Energy state of the art in schools

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1. Introduction

In December 2008 the European leaders agreed on a Climate and Energy plan. One of the goals of that plan is to reduce the use of energy by 20% in 2020. Energy is necessary for maintaining the European economy as well as people's health, their well-being and their lifestyles. To achieve the 2020 European goal of energy reduction, Europe needs individuals with the knowledge, skills and attitudes how to use energy resources wisely. Only then this goal might be achieved.

Energy literacy is critical to Europe's environmental and economic future. Energy education as an integral part of the school curriculum can contribute to produce energy-literate European citizens. For this reason the European Commission started the 'Intelligent Energy Europe'-programme. The programme enables several organisations all over Europe to experiment with activities contributing to the goals of the Climate and Energy plan mentioned. Part of the programme is the 'Energy, Education, and Governance Schools'-project; the EGS-project.

2. Research questions

The first objective of the EGS-project is to define a framework to implement energy efficiency at schools. Therefore, the project includes among others a *survey* to study and describe the energy state of the art in European schools.

> The **WP2 Definition of the "energy" state of the art in the schools** aims at defining the actual framework of the implementation of energy efficiency at school being a necessary knowledge base for successive activities. By this way awareness raising, networking, sharing of experiences will begin as well. Main activities that have been lead so far within the participating schools in the energy sector are the object of the surveys (didactic programmes and activities for students; Teachers' training programmes; Involvement actions for families; participation of families in school activities; cooperation initiatives with SMEs and Local Authorities; energy audit in schools, RES applications, etc.). The collected information will be published in the Deliverable 2.1 (Census report of energy best practices for each participant school) and will available for the WP3. (Annex I, last revised *02/07/2008*, page 18)

The central theme of the survey is whether schools are aware or *conscious* of their practices in energy-usage i.e. energy efficiency. If that's the case this must be visible in their *activities*. Referring to efficient energy-usage schools does have different roles:

- they use accommodations for educational activities and as such they are *energy consumers*;
- they teach and train the younger generation and from that point of view they have a role as *educators of (new) energy consumers*.

So the survey should gather information on schools being a consumer of energy as well as an educator of energy consumers.

The object of the survey will be the activities of schools concerning both roles. The first group of research questions refers to the role of schools as a consumer of energy and the second group to their role as an educator.

1) If schools have an *awareness* of the energy they use being an energy consumer themselves, the topic is which 'factors' might be responsible for the way schools fulfil these role efficiently. Factors that may influence their energy-consumption (positive or negative) are:

- the kind of accommodation they use for educational activities;
- the options they have to make their own energy-policy.

2) If schools are *conscious* of their energy-usage combined with their role as an educator of (new) energy consumers, the topic is how this reflects their everyday educational activities. Outcomes of how schools fulfil the role of educating young efficient energy consumers can be:

- the content of education, the curriculum;
- the needs mentioned for training their professionals on specific subject matters.

To answer both research questions a questionnaire is compiled that affects both roles of schools. Specific questions are clustered around themes like 'accommodation', 'governance', the educational content or 'curriculum', and the 'training needs' of both teachers and other school staff. Next to this, data shall be collected on energy 'best practices' for each participating school.

3. Data collection

10 EU-countries take part in the EGS-project (and 23 partners). Each country should collect data of 4 schools (that is of the partner school themselves and from 3 other schools). The total maximum number of respondents will be 40.

In January 2009 the last audit on the questionnaire amongst the project partners was completed and at the end of January 2009 it has been send out to all the participants of the EGS-project. Preliminary results of the survey are reported in March 2009. As the response is rather small (< 50%), a reminder has been posted at the end of March and in April 2009.

Response

The response on the questionnaire is (39/40*100%=) 97%. Not all responses on the questionnaire could be proceeded. The reasons for non-response can be very different but they are not explored. One possible reason seems to be important enough to be mentioned. Schools may have problems in collecting some data, especially the data on their energy consumption irrelevant whether or not they are aware of their energy usage. From that point of view the response of Italy is quiet remarkable. More than 1/3 of the respondents are Italian schools. This means that the results are *biased* by Italy.

Different types of schools are included in the survey. Of each school the name has been collected and based on this so-called 'type of school' an indicator of the educational level is

determined. Only in one case the educational level remains unknown and most schools provide vocational education.

Education

Educational level	%
primary school	5
secondary school	34
vocational education	61
Total	100

Quality of the data

To answer the research questions correctly and to be able to compare the data of the countries i.e. the schools involved, it is important that there exists an agreement on the questionnaire. All participants of the EGS-project should have the same opinion on the concepts underlying the different questions. Subsequently the method used to approach schools and ask them to fill in the questionnaire should be identical.

The questionnaire is composed by using the method of auditing. During a workshop at the first management meeting of the project, the themes are discussed and elaborated. Next a rough version of the questionnaire has been send out to all 23 EGS-partners at the end of 2008. The feedback of these auditors is collected, reviewed and incorporated in the final questionnaire (see Appendix 1).
An evaluation whether the instructions are followed as planned and agreed upon, has not been carried out. A brief check of the data collection makes clear that this might have caused the incoherencies observed. Not all the questions are accompanied by notes on 'how' to answer them and several questions need not to be answered unconditionally. Therefore new data are constructed based on the 'old-ones', whereby missing values are recoded as 'unknown'. Furthermore in some cases the new data are categorized also to facilitate a comparison between countries and/or schools.

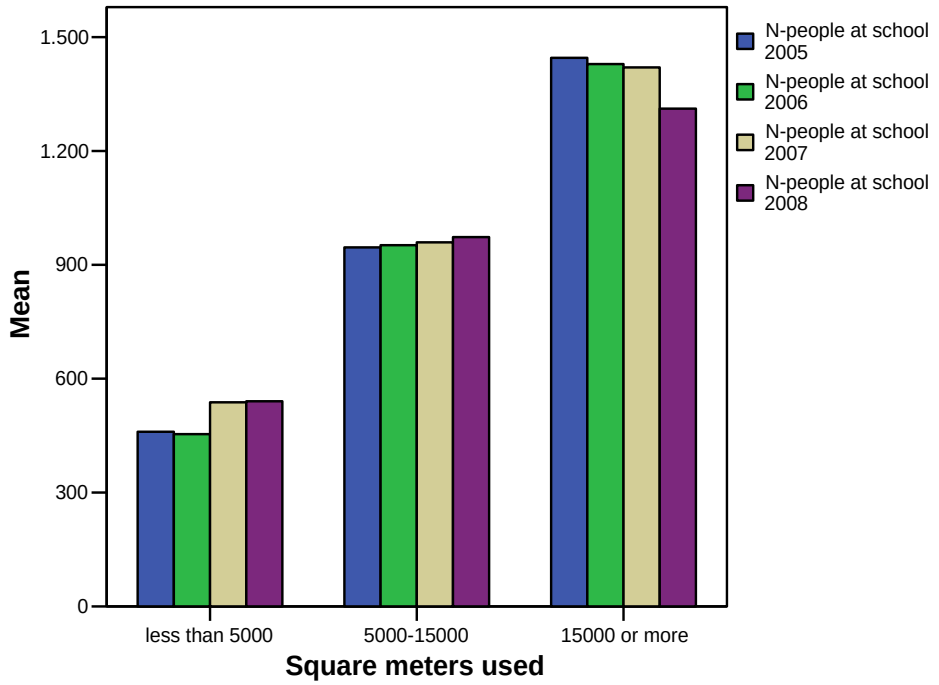
4. Results: schools as consumers

Accommodation

Schools make use of accommodations for educational activities and as such they are energy consumers. The kind of buildings in which their accommodations are situated, might influence the energy consumption.

Here most of the accommodations used for educational activities are rather old: 74% of the buildings are constructed over 20 years ago. Of these buildings 11.000 m2 at the average is occupied by the schools. The number of people (in full-time equivalents per week) visiting

these schools for work or study and using the square meters space for their activities during the years 2005-2008, remains more or less stable.



The energy consumption in the successive four years mentioned, demonstrates more fluctuations. Related to the dominant energy sources – Electricity and Gas - the mean volume of Electricity (Kwh) consumed in 2008 compared to the volume in 2005 is relatively high. At the same time the volume of Gas (m3) in 2008 has declined.

Accommodation

Energy used (%)				
	2008	2007	2006	2005
Electricity				
- less than 30000	18	13	14	8
- 30000-60000	21	27	14	17
- 60000-120000	18	13	25	29
- more than 120000	43	47	47	46
Gas				
- less than 30000	38	26	13	15
- 30000-60000	14	32	25	23
- 60000-120000	33	32	37	31
- more than 120000	15	10	25	31

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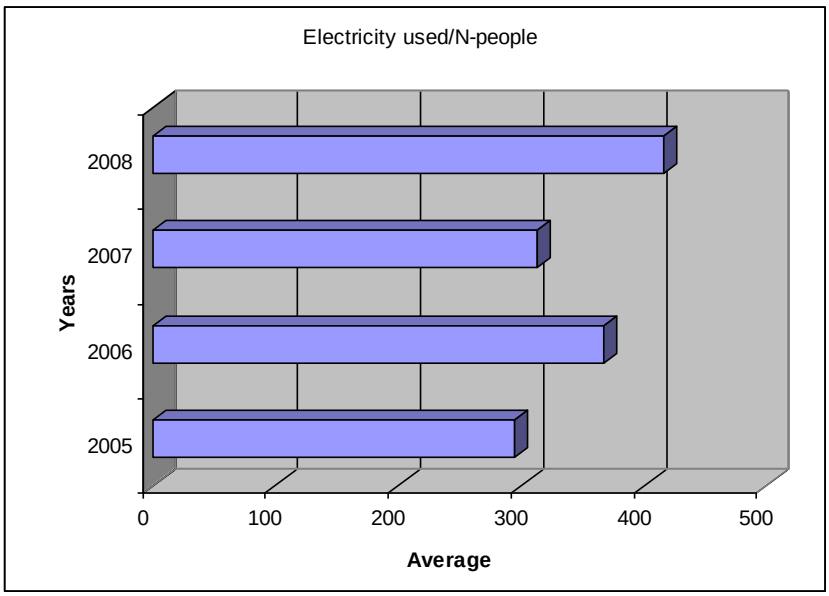
Looking at the proportion of Electricity used in the years 2005-2008 controlled by the number of people visiting the schools during 2005-2008, makes clear that no pattern exist i.e. between years rise and fall of energy consumption is obvious.



Still, these kind of figures may be valuable to monitor one's consumption behaviour. For instance: the data gathered on 'Electricity used in 2005 controlled by the number of people at school in that specific year' can be used as a schools benchmark to compare its individual energy usage during the next following years.

The year of construction of a building, the age of the accommodation, seems to be an important factor for this variety in energy consumption. The results show that the older an accommodation is the more Gas (m3) is consumed. Next to Gas and Electricity proportionally more other energy sources are used like Petrol and Fuel Oil.

Governance

Schools - being an energy-consumer - might have the scope of policy-making referring to their use of energy. The owner of the building or accommodations they use for educational activities can restrict their 'influence' or willingness of policy-making.

The majority of the schools involved in this survey are owned by a local authority: only in 18% of the cases the government is the property owner and 5% of the schools are possessed by a private institute. Despite this ownership, most schools – 79% - claim that they can influence their energy-usage. They manage this by private or public experts (each 3%), through the school board (13%) or headmaster (36%) and above all by a mix of management styles (45%). One school describes this mix as follows: "The use of energy is managed by a private consulting company; the caretaker monitors the energy consumption and one teacher is responsible for the environmental protection i.e. coordinates the work that will be done by a green-team of students."

Independent of the school's influence on energy-usage, the habits they practices daily to reduce their energy consumption varies a lot.

Habits practised (%)	
- double glazing	76
- use of specific lamps	71
- appliances with low consumption	42
- use of circulating water	21
- sun protection	21
- power switches	21
- others	37

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Most schools mention to use more than two habits.

To encourage any reduction of energy consumption schools mostly utilizes internal communication (89%). But they hardly work with action plans (41%) or rely on any relevant national energy policy plan (26%). Still nearly 50% got some (financial) support in the area of sustainable energy use. This might be caused by the relationship with the owner of the building or accommodations schools occupy for their educational activities. The results show that for instance internal communication is mostly used by schools that are owned by a local authority. The same goes for (the minority of) schools who do work with action plans or can rely on the existence of a national energy policy plan.

Conclusions

Schools are energy consumers themselves. Although they might be aware of the amount and kind of energy they use, their consumption-pattern seems to be determined by the year of construction or age of the accommodations they occupy for educational activities. The ownership of that building seems to be an important factor for the different options they have to influence the energy they consume and to make their own energy policy. They do not rely on action plans and/or national energy policy plans.

5. Results: schools as educators

Curriculum

Schools are educators of (new) energy consumers and this might be reflected in their everyday educational activities especially in the content of the curriculum.

Here most of the schools (87%) claim that ‘energy’ is a subject matter of their curriculum, i.e. energy is mainly integrated into multiple subjects of the curriculum. So different kinds of energy are recognizable in the curriculum.

Education

Kinds of energy in curriculum (%)	
- electric energy	92
- thermal energy	84
- potential energy	74
- chemical energy	74
- kinetic energy	68
- nuclear energy	53
- surface energy	32
- geothermal energy	58
- others	24

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Within 78% of the schools involved in this survey, the teachers (or a group of teachers) are free to implement energy in their curriculum. By doing this, they are hardly restricted by the school management or by schools being an organisation that must follow national or regional directives. Next to the teachers, students are actively engaged in 'energy issues'. They participate in specific projects (79%) or contribute to the realisation of thematic days (62%) and/or are involved in workshops (38%). This might be influenced by the age group of students or to be more specific by the type of school, the so-called educational level. The results show that if students do participate in projects or workshops and/or contribute to thematic days, schools mostly provide vocational education.

Training needs

Training of teachers and other school staff is an important part of the EGS-project. Therefore some information on training needs is gathered.

Only 55% of the schools involved, mention that their teachers are trained enough to provide lessons on energy-usage. Still they feel pretty competent on different relevant subject matters related to 'energy education'. However a more specific look at the results show that teachers do not feel very competent. They score mainly on level 2 and 3 on a scale of 5. They do not feel competent on the subject of Institutional framework and European standards.

Training Needs

Competence (1-5)	1	2	3	4	5
- on sustainable development	6	22	**42**	19	11
- education on sustainable development	6	**33**	28	25	8
- problems of energy and environment	3	**30**	**30**	25	11
- energy efficiency and saving	3	33	**36**	8	19
- renewable energy sources	3	28	**38**	17	14
- institutional framework	19	**50**	25	6	0
- european standards	37	**39**	20	4	0

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Next to this and whether or not schools claim that their teachers are trained, their need for training plans related to the specific subject matters or topics is different for the group 'teachers' compared to the group 'other school staff'.

EGS Training Needs

Topics yes (%)	Teachers	Other school staff
- on solar thermal	70	62
- on photovoltaic	70	66
- on hydroelectric and marine energy	39	25
- on energy from biomass	57	41
- on geothermal	48	47
- on other alternative sources	36	31

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To be more precisely: on the topic 'problems of energy and environment' they want training plans for their teachers on energy scenario (90%) and climate change (77%). On the topic 'principles and use of renewable energy sources' this need refers to subjects as solar thermal (70%) and Photovoltaic (70%). (This will be elaborated in WP3 'Strengthening the schools capacities in the energy sector'.)

Conclusions

Schools are educators of (new) energy consumers. Although energy is a subject matter of the curriculum, the way this is organised seems to depend on the type of school; the educational level. Furthermore, at the average they feel competent on relevant topics but also have specific desires for teacher training programmes, more than for their other school staff.

6. Best Practices

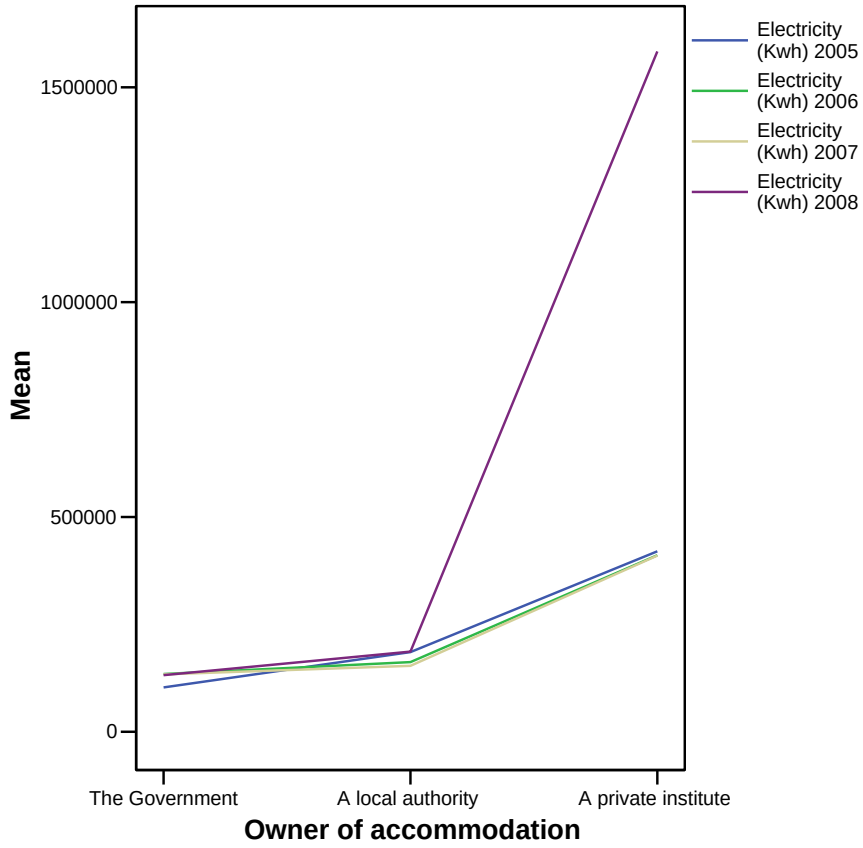
Schools might have some experience with reducing their energy consumption and/or the role of educating the younger generation to use energy efficiently.

The majority of the schools involved in this survey do cooperate in an energy programme with other organisations i.e. 32% do not participate in any programme at all. If they collaborate in a programme, they mainly are engaged in local and regional activities (68%). At the same time no more than 36% of the schools already use alternative energy sources and in that case solar energy dominates. Other sources are biomass or the temperature of the ground-water for heating purposes. Moreover, the schools pay little attention to the technical aspects of energy (40%); barely incorporate sustainable development in their everyday educational activities (31%), but 53% of them focus the educational programmes on students attitude toward energy. And finally, 74% of the schools do make an energy audit of the accommodations they use related to their energy consumption.

7. Final remarks

The central theme of the survey is whether schools are aware or *conscious* of their practices in energy-usage i.e. energy efficiency. If that's the case this must be visible in their *activities*.

Schools do use accommodations for educational activities and being an *energy consumer* they might be aware of the amount and kind of energy they consume i.e. their consumption (over the last four years) consists mostly of Electricity and Gas. But this consumption-pattern is more or less determined by the year of construction or age of the accommodations they occupy for these activities. The ownership of that building influences the options they have to manipulate their consumption-habits and make their own energy policy. It also influences the consumption – for instance the Electricity used.



Because most old accommodations are owned by a local authority, at the local level there seems to be no need to challenge their consumption-behaviour. At the same time for schools there might be room enough for change.

Schools may perhaps want to be a good example in their energy behaviour being an *educator of (new) energy consumers*. They integrate energy into multiple subjects of the curriculum. But the way this is organised, depends on the type of school, the educational level the school represents. At the same time the type of school influences their options to

make an own energy policy and the amount of teachers being trained enough to provide lessons on energy-usage i.e. the wishes for teacher training programmes.

Appendix

1) Questionnaire Energy State of the Art frequencies.

2) Energy State of the Art, WP2-Results of the Questionnaire, May 2009.