stem to Read

Powered by Wind

This kit provides a wide range of activities to explore energy and wind. Create art with air, use wind to move a car and harness the power of energy!

NEW MEXICO STATE LIBRARY

INVENTORY OF TRUNK

Powered by the Wind

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❑	❑	5 laminated activity sheets
		<u>Books</u>
❑	❑	*Gilberto and the Wind* by Marie Hall Ets
❑	❑	*Energy Makes Things Happen* by Kimberly Brubaker Bradley

Over →

- ❑ ❑ *The Windy Day* by Anna Milbourne and Elena Temporin
- ❑ ❑ *Hot Air: The (Mostly) True Story of the First Hot-Air Balloon Ride* by Marjorie Priceman
- ❑ ❑ *The Wind Blew* by Pat Hutchins
- ❑ ❑ *Like a Windy Day* by Frank Asch & Devin Asch
- ❑ ❑ *The Boy Who Harnessed the Wind* by William Kamkwamba and Bryan Mealer
- ❑ ❑ *I Face the Wind* by Vicki Cobb
- ❑ ❑ *Can You See the Wind?* by Allan Fowler
- ❑ ❑ *Air is All Around You* by Franklyn M. Branley
- ❑ ❑ *Pinwheel* by Salina Yoon

<u>Wind Cars</u>

- ❑ ❑ 6 car bodies
- ❑ ❑ Wooden dowels
- ❑ ❑ Bag of foam sails
- ❑ ❑ 2 fans

<u>Air Paintbrush</u>

- ❑ ❑ 4 paint cups with lids and funnel lids

<u>Powered by Light: Solar Cells</u>

- ❑ ❑ Solar cell: monkey
- ❑ ❑ Solar cell: pandas
- ❑ ❑ Solar cell: frog
- ❑ ❑ Solar cell: red flower
- ❑ ❑ Solar cell: black beetle
- ❑ ❑ Solar cell: gold beetle
- ❑ ❑ Clip on LED desk lamp
- ❑ ❑ 2 flashlights

<u>Windmills</u>

- ❑ ❑ 4 pre-made "party" windmills
- ❑ ❑ 2 bags of Knex pieces for windmills
- ❑ ❑ 3 bags of pre-made windmill blades
- ❑ ❑ 4 peg boards.

<u>How Many Ways to Turn on a Light?</u>

- ❑ ❑ 2 wire strippers
- ❑ ❑ Digital multimeter
- ❑ ❑ 2 hand generators
- ❑ ❑ 2 solar cells
- ❑ ❑ 2 battery holders
- ❑ ❑ 2 buzzers
- ❑ ❑ 2 LEDs
- ❑ ❑ 2 motors

❑	❑	2 windmills
❑	❑	Cables
❑	❑	Multimeter directions
❑	❑	2 Energy conversion kit study guides

To Be Provided by Borrowing Library*

❑	❑	Drinking straws
❑	❑	Bottle of blue tempera paint
❑	❑	Bottle of red tempera paint
❑	❑	AA batteries
❑	❑	Electrical tape
❑	❑	Craft foam
❑	❑	Copy paper
❑	❑	Pipettes
❑	❑	Additional flashlights
❑	❑	Additional solar toys

* Some of these materials are provided in the kit but may be recommended to purchase as they will not be restocked by NMSL in the future.

Checked by _____ Date _____

Checked by _____ Date _____

Wind Cars

Beforehand:
Check that all materials are in working order. In particular, check that sails are in good shape. There should be a minimum of 12 in the kit. Make new ones using the different patterns as necessary. Replace broken dowels as needed.

Materials:

- Craft Foam Sails minimum of 16 total, four different styles
- ¼" Dowels 12 inch lengths - minimum of 15
- Car Bodies - 6
- Fan

Preparation:
Clear an area to be used as a road for the cars. Set the fan at one end of the defined track space. On a table nearby, set out 4-5 car bodies, 8-10 sails of different shapes and sizes, and 8-10 dowels. Put together a model wind car. Set up prompt.

Questions to Extend Discoveries:
Invite participants to build a car with a sail. Next, set it in front of the fan. Make sure the fan is on and the moving air blows directly on the wind car. What happens to the car? Encourage participants to experiment with changing the shape and size of the sail to see how it changes how the car moves when pushed by the wind. Also experiment with the speed of the fan to see how it changes the movement of the car. The following questions can be used to encourage discoveries:

"What happens to your car when you put it in front of the fan?"
"What happens if you change the speed of the fan?"
"What happens if you change out the sail?"
"What do you notice about the size of the sail and how the car moves?"
"What do you notice if you keep the same size sail and change the speed of the fan?"
"What happens if there is no sail on the car?"
"Try adding more than one sail. What happens now?"
"What do you notice about the shape of the sail and the velocity the car moves?"
"What do you notice about the speed of the fan and the velocity the car moves?"
"Design a car with a sail that the wind pushes slowly."
"Design a car with a sail that the wind pushes quickly."
"Try orienting the sail in different directions. What do you notice about how the car moves?"

Air Paintbrush

Beforehand:
Check that there are enough materials in the kit. Restock if necessary.

Materials:

- Copy paper 8 ½" x 11" or fingerprint paper - minimum of 100
- Drinking straws - minimum of 100
- Tempera paint in 2 different colors
- Pipettes - 20, includes spares
- Paint cups with lids - minimum of 2
- Paper Towels - TO BE GATHERED (not in kit)

NOTE: Pipettes may become tinted with color over time. If washed out each time, they should last a long time.

Preparation:
Place a tablespoon of one color of tempera paint in a paint cup. Dilute with equal amounts of water. Consistency should be slightly thicker than water and able to be siphoned up and squirted out by a pipette. Place a pipette in the paint. Repeat with the second color of tempera paint. On the table, set out a stack of 15 or so sheets of paper, new drinking straws (20), and diluted cups of paint. Create an example painting. Set up prompt.

NOTE: Tables can be covered with painter's plastic.

Questions to Extend Discoveries:
Squirt the pipette to set a small amount of paint on the middle of the piece of paper. Take a straw and blow through it with enough force to move the paint. Encourage participants to see what kinds of designs they can make by moving where and how they are blowing. Use the questions below to encourage discoveries.

"Try blowing on the paint from different directions. What happens?"
"Try blowing softly. What do you notice about how the paint moves?"
"Try blowing in a quick burst. What do you notice about how the paint moves?"
"Blow on the paint by blowing straight down on the paper. How does the paint move?"
"Blow on the paint by holding your straw parallel to the paper. How does the paint move?"
"Add a second color of paint in a line. Try blowing on this line of paint. What happens?"

Powered by Light: Solar Cells

Beforehand:
Check that lamp and flashlights work. Hold the lights directly over the solar cells of the toys to ensure they react to the "sunlight".

Materials:

- Variety of toys that have solar cells (8)
- Clip on LED desk lamp
- Flashlights - 4

Preparation:
Plug in LED desk lamp and clip to the table. Set out a selection of toys and flashlights. Set up prompt.

Questions to Extend Discoveries:
Invite participants to see if they can use a light source (aka the "sun") to get the solar cell toys to move. The following questions can be used to encourage discoveries:

"What happens if you place one of the toys beneath the desk lamp and turn on the light?"
"Try moving the light closer to the toy. What do you notice happening?"
"What happens if you move the light source further away?"
"Turn on a flashlight and point it at the solar cells on one of the toys. What happens?"
"What do you discover if you move the flashlight closer and further away from the solar cell?"

To Extend: What happens if the solar toy is placed in direct sunlight, either in a window or outside? Compare how the toy works near the window versus outside. Some windows have a special UV film.

How Many Ways to Turn on a Light?

Beforehand:

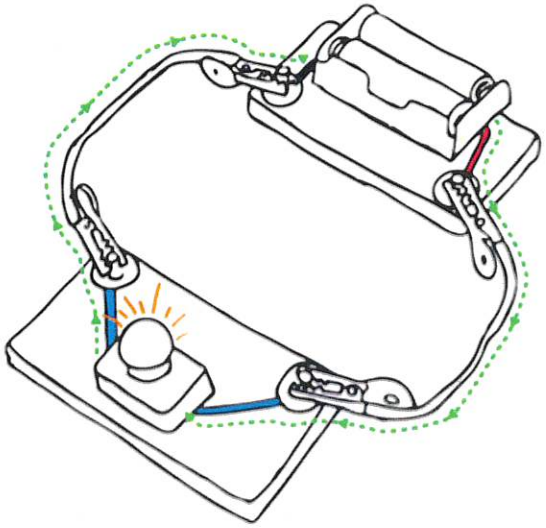
- Check for broken connections and repair them.
- Put batteries and light bulbs in appropriate holders They should be removed from their blocks after each program.
- Use the multimeter to check batteries. A good voltage reading is 1.4 V or higher.

Background Information and Tips for Facilitator:

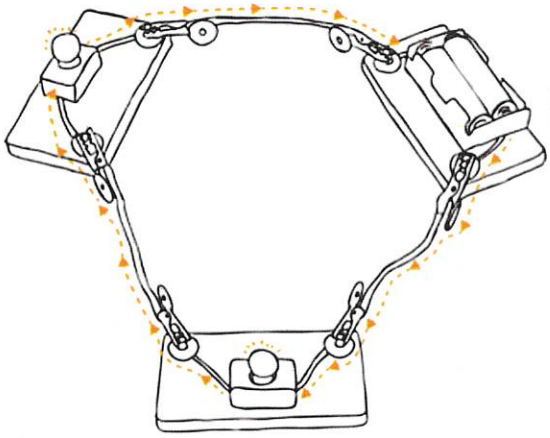
What is a circuit? A circuit is a closed loop (like a circle) where electrons flow from an energy source, such as a battery, to the object being turned on, such as a light bulb, and back again. Switches work by breaking the circuit (loop), thereby breaking (interrupting) the connection so that the electrons cannot flow. See graphics below for basic types of circuits.

Images from CIP Learning Store

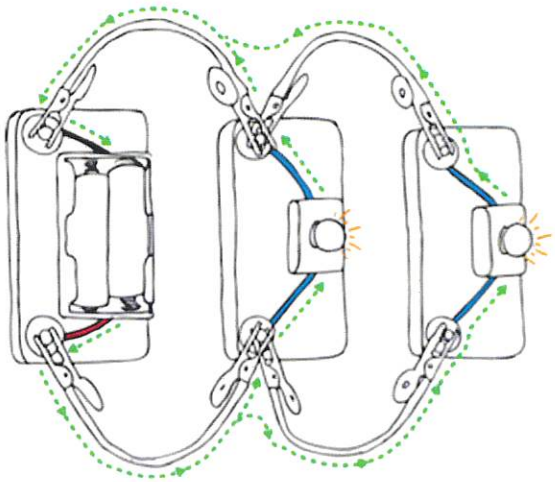
Simple Circuit



Series Circuit



Parallel Circuit



A **Battery Block** is specially designed with a resettable fuse, which protects it from short circuits (which can cause batteries to get very hot and, on occasion, can cause them to catch fire). A short circuit is when a battery is connected back to itself without the electrons traveling through and powering a device such as a light bulb.

Materials:

- Energy Conversion Circuit Blocks
  - Hand generator (mechanical energy) -2
  - Batteries (chemical energy) - 2
  - Solar cell (sunlight/radiant energy) - 2
  - Windmill (wind power/ mechanical energy) - 2
  - LED - 2
  - Motor - 2
  - Buzzer - 2
  - Cables/wire - 12

- AA batteries - 2 required for each battery block

Optional to Gather:

- Multimeter - can be used to measure the voltage and amperage produced by the different energy generating devices
- Wind source such as fan (to gather or share with other activities) or hair dryer (to gather, not included in the kit)

NOTE: Batteries should **NOT** be stored in the battery holder. Removing the batteries after use will keep the battery holder from being destroyed if a battery leaks.

Preparation:
Set circuit blocks on the table. Set up the prompt.

Questions to Extend Discoveries:
Invite participants to create a circuit using two wires and the battery so that they turn on something, like a light bulb. Encourage participants to see what else can they turn on or off. Encourage participants to try different energy sources, like a hand generator or solar cell. Use the following questions to encourage and scaffold discoveries:

"Show me what you have discovered."
"What have you been able to turn on?"
"I noticed that you made a circle between the battery and light bulb with the wires. What would happen if we made this circle bigger and included another block?"
"How would you create a circuit that uses the hand generator to turn on the light bulb?"
"How would you turn on the light using the solar panel? … the windmill?"
"Try turning on the motor or the buzzer using the different energy sources. What do you discover about them?"

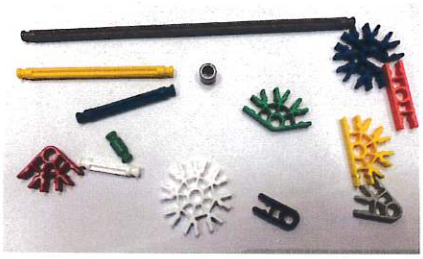
NOTE: If the battery becomes hot, a short circuit has been created. A basic example of this is when a battery is connected back on itself without traveling through something else and doing work (e.g., powering a light bulb).

Windmills

Beforehand:
Check that there are enough windmill blades. Repair or make new ones if needed. Templates for windmill blades are included in the binder

Materials:

- Windmill blades made from K'Nex® and craft foam -
    - Minimum of 4 of each of four different shapes and sizes
- K'Nex® pieces [see image below]
- Pegboard Bases
- Fan



K'nex® pieces

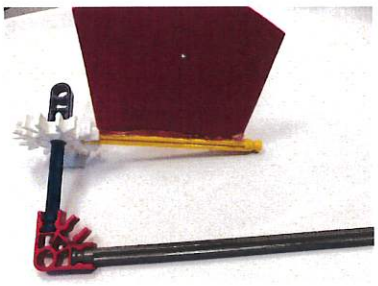
Windmill blades

Preparation:
Set up a fan. Set pegboard bases in front of the fan. Create an example windmill. Set out a selection of K'Nex® pieces and windmill blades. Set up prompt.

Questions to Extend Discoveries:
Invite participants to create a windmill that will rotate in the wind created by the fan. Encourage participants to try different size blades, different numbers of blades, and orienting the blades in different directions to see what they can discover. Use the following questions to encourage and scaffold discoveries:

"What happens to your windmill when you place it in front of the fan?"
"Try moving your windmill closer to the fan. What happens? Further away. What happens?"
"Try turning your windmill blades so they face a different direction. What do you notice?"
"What happens if you change the number of blades?"
"What happens if you change the size of the blades?"
"How would you design your windmill so that it spins quickly? Slowly?"

NOTE: The hub that the windmill blades are attached to needs to be able to rotate freely around an axle to allow the windmill to move.



To Extend: For a take home activity, have participants make a pinwheel. A variety of patterns and basic instructions can be found online. A pinwheel pattern and directions is also included in the binder.