Audio-Visual script:

Ripley's Believe it Or Not Discoveries in Matter and Energy

Written for the Society for Visual Education

	Audio	**Visual**
1	Title Frame	
2	Would you believe…	TITLE: "Would You Believe…"
3	A balloon powered by birds?	Old print: hot-air balloon with birds
4	Or a cart drawn by kites?	Old print: cart with attached kites
5	How about a vacuum cleaner had to pump with your feel while you vacuumed?	Old print: vacuum cleaner with foot pump
6	The balloon, the cart, and the vacuum cleaner are all from the pages of "Ripley's Believe It Or Not". And they all have one thing in common: the people who invented them dreamed up unusual ways of getting energy to make their inventions work.	"Ripley's Believe It Or Not" logo
7	When people started inventing machines to do their work for them, they had to face the problem of finding sources of energy to run those machines.	Photo: boy in the middle of a field with a vacuum cleaner, holding its plug with a confused expression on his face
8	There are some energy sources that people have always known about – the sun, wind, running water, fire. The first important energy inventions used these sources to perform new tasks, or to perform the old tasks more efficiently.	4-way split frame: sun, clouds, stream, fire
9	For example, fire has always been a good source of heat and light. But there have been many inventions that help fire do its job even better.	Campfire
10	Believe it or not, glass globes filled with water were used in the eighteenth century to magnify candlelight. The globes make the candle flame a better source of light.	"Ripley's Believe It Or Not" cartoon
11	For centuries, fire in a fireplace was the best way of heating a home. But around the 1770s, a new invention changed that.	Photo of old-fashioned fireplace
12	This was the Franklin stove – named after its inventor, Ben Franklin. The cast-iron stove brought the fire away from the wall, so that much more air got to the fire – it burned better, and gave off more heat.	Drawing of Franklin stove
13	Benjamin Franklin was famous for being both a scientist and an inventor. His scientific discoveries were important to the development of electrical power. Also, he invented the rocking chair, the harmonica, the street lamp, the lightning conductor, double spectacles, and the Franklin stove. Believe It Or Not, he even invented the system and term "United States of America."	"Ripley's Believe It Or Not" cartoon

	Audio	**Visual**
14	But science and invention don't always go together, as with Ben Franklin. Sometimes, a new scientific theory touches off many new inventions by suggesting a whole new way of looking at things. Other times, though, a new idea in science remains "just a theory" – until an inventor thinks of a way to use it.	Cartoon of 'scientist' in chemistry lab
15	And sometimes it seems like an important invention had hardly anything to do with scientific theory at all. For example, let's take a look at the development of steam power.	Photo of old-fashioned steam locomotive
16	Believe It Or Not, a toy in which a sphere was spun by steam jets was invented in Egypt in 200 B.C.	"Ripley's Believe It Or Not" cartoon
17	The history of the modern steam engine started in 1695, when a Frenchman named Denis Papin invented a steam-operated pump to drain mineshafts. Papin boiled water at the bottom of a metal cylinder. The expanding steam pushed a piston up the cylinder, and, this way, operated the pump. It worked, but not very well.	Diagram of Papin steam apparatus
18	Around 1705 in England, John Newcomen was testing a similar machine when some cold water accidentally got into the cylinder and condensed the steam. The steam stopped expanding so quickly that a vacuum formed in the cylinder. This pulled the piston down so fast that it smashed the engine!	Diagram of Newcomen apparatus
19	The sudden production of a vacuum in the cylinder was the real key to steam power. Newcomen's engine was a success. But it was an improved model designed by James Watt in 1769 that really started things. Steam-powered factories, trains and ships led the Industrial Revolution of the 1800s.	19^{th}-century engraving of factory machinery
20	The steam engine was a new way of using old energy sources – fire and water. But electricity was a different story. No one knew much about electrical energy until scientists began experimenting with it. Scientific discoveries and theories led inventors to produce energy in ways no one had seen before.	Closeup of Van de Graff generator
21	Starting in the 1600s, scientists became interested in a strange force that would attract small bits of paper or cloth to glass globes, or gives off sparks of light. Where did it come from? Was it anything like lightning, or magnetism?	Old print of Mesmer with apparatus
22	As early as 1672, Otto Von Guericke made a machine to produce this strange force, so that he could study it better. This machine produced electric sparks by friction, in much the same way you can by shuffling your feet on a rug.	Old print of ball-like electrical apparatus

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23	This machine was a sensation in Europe. Other inventors used its sparks to light fires – even to set off gunpowder. Quack doctors claimed that this energy flowing through the body could cure all kinds of diseases	Old print of 18th-cen doctors treating women with elaborate pompadours in magnetic baths
24	Then, in 1752, Benjamin Franklin flew his famous kite, with a key attached to the string. Franklin showed that the key could charge up a Leyden jar, which was an early form of battery. This proved that lightning and electricity were the same thing.	Drawing of Franklin flying kite
25	Franklin used his discovery to invent the lightning rod, which protected buildings and ships. Franklin produced an important scientific theory and a new invention. And not only that …	Diagram of lightning rod on a house
26	… he also started a new fashion. Believe It Or Not, "Franklin Wires" adorned the hats of chic Parisian women in 1776 in honor of Benjamin Franklin's invention – the lightning rod.	"Ripley's Believe It Or Not" cartoon
27	Then, in 1786 – another lucky accident. An Italian biology professor was dissecting a frog on an iron plate. When he poked the frog with a brass wire, electricity flowed between the wire and the plate – and made the frog's leg jump!	Drawing of frog on dissecting table
28	Another Italian, Alessandro Volta, figured out that the contact between two different metals had caused the spark. In 1796, Volta put together a stack of zinc and copper plates that gave off a steady and lasting electric current. This invention, called the "Voltaic pile," was the first useful electric battery.	Diagram of Voltaic pile
29	Meanwhile, the Danish scientist H.C. Oersted tried to prove that electricity had nothing to do with magnetism. He ended up proving just the opposite!	Photo of Oersted
30	In England in 1831, Michael Faraday turned Oersted's failed experiment into a big success. He invented a machine that spun a magnet inside a coil of wire – the first practical generator of electricity.	Diagram of Faraday apparatus
31	So by 1831, all the most essential devices for making electrical power work had been invented – the battery in Italy, the generator in England, metal conductors in the U.S. But electrical energy was still just a scientific curiosity – nobody had come up with a really important use for it yet.	Cartoon or engraving of 18th-century scientist with fanciful electrical apparatus
32	About 1856, a British scientist named Frederick Holmes decided to take a look at an old electrical trick: making an electrical spark jump between two poles.	Photo of Holmes

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33	Holmes revved up a powerful new generator based on Faraday's, and put carbon rods between the two poles. The strong electrical current made the tips of the rods glow brightly. Holmes had produced the first electric arc light.	Photo of electric arc
34	In 1878, the arc came to the attention of an American inventor, Thomas Edison, who often said: "I can never pick up a thing without wishing to improve it." Now, Edison figured he could improve Holmes' invention by putting the two poles inside a glass bulb and pumping the air out.	Photo of Edison
35	His big challenge was to find something better than a carbon rod to go between the two electrical poles. He had a lot of better ideas. In fact, Edison, before settling on carbon as the filament for the electric light bulb, tested one thousand six hundred different materials – Believe It Or Not!	"Ripley's Believe It Or Not" cartoon
36	Finally, in October of 1879, Edison tried a piece of bamboo treated with carbon. This bulb burned continuously for one hundred and seventy hours. Edison and his assistants stayed up and watched it the whole time!	Photo of Edison and team in lab
37	Soon, the electric light bulb was in millions of homes all over the world. It started a wave of technological advances. And it earned Thomas Edison praise and honors from all over the world. In fact, Believe It Or Not …	Old print of old-time lamp with old-time light bult
38	The Thomas Edison monument in Kyoto, Japan, is located in the grove from which the American inventor obtained the bamboo used as a filament in his first incandescent lamp.	"Ripley's Believe It Or Not" cartoon
39	Edison considered himself an inventor and *not* a scientist. He joked about mathematicians and theoretical scientists, because he believed in making progress through painstaking hard work. That was his formula for genius, after all -- one percent inspiration and ninety-nine percent perspiration.	Photo of Edison slumped over staring at light bulb
40	That may have worked for Thomas Edison. But the next big energy invention was born out of abstract scientific reasoning and complicated mathematics. The man who started it all was Albert Einstein.	Photo of Einstein
41	Believe It On Not, Albert Einstein, the mathematical genius, did not learn to talk until he was three years of age. And while attending school in Munich, Germany, he maintained only average grades.	"Ripley's Believe It Or Not" cartoon

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42	But in 1905, when he was 25 years old, Einstein published a theory that changed the way scientists thought about the universe. It was the Theory of Relativity, and it contained the famous equation:	Photo of young Einstein
43	"E equals M C squared." The "E" stands for energy, and the "M" stands for matter. What Einstein proposed in 1905 was that energy equals matter – that matter is actually a highly concentrated form of energy.	"$E=mc^2$" in big letters
44	This was an important idea for scientists studying the particles that make up atoms. What Einstein's theory suggested was that even one of those tiny particles could be converted into an enormous amount of energy, if it could be broken away from the atom.	Graphic of atom
45	This theory was supported by studies done in France by Madame Marie Curie. She and her husband, Pierre Curie, were investigating strange rays given off by the elements thorium and uranium. They discovered many beneficial uses for these rays, which they called radioactivity.	Photo of the Curies
46	Marie Curie made many important discoveries. But male scientists didn't give her the recognition she deserved. Believe It Or Not, Marie Curie was awarded the Nobel Prize in 1903 and again in 1911 – but was refused admittance to the French Academy of Sciences.	"Ripley's Believe It Or Not" cartoon
47	One of the Curies' greatest discoveries was that radioactivity is actually made up of energy and particles from atoms that are thrown off when atoms break apart.	Diagram of atom splitting, throwing off particles
48	Splitting atoms was exactly what other scientists were trying to do – and it was exactly what would release great amounts of energy, according to Einstein's theory.	Similar diagram of nuclear chain reaction
49	Other scientists learned to control the splitting of the atom. Building on the work of the Curies, they learned how to use the atom as a source of incredible amounts of energy. Scientists had developed nuclear power.	Photo of nuclear power plant towers
50	The nuclear power plant of today is the product of many centuries of science and invention. The nuclear chain reaction produces intense heat, which is used to convert water into steam. The steam is used to run a kind of steam engine, called a steam turbine. And the turbine is connected to an electrical generator.	Diagram showing the parts of a nuclear power plant
51	Nuclear reactors produce more energy than any other kind of energy source known. But that's what worries some people. After that same nuclear power is also …	Photo of nuclear power plant with electrical power plant
52	… the destructive force behind the atom bomb. Many people worry that we don't know how to handle that much power safely.	Photo of devastation of Nagasaki after nuclear bomb

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53	Others argue that, with other sources of energy running low, nuclear energy is the best hope for the future. These people hope that tomorrow's inventors and scientists will develop ways to make nuclear power safer to use.	Photo of nuclear scientists at work
54	Opponents of nuclear power place their faith in inventors to think up new energy sources – like solar energy, or new designs for windmills. These inventors have gone back to the first energy sources – the sun and the wind.	Split screen: solar panel installation and modern-design windmill
55	So we haven't run out of the need for new invention and new inventors. And you never know where the next big energy invention will come from.	Photo of science fair kids
56	After who would have guessed that a machine to drain mine shafts would be used to run trains and factories?	Repeat of engraving of Papin or Newcomen steam engine
57	And who would have thought that a biology professor and his dissected frog would help us light up the world with electricity?	Repeat of engraving of frog on dissecting plate
58	You never know what inventors will turn to next. So keep your eye on strange, out-of-the-way facts and discoveries. Who knows? You might just find the key to the next great invention …	Photo of kids reading or experimenting
59	… in the pages of Ripley's Believe It Or Not!	"Ripley's Believe It Or Not" logo
60	End Frame	
61	Credits	