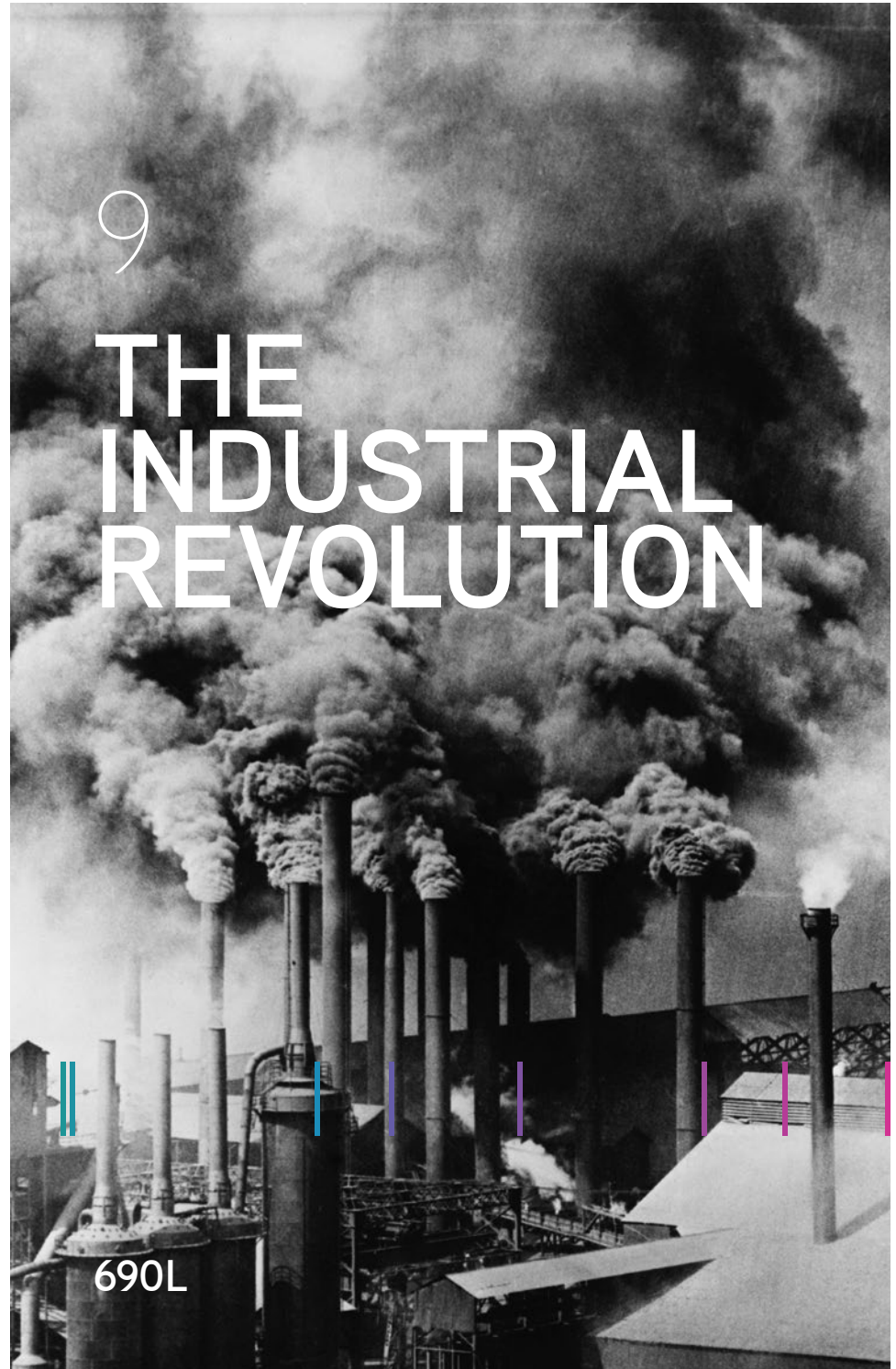


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THE INDUSTRIAL REVOLUTION



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BIG HISTORY PROJECT





THE INDUSTRIAL REVOLUTION

FOSSIL FUELS, STEAM
POWER, AND THE RISE OF
MANUFACTURING

By Cynthia Stokes Brown, adapted by Newsela

Fossil fuels, like coal, led to innovative machines. These inventions launched a period of rapid change. Human society was transformed forever.



Workers shovel coal in England, 1912

The transformation of the world

Try to imagine your life without any machines. Think about all the machines in your house. You may be surprised how many there are.

Imagine young people who grew up before machines. How did they get around? How did they communicate? What did they eat?

At one time, humans provided most of their own energy. They ate plants and animals for fuel. All life depended on the energy the Sun sent to the Earth.

Everything changed during the Industrial Revolution, which began around 1750. People found a new source of energy. That source was fossil fuels — coal, oil, and natural gas. Fossil fuels formed underground from the remains of plants and animals from long ago. Burning fossil fuels released energy that came from the Sun. The energy had been stored for hundreds of millions of years.

Coal was formed when huge prehistoric trees fell and were covered with water. Oxygen and bacteria could not decay them. Materials pushing down compressed the trees into dark, burnable rock.

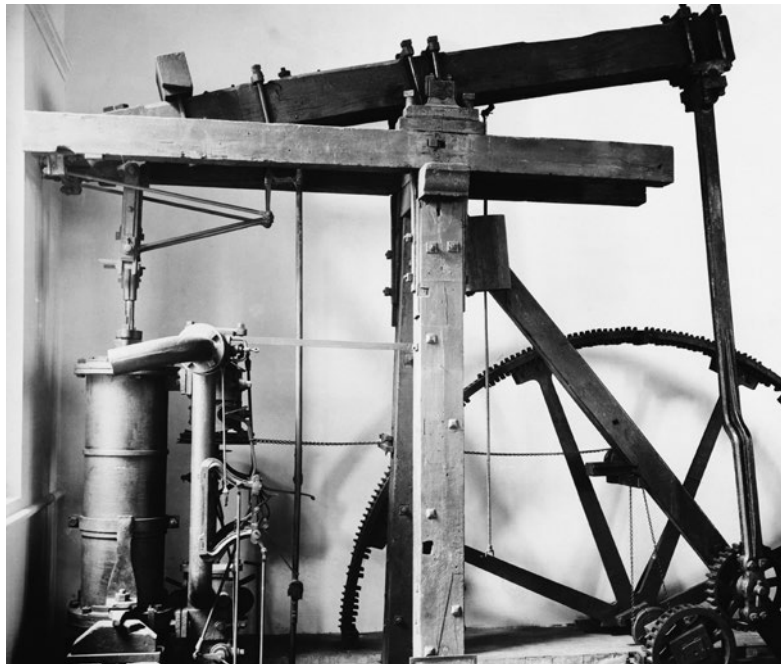
Coal, oil, and gas are relatively common on Earth. But they are not evenly distributed. Some places have much more than others.

Early steam engines

The story of the Industrial Revolution begins on the small island of Great Britain. People used wood to build houses or ships. They also used wood for cooking and heating. But now most of the trees were gone. People needed something else to burn. They turned to the black rocks (coal) that they found in the ground.

Soon they were digging deeper to mine this coal. These coal mines, deep in the Earth, began to fill with water. Using horses to pull up bucketfuls of water was too slow.

A Scottish instrument-maker named James Watt (1736 — 1819) came to the rescue. In 1776, he designed an engine that used burning coal to produce steam. The steam caused a piston to move up and down. His steam engine



A James Watt steam engine

was first used to pump water out of coal mines. But the engine worked well and it found many uses. Watt became a very rich man. After 1800, other people improved his engine. By 1900, engines burned 10 times more efficiently than in 1800.

Around 1800, British colonies in North America were producing lots of cotton. Machines were used to spin the cotton and weave it into cloth. Attaching a steam engine to these machines made the work go much faster. Soon there were large factories powered by steam engines. People began to leave the countryside to work in these factories.

The British also invented steam locomotives and steamships in the early 1800s. These inventions revolutionized travel. In 1851, they held the first world's fair. They showed off telegraphs, sewing machines, and revolvers. This demonstrated that they were the world's leading manufacturer of machinery. By then, many places in Britain had factories, big cities, and railroads. These were the signs of an industrial society.

Why Britain?

Britain wasn't the only place that had coal. So why didn't the Industrial Revolution begin in China, or somewhere else? Did it start independently in Britain, or were there global forces at work? Did geography or cultural institutions matter more? Historians have investigated these questions.

Industrialization may have begun in Britain due to:

- A lack of wood and lots of coal
- Rich businesspeople
- A capitalist system with limited government involvement
- Government support for business projects
- Cheap cotton produced by slaves in North America
- High literacy rates
- Rule of law
- Valuable immigrants

Historians believe Industrialization didn't begin in China due to:

- China's coal being far from the big cities
- China's large population that made human labor possible
- Confucian ideals that valued stability and discouraged experimentation and change
- Lack of Chinese government support for sea explorations
- China's focus on defending itself from nomadic attacks

Global forces influencing the development of industrialization in Britain include:

- Britain's location on the Atlantic Ocean
- British colonies in North America, which provided land, labor, and markets
- Silver from the Americas
- New thoughts about the economy that encouraged business risk-taking

The spread of the Industrial Revolution

Britain wanted to keep secret how its machines were made. But visitors soon learned about them. They took the techniques back to their home countries. Sometimes they smuggled machines out in rowboats.

The first countries after Britain to develop factories and railroads were Belgium, Switzerland, France, and Germany. Building a national railroad system was an essential part of industrialization. Belgium, France, Switzerland, and Germany all began to build railroads in the mid-1800s.

Industrialization came to the United States in 1789. Samuel Slater left Britain for Rhode Island. He set up the first textile factory on U.S. soil. He couldn't bring any notes or plans from Britain. Slater had to set up the factory from memory.



British sailing ships in Calcutta Harbor, c. 1860

Railroad construction in America boomed from the 1830s to 1870s. The American Civil War (1861 — 1865) was the first truly industrial war. The factory-based North was fighting the agriculture-based South. Industrialization grew explosively after the war. By 1900, the United States had overtaken Britain in manufacturing. The U.S. now produced 24 percent of the world's output.

Four decades before that, both Russia and Japan gave up their feudal systems. They had to compete in the industrializing world. Japan's monarchy was flexible enough to survive early industrialization.

But in Russia, the czar tried to industrialize a rural country while keeping his dominance. Factory workers often worked 13-hour days without any legal rights. Eventually, workers rebelled. A revolution brought the Communist party to power in 1917.



Workers haul coal to waiting barges near Fengjie, China, 2005

Industrialized nations used their strong armies and navies to colonize many parts of the world that were not industrialized. They needed raw materials for their factories. This colonization is known as imperialism. In 1800, Europeans occupied or controlled about 34 percent of the land surface of the world. By 1914, this had risen to 84 percent.

Consequences of the Industrial Revolution

The effects of industrialization are astonishing. In 1700, before fossil fuels, the world's population was 670 million. By 2011, it was 6.7 billion. This was a tenfold increase in only 300 years.

In the twentieth century, the world's economy grew fourteenfold. Per capita income grew almost fourfold. The use of energy expanded at least thirteenfold. This kind of growth has never been seen in human history.

Many people today enjoy the benefits of industrialization. Extra energy flows through the system. It allows many of us to do much less physical labor than earlier generations. People today are able to feed and raise more babies. Many people vote and participate in modern states. These states provide education, social security, and health benefits. Large numbers of people enjoy levels of wealth, health, education, travel, and life expectancy unimagined before industrialization.

However, the benefits of industrialization have come at great cost. For one thing, the rate of change (acceleration) is now incredibly rapid. It's so fast that individuals and social systems struggle to keep up. And perhaps life has less individuality now that most things are made in factories.

The industrial system has become more complex. It has also become more fragile. Industrialization needs many parts to work together smoothly. Any one component could fail.

We know that many of the essential parts of the industrial system, and the natural resources it depends on, are being undermined. The soil. The oceans. The atmosphere. The underground water levels. Plants. Animals. All these are at risk.

Will uncontrolled growth continue? Are we approaching the end of an unsustainable industrial era? Whatever the future holds, we'll be dealing with the consequences of modernization for years to come.

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Smokestacks in Pittsburgh, Pennsylvania, 1890s

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Workers shovel coal into boilers at a coal mine in England, 1912

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James Watt's "Sun and Planet" steam engine

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Calcutta Harbor, c. 1860

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Workers hauling coal near Fengjie, China, 2005

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