Copymaster Number	Copymaster Name
Copymaster 1	Student Chapter Organizer
Copymaster 2	Windmill Template
Copymaster 3	Explore Energy Stations
Copymaster 4	Scoring Rubric—Power Mandate
Copymaster 5	Energy Summary Sheet, Teacher
Copymaster 6	Energy Summary Sheet, Student
Copymaster 7	Family Energy Conservation Checklist
Copymaster 8	Power Professionals
Copymaster 9	2020 New LADWP Power Mix
Copymaster 10	Different Energy Systems (separate file)

E-Motion

Engage – Plugging In
Key Idea:

Can you make electric energy?

Explore – Spinning Spectacular
Key Idea:

What kinds of energy are converted to electric energy?

Explain – Notions of E - Motion
Key Idea:

What are ways to conserve power?

Main Concepts

- Energy must be converted for use as heat, light, or transportation.
- No source of energy is perfect; energy is lost in conversions to electricity.
- All ways to make energy have costs.
- New technologies and conservation are the cleanest forms of new energy.
- Many career opportunities are available in making power for communities.

Explore – Protecting Power—Conservation
Key Idea:

Evaluate – Energy Mandate
Key Idea:

How will your community provide power for you and your school?

Elaborate – Power Careers
Key Idea:

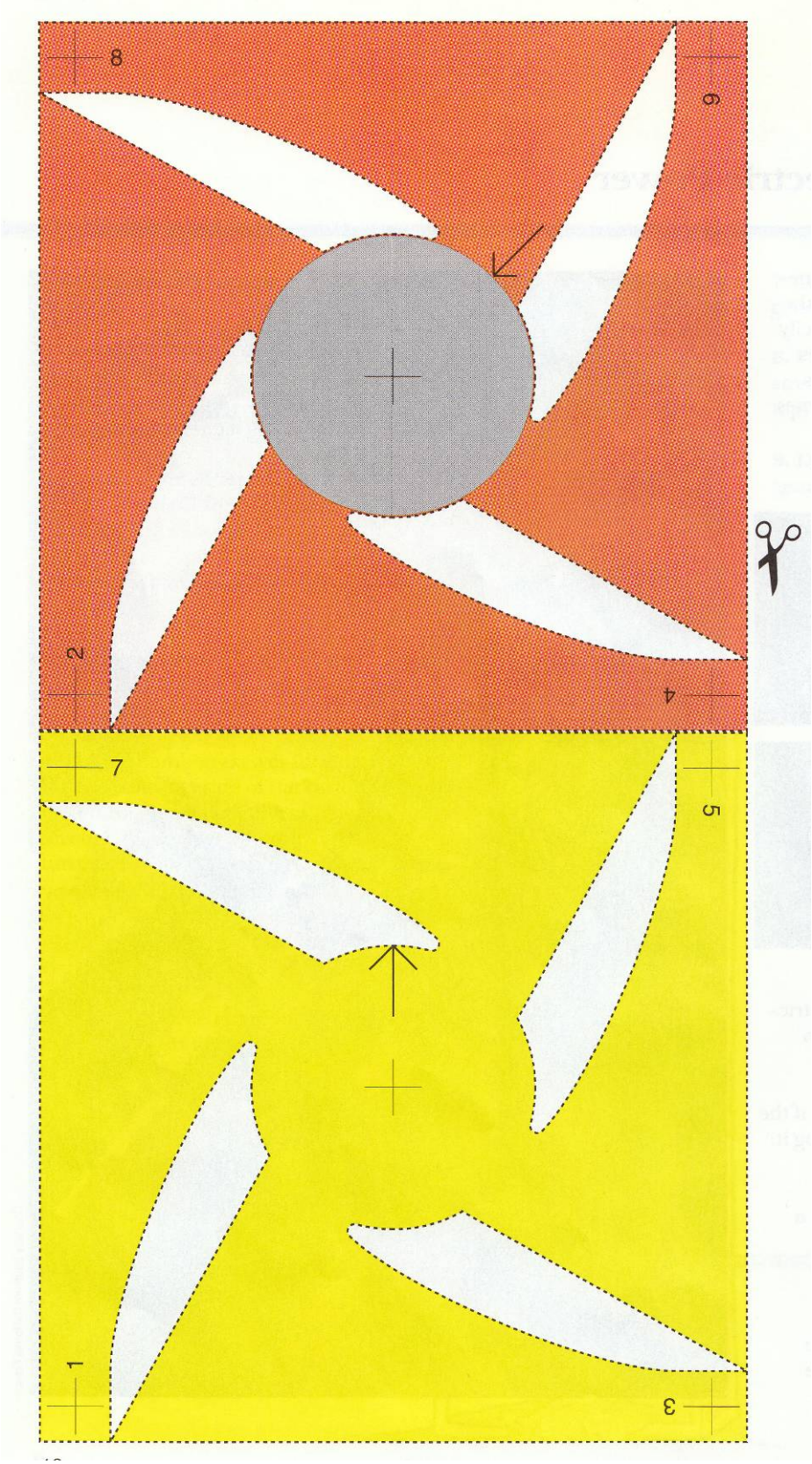
What jobs help provide power?

Elaborate – Costs of Power
Key Idea:

What are the costs and benefits of saving energy?

Copymaster 1

Windmill Template



Copymaster 2

Explore—Energy Stations

Station #1: Windmill

Draw a picture of the system (with labels, etc.).

Station Data: How much current do you record with multimeter?

General Questions

Is the form of input energy different from the output energy? Explain.

Could your power utility use this system to generate electricity? Explain your thinking.

Is the energy from this system available all the time, or only at certain times? Explain your thinking.

Station #2: Solar Cell

Draw a picture of the system (with labels, etc.).

Station Data: How much current do you record with multimeter?

General Questions

Is the form of input energy different from the output energy? Explain.

Could your power utility use this system to generate electricity? Explain your thinking.

Is the energy from this system available all the time, or only at certain times? Explain your thinking.

Station #3: Battery and Bulb

Draw a picture of the system (with labels, etc.) for how you lit the bulb.

Station Data: How did you light the bulb? How does energy from the battery change forms?

General Questions

Is the form of input energy different from the output energy? Explain.

Could your power utility use this system to generate electricity? Explain your thinking.

Is the energy from this system available all the time, or only at certain times? Explain your thinking.

Station #4: Copper Coil and Strong Magnet

Draw a picture of the system (with labels, etc.).

Station Data: Does the magnet need to move to make an electric current? What is your evidence?

General Questions

Is the form of input energy different from the output energy? Explain.

Could your power utility use this system to generate electricity? Explain your thinking.

Is the energy from this system available all the time, or only at certain times? Explain your thinking.

Station #5: Coil and Magnet EM Java Applet

Draw a picture of the system (with labels, etc.).

Station Data:
With more loops in the coil, I see that electric current…

With a stronger magnet, I see that the electric current…

General Questions

Is the form of input energy different from the output energy? Explain.

Could your power utility use this system to generate electricity? Explain your thinking.

Is the energy from this system available all the time, or only at certain times? Explain your thinking.

Station Activity	Draw a picture of the system.	Is the input energy different from the output energy? Explain.	Could your power company use the system for electricity? Explain.	Is the energy available all the time or only at certain times? Explain.	Additional Observations and Data
Station #1 Windmill					How much current do you record?
Station #2 Solar Cell					How much current do you record?
Station #3 Battery and Bulb					How did you light the bulb? Where does the battery energy go?

Station Activity	Draw a picture of the system	Is the input energy different from the output energy? Explain.	Could your power company use the system for electricity? Explain.	Is the energy available all the time or only at certain times? Explain.	Additional Observations and Data
Station #4 **Copper Coil and Magnet**					Does the magnet need to move to make electric current? What is your evidence?
Station #5 **Coil and Magnet EM Java Applet**					With more loops, I see that the electric current… With a stronger magnet, I see that the electric current...

Power Mandate Scoring Rubric

Highest levels of performance

Weight	Task	3	2	1
5%	**1. Family Conservation Checklist**	Did checklist, and contributed to class discussion.	Checklist was incomplete, or student didn't discuss.	No checklist, or student didn't offer ideas.
25%	**2. Conduct and work with panel**	Works well with panel members, and individually on questions.	Could work on teamwork skills and focus on answering questions.	Has poor teamwork skills, and needs better focus on questions.
25%	**3. Showing shift to 2020 power mix for LADWP**	Team has a table where renewable energy sources make-up 35% of the total. Non-renewables are decreased.	Table doesn't have renewables equaling 35% of total, as per law. Non-renewables still more than 35% of mix.	Table for team doesn't make sense for the 2020 law. Non-renewables still shown as key part of LADWP mix.
45%	**4. Response to individual prompts**	Explanations are clear, use evidence, and shift energy production away from hydroelectric in a drought.	Explanations don't use clear evidence, and don't clearly show link between natural events like drought and power production.	Explanations don't show need to adjust energy production based on natural events such as a drought.

All writing and pictures must be legible and neat, or your assignment will be returned.

Energy Summary Sheet, Teacher

Power source	LADWP's energy mix	California's energy mix	Renewable or Non-Renewable	Cost to produce	Energy provided by
Solar	**<1%**	**<1%**	R	10-50	Sunshine
Wind	**1%**	**<1%**	R	6-9	wind energy
Coal	**46%**	**29%**	NR	2-4	burning of coal
Oil	**0%**	**0%**	NR	Not in CA anymore	burning of oil
Natural Gas	**29%**	**35%**	NR	5-10	burning of natural gas
Small Hydro	**6%**	**<1%**	R	2-10	running water or reservoir
Large Hydro	**8%**	**31%**	NR	2-5	reservoir
Geothermal	**<1%**	**4%**	R	8-12	Heating water within the earth
Biomass and waste	**1%**	**<1%**	R	8-12	plant material or landfill wastes
Wave	**0%**	**0%**	R	Not commercial in Southern CA	ocean waves
Nuclear	**9%**	**0%**	NR	2-4	splitting atoms
Conservation	**N/A**	**N/A**	R	--	N/A

Power source	Waste	Non-monetary Costs	Energy conversion route	Hidden Environmental Costs	Can source be less polluting?
Solar	non-recyclable silicon, plastic etc.	habitat depletion, visual impact	PE → EE	Solar is only available when the sun is shining, but that is usually when most electricity is used. Thermal storage could help.	Yes, with improvements in manufacturing processes.
Wind	non-recyclable construction materials	habitat depletion, visual impact, bird deaths	KE → ME→EE	Wind is an intermittent resource and cannot be dispatched when needed.	Yes, with improvements in manufacturing processes.
Coal	greenhouse gases; air pollution	mining and drilling, habitat destruction, visual impact	CE → KE →ME →EE	Respiratory diseases, healthcare costs, monument defacing	Yes
Oil	greenhouse gases; air pollution	mining and drilling, habitat destruction, visual impact	CE → KE →EE	Respiratory diseases, healthcare costs, monument defacing	Yes
Natural Gas	greenhouse gases; air pollution	mining, habitat destruction, visual impact	PE →CE → KE →EE	Respiratory diseases, healthcare costs, monument defacing	Yes
Small Hydro	non-recyclable construction materials	habitat destruction	PE → KE →ME →EE	Water diversion; construction	Not much
Large Hydro	non-recyclable construction materials	habitat destruction, silt and sediment build-up, visual impact	PE → KE →ME →EE	Habitat destruction	Not much
Geothermal	non-recyclable construction materials	Drilling, piping, habitat destruction, visual impact	PE → CE →EE	Waste management	Yes
Biomass and waste	non-recyclable construction materials	?	PE →CE → KE →EE	Respiratory diseases, healthcare costs, monument defacing	Yes
Wave	non-recyclable construction materials	?	PE → KE →ME →EE	Potential impacts to marine life	Unknown
Nuclear	radioactive materials	mining, habitat destruction, visual impact	PE → KE →ME →EE	Radioactive waste management for 1,000s of years	Yes
Conservation	N/A	N/A	N/A	N/A	

Energy Summary Sheet, Student

Power source	LADWP's energy mix	California's energy mix	Renewable or Non-renewable	Cost to produce	Energy provided by
Solar	**<1%**	**<1%**		10-50	
Wind	**1%**	**<1%**		6-9	
Coal	**46%**	**29%**		2-4	
Oil	**0%**	**0%**		Not in CA anymore	
Natural Gas	**29%**	**35%**		5-10	
Small Hydro	**6%**	**<1%**		2-10	
Large Hydro	**8%**	**31%**		2-5	
Geothermal	**<1%**	**4%**		8-12	
Biomass and waste	**1%**	**<1%**		8-12	
Wave	**0%**	**0%**		Not commercial in Southern CA	
Nuclear	**9%**	**0%**		2-4	
Conservation	**N/A**	**N/A**		--	

Power source	Waste	Non-monetary Costs	Energy conversion route	Hidden Environmental Costs	Can source be less polluting?
Solar	non-recyclable silicon, plastic etc.			Solar is only available when the sun is shining, but that is usually when most electricity is used. Thermal storage could help.	Yes, with improvements in manufacturing processes.
Wind	non-recyclable construction materials			Wind is an intermittent resource and cannot be dispatched when needed.	Yes, with improvements in manufacturing processes.
Coal	greenhouse gases; air pollution			Respiratory diseases, healthcare costs, monument defacing	Yes
Oil	greenhouse gases; air pollution			Respiratory diseases, healthcare costs, monument defacing	Yes
Natural Gas	greenhouse gases; air pollution			Respiratory diseases, healthcare costs, monument defacing	Yes
Small Hydro	non-recyclable construction materials			Water diversion; construction	Not much
Large Hydro	non-recyclable construction materials			Habitat destruction	Not much
Geothermal	non-recyclable construction materials			Waste management	Yes
Biomass and waste	non-recyclable construction materials			Respiratory diseases, healthcare costs, monument defacing	Yes
Wave	non-recyclable construction materials			Potential impacts to marine life	Unknown
Nuclear	radioactive materials			Radioactive waste management for 1,000s of years	Yes
Conservation	N/A			N/A	

Family Energy Conservation Checklist

	Suggestions
1. Are all lights turned off when everyone has left the room even for a few minutes? __ Yes __ No	It is not true that it is less costly to leave fluorescent lights burning even for a few minutes.
2. In rooms that have heating or air conditioning, are the doors and windows closed? __Yes __ No	
3. If you have an air conditioning system or a room air conditioning unit, are the filters cleaned or changed regularly? __Yes __ No	Clean filters enables the air conditioning system to operate more efficiently.
4. Are window blinds, draperies, or shades closed to reduce the heat load? __Yes __ No	Blinds, draperies or shades closed during the warmest part of the day help keep out extra heat and allows the the air conditioning system to operate more efficiently.
5. Are all unneeded lighting fixtures or electrical appliances disconnected or removed? __Yes __No	
6. Does your refrigerator door form a tight seal so no air escapes? __Yes __No	See if you can place a dollar bill between the door and seal. If the dollar can be easily slid out, the refrigerator door gaskets probably need to be replaced.
7. Have you purchased Compact Fluourescent Lights (CFLs) to replace incandescent lights? __Yes __No	CFLs provide the same amount of light as comparable incandescent lights but use one third of the energy and last ten times longer. However, CFLs shouldn't be used with dimming devices or in enclosed fixtures.

8. Are air conditioning units turned off when they are not needed?
__Yes __No

9. Are thermostats set at 78 degrees Fahrenheit in summer and 68 degrees in winter?
__Yes __No

10. Have you installed or are you using ceiling fans or whole house fans for comfort cooling?
__Yes __No

11. If you are purchasing new electrical appliances, are they labeled as energy efficient "Energy Star" products?
__Yes __No

12. To reduce the heat from the sun have you considered planting shade trees on south and west systems facing sides of your home?
__Yes __No

Trees are not only beautiful but can help air conditioning operate more efficiently by keeping some of the heat from the sun away from walls.

For further information about Los Angeles Department of Water and Power (LADWP) Conservation Programs including rebates call 1-800-DIAL DWP or 1-800-827-5397.

I have discussed the important energy saving tips with

_____ _____

Student's Name Signature of Adult

Power Professions

Lineman / Electrician

Electricians and linemen install, repair, and maintain electrical equipment. What do we mean by electric equipment? You've certainly seen the power lines or utility boxes that help bring power to your home. These workers may also operate some of the power company equipment at central facilities and distribution centers. Often, electricians and linemen need to work with the electrical engineers who designed the systems. Linemen help distribute electricity in your community.

Chemist

Chemists work with matter. They study the behavior of atoms and molecules, often in reactions. A water chemist is important because many natural substances dissolve in water. Or, a water geochemist may study the watershed providing water to a river. Chemists at the power company may investigate how the company affects local water. For exmple, what happens when warmed waters from power plants are placed back in to natural settings? Chemists also study materials. For example, what substances work best in silicon solar cells? Chemists address these sorts of questions.

Customer Service Representative

Customer service representatives help people use electricity. They answer many important kinds of questions that users may have about the company. This can include information about bills, or setting up service. They can also direct you to other departments that can help you further with your specific questions. They're not involved in producing energy. However, they are key bridge between the company generating power, and the customers who use the power.

Mechanical Engineer

Mechanical engineers design tools, engines, and machines. The systems include pipes, wires, and the heavy machinery of power plants. Mechanical engineers also help build new facilities for generating energy. One example is new sets of solar thermal facilities in Southern California. Another example is wind mill farms. These engineers help generate the power, and get it to your community.

Power Plant Operator

Power plant operators oversee the production of power. They track the use of energy in your community. They work in solar, wind, and hydroelectric facilities. They run power plants on a day-to-day basis. This is especially important during periods of high energy use, such as during hot summer days. At times, plant operators also need to respond to emergencies. Such emergencies could develop from seismic events (earthquakes), or gradual changes in climate, such as lower amounts of rainfall. They need to get the power ready for you to use.

2020 New Power Mix

Power source	Current LADWP energy mix	Proposed 2020 LADWP Energy Mix	Change in Total	Reason / Rationale for Change
Solar	**<1%**			
Wind	**1%**			
Coal	**46%**			
Oil	**0%**			
Natural Gas	**29%**			
Small Hydro	**6%**			
Large Hydro	**8%**			
Geothermal	**<1%**			
Biomass and waste	**1%**			
Wave	**0%**			
Nuclear	**9%**			
Conservation	**N/A**			
TOTAL				