TOWARDS THE USE OF RENEWABLE ENERGY SOURCES IN THE HOME

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The paper presents the first results of the European Save project "Realising the potential for small scale renewable energy sources in the home" – Kyotointhehome. The project's global aim is to inform and educate teachers, students and their families so that they can realise the need and can assess the potential for energy efficiency (EE) measures and renewable energy sources (RES) in their homes. The project resources were translated and will be trialled by 16 partners in 10 European countries.

The first step in realizing a web-based methodology which will enable families to assess how RES can be incorporated into energy efficient homes was accomplished. The web application "KYOTOINHOME" will help the citizens to identify what they can do to help their community meet the Kyoto target for greenhouse gas reductions and prevent global warming. This application provides useful information on how the citizens can use renewable energy sources in their home to provide space heating and cooling, hot water and electricity. A methodology for assessing heat loss in a dwelling and application of heat pump system was elaborated and will be implemented this year. For schools, we developed and will trial a set of practical activities concerned with preventing climate change through using renewable energy sources. Complementary resources were also developed in the Romanian research project CREFEN.

Keywords: renewable energy sources, energy policy, education, methodology, Internet

1. Introduction

Renewable energies are essential contributors to the energy supply portfolio as they contribute to world energy supply security, reducing dependency on fossil fuel resources, and provide opportunities for mitigating greenhouse gases [1]. The future strong growth of renewable energy must be part of our energy policies. RES clearly reduce emissions, both local and greenhouse gas related. In

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addition, renewable energies generally improve the security of energy supplies, by diversifying and decentralising energy supply both with indigenous sources and with imports. And finally, renewable energy technologies form a dynamic hi-tech sector which provides economic growth and jobs for our economies and help maintain our competitiveness [2].

It is essential to limit greenhouse gas emissions so that the global earth temperature does not rise by more than 2C above its pre industrial level. This requires people to realiye that it is important to begin the conversion to a more sustainable way of life as soon as possible. The two key steps are to use energy more efficiently and to convert from using fossil fuels to RES like wind, solar and biomass which have their own characteristics which differ appreciably from that of fossil fuels. Their great advantages of global abundance and non polluting mode of use has to be offset by their variation in intensity on both a diurnal and seasonal basis.

The Romanian strategy of valorization of RES *(2003)* defines the following objectives: integration of RES into the national energy system, the diminish of technico-functional and psycho-social barriers for RES valorization, simultaneously with the assurance of economic competitivity, promotion of the private investments, energy supply of isolated places by using the local RES potential and facilitation of the participation of Romania in EU market of "Green certificates" for energy from RES [3]. In the context of *European Directive no. 77 concerning the promotion of electrical energy from RES on internal energy market*, Romania has the target of 33% electricity from RES in 2010 and 11% electrical and thermal energy in the same year.

The paper presents some results of the European IEE project "Realising the potential for small scale renewable energy sources in the home – Kyotointhehome" (KITH) and of the Romanian research project CREFEN, which will raise awareness of the potential of RES and will create an understanding of how we can adapt to the use of these sources in our homes. The EU Kyoto target for greenhouse gas reductions can be met if families realise that they each can do something to reduce the environmental pollution associated with energy usage.

2. Obiectives

The objectives of the project are:
- To upgrade existing educational materials to include the application of RES to energy efficient homes and to trial these resources in schools. Various topics will be introduced and practical activities described to illustrate the principles of the various technologies;

- To develop a web based methodology for assessing the potential for energy savings and small scale RES in the home and to trial this with the student families to illustrate to them ways of saving both money and the environment;
- To develop methodologies for training teachers. These will be developed in collaboration with education professionals across Europe;
- To disseminate the project deliverables particularly during EU energy efficiency and Green weeks when other initiatives and studies are presented which will enable exchange of ideas and best practice.

Both information and education are important and cannot be separated [4-5]. The *unique* approach of this project is to engage both students and their families as the concepts of and reasons for saving energy and using RES are best understood through a dialogue.

The methodology for identifying the phases and organising the work is described bellow:

Phase 1: Resources for teachers and students - Expansion of activities, Explanation how RES can be used in the home, Need for insulating dwelling before introducing RES;

Phase 2: Resources for families- Expansion of activities, Describing the various types of RES in a simple manner, Reducing energy bills by insulating dwelling;

Phase 3: Educating teachers and students - Expansion of activities, Methodology for teaching teachers, Practical activities for students;

Phase 4: Motivating families - Expansion of activities, Involving the families, Identifying the potential;

Phase 5: Dissemination - Expansion of activities, Expanding the project website with new text, Including new languages on the web site, Organising workshops for relevant stakeholders and actors, Raising awareness during EE and green weeks.

3. Materials and Methods

The Kyotoinhome server is a standard Compaq PC (800 MHz, 20Gb, 512 Mb). The software used is Windows 2000 as operating system and SQL Server 2000 as DBMS to develop the database. The interface was developed in Macromedia Dreamweaver, Java script and ASP (Active Server Pages).

We used for collaborative work and publication space DotNetNuke, an open source web application framework. DotNetNuke promotes human participation and the sharing of knowledge [6]. The following are the main features of the cooperation system that user can access:

- *Authentication:* People have to identify themselves by using their username and password before accessing the KITH workspaces.

- *Member administration:* Furthermore, the system provides facilities for the management of members of a workspace. Members can be added to or removed from workspace by those members who have the authorisation. The administrators can define and assign roles for different user groups, such as: registered users, subscribers, content providers, affiliates, media, etc.
- *Access rights:* The members of a workgroup may have different access rights to the objects contained in their workspace. The creator of a document can define some members to be able to update a document, whereas other members are only allowed to read it.
- *Documents management:* Document production plays an important role in many cooperation task. Therefore KITH workspace offers sophisticated document management. The aim of document management is to allow people to share and organize electronic files (Figure 1). Users are able to explicitly put new versions of a document in a workspace without overwriting elder ones and only the owners of an object are allowed to delete objects from the file system. The main features are the following: files can be stored anywhere on the server; view and edit privileges can be set for every item; permissions are by default inherited from parent collection; permissions can be altered for whole collection including sub collections; old versions of a document are kept on the server and can be 'rolled-back'; undelete/recycle bin feature; file locking; logging of actions on documents including downloads; mass import of existing file structures; recognition of major file formats (extensible); optional moderation of content; localized static texts; both meta-data and full-text search of files; breadcrumbs to ease navigation; browseable categories that can be hierarchically related; subscription to items sending notifications of changes.
- *Meeting administration:* The system also provides facilities for the management of the meeting. The meeting can be added or removed by the organiser and invitation to the meeting is send automatically to all participants.
- *Discussion forum:* Users may start discussion on a topic and the system presents the threads in a user friendly manner. Interested people can view the progress of the discussion and contribute to it at times of their choosing.
- *Event services:* They allow users to coordinate their work. It provides users with information on the activities of others users, with the respect to the objects within a shared workspace. An event is generated by an access to a workspace, e.g. a new object is put into the workspace, a new version of an existing one was created or an object was renamed.

The "Kielce" discussion, a written-oral, multilevel technique of discussion that is combined with visualisation and held in groups, was used as a main method in the resources for the school. The Kielce discussion is in essence, a didactic discussion involving the organised exchange of thoughts and opinions on a subject within a group. Discussion is an art of expressing opinion, reasoning and

learning to respect the opinions of others. The "Kielce" discussion proceeds as follows:
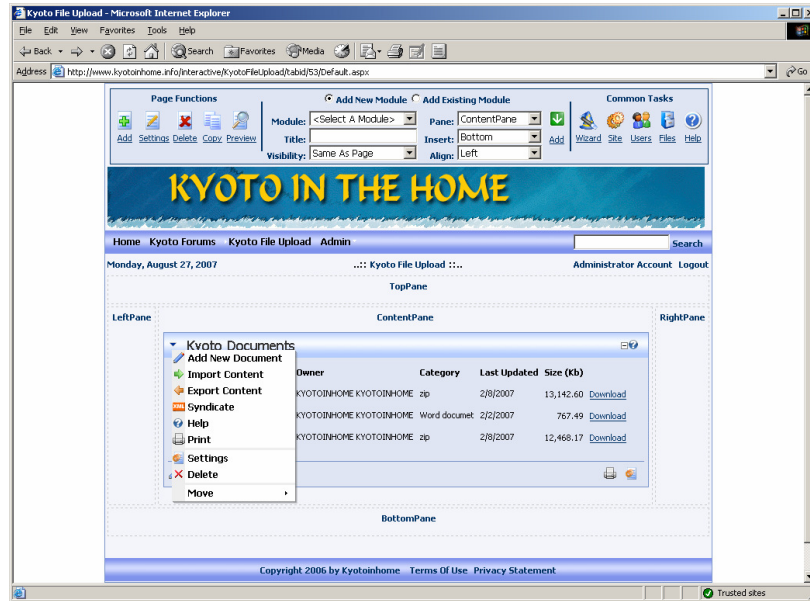

Figure 1 – Documents management

• The teacher writes questions on a board or on large sheets of paper. Each question is assigned a different colour;

• Students answer the questions anonymously in writing. They can provide more than one answer to each question. They take down each answer on a separate slip of paper the colour of which corresponds to the given question;

• The teachers collects the answers and sorts for each question;

• The teacher randomly divides the class into as many groups as there were questions. Each group works on one of the questions, analysing answers of class members and compiling them in the form of a poster;

• Each group then presents their posters which reflect the opinions of the whole class on the various issues discussed.

4. Results

The main resources are available in all partner languages and include: the KITH handbook, and the website application (www.kyotoinhome.info).

The KITH handbook provides: resource information for teachers, practical activities for students including work sheets, and background notes on the key topics.

In the KITH handbook it was developed a set of resources for use by teachers and students on the application of small scale renewable energy sources to the home. These resources cover the following topics which can be grouped into three topics – background information, passive means of reducing heat loss and solar gain and renewable energy sources (Figure 2).

Sustainable use of energy
Energy efficiency in the home
Renewable energy sources
Heat flow in buildings
Passive solar
Solar water heating
Heat pump systems
Biomass
Wind energy
Photovoltaic systems

Figure 2 – The topics of the handbook

In the KITH handbook, each section of text is followed by a suitable practical activity for the student and notes for teachers (see examples below). These comprise some 60 in total so the teacher has to be very selective in deciding which source materials to use.

Such activities enable the student(s) to explore a topic and then to discuss their analysis or solution(s) with other groups in the class. Some activities involve measurement and uncertainties arise over the reliability and reproducibility of the data which is inherent in making measurements relating to renewable energy sources.

Activities are planned to be the core element of each lesson. These activities can be used individually or alternatively, they can be grouped together to generate not only awareness of the environmental problems associated with energy use, but also identify solutions which can reduce energy use.

For each activity there will be: Resource material providing background information for introducing the subject, Work sheets for students, and Notes for teachers.

Evaluation exercises help a student express his or her opinion on various issues. The exercises are designed so that: everyone thinks on their own, everyone listens to the others carefully, and everyone can express their opinion.

Figure 3 – The Kyotoinhome web site

The project website (www.kyotoinhome.info) provides:

• suitable information to encourage everyone to do something in their home to reduce energy consumption;

• how to reduce the heat loss during the winter and minimise solar gain during the summer

• a simple method for deciding which renewable energy source might be suitable and information on the nature and characteristics of each renewable source.

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The KITH web application comprises a systematic rationale of each of the 10 topics in the handbook under the following headings: Description, Advantages,

Disadvantages, Basic principles, Climatic and environmental criteria, Installation, Economics, and Further advice.

The KITH interactive workspace increases the co-operation between KITH partners and between partners and teachers.

5. Conclusion

The resources are comprehensive and useful and are a level which enables them to be used by both teachers and students. The holistic approach KITH has adopted to energy use provides not only an interesting science topic but also reinforces many of the concepts that students will have learnt but yet applied such as energy conversion and the generation of electricity and the production of hot water by non polluting means. The success to the use of these resources are the interest of the teachers, their willingness to find time to provide a set of lessons, the ability to discuss rationally how we maintain an acceptable standard of living whilst transforming our energy dependence from fossil fuels to renewables.

The potential impacts of Kyotoinhome project are:

• to inform EU citizens and empower them to realise the potential for saving energy, money, ever depleting natural resources and the environment;

• to deliver resources which have been trialled and tested in 10 European countries linking EE savings and application of small-scale RES in the home;

• to help communities locally to meet their share in the reduction of greenhouse gas emissions;

• to involve local stakeholders and motivate them to help all families with their community whether they own, rent or occupy their homes.

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