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Contrasting CLIL and Traditional Second Language Acquisition Models:
a Case Study in Primary Education.

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by

David Sánchez Díez.

Supervisor: Dr. Ramiro Durán Martínez

Tutor: Dr. Elena González-Cascos
Jiménez

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1. Introduction

Many claims have been made for CLIL to be beneficial for formal mandatory education and particularly for the acquisition of a second language (Coyle, 2008; Eurydice, 2006; Lasagabaster, 2008; Marsh 2000). When this approach is adopted by teachers in order to teach a content area in a foreign language, traditional second language teaching models based on a more linear and formal structure, such as PPP (presentation, practice, production), are left aside. The choice of the teaching model will influence the student's learning on both content and second language acquisition. This case study will contrast the results of two methodologies, a CLIL project and a traditional linear unit, when applied into two different groups of Year Five Primary Education students at a Spanish bilingual school.

This comparison has been done analysing the acquisition of receptive vocabulary during two different series of lessons about Energy. Both of them belong to the subject of Natural Science, which is mandatorily taught in English for these 56 students whose first language is Spanish. These students are accustomed to a CLIL methodology but the series of lessons devoted to Energy were differently addressed in the two Year Five groups; one carried on with a CLIL methodology (a CLIL Project, Appendix A) and the other group was taught using a PPP teaching model (a PPP Unit of Work, Appendix B). Given the amount of students involved in this case study, the conclusions coming from the obtained results should be taken with prudence.

2. Theoretical Framework

Following Meyer 2010, to achieve a satisfactory CLIL practice the four C's (culture, content, cognition and communication) should be the base of innovative

materials and speaking, as a communicative skill, must be fostered. Meyer (2010) proposes the CLIL-Pyramid as a task planning tool that aims to be helpful for building quality materials:

- The base of the CLIL-pyramid is the topic selection (*Energy* in this project, appendix A).
- The next layer of the CLIL-pyramid is based on the choice of media; e.g. resources, materials ...
- Next step in the CLIL-pyramid is a key programming level: the task selection where cognition and communication are a must, the output has to follow a scaffolding process in order to be meaningful for the students' acquisition of the second language. In the CLIL project designed for this case study; speaking frames were designed for performing this scaffolding process (Appendix-A1).
- The peak of the CLIL-pyramid is the implementation of the project.

According to Meyer (2010) there are six strategies to be followed by the CLIL teacher to be successful: to enrich the input, to scaffold learning, to add an intercultural dimension, to make tasks HOT (high order thinking), to enrich interaction, to push output and to build a sustainable learning in the student.

The first strategy is to enrich the input making it “meaningful, challenging and authentic” (Meyer, 2010) in order to motivate students and so, to open their affective filter; a filter that filtrates the amount of input in learners' brains and it is responsible for individual variation in second language acquisition, the affective filter hypothesis was first proposed by Dulay and Burt (1977). The CLIL project *Energy* (Appendix A) is

designed to make the input challenging and meaningful using authentic materials; the second language is acquired in the most genuine context for a formal education student, his or her daily classes shared with his or her classmates.

Meyer (2010) advocates that the material selection should balance the teacher directed and the learner directed tasks; teacher directed tasks must aim to model scaffolding; on the other side, learner directed tasks should let students hold the floor and develop their communicative productive skills. Teacher Talking Time will decrease but it will be more effective and over all will support language production. According to Anderson's Control of Thought (ACT) theory, "Declarative Knowledge has to be changed into Procedural Knowledge through practice, monitoring contexts and appropriate feedback" (Anderson, 2013). This key point is one of the aims at designing the CLIL unit *Energy* (Appendix A); the teacher models the dialogues and then monitors the tasks that are basically performed by students, the material selection is based on speaking frames (appendix A1) or Natural Science experiments (appendix A2) that are accessible for Year Five students.

Meyer (2010) states that CLIL will help teachers to make the acquisition of a second language and contents a High Order Thinking process where the understanding, synthesize, evaluation and creation will always be triggered. This process will be based upon the verbalization of thinking. Language development is an aim in itself to use language for complex thinking. The CLIL project designed for this case study encouraged students to verbalize their thinking in the foreign language by the application of tasks where mutual cooperation among partners was required and linguistically framed.

According to Marsh (2010), CLIL has to develop a positive “can do” attitude in the language learners and it has to be based on the dual-based education providing opportunities to use language in a natural way; this is the strongest point of CLIL since the student communicates in a natural way and the opportunity to use language is granted lesson by lesson. Language is a communicative tool and the aim for different purposes at the same time. That is the reason why the CLIL project *Energy* associates the content, Natural Science experiments (Appendix A.2.) and speaking frames (Appendix A.1.) that provide an accessible scaffolding for students to communicate and , at the same time, build their understanding about the different secondary domains and consequently about the main topic, energy.

The use of a foreign language develops thinking skills (Snow et Al. 1989; Kohonen V. et Al, 2014; Cheng, 2015), so CLIL based on exploratory talk allows us to structure discussion being the theory behind small group activity and discussion, ideas are represented in the form of models: testable, revisable, exploratory, conjectural and generative; they must be the evidences of the way natural world works. These models are theories to generate hypotheses and its main function is to be the base for students to make predictions.

Following Dale et Al. (2011) a CLIL project must be cross curricular to ensure the learning to be motivating and there must be a noticeable link between the final product and the real world. For these two reasons every single activity of the project has been connected to the project’s final enterprise, an individual portfolio that is personally collected and assessed by each student with the help of a rubric that is

included at the end of Appendix A. The teacher applied the same rubric the students manipulated to grade every class member.

Consequently; teacher's role is challenged in this process since the student has to improve linguistically, so the teacher has to organize this development through every single project or unit along the academic year: this organization through projects has to depart from a motivating to an assessing role going through a facilitating, mediating and coaching position. The teacher is not just an information store and dealer who gives pieces of its valuable treasure anymore.

According to Hicks (2003) language is a cognitive resource, it is the mediator of children's thinking and learning. Language is seen as a way children are functional members of society as well; furthermore, abstract representations are built upon language. These visions of language as the primary root for thought come from Vygotsky's theory about sociocognitivism (Williams, 1989); CLIL as an approach and this particular project aim to deal with these basic functions of language for children in a communicative context, their Natural Science class.

The physical classroom is transformed into a real communication environment where students can learn and develop their personal and linguistic skills. According to Mercer (2008); the Intermental Development Zone (IDZ) in which learning takes place is constantly reconstituted and has to be challenged in order to be successful: minimizing misunderstanding and maximizing motivation. The IDZ is enriched by mutual achievement because the counterpart is taken into account, and real solidarity among peers is implemented as a personal and social value necessary for our students to make them active citizens of the global era.

This sociocultural view relates individual thinking and collective intellectual activities of groups. An active bond is formed between individual and collective thinking, this bond strengthens the conjunction of the intermental and intramental dimensions of the human being.

The traditional class discourse follows a direct mode of instruction: Initiation, Response and Evaluation pattern or an Initiation Response and Follow up formula looking for a right answer where the student should not commit mistakes or errors restricting the pupil's creativity. The monologue or narrative discourse based on teacher's talking time is an instructional discourse structure that leaves no room for the children's Inquiry. The CLIL unit designed for this case study, appendix "A", follows the theoretical structure and aims depicted above following a CLIL methodology. There is an ample variety of *hands-on* activities (appendix A.2.) and a high use of speaking frames (appendix A.1.) in order to enhance HOT (High Order Thinking) tasks and to push their oral and written production in the foreign language.

On the other hand; the narrative teaching approach is still used by most of English as a Foreign Language (EFL) teachers; Cook (2008) identifies this pattern as the major distinctive trait of the "mainstream EFL style". This teaching style can be identified when teachers are the main source of knowledge in class; so, they direct a presentation of the contents that will be practiced during the lesson; afterwards there will be a production stage where the students will be able to provide a right answer for the tasks the teacher implements in class. This teaching pattern is also known as PPP (Presentation – Practice – Production); this pattern is so commonly extended at the formal education that some authors call it the "school model" (Sánchez 1993, 2001, 2004).

The roots of PPP can be observed from the second half of the twentieth century following the Structural Methods (Audiolingualism, British Situational Teaching Method or the Audiovisual Method) which aimed for the acquisition of formal grammar structures. This teaching pattern fitted well in the teaching of grammatical structures since it allowed the teacher to present and model a linguistic structure; afterwards, the student was given the chance to use that structure in different situations. At this point, the structure was supposed to be acquired by the pupil since he or she could, linguistically speaking, transfer that structure to different contexts successfully.

PPP, then, consists of three steps; these three steps were taken into account at designing and implementing the Unit of Work *The Energy* , appendix “B”, designed for this case study:

- An initial Presentation step, P1: the teacher controls the pace of the teaching process. The materials in this phase contain all the aimed items.
- A Practice step, P2: which still keeps a high control by the teacher; he checks students’ understanding of the items presented in the previous stage. These tasks look for accuracy of forms; fluency, as a linguistic productive oral characteristic, is left aside and it will be aimed at the next stage.
- A production phase, P3: where more autonomous and creative tasks are implemented, the structures are used freely by the students under the supervision of the teacher. These activities aim for an improvement in fluency and are usually based on problem-solving and information-gap tasks.

Psychologically, PPP connects with the frame of skill learning or ACT-R (Adaptive Control of Thought-Rational) depicted by Anderson (Anderson, 1982 and 2010). Anderson distinguishes, as modern cognitive psychology does, between declarative and procedural knowledge as the modes of knowledge in memory. Declarative knowledge is the knowledge about the model and procedural knowledge is the knowledge of how to use that model. Anderson describes three phases to achieve knowledge fulfillment: declarative stage, procedural stage and automatic stage. These three stages correlate with the three steps described above as required for a PPP unit.

Psycholinguistically, the first two steps of PPP allow students to notice specific linguistic characteristics that will match their previous knowledge on the issue as well. The importance of production is related to Swain's "Comprehensible Output Hypothesis" (Swain, 1985, 1995, and 2005) where he claims that learners must speak in class for achieving linguistic aims.

Pedagogically, PPP assures to keep an organization that makes students feel more secure in class (Sánchez, 2001); this fact triggers the linguistic potentiality of foreign language learners. Pedagogical predictability, consciously or unconsciously, promotes the feeling of security but at the same time it might provoke boredom in the students who might lose their motivation in class (Lewis, 1996; Sánchez, 2001, 2004; Scrivener, 1996; Skehan, 1998; Ur, 1996).

3. Study

This study case aims to clarify the consequences of implementing two different teaching approaches analyzing the students' acquisition of written receptive vocabulary. The content aims of the CLIL project (Appendix A) and the PPP Unit of Work (Appendix B), were the same and their key-topic too, the Energy, and so it was

the objective final assessment based on a test to check the receptive vocabulary they had acquired. This factor was chosen looking for objectivity and because “vocabulary size is directly related to the ability to use English” (Schmitt et Al., 2001)

In the following table the content aims of both programming units (CLIL project and PPP unit) are described:

<ul style="list-style-type: none"> • To understand concepts related to energy. 	<ul style="list-style-type: none"> • To explore concepts related to different types of energy.
<ul style="list-style-type: none"> • To demonstrate understanding of different types of energy and light. 	<ul style="list-style-type: none"> • To explore concepts related to the properties of light.
<ul style="list-style-type: none"> • To recognize the necessity of saving energy and use renewable sources of energy. 	<ul style="list-style-type: none"> • To understand how the energy consumption varies according to wealth and climatic conditions.
<ul style="list-style-type: none"> • To classify energy into different types according to its source. 	<ul style="list-style-type: none"> • To realize energy is continuously transformed and produced.
<ul style="list-style-type: none"> • To contrast renewable and non-renewable sources of energy. 	<ul style="list-style-type: none"> • To differentiate between renewable and non-renewable sources of energy.
<ul style="list-style-type: none"> • To be conscious of the way we use energy in our daily lives. 	<ul style="list-style-type: none"> • To understand the concept of sound as a form of energy and its properties.
<ul style="list-style-type: none"> • To recognize the benefits of the use of renewable sources of energy. 	

Table1. Content aims of both programming units, CLIL project and PPP unit.

3.1. Subjects

This case analyzed the results of a group of 56 Year Five Primary Education students whose first language is Spanish and whose standard of English is A2 according to the Common European Framework of Reference for Languages (Council of Europe, 2002). They have been following a bilingual learning curriculum for five years that implements the English language as vehicular for the subjects of Science, Social Studies, Arts and Crafts and English; these four subjects entail nine classes a week, the 36% of their school timetable.

The 56 students were divided into two groups, class A and class B, that were instructed by the same teacher; the A group attended to the classes following a CLIL

project, appendix “A”; and the B group followed a PPP unit, appendix “B”. The A group was made of 15 girls and 13 boys, the B group had the same amount of boys and girls. There were five children with Educative Special Needs in group A (four had attention deficit disorder and one cognitive precocity). Group B was very similar in this aspect too, since five children had Special Educational Needs; one student was cognitively premature and four students suffered from attention deficit disorder, one of them was hyperactive. The class groups are reorganized academic year by academic year to get heterogeneous groups with similar standards according to their cognitive skills and academic performance.

Taking into account the size of the group of subjects and the special academic development of these students; the results and subsequent conclusions of this case study must be taken with caution.

3.2. Methodology

The analysis of the acquisition of the receptive vocabulary was adopted as the factor for the comparison between both teaching approaches in order to get objective data and because the acquisition of receptive vocabulary is a key-element in the linguistic development of a second language speaker (Nation 1983). The test to analyze this aspect, appendix “C”, was not the only one the students had to take but it was the one that could be done by both groups since the content tests on the main topic and secondary domains were different because of the methodology implemented.

The test considered two different features of receptive vocabulary: vocabulary size and depth of vocabulary; according to Read (2007) these two aspects have to be measured for considering receptive vocabulary. To assess the vocabulary size a *Yes / No* format task is recommended and to test the depth of vocabulary a word

association format task has been used in different language testing formats internationally accepted (Goldberg et al., 2008). “The most used measure of English vocabulary size for L2 learners is Nation’s Vocabulary Levels Test” (Read, 2007), because it measures at the same time the two key criteria for testing receptive vocabulary: size and depth of knowledge.

The last version of Vocabulary Levels Test was released in 2001. It is based on matching the target words with synonyms or definitions and aims to “assess vocabulary for pedagogical and research purposes” (Schmitt, N., Schmitt, D. and Clapham C. 2001). The Vocabulary Levels Test is arranged in groups of three definitions that have to be matched with three words that are listed in a group of six, example taken from the Vocabulary Levels Test:

- a. Business ___ Part of a house
- b. Clock
- c. Horse ___ Animal with four legs
- d. Pencil
- e. Shoe ___ Something used for writing
- f. Wall

The listed words are arranged in alphabetical order and the definitions according to their length, the definitions are taken as short as possible; in the case of the same amount of words the definitions are alphabetically ordered due to their first word. These premises are implemented to minimize the influence of guessing. Ten sets of six words and three definitions make up the test; each correct answer, matching

each definition with each target word, is given one point so that the maximum score is 30 points.

The vocabulary test designed for this study case, appendix "C", follows the same structure of the Vocabulary Levels Test: ten groups of six words, alphabetically ordered, and three definitions, arranged according to the number of words, were designed. These structural features were used to design the test in order to minimize the effects of guessing.

Data were collected in one session during class time from both groups. The time allotted to complete the task was 10 minutes. All the 56 students completed the test. At the beginning of the test, clear instructions together with an example were given both orally and in written form to clarify what they were being asked to do. Tests were corrected and total scores obtained. 0 was the minimum score and 30 was the maximum.

3.3. Results

Table 2 presents the average scores of the A group (the CLIL group); students' scores are simply added and divided by the number of subjects being part of the named group. The results have been converted into a percentage scale for the comparison to be easily established.

	Score (x/30)	Scores (%)
Whole group	27,5	91,6%
Girls	27,8	92,6%
Boys	27,2	90,6%
Attention Deficit Hyperactivity Disorder	22,2	74%
Cognitive Maturity	30	100%

Table 2. Scores of students following a CLIL instruction

Table 3 shows the average outcomes of the B group (the PPP group); students' scores are simply added and divided by the number of subjects being part of the named group. The marks were also transformed into percentages for a clearer comparison between both groups.

	Score (x/30)	Scores (%)
Whole group	23,2	77,3%
Girls	23,1	77%
Boys	23,3	77,6%
Attention Deficit Hyperactivity Disorder	16	53,3%
Cognitive Maturity	30	100%

Table 3. Scores of students following a PPP instruction

4. Discussion and Conclusions

The results obtained in both cases achieved a high standard since the average grades did not lower the 70% of success; the difference between the scores of both approaches is a 14.3% higher in the case of the CLIL approach. We have to take into account that the CLIL project was implemented in 27 lessons, around 20 hours of

instruction; the PPP unit was delivered in 16 lessons, around 13.5 hours of instruction. The difference between the average time for a CLIL lesson (44 minutes) and a PPP lesson (50 minutes) is due to the fact some CLIL lessons did not require the 50 minutes available for each session but the PPP class did. This means the CLIL project was 33.5% longer than the PPP unit to achieve a 14.3% of improvement in students' acquisition of written receptive vocabulary.

In the two approaches the research makes visible a meaningless difference according to the sex of the participants, being the biggest difference of 1 point between boys and girls attending CLIL classes, and not even half a point among the boys and girls following a PPP instruction.

There was one child in each group more cognitively mature than her partners; the performance of both kids was perfect, they got a 100% of acquisition of written receptive vocabulary. It seems that the pedagogical approach does not influence these students in this aspect of the second language acquisition since their standards are the highest possible grades in both cases.

Dealing with the scores of children diagnosed with an Attention Deficit Hyperactivity Disorder (ADHD); we can notice a variation of 20.7 % between the CLIL project and the PPP unit of work since the students from the A group scored a 74% of performance and the ADHD students from the B group got a 53.3%. We can conclude that CLIL can be strongly recommended for the instruction of ADHD students since it narrows the difference in attention, and subsequently in motivation, of these students with ADHD and their partners.

We can state that the results obtained by the ADHD students from group A (74%) are very similar to the average score obtained by the students in group B

(77.3%); this means the attention awakened by the PPP unit among the students was very similar to the level of attention a ADHD student reaches; taking into account the correlation between attention and motivation at the school context; we can remark that PPP as an approach for content areas delivered in a second language is demotivating for students if compared with CLIL.

We can conclude that to follow a CLIL methodology at teaching a content area in a second language is worthy as long as the teacher has enough time since this approach required a 33.5% more time than a traditional linear approach for the same content aims. This recommendation in favor of the CLIL approach is stronger in educational environments where the number of students with ADHD is meaningfully high.

5. Further Studies

This study was performed using the data gathered in a series of lessons within the frame of an academic year; so, it would be interesting to measure the written receptive vocabulary gained by students at the end of compulsory education following a CLIL methodology and to compare these data with the results obtained by students who do not attend CLIL programs.

It will be also of great interest to check the results obtained by students of this age considering other criteria, related to vocabulary or not, to see if the results obtained are similar to the ones obtained at dealing with the written receptive vocabulary.

It would be worthy as well to appraise if the results already analyzed are repeated and representative in different contexts around the world where CLIL

methodologies are being implemented together with other traditional approaches and pedagogical models.

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Appendix A- CLIL Project

Topic: The Energy

The project *The Energy* uses Exploratory Talk for the students to achieve the aims named at the Theoretical Frame section of this case study. Its main domain is Energy and there are seven Secondary domains that are interdependent and cross-curricular. The classroom language is English; second language for all these 10 / 11 year old kids taking Primary Education Year Five at a Bilingual School in Spain.

Secondary Domain number 1

Topic: Energy, activation of previous knowledge.

Media: Last academic year Science Class Blog.

L-Skills: Speaking, Listening, Reading and Writing

Task: Do a mind-map

HOT: Summarize and predict.

Lesson 1, Science class

Students will be arranged in pairs and previous academic year, Year 4, Science Class Blog will be projected on the White Board.

<http://scienceyearfour.blogspot.com.es/2014/05/uses-of-energy.html>

They will read the text about the uses of energy within the work-pair and will have to agree on a mind map for the information contained in the entry.

When they finish, the students are asked to give examples of the way the human beings use of energy till every pair finishes the mind map. The teacher gives an example, e.g: **When you play videogames, you use electricity.* The teacher fixes on the Science Focus Wall the speaking frame number 1 to involve students in exploratory talk.

Every pair will explain an example they have spoken about to the rest of the class and the class will have to say the type of energy they are talking about.

Lesson 2, English class

The teacher shows the same entrance of the blog on the white board and arranges the group in fours. They will be asked to read the entry properly and highlight a word in it they know a lot and they think it will be interesting to learn more about. The teacher has to guide the upcoming discussions towards energy as the key word in the entry showing verbally the pupils it is the abstract idea behind forces, they will use speaking frame number 2 for this task

They will follow this sequence before getting to a conclusion: they will have 3 minutes to speak about it with their Face partner, then 3 minutes to speak about that word with their Shoulder partner and other three minutes to speak about that with their cross partner. After these ten minutes of Exploratory Talk they will agree on one word from the definition giving reasons about their choice; they have to write down the word and express what they already know about it: they can write, draw, give examples, etc ...

The speaker of every group writes the chosen word on the green board. When they finish they realize most of them chose Energy and the teacher will say that it will be the topic for the next project.

Lesson 3, Arts and Crafts.

The pairs arranged for the first lesson will do their mind map on a chart to be shown on the class walls illustrating the main points of it.

They will explain their illustrated mind maps to the rest of the class before fixing them on the classroom walls.

Secondary Domain number 2

Topic: Energy Transformation

Media: Experiment

L-Skills: speaking, listening, writing.

Task: Do a chart.

HOT: cause and effect, prediction, comparing.

Lesson 1, Science class

The teacher will arrange the class in fours. Students will do a hands-on activity, experiment number 1 from www.usborne-quicklinks.com.

Then the teacher shares out a chart, speaking frame #3, where they will have to write down the data they will collect. This data will have to be compared afterwards with their predictions.

They will give an explanation for the phenomenon; the discussion will be driven by the teacher to the conclusion that energy cannot be seen but it is transformed; the sound of the speakers makes air vibrate and if it is strong enough can make the food wrap vibrate. The power of vibration depends on volume.

The energy is transformed:

**can they give and explain more examples of energy transformation?*

Lesson 2, English class

The English teacher will use speaking frame #3 to initialize the students with the first class conditional clauses.

He/she will give an oral example: **If the volume is 1-10, 1-10 tissue paper balls fall.*

Every group will have to do ten sentences where they show all the cases from the hands-on activities they did on the Science class.

Then the teacher writes down an example as the oral one shown above. Children will have to write down sentences about their experiment data.

Afterwards, students will do other sentences about daily-life activities using this structure.

Lesson 3, Science class

They will do a bar-chart with the data taken from the “Measure the Volume” Experiment on their notebooks.

As long as they finish they will be arranged in pairs and will compare their bar-charts with those of their partners.

The teacher will have to guide the conversations for them to try to guess the reasons for the possible differences. Probably those differences will have to do with the different distances between the bowl and the stereo.

When the whole class is done, the teacher will show the whole class two bar-chart examples where possible differences are visible. The teacher will show how the distance between the stereo and the bowl makes a difference.

The end of this lesson will be devoted to other examples they know energy is transformed: electricity into heat, wind power into electricity, solar power into heat ...

Secondary Domain number 3

Topic: Renewable Vs. Non-renewable.

Media: Experiment, video,

L-Skills: reading, writing, speaking, listening

Task: do a summary and a mind map

HOT: Prediction, summarize, compare and contrast

Lesson 1, Science Class

The class will be arranged in groups of four to perform the experiment number 2. Students go back to the classroom after placing the experiment system and in fours will have to speak about the changes that will take place on the marshmallow and why. The reason is the solar energy. They use speaking frame number 4 that is placed on the Science Focus Wall.

When all the groups explain their predictions the teacher will burn a marshmallow with a lighter and will ask what has happened and if there is any kind of energy involved in the process. A follow-up dialogue is established:

**What is the source of energy?*

**Do you know any other sources of energy?*

Lesson 2, Science Class

The students will go and take their experiments and check out if something has happened and why. The marshmallow will change if it is sunny otherwise it will remain unchanged. In both cases students will have to explain the reason for both possibilities within the group and will speculate with the other possibility taking place.

They will watch the video:

<https://www.youtube.com/watch?v=4BUa6cUjFGg#t=71>

They will speak about these sources of energy and the teacher will write the name of the renewable sources of energy on the green board.

The teacher will ask if they have something in common if they compare the marshmallow burnt with a lighter or by the sun.

This will lead a five minute conversation in the small groups. The teacher will recapitulate all the ideas they got about renewable sources of energy writing them on a text document that is shown on the white board at the same time they hold the floor to explain their conclusions to the rest of the class.

Lesson 3, Science Class

The class starts with the projection of the text document entitled renewable sources of energy and characteristics of them. They will do a choral activity where they will remember the renewable sources of energy and the teacher will type them on this document.

Another video about non-renewable sources of energy is shown:

<https://www.youtube.com/watch?v=NaLBvHYyUA#t=48>

They must dialogue within the groups about the differences between renewable and non-renewable sources of energy and name some of them. This information will be included into the common text document.

Individually they will summarize the two main sources of energy, naming examples and explaining their features with the help of their text book. As long as they finish they compare their summary with another partner's summary and will have to speak about the differences.

They will conclude this lesson doing a mind map about renewable and non-renewable sources of energy.

Secondary Domain number 4

Topic: Green Planet

Media: Visual, video,

L-Skills: Speaking, listening and writing.

Task: Do several charts to organize graphically.

HOT: contrast, compare, and connect

Lesson 1, English Class

Students perform different daily life activities and their partners have to guess the activity they are performing. The teacher writes on the green board those activities.

When they get ten, they are arranged in pairs and every peer has to design a timetable illustrating the activities he or she guesses his or her partner does and the time these activities are performed.

When they finish they can illustrate their timetable; afterwards they compare the predicted schedule with their peer's real day using speaking frame number 5 that will be displayed on the Science Focus Wall. Then the teacher asks them to think about the type of energy they use to perform those activities. The teacher or a Secretary student takes notes on the green board matching the activity with the use of energy.

The class ends with every student explaining his or her day to another partner, the hearer has to tell the energy the speaker is using for that activity.

Lesson 2, Science Class

They will watch the video about Non-renewable Vs Renewable Energy again:

<https://www.youtube.com/watch?v=NaLBvHYyUA#t=48>

They will explain in their small inquiry group of four students the way they could save energy following the timetable they did at the English class.

The teacher will ask *“Why is it important to save energy? How do you know that?”* Every conversation group will have to design a timetable where no energy is used; they must change the activities and notice how dependent we are on energy.

They will contrast this ideal timetable to each one’s real timetable: first with their face partner, then with their shoulder partner and finally with their cross partner. After these three steps they will compare their timetable to a more efficient, energetically speaking, timetable in the whole conversation group.

Lesson 3, Arts and Crafts Class.

In pairs: they will design a collage with cardboard and pictures from magazines, they have to illustrate a real day time line on one side of a large cardboard. On the other side they will do a day’s timeline collage of a perfect energetic day.

They will show the perfect energetic day chart on the classroom walls and explain their partners how that day would be.

The teacher will press them to answer the question:

**“What’s the biggest difference with a real day in your life?”*

A student will take note on the green board with the teacher’s help.

Lesson 4, Arts and Crafts.

The teacher will display flashcards on the classroom and the students will arrange them into two groups, renewable and non- renewable sources of energy.

They will sit down in their small Inquiry group of four and will see how these sources of energy could improve their day energetically and environmentally. They will use their real illustrated time lines to check out the renewable sources of energy are helpful and must be used. They will stick pieces of paper writing the solution to those habits we have in our daily life. Most of them should be about saving energy and the use of renewable sources of energy instead of non-renewable sources of energy.

Lesson 5, Social Studies.

A world map showing the energy consumption in each continent is projected.

http://upload.wikimedia.org/wikipedia/commons/7/76/Global_energy_consumption.jpg

In groups of four they will arrange the continents according to the energy consumption. They will use ordinal numbers. They will follow the four step process. The last step is to do it chorally. One group will give their conclusions and another classmate will take note on the green board.

Then they see a picture of the world at night, in their Inquiry groups they will have to establish the connection among the consumption ranking and the picture they can see on the white board:

http://www.twanight.org/newtwan/images/Earth_at_Night_Image_Mapping_600x300.jpg

Lesson 6, Science

The teacher will write down on the green board the classification they did of energy consumption by continents with the help of the whole class. Then the teacher will show a world map illustrating the use of renewable sources of energy.

<http://www.geocurrents.info/wp-content/uploads/2012/07/Renewable-Energy-by-County-Map.jpg>

They have to do another classification in the Inquiry group: this classification will be about the use of renewable sources of energy. They will do it following the four step pattern. The results are written down on the green board by a student with the teacher's help in such a way that it is easy for them to see the contrast between the energy consumption and the use of renewable sources of energy.

They will write down their conclusion chart classifications on their notebooks.

Lesson 7, Science

The teacher will ask the students to explain their partners in the Inquiry group their conclusions. The teacher will project this image on the white board:

<http://1.bp.blogspot.com/lmCA1MRok0c/TqQbD6kgAgI/AAAAAAAAZT0/1CIB-JVyxVY/s1600/world-energy-report.jpg>

The teacher will explain them the key of the graph and then they will have to explain their partners in the Inquiry group what they can observe.

Then the teacher asks *“how can it be the difference so high?”* With a follow- up conversation where the why- questions must be the reference. There will be no right or wrong answers.

They have to think about our own country and predict to which use of energy Spain`s consumption is closer in their Inquiry group. Then they have to explain their answer to their partners giving reasons otherwise the teacher will press them to give reasons with questions such as *“why do you think so?”*

Another graph will be projected where they will see the oil consumption by country and per capita:

<http://betacity.files.wordpress.com/2011/06/energy-consumption-total-and-per-capita-2002.jpg>

Then the teacher will show them another graph where the source of electricity in Spain is illustrated:

http://arizonaenergy.org/News_11/News_Apr11/1332-wind-becomes-spain-s-biggest-energy-source.jpg

They will check out in their Inquiry groups if their predictions were right and which countries consumptions are similar to the Spanish one and why.

Secondary Domain number 5

Topic: Renewable sources of energy in action.

Media: Experiment

L-Skills: Speaking, listening, writing, reading.

Task: do a water power station

HOT: Create, hypothesize and evaluate.

Lesson 1, Arts and crafts

The students will be asked:

“Which is the most important renewable source of energy at their hometown?”

The teacher will guide the discussion to Hydro power.

They will do a water power station using a plastic bottle, experiment number 3 taken from www.usborne-quicklinks.com.

The teacher will explain that movement is the hydro power and it is the same energy that can be used to produce electricity. The teacher will ask if they have visited any hydro power plant and the names of them. They will explain to their Inquiry group partners how a water power station gets the energy.

Lesson 2, Arts and Crafts

In their Inquiry groups they will have to list all the renewable sources of energy they know. They will be asked to explain the hydro power and solar energy experiments they have already done.

They will be asked how windmills can produce electricity; the inquiry groups will be put into action to get to the conclusion that the energy of the wind is transformed into electricity. The teacher will explain them they will transform the wind into energy in the same way a windmill does, this will be performed by a hands on activity, experiment number 4 from www.usborne-quicklinks.com.

They will explain to their Inquiry group partners how their windmill gets the energy the difference between their windmills and the ones producing electricity.

Lesson 3, Science

Every Inquiry group displays their experiments about solar energy, wind power and hydro power on their desks. They explain following the Exploratory Talk routine the experiments. When every group has its own conclusions every kid will do a summary on his or her notebook.

Then students will explain the summary within the Talk group, if the pupil wants to change the summary he can do it.

Secondary Domain number 6

Topic: Light: properties and instruments to control light.

Media: Experiments.

L-Skills: Speaking, listening, reading and writing.

Task: mind map and hands on activities.

HOT: compare, contrast, predict, evaluate

Lesson 1, Science Class

The teacher will remember them the solar energy experiment, and will ask:

**“Can you see solar energy?”*

There will be a choral dialogue that the teacher must guide through “wh-questions” to Light as a type of energy that can be seen by the human eye.

The next task will be an Inquiry group task where they will have to write down as many sources of light as they can. A classmate will take note of all the sources of light they could name after the Inquiry group dialogue.

The teacher will guide next conversation: from the light sources listed which one is the most important on and why. They will have to write down on their

notebooks the sources of light and the environment where they are important. They should highlight the importance of the sun as the main natural source of energy.

Lesson 2, Science

The teacher will lower the blinds of the classroom and turn off the lights. Then he will turn on a torch and ask about the color of the torch light. The teacher will ask a student to hold the torch and he will use a plastic pen as a spectrograph to separate light into its spectrum of colors. The students will do the same with a sunbeam raising a bit the classroom blinds. They will do it in their Inquiry groups. They will speak about natural phenomena where they have seen this. They will try to remember the spectrum of colors as well taking notes of it too.

Lesson 3, Science

They will have to predict what is going to happen to the light rays from the torch when they hit the green board, a smooth and flat surface. This will be done in the Inquiry groups supporting this task by speaking frame number 6. Then the teacher will ask them about the differences when doing the same on a rough surface.

They have to speak about their predictions.

Then they will see whether their predictions were good or not.

The teacher will tell this phenomenon is called Reflection.

Lesson 4, Science

The teacher shows them again how the spectrum of light can be seen when going through a spectrograph; the teacher will use a prism this time. He will ask what is happening and they will explain it to a pair peer using speaking frame number 7.

He will show a glass full of water and they will predict in their Inquiry group what will happen when the light ray passes through the water. They will make their guesses and then they will do it by themselves and see the difference with their guess.

Afterwards the teacher will tell them next experiment: they will put a pen in the glass full of water and beforehand they will predict what is going to happen. When

their predictions are done with the support of speaking frame number 7 they will be ready to do it. The teacher will explain the phenomenon of Refraction and that it happens when light goes through materials of different densities.

Lesson 5, Science

They have to remember the features of light, there will be whole-class brainstorm; afterwards they will have to do an individual mind map about Light.

The teacher will display in the middle of the classroom different instruments that control and detect the light; e.g.: a telescope, a camera, a microscope, binoculars, and a magnifying glass.

They will explain the way these instruments modify the light and their uses.

Secondary Domain, number 7

Topic: Sound; features and types of sounds

Media: Experiments

L-Skills: speaking, listening, reading, writing.

Task: Take accurate notes of hands on activities.

HOT: Prediction, compare and contrast.

Lesson 1, Science

The teacher will quickly repeat the experiment with the stereo and he/she will lead a conversation where the students have to link the sound to energy.

The students will have a glass with water and the teacher will ask them to touch the surface with their pens to see the waves they produce the teacher will tell them the sound and the water waves move in the same way. They will explain the similarities and differences between sound and water waves.

They will check out the sound waves with an easy performing experiment, experiment number 4 from www.usborne-quicklinks.com.

Before the first time they knock the fork against the desk they will do their predictions and will have to explain the differences between those predictions and what they have just seen and heard. They will do the same with the second performance.

Lesson 2, Arts and Crafts

They will do a guitar with a shoe box and different types of rubbers, experiment number 6 from www.usborne-quicklinks.com, so they can see the different vibrations and the sounds they produce. They will do this experiment in pairs.

Lesson 3, Science

The teacher will make an annoying noise and they will have to explain the differences between music and that noise, they will do it in their Inquiry groups with the support of speaking frame number 8.

Then the teacher will tell them to list more annoying noises.

The teacher will use the shoe box guitar for the children to understand the difference between the features of sound: Pitch, Duration and Intensity.

They will be arranged in their Inquiry groups, so each group will have two fake guitars to follow the four step structure. The teacher will share out speaking frame number 9 to each student. They will produce high and low sounds, short and long sounds and loud and quiet sounds. They will have to explain how to produce ones and the others. The teacher will guide next step for them to see how the plucking or the guitar strings is related to the pitch, duration and intensity of the sounds and how the energy is transformed from the finger energy to the sound waves.

Assessment: The assessment of a CLIL project must take into account linguistic development and scientific concepts at the same time. Students' assessment along a CLIL project integrating Inquiry Science and Exploratory Talk must be based upon a rubric incorporating: concepts, language structures, collaborative organization and communication. The collaborative nature of these two approaches commands to add a collaborative dimension to the assessment based on a rubric. Rubrics allow the teacher

to develop assessment along a complex cross-curricular project and students know what they are expected to learn, understand and do.

The rubric designed for this project considers the seven domains, no domain prevails over the others and the language aims, contents aims and cooperative working skills are considered:

<https://www.rcampus.com/rubricshowc.cfm?code=JCC4WA&sp=true&nocache=1398427205624>

Appendix A. 1. Speaking Frames for the CLIL Project *The Energy*

Speaking frames are used as graphic organizers to scaffold the students' speaking production. Once the students have the frames in their hands the teacher introduces the frame and gives an example about how to use it to the whole group. Then, they are used within the enquiry group to support oral communication and self-confidence. The main purpose of the frames is to assure the students feel confident with certain structures that will be recurrent along the project; these structures will be safe linguistic patterns for the students at real communicative contexts.

This kind of speaking frame where several options are offered to the student are suitable for fifth graders, 10-11 years old, since they are able to organize abstract concepts; at the same time, to categorize is a High Order Thinking task that challenges their cognitive skills.

The nine speaking frames designed for this project provide students with a wide variety of opportunities to express themselves orally: from those that try to track their oral production tightly (speaking frames number 1,3,4,6 and 7) to those that allow the students to speak and produce feeling themselves confident and free at the same time (speaking frames number 2, 5, 8 and 9). It is important to highlight that most of these speaking frames (speaking frames number 3, 4, 5, 6 and 7) aim at hypothesizing before the experiential activity, another High Order Thinking skill worthy to develop at this early educative stage.

- Speaking frame number 1

This speaking frame will be implemented at the first lesson of the Secondary Domain number 1. This lesson is a Science class where they will be able to differentiate the uses of the different energy forms.

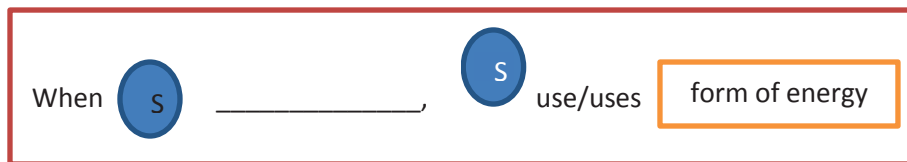
The students will say to the partner one example following the frame and the peer will agree or disagree giving reasons.

Sample exchange:

**Student A: When I play videogames, I use electricity.*

Student B: I agree with you. When my mum cooks, she uses kinetic energy.

Student A: I disagree with you because she uses thermal energy.



- Speaking frame number 2

Speaking frame number two is designed for the second class of the first Secondary Domain; it is an English class where they have to describe and hypothesize what they know about energy. They will relate the concept of energy to the concept of work.

They will work within the enquiry group following a four step mechanism where they will scaffold their oral production sharing their thoughts about this concept that is related to the very previous class. Sample exchange:

** Student A: I think the word is energy.*

*Student B: I agree with you. I see/feel/hear energy when I _____(*turn on the light)*

Forces:

Forces give an object the energy to move, stop or change its direction.

Word:

What do we know about it?

- Speaking frame number 3

This speaking frame will be used in the first lesson of the second Secondary Domain that is a Science class and it will be reused at the next lesson that is an English class. The aims of the same speaking frame will vary in both lessons.

At the Science class, the frame will allow students to predict; and at the English class, it will support the use of conditional clause type 1.

Sample exchange:

**Student A: If the volume is 6, 3 tissue paper balls will fall.*

Student B: I disagree; If the volume is 6, 2 tissue paper balls will fall.

Student A: Let's check ...

Measure the Volume:

Volume	Paper balls fallen
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

If the volumen is ○ ,
○ tissue paper balls will fall.

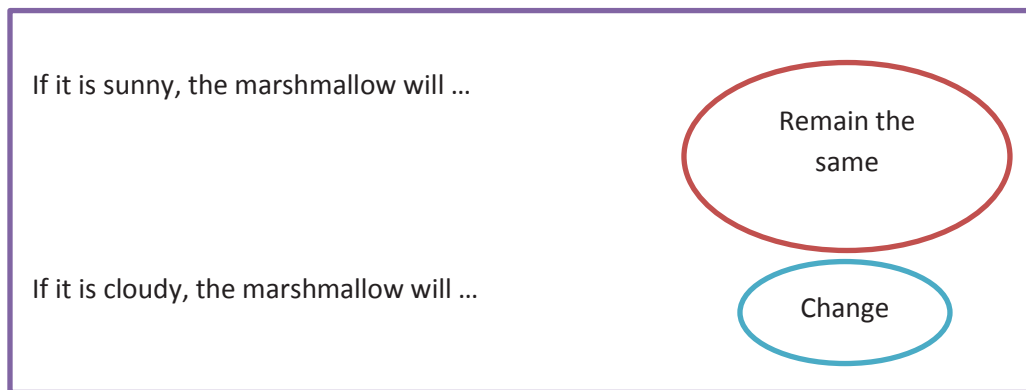
- Speaking frame number 4

This speaking frame will be used by students in the first lesson of Secondary Domain number four. This Science class is totally based on prediction and to help students to predict is the aim of this speaking frame. The scaffolding of the conditional clause carries on with this activity; at this point students feel confident with its oral production and understanding.

Sample exchange:

**Student A: If it is sunny, the marshmallow will remain the same.*

Student B: Uhh, I think if it is sunny, the marshmallow will change



Speaking frame number 5

This speaking frame is a graphic organizer that will support their predictions on their peer's daily life. It will be implemented at the third lesson of the sixth secondary domain.

This class is a Science class where students will figure out how a common day of his/her partner is and to notice the importance of energy consumption.

Sample exchange:

** Student A: I think you play football on Monday.*

Student B: No, I play chess on Monday, I use energy because I need light. I think you come to school on Monday.

Student A: Yes, I do. I come to school on Monday. I use energy for this. I come by bus.

Monday	Tuesday	Wednesday	Thursday	Friday

I think you _____ on _____.

I _____ on _____. I *use/don't use* energy for this.

- Speaking frame number 6

The main goal of this speaking frame is prediction. The frame will be used at the fourth lesson of Secondary Domain number six; this class belongs to the Science subject.

Sample exchange:

**Student A: When the light ray hits the Green board it will light the board.*

Student B: Yes, and it will reflect on many directions.

Student A: mmmm ... I disagree ... it is a flat surface ...

When the light ray hits the Green board it will _____.

When the light ray hits a rough surface it will _____.

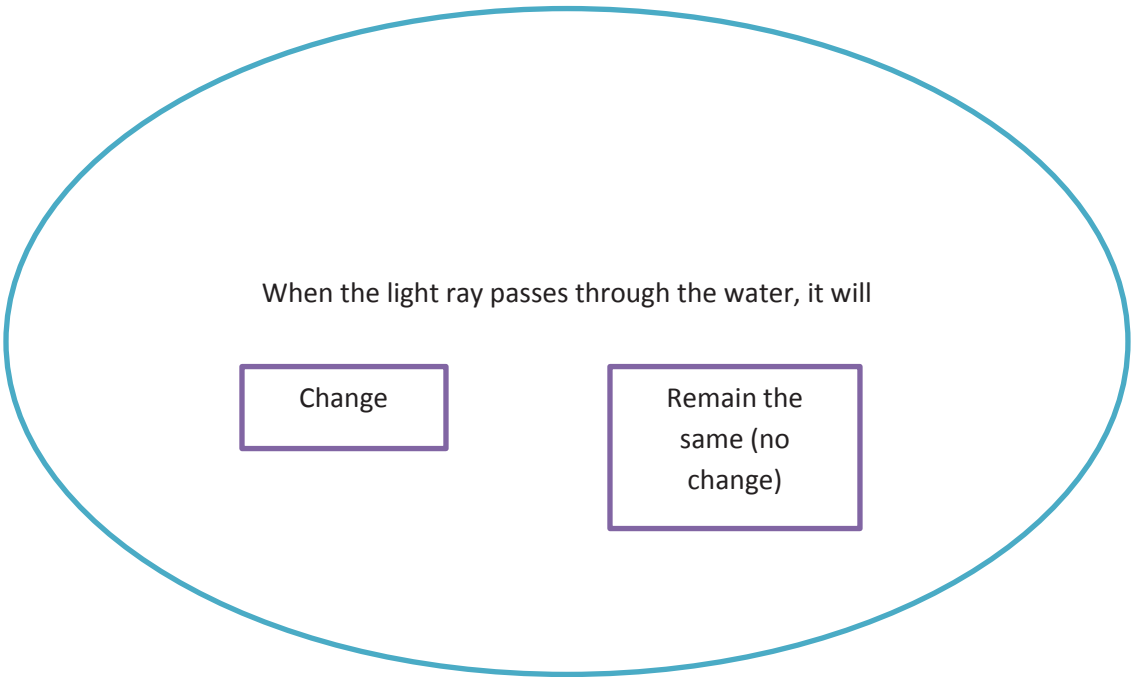
- Speaking frame number 7

Once again the aim of this frame is prediction. It will be support the learners' predictions at the fourth class of the sixth Secondary Domain, a Science class.

Sample exchange:

**Student A: When the light ray passes through the water, it will remain the same.*

Student B: I am not sure, let's wait and check. I think when the light ray passes through the water, it will change.



- Speaking frame number 8

This speaking frame will be the introduction and linguistic warm-up for a Science class about Sound; it is the third class of the Secondary Domain number 7. The aim of the task this frame will support is to realize the big amount of sound input we receive daily and classify it according to the students' own preference.

Sample exchange:

**Student A: I think music is a sound, I love music.
 Student B: I agree with you, I like music too. I think a car makes noise, I don't like it.*

Sound	Noise

- Speaking frame number 9

This frame will scaffold their enquiry process to understand the different features of sound as a type of energy; it will be used at the third class of the Secondary Domain number 7.

Sample dialogue:

** Student A: If I touch/play a short and thick string, the pitch is low.*

Student B: I agree with you and the duration is short.

Student A: I am not sure about the Intensity ...

Student B: I think it is loud, let's play another type of string...

Pitch	High	Low
Kind of string:		
Long/Short		
Thick/Slim		

Duration	Short	Long
Kind of string:		
Long/Short		
Thick/Slim		

Intensity	Quiet	Loud
Kind of string:		
Long/Short		
Thick/Slim		

Appendix A. 2. Experiments for the CLIL Project *The Energy*

Experiment number 1.

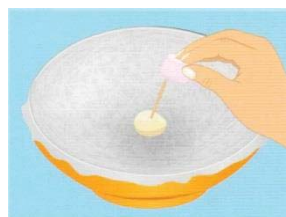
Every group will have a bowl, a piece of plastic food wrap, a piece of tissue paper and a CD player. They will stretch the piece of plastic food wrap as tightly as possible around the bowl and they will put ten small balls of tissue paper on the plastic food wrap.

They will turn on the stereo close to the bowl with a low volume. Before doing it so the teacher introduces the new vocabulary involved in the activity: *stereo, volume and to fall*. The teacher asks what is going to happen, they will do their predictions and every group's speaker will tell the rest of the class those predictions.



Experiment number 2.

They will place a piece of poster tack down in the middle of a bowl that will be covered with kitchen foil. They will put a marshmallow on a toothpick and push the other end of the toothpick into the poster tack. The teacher asks about if there is any change in the marshmallow, they will speak about a mechanical change since a toothpick pierced the marshmallow.

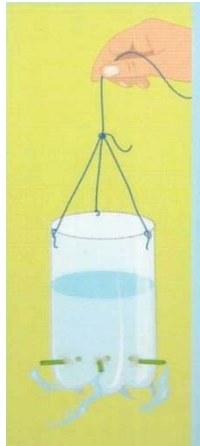


The experiment will be placed on a place where the sun will heat the system.



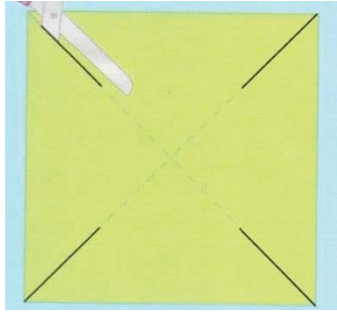
Experiment number 3.

1. Cut the top of a large plastic bottle. Make six holes around the base with a pencil.
2. Cut a straw into two centimeter pieces long and push them into the holes securing them with tape.
3. Make three holes at the top of the bottle and tie a piece of string. Then tie the strings to a fourth piece of string.
4. Pour a jug of water and the energy of the water will make the bottle spin.

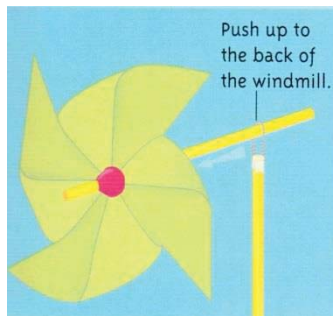


Experiment number 4.

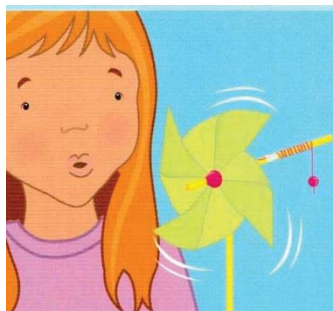
1. Cut out a square of bright paper 4 x 4 inches. Cut halfway down from each corner to the middle.



2. Fold the corners to the middle and glue them. The folds must curve and not lie down.
3. Make a hole in the middle with a pencil and push a straw through. Secure its position with poster tack.
4. Tape a paperclip to a second straw. Push the windmill through the paperclip.

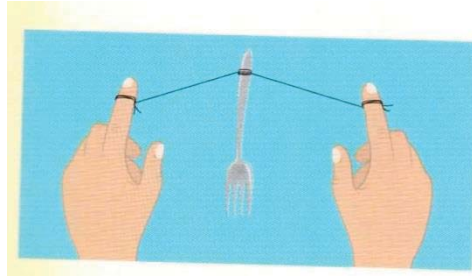


5. Cut a piece of thread about the length of two straws. Stick a small lump of poster tack to one end.
6. Tape the thread to the windmill straw.
7. Hold the other straw and blow; the windmill will spin around making the thread roll up.



Experiment number 5.

1. Cut a piece of thread. Tie the middle to the end of a fork. Wind the ends around your fingers.



2. Swing the fork so it knocks against your desk. You will hear a clink.
3. Now touch your index fingers to the flaps in front of your ear holes and let the fork hang down.
4. Swing the fork: what do you hear now?



Experiment number 6

1. Paint a circle in the middle of a shoe box. Take two rubber bands the same length but different thicknesses.
2. Stretch the rubbers around the shoe box. Pluck each one with your finger:
 - *Is there any difference?*
 - *What is the difference?*
 - *What is the only possible source of that difference?*

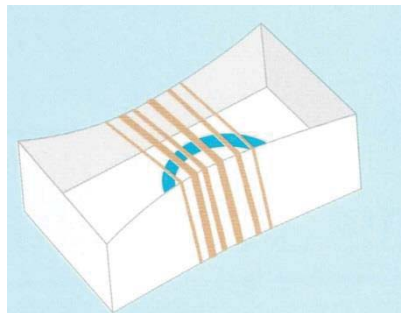
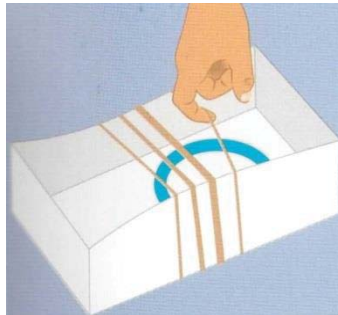
3. Take two bands, the same thickness but different lengthiness. Before plucking the rubbers:

**Which one will sound louder?*

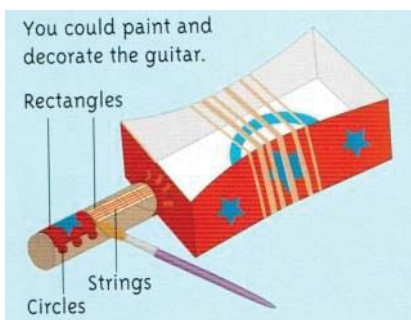
4. Stretch the rubbers and pluck them.

**Were you right?*

**Do they sound the same?*



5. You can make it more like a guitar.



Energy:

Energy allows us to do many things we wouldn't otherwise be able to do. We can't always perceive it but it's all around us. Energy gives us light, sound and heat. It also makes things move and powers machines.



Energy is the ability to do work.

Forms of energy:

- Light.

Most of light on Earth comes from the Sun. Light sources can be natural, such as the stars, or artificial, such as light bulbs and torches.

Light travels very fast. It is the fastest form of energy. It travels at 300.000 kilometres per second.

Even though light looks white, it's made up of seven different colours.



Light illuminates objects and allows us to see shapes, colours and sizes.

Light always travels in a straight line until something gets in its way. When that happens, light can be absorbed, reflected or refracted, depending on what kind of surface it hits. When light is absorbed, it transforms into thermal energy. When light hits an opaque object, some colours are absorbed and others are reflected. The colour we see is the colour that the object reflects.

- Chemical energy.

Chemical energy is released when a chemical reaction occurs. When a car burns petrol, a chemical reaction occurs between the petrol and oxygen. This chemical energy is then transformed into kinetic energy.

Batteries and food are sources of chemical energy too.



- Sound energy.

Sound is a vibration and can travel in any direction from the source. Vibrating objects transmit these vibrations into the air. The vibrations move through the air until they reach our ear. We perceive large vibrations as loud sounds and small vibrations as soft sounds.

Sound can travel very quickly, but not as fast as light.

Sound can travel through gases, liquids and solids, even if they are opaque. Sound cannot travel through a vacuum because in a vacuum there are no particles to vibrate.



- Kinetic energy.

All moving things, from large planets to tiny atoms, have kinetic energy. This energy is produced through motion or movement. The heavier and object is, and the faster it moves, the more kinetic energy it has.

Examples of kinetic energy include a moving car, a windsurfer or your bike when it is in movement. Living things have kinetic energy too.



- Electrical energy.

Electrical energy is used to power machines. We can transform it into light, sound, heat and movement.



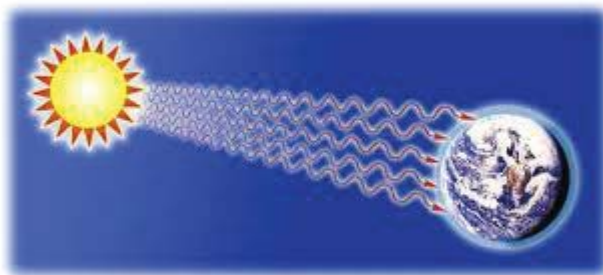
The energy to generate electricity comes from different sources. A lot of our electricity is still produced by burning fossil fuel. Electricity can also be generated using energy from sunlight, wind, water and biomass. It is also produced in nuclear power stations.

- Thermal energy.

Thermal energy flows from a warm substance to a cooler substance. This flow of thermal energy is called heat. A change in the thermal energy of a substance can also make the substance change state.



The sun is the main source of heat on Earth. Other sources include fossil fuels, which we use to warm our houses and cook our food. These fuels come from under the ground and include coal, oil and gas.



Tasks:

- 1- Give an example of each form of energy.
- 2- Indicate the forms of energy produced in each case.
 - A bonfire.
 - A fan.
 - Fireworks.
 - Firecrackers.
- 3- Think about what happens if you don't have a proper breakfast. Which food is good to eat at breakfast and why?
- 4- Why are the clothes preferred in summer?
- 5- Circle the correct words in the following text.

You can't see **light / energy**, nor can you touch it or hold it in your hands, but it is everywhere. Energy **causes / influences** changes in the things around us. It comes from many **sources / places**. Fossil fuel is the **least / most** common source of energy, but it can be harmful in the long term. **Renewable / Non-renewable** energy sources are those which will never run out.

- 6- Match the forms of energy to their description (s).

a. Chemical energy
b. Electrical energy
c. Kinetic energy
d. Light energy
e. Sound energy
f. Thermal energy

1. It is the fastest form of energy.
2. Food is a source of this form of energy.
3. All moving things have this energy.
4. It flows from a cooler substance to a warmer one.
5. It is used to power machines.
6. It travels in straight lines.
7. It can be transformed into heat, light or sound.
8. This form of energy is a vibration.
9. This energy is released when a chemical reaction occurs.
10. The Sun is the main source of this form of energy.

- 7- Read the text and answer the questions below.

Loud noises can harm your hearing. Sound travels in waves and when these waves are very powerful, they can damage the nerve cells in your ears. Scientists use decibels (dB) to measure the energy in a sound wave. Studies have shown that prolonged exposure to sounds above 85 dB can be harmful. A normal conversation, for instance, measures about 60 dB while the alarm of fire used by firefighters is about 140 dB. If you use headphones, you must be very careful, because the sound is usually around 100 dB.

- a) Which types of noise are dangerous to human hearing?
 - b) Why can headphones damage your hearing?
 - c) Which unit is used to measure the energy in a sound wave?
- 8- Complete the table with a tick or a cross.

	A solid and opaque object	A liquid	A gas	A vacuum
Light can travel through ...				
Sound can travel through ...				

9- Circle the odd one out

- a) Translucent insulator opaque light transparent.
- b) Batteries food kinetic energy chemical energy reaction.
- c) Conductors Insulators circuit dam charges.
- d) Chemical kinetic caloric thermal electrical.
- e) Solar panel oil spill wind turbine dam nuclear power station.

Energy sources:

Energy sources are either renewable or non-renewable. Some sources are more environmentally harmful than others. It is essential that we get our energy without adding to problems like global warming, water and air pollution, acid rain, habitat destruction or biodiversity loss.

- Renewable energy sources.

Renewable energy sources can be replaced, so they will never run out. Sunlight, wind and water are common sources of renewable energy, whereas biomass and geothermal energy are less well known.



1. Solar energy.

This energy is renewable and doesn't pollute. However, solar panels can only be used in sunny climates.



2. Wind energy.

This energy is clean and renewable but wind turbines only work in windy places. They can also damage habitats and kill birds.



3. Water energy.

This energy is renewable and doesn't create pollution, but the construction of dams damages habitats and causes biodiversity loss.



4. Biomass.

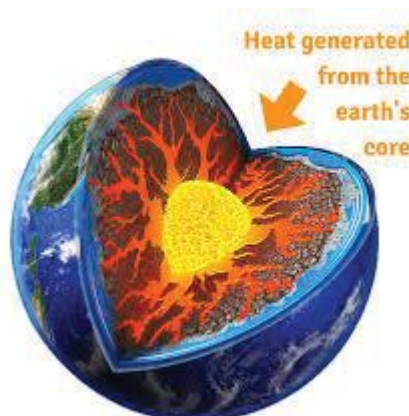
Biomass is organic material derived from living things, such as wood, dried vegetation or food waste. Like fossil fuels, biomass is burned in power stations to boil water. This produces steam, which turns a turbine and generates electricity.

Biomass is renewable but, unfortunately, burning biomass causes air pollution and contributes to global warming.

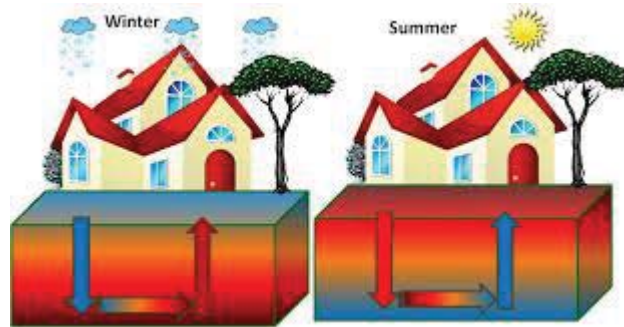


5. Geothermal energy.

Geothermal energy is heat produced by the decomposition of underground radioactive substances. Some geothermal energy reaches the surface of the Earth naturally, in the form of volcanoes or hot springs.

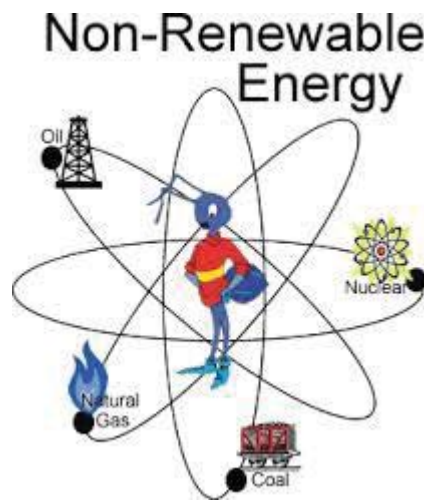


Geothermal energy is renewable and isn't contaminating, but it is limited to certain geographic areas.



- **Non-renewable sources of energy.**

Non-renewable energy sources are limited. It is practically impossible to regenerate them. Fossil fuels and uranium are non-renewable energy sources.



1. Fossil fuels.

These fuels include coal, oil (and its products) and natural gas. They are a product of decomposed organic material that has been deep underground for millions of years. If we use up these energy sources, they can't be replaced in a very long time.



-Coal is a non-renewable and a pollutant but it produces large quantities of energy. Burning coal is a cause of global warming.



- Oil is non-renewable and oil spills can cause ecological disasters but it is really easy to transport and store. The combustion of oil and related products is a significant cause of global warming and air pollution.



2. Uranium.

Nuclear power stations use radioactive metal, called uranium, instead of fossil fuels to generate electricity.



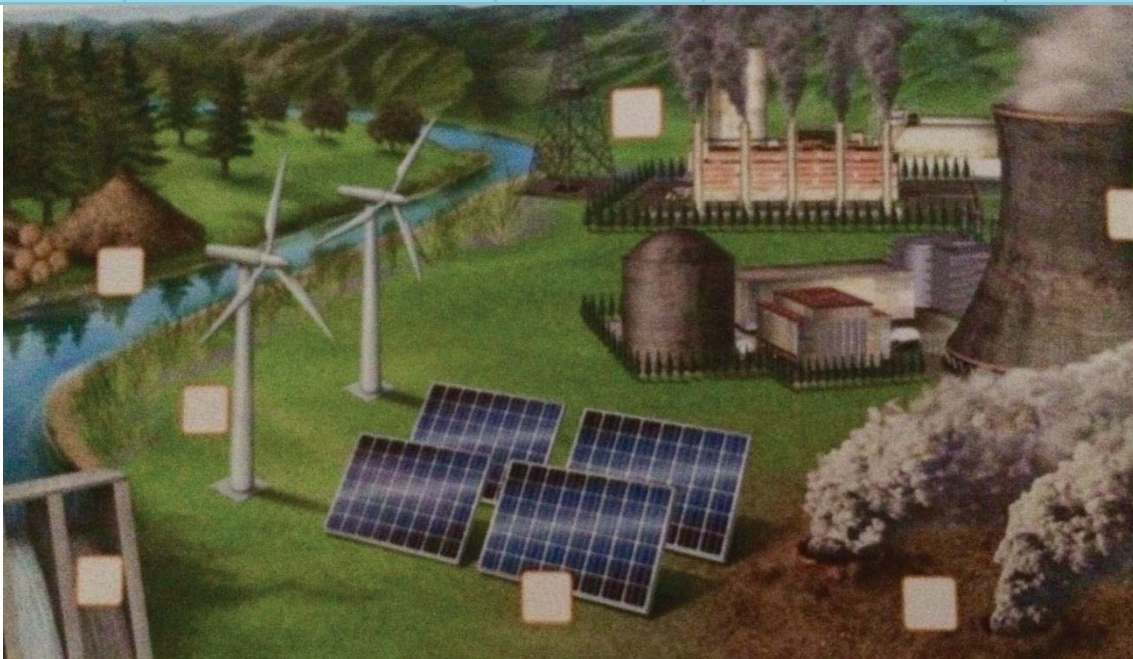
Uranium is non-renewable but we have enough uranium to generate electricity for many centuries. Nuclear power stations are expensive and they also produce radioactive waste products. Radioactivity is harmful to humans because it causes cancer.



Tasks:

1. Make a table off advantages and disadvantages of each energy source.
2. Search for information about which renewable energy sources are used in your area.
3. Search for new information about the Fukushima and Chernobyl nuclear disasters and answer the following questions in each case.
 - a. When and where did the disaster happen?
 - b. Were there any negative consequences? What were they?
 - c. In what way is radioactivity harmful?
4. Label the sources of energy using the words from the box. There are some extra words.

a. Fossil fuels	b. Magnetism	c. Light	d. Water energy	e. Solar energy
f. Biomass	g. Geothermal energy	h. Sound	i. Wind energy	j. Uranium



5. Read the following text and say whether the following statements are true (T) or false (F). Give reasons for your answer.

Flowing water creates energy that can be captured and transformed. Water power can be used to produce both mechanical and electrical energy. We use dams to contain the flow of a river and create artificial lakes and reservoirs. This water can then be released; it flows downhill in enormous quantities and generates vast amounts of energy. The force of the water spins a turbine or wheel which, in turn, activates a generator. The generator transforms this force in electricity. Water power has been used for thousands of years to create mechanical energy for a wide variety of purposes. It was also the main mover of the industrial revolution in Europe.

- a. Flowing water can create electricity.
 - b. Dams contain artificial lakes.
 - c. Water flows uphill.
 - d. Water power is a new type of energy.
 - e. Water power was used in the industrial revolution.
6. Complete the table using the energy sources in the previous activity. Say whether they are renewable (R) or non-renewable (NR).

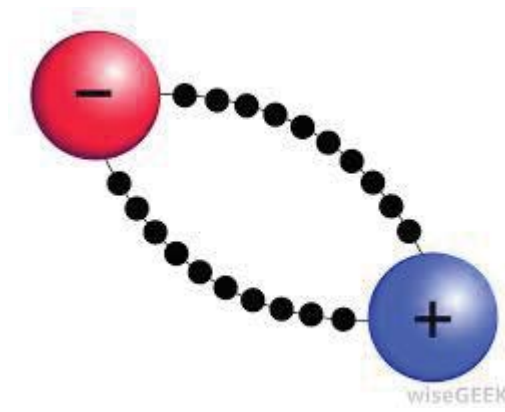
Energy source (R / NR)	Disadvantages	Advantages

Electricity



All objects contain electrical charges which can be positive or negative.

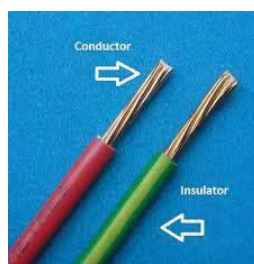
- If an object contains more positive charges than negative charges, it has a positive charge.
- If an object contains more negative charges than positive charges, it has a negative charge.



Objects with opposite electrical charges attract each other; objects with the same electrical charge repel each other.

Materials can be electrical conductors or electrical insulators.

- Metals, such as copper and aluminium, are good electrical conductors.
- Wood, rubber, glass, wool, cotton and plastic are all good electrical insulators.

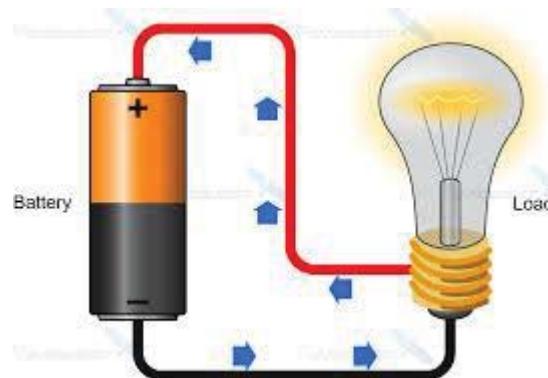


There are two types of electricity; current electricity and static electricity.

- Current electricity:

When an electrical charge moves in an electrical conductor, we have current electricity. This movement of electrical charges is known as an electrical current. Electrical currents flow through conductors. An electrical charge can't easily move through electrical insulators.

An electrical circuit is made up of different parts which are all connected together. An electrical current can only pass through a circuit that is closed.



- Static electricity:

Static electricity is a form of electricity that does not flow. Lightning during a thunderstorm or your hair sticking up in the air after having been brushed are examples of static electricity. We can produce static electricity when we rub two non-metal objects together.



Magnetism

A magnet is an object which can attract certain metals, for example iron and mixtures of iron, such as steel. Magnetism is the ability to attract these metals. Magnetism is the ability to attract these metals. Magnetism can be natural or man-made.



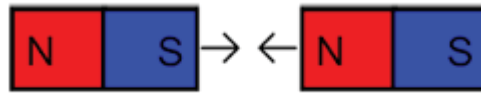
- The mineral magnetite is a natural magnet.



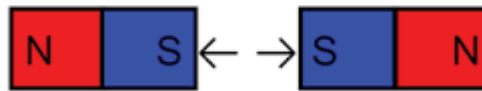
- Most of the magnets we use nowadays are man-made and manufactured from metals.



Magnets can take different shapes and sizes, but all magnets have two poles, at the ends of the magnets, which attract metal objects. The poles are called the North Pole (N) and the South Pole (S). If you break a magnet into pieces, each piece will also have a North Pole and a South Pole.



Opposite poles **attract**



Same poles **repel**

When two magnets touch at the poles, one of two things can happen:

- If we put the same pole together, the magnets repel each other. This means they move away from each other.
- If we put opposite poles together, the magnets attract each other. This means they move towards each other.

Tasks

1. Label the photos with the type of electricity they show.





2. Match the sentences to the photos in the previous activity.
 - a) A form of electricity that doesn't flow.
 - b) The movement of electrical charges in an electrical conductor.
 - c) We can produce it when we rub two non-metal objects together.

3. Identify the mistakes in the following sentences about magnetism and rewrite them.
 - a. A magnet can attract objects made from all types of metal.
 - b. All magnets are man-made.
 - c. Most magnets have two poles.
 - d. Opposite magnetic poles repel each other.
 - e. The needle of a compass always points to the Earth's core.

4. Decide whether the following examples describe current or static electricity.
 - a. Lighting a lamp.
 - b. Balloons sticking to your hair.
 - c. Starting a car engine.
 - d. Sparks when you take off a jumper.

5. Look for information about when and where the compass was invented.

REVIEW TASKS

1- Read the texts below.

-A-

When sound reaches an obstacle in its path, it is reflected. Echo and reverberation are two examples of sound reflection. Reflected sound produces an echo if the sound is reflected from a long distance, like a valley. This is because it takes time for the sound to return to the ear. This means we hear two sounds: first the original sound and then the reflected sound or echo.

When sound is reflected from a short distance, however, the reflected sound can be heard by the ear almost immediately. Reverberation is caused when the reflected sounds are blended with the original sound.

-B-

Light can be absorbed, reflected or refracted. Reflection takes place when light hits an object and bounces back. If the surface is smooth and flat, all the light rays reflect at the same angle. That is why a flat mirror shows us as we are. If the surface is rough, bumpy or uneven, the light rays scatter and the image we can see is not clear. When light passes from one transparent substance, such as air, to another of a different density, such as water, the light bends at an angle where the two surfaces meet. This bending of light is called refraction.

- Decide if the sentences below refer to A, B or both:
 - a. The text is about light energy.
 - b. The text speaks about reflection.
 - c. The text speaks about refraction.
 - d. Light bends where two surfaces meet.
 - e. Distance affects the type of reflection

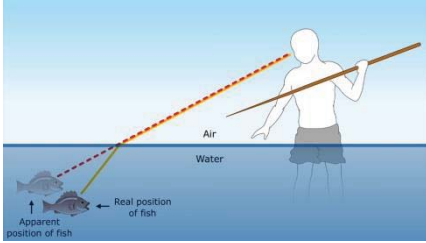
- Design a mind-map of each text and then summarize both texts.

- 2- Look at the following photos. Say which form of energy each picture is related to and why.



- 3- Answer these questions.
- What is the fastest moving form of energy?
 - What kind of energy does food contain?
 - Can both light and sound travel through solids?
 - What happens if you put two south poles of a magnet together?
 - What is our main source of thermal energy?
 - Where does biomass come from?
 - What is the difference between current and static electricity?

4- Describe what is happening to light in these two pictures?



5- Write complete sentences by matching the following sentence halves. Give an explanation for your choice in every sentence.

- a. The combustion of fossil fuels ...
- b. The measurement of how cold or hot objects are ...
- c. All moving things ...
- d. Nuclear power stations ...
- e. The flow of thermal energy ...

- 1. ... have kinetic energy.
- 2. ... is called temperature.
- 3. ... produce dangerous radioactive waste.
- 4. ... is called heat.
- 5. ... causes global warming.

6- Answer the questionnaire about how much energy you and your family use.

	Always	Sometimes	Never
Do you use the lift?			
Does your family use energy saving light bulbs?			
Do you switch off the lights or electrical appliances when you are not using them?			

- Think of another question to add.
- Think of four ways you can use less electricity and thus save energy.
- Make a list of suggestions for saving energy at school.

Appendix C. Receptive Written Vocabulary Test

Student Instruction Sheet for Vocabulary Test.

This test is a vocabulary task. You have to select the correct word for every meaning. Write the number of the right word next to its meaning.

Example:

- a) Baby ___ Very young child
- b) Book
- c) Cat ___ Seat for one person
- d) Chair
- e) Crayon ___ Small domesticated carnivorous mammal
- f) Shop

You should answer it as it follows:

- a) Baby *a* Very young child
- b) Book
- c) Cat *d* Seat for one person
- d) Chair
- e) Crayon *e* Small domesticated carnivorous mammal
- f) Shop

There are three words in each table to make the test more difficult; in the example above, these words are *book*, *crayon* and *shop*.

If you do not know the meaning of a word, do not try to guess. If you are not sure about a word, try to find the right answer.

Vocabulary test

Topic: Energy

- a) Electricity ___ Becoming hot
b) Light
c) Power ___ It is a vibration
d) Sound
e) Source ___ It is the fastest form of energy
f) Warming
- a) Bulb ___ A glass which provides light
b) Charge
c) Habitat ___ The main source of light
d) Nuclear
e) Sun ___ A portable battery-powered electric lamp
f) Torch
- a) Chemical ___ Form of energy in moving objects
b) Dam
c) Electricity ___ Energy released when a reaction occurs.
d) Kinetic
e) Radioactivity ___ Energy flowing from a warm substance to a cooler substance.
f) Thermal
- a) Electricity ___ To Supply with electrical energy
b) Machine
c) Magnetism ___ Attractive and repulsive forces between objects.
d) Natural
e) Power ___ Form of energy resulting from the existence of charged particles
f) Release
- a) Fossil ___ It can finish.
b) Heavy
c) Lake ___ It can be replaced.
d) Non-Renewable
e) Renewable ___ Remains of a living thing embedded in stone.
f) Rock

- a) Biomass ___ Air movement, green source of energy
- b) Geothermal
- c) Pollution ___ Organic material derived from living things
- d) Uranium
- e) Water ___ Heat produced by the decomposition of underground radioactive substances
- f) Wind

- a) Air ___ Gaseous fossil fuel
- b) Coal
- c) Diamond ___ Liquid fossil fuel
- d) Gas
- e) Oil ___ Solid fossil fuel
- f) Water

- a) Charge ___ It causes electricity
- b) Ecosystem
- c) Electron ___ Natural environment of a living-thing
- d) Habitat
- e) Magnet ___ Object which can attract certain metals
- f) Object

- a) Attract ___ Repulse
- b) Bring
- c) Cause ___ Come together
- d) Equal
- e) Opposite ___ Completely different
- f) Repel

- a) Energy ___ Produce
- b) Generate
- c) Iron ___ Radioactive metal
- d) Transform
- e) Uranium ___ Ability to do work
- f) Wire