WHAT IS CO-GENERATION?
Co-generation is the production of electricity in combination with another industrial process. Co-generation plants are often thermal generators installed in industries that produce or require heat. In effect, the heat is used twice – once to generate electricity and once for another purpose, resulting in a very efficient process overall.

In New Zealand, co-generation plants are found in the wood processing, dairy and steel industries.

WHAT TYPES OF CO-GENERATION ARE THERE?
Co-generation systems can work in one of two ways.

**Botting cycle**
Heat is produced in the form of high-pressure steam and used in the industrial process. The leftover heat is then recovered and used to make steam that drives a turbine and generator.

**Topping cycle**
This works the other way around. First, electricity is generated, usually through an open-cycle gas turbine, then the waste heat is used to produce steam for industrial purposes.

Many power stations now use the more efficient combined-cycle gas turbines. Technically speaking, combined-cycle gas turbines are themselves examples of co-generation. First, gas is ignited. It expands as it burns in a gas turbine connected to an electrical generator, then the leftover heat from this process is used to make steam, which drives a steam turbine and a second generator. The second generator is not as efficient as the first, but still produces electricity from what could have been waste heat.

WHAT ARE THE ADVANTAGES OF CO-GENERATION?
Co-generation makes use of excess heat, which helps to improve the overall efficiency of the process. Co-generation can save businesses money, as they can generate their own electricity and steam supply at the same time. They can sometimes also sell electricity to the national grid, which provides power to New Zealand.
WHAT ARE THE DISADVANTAGES OF CO-GENERATION?
Even though co-generation produces electricity efficiently on site, it burns non-renewable sources that produce carbon dioxide emissions.

HOW CAN CO-GENERATION BE USED IN NEW ZEALAND?
Although co-generation is a relatively new technology in New Zealand, several of our primary industries are being made more efficient by installing co-generation plants. For example, a timber mill or paper mill might burn waste wood scraps to produce heat. This might be used to drive a steam turbine and generate electricity for the mill. The excess heat from the turbine might be further used, such as for drying purposes, while any electricity that is not needed could be fed into the national grid. This would be an extremely efficient use of what may have been unwanted waste.

The steel industry uses huge amounts of energy in its iron melters. In the steel-making process, there is a lot of waste gas from the furnaces. In a co-generation plant, this waste gas would be recovered and burnt, and the heat used to produce steam to drive a steam turbine and generator.

For industries that require heat for drying, such as the dairy industry when drying milk powder, it can be economical to produce their own electricity by running a small generating plant, and then to use the waste heat from the turbine for the drying process.

ACTIVITY
Small group brainstorming activity

- Think of at least one other business that could use co-generation. Look at the types of waste the business is creating and how the waste could be used to generate energy.
- Do you think co-generation is an environmentally-friendly type of energy generation? Explain.
- Discuss whether small- or medium-sized enterprises could pool their resources and use co-generation as a method of generating energy.

SUPPORTING RESOURCES
- Energy Efficiency and Conservation Authority: www.eeca.govt.nz
- Ministry of Economic Development: www.med.govt.nz
- Genesis Energy: www.genesisenergy.co.nz