# Which power source? – solving the crisis in Kiama

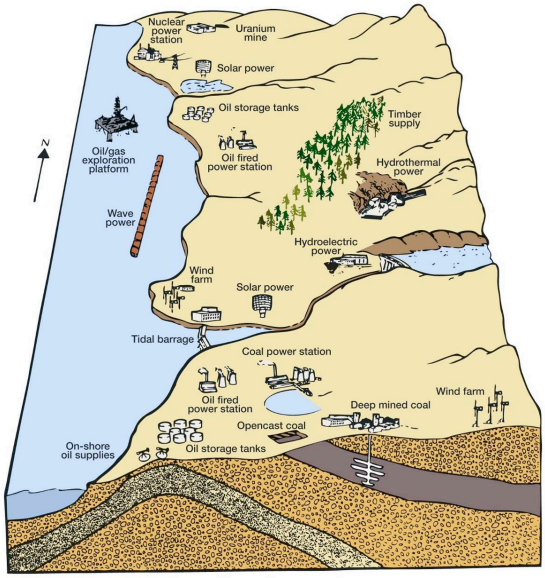
## Searching for all the power sources that could be developed in a mythical country

Kiama has a power crisis. It used to get all its power from oil supplied by Turaba, the country next door. But there has been a border dispute in the Barotsi Hills region – and Turaba has cut off all oil supplies.

Ask your pupils to study the map for clues to all the different power sources Kiama might develop instead. Ask them to work in groups to:

- write a list of all the power sources that could be developed;
- put the list of power sources into a table and list the advantages and disadvantages of each (for example some may be renewable, some may be cheaper or easier to develop than others, etc.);
- decide on the four best options and prepare a presentation on why these choices have been made.

When they have finished, show them the diagram below of Kiama with many of its potential power sources developed, to see which ones they had missed – or whether they had spotted any other possibilities (a larger version of this diagram is given on the final page of this Earthlearningidea).

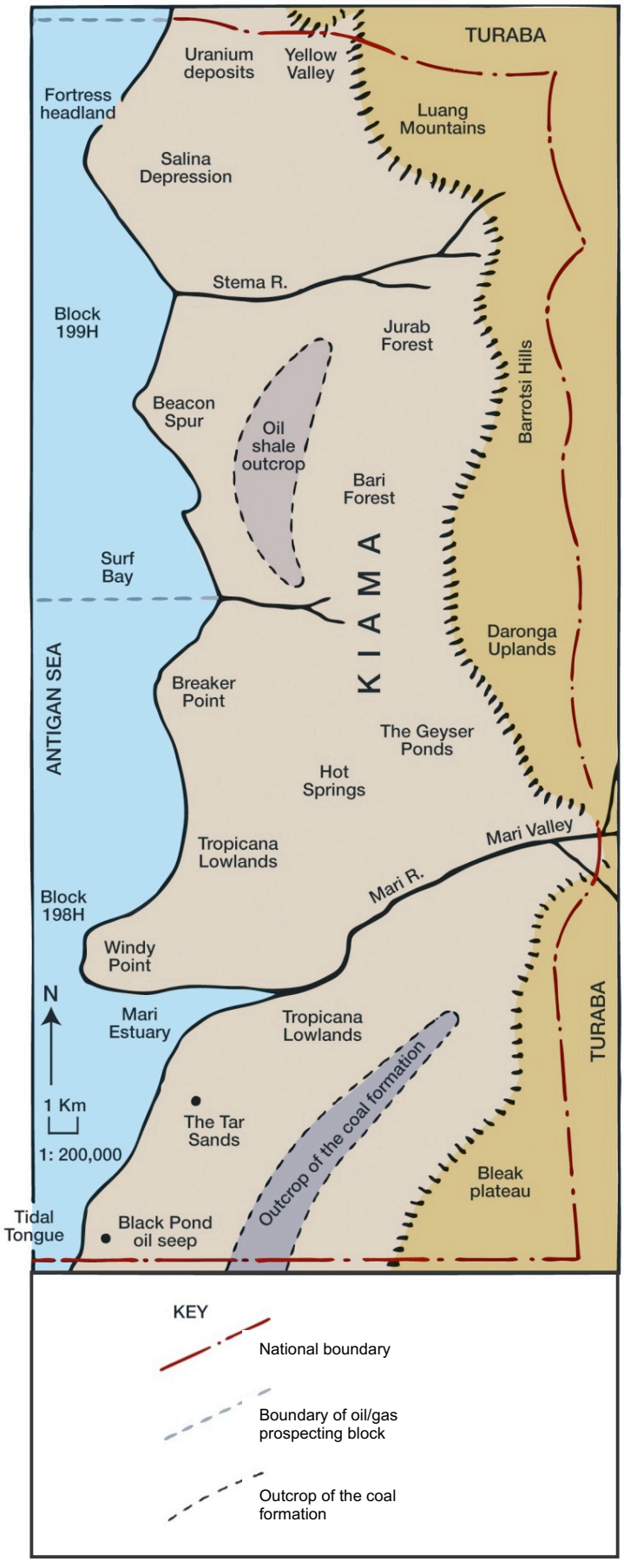



A block diagram of the mythical country of Kiama showing power sources that could be developed there.

Ask which energy sources are best for:

- fuelling cars and trucks;
- providing power whatever the weather;
- giving the least pollution;
- giving long-term secure power supplies;
- causing the least environmental problems.

Ask which is the worst for being in 'your back yard' (people who don't want industrial developments near them are often described as NIMBYs – Not In My Back-Yard);



## The back up

**Title:** Which power source? – solving the crisis in Kiama.

**Subtitle:** Searching for all the power sources that could be developed in a mythical country.

**Topic:** Pupils study a map to find clues to the different energy sources that could be exploited in a country.

**Age range of pupils:** 10 – 16 years

**Time needed to complete activity**: 30 minutes

**Pupil learning outcomes:** Pupils can:

- list a range of potential power resources for a country;
- debate the advantages and disadvantages of each of the power sources;
- decide on the best options and explain their decisions;

**Context:**
Pupils use a map to identify and debate a range of possible energy sources for a mythical country. Pupils of lower ability who may find it difficult to use a map, could base this discussion on a large copy of the block diagram of the country with the possible power sources shown – given below. Possible power sources with some of their advantages and disadvantages are shown in the table below. "Fracking" techniques are becoming widespread, where methane gas is released from shales at depth, by forcing water down drill holes to fracture the rock.

**Following up the activity:**
Pupils could be allocated different power sources to research on the internet before sharing their findings with the rest of the class.

| Potential power sources | Renewable or non-renewable? | Problems or benefits with usage | Successful large scale use today? |
|---|---|---|---|
| Oil | Fossil fuel so non-renewable | Burning pollutes atmosphere | Most widely used energy source today (almost 40% of primary energy supplies) |
| Gas | Fossil fuel so non-renewable | Burning pollutes atmosphere | Widely used |
| Coal | Fossil fuel so non-renewable | Burning pollutes atmosphere | Of lessening importance in Europe but growing rapidly in China and India |
| Oil shale | Fossil fuel so non-renewable | Burning pollutes atmosphere | Exploited in only a few areas, where other fuel sources are not available – technology being developed |
| Fracking of shale | Fossil fuel so non-renewable | Burning pollutes atmosphere | Widely used in the United States; prospecting taking place in Europe |
| Tar sands | Fossil fuel so non-renewable | Burning pollutes atmosphere. Widespread devastation of environment | Big resources in Venezuela and Canada. Beginning to be exploited, technology being developed |
| Uranium (nuclear) | Non-renewable but reprocessing and use of breeder reactors helps | Radioactivity pollution problems and risk of major pollution disaster | Fairly large scale usage and increasing |
| Geothermal | Non-renewable except in active volcanic areas, since energy is extracted at a much faster rate than it can be replaced | Non-polluting | Some small scale projects are in operation in active volcanic areas such as Italy, Iceland and New Zealand. Even smaller projects are working in other areas such as the UK and France |
| Ground-source heat pumps | Depends on solar heating of uppermost 100m or so of ground, therefore renewable | Needs an aquifer. Needs electrical input to drive pumps | Of growing importance in many countries. Very efficient |
| Water (hydro) | Renewable | Non-polluting but large new reservoirs must be created | Widely used in water-rich countries (eg New Zealand, Norway and Britain) but not available in dry or flat areas |
| Waves | Renewable | Non-polluting | At experimental stage only |
| Wind | Renewable | Non-polluting but wind farms look unsightly. Only works when the wind blows | Increasing usage both onshore and offshore |
| Tides | Renewable | Non-polluting but tidal barrages affect estuarine environments and shipping | Some fairly large schemes working on suitable estuaries today (eg in France) |
| Solar | Renewable | Non-polluting but large areas of solar panels look unsightly | For large scale production, at experimental stage only |

| Potential power sources | Renewable or non-renewable? | Problems or benefits with usage | Successful large scale use today? |
|---|---|---|---|
| Burning natural wood | Non-renewable at the rate wood is used | Burning pollutes atmosphere | Still wide scale usage for domestic purposes in developing countries (eg in Africa) |
| Burning dung or other agricultural residues | Renewable but major loss of nutrients to soil | Burning pollutes atmosphere | Wide scale usage for domestic purposes in developing countries (eg in India) |
| Biogas, from anaerobic digestion of organic matter in tanks to produce methane | Renewable | Manure not available for spreading on land | Widely used in China and on some British farms |
| Biomass, energy produced from fast-growing crops | Renewable | Land not available for growing food crops | Sugar is grown and fermented to produce alcohol in some countries. In other areas, fast-growing timber is grown and burnt |
| Burning rubbish | Renewable | Burning pollutes atmosphere | In Nottingham, domestic rubbish is burned to produce hot water |
| Refuse dumps | Renewable | Smell: possible pollution of groundwater | Methane is locally recovered from dumps of domestic waste and used as fuel |

**Underlying principles:**

- There is a wide range of different power sources, each with its own characteristics and advantages and disadvantages, as outlined in the table.
- The choice of the most appropriate power source for a purpose or a region depends on a number of factors.
- The term 'energy source' is widely used, but 'power source' is preferred by physicists, because of the more specific use of the term 'energy' in physics.

**Thinking skill development:**

Pupils use map skills in interpreting the map and could encounter construction, cognitive conflict and metacognition during discussions around the different power source possibilities.

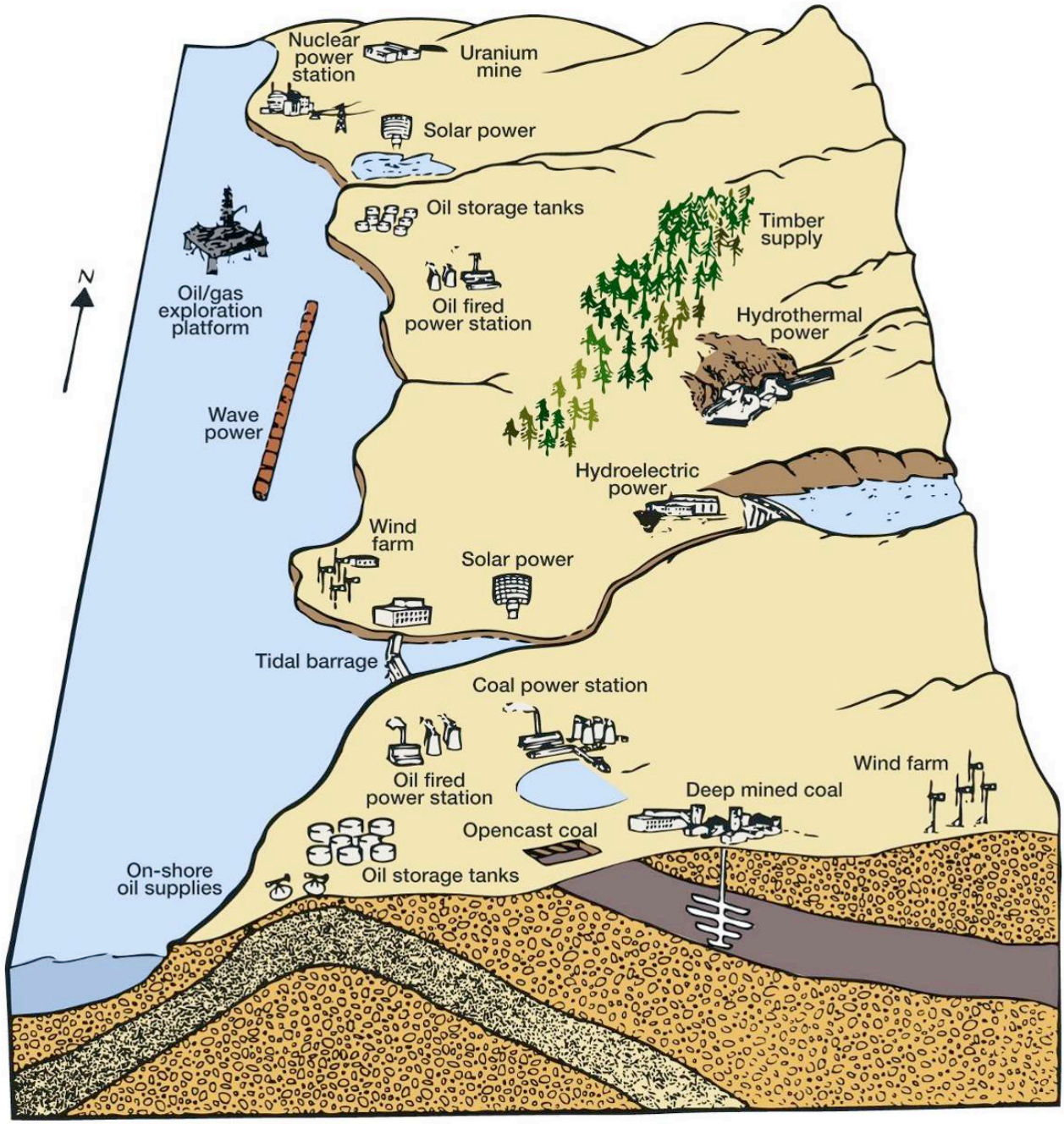
**Resource list:**

- sheet with the map (and or block diagram) and the questions

**Useful links:**

More about different sources of power can be found on the internet by typing 'energy resources' into a search engine. A nice animation can be found at: http://www.oresomeresources.com/ whilst activities linked to coal can be found in the Earth Science Teachers' Association publication 'Power from the past' at: http://www.nationalstemcentre.org.uk/elibrary/resource/1149/power-from-the-past-coal

**Source:** This activity was first published as part of the *Crisis in Kiama: which energy source now?* activity, in the Science of the Earth 11 – 14 booklet, *Power source: oil and energy* published by the Earth Science Teachers' Association in 1992. Geo Supplies Ltd, Sheffield, and was further developed by the Earth Science Education Unit (ESEU). The two diagrams were kindly provided by ESEU (www.earthscienceeducation.com)

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