children at this age has worked well because they are starting to think in complex terms. They are not yet set in their opinions, but are starting to form them. They also have few inhibitions about raising serious questions about the moral and ethical implications of climate change. Also, SAUCE they experience SAUCE before they have to make choices in some national educational contexts (e.g., the UK) between an emphasis on humanities or on natural sciences in their secondary schooling.

However, teaching children is a special skill, and a distinct challenge to those not trained for it. It is also important that established academics recognise this. It certainly takes some experience to get a sense of the right mix for workable approaches. We can view the different series of SAUCE programmes as a series of experiments with changing methods and substantive content, each programme an iteration of the previous one. The SAUCE project experience did show that energy experts and university researchers can make a valuable contribution to the energy education of children, but the impact was greater if the approach was appropriate to the age of the target group of pupils. Linked to this is

the difficult choice to be made between numbers of pupils involved and the effectiveness of the programmes, which depends on local factors such as education systems and will therefore necessarily remain a local one.

SAUCE demonstrated that universities can make a valuable contribution to capacity development for local energy education

With respect to the role of the university as an institution, several points may be made: First, the university and its campus can provide a productive learning environment for young children, and has proven to be a suitable and well-equipped place for teaching about energy and climate change. Teachers also explicitly appreciated the university as a place for learning independent of commercial interests, in contrast to energy education initiatives sponsored by energy utilities.

Second, the university has also been an effective agent for networking. SAUCE brings together local actors from the academy, policy, the voluntary sector, economy and schools, with universities acting as a hub for development of networks of actors in energy education. Universities are well-suited to take on this role. Their institutional status and their positive reputation serve as a door-opener to many, making it easier to win partners, and thereby raising their own profile.

This involved intense and unexpected levels of effort in building a network for SAUCE and for convincing individual actors to engage in SAUCE. This is particularly true when it comes to the university itself, its administration and potential programme contributors, as children are not their usual target group. As a consequence, the networking effort has placed exceptional demands on the staff developing and delivering SAUCE, given the contrary incentive structure of higher education today, especially for research-active staff. Therefore, SAUCE has been a labour of love, or at least a labour involving a substantial proportion of voluntary staff time, for participating academics.

From a management perspective, the three-year project period under the Intelligent Energy Europe programme has proved appropriate. This gave just enough time to develop, test and refine the SAUCE programme model and establish productive links to the local education network. By the end

of the period, the SAUCE programme was a well known educational format and highly regarded, both by educators and decision makers, across the SAUCE partners' regions. Having sufficient time to develop SAUCE was important in order to prepare the ground for a continuation of SAUCE at the host universities after the end of the project period in August 2011.

With respect to the dissemination of the model to other European countries, the SAUCE partner universities have demonstrated that the model itself is flexible and can be modified and adapted to the different local educational contexts and the respective university's specialisation and structure. To this end, SAUCE partners identified and published key elements of transferable best practice, but also had to recognise the limits to transferability. Respecting time and other constraints in present academia, availability of an organisational and management framework at the targeted universities as well as financial support from external partners have been identified as major success factors for dissemination. Furthermore, dissemination of SAUCE became more effective in the final project year, when accounts could be based on the partners' own learning experience.

SAUCE in the coming months

The primary task in the coming months will be to continue dissemination of SAUCE throughout Europe. Presentation of project results to member universities of EUCU.NET at the network's Annual Conference in Ankara, Turkey, in November 2011 will be a first step, with a focus on results of the SAUCE evaluation. This will be followed by further presentations at academic conferences regularly attended by individual SAUCE partners, at national and international level. Some partners have plans for dissemination of SAUCE to the African, Caribbean and Pacific countries in the longer term. Dissemination will also be enhanced through development of research interests stimulated by the SAUCE educational methodology.

Policy stakeholders and educators will be the second important national target group, in efforts to raise support and funds for future programmes. Reaching these target groups will also serve to disseminate the SAUCE

approach to educators and teachers, including potential SAUCE partners at local level. The dissemination effort will be supported by the two major SAUCE publications, the SAUCE Handbook and the SAUCE Resources Guide, with additional information made available on the project website to be relaunched in December 2011.

The majority of SAUCE universities will continue with their own SAUCE activities. This continuity will lead to further partnerships, strengthen the European and the global energy education network and allow further refinement of the SAUCE approach.





10 Conclusions and Recommendations

This report shows that ‘SAUCE’ has more than met its key aims and objectives. The programme has provided a mix of events and learning experiences appropriate to the complexity of the topics of energy and climate change, to the variety of local contexts in which the programme has run, and to the target age group of children. Taken as a whole, it has exceeded the planned scale of provision of places at SAUCE events. It has also served to better integrate universities into existing environmental education networks and to develop or strengthen such networks.

The SAUCE programme format that has emerged is flexible in both content and structure, acknowledging the value of full contextualisation of the programme according to type of university, its location, national ESD experience, and so forth. What partners have

demonstrated is that specialists in energy, the arts and the social sciences can work together to make a valuable contribution to education in climate and energy, be it through their own contributions to programme content, and/or by taking on a managing role bringing together the various disciplines and actors and negotiating with them the development of topical approaches for the programme. Ultimately, this may also reflect the emerging function of universities in facilitating the sustainable development of their communities and their acceptance of social and economic responsibilities, which in turn provide added value to the universities.

There have also been clear benefits to the participating universities. They have enhanced their reputations in the local and national communities concerned with improving performance in mitigation and adaptation in response to climate change, in particular with regard to renewable energy policies and appropriate energy behaviour. They have also been given the opportunity to demonstrate

SAUCE programmes will prove 'sustainable' and continue to be run at SAUCE partner universities in 2012 and beyond

Thanks to continuous and intensive networking, three SAUCE universities have officially committed to offer SAUCE programmes beyond the end of the IEE-funded project period. To secure this commitment, SAUCE partner institutes needed to convince university leadership to promise organisational support and funding of staff and also to find partners to finance part of the programmes or take over part of the organisational effort: At Aalborg University, support has been obtained for continuation of the local SAUCE programme SKUB as a permanent institution, which will allow researchers to invest time in the programme. In a new cooperation, programme coordination has been taken over by the Centre for Science, Technology and Health in Northern Jutland (NTS-Centre Northland). It is one of five national centres to support science education in Denmark and was established at AAU Department of Learning and Philosophy in 2009. This administrative support relieves the scientific staff from organisational tasks, and they will continue to offer SAUCE workshops and activities. The fourth SAUCE programme will be carried out in May 2012 and has already been fully booked by local schools.

At Freie Universität Berlin, continuation of the SAUCE programme has been made an integral part of the University's climate protection activities. Freie Universität Berlin has officially pledged to continue the SAUCE programmes as part of the Climate Protection Treaty signed with the government of Land Berlin. The University has set aside funding for the coming four years to finance organisational tasks for SAUCE at the Environmental Policy Research Centre. Additional funding will be contributed by the Berlin Senate Departments for Health, Environment and Consumer Protection and for Education, Science and Research as well as by private funding sources.

Third, SAUCE will continue to be offered at Vienna University of Technology, thanks to funding from the state province of Lower Austria and the Federal Ministry of Agriculture, Forestry, Environment and Water Management. The programmes will be offered with the same thematic focus but expand the target groups to

include 14 and 15 year-olds. One of the reasons for the public funding of SAUCE was the very positive reception of the programme by teachers and pupils.

At a fourth university, the final decision has not yet been taken, but would be welcomed by many. The core SAUCE team around CSTM at University of Twente (consisting of CSTM, another professor from UT and the municipal nature and environment organisation) has proposed several options for a continuation of the SAUCE programmes. One of the most likely options would be to develop a series of activities for children on the theme of energy, to be offered by a local alliance of different organisations. Within this setting, the SAUCE partners could continue to provide energy lectures and workshops for children at the university.

Finally, London Metropolitan University, in appreciation of the impact SAUCE has on its relations with schools, has invited the SAUCE team to submit an application for internal support of a continuing SAUCE programme, with an opportunity to try further variants. The University has limited internal capacity in energy education, but links have been developed to work with Architecture and Music as part of the future programme. The host Faculty of Applied Social Sciences merged with the Faculty of Humanities, Arts, Languages and Education on 1 August 2011, resulting in the Faculty of Social Sciences and Humanities, which will make it easier in future to recruit students interested in ESD to help with the programme. Unfortunately, a number of public programmes that supported SAUCE have been shut down due to public spending cuts, but some of the key actors are developing new organisations with whom SAUCE could partner in future.

Altogether, in five of the six SAUCE partner countries, SAUCE programmes will, or most likely will, continue to be offered at local universities. This will allow SAUCE universities to maintain and expand the network and contacts with programme partners, and to support teachers in their efforts to teach energy topics and related skills to their pupils. These results are particularly gratifying in the context of the recent economic crunch, which has substantially reduced public educational spending in several partner countries.

how they can work across academic departments, or silos, to address problems of key relevance to policy. They have further benefited from the exposure of pupils from 'non-traditional' backgrounds, i.e. without previous family experience of higher education, as have these pupils.

The schools, the project's main target group, have gained from provision of materials for integration into the curriculum, as well as enhanced energy efficiency and cost savings resulting from engagement with energy and climate issues. While the direct impact of SAUCE on the energy consumption of schools is hard to demonstrate, as public policy has also been increasingly engaged with energy efficiency, SAUCE has at the very least been timely and appropriate.

Participating teachers have been exposed to opportunities for continuing professional development, and provided with tools to sustain the impact of SAUCE on children's understanding and behaviour on their return to everyday life in the school and the community. The SAUCE programmes also act as an important stimulus, even for previously committed teachers, to innovate in school by improving energy management and including climate and energy components of ESD in the curriculum.

The second target group, independent environmental educators from the informal and non-formal sectors, have been able to strengthen their integration into networks, with universities acting as (at least temporary) hubs. They have also had an opportunity to present and hone their materials in an environment of constructive criticism from the academy.

One of the key indicators of the success of the SAUCE programme is the extent to which universities and their partners in the external networks have committed to support for the first three years of the programme and, in many cases, to continuing beyond the period of IEE support. Additional third-party as well as political support for some of the SAUCE programmes has also strengthened them and contributed to their success.

Challenges remain. In the context of the new austerity, government support for independent institutions delivering 'SAUCE' type training has, in some countries,

dwindled and key institutions, or NGOs, have had to shut their doors. This is short-sighted, as maintenance of common pool resources and development of new, renewable energy technologies are preconditions of future economic as well as social sustainability.

However, the 2008 economic 'crunch' has also been grasped as an opportunity to redesign economies for a low carbon future, in the shape of the 'Green New Deal' and based on development of green skills in the future workforce. SAUCE is one component of the preparation of the necessary awareness and skills of the workforce that will have to address these issues in the transition to a fair, low carbon economy.

As ever, when policy transfer is at issue, which was the case for five of the six partner countries in adapting the original Berlin pilot study to their own context, wholesale transfer without accompanying institutional change has been a challenge, recognized in the decision to work with parallel models of 'open campus' and 'closed cycle' programmes, or a mix of the two. Also, the balance of contributions to programmes from internal university staff and from local or national energy educators has reflected differences in local opportunity structures.

Dissemination to other universities within as well as between countries will need to take this into account, as rural, or provincial, universities may have more in common with one another across countries than with metropolitan universities within countries. The demands on teachers in terms of increasing 'efficiency' of their timetables and on academics to focus on published research outcomes further underscore the effectiveness of the SAUCE programme – that it has succeeded in spite of these countervailing pressures.

Variations in the extent of integration of climate and energy issues in the formal curriculum have also proved important, as SAUCE programmes in the different countries have started from different levels of prior provision, and therefore have had different learning curves. The same may be said for the individual institutions involved in SAUCE, which vary from research-intensive science and technology based ones to others with the main emphasis on teaching and humanities and social sciences. It is important, though, to recognize the importance of both aspects to final outcomes that depend on an interdisciplinary approach.

For the future, then, we would recommend sustaining efforts in the current SAUCE partner institutions, perhaps with more flexibility of approach as discussed above, but also targeted

collaboration with new partners, including in new countries. In preparation of this further dissemination, SAUCE identified two key groups of partners to be targeted and harnessed to promote SAUCE. One group includes politically and financially strong stakeholders in local and national energy education to secure programme funding. The other group includes institutions and organisations charged with developing and installing science communication, or STEM related, programmes at universities, as they are potential partners in taking on management tasks.

As CO₂ emissions from the emerging economies of China and India grow, and the USA still fails to take the required action, it is important that initiatives such as SAUCE reach out to include the young people of these countries as well as of the wider European community of nations.

Since the credit crunch and Fukushima, public policy on energy has taken divergent paths, with Germany leading the exit from nuclear technology, and therefore probably better positioned to support green skills initiatives, along with other non-nuclear countries in Europe. It is important for climate and energy education generally, and long-term sustainability of SAUCE in particular, that the benefits of SAUCE are conveyed effectively to policymakers. We hope that the integration of the work of all SAUCE partners into two generic publications, the Handbook and the Resources Guide, will serve as a basis for wide adoption of this model, and that this also helps the academy rediscover its responsibilities to society as well as the economy.



The international SAUCE team in front of Latvia University, Riga

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A summary of conclusions and tips from the SAUCE partners' experience has been published in the **SAUCE Handbook and in the SAUCE Resources Guide**. Both publications are available in English, Danish, German, Italian, and Polish print editions and can be downloaded from the project website: www.schools-at-university.eu



