



## EDUCATION AND BACKGROUND MATERIAL

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## CONTENT

1. Introduction .....	2
2. Methodology .....	4
3. Project-relevant energy-related themes .....	14
4. Player's Manual .....	50

# 1. INTRODUCTION

## 1.1. CONTACT INFORMATION

For more information you could visit the website <http://www.EnerCities.eu> or contact Lancaster & Morecambe College projects Department [Europe@lmc.ac.uk](mailto:Europe@lmc.ac.uk)

## 1.2. FOCUS OF THIS DOCUMENT

This document gives an overview of the energy-related themes that are to be linked to the so-called education toolkit of EnerCities. The views, concepts and research in this toolkit does not necessarily reflect the views of Lancaster and Morecambe College, The EnerCities Partners, Intelligent Energy Europe or The European Commission. It is purely a device to stimulate discussion and debate about the key issues and concepts involved in the game and platform EnerCities. The purpose of this document is to support project-involved education institutions to gather relevant energy-related content, sources and institutes that can be linked to the energy-related themes as mentioned in this document. Education institutions can use the education toolkit to embed the EnerCities game in school curricula. The toolkit offers a framework of energy-related themes, links to education content related to energy, signposting to relevant sources and institutes etc.

Chapter 1 introduces the project EnerCities.

Chapter 2 gives an overview of methodology and experiences useful to deliver the content in a learning situation with what is a new tool for the modern teacher's toolkit.

Chapter 3 introduces the project-relevant energy-related themes. It also offers an introduction to the main sources of further reading and research. Concepts relating to Energy & Society on every level are introduced concluding with a section about e-learning and Serious Games.

Chapter 4 is directly concerned with the Energy sources and other features in the EnerCities Game itself.

### 1.3. FOCUS OF PROJECT ENERCITIES

Project EnerCities offers a game-based learning platform (serious game) where young people in Europe can experience energy-related implications (e.g. energy consumption, energy savings, renewable energy, energy & environment). Serious gaming is the application of gaming technology in combination with learning methodologies to solutions of problems and/or regarding challenges faced by businesses, education institutes and other organizations. Serious games include games used for educational, persuasive, political, or health purposes. The heart of the platform will be group competitions to create and expand virtual cities dealing with pollution, energy shortages, energy reduction plans, renewable energy projects etc. The platform is attractive for youngsters: advanced on energy topics, teamwork-oriented, competition-based and community-driven. Education programmes are integrated with the game-based learning platform via a to be developed education toolbox. This integration will be piloted in 5 education institutions (located in various countries in Europe). European rollout of the platform - accompanied with an education toolbox - is facilitated among 50 education institutions. Events are organized to share experiences. The project makes youngsters via competition aware of energy-related implications and will have the ability to change their energy attitudes and behaviour. Education institutions will have state-of-the-art and attractive learning tools to upgrade their education programmes. The duration of the project is 36 months in order to maximize the rollout and the usage of the project's infrastructure.

Research indicates that playing EnerCities has effects on the awareness and attitudes of youngsters regarding sustainability, environment and energy saving (at home). For more information about this research:

- Knol & De Vries (2011), *EnerCities, a serious game to stimulate sustainability and energy conservation: preliminary results*. eLearning Papers, <http://elearningpapers.eu/en/download/file/fid/23295>, July.
- De Vries & Knol (2011), *Serious gaming as a means to change adolescents' attitudes towards saving energy; preliminary results from the EnerCities case*. Proceedings EDEN Annual Conference, Dublin (Ireland).

## 2. METHODOLOGY

### 2.1. BACKGROUND - GAMES IN THE CLASSROOM

The development of computers and the rise of the Internet has stimulated the debate about how games and simulations can be used to support learning. The rise in the use of various hands-on and visual technologies in the classroom as well as for home users prompted a recent JISC (*Joint Information Systems Committee*) commissioned study. The Learning in Immersive Worlds report was commissioned by JISC in order to explore the potential for the use of games to support learning and teaching in the higher education and post-16 sectors.

As an introduction to the concept of gaming in education a brief flyer was compiled that summed up the thinking and reality that prompted further study into the topic,

*“Computer and console games are increasingly being used as part of leisure time activities. Currently 52 per cent of UK households have Internet and increasingly broadband access. In addition, there are 20.8 million consoles and handhelds in UK homes. Over the last ten years, more than 335 million leisure software titles have been sold (Office of National Statistics/Screen Digest/Chart-Track, 2006). Wider use of games technologies in the home is increasing the interest in the use of games in educational contexts and this is in turn leading to an increasing use of games, particularly in schools and colleges, but also in universities.”*

<http://www.jisc.ac.uk>

*“...computer games could have an important role to play in learning but that for learning to take place, games must be related to learning outcomes and be relevant to real world contexts of practice.”*

<http://www.elearning.ac.uk>

*‘There needs to be an emphasis upon embedding games effectively and in accordance with sound pedagogic principles.’*

<http://www.seriousgameseurope.com>

## 2.2. INCORPORATION OF THE PROJECT ENERCITIES INTO REGULAR LESSONS IN AN EDUCATIONAL SETTING

As a teacher or session leader you might want to read the next section which raises practical issues encountered during the incorporation of the EnerCities game into classes at two different levels of study.

Using EnerCities advances Basic IT skills in the classroom by:

- Utilizing email
- Form completion / Password setting
- Setting up accounts
- Keyboard and mouse use
- Following on-screen instruction.

On the topic of energy EnerCities raises issues of:

- Awareness of responsible energy use
- Co-dependence of natural resources, the environment, economy, population growth and urban landscape
- Basic function of education regarding energy
- Cause and Effect of population growth
- Climate change debates
- Sustainability

- Global warming
- Industry and the environment
- The rise of new manufacturing powers i.e. China and India
- The price of fuel
- Our moral obligation to the planet
- Local issues about transport

EnerCities more generally can also offer:

- Collaborative and active learning opportunities
- Group discussion
- Competition based activities
- Decisions making opportunities

## 2.3. SCENARIOS

### 2.3.1. SCENARIO 1

Scenario 1 was the first session where EnerCities had been used as a main focus for a PSHE class with a group of 15+ year olds at a Further Education College. Technical help was available throughout the session and a very welcome support to the teacher with this challenging group of young learners. The session was due to last two hours with a short comfort break half way through.

- *The Unity3d plug-in had to be pre-installed on the standard college machines which were in a protected state (standard users didn't have installation rights to install the Unity3d plug-in)*
- *A 15 minute introduction of the issues and the concept of the game was given to the learners in a didactic approach. The various concepts of energy in the toolkit were discussed and contextualised relating to the game and followed by a short question and answer exchange.*
- *After the introduction students were then directed to the game website [www.EnerCities.eu](http://www.EnerCities.eu) where they had to register usernames to give them access to the game. This process required a valid email address as the EnerCities user account required validation before use.*
- *The registration process presented questions about the users' age, time zone and also asked for the user to remember a password and a teacher code. (The teacher code was pre-issued and was used to bind the student scores to a particular group)*
- *After a successful registration students accessed their chosen email account to activate the EnerCities account (In some cases the email took more than a few minutes to arrive but normally it arrived within a minute or so)*
- *After activation the student had to re-log on (remembering their password which did cause some issues even though it was about 3 minutes since they devised it)*
- *They then played the game and required only minimal instruction to manipulate the objects on the game grid.*
- *Some players sought to destroy the planet from the outset which, despite being initially challenged, raised as much debate later as any other approach.*
- *Scores were compared throughout the session and a real sense of competition occurred (inevitably some players lost interest when a high score wasn't possible and restarted before posting a score)*

- *Each player managed two rounds of EnerCities before the teacher brought the class to attention.*
- *Learners were asked to focus on the interactive whiteboard display and collaborate on a team effort using what they had discovered.*
- *The student who managed the best score was invited to lead this attempt.*
- *Contributions were offered by the whole group in a lively and constructive way.*
- *When an interest point or relevant issue was raised the game was paused and debate continued.*
- *The game was concluded and a session debrief explored the topics raised and issues that the game highlighted were documented as;*
  - *local energy concerns*
  - *low voltage light bulbs*
  - *nuclear power*
  - *finite oil, gas and coal supplies*
  - *power used by devices on stand-by*
  - *computer use*
  - *cause and effect*
  - *wind turbines*
  - *solar power*
  - *energy prices*
  - *responsible energy use*

### 2.3.2. REFLECTION ON SCENARIO 1

- *Checking the software plug-in was working and having technical help at hand turned out to be a wise move. The website had a tendency to lock out the user after too many failed log in attempts.*
- *It would have been better to set up the accounts and get the players to the game screen before introducing the game concepts and energy themes. The students were distracted by the fact that the game was ready to play and the teacher was preventing this by their didactic delivery.*
- *Even without proper instruction most of the students (not all) got to grips with the game without the need for much help at all.*
- *The urge to destroy the planet was an approach that was taken by a few of the students which raised interesting questions for the later debate.*
- *The game encouraged a feeling of competition among the players but this was energetically channelled into one of collaboration with tactics shared and methods explained among the group.*
- *It wasn't correct to assume all of the students were familiar with gaming and email. Some needed more help than others. It might be handy to set up a generic account for plan B*
- *Less time with the didactic approach and more hands on initially would have been better and kept the students engaged.*
- *The idea of peer support worked well to foster a collaborative atmosphere in the room.*
- *Rewarding the best score and offering class responsibility to a student was a useful exercise and beneficial to the dynamics of the group.*
- *Energy it seemed isn't a topic close to the heart of all our young learners but they are all consumers of it and the media attention to it. Everyone made a useful contribution to the session and had some experience or knowledge to share.*
- *Most of the students were engaged by the game and the concept of scoring although what the points were awarded for was a little confusing to even the most able among them.*
- *They approved of the look and feel of the game and statistics show that many of them revisited the game on several occasions to improve their score.*
- *Users went on to play the game at home and are following the application on Facebook.*

### 2.3.3. SCENARIO 2

Scenario 2 was the second session where EnerCities had been used but this time the players were an IT class with a group of 16-18 year olds at a Further Education College. Like previously, technical help was available throughout the session and a very welcome support to the teacher with another group of more able, but still challenging young learners. The session was due to last two hours with a short comfort break half way through.

- *As before the Unity3d plug-in had to be pre-installed on the standard college machines which were in a protected state (standard users didn't have installation rights to install the Unity3d plug-in)*
- *A 5 minute introduction of the issues and the concept of the game was given to the learners. The various concepts of energy in the toolkit were discussed and contextualised relating to the game (there was no a short question and answer exchange at this stage)*
- *After the 5 minute introduction students were then directed to the game website [www.EnerCities.eu](http://www.EnerCities.eu) where they had to register usernames to give them access to the game as in the previous session. And like before the process required a valid email address as the EnerCities user account required validation before use.*
- *The registration process presented questions about the users' age, time zone and also asked for the user to remember a password and a teacher code. (A different teacher code was pre-issued and was used to bind the student scores to this particular group)*
- *After a successful registration students accessed their chosen College Student account to activate the EnerCities account (In all cases the activation arrived in minute or so)*
- *After activation the learner had to re-log on (remembering their passwords which wasn't an issue in this class of IT students)*
- *They then played the game and like the previous group only required minimal instruction to manipulate the objects on the game grid.*
- *Strangely, just like in the previous group players sought to destroy the planet which the teacher in this session actively encouraged (in the game setting of course)*
- *As before, a real sense of competition was present throughout the group of what appeared to be competent gamers.*
- *Each player managed two rounds of EnerCities before the teacher brought the class to attention.*
- *Only now the teacher opened the group up for questions about what they had discovered.*

- *A quick fire questions and answers activity sprang out into a lively debate about how much oil was actually left in the earth and whether hydrogen cars had a future.*
- *This energy was channelled into the short survey they were asked to complete about what they liked or didn't like about the game and what they would like to see in it. Rioting, Explosions, Armageddon and the usual teenage requests. But this was a useful reflective exercise and brought the issues to life.*
- *Only after the questionnaire was completed were learners asked to focus on the interactive whiteboard display and collaborate on a team effort using what they had discovered.*
- *Again, the student who managed the best score was invited to lead this attempt.*
- *Contributions and tips were invited by the teacher from the whole group.*
- *When an interest point or relevant issue was raised the game was paused and debate continued.*
- *The game was concluded (with a high score) and again the session debrief explored the topics raised and issues that the game highlighted were documented as;*
  - *hydrogen cars*
  - *computer power consumption*
  - *public unrest*
  - *low voltage light bulbs,*
  - *nuclear power and nuclear disaster*
  - *Simcity and computer games in the classroom*
  - *local power issues*
  - *local gas storage*

- *UK oil, gas and coal supplies,*
- *energy consumption, cause and effect*
- *wind turbines and solar power*
- *responsible energy use, which was used as the trigger for the end of the lesson as all the students dutifully switched off all computers and took all monitors out of stand-by*

#### 2.3.4. REFLECTION ON SCENARIO 2

- *Checking the software plug-in was working and having technical help at hand turned out to be a wise move.*
- *Getting the players to the game screen before introducing the game concepts and energy themes worked well. It avoided 15 minutes of didactic delivery the students didn't want.*
- *Even without proper instruction ALL of the students registered, launched played with the game without the need for help.*
- *As in the first class the urge to destroy the planet was an approach that was taken by a few of the students but encouraged by the tutor (in the game of course) to inform later debate. This turned out to be a very useful and informative exercise.*
- *The game encouraged a feeling of competition among the players but this was energetically channelled into one of collaboration, with tactics shared and methods explained among the group members.*
- *It might still be prudent to set up a generic account for plan B.*
- *Less time with the didactic approach and more hands on worked well and kept the students engaged.*
- *Peer support worked well to foster a collaborative atmosphere in the room.*
- *Rewarding the best score and offering class responsibility to a student was a useful exercise and beneficial to the dynamics of the group.*

- *Everyone made a useful contribution to the session and had some energy experience or knowledge to share.*
- *Most of the students were engaged by the game and the concept of scoring, although what the points were awarded for was a little confusing to even to this 'game savvy' group.*
- *They generally approved of the look and feel of the game (despite being familiar with all of the latest game titles and consoles)*
- *Statistics show that many of them revisited the game on several occasions to improve their score and challenge their classmates.*
- *Several users went on to play the game at home and are following the application on Facebook.*

### 3. PROJECT-RELEVANT ENERGY-RELATED THEMES

#### 3.1. INTRODUCTION

Overview of the themes Regarding the EnerCities education toolbox a set of energy-related themes should be embedded. The table below gives a set of energy-related themes that are (to be) considered by the consortium. Themes considerations are related to the target groups (mainly youngsters); the needed educational character of the game and related education toolbox; the ability of the game and related toolbox to change attitudes of the target groups' individuals regarding energy consumption, energy efficiency and renewable energy; and complexities of certain themes.

Energy Policy Background	Energy & Society	Energy, Technologies, Efficiency & Transition
<p>Take action regarding climate change.</p> <p>Be more competitive in the use of energy and therefore in the use of (energy)resources.</p> <p>Be less independent from current (traditional) energy sources and structures in our society (especially natural resources like petroleum and natural gas).</p> <p>Strive for a society based on a balance between sustainability, wellbeing and welfare</p>	<p>Energy &amp; socio-economic aspects (e.g. welfare / well-being, social acceptance, not-in-my-backyard syndrome)</p> <p>Energy security (e.g. imports / exports, supply guarantee / diversify, natural resources, geopolitics, energy storage, costs, electricity network, gas network energy democratization)</p> <p>Energy &amp; economics (e.g. economic investment, performance, budget, maintenance costs)</p> <p>Energy, sustainability &amp; environment (e.g. natural resources, environment, standard of living, green-house-gasses emissions, health, pollution)</p>	<p>Renewable energy (e.g. wind energy; solar heat; solar PV electricity; solar thermo-electricity; geothermal energy for heat and electricity; bio mass; ocean and sea energy) and non-renewable energy sources (nuclear).</p> <p>Energy saving &amp; efficiency (e.g. powering appliances and systems (industrial / household), transport (efficiency), heating / cooling, light)</p> <p>Energy transition (e.g. sustainable transport, sustainable electricity, sustainable heating / cooling, green-house-gasses emission reduction, energy storage, energy security)</p>

### 3.2. INTRODUCTION TO THE THEMES - DEFINITION, POLICY, IMPLEMENTATION AND FURTHER READING

The very nature of this project and the products contained herein are intended as a platform for educational debate and to simulate young people into firstly an attitude change which will transform into a behavioural change.


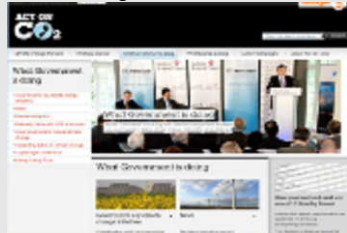

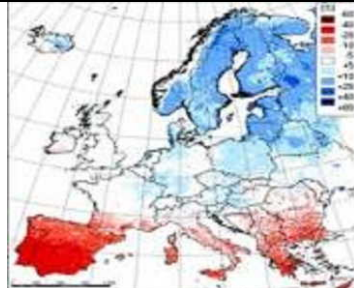

The politics of energy and controversial debates that surround this emotive subject makes it difficult to offer definitive answers to the questions that circulate around the globe on the theme of energy consumption and the following toolbox does not necessarily reflect the view of the educational establishment using it but merely a means to raise awareness of the need for a change in attitude and behaviour regarding energy consumption.

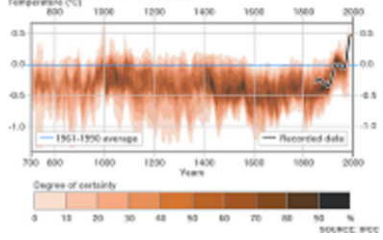




It is anticipated that basic definitions of the main topics and technologies should be taken from the EU Energy Portal and other reliable sources, then extending the potential for debate by introducing alternative arguments, views and research alongside.


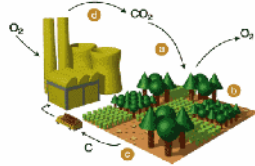
The key Aspects of Policy are considered from national and local levels with international, national directives and local government initiatives on the key themes.



Implementation aspects can be any barrier or controversy surrounding the key themes and a chance to consider the debate and bring the concepts down to the level of the individual and local level.

Further useful links to further sources of information are also included.

	Introduction and definition	Policy aspects	Implementation aspects	Additional information
Take action regarding climate change	<p>What is Climate change?</p> <p>Changes in the Earth's climate, especially those produced by global warming</p> 	<p>What about climate change and policy on an International Level?</p> <p>The European Union is working actively for a global agreement to control climate change and is taking domestic action to achieve substantial reductions in its own contribution. It is also developing a European strategy for adapting to climate change.</p> 	<p>Positive and negative implications of policy implementation in the UK.</p> <p>The British government has been accused by Greenpeace of trying to strangle development of renewable power in Europe, and in particular in the UK &gt;&gt;&gt;</p>	<p>Another brief history of climate change</p> <p>As the UN climate summit in Copenhagen approaches, BBC News environment correspondent Richard Black traces key milestones, scientific discoveries, technical innovations and political action &gt;&gt;&gt;</p>
	 <p>ukcip.org.uk - what is climate change?</p>	 <p>ec.europa.eu future action</p>	<p>UK 'needs step change' on climate &gt;&gt;&gt;</p>  <p>www.oxfam.org.uk climate change</p>	<p><a href="http://www.carbontrust.co.uk/publications/publicationdetail?productid=CTC502">http://www.carbontrust.co.uk/publications/publicationdetail?productid=CTC502</a>  <a href="http://www.carbontrust.co.uk/publications/publicationdetail?productid=CTC519">http://www.carbontrust.co.uk/publications/publicationdetail?productid=CTC519</a></p>
				<p><a href="http://www.centrica.com/index.asp?pageid=51-downloadable%20media%20pack%20from%20Centrica">http://www.centrica.com/index.asp?pageid=51 - downloadable media pack from Centrica</a></p>

	<p>decc.gov.uk - what is climate change? ' Over the last 100 years the average global surface temperature has risen by about 0.74C' &gt;&gt;&gt;</p> 	<p>ec.europa.eu climate action          The EU adopted an integrated energy and climate change policy in December 2008, including ambitious targets for 2020. It hopes to set Europe on the right track - towards a sustainable future with a low-carbon, energy-efficient economy - by:          cutting greenhouse gases by 20% (30% if international agreement is reached)</p>	<p>Be Part of the Solar Generation          Climate change is a problem that the current generation is imposing on many to come. Greenpeace's global youth activism community is centered around clean energy solutions for the future.</p> 	<p><a href="http://www.bbc.co.uk/sn/hottopics/climatechange/index.shtml">http://www.bbc.co.uk/sn/hottopics/climatechange/index.shtml</a></p> <p><a href="http://actonco2.direct.gov.uk/actonco2/home.html">http://actonco2.direct.gov.uk/actonco2/home.html</a></p>
	<p>en.wikipedia.org - what is climate change?</p> 	<p>reducing energy consumption by 20% through increased energy efficiency meeting 20% of our energy needs from renewable sources.</p>	<p>How to tackle your emissions          Co2 Calculator &gt;&gt;&gt;</p> 	<p><a href="http://www.bbc.co.uk/sn/climateexperiment/">http://www.bbc.co.uk/sn/climateexperiment/</a></p> <p><a href="http://direct.gov.uk/en/Environmentandgreenerliving/Thewiderenvironment/DG_070060">http://direct.gov.uk/en/Environmentandgreenerliving/Thewiderenvironment/DG_070060</a></p>
	<p>en.wiktionary.org/wiki/climate_change</p>	<p>UK National Level policy aspects.          What is the UK doing?          campaigns2.direct.gov.uk Road to Copenhagen          What the UK Government is doing          The government's "renewable energy strategy" is legally bound to cut CO2 emissions by 34 per cent by 2020 and by 80 per cent by 2050 &gt;&gt;&gt;</p>	<p>Energy bills will rise in low-carbon economy &gt;&gt;&gt;          £100 billion investment in building new infrastructure and most of the cost is likely to be passed onto the consumer by energy companies &gt;&gt;&gt;          Offset your CO2 emissions...</p>	<p><a href="http://news.bbc.co.uk/1/hi/sci/tech">http://news.bbc.co.uk/1/hi/sci/tech</a></p>
	 <p><b>Animated guide</b>          How the Greenhouse effect works</p>	<p>Priorities are also fed down to the Local Level – councils have to act too!  <a href="http://lancaster.gov.uk">lancaster.gov.uk</a> - climate change</p>	<p>Meanwhile, as the EU works towards the 2020 deadline for its policy targets, it is also rising to the challenge of halving global emissions by 2050  <a href="http://ec.europa.eu/climateaction/eu_action/index_en.htm">http://ec.europa.eu/climateaction/eu_action/index_en.htm</a></p>	<p>Act Now - Change the Future  <a href="http://lessuk.org">lessuk.org</a> why protect the environment</p>


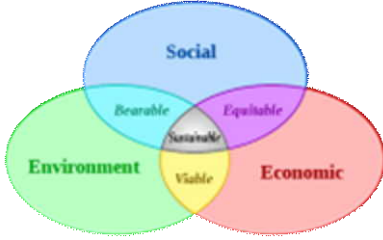

	<p>Greenhouse gasses          Gases that have the above property are known as Greenhouse Gases (GHG), and include:          Carbon dioxide (CO<sub>2</sub>)          Methane (CH<sub>4</sub>)          Nitrous oxide (N<sub>2</sub>O)          Water vapour (H<sub>2</sub>O)</p>	 <p>An excerpt from a speech in which Gordon Brown called for "vision &amp; determination" from world leaders to rise to the challenge of climate change</p>	 <p>Biomass is not 'carbon neutral. Rather it is a low carbon fuel, but carbon is emitted, usually as a result of energy use, as a result of planting, harvesting, processing, transport and often fertilizer and pesticide production and administration.</p>	<p><a href="http://www.greenpeace.org/international/campaigns/climate-change/changethefuture">http://www.greenpeace.org/international/campaigns/climate-change/changethefuture</a></p> <p><a href="http://www.biomassenergycentre.org.uk">http://www.biomassenergycentre.org.uk</a></p>
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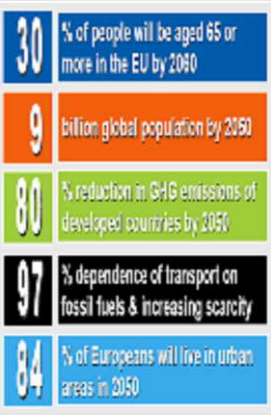

	Introduction and definition	Policy aspects	Implementation aspects	Additional information
Be more competitive in the use of energy and therefore in the use of (energy) resources	Energy efficiency Making Energy More Competitive and Less Expensive	Combating climate change The EU leads the way >>>	Social Responsibility The UK have now introduced Energy ratings for homes, white goods, and most buildings	<a href="http://www.communities.gov.uk/planningandbuilding/theenvironment/energyperformance/homes/">http://www.communities.gov.uk/planningandbuilding/theenvironment/energyperformance/homes/</a>
	Personal responsibility for Climate Change	Q&A: The Copenhagen climate summit >>> Gordon Brown has outlined his vision for a green new deal that he hopes will pave the way for a low carbon economic recovery. 	The EU Energy Label is a compulsory notice that is applied to all white goods and home appliances sold within the EU. It allows consumers to clearly see the efficiency and energy consumption of a product >>>	The section contains frequently asked questions on various aspects of energy performance and buildings
	How to live a low-carbon life the individual's guide to stopping climate change	<a href="http://ec.europa.eu/energy/strategies/2009/2009_07_ser2_en.htm">http://ec.europa.eu/energy/strategies/2009/2009_07_ser2_en.htm</a>	Buildings are responsible for almost 50 per cent of the UK's energy consumption and carbon emissions >>>	<a href="http://en.wikipedia.org/wiki/World_energy_resources_and_consumption">http://en.wikipedia.org/wiki/World_energy_resources_and_consumption</a>
29 October 2007. The Prime Minister has welcomed the launch of the International Carbon Action Partnership (ICAP) >>>		The global recession provides a window of opportunity to curb climate change and build a low-carbon future, says the International Energy Agency (IEA). >>>	<a href="http://www.youtube.com/user/DowningSt">http://www.youtube.com/user/DowningSt</a>	



	Introduction and definition	Policy aspects	Implementation aspects	Additional information								
Be less dependent from current traditional energy sources and structures in our society (especially natural resources like petroleum and natural gas; prepare society for the end of fossil fuels)	What happens when traditional energy resources run out?	Contingency Policies if traditional energy resources are interrupted or lost...	Non-renewable energy sources, do, as their name suggests, run out. Apart from their impact on global warming, they are finite. Putting a date on these energy sources underscores the world's need for true sustainable energy sources >>>	<a href="http://www.energy.eu/#depletion">http://www.energy.eu/#depletion</a>								
	Natural Gas >>>	<table border="1"> <tr> <td colspan="2">Natural Gas (in cubic meters) &gt;&gt;&gt;</td> </tr> <tr> <td>Total world reserves Jan. 1st 2010:</td> <td>171514266542404</td> </tr> <tr> <td>World usage per second:</td> <td>92653</td> </tr> <tr> <td>Estimated date of exhaustion:</td> <td>09:25 Sep 12, 2068</td> </tr> </table>	Natural Gas (in cubic meters) >>>		Total world reserves Jan. 1st 2010:	171514266542404	World usage per second:	92653	Estimated date of exhaustion:	09:25 Sep 12, 2068	Grants may be available to certain people in the UK >>>	International Energy Agency Energy Institute  World Energy Council  The Gas Forum
	Natural Gas (in cubic meters) >>>											
	Total world reserves Jan. 1st 2010:	171514266542404										
	World usage per second:	92653										
Estimated date of exhaustion:	09:25 Sep 12, 2068											
Coal >>>	<table border="1"> <tr> <td colspan="2">Coal (in metric tonnes) &gt;&gt;&gt;</td> </tr> <tr> <td>Total world reserves Jan. 1st 2010:</td> <td>834684384000</td> </tr> <tr> <td>World usage per second:</td> <td>203</td> </tr> <tr> <td>Estimated date of exhaustion:</td> <td>20:05 May 19, 2140</td> </tr> </table>	Coal (in metric tonnes) >>>		Total world reserves Jan. 1st 2010:	834684384000	World usage per second:	203	Estimated date of exhaustion:	20:05 May 19, 2140	This policy extends to more ambitious projects such as Solar Heating Systems >>>	Will You Join Us  OPEC	
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Scientists challenge major review of global reserves and warn that supplies will start to run out in four years' time >>>	<a href="http://www.clean-energy-ideas.com/">http://www.clean-energy-ideas.com/</a>	Subsidising alternative energy Favourable sustainable planning applications.	Power Companies have a duty to the their customers and the planet EDF have a vision statement that is interesting									



	<p>Energy is central to our lives. We rely on it for transport, for heating and cooling our homes, and running our factories, farms and offices. However, fossil fuel is a finite resource and is a major cause of global warming. So we can no longer take energy from fossil fuels for granted. We must create an integrated energy and environment policy based on clear targets and timetables for moving to a low-carbon economy and saving energy &lt;&lt;read more &gt;&gt;</p>	<p>Ofgem publishes a comprehensive review of Britain's energy supplies</p> <p>The UK will struggle to meet legally binding commitments to produce 15% of power from renewable sources unless resources are ploughed into wind energy, according to new research from the Institute for Public Policy Research (IPPR) &gt;&gt;&gt;</p> <p>A government source said: "At the moment the system is far too bureaucratic and can put the householder at a disadvantage. We aim to change that."</p>	<p>Selling renewable energy back to national grid.</p> <p>Householders who generate their own energy will find it easier to sell excess supplies back to the National Grid under government "green" plans &gt;&gt;&gt;</p> <p>The IPPR claim only 700 people are currently employed in the wind energy sector, and only one UK-based factory manufactures parts for wind turbines &gt;&gt;&gt;</p>	<p>Energy Saving Trust best practice in housing</p> <p>Centre For Global Energy Studies</p> <p><a href="http://www.nationalgrid.com/uk/">http://www.nationalgrid.com/uk/</a></p>
	<p>Strive for Energy Autonomy &gt;&gt;&gt;</p>	<p>Renewable energy commercialization &gt;&gt;&gt;</p>	<p>Education of future energy consumers EnerCities ☺</p>	<p>Centre for Alternative Technology <a href="http://www.micropower.co.uk/">http://www.micropower.co.uk/</a></p>




	Introduction and definition	Policy aspects	Implementation aspects	Additional information
<p>Strive for society based on balance between sustainability, wellbeing &amp; welfare</p>	<p>The UK Public Health Association (UKPHA) has suggested that if calls for action to link health and sustainability fail, then 'there is very little hope for the future health of humanity' &gt;&gt;&gt;</p>	<p>UK governments have consistently failed to tackle rising levels of chemical pollution in the atmosphere in cities and urban areas &gt;&gt;&gt;</p>	<p>There is widespread public recognition that the climate, irrespective of the cause, is changing &gt;&gt;&gt;</p>	<p>All sources are taken from: <a href="http://www.healthyfuture.org.uk/convergent.html">http://www.healthyfuture.org.uk/convergent.html</a></p>
	<p>Environmental degradation consequences A proliferation of toxic/harmful residues in the environment which are absorbed, metabolised or stored within the human body, affecting the function of the immune system, the nervous system, and the reproductive and respiratory systems. These toxins/residues are also capable of leading to cancer Loss of green space and contact with nature, leading to reduced physical activity and mental ill-health</p>	<p>Local authorities have traditionally focused on local environmental quality but are becoming more involved (e.g. through the planning system to encourage renewable &gt;&gt;&gt;</p>	<p>Behaviours are already changing and there are some positive signals. The committed few are becoming larger in number and enough to support impressive, if still niche, progress. Recycling is the success story to date, with rapid shifts in parts of the country &gt;&gt;&gt;</p>	<p>IPCC. Climate change 2007: synthesis report. IPCC, 2007.</p>






	<p>Climate change consequences          Flooding, causing disruption of infrastructure resulting in deaths from injuries, water-borne diseases, and psychological stress          Increase in vector-borne diseases          Water shortages          Loss of productive land for cultivation and livestock          Pressures from population movement, thus rapidly reducing productive land areas          Significant increase in heat related deaths.</p>	<p>The public look to Government to orchestrate collective action &gt;&gt;&gt;</p> 	<p>However, many consumers still seek to make changes at the margins of their lifestyles &gt;&gt;&gt;</p>	<p>UKPHA. Climates and change: the urgent need to connect health and sustainable development. London: UKPHA, 2007.</p>
	<p>Consequences of (unsustainable) economic development          Inequitable distribution of resources          Over-consumption in the developed world, leading to obesity and the diseases of affluence. Under-consumption in the developing world (i.e. malnutrition), driven by the unequal use of resources and powerful global economic interests          Poorly-controlled land use planning leading to degradation of the built environment and transport infrastructure.</p>	<p>The public agree, in principle, that government has the mandate to lead, although their response to potential interventions is more complex. The nature of the intervention is key: certain measures — particularly fiscal — are contentious, whereas others (e.g. ‘editing out’ certain consumer choices, like incandescent light bulbs) are widely supported &gt;&gt;&gt;</p>	<p>According to the European Environment Agency, two-thirds of catastrophic events since 1980 have been climate-driven by floods, storms, droughts or heatwaves &gt;&gt;&gt;</p>  <p>ht  <a href="http://actonco2.direct.gov.uk/actonco2/home.html">tp://actonco2.direct.gov.uk/actonco2/home.html</a></p>	<p>RCEP. The urban environment. London: RCEP, 2007.</p> 

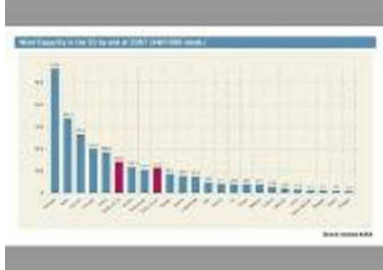

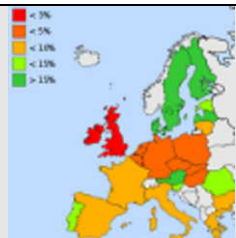
Energy & socio-economic aspects	Introduction and definition	Policy aspects	Implementation aspects	Additional information
1. Welfare / well-being	Pollution is the introduction of contaminants into an environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organisms >>>	Winter Fuel Allowance If you are aged 60 in the UK >> Also, you may be eligible for a Cold Weather Payment for each week of very cold weather in your area if you get Pension Credit or income-related Employment and Support Allowance with a support or work related activity component in the main phase >>>	Ageing population 	<a href="http://www.healthyfuture.org.uk/convergent.html">http://www.healthyfuture.org.uk/convergent.html</a>
2. Energy saving & efficiency policies / behaviour	A sustainable future for transport: Towards an integrated, technology led and user friendly system >>> 	The UK government's Low Carbon Building Programme - Current grant levels are as follows: • Solar thermal (hot water) £400 or 30%, whichever is lower • Solar photovoltaic (electricity) £2,000 per kW of installed capacity, max £2500 • Wind Turbines £1,000 per kW of installed capacity, max £2500 • Micro-Hydro £1,000 per kW of installed capacity, max £2500 • Ground source heat pumps £1,200 or 30%, whichever is lower • Automated wood pellet room heaters/stoves £600 or 20%, whichever is lower • Wood fuelled boiler systems £1,500 or 30%, whichever is lower Energy Action Grants Agency Climate change impacts in the North West >>>	Subsidised energy saving products on sale... E.ON Subsidised Energy Saving Light Bulbs “ The cost of addressing climate change is manageable. The cost of not doing so is unaffordable ” Yvo de Boer, UNFCCC  Turning your home green <a href="http://generic.webchats.tv/chat/turning_your_home_green">http://generic.webchats.tv/chat/turning_your_home_green</a>	<a href="http://www.npower.com/web/solarpv/index.htm">http://www.npower.com/web/solarpv/index.htm</a>  Try this serious game - you are president of the European Nations. You must tackle climate change and stay popular enough with the voters to remain in office >>>  Energy Efficiency Advice Centres Centre for Alternative Technology The Energy Saving Trust <a href="http://www.est.org.uk">www.est.org.uk</a> supports and oversees a UK wide network of local Energy Efficiency Advice Centres that can provide help and assistance for households to save energy, money and the environment. They can also advise on energy generation.  <a href="http://ec.europa.eu/transport/index_en.htm">http://ec.europa.eu/transport/index_en.htm</a>


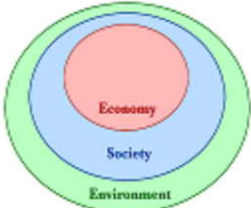
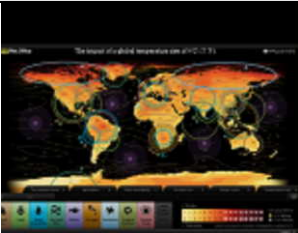
<p>3. Social acceptance / Not-in-my-backyard syndrome</p>	<p>NIMBY is an acronym for 'not in my back yard'. The term (or the derivative Nimbyism) is used pejoratively to describe opposition by residents to a proposal for a new development close to them.</p> 	<p>The government says the county needs 30% of its electricity to come from renewable sources by 2020, but there is little chance of reaching that target when local opposition is so fierce &gt;&gt;&gt;</p> 	<p>Scotland risks being left behind in the race for green technology by an epidemic of nimbyism holding up planning applications and threatening to derail government targets for renewable energy &gt;&gt;&gt;          Green energy hit by 'faceless Nimbys'&gt;&gt;          Ecotowns and turbines are a political slap in the face of the landscape - Climate change is like defence during the cold war, wrapped in hysteria of envy, class, greed and commercial interest &gt;&gt;</p>	<p><a href="http://www.nimbyexperts.com/1/post/2009/08/nimbies-do-not-exist-according-to-new-study.html">http://www.nimbyexperts.com/1/post/2009/08/nimbies-do-not-exist-according-to-new-study.html</a></p>
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Energy security	Introduction and definition	Policy aspects	Implementation aspects	Additional information
Imports / exports	<p>Access to cheap energy has become essential to the functioning of modern economies. However, the uneven distribution of energy supplies among countries has led to significant vulnerabilities <a href="#">«more»</a></p> <p>Reliance on energy from/to other nations regarding peak demand.</p>	<p>Free market for energy supply  <a href="#">Britain pays high price for dream of free energy market &gt;&gt;&gt;</a>                      After spending most of the last 30 years as a net exporter of energy the UK became a net importer in 2004 and imports look set to increase in the future. This, alongside higher fuel prices, increased concern over the security of energy supply and a shortage of gas imports last winter, has increased the attention on energy imports and exports <a href="#">&gt;&gt;&gt;</a></p>	<p>Unstable prices  <a href="#">The easy conclusion is that Britain's short-term deregulated gas market isn't working &gt;&gt;&gt;</a>                      International Credit Crisis                      Price capping  <a href="#">Is global oil production reaching a peak?</a></p>	
2. Supply guarantee / diversify	<p><a href="#">Fossil Fuel Debate ««more»»</a>                      Cost effective extraction of fossil fuels. Supply threatened by conflict.  <a href="#">energy pipeline that supplies West threatened by war Georgia conflict</a>  <a href="#">Oil and gas travelling through Georgia was supposed to free Europe from Russia. Not anymore.</a>  <a href="#">Is Russia using its energy reserves as a means of blackmailing its western neighbours?</a></p>	<p>Diverse methods of energy production  <a href="#">Growing demand, insecure and scarce supply, increasing prices and global warming have returned oil to the centre of political debate.</a>  <a href="#">With oil remaining an important energy source EU activities on oil have one main goal: reliable access to energy at reasonable prices for all Europeans &gt;&gt;&gt;</a>                      NIMBY                      Energy Self sufficiency</p>		
3. Natural resources	<p>Natural resources (economically referred to as land or raw materials) occur naturally within environments that exist relatively undisturbed by mankind, in a natural form.                      A natural resource is often characterized by amounts of biodiversity existent in various ecosystems.</p>	<p><a href="#">UK good source of wind power and tidal power &gt;&gt;&gt;</a>                      Comparing the UK with other EU countries, the IEEP found that wind turbines met just less than 2% of the UK's electricity demands in 2007, making the UK thirteenth in a league table of wind power per head of population, trailing behind Estonia and only just ahead of Belgium.</p>	<p>Cost                      Environmental Impact - Natural resources are derived from the environment. Many of them are essential for our survival while others are used for satisfying our wants</p>	<p><a href="http://www.nce.co.uk/rspb-drops-wind-power-objections/1995785.article">http://www.nce.co.uk/rspb-drops-wind-power-objections/1995785.article</a></p>
4. Geopolitics	<p><a href="http://en.wikipedia.org">en.wikipedia.org</a> <a href="#">What is Geopolitics?</a>  <a href="#">The Changing Geopolitics of Oil and Gas</a>  <a href="#">Oil &amp; Gas: Crises and Controversies</a></p>	<p>'Geopolitics' represents the struggle between powers for control over something in particular – Oil is a good example.                      Pre WW1 Britain intervened in the Middle East over oil.                      More recently Natural Gas and Geopolitics have played a part in European Politics                      Read more here <a href="#">&gt;&gt;&gt;&gt;</a></p>		<p><a href="http://www.youtube.com/watch?v=fnsBU_XWQJ8&amp;feature=Playlist&amp;p=7657A1166295348A&amp;index=10">http://www.youtube.com/watch?v=fnsBU_XWQJ8&amp;feature=Playlist&amp;p=7657A1166295348A&amp;index=10</a></p>




<p>5. Energy storage</p>	 <p>Gas - <a href="http://guardian.co.uk/gas-storage-energy">guardian.co.uk gas storage energy</a></p> <p>Petroleum and Oil - An oil depot typically has tankage, either above ground or underground, and gantries for the discharge of products into road tankers or other vehicles (such as barges) or pipelines</p> <p>Nuclear Uranium Storage - <a href="http://en.wikipedia.org/wiki/Depleted_uranium">http://en.wikipedia.org/wiki/Depleted_uranium</a> <a href="http://en.wikipedia.org/wiki/Nuclear_fuel_cycle">http://en.wikipedia.org/wiki/Nuclear_fuel_cycle</a></p>	<p>World depleted uranium inventory</p> <table border="1"> <thead> <tr> <th>Country</th> <th>Organization</th> <th>Estimated DU stock (tonnes)</th> <th>Reported</th> </tr> </thead> <tbody> <tr> <td>United States</td> <td>DCE</td> <td>480,000</td> <td>2002</td> </tr> <tr> <td>Russia</td> <td>FABA</td> <td>480,000</td> <td>1996</td> </tr> <tr> <td>France</td> <td>Aura AG</td> <td>190,000</td> <td>2001</td> </tr> <tr> <td>United Kingdom</td> <td>BNFL</td> <td>20,000</td> <td>2001</td> </tr> <tr> <td>Germany</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Netherlands</td> <td>URENCO</td> <td>15,000</td> <td>1999</td> </tr> <tr> <td>United Kingdom</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Japan</td> <td>JNFL</td> <td>10,000</td> <td>2001</td> </tr> <tr> <td>China</td> <td>ORNC</td> <td>2,000</td> <td>2000</td> </tr> <tr> <td>South Korea</td> <td>KAEI</td> <td>200</td> <td>2002</td> </tr> <tr> <td>South Africa</td> <td>HECSA</td> <td>70</td> <td>2001</td> </tr> <tr> <td>TOTAL</td> <td></td> <td>1,988,200</td> <td>2002</td> </tr> </tbody> </table> <p>Source: IAEA, International Atomic Energy Agency</p> <p>as UK gas production falls and imported gas from more distant countries is required to meet the needs of UK homes and industry &gt;&gt;&gt;</p>	Country	Organization	Estimated DU stock (tonnes)	Reported	United States	DCE	480,000	2002	Russia	FABA	480,000	1996	France	Aura AG	190,000	2001	United Kingdom	BNFL	20,000	2001	Germany				Netherlands	URENCO	15,000	1999	United Kingdom				Japan	JNFL	10,000	2001	China	ORNC	2,000	2000	South Korea	KAEI	200	2002	South Africa	HECSA	70	2001	TOTAL		1,988,200	2002	<p><a href="#">Underground gas storage link</a> The Government also recognizes that improvements to the gas supply infrastructure are required, including the need for significant increases in gas storage capacity; best met by the construction of underground storage facilities &gt;&gt;&gt; <a href="http://news.bbc.co.uk/1/hi/uk/4517962.stm">http://news.bbc.co.uk/1/hi/uk/4517962.stm</a> <a href="#">EDF Holford Gas Storage Project</a></p> <table border="1"> <tr> <td>Location</td> <td>Byley, Cheshire</td> </tr> <tr> <td>Number of caverns</td> <td>8</td> </tr> <tr> <td>Capacity</td> <td>156 million cubic metres (mcm)</td> </tr> <tr> <td>Capability</td> <td>Steady-state injection &amp; withdrawal at a rate of 16mcm/day</td> </tr> <tr> <td>Cavern size</td> <td>100m in diameter x 100m high (approx)</td> </tr> </table>	Location	Byley, Cheshire	Number of caverns	8	Capacity	156 million cubic metres (mcm)	Capability	Steady-state injection & withdrawal at a rate of 16mcm/day	Cavern size	100m in diameter x 100m high (approx)	 <p>Sunday, December 11, 2005, was a day without sun for many Londoners. At about 6 a.m. local time, an explosion rocked a fuel depot in Hertfordshire, approximately 40 kilometers (25 miles) north of London. The ensuing oil fire sent thick clouds of sun-blocking black smoke billowing over London and South England &gt;&gt;&gt;</p>
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<p>6. Costs</p>	<p>Rising costs <a href="http://telegraph.co.uk/Rising-fuel-prices">telegraph.co.uk Rising fuel prices</a></p>		<p><a href="#">BBC News website readers across Europe have been reacting to the continent's surging fuel prices &gt;&gt;&gt;</a></p>																																																															




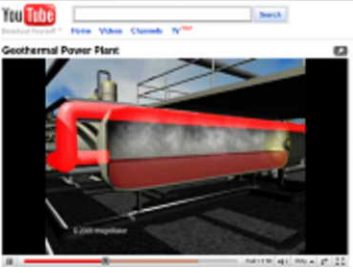
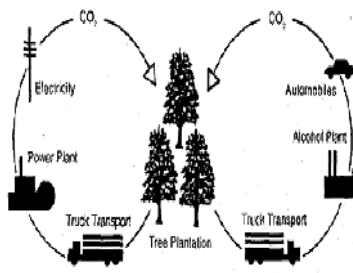
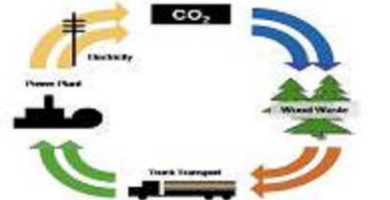
<p>7. Electricity network</p>	<p>UK Electricity from France at peak demand          Coping with peak time demand          In terms of energy use, peak demand describes a period of strong consumer demand &gt;&gt;&gt;</p> <p><a href="#">Power cuts and reduced supply voltages - as a warning sign of more trouble to come &gt;&gt;&gt;</a></p>	<p><a href="#">Britain should increase use of nuclear power, says cabinet minister John Hutton &gt;&gt;&gt;</a></p> <p>But what about coal?          The Government gave its backing to coal-fired power generation yesterday, in what green campaigning groups interpret as a signal that it is set to approve Britain's first new coal power plant in 20 years "The Government's inability to make long-term energy security decisions over the last decade is coming home to roost," said the industry watcher. "Lack of political will to make tough decisions has left Britain short of power." &gt;&gt;&gt;</p>	<p><b>NIMBY</b>          Education/research/national priority</p>  <p>Householders who generate their own energy will find it easier to sell excess supplies back to the National Grid under government "green" plans &gt;&gt;&gt;</p>	 
<p>8. Gas network</p>	<p>Gas from Russia          North Sea          Alternative Gas sources          Morecambe Bay in North West England</p>	 <p>The Bear Growls, The EU Grovels: Adventures in the European Gas Market &gt;&gt;&gt;</p>	<p>Supply, price, conflict, Political  <a href="http://www.dailymail.co.uk">www.dailymail.co.uk</a> The-Pipeline-War-Russian-bear-goes-Wests-jugular  <a href="#">Tony Hayward, BP's chief executive, said proven natural gas reserves around the world have risen to 1.2 trillion barrels of oil equivalent, enough for 60 years' supply – and rising fast &gt;&gt;&gt;</a></p>	<p><a href="http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/6299291/Energy-crisis-is-postponed-as-new-gas-rescues-the-world.html?utm_source=Telegraph.co.uk&amp;utm_medium=TD_energy&amp;utm_campaign=Financial">http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/6299291/Energy-crisis-is-postponed-as-new-gas-rescues-the-world.html?utm_source=Telegraph.co.uk&amp;utm_medium=TD_energy&amp;utm_campaign=Financial</a>          Interesting comments page  <a href="http://www.centrica.com/index.asp?pageid=446">http://www.centrica.com/index.asp?pageid=446</a></p>
<p>9. Energy democratisation</p>	<p>Competitive Markets for Energy          Independent energy watchdogs etc</p>	 <p>Electricity and Gas: You choose!          nopolies commission OFGEN?</p>	<p>Genuine monitoring of Gas Supply          Present in UK for several years          Choice can offer money saving for customers if they have reliable information.          This can relate to price and commitment to sustainability etc</p>	




Energy & economics	Introduction and definition	Policy aspects	Implementation aspects	Additional information
1. Economic investment	The present-day renewable-energy industry is an energy industry focusing on new and appropriate renewable energy technologies, which excludes large-scale hydro-electricity. Investors worldwide have paid much greater attention to this emerging renewable energy industry in recent years.	Ofgem: £200bn of energy investment needed. Stopping the lights going out in the UK will take £200bn of new investment in the energy sector, the power regulator Ofgem has calculated.		
2. Performance	Energy economics is a broad scientific subject area which includes topics related to supply and use of energy in societies	Miliband faces anger over Vestas plant		
3. Budget		Supporting projects properly could easily cost billions (£), and so far we have no details of how that cost will be met. The Treasury says there will be a “mechanism”, which seems to mean an extra levy on bills. The only amount committed from public spending is £90m to pay for the costs of detailed project design >>>	Wind power companies fear that rapid increases in capital costs are undermining the economic viability of offshore projects >>>	<a href="http://www.biee.org">http://www.biee.org</a>
4. Maintenance Costs	Economic viability is now a major barrier to deployment for offshore wind projects.” BWEA	Wind power: Chancellor urged to use budget to aid ailing developers	There are additional costs for renewables in terms of increased grid interconnection to allow for variability of weather and load, but these have been shown in the pan-European case to be quite low—overall, wind energy costs about the same as present-day power >>>	


Energy, sustainability & environment	Introduction and definition	Policy aspects	Implementation aspects	Additional information
1. Natural resources	<p>The Living Planet report calculates that humans are using 30% more resources than the Earth can replenish each year, which is leading to deforestation, degraded soils, polluted air and water, and dramatic declines in numbers of fish and other species. As a result, we are running up an ecological debt of \$4tr (£2.5tr) to \$4.5tr every year - double the estimated losses made by the world's financial institutions as a result of the credit crisis &gt;&gt;&gt;</p>	<p>"We need to be more aware of the benefits that a healthy natural environment can offer us." Hilary Benn, Secretary of State</p> <p><a href="#">The Ecosystems approach action plan &gt;&gt;&gt;</a></p>	<p><a href="#">World is facing a natural resources crisis worse than financial crunch &gt;&gt;&gt;</a></p> 	<p><a href="http://www.defra.gov.uk/environment/">http://www.defra.gov.uk/environment/</a></p> <p><a href="http://www.defra.gov.uk/environment/policy/natural-environ/documents/healthy-nat-environ.PDF">http://www.defra.gov.uk/environment/policy/natural-environ/documents/healthy-nat-environ.PDF</a></p>
2. Environment	<p>Management of all components of the bio-physical environment, both living (biotic) and non-living (abiotic) &gt;&gt;&gt;</p>	<p><a href="#">The Government should provide strong leadership to tackle the lack of specialist know-how in local authorities, set local targets for wind turbines and make sure planning decisions take account of the fact wind power is a national priority.</a></p>	<p><a href="#">The Royal Society for the Protection of Birds (RSPB) have dropped the majority of its objections to wind farms in the UK on the back of new research it has commissioned</a></p>	
3. Standard of living	<p>As fossil fuels are depleted, will mankind develop renewable energy quickly enough to assure continuation of a decent standard of living? &gt;&gt;&gt;</p> <p>There is a myth that we must lower our standard of living in order to avoid the effects of climate change but the reality is that alternative solutions do not sacrifice comfort &gt;&gt;&gt;</p>	<p><a href="#">More ways for communities to benefit from the wind farms on their doorstep should be promoted to win public support. This could be through direct ownership of the turbines, reduced bills, improvements to the local environment or money for local facilities.</a></p>		


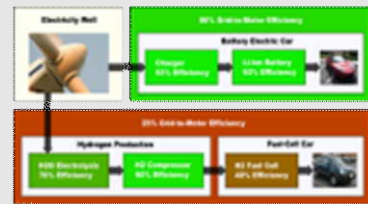


<p>4. Green-house-gases emissions</p>	<p>"Greenhouse gases": Threat to human health  <a href="#">&gt;&gt;&gt;</a></p>	<p>While the country is on track to reduce its greenhouse gas emissions by almost double its Kyoto target, David Miliband said the domestic goal of cutting CO2 emissions by 20% on 1990 levels "looked increasingly difficult to achieve".</p>	<p>"Aviation is the fastest growing source of carbon dioxide in the UK. Emissions have more than doubled since 1990.          "The government must do more to ensure that the cost of flying reflects the environmental damage that aviation causes.          "And it should abandon plans to allow new runways to be built."</p>	<p><a href="http://www.guardian.co.uk/environment/2009/mar/24/global-warming-public-health-america">http://www.guardian.co.uk/environment/2009/mar/24/global-warming-public-health-america</a>          Friends of the Earth</p>
<p>5. Pollution</p>	<p>Any substances in water, soil, or air that degrade the natural quality of the environment, offend the senses of sight, taste, or smell, or cause a health hazard.</p>		<p>Sulphur dioxide levels decreased by 90 per cent, there was around half the amount of ozone and visibility increased by 40 kilometres  <a href="#">&gt;&gt;&gt;</a></p>	



Renewable energy	Introduction and definition	Policy and Implementation	Technology	Additional information
1. Wind energy	<p>What is Wind Energy?  <a href="http://en.wikipedia.org">en.wikipedia.org</a> <a href="http://www.lowcarbonbuildings.org.uk/micro/wind/">Wind turbine</a>  <a href="http://www.lowcarbonbuildings.org.uk/micro/wind/">http://www.lowcarbonbuildings.org.uk/micro/wind/</a></p> <p>The Global Wind Energy Council (GWEC) predicts that wind power will provide almost 29pc of world electricity by 2030.</p>	<p>Subsidy / Planning / Consideration of Natural Energy Source for UK  <a href="#">Wind power ticks more good boxes than almost any other option. It is clean, nearly silent, emits no CO2, pays its way, and is "home made" - no small matter as Europe's reliance on imported gas jumps from 54pc to 80pc over the next 15 years &gt;&gt;&gt;</a>                      An energy investor has proposed a method of speeding up planning permission for onshore wind projects &gt;&gt;&gt;</p>	<p>Investment in R&amp;D Efficiency / Design  <a href="#">In Spain every mill costs €2.6m (£2m) to buy and erect, yet the Danish manufacturer Vestas is sold out until 2010 &gt;&gt;&gt;</a>                      E.On has a £75m project on Soby Sands off the coast of Norfolk, where 30 turbines are cranking out 60 MW for 30,000 homes. Here in the UK, wind power is the fastest-growing renewable energy sector, says The Independent, with power group E.On planning 83 wind turbines off the coast of Yorkshire &gt;&gt;&gt;</p>	<p><a href="http://www.lowcarbonbuildings.org.uk/micro/wind/">http://www.lowcarbonbuildings.org.uk/micro/wind/</a>  <a href="#">Centre for Alternative Technology</a>  <a href="#">The British Wind Energy Association</a>  <a href="http://www.nce.co.uk/home/energy/sea-of-possibility/5209383.article">http://www.nce.co.uk/home/energy/sea-of-possibility/5209383.article</a></p>
2. Solar heat	<p>What is Solar Heat?                      Solar water heating or a solar hot water system is water heated by the use of solar energy  <a href="#">&lt;&lt;&lt;read more&gt;&gt;&gt;</a></p>	<p><a href="#">The current energy policy of the United Kingdom is set out in the Energy White Paper of May 2007, building on previous work including the 2003 Energy White Paper and the Energy Review Report in 2006 &gt;</a></p>	<p>Technology is constantly improving " the silicon panels that are vital to the process of converting sunlight to electricity are becoming more efficient, while cost per kilowatt hour is steadily falling, bringing it closer to alternatives such as wind.</p> 	<p><a href="#">The Solar Energy Society (UK-ISES)</a></p>
3. Solar PV electricity	<p>PVs) are arrays of cells containing a Solar photovoltaic material that converts solar radiation into direct current electricity &gt;&gt;&gt;</p>			<p><a href="#">The Solar Energy Society (UK-ISES)</a></p>




<p>4. Solar thermo-electricity</p>	<p>Solar thermal energy is a technology for harnessing solar energy for thermal energy (heat) &gt;&gt;&gt;</p>			<p><a href="#">The Solar Energy Society (UK-ISES)</a></p>
<p>5. Geothermal energy for heat and electricity</p>	<p>Geothermal power is power extracted from heat stored in the earth. This geothermal energy originates from the original formation of the planet, from radioactive decay of minerals, and from solar energy absorbed at the surface</p>			
<p>6. Bio mass into electricity</p>	<p>Biomass is a renewable energy source because the energy it contains comes from the sun. When Biomass/carbohydrates are burned, they turn back into carbon dioxide and water and release the sun's energy they contain &gt;&gt;&gt;</p>	<p>A study in Science concludes that, on average, using biomass to produce electricity is 80 percent more efficient than transforming the biomass into biofuel &gt;&gt;&gt;</p>		<p><a href="http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-biomass-energy-works.html">http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-biomass-energy-works.html</a></p>
<p>7. Bio mass into heat</p>	<p>The most common processes developed so far use combustion to release energy. Just like coal is burned to produce power, biomass can be burned too.</p>			<p><a href="http://www.iptv.org/exploremore/energy/profiles/biomass.cfm">http://www.iptv.org/exploremore/energy/profiles/biomass.cfm</a></p>

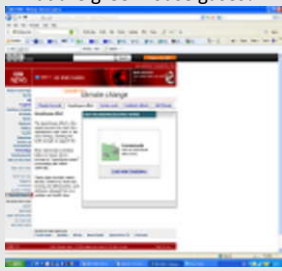


<p>8. Bio mass into transport</p>	<p>Biomass is defined as all plant and animal matter of the Earth's surface &gt;&gt;&gt;</p>	<p>Energy consumption in the transport sector depends almost exclusively on imported fossil fuels – oil. The sector is forecast to grow more rapidly than any other up to 2020 and beyond &gt;&gt;&gt;</p>		
<p>9. Water hydro power</p>	<p>Humans have used water energy for centuries in the form of the waterwheel. And unlike solar and wind power, the advantage of hydro power is that you can predict when the power will arrive and how long it will last. A perfect source of energy, but only if it can be captured and converted.</p>	<p>A new Environment Agency report has identified thousands of potential small-scale hydropower sites in English and Welsh rivers that could power up to 850,000 homes &gt;&gt;&gt;</p> 		<p><a href="http://www.guardian.co.uk/environment/interactive/2010/mar/09/map-hydropower-hotspots-uk">http://www.guardian.co.uk/environment/interactive/2010/mar/09/map-hydropower-hotspots-uk</a></p> <p>Fury at plan to power EU homes from Congo dam &gt;&gt;&gt;</p>
<p>10. Ocean and sea energy</p>	<p>Tidal Energy: Tidal energy is contained in the tides, the waves, temperature gradients of the Ocean, at the junction of rivers and seas (Osmotic) and ocean currents &gt;&gt;&gt;</p>	<p>The UK is well placed in terms of marine energy. There is significant wave resource around the country, some of the best in the world. It has been estimated that marine renewables could meet 15% to 20% of current UK electricity demand &gt;&gt;&gt;          Severn Estuary biodiversity threatened by tidal plans &gt;&gt;&gt;</p>		<p><a href="http://www.greenpeace.org.uk/files/efficiency/index.html">http://www.greenpeace.org.uk/files/efficiency/index.html</a></p>

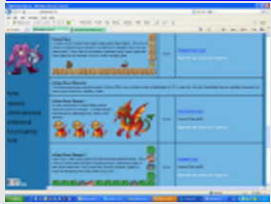
<p>Non-renewable energy as fossil fuel alternatives: nuclear energy</p>	<p>Nuclear power is generated using Uranium, which is a metal mined in various parts of the world.  <a href="#">home.clara.net uranium nuclear the energy released in nuclear reactions or transitions</a></p> <p>Nuclear Fission:  <a href="http://www.energy.eu/#depletion">http://www.energy.eu/#depletion</a></p> <table border="1" data-bbox="338 470 629 793"> <tr> <td colspan="2">Uranium (in metric tonnes U-235)</td> </tr> <tr> <td>Total world reserves Jan. 1st 2010:</td> <td>17963</td> </tr> <tr> <td>World usage per second:</td> <td>0.00000422220 17</td> </tr> <tr> <td>Estimated date of exhaustion:</td> <td>23:12 Nov 28, 2144</td> </tr> </table>	Uranium (in metric tonnes U-235)		Total world reserves Jan. 1st 2010:	17963	World usage per second:	0.00000422220 17	Estimated date of exhaustion:	23:12 Nov 28, 2144	<p><a href="#">Nuclear Power Plants could be built in Developing Countries through Carbon Credits. &gt;&gt;&gt;</a></p> <p>Nuclear development in the UK          The UK Government announced in 2008 that it is in "the public interest to allow energy companies the option of investing in new nuclear power stations &gt;&gt;&gt;</p> <p>Subsidy / Planning / Consideration of Natural Energy Source for UK Toxic Issue          Terrorist Target: a topic that divides Western countries in particular. The French rely on them, but German legislation effectively outlawed new reactors in 2002</p>	<p>Despite high initial build costs and long lead times for new plant, nuclear energy is still the only economically scaleable alternative to fossil fuels</p> <div data-bbox="1220 336 1592 608">  </div> <p>Research &amp; Development / Decommissioning / Synthesis / Replenishment of Fissionable Material / Disposal of Radioactive Waste / Half Life consideration:  <a href="http://www.youtube.com/watch?v=pXd4NGO8W6o">http://www.youtube.com/watch?v=pXd4NGO8W6o</a></p>	<p>Nuclear energy can be produced by both the fission and fusion. Until now the process of fission is the only one that has been available for commercial production, but today have made significant progress in fusion energy production (but is not expected to be a commercial technology until about 2050 according to ITER project).</p>
Uranium (in metric tonnes U-235)												
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Energy saving & efficiency	Introduction and definition	Policy and Implementation	Technology	Additional information
1. Powering appliances and systems (industry / households)		<p>Running electrical equipment is one of the biggest uses of electricity in most homes, so it adds to climate change and your bills. By 2010, electrical items are likely to be using more energy than anything else in people's homes, except heating.</p> <p>The average person in the UK throws away 3.3 tonnes of electrical waste in their lifetime.</p>		
2. Transport (efficiency) (industry / households)	<p>Transport systems are major emitters of greenhouse gases, responsible for 23% of world energy-related GHG emissions in 2004, with about three quarters coming from road vehicles &gt;&gt;&gt;</p>	<p>A wide reaching subject crosses over into every aspect of a citizens life and concerns such as: Transport engineering, Flexible working, Hybrid Vehicle, Electric Car, Toll roads, Congestion charging, Road pricing, Intelligent transportation system, Carpooling</p>	<p>Battery vs Hydrogen in Green vehicles &gt;&gt;&gt;</p> 	 <p><a href="http://www.direct.gov.uk/en/Environmentandgreenerliving/Greenertravel/index.htm">http://www.direct.gov.uk/en/Environmentandgreenerliving/Greenertravel/index.htm</a></p>
3. Heating / cooling (industry / households)		<p><u><a href="#">Give your home a check up and you could save around £300 per year.</a></u></p> <p>Up to 125,000 households in England with working 'G-rated' boilers can apply through the Energy Saving Trust for a voucher. This will entitle them to £400 off the price of a new, modern 'A-rated' boiler or a renewable heating system like a biomass boiler or a heat pump.</p>		
4. Lighting (industry / households)		<p>A global switch to efficient lighting systems would trim the world's electricity bill by nearly one-tenth &gt;&gt;&gt;</p> <p>“ They waste so much energy that if they were invented today, it is highly unlikely they would be allowed onto the market ”</p>		<p><a href="http://www.youtube.com/watch?v=MJxzJxpPjZl">http://www.youtube.com/watch?v=MJxzJxpPjZl</a></p> <p><a href="http://www.energysavingtrust.org.uk/Compare-and-buy-products?gclid=CPPOr9HuuKACFRQulAodzRWGTg">http://www.energysavingtrust.org.uk/Compare-and-buy-products?gclid=CPPOr9HuuKACFRQulAodzRWGTg</a></p>

<p>5. CHP (combined heat and power)</p>	<p>Combined heat and power, CHP) is the use of a heat engine or a power station to simultaneously generate both electricity and useful heat. It is one of the most common forms of energy recycling.          Imagine a car engine in winter, when the reject heat is useful for warming the interior of the vehicle.</p>	<p>The UK is also actively supporting combined heat and power. In light of UK's goal to achieve a 60% reduction in carbon dioxide emissions by 2050, the government has set the target to source at least 15% of its government electricity use from CHP by 2010.[13] Other UK measures to encourage CHP growth are financial incentives, grant support, a greater regulatory framework, and government leadership and partnership.</p>	<p>Masnedø CHP power station in Denmark. This station burns straw as fuel.          Adjacent greenhouses are heated by district heating from the plant.</p> 	
<p>6. Use of resources</p>				<p><a href="http://www.energysavingtrust.org.uk">http://www.energysavingtrust.org.uk</a></p>
<p>7. Domotics</p>	<p>“The efficient integration of the electrical equipment and systems in a house such that they provide optimum comfort, convenience, safety, security and energy management”</p>	<p>Efficiency planned into building design and grants to enable green solutions and retrofit ideas</p>	<p><a href="http://en.wikipedia.org/wiki/Home_automation">http://en.wikipedia.org/wiki/Home_automation</a></p> 	<p><a href="http://www.domotics.uk.com/">http://www.domotics.uk.com/</a></p>
<p>8. Energy saving &amp; efficiency designing</p>	<p>The Code for Sustainable Homes sets the pathway for all new homes to be zero carbon by 2016. But refurbishment of existing stock has a major part to play in meeting the UK's long term carbon reduction targets &gt;&gt;&gt;</p>	<p>The UK Government funds schemes providing up to £3,500 to households on certain benefits (see below for examples of eligibility criteria) to improve their heating and energy efficiency &gt;&gt;&gt;</p>	<p>Insulate six million homes by the end of 2011. Secondly, all practical lofts and cavity walls are to be insulated by 2015 and finally, seven million 'eco upgrades' are to be offered by 2020 along with the installation of smart meters in all homes &gt;&gt;&gt;</p>	<p><a href="http://www.energysavingtrust.org.uk/business/Business/Housing-professionals/Publications">http://www.energysavingtrust.org.uk/business/Business/Housing-professionals/Publications</a></p>

Topic	Introduction and definition	Policy and Implementation	Technology	Additional information
1. Sustainable transport	<p>Changing patterns of energy use, where energy quantities and quality interact in numerous important ways can be considered energy transitions  <a href="http://www.eoearth.org/article/Energy_transitions">http://www.eoearth.org/article/Energy_transitions</a></p>	<p>The Government is committed to assisting the decarbonisation of transport and the transition to a sustainably lower carbon vehicle fleet. Incentives through the tax system. Support for European wide regulation to tighten vehicle standards            Committed around £400m of support to encourage the development and uptake of ultra low carbon vehicles. UK National incentives:            Vehicle Excise Duty exemption            Enhanced Capital Allowance            Lowest rate of Benefit in Kind /company car tax            Lower rate of VAT for domestic electricity</p>	<p>Electric Vehicles            There are two types of EV, both of which offer lower CO2 emissions than normal internal combustion engine vehicles:            All-electric EVs are vehicles with an electric motor, with power coming from a rechargeable battery;            Plug-in Hybrid Electric Vehicles (PHEVs) are powered by both mains chargeable batteries and a normal internal combustion engine. It is likely that PHEVs could be run in all-electric mode for short to medium distance journeys with the petrol engine used for longer journeys.</p>	<p><a href="http://www.dft.gov.uk/pgr/sustainable/olev">http://www.dft.gov.uk/pgr/sustainable/olev</a>  <a href="http://www.dft.gov.uk/pgr/sustainable/olev/research">http://www.dft.gov.uk/pgr/sustainable/olev/research</a>  <a href="http://www.dft.gov.uk/pgr/sustainable/olev/grant">http://www.dft.gov.uk/pgr/sustainable/olev/grant</a>  <a href="http://www.berr.gov.uk/files/file48653.pdf">http://www.berr.gov.uk/files/file48653.pdf</a>  <a href="http://www.dft.gov.uk/adobepdf/187604/ultra-lowcarbonvehicle.pdf">http://www.dft.gov.uk/adobepdf/187604/ultra-lowcarbonvehicle.pdf</a></p>
2. Sustainable electricity	<p>Sustainable energy is the provision of energy such that it meets the needs of the present without compromising the ability of future generations to meet their needs &gt;&gt;&gt;</p>	<p>The energy and climate change secretary, Ed Miliband, today announced details of a "green loans" scheme to help people pay for improvements to their homes to make them more energy efficient &gt;&gt;&gt;            Energy co-operatives.            Love thy neighbour – pool your energy bills, says Labour - General election manifesto to encourage creation of community co-ops for getting good deals on insulation and solar panels &gt;&gt;&gt;</p>	<p>The 'Razor', a newly completed tower block in Elephant and Castle, London, will generate nearly a tenth of its own energy through its three rooftop turbines &gt;&gt;&gt;</p> 	<p><a href="http://www.guardian.co.uk/environment/greenbuilding">http://www.guardian.co.uk/environment/greenbuilding</a></p> 
3. Sustainable heating / cooling	<p>Renewable heat is an application of renewable energy and it refers to the renewable generation of heat, rather than electrical &gt;&gt;&gt;</p>	<p>Energy co-operatives.</p>	 <p>A typical hot water heat recycling unit in a family residence</p>	<p><a href="http://www.berr.gov.uk/files/file43609.pdf">http://www.berr.gov.uk/files/file43609.pdf</a></p>

<p>4. Green-house-gasses emission reduction</p>	<p>What are greenhouse gases?</p>  <p>In 2001, scientists predicted the Earth would warm by 1.4 - 5.8C by 2100 &gt;&gt;&gt;</p>	<p>UK Energy and Climate Change Minister Ed Miliband is calling for the Government to adopt proposals that would say no to any new coal-fired power stations without carbon capture and storage (CCS) technology &gt;&gt;&gt;</p> <p>"Fossil fuels will remain an important source of energy and coal is a cheap and relatively secure fuel so we have to find a way of using those fossil fuel plants and capturing the CO2 and storing it somewhere". Greenhouse gas emissions created by Britons are probably twice as bad as figures suggest, says the government's new chief energy scientist &gt;&gt;&gt;</p>	<p>Carbon Capture and Storage - Scotland could store hundreds of years' worth of CO<sub>2</sub> &gt;&gt;&gt;</p> <p>The Energy Technologies Institute has launched a project which could see the UK as the first country with a comprehensive assessment of national CO2 storage capacity &gt;&gt;&gt;</p> <p>Consumers also seem set to pay for the expansion of the government's support for carbon capture and storage: the plan now is to support two to four plants, instead of just one, as previously planned &gt;&gt;&gt;</p>	<p><a href="http://www.geos.ed.ac.uk/sccs/">http://www.geos.ed.ac.uk/sccs/</a></p> <p><a href="http://www.energytechnologies.co.uk/Home/News.aspx">http://www.energytechnologies.co.uk/Home/News.aspx</a></p> <p><a href="http://news.bbc.co.uk/1/shared/spl/hi/sci_nat/04/climate_change/html/greenhouse.stm">http://news.bbc.co.uk/1/shared/spl/hi/sci_nat/04/climate_change/html/greenhouse.stm</a></p>
<p>5. Energy storage</p>	<p>Many renewable energy systems produce intermittent power. In this case, energy storage becomes absolutely necessary to provide firm energy supplies using intermittent sources such as wind or solar power &gt;&gt;&gt;</p>	<p><a href="#">Energy security: prevent future disruption and expand gas storage capacity, say MEPs &gt;&gt;&gt;</a></p>	<p>Old gas storage as a means of storing CO2? <a href="#">Power Generation - UK launches £3.5 million study of carbon storage potential &gt;&gt;&gt;</a></p>	
<p>6. Energy security</p>	<p><a href="#">"Leaving the present system of market arrangements and other incentives unchanged is not an option."</a></p> <p>Alistair Buchanan , Ofgem</p>	<p><a href="#">Europe calls to reduce dependency on Russian gas supplies &gt;&gt;&gt;</a></p> <p><a href="#">MEPs also approved of the idea of a European "supergrid" of electricity and gas &gt;&gt;&gt;</a></p>	 <p>This report focuses on the changing UK and global energy picture, pointing out that even with ambitious climate change targets, the world is still likely to be reliant on coal, oil and gas to meet over two-thirds of its energy needs by 2030 &gt;&gt;&gt;</p>	<p><a href="http://www.decc.gov.uk/en/content/cms/what_we_do/change_energy/int_energy/security/security.aspx">http://www.decc.gov.uk/en/content/cms/what_we_do/change_energy/int_energy/security/security.aspx</a></p>
<p>7. From central to distributed electricity network</p>	<p>Currently, industrial countries generate most of their electricity in large centralized facilities, such as fossil fuel (coal, gas powered) nuclear or hydropower plants.</p>	<p>These plants have excellent economies of scale, but usually transmit electricity long distances and can affect the environment &gt;&gt;&gt;</p>		
<p>8. New network for hydrogen</p>	<p>The term hydrogen economy describes an overall national energy infrastructure based on hydrogen produced from non-fossil primary energy sources &gt;&gt;&gt;</p>	<p>Hydrogen is a universal fuel that will play a major role in our clean, sustainable energy future &gt;&gt;&gt; Hydrogen is claimed to be a good fuel for IC engines with the potential to improve efficiency by around 20% compared to the use of gasoline &gt;&gt;&gt;</p>	<p>In the transportation sector, many automotive manufacturers consider hydrogen to be the leading contender for a new generation of highly efficient 'zero-emission' vehicles. &gt;&gt;&gt;</p>	<p><a href="http://www.h2net.org.uk/About/Hydrogen_economy.htm">http://www.h2net.org.uk/About/Hydrogen_economy.htm</a></p>

Elearning & serious games	Introduction and definition	Education aspects	Implementation aspects	Additional information
E-learning	<p>What is E-Learning? e-Learning – services which are delivered, enabled or mediated by ICT for the purposes of delivering education, and the technology and services which help create, manage and deliver those activities &gt;&gt;&gt; <a href="#">definitions of E-Learning</a>  <a href="http://en.wikipedia.org/wiki/E-learning">http://en.wikipedia.org/wiki/E-learning</a></p>	<p>e-learning makes use of information and communications technology to provide innovative ways to learn.  <a href="http://direct.gov.uk/en/E-learning">direct.gov.uk/en E learning</a>  <a href="http://elearning.ac.uk/effective-practice">elearning.ac.uk effective practice</a>  <a href="http://jisc.ac.uk/elearning">jisc.ac.uk elearning</a></p>	<p><a href="#">Ten quick wins in e-learning</a> by Clive Shepherd</p> <ol style="list-style-type: none"> <li>1. Use what's on the shelf</li> <li>2. Focus on the business</li> <li>3. Make sure there's something for everyone</li> <li>4. Obtain senior management involvement</li> <li>5. Solve real problems</li> <li>6. Use the full range of e-learning methods</li> <li>7. Provide a gateway to learning</li> <li>8. Look for a receptive audience</li> <li>9. Use a hosted solution</li> <li>10. Don't sacrifice the long term</li> </ol>	<p><a href="#">Universities told to catch the e-wave</a>            Problems at e-learning university?  <a href="http://direct.gov.uk/en/E-learning">direct.gov.uk/en E learning</a>  <a href="http://elearning.ac.uk/effective-practice">elearning.ac.uk effective practice</a>  <a href="http://jisc.ac.uk/elearning">jisc.ac.uk elearning</a></p>
Serious Games	<p>A serious game is a game designed for a primary purpose other than pure entertainment &gt;&gt;&gt;&gt;  <a href="http://www.seriousgames.org">http://www.seriousgames.org</a>  <a href="http://www.seriousgameseurope.com">http://www.seriousgameseurope.com</a>  <a href="http://www.seriousgamesradio.com">Serious Games Radio Programme</a>  <a href="http://www.seriousgamesinstitute.co.uk">http://www.seriousgamesinstitute.co.uk</a></p>	<p><b>'Learning through play is a fundamental way in which we understand key life skills'</b>  <a href="http://playgen.com/serious-games-for-schools">http://playgen.com/serious-games-for-schools</a>            Serious games are digital computer games with an educational purpose  <a href="http://www.coventry.ac.uk/sgarg">http://www.coventry.ac.uk/sgarg</a></p> 	<p>Much of the recent research and practical application of games-based learning in classrooms identifies a number of benefits game-playing in schools. These include:</p> <ul style="list-style-type: none"> <li>motivating learners to succeed and to continually improve</li> <li>fostering self-esteem, self-determination and enhancing self-image</li> <li>facilitating collaborative learning</li> <li>Implicitly develop learners ability to observe, question, hypothesise and test</li> <li>facilitate metacognitive reflection</li> <li>develop complex problem-solving skills</li> <li>make school an exciting place to be and offering inroads into other curricular areas.</li> </ul>	<p><a href="http://www.ltscotland.org.uk/ictineducation/gamesbasedlearning">http://www.ltscotland.org.uk/ictineducation/gamesbasedlearning</a>  <a href="http://www.gamasutra.com">http://www.gamasutra.com</a>  <a href="#">What Kids Learn That's POSITIVE From Playing Video Games</a>            By Marc Prensky  <a href="http://www.gamelearning.net">http://www.gamelearning.net</a>            useful resources for free information and tools</p>

### 3.3. OTHER USEFUL LINKS

#### Consumer groups

1. [Energywatch](#)
2. [Energy action scotland](#)

#### Energy conservation, renewables & environment

1. [Action energy](#)
2. [The carbon trust](#)
3. [Renewable power association](#)
4. [Energy saving trust](#)
5. [Royal commission on environmental pollution](#)
6. [The solar energy society \(uk-ises\)](#)
7. [Uk energy research centre](#)
8. [Environmental change institute](#)

#### Regulators

1. [The office of gas and electricity markets \(ofgem\), uk](#)
2. [Northern ireland authority for energy regulation \(niaer\)](#)
3. [The commission for energy regulation \(cer\), ireland](#)

#### Transmission & distribution companies

1. [Bord gáis energy supply](#)
2. [Interconnector uk ltd.](#)
3. [Transco](#)
4. [National grid](#)

### 3.4. RENEWABLE ENERGY CONCEPTS AND DEFINITIONS

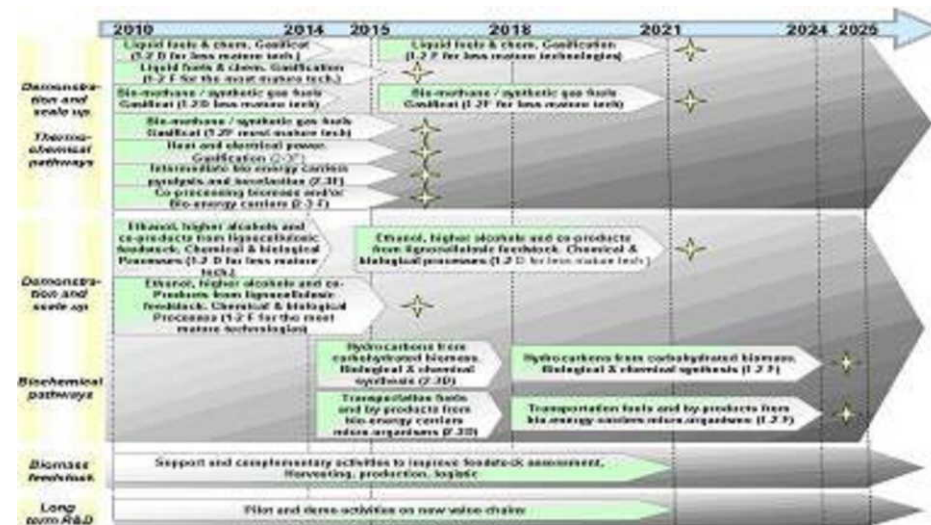
Renewable energy concepts and definitions from website [Intelligent Energy – Europe](http://Intelligent Energy – Europe)

#### 3.4.1. BIO ENERGY

Biomass is derived from different types of organic matter: energy plants (oilseeds, plants containing sugar) and forestry, agricultural or urban waste including wood and household waste. Biomass can be used for heating, for producing electricity and for transport biofuels. Biomass can be solid (plants, wood, straw and other plants), gaseous (from organic waste, landfill waste) or liquid (derived from crops such as wheat, rapeseed, soy, or from lignocellulosic material).

The use of biomass can significantly reduce greenhouse gas emissions. The carbon dioxide it gives off when it is burned is counterbalanced by the amount absorbed when the plant in question was grown. However, generating net greenhouse gas savings also depends on the cultivation and fuel production processes used.

Following the Commission's [Biomass Action Plan](#), several Member States have produced their own national action plans. Most recently, the Commission has conducted a study into the permitting procedures of biomass installations, and is assessing the options for developing biomass sustainability criteria (including through recent public consultations).



#### Biofuels and other renewable energy in the transport sector

Energy consumption in the transport sector depends almost exclusively on imported fossil fuels – oil. The sector is forecast to grow more rapidly than any other up to 2020 and beyond. And the sector is crucial to the functioning of the whole economy. The importance and the vulnerability of the transport sector require that action is taken rapidly to reduce its malign contribution to sustainability and the insecurity of Europe's energy supply.

The Community does this with a wide range of measures, covering emissions reductions, energy efficiency measures, green public procurement rules in transport, and with the promotion of renewable energy sources for the transport sector. Under Directive 2003/30/EC (see below) Europe established the goal of reaching a 5.75% share of renewable energy in the transport sector by 2010. Under the [new directive on the promotion of renewable energy](#), this share rises to a minimum 10% in every Member

State in 2020. Whether it is electricity or hydrogen from renewable energy sources, or 1<sup>st</sup> or 2<sup>nd</sup> generation biofuels, there is an urgent need to ensure we meet this goal. The new directive on renewable energy also aims to ensure that as we expand the use of biofuels in the EU we use only sustainable biofuels, which generate a clear and net GHG saving and have no negative impact on biodiversity and land use.

## Biofuels

Biofuels are so called as they are made from various transformations of plant or animal matter. They can be used in vehicle engines, replacing conventional fossil fuel derivatives. Under this designation, however, there are two completely different product lines, bioethanol and biodiesel.

Bioethanol is derived from traditional crops such as wheat, corn or sugar beets, through adaptation processes the raw material, fermentation and distillation. Its applications are directed to mix with gasoline or the production of ETBE, an oxygenated additive for unleaded gasoline.

The production of biodiesel is made through transesterification operations and refining of vegetable oil, either pure (sunflower or others) or used. The product thus obtained is used in diesel engines as diesel substitute.

## Biomass / Waste

This is the case of municipal solid waste (MSW), wood, wood waste and other solid waste, the production is derived from the heat produced after combustion and corresponds to the heat content (LHV) of fuel. In the case of anaerobic digestion of wet wastes, production is the heat content of the biogas produced, as in the case of biofuels.

Biomass is a renewable, low carbon fuel that is already widely, and often economically available throughout the UK. Its production and use also brings additional environmental and social benefits. Correctly managed, biomass is a sustainable fuel that can deliver a significant reduction in net carbon emissions when compared with fossil fuels

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### 3.4.2. HYDRAULICS

A hydraulic unit consists of all elements needed to transform the energy of a watercourse - because of the level difference between two points - into usable energy for the man (usually electricity, which is called hydro).

Mini-hydro is that hydro power plant with a capacity not exceeding 10 MW. According to the installation site, can be classified mainly into three broad groups:

- Fluent (in the course of a river directly)
- Of Prey (in this case is channelled and derives part of the river flow to better use the jump occurred in a dam)

- Pumping, pumping storage (they are the same type as those of prey, but have the capacity to store water in the bottom of the plant and recover some of this water at times when surplus electricity into the grid by pumping the same to the top of the plant)

3.4.3. WIND ENERGY

Wind energy is one of the most promising renewable energy technologies, and is an area in which there have already been many developments and improvements to make electricity generation more effective. Between 1995 and 2005, cumulative wind power capacity in the EU increased by an average of 32% per year. Developing wind resources offshore is a particular priority of the Community.



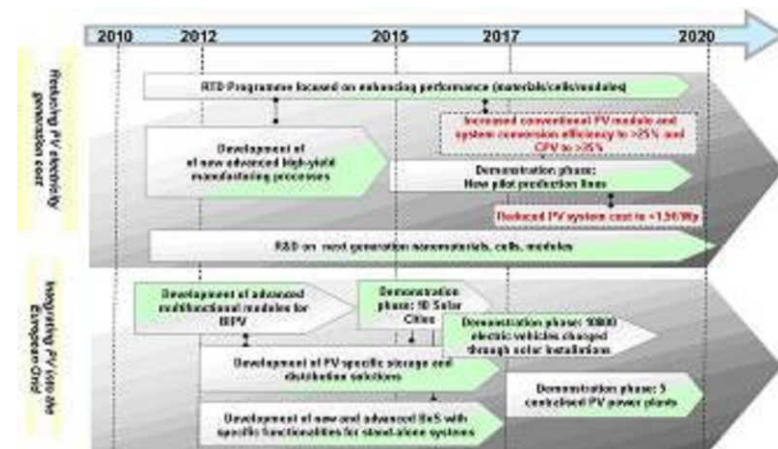
3.4.4. SOLAR ELECTRICITY

The sun is the world's primary source of energy, and solar power systems can harness the sun's rays as a high temperature, clean energy source for heat or electricity.

But to produce electricity, the solar power has to be concentrated or focused. This is because solar radiation reaches the earth's surface with a density that is adequate for heating but not for an efficient thermodynamic cycle for producing electricity.

There are different types of concentrating solar power (CSP) technologies/systems:

Parabolic solar collectors or curved 'troughs' enable the sun's rays to converge towards a single point to collect heat from the sun.



Solar tower power plants involve hundreds or even thousands of mirrors following the sun's path and concentrating its rays onto a receiver at the top of a tower.

Solar dish/engine systems see parabolic dishes transfer solar radiation to a 'Stirling engine' – an engine using heat to act on a fluid.

The sun's rays can also be used to activate chemical reactions to produce fuels and chemicals. In the medium- to long-term, other applications will include environmentally-friendly technologies.

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#### 3.4.5. SOLAR HEATING AND COOLING

Electricity and transport fuels are obvious types of energy we use, but our biggest use of energy is for heating and cooling purposes. Renewable energy sources can be used to generate electricity which we can then use to heat or cool our homes, but it can and is also used directly: as firewood, for instance, in our fireplaces (or other forms of biomass such as pellets and in fireplaces, stoves or boilers). Solar power and geothermal power can also be used directly to heat water, or for household heating systems, using solar panels and heat pumps.

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#### 3.4.6. GEOTHERMAL ENERGY

Geothermal energy has been used for centuries for bathing and heating water. It is extracted from the earth's natural heat in dry, steam or liquid form and can be used for electricity and heating.

Deep geothermal resources include: hydrothermal (hot water and/or steam trapped in fractured or porous rock), geo-pressured (hot water aquifers under high pressure), and enhanced geothermal systems (geological formations that are dry but abnormally hot).

In Europe, the 'heat pump' is the most promising way of using geothermal energy. This consists of extracting heat from hot, shallow geothermal fluid and transferring it to water or air, which is used to supply heat for space heating.

Even at shallow depths of 50-100m, the earth harbours heat that can be extracted by heat pumps – often located in the gardens of suburban houses – and used directly in domestic heating. Heat can also be returned to the earth for storage as a way of 'air conditioning' homes and buildings.

### 3.4.7. TIDAL ENERGY

Tidal energy is contained in the tides, the waves, temperature gradients of the Ocean, at the junction of rivers and seas (Osmotic) and ocean currents. This energy has been used since centuries in different ways, but given the huge energy potential contained in these resources are currently investigating new forms of exploitation that are more profitable in the world today.

### 3.4.8. RELATED CONCEPTS

Thermal Power Plants:

They use technology to produce electricity by burning and heat generation produced. You can burn fossil fuels, energy recovery from waste, or biomass can also burn.

Power Unit:

Energy dependency shows the extent to which a country relies on imports to meet their energy needs. It is calculated using the formula: 'net imports' / 'gross inland consumption + bunkers'.

Energy Intensity:

Energy intensity gives an indication of the efficiency with which energy is used to produce added value. It is defined as the proportion of gross domestic energy consumption to Gross Domestic Product.

Final Energy Consumption:

The final energy consumption refers to the energy finally consumed in the transportation, industrial, commercial, agricultural, public sector and households. Excluding losses in the sector of energy conversion and specific to the energy industries

Calorific value (GCV):

The calorific value is the total amount of heat released by a unit quantity of fuel, when burned completely with oxygen, and when the combustion products are returned to room temperature. This amount includes the heat of condensation of water vapour contained in the fuel and water vapour formed by combustion of any hydrogen contained in fuel.

### Gross Inland Consumption (GIC):

Gross Domestic consumption is the amount of energy consumed within the borders of a country. It is calculated using the following formula: primary production + recovered products + imports + stock changes - exports - bunkers (ie quantities supplied to sea-going ships)

### Lower calorific value or net (PCI):

The lower calorific value is the amount of heat released by a unit quantity of fuel, when burned completely with oxygen, and when the combustion products are returned to room temperature. This amount does not include the heat of condensation of water vapour contained in the fuel or water vapour formed by combustion of any hydrogen contained in fuel.

### Primary Energy Production:

The primary energy production is the extraction of energy from a natural source. The exact definition depends on the fuel involved

### Fossil Fuels: Coal, lignite:

The amount of fuel extracted or produced, calculated after the operations for the extraction of raw materials. In general, the production includes the quantities consumed by the producer during the production process (eg for heating or operation of equipment and auxiliaries) as well as the quantities supplied to other producers at the site of energy for processing or other uses . This is a finite resource that emits greenhouse gases in the burned part of other impacts. You can see what remains of coal reserves in the world (which depends on world reserves and consumption rate) on the Web [www.energy.eu](http://www.energy.eu)

### Oil:

Fuel extracted or produced within national boundaries, including production at sea. Production includes only marketable production, and excludes all other quantities. Production includes all crude oil, natural gas liquids (NGL), condensates, etc. This is a finite resource that emits greenhouse gases in the burned part of other impacts. You can see what remains of oil reserves in the world (which depends on world reserves and consumption rate) on the Web [www.energy.eu](http://www.energy.eu)

### Natural Gas:

The quantities of dry gas, measured after purification and extraction of natural gas liquids and sulfur. Production includes only marketable production, and excludes any quantities re-injected, ventilation and burned, and extraction losses. Production includes all quantities used in the natural gas industry, in gas extraction, pipeline systems

and processing plants. This is a finite resource that emits greenhouse gases at its burnt, apart from other impacts. You can see what remains of natural gas reserves in the world (which depends on world reserves and consumption rate) on the Web [www.energy.eu](http://www.energy.eu)

Nuclear:

The amount of heat produced in a reactor. Production is the actual heat produced or heat calculated on the basis of gross electricity and heat efficiency of the power plant. Nuclear energy can be produced by both the fission and fusion. Until now the process of fission is the only one that has been available for commercial production, but today have made significant progress in fusion energy production (but is not expected to be a commercial technology until about 2050 according to ITER project).



Heysham Power Station

The energy from fission is based on finite reserves of uranium found on Mars, this energy also have significant environmental problems with nuclear waste, among others. You can see what remains of uranium reserves in the world (which depends on world reserves and consumption rate) on the Web [www.energy.eu](http://www.energy.eu)

### 3.5. FIGURES

These represent figures for the carbon or carbon dioxide emitted by full combustion of each fuel, per unit of energy. Note that life cycle CO<sub>2</sub> emissions depend strongly upon details of supply chains, production techniques, forestry or agricultural practice, transport distances, etc. Source: Carbon emissions of different fuels - <http://www.biomassenergycentre.org.uk>

Fuel	Net calorific value (MJ/kg)	Carbon content (%)	Direct carbon emission from combustion		Direct CO <sub>2</sub> emission from combustion		Approx. life cycle CO <sub>2</sub> emissions (including production) See note 1		Annual total CO <sub>2</sub> emissions to heat a typical house (20,000 kWh/yr)		
			kg/GJ	kg/MWh	kg/GJ	kg/MWh	kg/GJ	kg/MWh	kg	kg saved compared with oil	kg saved compared with gas
Hard coal	29	75	26	94	95	345	134	484	9680	-2680	-4280
Oil	42	85	20	72	73	264	97	350	7000	0	-1600
Natural gas	38	73	19	69	70	253	75	270	5400	1600	0
LPG	46	82	18	64	65	234	90	323	6460	540	-1060
Electricity (UK grid)	-	-	35	125	128	460 See note 2	150	530	10600	-3600	-5200
Electricity (large scale wood chip combustion)	-	-	160	576	584	2100	16	58	1160	5840	4240
Electricity large scale wood chip gasification)	-	-	80	286	292	1050	7	25	500	6500	4900
Wood chips (25% MC) Fuel only	14	37.5	27	96	98	354	2	7	140	6860	5260
Wood chips (25% MC) Including boiler	14	37.5	27	96	98	354	7	25	500	6500	4900
Wood pellets (10% MC starting from dry wood waste)	17	45	26	95	97	349	4	15	300	6700	5100
Wood pellets	17	45	26	95	97	349	9	33	660	6340	4740

Fuel	Net calorific value (MJ/kg)	Carbon content (%)	Direct carbon emission from combustion		Direct CO2 emission from combustion		Approx. life cycle CO2 emissions (including production) See note 1		Annual total CO2 emissions to heat a typical house (20,000 kWh/yr)		
			kg/GJ	kg/MWh	kg/GJ	kg/MWh	kg/GJ	kg/MWh	kg	kg saved compared with oil	kg saved compared with gas
(10% MC) Including boiler											
Grasses/straw (15% MC)	14.5	38	26	95	97	348	1.5 to 4	5.4 to 15	108 to 300	6892 to 6700	5292 to 5100
Biogas (60% CH4 40% CO2)	30	56	19	67	68	246	-	-	-	-	-

## 4. PLAYER'S MANUAL

### *Introduction*

EnerCities is about building your own city and learning more about energy. Our world can be described by its population, our economies and the environment. In EnerCities, your challenge is to find a balance between them!

### *Goal*

The main goal of the game is to grow your population to 200 and reach level 5.

### *Building your city*

You can build various types of structures to expand your city. The five main categories are visible in the top menu: residential, environment, economy, well-being and energy.



Building is simple -move the mouse cursor over one of the category icons, select and drag one of the buildings from the popup menu, and place it on an empty square in the game world. Presto!



### *Building types*

The main goal of the game is to grow your population to 200. By building residential structures, your city will automatically expand. Of course, building structures costs money. You start out with a bit of cash, but soon you'll need more. That's where economic buildings come in.

Your city also requires power. That's what you need the various energy sources for. Certain power plants are much more efficient than others, but might have a negative impact on the environment.

That's why you should also add parks and forests -environmental structures.

And finally, in order to keep your population happy, there are also markets, public services and stadiums to be constructed. These are the so called well-being structures.

### *Balancing your city*

By balancing all these factors, your city will thrive and grow. You can check your city's progress by looking at all the icons in the lower left and right corners of the screen.

They are, in order: power, money, oil, population, economy, environment, well-being.

The star represents Victory Points, which you'll earn for special actions you perform in the game. Try to find out how you can earn them!

Oh, and the character's name is Alex. She's there to help you out and offer tips!

### *Winning the game*

As soon as your population reaches 200, you have completed the game. Your score will be added to the highscore page. Play the game again to see if you can beat your own score, and those of your friends.

Can you reach a healthy balance between your economy, environment and well-being? Or are you a money-hungry tycoon going for the cash? Maybe you love nature and want nothing but the best for your population. It's up to you to decide how you'll play EnerCities!

