UNIT 1: My Energy Diary

Unit 1 My Energy Diary is comprised of 7 activities that have been informed by the ENERGE Energy Literacy Framework. A guide to the ENERGE Energy Literacy Framework can be found on the main page. This unit is focused on the personal interactions with energy that shape everyday life and uses home environments as real-world laboratories to explore ideas and issues surrounding energy use, energy conservation and energy efficiency in the home. In activities 1.1, 1.2 and 1.3 students will measure energy use, read and extract relevant information from utility bills, convert between physical units to domestic energy units of energy, apply a monetary value to energy consumption and manage energy budgets. In activities 1.4 and 1.5 students draw and interpret energy transfer diagrams and measure the total energy used by devices and determine their efficiency. In activities 1.6 and 1.7 students monitor and evaluate the patterns of energy use in their own homes. Students also explore a number of energy efficient solutions for the home and calculate their associated payback costs. This unit gives a real-world context to the principle of energy conservation. Students also have the opportunity to further develop their energy literacy through collaborating with others and through developing their data analysing, problem-solving, decision making, critical thinking and numeracy skills. The following sections provide an overview of the seven activities that make up UNIT 1. In particular, the energy literacy outcomes, the associated skills & competencies addressed and how the activities link to the national curricula are outlined in tables 1.2-1.4.

OVERVIEW of UNIT 1 My Energy Diary

Table 1.1 Activities and titles are given, the time required to complete the activity and the ISCED classification.

	Activity Title	**Estimated time (min)**	**Level**	
			ISCED 2	**ISCED 3**
Activity 1.1	Stop Electricity from Leaking	30-45	X	X
Activity 1.2	Calculating the cost of energy in the home	30-45		X
Activity 1.3	Calculating the cost of energy in the community	30-60		X
Activity 1.4	Energy Sankeys: Calculating Energy Efficiency	20-30	X	X
Activity 1.5	My thermal comfort at home	20-30	X	X
Activity 1.6	Monitoring energy consumption in the home	30-45		X
Activity 1.7	Calculating payback costs in the home	30-45	X	X

Activities Mapped to Subjects in National Curricula

Table 1.2 Activities are mapped to subjects in National Curricula .

	Science	Technology & Informatics	Engineering	Mathematics	Home Economics	Geography	English	Design & architecture	Civics & politics	Society & Health	Business & Economics
Activity 1.1	X				X					X	
Activity 1.2			X		X				X		
Activity 1.3			X		X				X		
Activity 1.4			X		X				X		
Activity 1.5	X	X		X			X	X	X	X	
Activity 1.6	X	X	X		X			X	X	X	X
Activity 1.7					X				X		

Activities Mapped to Energy Literacy Characteristics

Table 1.3 Activities are mapped to Energy literacy Characteristics.

	C1	C2	C3	C4	C5
Activity 1.1	X		X	X	
Activity 1.2	X				
Activity 1.3	X	X	X		
Activity 1.4	X		X	X	
Activity 1.5		X	X	X	X
Activity 1.6	X		X	X	X
Activity 1.7	X	X	X	X	

Skill & Competencies Addressed

Table 1.4 Activities are mapped according to Skills & Competencies addressed.

	Decision Making	Problem Solving	Design/innovating	Data Analysing	Collaborating	Communicating	Research	Critical Thinking	Numeracy
Activity 1.1	X				X				
Activity 1.2			X		X				X
Activity 1.3			X		X				X
Activity 1.4			X		X	X			X
Activity 1.5	X	X		X		X	X	X	X
Activity 1.6	X	X	X		X	X		X	X
Activity 1.7					X				X

Activity 1.1 Stop Electricity from Leaking

This activity explores the topic of "leaking electricity" or "phantom loading". Students use watt meters to measure and tabulate power readings for appliances operating in (a) on mode and (b) standby mode. Students calculate energy consumption due to phantom loading in (i) kWh and (ii) the annual cost per kWh. Students graph their data and answer a number of questions. Students offer recommendations for reducing leaking electricity in their homes and classrooms.

Duration	
30-45 minutes	
Energy Literacy Characteristics addressed:	
C1	Grounded understanding of science and how energy is harnessed and used to power human activity
C4	Cognisant of the impact of personal energy-related decisions and actions on the environment & global community
C5	Strive to make choices and decisions that reflect these attitudes with respect to energy resource development and energy consumption
Skills & Competencies addressed:	
• Numeracy	• Data Analysis
Subject links in National Curricula:	
• Science • Technology & Informatics • Engineering	• Mathematics • Home Economics • Social & Health
Level	
ISCED 2 ISCED 3	

Suggestions for use:

1. Begin with a discussion about leaking electricity (standby operation mode).
2. Students should gather at least 3 electrical appliances from the classroom. Each student group should have access to an electrical outlet and a watt meter.
3. Give students a copy of the worksheet included in the materials section of this page. The worksheet contains instructions for carrying out this activity. This worksheet can be modified.
4. Ask students to use the watt meter to measure the electricity used by appliances in standby mode when in use. The meter measures:

   Power (W) = Electrical Energy/time

   Ask students to record their Watt meter readings in table format. Students should use thew following equation to convert their readings to kWh:

   Energy (kWh) = power (W) ÷ 1000 X time (h) X 365 (days)
5. The average cost of a kWh in EUR included can be sourced online. Students should create a chart or graph that shows the total cost of total kWh used per year for each appliance when in use and in standby mode.
6. Students should answer the follow-up questions provided on the worksheet.

Extensions to Activity 1.1

Ask students to calculate the annual quantity of CO_2 emitted per kWh for each appliance. Students can search for the equivalent CO_2 per kWh that is specific to their region. Otherwise, an average value of 0.296 kg/kWh can be used.

Materials

Activity 1.1 Student Worksheet

- Electrical appliances
- Watt Meter
- School utility bills (optional)

Activity 1.2 Calculating the cost of Electricity in the Home

In this activity, students use historical energy consumption data for a sample household to calculate the total daily, monthly and annual power output and energy consumed for a range of appliances. Students apply a monetary value to the energy consumption using price per unit kVA (and kWh). Students will compare the costs of off-peak energy use with peak time costs. In part B of this activity, students can carry out a mathematical exercise where they use the transformer formula to solve a real world problem. The purpose of the exercise is to ensure pupils can manipulate the equation for primary and secondary coils and understand the theory behind it. Part B is optional.

This activity was developed by Lycée Gaudier-Brzeska for the STi2D curriculum in France. ENERGE has been granted permission by the author to promote this activity.

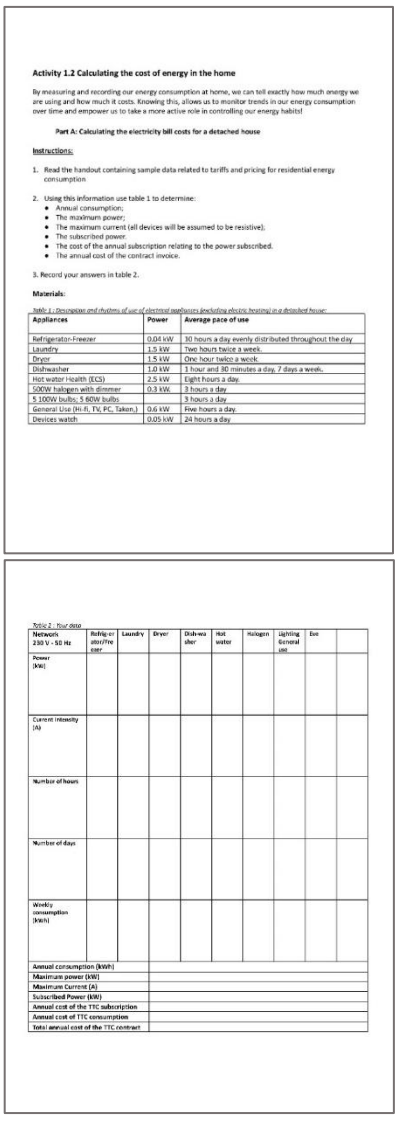
Duration	
• 30-60 minutes	
Energy Literacy Characteristics addressed:	
C1	Grounded understanding of science and how energy is harnessed and used to power human activity
C4	Cognisant of the impact of personal energy-related decisions and actions on the environment & global community
C5	Strive to make choices and decisions that reflect these attitudes with respect to energy resource development and energy consumption
Skills & Competencies addressed:	
• Numeracy • Data Analysis	• Problem-solving
Subject links in National Curricula:	
• Science • Technology & Informatics • Engineering	• Mathematics • Home Economics • Social & Health
Level	
• ISCED 3	

Suggestions for use:

1. Begin with a discussion about household appliance power output, energy labels and domestic energy consumption costs per kWh (and kVA if applicable)

2. Students can work alone or in groups.

3. Give students a copy of the student worksheet which contains the historical household enegry consumption data. Students use the table in the handout to record their work. The average cost of a kWh in EUR included can be sourced online.



Activity 1.2 Calculating the cost of energy in the home

By measuring and recording our energy consumption at home, we can tell exactly how much energy we are using and how much it costs. Knowing this, allows us to monitor trends in our energy consumption over time and empower us to take a more active role in controlling our energy habits!

Part A: Calculating the electricity bill costs for a detached house

Instructions:

1. Read the handout containing sample data related to tariffs and pricing for residential energy consumption
2. Using this information use table 1 to determine:
   - Annual consumption;
   - The maximum power;
   - The maximum current (all devices will be assumed to be resistive);
   - The subscribed power
   - The cost of the annual subscription relating to the power subscribed.
   - The annual cost of the contract invoice.
3. Record your answers in table 2.

Materials:

Table 1 : Description and rhythms of use of electrical appliances (excluding electric heating) in a detached house:

Appliances	Power	Average pace of use
Refrigerator-Freezer	0.04 kW	30 hours a day evenly distributed throughout the day
Laundry	1.5 kW	Two hours twice a week.
Dryer	1.5 kW	One hour twice a week.
Dishwasher	1.0 kW	1 hour and 30 minutes a day, 7 days a week.
Hot water Health (ECS)	2.5 kW	Eight hours a day.
500W halogen with dimmer	0.3 kW.	3 hours a day.
5 100W bulbs; 5 60W bulbs		3 hours a day
General Use (Hi-fi, TV, PC, Taken.)	0.6 kW	Five hours a day.
Devices watch	0.05 kW	24 hours a day

Table 2 : Your data

Network 230 V - 50 Hz	Refrig-erator/Freezer	Laundry	Dryer	Dishwasher	Hot water	Halogen	Lighting General use	Eve	
Power (kW)									
Current intensity (A)									
Number of hours									
Number of days									
Weekly consumption (kWh)									

Annual consumption (kWh)	
Maximum power (kW)	
Maximum Current (A)	
Subscribed Power (kW)	
Annual cost of the TTC subscription	
Annual cost of TTC consumption	
Total annual cost of the TTC contract	

Fig. 1. Activity 1.2 Student Worksheet

Extensions to Activity 1.2

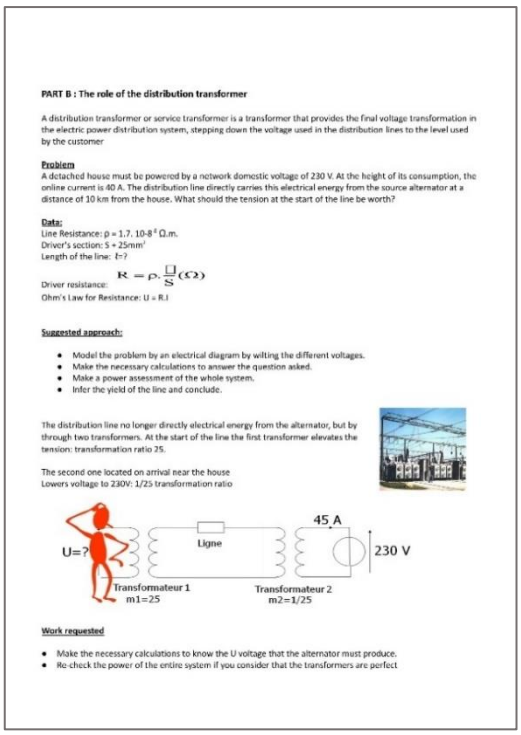
Activity 1.2 PART B

1. This activity is best suited to older students (ISCED 3) studying a STEM based curriculum. This lesson can begin with a discussion about the electricity grid and the role of the transformer.

2. Suggested approach: Model the problem by an electrical diagram by wilting the different voltages. Make the necessary calculations to answer the question asked. Make a power assessment of the whole system. Infer the yield of the line and conclude.

3. Work needed from students: Students need to model the problem by an electrical diagram by wilting the different voltages. Students need to make the necessary calculations. Students need to make a power assessment of the whole system.

4. Students need to determine the yield of the transmission line. Students should make the necessary calculations to know the U voltage that the alternator must produce. Students should re-check the power of the entire system if the transformers are considered to be perfect. Determine the yield of the line and conclude.



PART B : The role of the distribution transformer

A distribution transformer or service transformer is a transformer that provides the final voltage transformation in the electric power distribution system, stepping down the voltage used in the distribution lines to the level used by the customer

Problem
A detached house must be powered by a network domestic voltage of 230 V. At the height of its consumption, the online current is 40 A. The distribution line directly carries this electrical energy from the source alternator at a distance of 10 km from the house. What should the tension at the start of the line be worth?

Data:
Line Resistance: ρ = 1.7. 10-8 Ω.m.
Driver's section: S = 25mm²
Length of the line: ℓ=?

Driver resistance: $R = \rho . \frac{\ell}{S} (\Omega)$
Ohm's Law for Resistance: U = R.I

Suggested approach:

- Model the problem by an electrical diagram by wilting the different voltages.
- Make the necessary calculations to answer the question asked.
- Make a power assessment of the whole system.
- Infer the yield of the line and conclude.

The distribution line no longer directly electrical energy from the alternator, but by through two transformers. At the start of the line the first transformer elevates the tension: transformation ratio 25.

The second one located on arrival near the house
Lowers voltage to 230V: 1/25 transformation ratio

Work requested

- Make the necessary calculations to know the U voltage that the alternator must produce.
- Re-check the power of the entire system if you consider that the transformers are perfect

Fig. 2. Activity 1.2 (Part B)

Materials

Activity 1.2 Student Worksheet (ENGLISH)

Activity 1.2 Student Worksheet (FRENCH)

Activity 1.2 Solution (ENGLISH)

Activity 1.2 Solution (FRENCH)

Activity 1.3 Calculating the cost of energy in the Community

In this activity students calculate the total energy consumed by common household devices as well as larger municipal systems in kWh. Students gain an understanding of energy efficiency and can determine the potential savings in cost associated with the instillation of more energy efficient lighting solutions for the community. This activity was developed by Lycée Gaudier-Brzeska for the STi2D curriculum and is being promoted as part of the ENERGE project.

This activity was developed by Lycée Gaudier-Brzeska for the STi2D curriculum in France. ENERGE has been granted permission by the author to promote this activity.

Duration	
• 30-60 minutes	
Energy Literacy Characteristics addressed:	
C1	Grounded understanding of science and how energy is harnessed and used to power human activity
C2	Understands the impact that energy production and consumption have on all spheres of our environment and society
C3	C3: Sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources
C4	Cognisant of the impact of personal energy-related decisions and actions on the global community
Skills & Competencies addressed:	
• Numeracy • Data Analysis	• Problem Solving
Subject links in National Curricula:	
• Science • Technology Informatics • Engineering	• Mathematics • Home Economics • Geography
Level	
• ISCED 3	

Suggestions for use:

1. Students can work alone or in pairs
2. Any number of these exercises can be assigned as an in-class assignment or as a homework assignment.
3. Teachers should choose from the 7 separate applications (exercises) and decide which applications they want to give to the students.

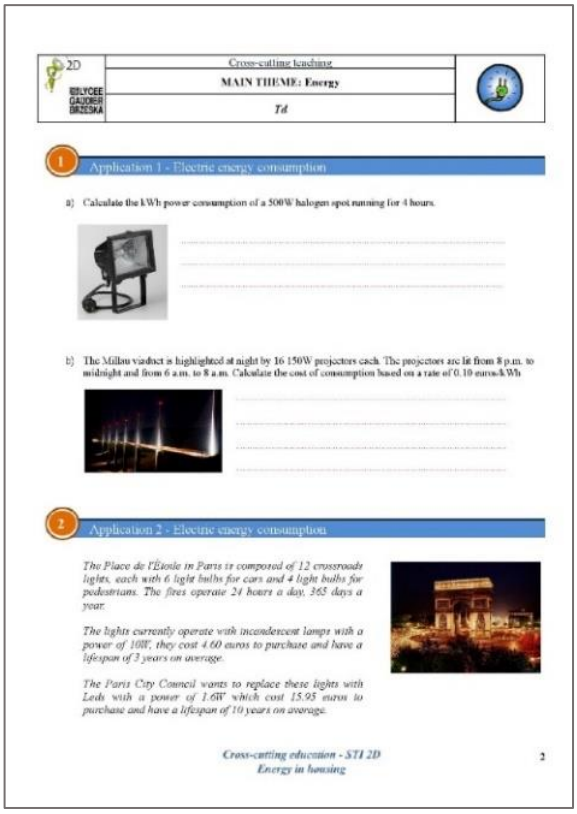


Fig. 3. Activity 1.3 Student Worksheet

Materials

Activity 1.3 Student Worksheet (ENGLISH)

Activity 1.3 Student Worksheet (FRENCH)

Activity 1.4 Energy Sankeys

In this activity students draw and interpret Sankey energy flow diagrams. Students learn that energy exists in different forms and can be measured in units of Joules (J). Students explore the topic of energy efficiency which is a measure of how much of the input energy is used usefully. Students will discover that energy can be changed from one form to another but that the total amount of energy does not change and how energy is always conserved. *This activity was developed by developed by SEAI in collaboration with CASTeL at Dublin City University. ENERGE has been granted permission to promote this activity.*

Duration	
• 30-60 minutes	
Energy Literacy Characteristics addressed:	
C1	Grounded understanding of science and how energy is harnessed and used to power human activity
C3	C3: Sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources
C4	Cognisant of the impact of personal energy-related decisions and actions on the global community
Skills & Competencies addressed:	
• Critical Thinking • Numeracy	• Data Analysis • Problem Solving
Subject links in National Curricula:	
• Home Economics • Technology & Informatics	• Engineering • Science • Mathematics
Level	
• ISCED 2 • ISCED 3	

Suggestions for use:

1. Give students a copy of the Activity 1.4 student worksheet.

2. Begin with an introduction to Sankey diagrams, ask students to describe the various types of graphs they use in other subjects such as maths, geography and business studies. Ask students the following questions:

   - What type of information do they give?

Answer: A Sankey diagram shows you how well a machine uses energy. In other words, it tells you if it uses it efficiently (without much waste) or inefficiently (with a lot of waste).

   - What shapes do these graphs take?

Answer: The thickness of the arrows shows how much energy is involved. (The length of the arrows does not matter in a Sankey Diagram.)

   - How do we interpret the resultant patterns?

Answer: Useful energy transfers are shown going left to right. Wasteful energy transfers are shown going upwards.

3. Ask the students to tell you what they understand by the terms efficiency and energy efficient.

   - In what circumstance might a microwave be more efficient than a cooker?
   - When would a microwave be more efficient than a kettle?

4. After establishing basics, teacher may wish to to prompt a discussion about energy efficient light bulbs.

   - Why has the EU eliminated the use of incandescent (filament) light bulbs?
   - What are the consequences of this law intended or otherwise?
   - What about catalytic converters – are they efficient or do they simply reduce the emission of noxious gases?

Materials

Activity 1.4 Student Worksheet (EN)

Activity 1.4 Student Worksheet Solutions (EN)

Activity 1.5 My Thermal Comfort at Home

This activity is a reflective learning exercise that introduces students to topic of thermal comfort by asking them to document what they do during a typical weekday and specifically what interactions with energy they have throughout the day (e.g., light, electricity or heating). Students appreciate the central role energy plays in our lives and how essential our interactions with energy are to our comfort and well-being. Students calculate and apply a monetary value to personal energy consumption. Students demonstrate an awareness of their responsibility to improve the efficiency of their interactions with energy. *This activity has been developed by CASTel at Dublin City University.*

Duration	
• 30-60 minutes	
Energy Literacy Characteristics addressed:	
C3	Sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources
C4	Cognisant of the impact of personal energy-related decisions and actions on the global community
C5	Strives to make choices and decisions that reflect these attitudes with respect to energy resource development and energy consumption
Skills & Competencies addressed:	
• Critical Thinking • Decision Making • Communicating	• Creating • Innovating • Numeracy
Subject links in National Curricula:	
• Science • Technology • Informatics	• Engineering • Geography • Home Economics
Level	
• ISCED 2 • ISCED 3	

Suggestions for use:

1. Give students a copy of the student worksheet.

2. Ask students to calculate the energy consumption for these devices in kWh and apply a daily and annual monetary cost to the energy consumed by these devices. Students can determine this by finding out the power in Watts. Students should use thew following equation to convert their readings to kWh:

   Energy (kWh) = power (W) ÷ 1000 X time (h) X 365 (days)

3. Students can take a pledge to be more pro-active and energy efficient in their daily lives by asking them about the roles they occupy inside and outside of school and what actions they can take now and, in the future, to improve their energy efficiency.

Fig. 9. Activity 1.5 Student Worksheet

Extensions to Activity

Materials

Activity 1.5 Student Worksheet (EN)

Activity 1.6 Monitoring energy consumption in the home

In this activity students extract relevant historic energy consumption data in kWh as well as the unit cost per kWh. Subsequent tabling and graphing of this data then enables students to visualise trends in household energy consumption over a long period of time. Following this, students to use this data to carry out a series of energy calculations that relate to personal energy consumption. Finally, students are encouraged to research energy efficient solutions for the home and then are asked to make informed decisions about how the energy efficiency of their home could be improved.

Duration	
• 30-60 minutes	
Energy Literacy Characteristics addressed:	
C3	Sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources
C4	Cognisant of the impact of personal energy-related decisions and actions on the global community
C5	Strives to make choices and decisions that reflect these attitudes with respect to energy resource development and energy consumption
Skills & Competencies addressed:	
• Critical Thinking • Decision Making	• Problem Solving • Data Analysis • Numeracy
Subject links in National Curricula:	
• Science • Technoloy • Informatics • Business	• Engineering • Home Economics • Social & Health • Economics
Level	
• ISCED 2 • ISCED 3	

Suggestions for Use

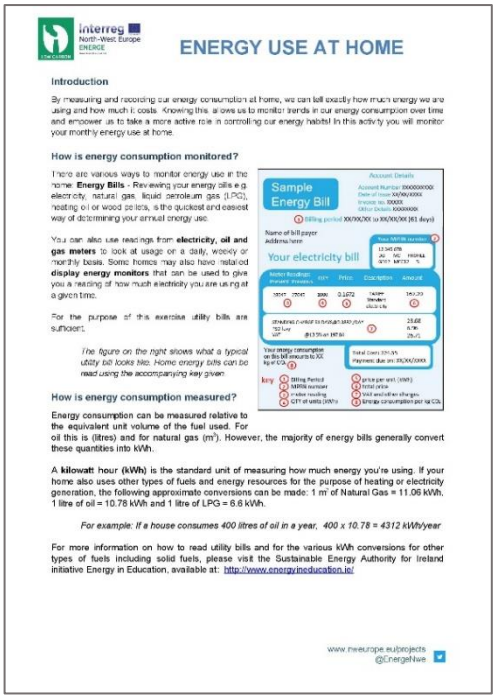
1. Section 1 (about your home) asks students to answer a series of questions about their home including the type of building that they live in, how many people occupy their home, the major source of energy used for heating and cooking in their home and what energy efficiency solutions (if any) are currently present in their home.

2. Section 2 (record your energy use) asks students to study their utility bills and to extract and log all relevant data related to energy consumption. Students will then table and graph this data and use it to answer sections 3 and 4.

3. Section 3 (calculate your energy use at home) requires students to use the data that they have tabled to complete a number of calculations that relate to the average cost of energy for the home and per person living in the home.

4. Section 3 (calculate your energy use at home) requires students to use the data that they have tabled to complete a number of calculations that relate to the average cost of energy for the home and per person living in the home.

5. Section 4 (take action) requires students to research energy efficient solutions for the home and suggest a number of energy efficient solutions they would like to see in their home.



ENERGY USE AT HOME

Introduction

By measuring and recording our energy consumption at home, we can tell exactly how much energy we are using and how much it costs. Knowing this allows us to monitor trends in our energy consumption over time and empower us to take a more active role in controlling our energy habits! In this activity you will monitor your monthly energy use at home.

How is energy consumption monitored?

There are various ways to monitor energy use in the home. **Energy Bills** - Reviewing your energy bills e.g. electricity, natural gas, liquid petroleum gas (LPG), heating oil or wood pellets, is the quickest and easiest way of determining your annual energy use.

You can also use readings from **electricity, oil and gas meters** to look at usage on a daily, weekly or monthly basis. Some homes may also have installed **display energy monitors** that can be used to give you a reading of how much electricity you are using at a given time.

For the purpose of this exercise utility bills are sufficient.

The figure on the right shows what a typical utility bill looks like. Home energy bills can be read using the accompanying key given.

Sample Energy Bill

Your electricity bill

How is energy consumption measured?

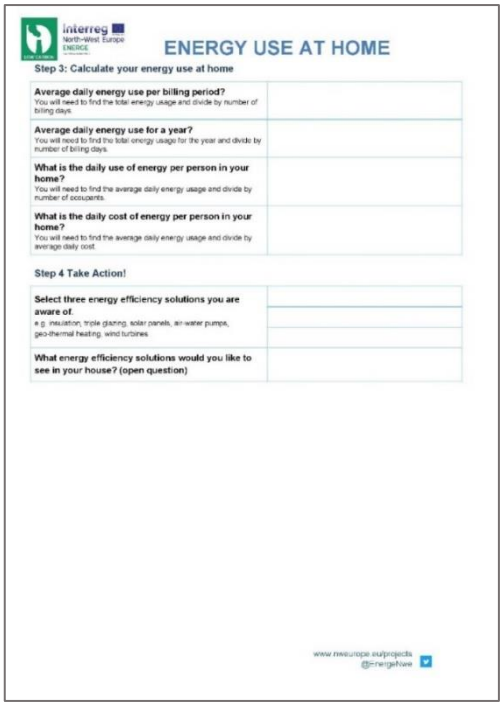
Energy consumption can be measured relative to the equivalent unit volume of the fuel used. For oil this is (litres) and for natural gas (m^3). However, the majority of energy bills generally convert these quantities into kWh.

A **kilowatt hour (kWh)** is the standard unit of measuring how much energy you're using. If your home also uses other types of fuels and energy resources for the purpose of heating or electricity generation, the following approximate conversions can be made: 1 m^3 of Natural Gas = 11.06 kWh, 1 litre of oil = 10.78 kWh and 1 litre of LPG = 6.6 kWh.

For example: If a house consumes 400 litres of oil in a year, 400 x 10.78 = 4312 kWh/year

For more information on how to read utility bills and for the various kWh conversions for other types of fuels including solid fuels, please visit the Sustainable Energy Authority for Ireland initiative Energy in Education, available at: http://www.energyineducation.ie/

www.nweurope.eu/projects
@EnergeNwe



ENERGY USE AT HOME

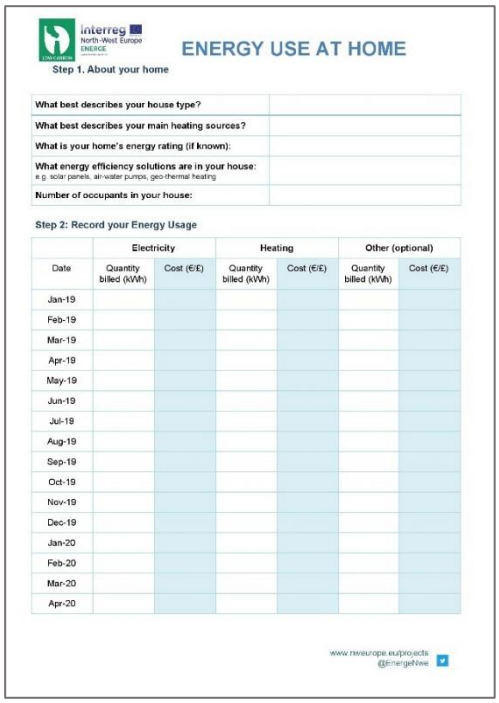
Step 3: Calculate your energy use at home

Average daily energy use per billing period? You will need to find the total energy usage and divide by number of billing days.	
Average daily energy use for a year? You will need to find the total energy usage for the year and divide by number of billing days.	
What is the daily use of energy per person in your home? You will need to find the average daily energy usage and divide by number of occupants.	
What is the daily cost of energy per person in your home? You will need to find the average daily energy usage and divide by average daily cost.	

Step 4 Take Action!

Select three energy efficiency solutions you are aware of. e.g. insulation, triple glazing, solar panels, air-water pumps, geo-thermal heating, wind turbines.	
What energy efficiency solutions would you like to see in your house? (open question)	

www.nweurope.eu/projects
@EnergeNwe



ENERGY USE AT HOME

Step 1. About your home

What best describes your house type?	
What best describes your main heating sources?	
What is your home's energy rating (if known):	
What energy efficiency solutions are in your house: e.g. solar panels, air-water pumps, geo-thermal heating	
Number of occupants in your house:	

Step 2: Record your Energy Usage

	Electricity		Heating		Other (optional)	
Date	Quantity billed (kWh)	Cost (€/£)	Quantity billed (kWh)	Cost (€/£)	Quantity billed (kWh)	Cost (€/£)
Jan-19						
Feb-19						
Mar-19						
Apr-19						
May-19						
Jun-19						
Jul-19						
Aug-19						
Sep-19						
Oct-19						
Nov-19						
Dec-19						
Jan-20						
Feb-20						
Mar-20						
Apr-20						

www.nweurope.eu/projects
@EnergeNwe

Fig. 4. Activity 1.6 Student Worksheet

Extensions to Activity

Materials

Activity 1.6 Student Worksheet (EN)

Activity 1.6 Calculation Spreadsheet (EN)

Activity 1.6 Sample utility bill (Ireland) (EN)

Activity 1.7 Calculating the payback costs of a low energy home

This activity introduces the concept of payback costs and helps students to understand methods to reduce energy loss from the home. The payback time of an energy-saving solution is a measure of how cost-effective it is. Students will use their numerical abilities to calculate the cost savings of different energy-saving strategies. This activity was developed by Mr. Robert Woodson who is a teacher of physics at Ysgol Bro Gwaun a secondary school in Pembrokeshire, Wales.

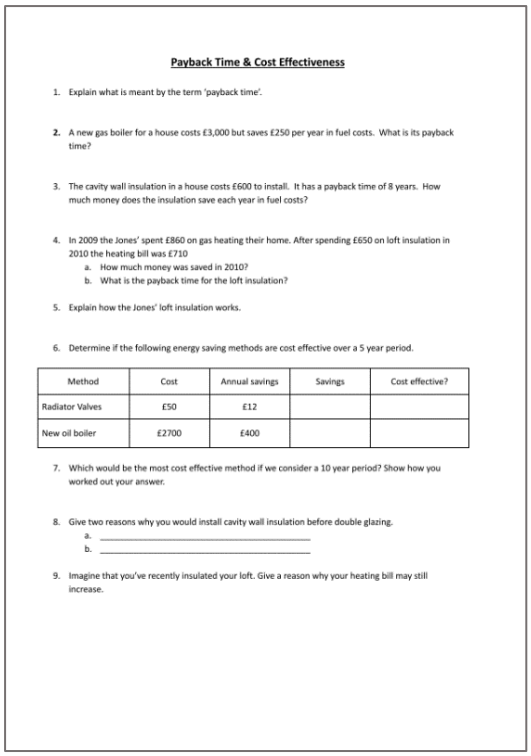
Duration	
• 30-45 minutes	
Energy Literacy Characteristics addressed:	
C3	Sensitive to the need for energy conservation and the need to develop alternatives to fossil fuel-based energy resources
C4	Cognisant of the impact of personal energy-related decisions and actions on the global community
Skills & Competencies addressed:	
• Critical Thinking • Numeracy	• Data Analysis • Research
Subject links in National Curricula:	
• Science • Technoloy & Informatics • Business	• Engineering • Home Economics • Social & Health • Economics
Level	
• ISCED 2 • ISCED 3	

Suggestions for Use

1. Begin by introducing students to the topic energy efficient solutions and pay-back costs using the introductory powerpoint resource. Key formula:

$$payback\ time = \frac{instillation\ cost}{annual\ savings}$$

2. Students should complete the first sections of the worksheet accompanying this activity.



Payback Time & Cost Effectiveness

1. Explain what is meant by the term 'payback time'.
2. A new gas boiler for a house costs £3,000 but saves £250 per year in fuel costs. What is its payback time?
3. The cavity wall insulation in a house costs £600 to install. It has a payback time of 8 years. How much money does the insulation save each year in fuel costs?
4. In 2009 the Jones' spent £860 on gas heating their home. After spending £650 on loft insulation in 2010 the heating bill was £710
   a. How much money was saved in 2010?
   b. What is the payback time for the loft insulation?
5. Explain how the Jones' loft insulation works.
6. Determine if the following energy saving methods are cost effective over a 5 year period.

Method	Cost	Annual savings	Savings	Cost effective?
Radiator Valves	£50	£12		
New oil boiler	£2700	£400		

7. Which would be the most cost effective method if we consider a 10 year period? Show how you worked out your answer.
8. Give two reasons why you would install cavity wall insulation before double glazing.
   a. _____
   b. _____
9. Imagine that you've recently insulated your loft. Give a reason why your heating bill may still increase.

Fig. 5. Activity 1.7 Student Worksheet

3. Students can use the second section of the worksheet to carry out their calculations. Alternatively, students can use this table to research the cost of energy efficient solutions for the home in their own country and calculate the associated payback costs.

Materials

Activity 1.7 Student Worksheet

Activity 1.7 Powerpoint Resource