



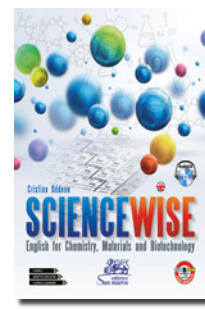
## Larderello, the Italian leading producer of geothermal electricity

Larderello is a little town in southern Tuscany, Italy. It is a geologically active area and it is renowned all over the world for being one of the leading producers of geothermal electricity. In ancient times the region was known for its exceptionally hot springs<sup>1</sup>, which Romans used for thermal bathing. The place was known with the name of Montecerboli up to the 19<sup>th</sup> century. In 1827 the French François de Larderel managed to extract **boric acid** from the volcanic mud, and in 1837 the Grand Duke of Tuscany Leopold II awarded him the title of Count of Montecerboli for this invention. In order to house the workers in the factories of boric acid, the town of Larderello was founded: the name was given in honour of Larderel's work. On the 4<sup>th</sup> of July 1904 in Larderello Prince Pietro Ginori used the emerging steam to turn a small turbine which succeeded in powering five light bulbs: this was the first demonstration ever of geothermal electricity generation. In 1911 the *Valle del Diavolo* (Devil's Valley) was chosen as the site of the first geothermal power station in the world. It remained the only geothermal

plant in the world until 1958, when New Zealand built a geothermal station in Wairakei. Geothermal power production is made possible in the site of Larderello by hot granite rocks located close to the surface. High pressure steam at about 220 °C is produced, which turns turbines and generates electricity. Currently two geothermal reservoirs are exploited: a shallow<sup>2</sup> reservoir and a more extensive reservoir at a depth of more than 2 km. Today one million houses are powered by geothermal electricity from Larderello, amounting to 4.8 billion Kwh per year, or 10% of the world's total geothermal electricity production. Geothermal power is considered a renewable energy source, but eventually the hot rocks

**Boric acid**, also known as boracic acid or orthoboric acid, is a weak acid of boron. It has the formula  $H_3BO_3$ . It has been commonly used since ancient times as a food preservative, a cleaning agent and as an antiseptic. Today it is also used as a flame retardant and to increase the chemical and temperature resistance of glass.

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### GLOSSARY

- 1 a small stream of water flowing naturally from the earth
- 2 of little depth



Geothermal power plant in Larderello Tuscany - Italy



below the surface will cool. In fact the steam pressure levels have dropped by 30% from the maximum levels of the 1950s. The main effort since 2002 has been the replacement of old power plants for a better efficiency and a lower environmental impact.

In the region there are about a dozen craters which were caused by explosive outbursts<sup>3</sup> of steam trapped below the surface. The largest one, with a diameter of about 250 m, is the Lago Chiavenna crater, which last erupted in 1282 and which is now filled by a lake.

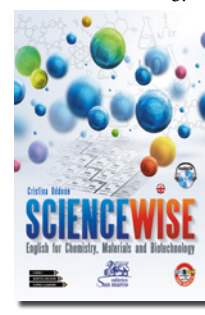
The history of the exploitation of geothermal energy is the theme of the **Larderello Geothermal Museum**, founded in 1956.

The history of the industrial exploitation of geothermal energy has been reconstructed by the **Larderello Geothermal Museum**. The collection includes samples of minerals and rocks, drilling machinery and electric power plant machinery. The collection comprises models concerning the extraction methods of boric acid, the drilling activities and the production of electric energy.

### GLOSSARY

**3** an explosion or eruption

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## ACTIVITIES

**1** Decide if the following sentences are true or false and then correct the false ones.

- |   |   |
|---|---|
| 1 Larderello is a little town in the south of Italy. <b>T F</b>                                     | 6 Geothermal electricity produced in Larderello corresponds to the 30% of the world's total geothermal production. <b>T F</b> |
| 2 The first extraction of boric acid from volcanic mud occurred in 1904. <b>T F</b>                 | 7 Although geothermal is considered a renewable source of energy, it eventually will extinguish. <b>T F</b>                   |
| 3 The <i>Valle del Diavolo</i> was the first site chosen for a geothermal power station. <b>T F</b> | 8 Lago Chiavenna is a lake located in a crater originated by an explosion. <b>T F</b>   |
| 4 The second geothermal power station in the world was built in New Zealand. <b>T F</b>             |   |
| 5 In the site of Larderello hot marble rocks are located close to the surface. <b>T F</b>           |   |

**2** Answer the following questions.

- Why is Larderello renowned all over the world?
- How were hot springs in the area used by the Romans?
- What was the first name of the place?
- What did François de Larderel do?
- Who gave him the title of Count of Montecerboli?
- What turns turbines and generates electricity?
- What types of reservoirs do exist?
- How many people use geothermal electricity from Larderello today?
- How many craters are there in the area?
- What were they caused by?

**3** Write next to each year the main events mentioned in the text.

- |         |       |
|---------|-------|
| 1 1282: | ..... |
| 2 1827: | ..... |
| 3 1837: | ..... |
| 4 1904: | ..... |
| 5 1911: | ..... |
| 6 1956: | ..... |
| 7 2002: | ..... |

**4** Find the words corresponding to the following definitions.

- |   |       |
|---|-------|
| 1 To have a widespread and good reputation                      | ..... |
| 2 Wet, sticky, soft earth                                       | ..... |
| 3 The discovery or production of some new process or machine    | ..... |
| 4 A building in which goods are manufactured                    | ..... |
| 5 To be selected from or preferred above others                 | ..... |
| 6 A coarse-grained, hard igneous rock                           | ..... |
| 7 An underground accumulation                                   | ..... |
| 8 To become less, to decrease in amount                         | ..... |
| 9 The act of providing a substitute for                         | ..... |
| 10 A bowl-shaped depression at the mouth of a volcano or geyser | ..... |

**5** Find out about other geothermal sites in the world and write a short fact file and report.