Turbines, Generators and Power Plants

ESP
It's Science Time!

Sasha, Maria and Darrell were at Sasha's house to work on a science project. As they entered Sasha's room, Maria turned on the light. Pop. The light bulb burned out in a flash of light.

"Hey guys, did you see that?" asked Maria. "I hate when that happens.

"Me too," said Darrell. "Someone should invent a light bulb that never has to be changed."

"That would be a great invention!" said Maria. "What are you doing this weekend?"

"Very funny," said Sasha. "My mom will be home soon. I will ask her to change the bulb. Let's work in the kitchen. There is plenty of light in there."

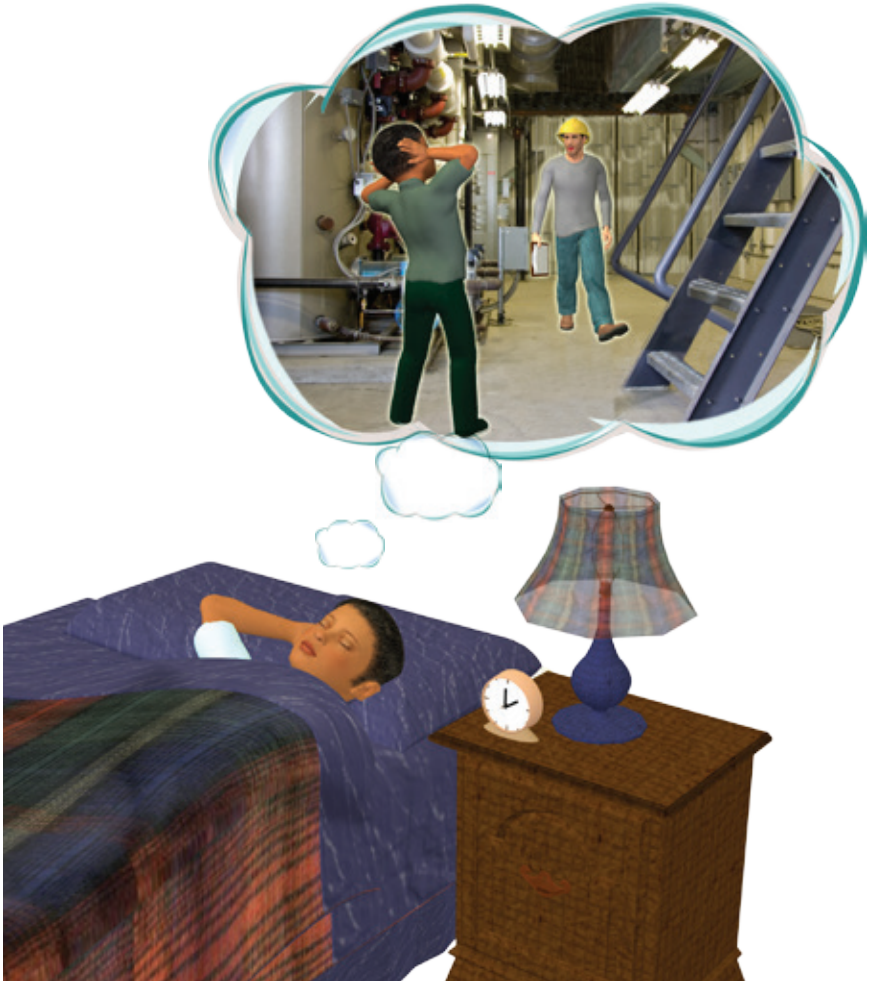
"Sasha, have you ever thought about where electricity comes from?" asked Darrell. "I know it comes into our houses through the power lines outside. But where does it come from before that?"

"I don't know, Darrell. Ask Mr. Thomas in science class tomorrow," said Sasha.

"That's a good idea. I will ask him," said Darrell.

Later that night Darrell was thinking about what happened at Sasha's house as he was falling asleep…….

He suddenly found himself inside a huge factory. The noise was loud, and he had to cover his ears. He almost did not hear the man with the hard hat yelling something in his direction.



"Young man, what are you doing here?" said the man with the hard hat.

"Where am I?" asked Darrell.

"You're inside the Springville Power Plant. We are one of the largest producers of electricity in the country. My name is Mr. Charge. I'm the plant supervisor," said the man with the hard hat.

"That explains it! My friends and I were talking about electricity this afternoon. I must be having a dream. My name is Darrell. It's nice to meet you," said Darrell.

"Well Darrell, I can show you around. Put on this hard hat and follow me," said Mr. Charge.

Darrell followed the man into a huge room filled with strange looking machines connected by pipes.

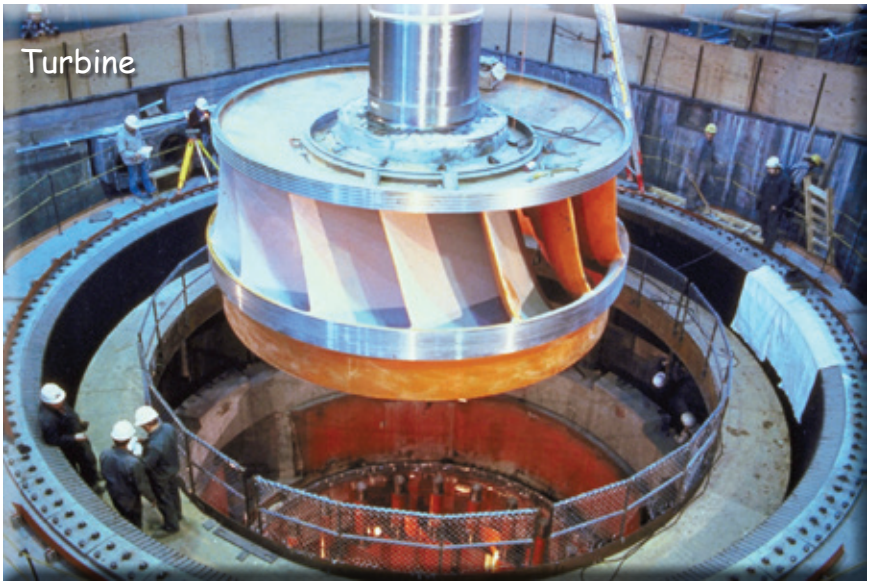
"Darrell, do you see those big containers over there? They are the boilers. They are filled with water that is heated until it turns to steam. The big pipes carry the steam into the next room where the turbines are located," said Mr. Charge. "Here at the Springville Power Plant, we burn coal to heat the water in the boilers. Other power plants burn wood, oil, or natural gas."


Boilers

"It must take a lot of heat to boil a pot of water that big!" said Darrell. "You said the steam goes through those pipes and into the turbines in the next room. What are turbines?" asked Darrell.

"Let's go see," said Mr. Charge. "Follow me, and stay close."

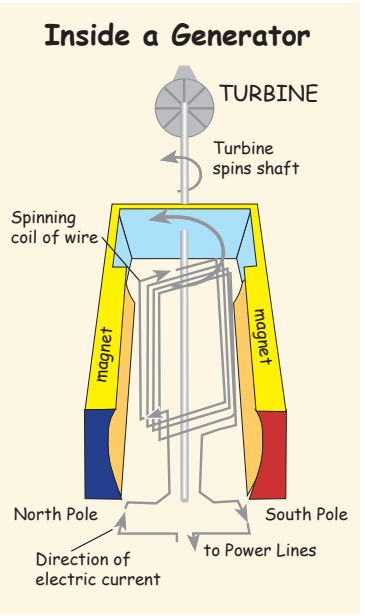
Darrell followed Mr. Charge into the next room. He saw the big pipes coming from the boilers. They were connected to another huge machine.

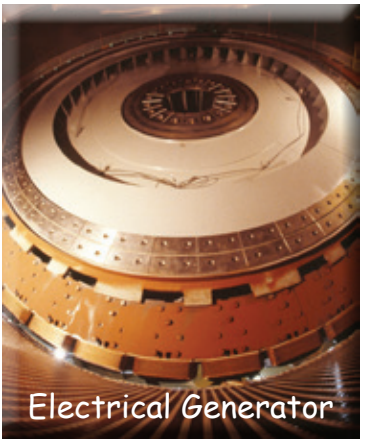


"This is the turbine. The big pipe on the side is where the steam comes in. The steam is hot. It is under a lot of pressure. When the steam moves into the turbine, it makes the turbine spin. The turbine has hundreds of blades. It is like a huge fan. The steam causes the fan blades to spin around really fast," said Mr. Charge. "A long pole is connected to the turbine. When the turbine spins, the pole spins too. The pole is connected to another machine called a generator."

"Wow!" said Darrell. "How does the generator work?"

"The generator is like a big box lined with strong magnets. The steam from the boilers spins the pole attached to the huge fan inside the turbine. The other end of the pole is attached to a large coil of wires. The coil spins inside the magnetic field made by the magnets. A current of electricity is then made in the wire. So, what the generator really does is change the mechanical energy from the spinning pole into electrical energy," said Mr. Charge. "The generator is based on the work of Michael Faraday in 1831. He was a British scientist. Faraday found that an electric current will flow through a wire that is moved through a magnetic field. The mechanical energy of the moving wire is changed into electrical energy."




Electrical Generator

"Now I understand. The electricity made by the generator is the power we use in our homes, schools and businesses," said Darrell. "Where does the electricity go after it leaves the power plant?"

"I will show you," said Mr. Charge. "Remember to stay close. We are going outside now."

"The electricity made at the power plant has to get to the customers who use it. Our whole country is criss-crossed with power lines. Electricity moves along the power lines to go where it needs to go," explained Mr. Charge.

"Is the electricity coming from the power plant strong enough to travel far distances?" asked Darrell. "Does it lose some of its strength the farther it goes? Not everyone lives near a power plant."

"That's a great question, Darrell!" exclaimed Mr. Charge. "You are right. The electricity does lose some of its power as it travels. So the first stop after the generator is the transformer."

"I know that word!" said Darrell. "Transform means to change something. What does the transformer change?"

"Actually, Darrell, there are two different kinds of transformers," said Mr. Charge. One is called a step up transformer. The other is called a step down transformer. The electricity that leaves the power plant needs to be stepped up. Remember, it may have to travel a really long distance. The transformer is changing the voltage of the electricity. Voltage is how much "push" the electricity is going to have."

"That makes a lot of sense," said Darrell. "But what about the step down? Where does that happen?"

"High voltage wires carry the electricity from the transformer at the power plant to substations. These substations are closer to our homes and businesses," said Mr. Charge. "At these substations, the electricity is stepped down to a lower voltage."

Transformer

"And from there it's safe to come into our homes?" asked Darrell.

"Not yet. It is still too powerful. It is safe to use the electricity from these substations to run big factories or an electric subway system. But it has to be stepped down one more time before it is safe to come into our homes," said Mr. Charge.

"Where does that happen?" asked Darrell. "Is there another substation?"

"Sort of," said Mr. Charge. "There is usually a small transformer right in your neighborhood. It is found near the top of a utility pole. This transformer reduces the voltage of the electricity one last time before it comes into our homes."

"I have been in some neighborhoods where it does not look like there are any power lines," said Darrell. "How do they get their electricity?"

"The same way!" exclaimed Mr. Charge. "In some neighborhoods, the power lines are underground. Underground lines are protected from the weather. Severe weather can cause the lines to break. Have you ever seen what can happen to power lines in an ice storm?"

"I sure have!" said Darrell. "I remember we lost power in my house for a whole week after an ice storm."

"Well, Darrell, you are almost home again. Look over there. That is your house. We have followed the electricity all the way from the power plant to your street," said Mr. Charge. "I only have one more thing to tell you about. When the electricity enters your home, it passes through a meter. The meter measures how much electricity your family uses. The power company then knows how much to charge your family for the electricity they use. It then goes through a fuse box or a circuit breaker in the house. Then it moves to the lights and appliances."

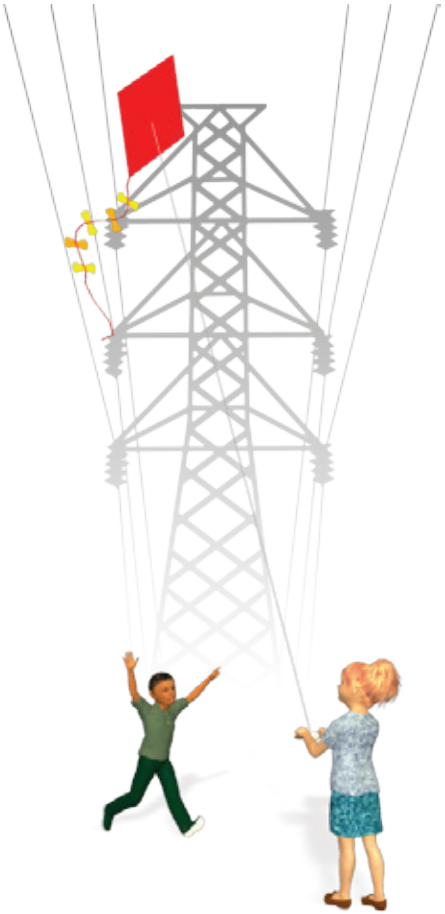
"This has been a great dream, Mr. Charge. I cannot wait to wake up and tell Sasha and Maria where I have been. I'll tell them all about what I have learned," said Darrell. "Thanks a lot!"

Just then, a strange buzzing sound began. Darrell turned over and shut off the alarm clock. He looked around. He was back in his bedroom again.

"Sasha and Maria are never going to believe this one!" Darrell laughed to himself as he got ready to leave for school.

Safety Notes about Electricity

- Never play around a transformer or substation. The electricity from a transformer is very powerful. Tell your parents to call the electric company if a toy lands in or around a transformer.
- Do not release helium balloons, especially Mylar balloons, into the air. The balloons can get caught in power lines. This can cause problems, including fires.
- Do not fly a kite near power lines. The kite string could link across the wires and complete a circuit. The electricity could then be passed on to you holding the string.
- You should never touch wires inside or outside your house. An electrician or the power company knows the proper way to fix high voltage electrical problems.



Electrical Circuits
Turbines, Generators and Power Plants

Correlation

Fountas & Pinnell	**S**	
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