

How happy are you and Your Family with the Electricity Bill?*



8th Grade science and technology module on determining energy consumption at home

Abstract

This module leads to a decision making activity, designed to consolidate learning about consuming energy, and energy saving, taking examples from everyday life and to introduce the electrical energy and power. It involves the reading of an electricity bill and checking that the calculation of the bill is correct. It introduces students to the (kilo) watt as a unit of power and the kilowatt hour as the unit used in the home for energy consumption.

Sect	Sections included		
1.	Student activities	Describes the scenario in more detail and the	
	(for students)	tasks the students should perform	
2.	Teaching guide	Suggests a teaching approach	
3.	Assessment	Gives suggested formative assessment strategies	
4.	Teacher notes	Gives expectations of calculations to be carried	
		out by students	

Acknowledgement

This module has been adapted from that developed under the PARSEL project (www.parsel.eu) as part of an EC FP6 funded project (SAS6-CT-2006-042922-PARSEL) on Popularity and Relevance of Science Education for scientific Literacy







Overall Objectives/Competencies: The students are expected to:

- 1. concerning the use of electrical energy and electrical power
- 1.1. Realize that the amount of energy that devices working with electrical energy consume per time differs
- 1.2. Define the electrical energy that devices working with electrical energy consume per time as the power of that device.
- 1.3. Express that electrical power units are named as watt and kilowatt
- 1.4. Realize that the amount of electrical energy consumed by devices working with electrical energy changes by power of devices and time in which devices run.
- 1.5. Express that the amount of energy consumed is named as "watt*second and kilowatt*hour"
- 1.6. Express the measures that should be taken for the consciously use of electrical energy

Curriculum content: power as (kilo)watts, energy as kilowatt hour,

Kind of activity: Designing a questionnaire, calculations involving (kilo) watts aad kilowatt hours, decision making discussion on realistic ways to reduce the electricity bill.

Anticipated time: 4 lessons

This unique teaching-learning material is intended to guide the teacher towards promoting students' scientific literacy by recognising learning in 4 domains – intellectual development, the process and nature of science, personal development and social development.

Its uniqueness extends to an approach to science lessons which is designed to follow a 3 stage model. For this the approach is intentionally from society to science and attempts to specifically meet student learning needs.

This uniqueness is specifically exhibited by:

- 1. a motivational, society-related and issue-based title (supported in the student guide by a motivational, socio-scientific, real life scenario);
- 2. forming a bridge from the scenario to the scientific learning to be undertaken;
- 3. student-centred emphasis on scientific problem solving, encompassing the learning of a range of educational and scientific goals;
- 4. utilising the new science by including in socio-scientific decision making to relate the science acquired to societal needs for responsible citizenship







How Happy are You and Your Family with the Electricity Bill?

Student Activities

The Scenario

Today, thanks to technological achievements, more and more equipment needs electric power to operate. Think what would happen if there was a black-out right now! What would be out of action? Unfortunately, as a result of the heavy use of electrical devices, the household electricity bill has become an important part of the family budget. But are you happy with this? Would you be interested in influencing the members of your family to see how it might be possible to reduce this bill? What devices are large users of electricity? Are they essential?

Below is an example of an Electricity Bill:

	GÜNDÜZ	PUANT	GECE
Son Endeks	4811,000	2633,000	3064.000
ilk Endeks	4667,000	2560,000	
(+/-) Kwh		210001000	43301000
Trafo Kaybı			
Tüketim	144,000	73,000	74,000
Birim Fiyat	0.162684	17 (307) (37) (37)	, ,,,,,,,
Tüketim Tutarı			
	Per.Sat.Hiz.Bd.	llet. Sis.Kul.Bd.	Dağıtım Bedeli
Birim Fiyat	0.001703	0.004596	0.025908
Tutar	0 50	1 24	
Sözleşme Gücü	5 64	DEMAND	1.51
Demand (kW)	3.01	Çarpan	
Güç Aşımı		Gösterge	
Güç Tutarı		Güç Birim Fiyat	
Güç Aşımı Tutarı		G.Aşımı Birim Fiyat	
E.Amade K.Bed.		Gerilim Trafo Oranı	
Enerji Tutarı	56 72	Akım Trato Oranı	
Enerji Fonu	0.42	Günlük Ort.Tüketim	5,596
TRT Payı	0.95	İlk Okuma	03.06.2009
Bel.Tük. Ver.	2 22	Son Okuma	24.07.2009
(+/-) Tutar	Grat	Okuma Saati	11:08.04
K.D.V.	10 00	Tebliğ Tarihi	24.07.2009
Teşvik İndirimi	10.03	Ekip	24.07.2005
Kira Bakım		Sonraki Okuma Dön.	
Güç Bedeli		Yuvarlama	+0.00
FATURA TUTARI		71,40 TL	10.00







Your Task

Within the whole Class:

- 1. Discuss/compare different electricity bills and find out which parameters/factors contribute to the total amount paid. Mention which of them are "internal" (from the family) and which are "external" (from the state).
- 2. Discuss the questions that will be included to create a questionnaire for the proposed research to find out which appliances are used I the home and for how often.

In Groups:

- 1. Each group is required to put forward 5 questions in a short time.
- 2. Discuss the questions and from the sources create a common questionnaire.
- 3. Each member of the group takes the responsibility to give the questionnaire to her/his family, plus one more family and bring responses to the next class.
- 4. Decide the selection of different electrical equipment for each group to study power, energy transformation and energy consumption in a period of time.
- 5. Design and carry out an experimental investigation to determine the consumption of each equipment selected.

In Groups:

- 1. Look over a part of the completed questionnaire (2 3) questions per group) and present the outcomes in bar diagrams or tables.
- 2. Prepare a presentation of the experimental results (measurements, calculations, etc).
- 3. Discussion and presentation of the conclusions of the equipment studied.

In Groups:

- 1. Fill in the table given in this worksheet
- 2. Answer the guestion given under the table
- 3. Please note that this task will be completed at the second lesson, because students needs to investigate at their homes.

As a Class:

- 1. Presentation, discussion and comparison of each group's outcomes.
- 2. Reach final conclusions on:

How it might be possible to reduce the electricity Bill.

What is meant by power and how important is it to be aware of this in determining items to reduce on the electricity bill?

Protecting the environment (power stations, fuels needed)

Effect on the State budget (fuels imported)





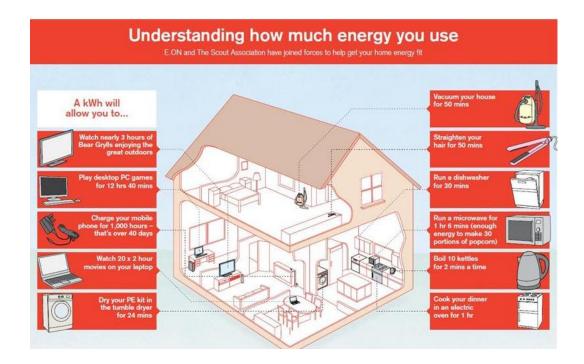


Discuss whether people are generally happy with their electricity bills or whether they would welcome guidance on how to reduce the bills (bearing in mind the percentage reduction you might be able to put forward) and determine certain ideas as proposals in order to change habits on consuming electric energy.

Fill in the table using 5 different equipments. One example is given in the table.

		<u> </u>
power	as	Energy as kilowatt hour
Watts		
2400 W		2.4 KW-hour
	Watts	Watts

- 1. According to the table, which equipment use most electrical energy?
- 2. Look at the picture below and search time for each equipments









How Happy are You and Your Family with the Electricity Bill?

Teaching guide

The activity relates to:

- Reinforcing an appreciation of the electric energy demands in every day life
- Being familiar with electrical energy consumption in a house
- Educating energy conscious citizens
- Introducing the concept of power

Lesson Learning Outcomes

Lesson 1

At the end of this lesson, students are expected to be able to:

- Look at an electricity bill
- Devise a questionnaire

Lesson 2

At the end of this lesson, students are expected to be able to:

- Analyse the questionnaire
- Determine appliances using most electricity
- Determine appliances used the most
- Read the electricity meter
- Fill in the table given in the students worksheet

Lesson 3

At the end of this lesson, students are expected to be able to:

- Understand the meaning of power and its units
- Understand the meaning of energy and its units
- Determining appliances that use much power

Lesson 4

At the end of this lesson, students are expected to be able to: Reach a justified decision whether the household is happy with its electricity bill







Suggested Teaching Strategy

- 1. The lesson starts from the scenario and by brainstorming ideas by students
- 2. Students are divided into groups to plan the development of their project
- 3. While discussing the questionnaire design, students are guided to include questions such as the following, in order to cover all the mentioned objectives:
 - How many and who are the members of the family (adults / children)
 - Time spent at home
 - Use of electric boiler, air-conditioner, etc Are they operating when no-one is at home?
 - Coffee machine: how many hours is it on during the day?
 - When you are on vacation do you turn off the T.V. completely?
 - Do you forget the lights are on and leave them on even when there is noone in the room?
 - How often do you make use of the washing machine and the electrical iron?
 - What do you think: saving electric energy at home plays a role in the protection of the environment?
- 4. During the selection of the equipment by each group, students are guided to make sure there are different ones by considering the power ratings of the equipment. The teacher introduces the units of power and allows the students to undertake a series of exercises to ensure they understand the meaning of pwer and the units used.
 - a. Every group plans its own project according to the given Students' Guide6. Discuss as a class about questions so as to develop the final form of the questionnaire
- 5. The teacher arranged for the completed questionnaires to be distributed, then discussed in groups and the findings are analysed and presented
- 6. Each group presents the investigation results and calculations to the class
- 7. The teacher guides the discussion of the outcomes from each group; as a class the students conclude, propose and finally decide about:
 - reducing electric energy consumption in a family and at state level (giving special attention to power ratings)
 - informing the members of their family about these matters
 - highlighting the environmental protection







Achieving the competencies

Competency	To be achieved by
1 Decide, with justification, how to	Discussing within the group and
have a balanced electricity bill	recording the decision so as to
	present to the rest of the class
2 Designing a questionnaire (as a	Students create the questionnaire as
research process) to obtain data on	a group and administer it to families
the major costs on electricity bills	
3. Communicating by presenting the	Students draw their own diagrams,
results in a tabular form / diagrams	take part in the oral discussions and
	record justifications for decisions
4 Cooperating as member of a group	Students cooperate in the group in
carrying out an investigation project	carry out the project and in making
	the decisions
5 Explaining the meaning of power	Students undertake to complete a
when used for electrical appliances,	written record to explain the meaning
rather than mechanical machines,	of power
and the units used to measure power	
6 Determining the relationship	Undertaking calculations of the
between power and energy and be	electricity consumed by various
able to calculate energy consumption	appliances in the home
knowing the power of an appliance	
7. Filling the table in the students	To get help from family members to
worksheet	clarify electrical equipments and their
	power value.







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Suggested Assessment

This guide to assessment strategies is put forward from different perspectives. In part A the assessment is based on the skill to be developed in the student. Part B is based on the assessment strategies to use in each lesson, whereas part C illustrates the assessment by the 3 different approaches which a teacher may use for formative assessment – observation, by oral communication, or by marking of written work. Summative assessment strategies are not shown, but these could relate to viva type oral communication and/or to the marking of written tests/examination questions.

Part A Assessment based on Skills Attained

Able to award a social values grade (objective 1).

Teachers listens to the discussions within the groups and the presentations to the class

- x Not able to contribute to the discussion in a meaningful way
- $\sqrt{}$ Participates in the discussion and is able to record the decision and the justification for this
- $\sqrt{}$ Not only participates in the discussion and puts forward a point of view but is able to do this with persuasion and can offer counter-arguments to points made by others.

Able to award a science method grade (objective 2).

The teacher marks the student questionnaires before the students to collect data for the community

- x Not able to suggest appropriate items for the questionnaire.
- $\sqrt{}$ Able to suggest items for the questionnaire and to put these into a useful sequence. Able to use the questionnaire to collect relevant data.
- Able to suggest key items for the questionnaire which are suitable and relevant for the community and is able to put forward a sampling plan that reflects the need for sampling of the community for a fair result.







Able to award a personal skills grade (objectives 3 and 4).

Teacher observes the students during the group work

- x Does not cooperate with others during the group discussions and activities.
- √ Participates in group work meaningfully, in the discussions and in the devising of questionnaires and recording of work in written form.
- $\sqrt{\sqrt{}}$ Not only participates in the group work and in the discussions and written work, but takes on a leadership role helping others to participate.

Able to award a science concept grade (objectives 5, and 6).

- x Not able to explain the meaning of power, the relationship between power and energy and the mechanism for calculating electricity used in the home
- \checkmark Able to explain the meaning of power and the relationship between power and energy with the help of the teacher. Able to read an electricity bill and determine the energy used.
- $\sqrt{}$ Able to fully understand and record in a meaningful way, the meaning of power and its links to energy. Able to read the electricity bill. Can deduce appliances that have been in great use.

Part B Assessed by Lesson

Lesson 1

	Lesson i		
	Dimension	Criteria for evaluation The student:	Mark/grade given $(\mathbf{x}, \sqrt{1}, \sqrt{1})$
		The Student.	
1	Creates a	Puts forward appropriate questions for	
	questionnaire	a questionnaire to find out what	
		appliances are used in the home and	
		how much electricity is used per	
		month.	
		Creates an appropriate questionnaire	
		to the level of detail required by the	
		teacher.	
		Develops an appropriate procedure to	
		collect data using their questionnaire	
2	Interpret an electricity	Looks at an electricity bill and able to	
	bill	understand the data given in the	
		various columns	
		Draws appropriate conclusions related	
		to the electricity used	







Lesson 2

	Dimension	Criteria for evaluation	Mark/grade given $(x, \sqrt{1}, \sqrt{1})$
		The student:	
1	Interpret or calculate	Interprets data collected in a justifiable	
	from data collected	manner including the use of	
	and making	appropriate graphs, tables and	
	conclusions	symbols.	
		Draws appropriate conclusions related	
		to appliances using the most	
		electricity.	
		Draws appropriate conclusions related	
		to the appliances used most	
		frequently.	
2	Answers questions	Provides correct written answers to	
		questions asked by the teacher on	
		their manner of interpretation and	
		drawing conclusions.	
3	Draws charts/tables.	Able to present findings in an	
		appropriate graphical representation.	
		Able to present graphical	
		representations in suitable detail.	
		Able to provide full and appropriate	
		headings for charts, tables.	

Lesson 3

	Dimension	Criteria for evaluation The student:	Mark/grade given $(x, \sqrt{1}, \sqrt{1})$
1	Explanations	Able to explain the meaning of power and the units used. Able to explain the meaning of energy and the units used.	
2	Interpret from data collected and drawing conclusions.	Interprets from the data collected those appliances which use much power compared with other appliances. Draws appropriate conclusions related to the use of such appliances.	







Lesson 4

	Dimension	Criteria for evaluation	Mark/grade given $(x, \sqrt{1}, \sqrt{1})$
		The student:	
1	Scientific or socio-	Able to work cooperative with others in	
	scientific reasoning	the group and consider the data	
		obtained and other factors.	
		Gives a justified socio-scientific	
		decision based on efficiency and other	
		factors whether families should be	
		happy with their electricity bill.	

Part C Assessment based on Teacher Strategy

Assessment Tool based on the Teacher's Marking of Written Material

	Dimension	Criteria for evaluation	Mark/grade given $(x, \sqrt{1}, \sqrt{1})$
		The student:	
1	Writes a plan or report	Puts forward an appropriate research/	
	of an investigation	scientific question and/or knows the	
		purpose of the investigation/	
		experiment	
		Creates an appropriate investigation or	
		experimental plan to the level of detail	
		required by the teacher	
		Puts forward an appropriate	
		prediction/hypotheses	
		Develops an appropriate procedure	
		(including apparatus/chemicals	
		required and safety procedures	
		required) and indicates variables to	
		control	
2	Record experimental	Makes and Records observations/data	
	data collected	collected appropriately (in terms of	
		numbers of observations deemed	
		acceptable/accuracy recorded/errors	
		given)	







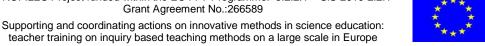
		. ,	3
3	Interpret or calculate	Interprets data collected in a justifiable	
	from data collected	manner including the use of	
	and making	appropriate graphs, tables and	
	conclusions	symbols	
		Draws appropriate conclusions related	
		to the research/scientific question	
4	Answers questions	Provides correct written answers to	
		questions given orally or in written	
		format	
		Provides answers in sufficient detail	
		especially when called upon to give an	
		opinion or decision	
5	Draws charts/	Able to provide graphical	
	diagrams/tables/	representation as required	
	models/symbolic	Able to present graphical	
	representations.	representations of a suitable size and	
		in suitable detail	
		Able to provide full and appropriate	
		headings for diagrams, figures, tables	
6	Scientific or socio-	Illustrates creative thinking/procedures	
	scientific reasoning	in solving problems	
		Gives a justified socio-scientific	
		decision to an issue or concern,	
		correctly highlighting the scientific	
		component	

Assessment Tool based on the Teacher's Observations

	Dimension	Criteria for evaluation	Mark/grade given $(\mathbf{x}, \sqrt{1}, \sqrt{1})$
		The student:	
1	Functioning in the group during experimentation or	Contributes to the group discussion during the inquiry phases (raising questions, planning	
	discussion	investigation/experiment, putting forward hypotheses/predictions, analyzing data, drawing conclusions, making justified decisions).	
		Cooperates with others in a group and fully participates in the work of the group.	



PROFILES Project funded within the EC FP7 Programme: 5.2.2.1 - SiS-2010-2.2.1



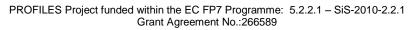


		There are a serial and a serial	
		Illustrates leadership skills – guiding the	
		group by thinking creatively and helping	
		those needing assistance (cognitive or	
		psychomotor); summarising outcomes.	
		Shows tolerance with, and gives	
		encouragement to, the group members.	
2	Performing the	Understands the objectives of the	
	investigation or	investigation/experimental work and	
	experiment	knows which tests and measurements to	
		perform.	
		Performs the investigation/experiment	
		according to the instructions/plan	
		created.	
		Uses lab tools and the measurement	
		equipment in a safe and appropriate	
		manner.	
		Behaves in a safe manner with respect	
		to him/herself and to others.	
		Maintains an orderly and clean work	
		table.	
3	Presenting the	Presents the activity in a clear and	
	investigation or	practical manner with justified decisions.	
	experiment orally	Presents by illustrating knowledge and	
		understanding of the subject.	
		Uses precise and appropriate scientific	_
		terms and language.	
		Presents with clarity and confidence	
		using an audible voice.	

Assessment Tool based on the Teacher's Oral Questioning

	Dimension	Criteria for evaluation	Mark/grade given $(x, \sqrt{1}, \sqrt{1})$
		The student:	
1	Questions to	Answers questions at an appropriate	
	individuals in a Whole	cognitive level using appropriate	
	Class setting	scientific language	
		Shows interest and a willingness to	
		answer	
		Willing and able to challenge/support	
		answers by others, as appropriate	









2	Questions to the	Able to explain the work of the group	
	group	and the actions undertaken by each	
		member	
		Understands and can explain the	
		science involved using appropriate	
		language	
		Willing to support other members in	
		the group in giving answers when	
		required	
		Thinks in a creative manner, exhibits	
		vision and can make justified decisions	
3	Questions to	Able to explain the work of the group	
	individuals in the	and actions taken by each member	
	group		
		Understands the purpose of the work	
		and shows knowledge and	
		understanding of the subject using	
		appropriate scientific language	
		Can exhibit non-verbal activity	
		(demonstrate) in response to the	
		teacher's questions, as appropriate	







How Happy are You and Your Family with the Electricity Bill?



Teacher Notes

- It is useful to collect electricity bills (at least 4) from households of one and four persons, with at least one for the winter period and another for a summer period.
- It is useful to have on display different equipment that need electric power to function. (e.g. T.V., iron, electric boiler, computer, electric oven, lights) (Alternatively students can check these apparatus at home, when parents can guide them to find the labelling indicate power consumption).
- Access to an electricity meter (this could be by means of a video/CD)



Student Handout

The following steps /questions are to help you to complete your project successfully:

- 1. Which criteria will you choose for selecting the house equipment?
- 2. Are you sure that you are measuring the consumption of only one piece of equipment at a time? How do you determine this?
- 3. Measure, for a time duration of 5 minutes, the energy consumption of each equipment on the house electric meter.
- 4. Notice the units which are used to measure energy.
- Calculate the energy consumption using the theoretic type (find it in your textbook), for the same equipment and the same period of time. Use the prospectus of the equipment for the power, etc. NOTICE: This step is omitted in the first grades.
- 6. Calculate the amount of money needed to be paid the consumption for each equipment
- 7. Which of the equipment consume more and which the less?
- 8. What is the energy transformation for each piece of equipment?
- 9. Is there a connection between the energy transformation taking place and the consumption?



PROFILES Project funded within the EC FP7 Programme: 5.2.2.1 – SiS-2010-2.2.1 Grant Agreement No.:266589

Supporting and coordinating actions on innovative methods in science education: teacher training on inquiry based teaching methods on a large scale in Europe







Student Handout 2

Exercise to Aid the Understanding of the Concept of Power

Answer the following:

- 1. On which of the following does the electricity we consume depends ? (there may be more than one correct response)
 - (a) the voltage of the appliance;
 - (b) the size of the appliance;
 - (c) the type of plug used;
 - (d) the current supplied to the appliance;
 - (e) how long the appliance is in use;
 - (f) the age of the appliance.
- 2. For each of those selected in question 1, give the name of the units in which it is measured, both as (a) the base unit and (b) when multiplied by 1000.
- 3. Look at the information supplied on an electrical appliance. Which of the units given in question 2 are observed?
- 4. As the manufacturer of the appliance does not know when, where or how long the appliance will be used, it can only indicate the power of the appliance. What units (by deduction or otherwise) represent the power of the appliance?
- 5. Link the units of power to the other units indicated in question 2.
- 6. If an appliance is plugged into the usual mains supply and had a rating of 0.25 amps, what power rating would you see written on the appliance?
- 7. If the power rating was given as 10 watts, what was the current drawn when the appliance was plugged into the mains supply?
- 8. The electricity meter needs to record the power of the appliance and the time for which it is used. What units does it use to do this? What are the units of electricity consumed which are written on the electricity bill?







Watt

The watt (symbol: W) is the SI derived unit of power, equal to one joule of energy per second.

A human climbing a flight of stairs is doing work at the rate of about 200 watts. A first class athlete can work at 375 watts for 30 minutes before exhaustion. An automobile engine produces mechanical energy at a rate of 25,000 watts (approximately 30 horsepower) while cruising. A typical household incandescent light bulb uses electrical energy at a rate of 40 to 100 watts, while the energy-saving compact fluorescent lights which are replacing them use 8 to 20 watts to yield the same light output.

Definition

One watt is one joule (the SI unit of energy) per second, that is 1 newton metre per second. It may be visualized simply as the amount of energy expended by a single candle.

$$1 \ W = 1 \ \frac{J}{s} = 1 \ \frac{kg \cdot m^2}{s^3} = 1 \frac{N \cdot m}{s}.$$

In electrical terms, it follows that:

$$1W = 1V \cdot 1A$$
.

That is, if 1 volt of potential difference is applied to a resistive load and a current of 1 ampere flows, then 1 watt of power is dissipated.^[2]

Origin and adoption as an SI unit

The watt is named after James Watt for his contributions to the development of the steam engine, and was adopted by the Second Congress of the British Association for the Advancement of Science in 1889 and by the 11th General Conference on Weights and Measures in 1960 as the unit of power incorporated in the International System of Units (or "SI").

Confusion of watts and watt-hours

Power and energy are frequently confused in the general media, for instance when a device is said to be rated at "100 watts per hour", which does not make any sense since a watt is a rate of doing work or using energy of 1 joule of energy per second. As a rate itself, a watt does not need to be followed by a time designation, unless one is talking about a change in power over time, analogous to an acceleration or deceleration.







Professional Reflection-Oriented Focus on Inquiry-based Learning and Education through Science Because a joule as a quantity of energy does not have a readily-imagined size to the layperson, the non-SI unit watt-hour, or rather its multiple the kilowatt-hour, is frequently used as a unit of energy, especially by energy-supply companies (electricity and natural gas suppliers) which often quote charges by the kilowatt-hour. A kilowatt-hour is the amount of energy equivalent to a power of 1 kilowatt running for 1 hour (3.6 MJ).

The watt-hour (symbol W·h or Wh) is a unit of energy. It is most commonly used on household electricity meters in the form of the kilowatt-hour (kW·h or kWh), which is 1,000 watt-hours. It is not used in the International System of Units (SI), despite being based on the watt, as the hour is not an SI unit. The SI unit of energy is the joule (J), equal to one watt-second. It is, however, a commonly used unit, especially for measuring electric energy.

1 watt-hour is equivalent to 3,600 joules (1 W x 3600 s), the joule being the canonical SI unit of energy. Thus a kilowatt-hour is 3,600,000 joules or 3.6 megajoules.

Pricing for kilowatt-hours

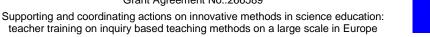
Power companies sell energy in units of kilowatt-hours. In general, energy (E) is equivalent to power (P) multiplied by time (t). To determine E in kilowatt-hours, P must be expressed in kilowatts and t must be expressed in hours. Suppose a 1.5-kW electric heater runs for 3 h. Then P = 1.5 and t = 3, so the energy E in kilowatt-hours is: E = Pt = 1.5 x 3 = 4.5 kWh If P and t are not specified in kilowatts and hours respectively, then they must be converted to those units before determining E in kilowatt-hours. Consider a set-up with one 100 W light bulb (0.1 kW) left on for 10 hours per day. This will consume 1 kilowatt-hour per day (0.1 kW x 10 h). If a power company charges 0.10/kWh, then this light bulb will cost 0.70 to operate over the course of a week (0.1 kW x 10 h x 0.10/kWh x 7 days in a week) (see unit juggling for more information).

Conversions

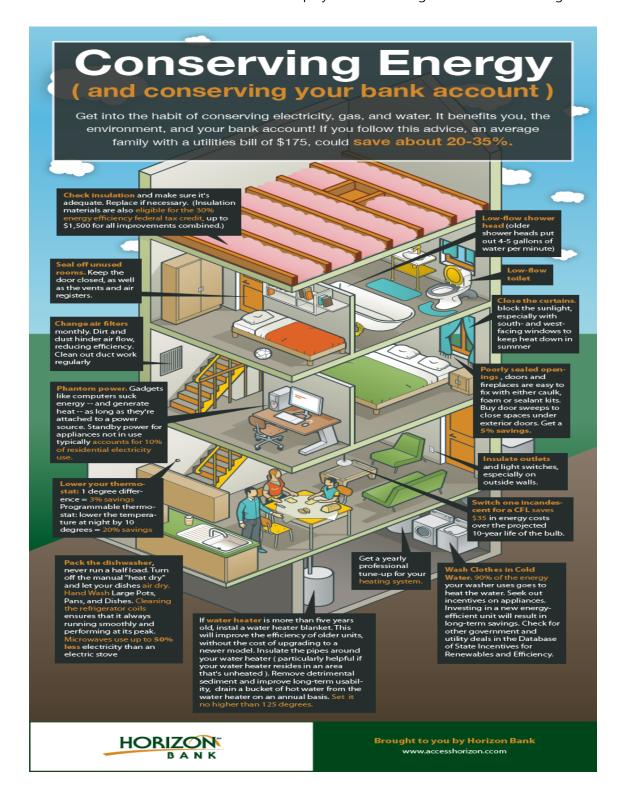
from / to	Joule	Watt-hour	Electronvolt	Calorie
	Coulo	Tratt Hour	2.000.01170.0	
1 1 1 kg m ²				
$1 J = 1 \text{ kg m}^2$	1	0.278×10^{-3}	6.241×10^{18}	0.239
			00	
1 W·h =	3600	1	2.247×10^{22}	859.8
		_22		-30
1 eV =	1.602 ×	4.45×10^{-23}	1	3.827 × 10 ⁻²⁰
			10	
1 cal =	4.1868	1.163 × 10 ⁻ `	2.613×10^{19}	1



PROFILES Project funded within the EC FP7 Programme: 5.2.2.1 – SiS-2010-2.2.1 Grant Agreement No.:266589









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