

**E(co)nergy**  
**Green energy and sustainable energy consumption**

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## **INTRODUCTION**

In 2008, the Brussels-Capital Region created “Research in Brussels” to promote scientific and technological research in Brussels and to encourage scientific study amongst young people in order to renew the pool of researchers in the future. Within this framework, a call for projects: 'Later, I'll be... Einstein!' is launched every year to financially support science awareness initiatives for young people in Brussels. In 2012, financial support was obtained for the E(co)nergy project, that aims to sensitize secondary school pupils (between 16 and 18 years old) with respect to sustainable energy production and consumption.

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## **1 ENERGY AWARENES**

### **1.1 The role of energy education**

The global energy demand is increasing steadily worldwide. The proposed remedies for the energy crisis, which poses problems with regard to environmental, economic, and energy security, include the development of new technologies for renewable energy [1] and changing the behavior of traditional consumers [2]. Education plays an integral role in efforts to establish energy awareness during childhood and should ideally take place while students are young [3]. Energy education is not only meant to develop energy professionals, it also looks beyond primary and secondary school education and include university level education as well [4].

### **1.2 Games as a tool to increase environmental and energy awareness**

Games are widely used in education: they introduce novelty into the curriculum and should be fun and interactive. Playing games is a way to deepen the participant's understanding and help them to apprehend diverse aspects of reality in new and more comprehensive ways [5]. However, games must be well prepared, well executed and well evaluated, realizing the intended effects and impacts of the games [5]. Besides the game-specific rules, some generic rules need be applied when playing any kind of game:

- (1) the contextualization and preparation for the game,
- (2) the execution including explanation to the participants of how to play the game an
- (3) the debriefing at the end of the game.

Whitin the E(co)nergy project, we used the EcoDuel<sup>®</sup> board game, which was developed to prepare students to analyze energy issues and make sound choices, both as consumers and as potential energy suppliers. The generic rules mentioned above were integrated in the project

## **2 E(CO)NERGY: METHODS**

### **2.1 General outline of the project**

The first phase of the E(co)nergy project consisted of the contextualization and preparation for the game. As an introduction to the main topics of the project, pupils filled out a questionnaire with regard to their own ecological footprint and energy consumption pattern. The topic of sustainable energy production was then instructed and analyzed in more detail during the educational game EcoDuel<sup>®</sup> (Fig.1), in which strategic choices have to be made with regard to different types of energy supply. In the following discussion, students reflected about sustainable energy production and consumption. Besides the more technical aspects such as energy efficiency and secondary environmental impacts of 'grey' and 'green' energy production, political and ethical consequence of the choices made during the game were addressed. To conclude, a visit to a solar panel installation, a windmill and biomass installation is organized in collaboration with Ecopower, a cooperative investing in projects with regard to renewable energy.



Fig. 1. The E(co)nergie project, including the EcoDuel<sup>®</sup> board game (left upper corner)

## 2.2 The educational game EcoDuel<sup>®</sup>

EcoDuel<sup>®</sup> [6] is an educational board game developed by “Solar Zonder Grenzen (Solar without frontiers)”. The target group for this game are people aged from 12 to 99 years old. The purpose of EcoDuel<sup>®</sup> is to increase environmental awareness amongst a broad public on a playful, interactive and entertaining way. The game wants to promote green energy and encourage people to think about different ways to produce energy. Additionally, within the framework of the E(co)nergie project, special attention was paid to sustainable energy consumption

For the bachelor students an additional goal was included in the project: by playing and explaining the game to secondary school pupils, organizational and relational competences of students are trained: The students must be able to give a clear explanation concerning a scientific subject (in the present case, sustainable energy production, explained by means of an educational game), they must be able to guide the game (including group and time management) and lead a discussing concerning the message formulated in the educational game.

EcoDuel<sup>®</sup> concerns the clash between different ways of electrical power production (coal power plants, gas power plants, nuclear power plants, solar panels, biomass plants and hydro-electric power stations). Pollution as a consequence of energy production is an essential element in the game. By producing electricity with ‘grey’ power plants, the environment is polluted, which is indicated by putting black panels in the region in which the energy is produced. If no measures are taken (e.g. replacing grey power plants by green power plants, remediation of polluted panels,

etc.), the complete region of a player will quickly become polluted and he will be out of the game [6].

Besides being an energy supplier in a certain region, each player is also a dreaded businessman and has to make the choice between switching to 'green' energy production or using conventional 'grey' power plants to provide the required energy supply. However, it is also important to make enough money to be able to build new power plants and/or to take over power plants from the adversary [6].

In this way, EcoDuel<sup>®</sup> is in fact a challenge between Ecology and Economy: EcoDuel<sup>®</sup> is also a very interactive game, full of potential strategies. Not only the investment in 'green' power supply (windmills, solar panels, biomass plant and hydro-electric power stations) can bring you to victory, but also the illegal deposition of waste. The winner of the game is the player who ends up with the less polluted area and/or the highest amount of 'green' power plants [6].

### **2.3 Ecopower cvba**

Ecopower cvba [7] is a cooperative under Belgian law for financing renewable energy projects. This company, that was founded in 1991, has a very specific approach: the aim of the cooperative is to collect funds for renewable energy projects from as many members as possible. Besides obvious financial motives (money is necessary for the investments), there is also the aim to develop a personal stake in sustainable development. Moreover, People who are involved with renewable energy (e.g. through their investments) tend to be more conscious of their own energy consumption. Ecopower does not only want to help an important issue in the energy debate, by making renewable energy available for all, as well as its financial benefits, but it also wants to play a role in rising the consciousness of people. Energy is a scarce resource, and energy saving and rational use of energy is actually the best strategy to tackle the uncertain energy supply in the future [7].

Shareholders can buy one or more shares at 250 euro each. Ideally, the decisions concerning the investments in green and renewable energy should involve as many of the shareholders as possible. Therefore, each shareholder receives one vote in the cooperative's General Meeting, regardless of the number of shares owned. As a legally recognised cooperative, Ecopower is required to limit shareholders' profit to 6%. This is not necessarily a limiting factor. On the contrary, it creates possibilities, as the financial surplus can be used to finance less profitable projects. Moreover, 6% is a good rate of return considering the current interest rates applicable to savings accounts [7].

## **3 RESULTS AND DISCUSSION**

### **3.1 The game as an educational tool**

In the present study, the game was used to make students explore certain aspects of reality, namely different forms of 'green' energy production, together with all their positive and negative aspects and consequences. Therefore, the game was played without too much introduction, but was followed by an extensive debrief. Dieleman and Huishing [5] describe three essential technical aspects involved in playing, which were also considered in the present project :

Some games must be played with certain tools and toys and it is important to prepare these aspects thoroughly. In the present project, the game EcoDuel<sup>®</sup> was first played several times with a group of people from the university and from the collaborating company (Ecopower) involved in the project. Besides getting familiar with the

technical aspects of the game (materials, rules), this was also the basis for a deeper analysis of the (scientific) content of the game and the message this game wants to bring to a wider public. (2) Secondly, an adequate room, providing sufficient space to allow different (up to 6) groups of 4-5 people to play the game, including the necessary tables and chairs, was available, as well as a PC and an overhead projector. (3) The last aspect, namely the safety of the participants was not an issue for the EcoDuel<sup>®</sup> game.

The debriefing session was considered a key aspect in playing the game and for the E(co)nergy project in general. Therefore, the moderator of the game started to ask after the participants' own findings with regard to the game (enjoyable, difficult to understand,...), which already gave rise to a deeper discussion concerning the information and (scientific) content included in the game. After this, some specific questions were launched. Some of the questions used in the debriefing session included:

- Which strategy was adopted by the group or by the individuals participating in the game to win? How can this be related with your own environmental awareness? Is this strategy realistic in a real world situation?
- What did you learn about energy production in general.? Which was the most environmental friendly way of energy production and which was the most efficient one? Is this in agreement with the real-life situation or are some important considerations not taken into account by the game?
- What did this game learn you about the energy policy of countries?. What did the game learn you about the ethical dimensions of energy production and supply (energy market)?
- Which other aspects related to energy production are not taken into account in the game?

Such debriefing sessions are essential to also help the participants to reflect on how they may use the lessons they learned in their personal and professional lives [5].

### **3.2 Integration in an academic curriculum**

Key competencies in higher education, such as problem-solving skills and the ability to collaborate successfully with experts and stakeholders may be most fully developed in new teaching and learning situations [8]. The E(co)nergy project has also been implemented in the curriculum of 2<sup>nd</sup> bachelor students of the Environmental Health and Safety Management program. The students (second bachelor year) followed a workshop in which they were trained to accompany the educational game EcoDuel<sup>®</sup> with pupils of the 3<sup>rd</sup> grade of secondary school and to facilitate the discussion afterwards, encouraging pupils to consider the complexities of 'sustainable' energy production and consumption (Fig. 2). By doing so, the students also practice important program-specific and behavioural competences such as team work, explaining scientific topics in a clear, comprehensive and attractive way, and leading a discussion with regard to a specific scientific subject. Afterwards 2<sup>nd</sup> bachelor students discussed the game and its procedures and each student wrote a reflection with regard to the scientific content of the game, the potential improvements and the usefulness to encourage environmental awareness.

The discussions, observations and reflections indicated that EcoDuel<sup>®</sup> is an attractive and enjoyable game. Students and pupils were motivated to learn and play the

game, and they were also critical towards certain aspects that were simplified in the game.



*Fig. 2. The Ecoduel workshop (left) and the seminar on renewable energy (right)*

### 3.3 Visit to Ecopower and its installations

To conclude the E(co)nergy project, students and secondary school pupils attended a seminar on renewable energy production given by a project engineer of Ecopower and visited a biomass plant, two windmills and a solar panel installation (Fig. 3). Besides the technical explanations, attention was also paid to social, economic and environmental consequences of renewable energy production. In this way, renewable energy was critically discussed within the broader framework of sustainability. Real-world learning opportunities contribute to the acquisition of key competencies in sustainability [9].



*Fig. 3. Visit to Ecopower biomass plant (left) and windmill (right)*

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