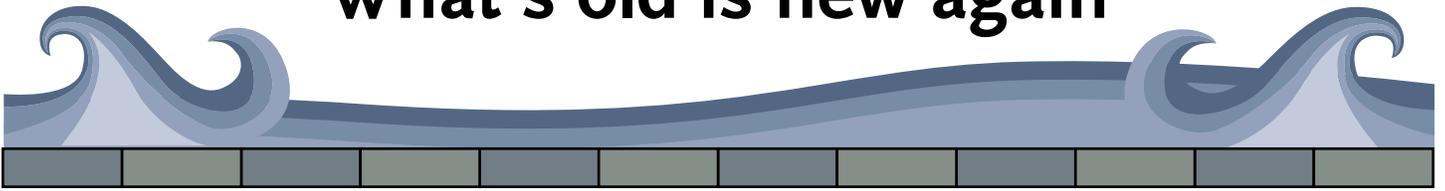


What's old is new again



Canadian Geographic's April 2016 issue features an infographic highlighting how the Archimedes screw, an ancient technology can be used to transform dams into hydroelectric power plants. With your students, use the infographic and the following activities to explore renewable energy, Canada's energy future and how old technology can inspire new ideas.

Check for understanding

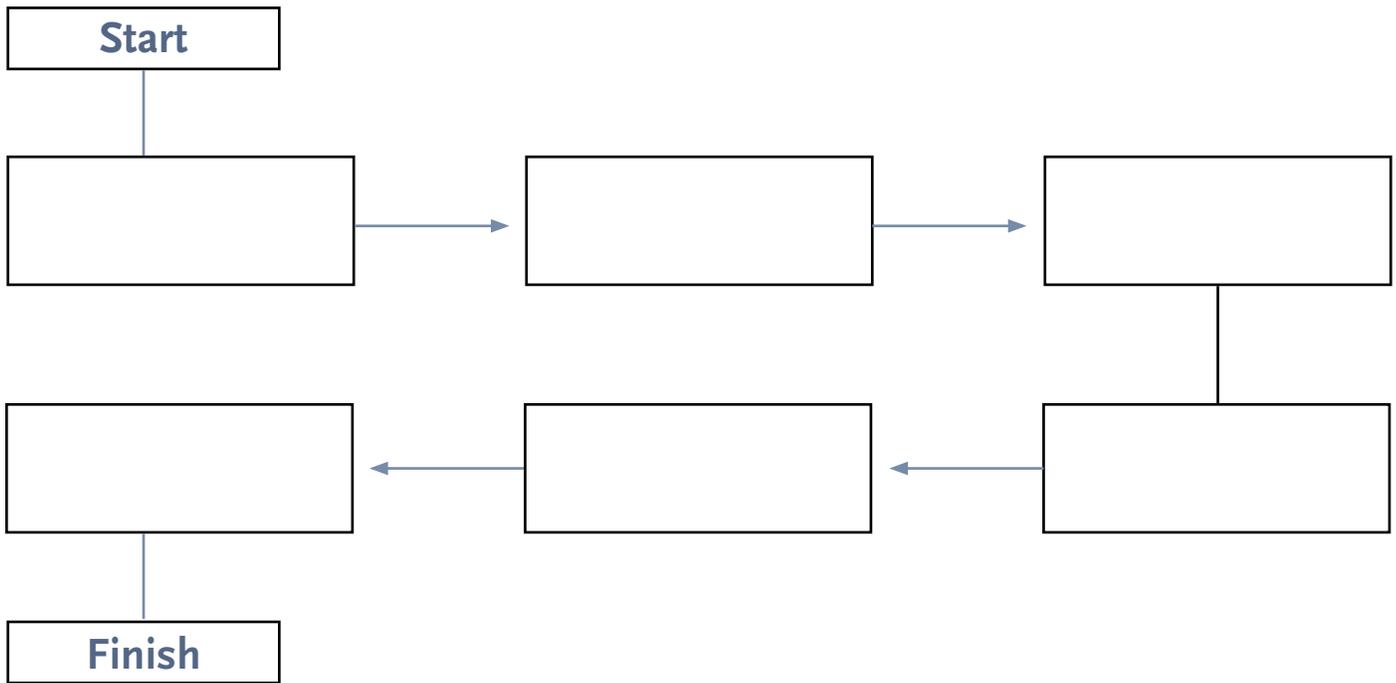
1. What was the initial purpose of the Archimedes screw when it was invented in the third century BC?

2. What does GreenBug's screw generator ensure?

3. How is this technology environmentally friendly?

4. Who can use the electricity produced at GreenBug's generating stations?

5. Examine the infographic and complete the flowchart below to show the steps it takes to generate power at one of GreenBug's power plants.



Discussion questions

6. What makes hydropower an attractive energy source?

7. What are some benefits of having so many different energy sources in Canada?

8. What are some potential problems that could arise from relying on only one energy source?

9. What energy sources do you feel would be best for Canada to use? Why?

10. What does Canada's energy future look like.

Extend your geographical thinking

11. a) Select a renewable resource that is different from hydroelectricity and draw your own infographic showing how it can be harnessed to produce electricity.

b) Complete the chart below and identify one advantage and one disadvantage for this type of energy source.

	Advantage	Disadvantage
Economic		
Environmental		
Physical (what the generating technology actually looks like) Advantages/ disadvantages to how it works		

Resources:

Online

Canadian Geographic
 Energy IQ
 Canadian Hydropower Association
 Greenlearning Canada

Videos

How it works: Hydroelectric power
 How Hydroelectricity works
 Hydroelectric power plant virtual tour
 The Largest Dam in the world
 Journey to the heart of Energy: How a hydropower plant works

What's old is new again

Ancient tech could transform old dams into power plants

By Brian Banks

IF YOU GET OFF THE expressways and out of Canada's biggest cities, you'll still see them: low dams and weirs on small rivers and streams, built mainly in the past two centuries to power mills and manage water. Quaint? Yes. Obsolete?

Not in the eyes of GreenBug Energy Inc., a Delhi, Ont., startup. Instead, it's using a new take on two-millennia-old technology — the Archimedes screw — to transform those dams and weirs into a local source of clean energy. GreenBug's screw generators — which it designs, builds, installs and operates jointly with property owners — go where conventional micro-hydro turbines, which pipe water through a wheel or blade, either cannot or would struggle to work because of size or efficiency.

Given the tens of thousands of such dams in Canada and the United States, the potential is enormous. That promise, coupled with a low-impact, fish-friendly design, earned GreenBug the 2015 3M Environmental Innovation Award. This graphic explains how the company's screw system works.

 Read a feature story about GreenBug Energy's innovative micro-hydro turbines at mag.cargogo.ca/april6/greenbug.

The unit is environmentally friendly. Equipment that contacts water is chemically inert and releases no harmful lubricants.

The top of the screw connects to a generator installed in a small service room above the waterline. Depending on the site and the screw, the amount of electricity produced can range from one to 300 kilowatts.

GreenBug's screw generator works with flows ranging from 100 to 10,000 litres per second and "heads" of water (height of the drop) from one to 10 metres, with about five metres being optimal.

The custom-designed screw is installed at the head alongside the existing channel.

The Archimedes screw was invented as a simple, reliable pumping technology to lift water in the third century BC and has been used this way for 2,000 years. But run it in reverse — positioned at a site with a water drop so that the weight of the flowing water turns the screw — and it can power a generator to make electricity.

The power can be used by the property owner, locally or, where regulations permit, sold back into the regional power grid. GreenBug's business model encourages site owners to participate as investors to share in this payback.

Water is diverted to the screw through a graded intake above the weir, with no pooling or flow interruption. Although flow rates vary naturally, the screw maintains its efficiency even when the volume is low.

The screw is designed to ensure safe passage for fish and other aquatic species. It turns at low speed and has compressible rubber bumpers at entry. In carrying the water, the screw acts more like an elevator than a blender, transferring a relatively stationary "bucket" of water down the column with each rotation. Not only is there enough space in the chamber for large fish (up to 15 centimetres wide and of any length — including eels), there is no added pressure or shear stress as exists with more conventional turbine technology.

Once the water exits the screw, it is immediately directed back into the original channel, ensuring 100 per cent of the original flow continues downstream.