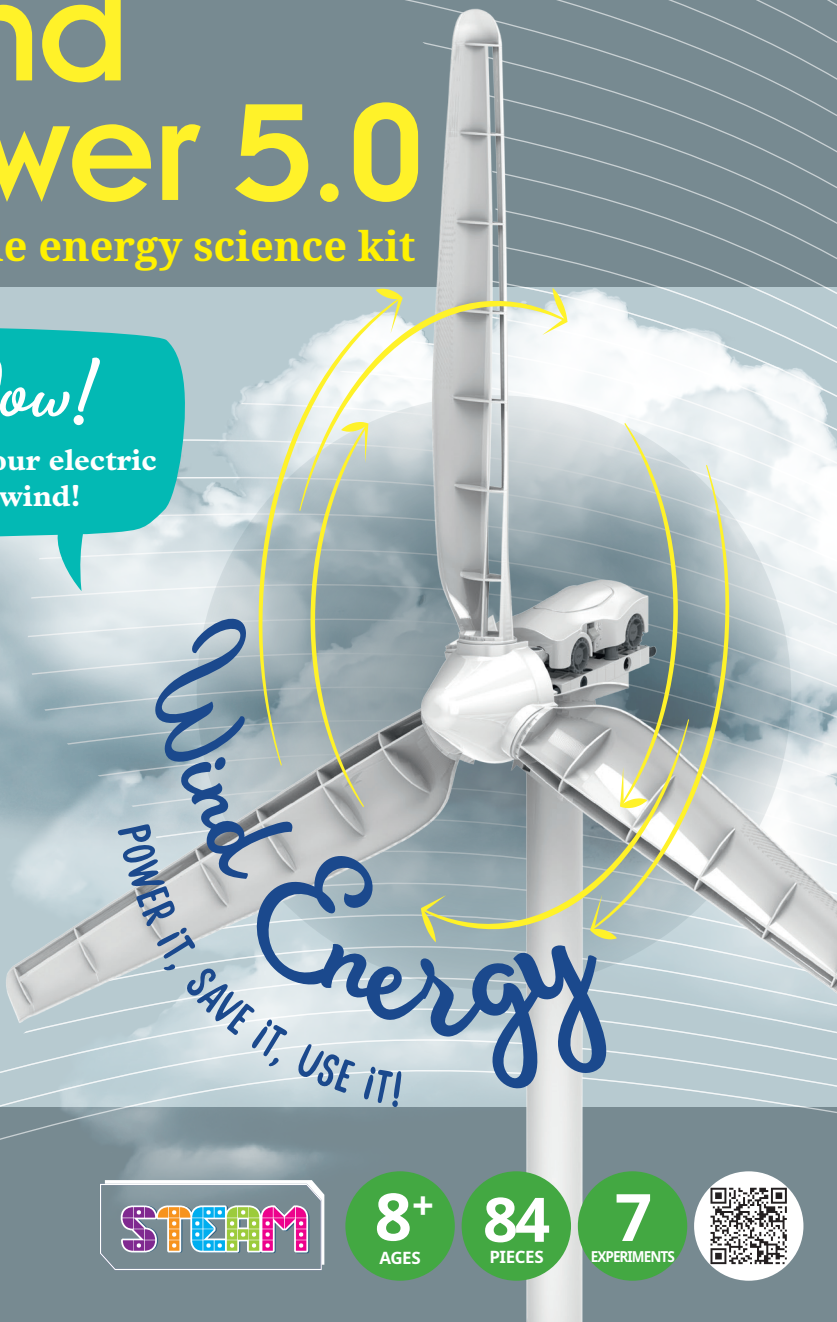
GIGO | GREEN ENERGY | # 7087

Wind Power 5.0

Renewable energy science kit

Wow!

Power your electric car with wind!



Wind Energy

POWER IT, SAVE IT, USE IT!

STEAM

8+ AGES

84 PIECES

7 EXPERIMENTS

TABLE OF CONTENTS

YOU WILL ALSO NEED:

Small and magnetic Phillips screwdriver, compass, device with internet access, scissors, piece of paper, pen, and tape.

TIP!

YOU CAN FIND ADDITIONAL KNOWLEDGE IN THE 'CHECK IT OUT' SECTIONS ON PAGES 19–22, 25, AND 31.

TIP!

YOU CAN FIND THE QUICK GUIDE TO OPERATING WIND TURBINES ON PAGES 32 AND 33.

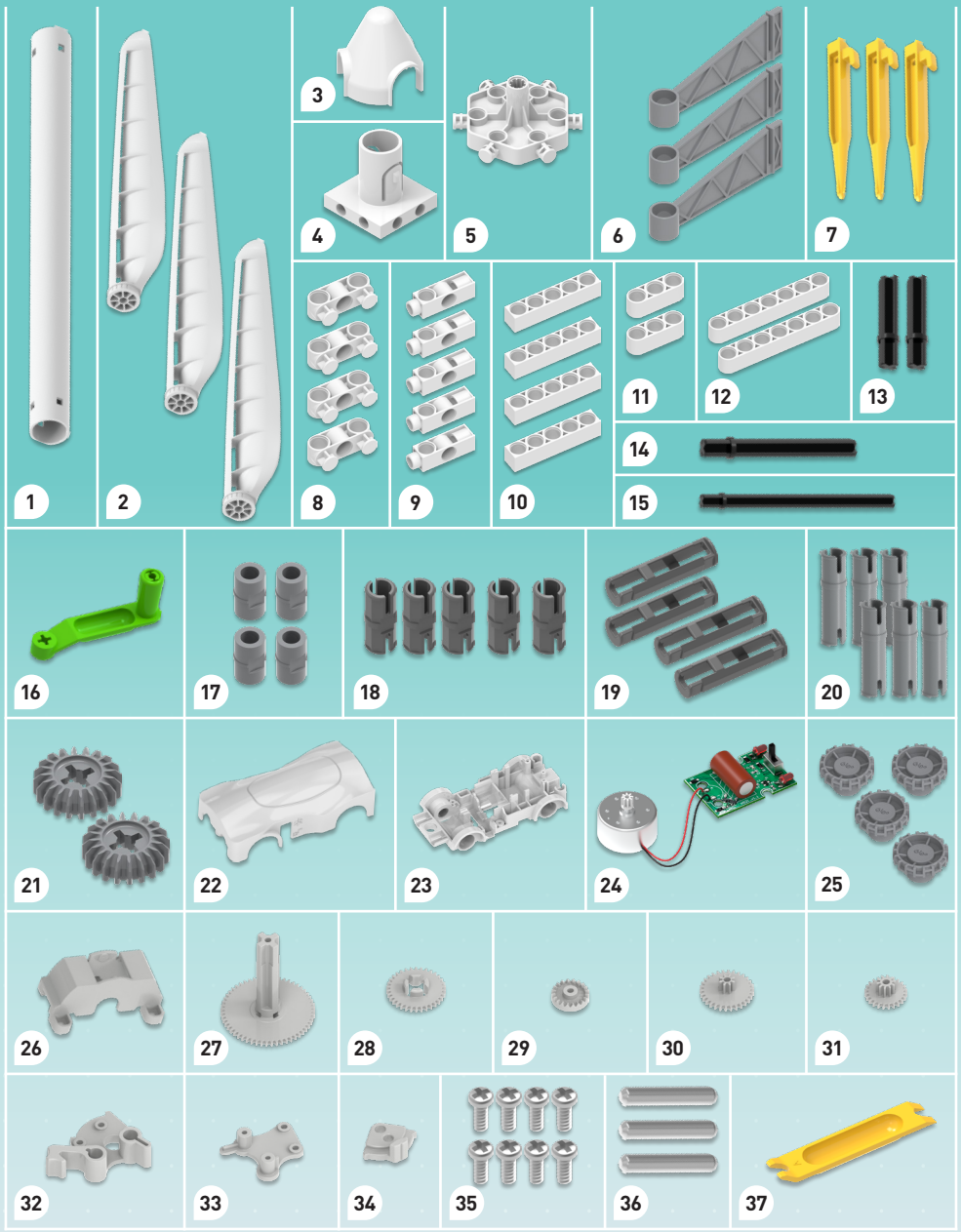
Yay!
— Let's go !

Checklist:

	NO.	Description	Qty.	Item No.
○	1	E-410mm TUBE	1	1060-W17-410W
○	2	C-WIND TURBINE BLADE	3	7430-W10-G1W
○	3	C-HUB	1	7400-W10-B1W
○	4	C-TUBE ADAPTER	1	7324-W10-E1W
○	5	C-ADAPTER	1	7400-W10-B2W
○	6	C-TENT STAKE FIXER	3	7430-W10-H1S
○	7	C-STAKE	3	7430-W10-I1Y
○	8	C-3 HOLE DUAL ROUND ROD WITH PEGS	4	7404-W10-B1W
○	9	C-3 HOLE DUAL ROD	5	7413-W10-Y1W
○	10	C-5 HOLE ROD	4	7413-W10-K2W
○	11	C-3 HOLE ROUND ROD	2	7404-W10-C1W
○	12	C-7 HOLE ROUND ROD	2	7404-W10-C2W
○	13	C-35mm AXLE II	2	7413-W10-O1D
○	14	C-60mm AXLE II	1	7413-W10-M1D
○	15	C-100mm AXLE III	1	7413-W10-L1D
○	16	C-CRANK	1	7326-W85-D1G
○	17	C-LONG PEG	4	7061-W10-C1S
○	18	C-STATIC AXLE CONNECTOR	5	1187-W10-E1S2
○	19	C-30mm STATIC CONNECTOR TUBE	4	7066-W10-A1S
○	20	C-30mm AXLE CONNECTOR	6	7413-W10-U1S
○	21	C-20T GEAR	2	7026-W10-D2S1
○	22	C-EV SHELL	1	7087-W10-A2W
○	23	C-EV CHASSIS	1	7087-W10-A1W
○	24	H-SUPERCAPACITOR SET	1	7087-W85-A
○	25	C-EV TIRE	4	7087-W10-B1S
○	26	C-EV MOTOR COVER	1	7087-W10-C1S
○	27	C-EV GEAR WITH AXLE	1	7087-W10-C2S
○	28	C-34T EV GEAR	1	7087-W10-C4S
○	29	C-20T EV CROWN GEAR	1	7087-W10-C3S
○	30	C-8T/30T DOUBLE SPUR GEAR	1	G30#1114-2
○	31	C-10T/24T DOUBLE SPUR GEAR	1	G30#2024B
○	32	C-EV GEARSTICK	1	7087-W10-C5S
○	33	C-EV GEAR HOUSING	1	7087-W10-C6S
○	34	C-EV POWER SWITCH	1	7087-W10-C7S
○	35	O-ROUND HEAD SCREW M2*5	8	M20-44
○	36	O-SHORT METAL ROD	3	M10#1155
○	37	B-PEG REMOVER	1	7061-W10-B1Y

KIT CONTENTS

What's inside your experiment kit:



Warning!

Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled.

Warning: This toy is designed for children aged 8 and up, as it contains accessible electrical components.

Instructions for parents or caregivers are included and must be followed.

Keep the packaging and instructions as they contain important information.

The kit may only be operated when fully assembled. An adult must verify proper assembly before use.

Notes on Environmental Protection /Notes on Disposal of Electrical and Electronic Components:

The electronic components of this product are recyclable. For the sake of the environment, do not throw them into the household trash at the end of their lifespan. They must be delivered to a collection location for electronic waste, as indicated by the following symbol:

Please contact your local authorities for the appropriate disposal location.

Here are the recommended handling suggestions:

Check for free appliance recycling centers or other reuse points in your area. Contact local authorities for details.
Delete personal data from old devices before recycling.
Remove detachable parts like batteries or bulbs before disposal to ensure proper recycling.
Opt for durable products and reuse old appliances whenever possible to reduce electronic waste.

Children can learn about wind power and its applications through the models in this kit. Before starting assembly, ensure the children are aware of essential electrical safety precautions.

IMPORTANT INFORMATION

Dear Adult Helpers,

Children love to be amazed, explore, and create. They want to try things for themselves and discover how things work.
With our Gigo experiment kits, they can do all this and more. It's not just about experiments—it's about nurturing curiosity and building confidence for a stronger, more capable individual.

Before starting, read the instructions with your child, review the safety information together, and keep them handy for reference. Ensure the models are correctly assembled and support your child throughout the experiments.

→ The wind turbine can be used both outdoors and indoors. It requires a wind force between 2 and 4 on the Beaufort scale to function properly. Stronger winds may damage the wheel. You can find the Beaufort scale on page 21, which explains wind speed classifications. Indoors, you can simulate wind by using a fan. This allows you to control the wind speed and create the necessary conditions for the wind turbine to operate, even when there is no natural wind available.

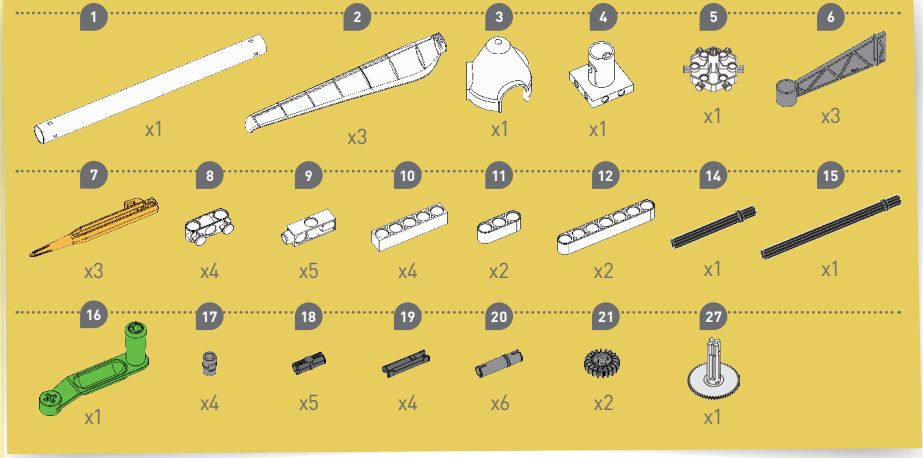
→ The wind turbine model is splash-proof and can be used outdoors. However, it is crucial to protect it from the weather, particularly from moisture and frost, which can cause significant damage to the electrical system and other components. To prevent any harm, make sure to store the model in a dry, sheltered area when not in use. After each experiment, it is important to carefully disassemble the wind turbine to safeguard its functionality. You can clean all external parts with a damp cloth, but please avoid using soap or detergents, as these may damage the materials. Remember, protecting the model from extreme weather conditions is essential to ensuring its long-term performance and safety. We hope you and your child have a great time exploring and experimenting with the kit!

Have Fun!

Building YOUR WIND TURBINE

Humans have been building wind turbines for centuries to harness the power of the wind. Initially used to grind grain, today they are primarily used to generate electricity. Now, it's your turn to build one for yourself and experience firsthand how wind energy works.

CONSTRUCTION OF THE WIND TURBINE



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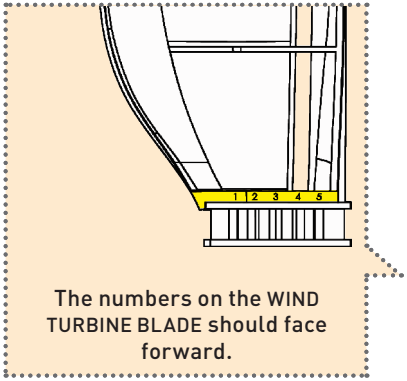
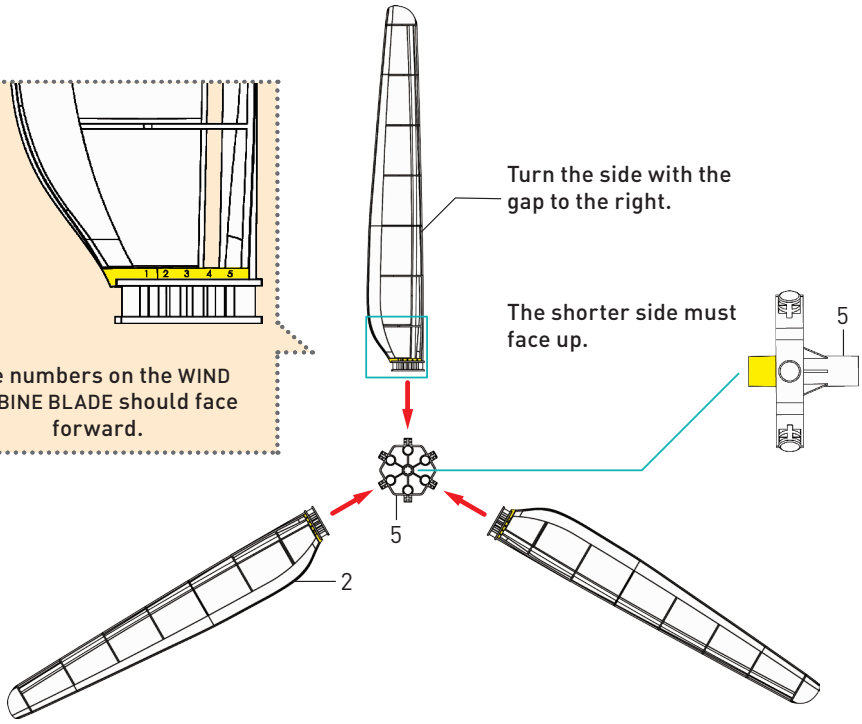


The numbers on the WIND TURBINE BLADE should face forward.



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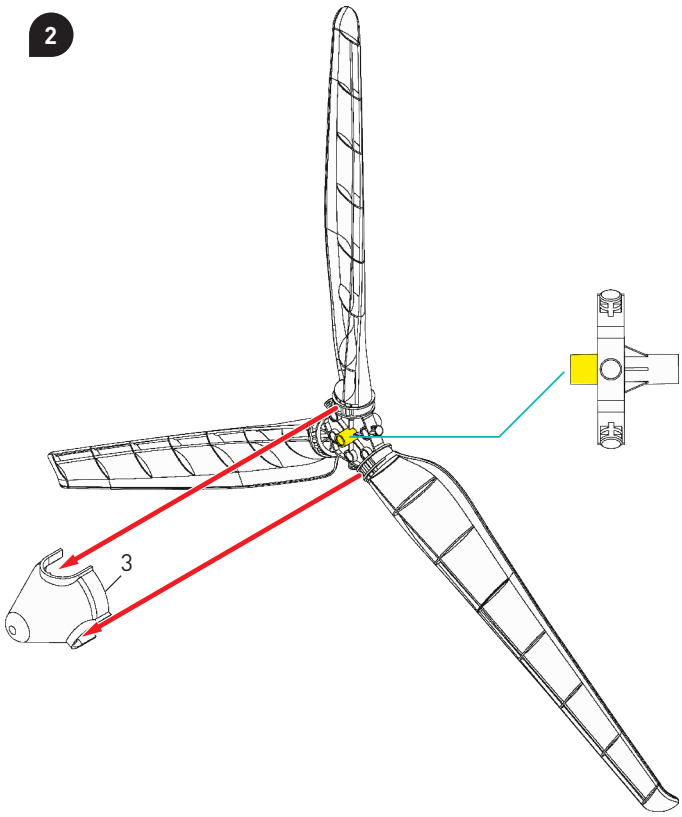

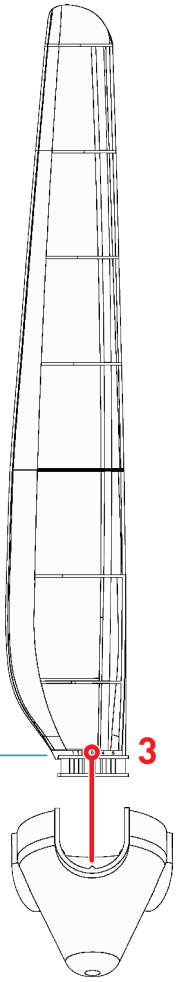

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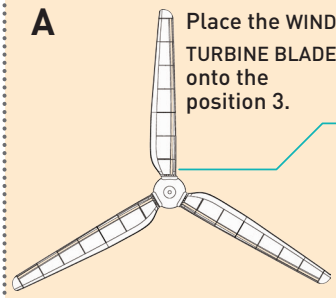
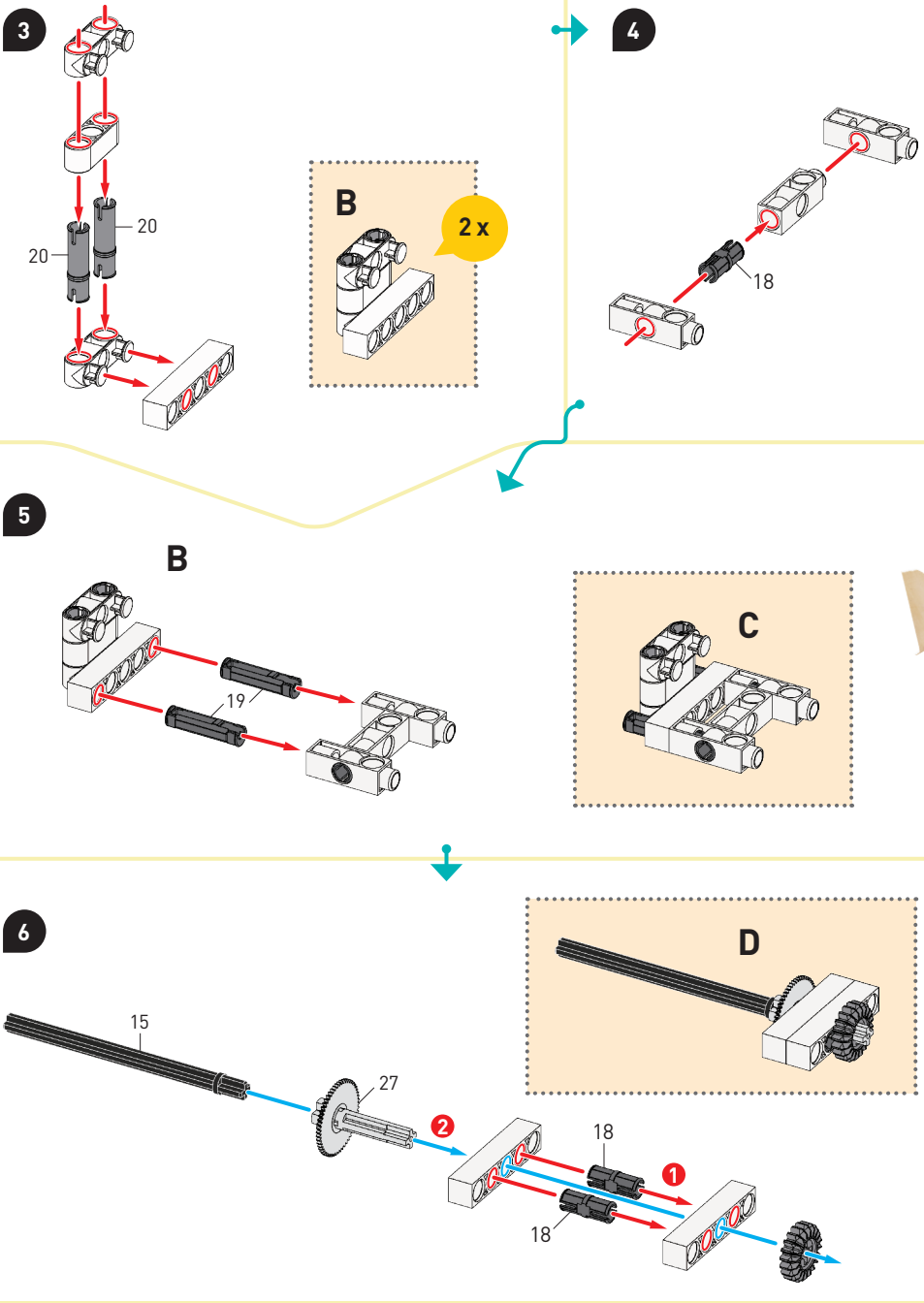
Place the WIND TURBINE BLADE onto the position 3.

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C
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D
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27
2
18
1
18

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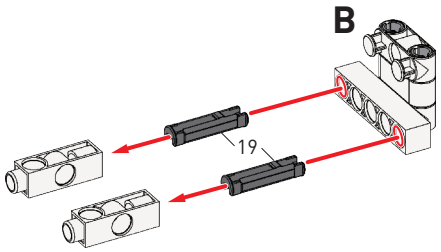

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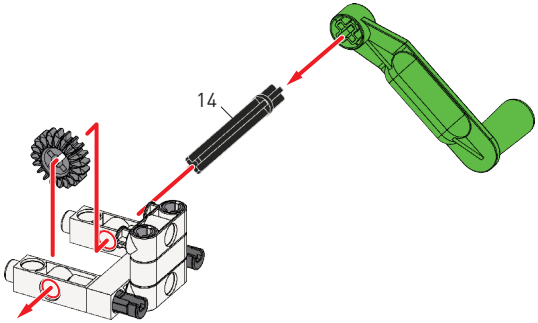
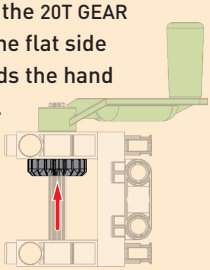
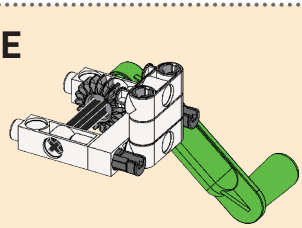


Press the 20T GEAR with the flat side towards the hand crank.





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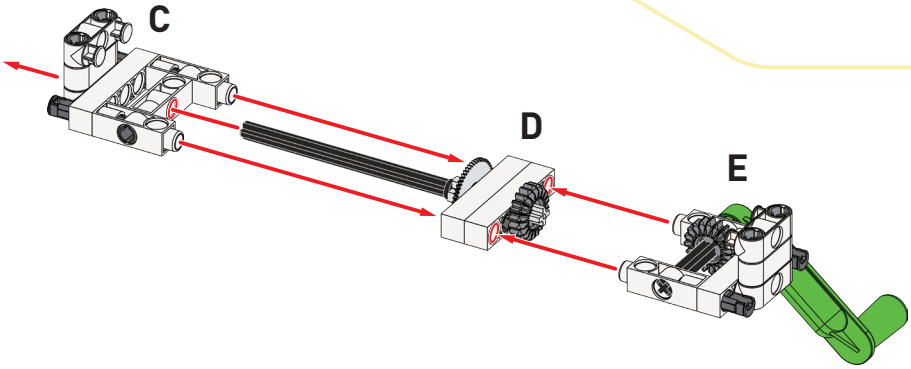
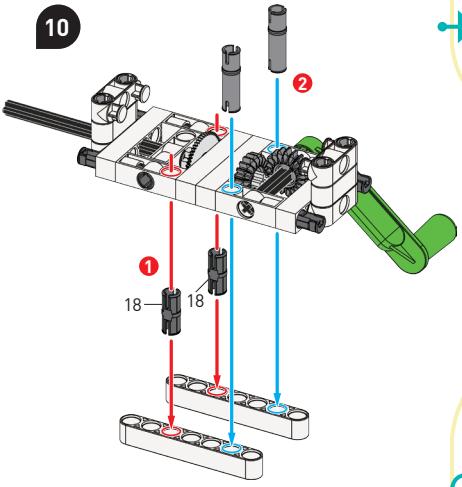
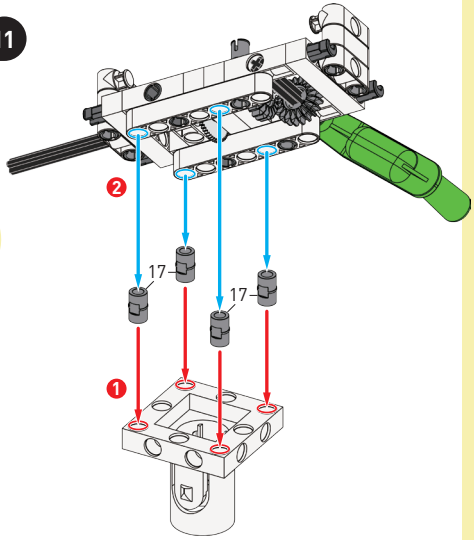
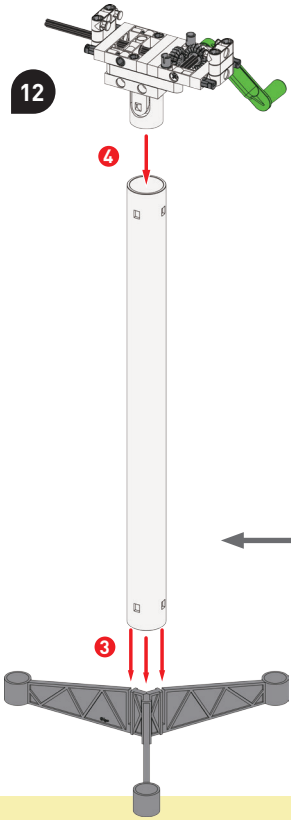
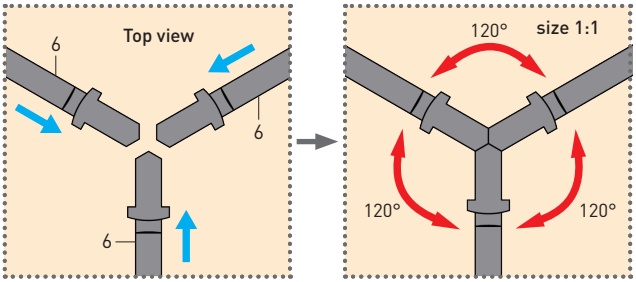


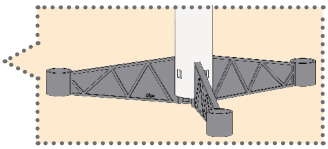






Put your TENT STAKE FIXER together and then plug in the 410mm TUBE on it.





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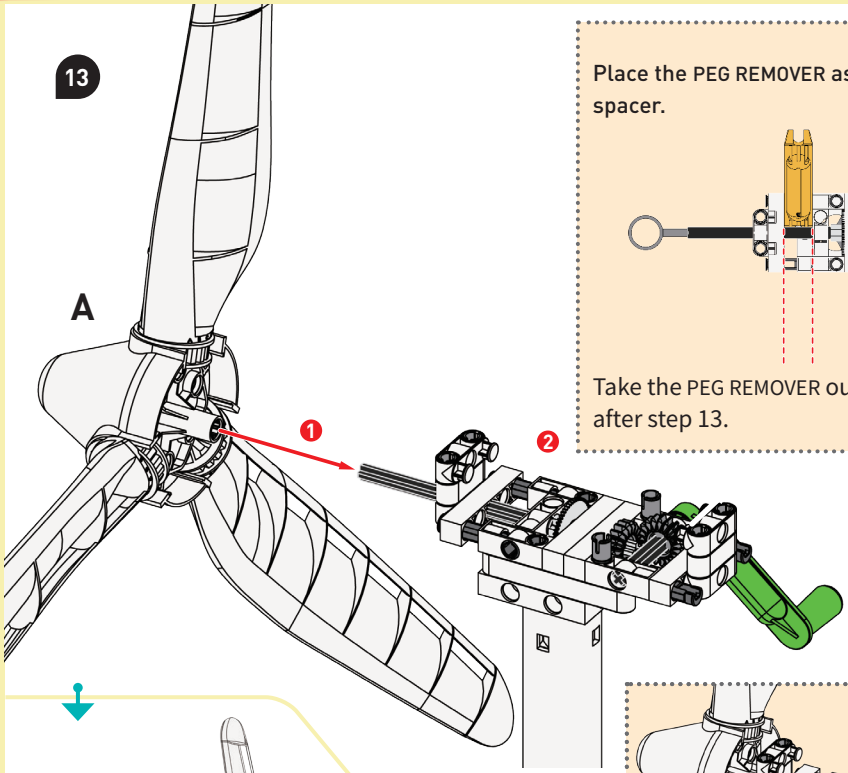
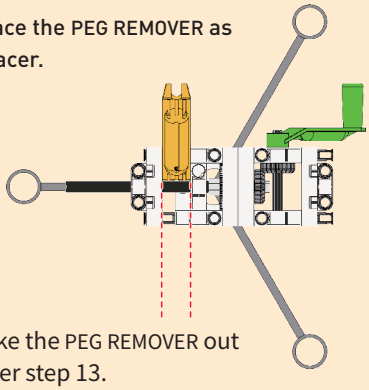
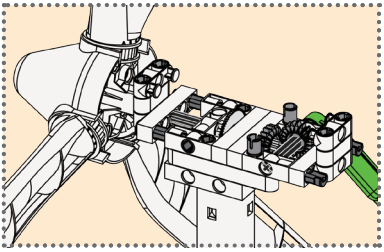


Place the PEG REMOVER as spacer.



Take the PEG REMOVER out after step 13.



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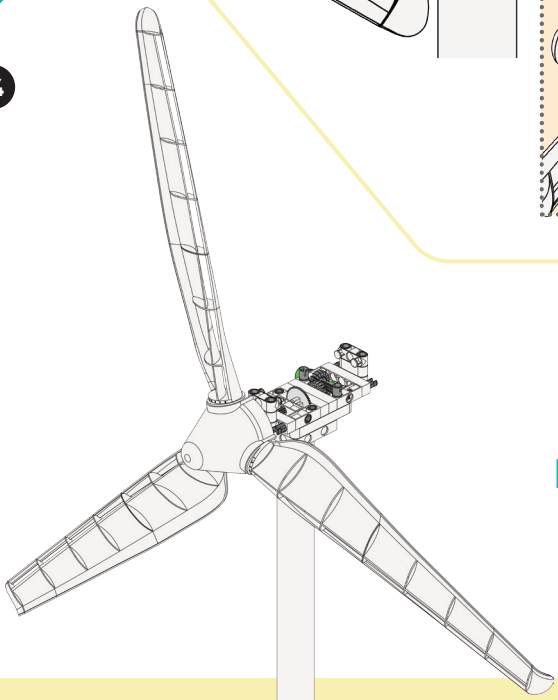
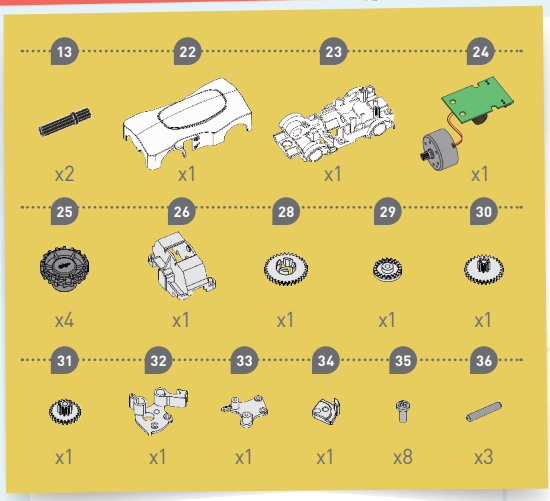


Done!

STRUCTURE OF THE ELECTRIC CAR



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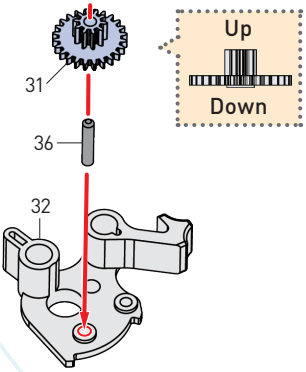
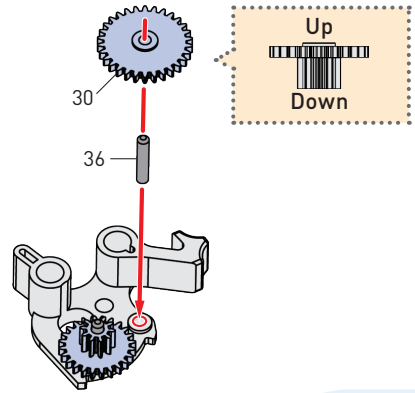


2 Ensure the gears are inserted correctly.



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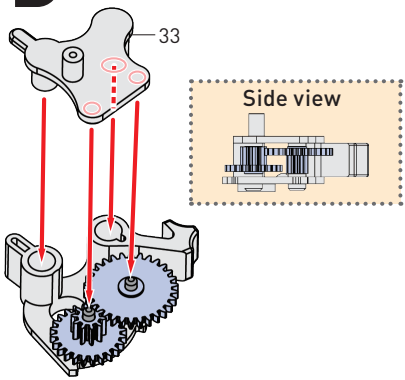
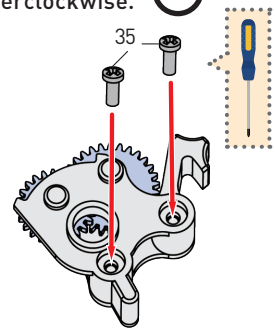


Turn it counterclockwise.

4



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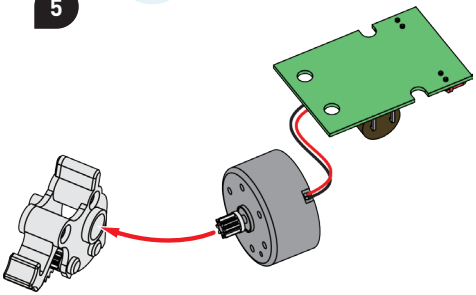

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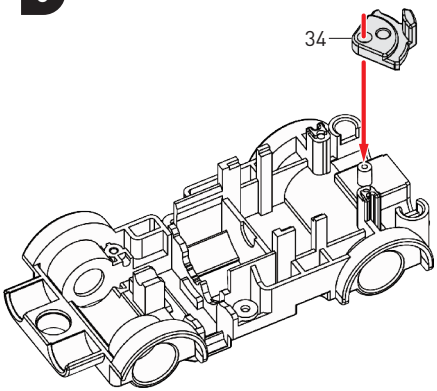

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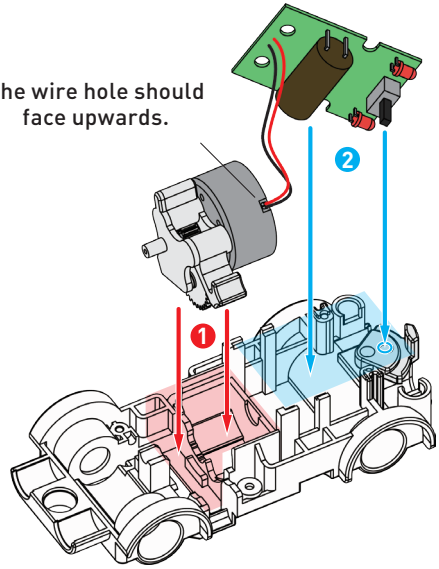
The wire hole should face upwards.



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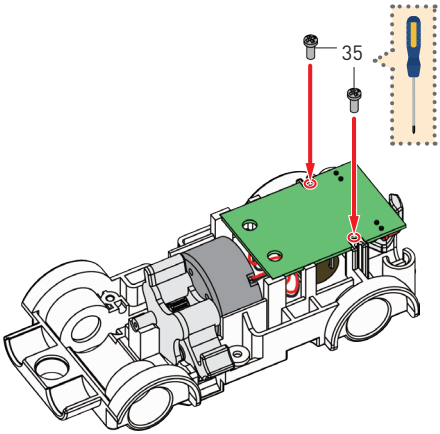

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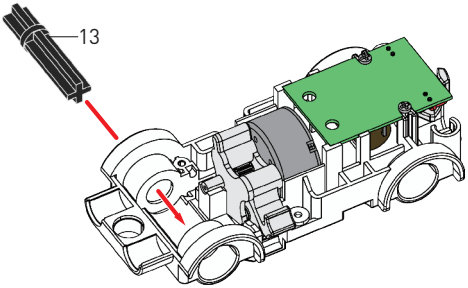

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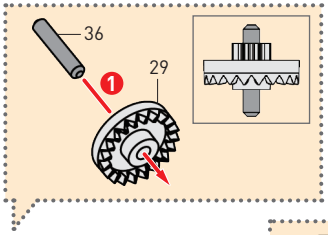

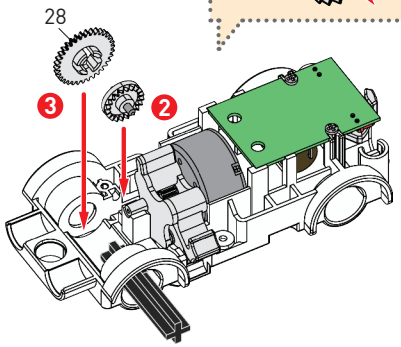

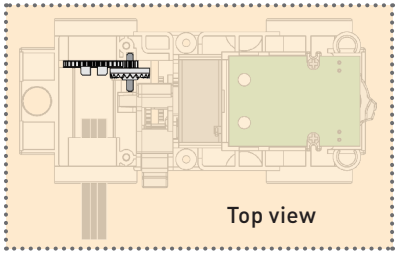

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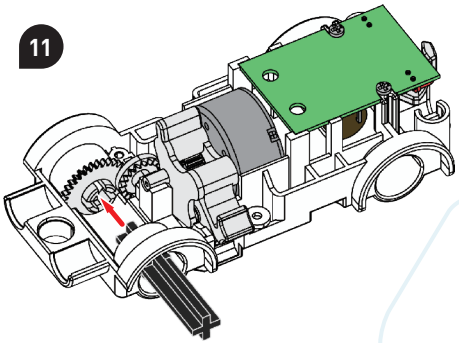

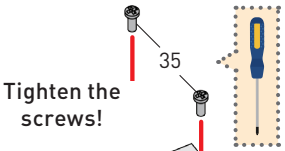

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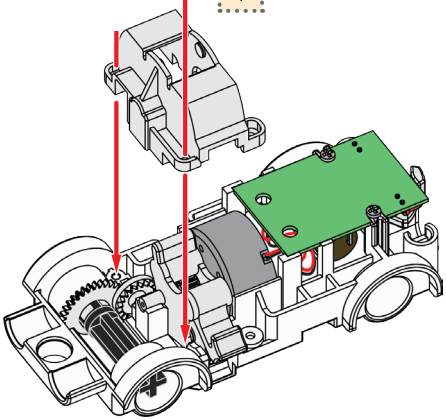

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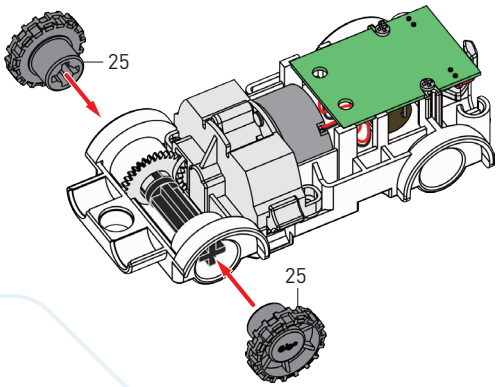

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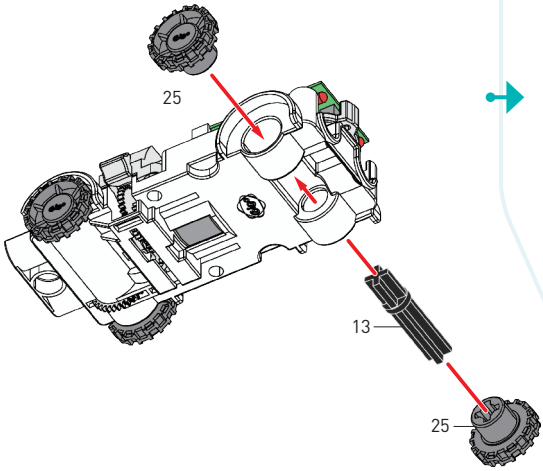

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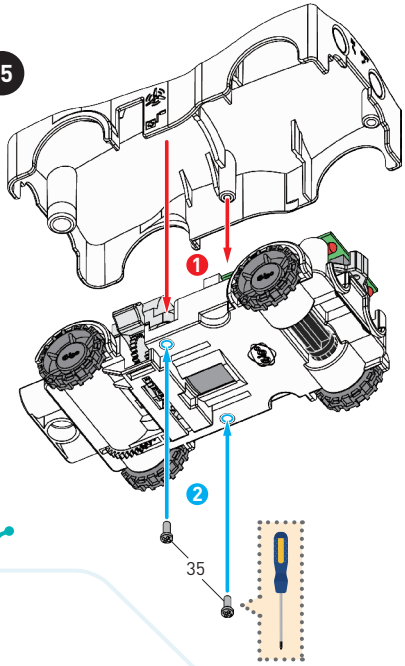
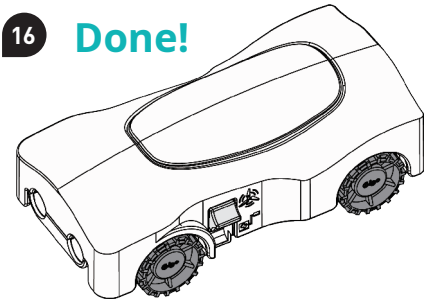


16 **Done!**



WHAT'S HAPPENING?

The nacelle of your wind turbine also serves as an electric car. It contains all the necessary technology, including an electric motor that functions both as a generator and an energy storage device. For more information about the technology, refer to page 25.

MOUNTING THE ELECTRIC CAR ON THE WIND TURBINE

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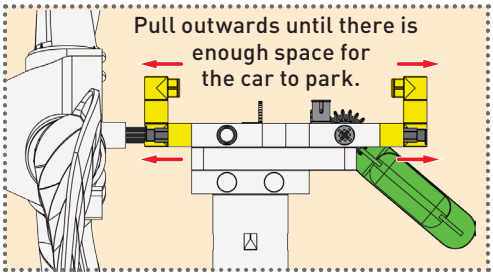

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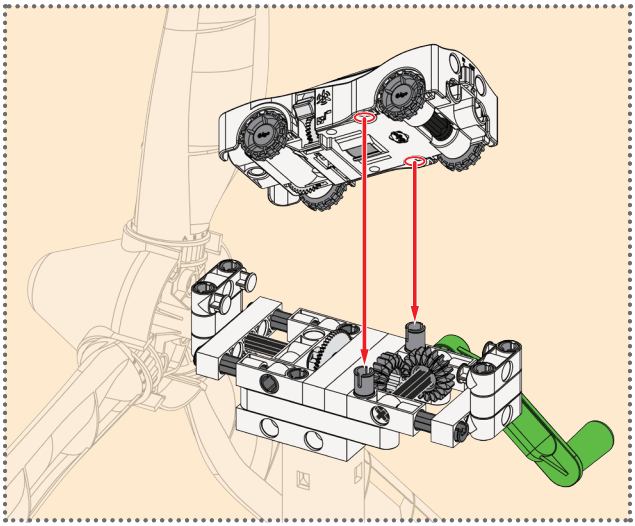

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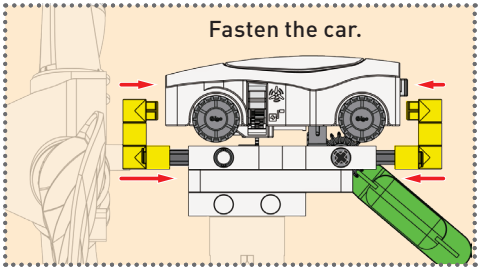

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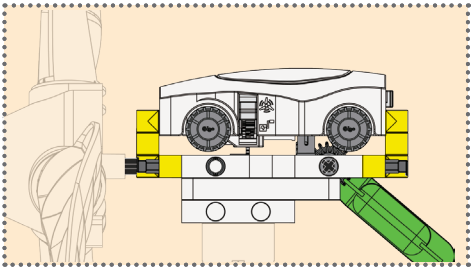

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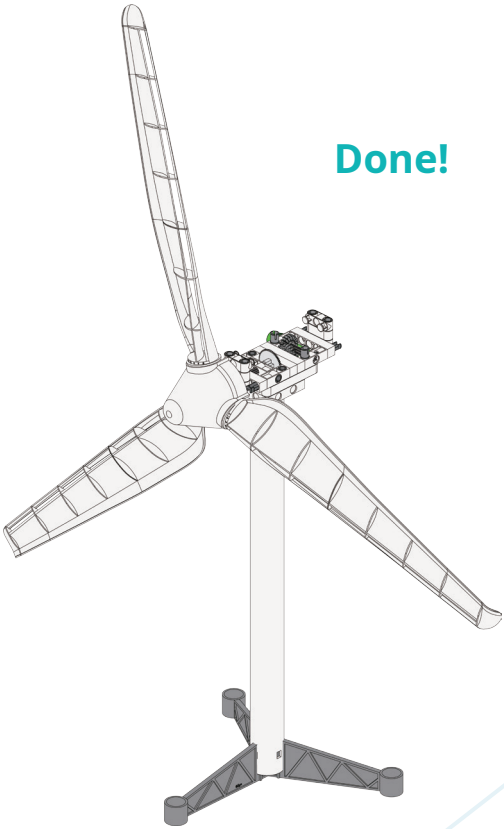
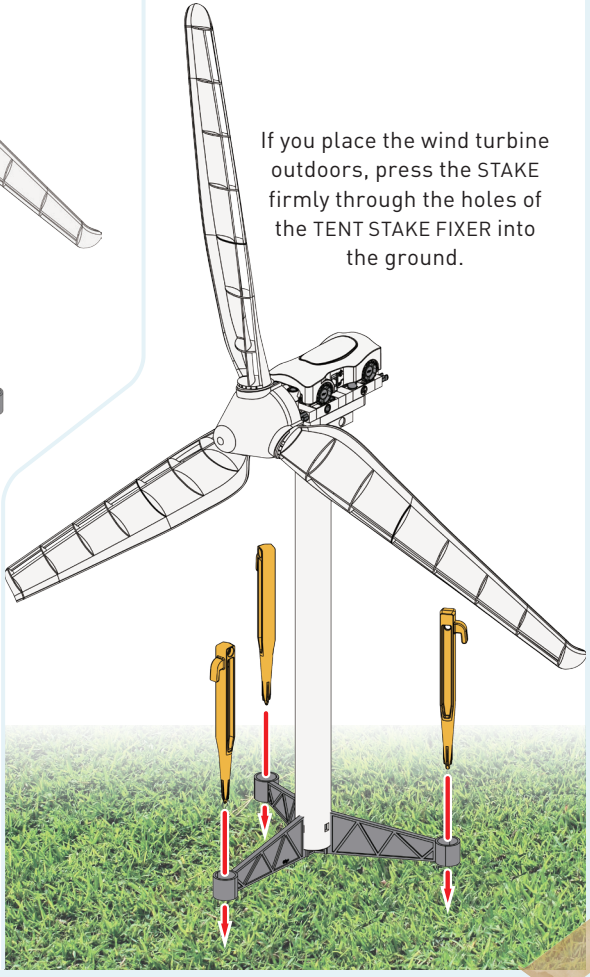


If you place the wind turbine outdoors, press the STAKE firmly through the holes of the TENT STAKE FIXER into the ground.



TIP!

FOR OPERATING THE WIND TURBINE AND CORRECTLY SETTING THE SWITCH, PLEASE REFER TO PAGES 32 AND 33.

EXPERIMENT 1

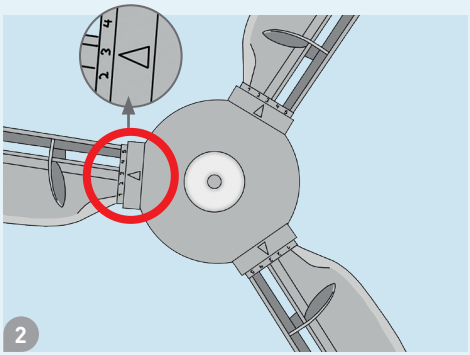
Faster than the wind!

You'll need

- **Wind turbine**
- **Electric car**

HERE'S HOW

1. Take your wind turbine to an open outdoor area, such as a meadow or playground. If it's a windy day, you can proceed directly to Experiment 4.
2. Adjust the WIND TURBINE BLADE to the position 3.
3. Switch the control on the side of the car to the wind turbine symbol.
4. Set the rear switch on the car to "IN".
5. Hold the wind turbine at arm's length in front of you and start running quickly. Ensure you are running against the wind, not with a tailwind.



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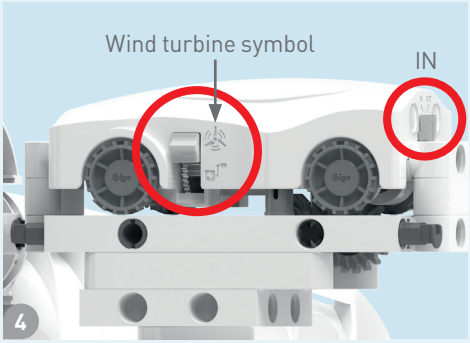

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5

WHAT'S HAPPENING?

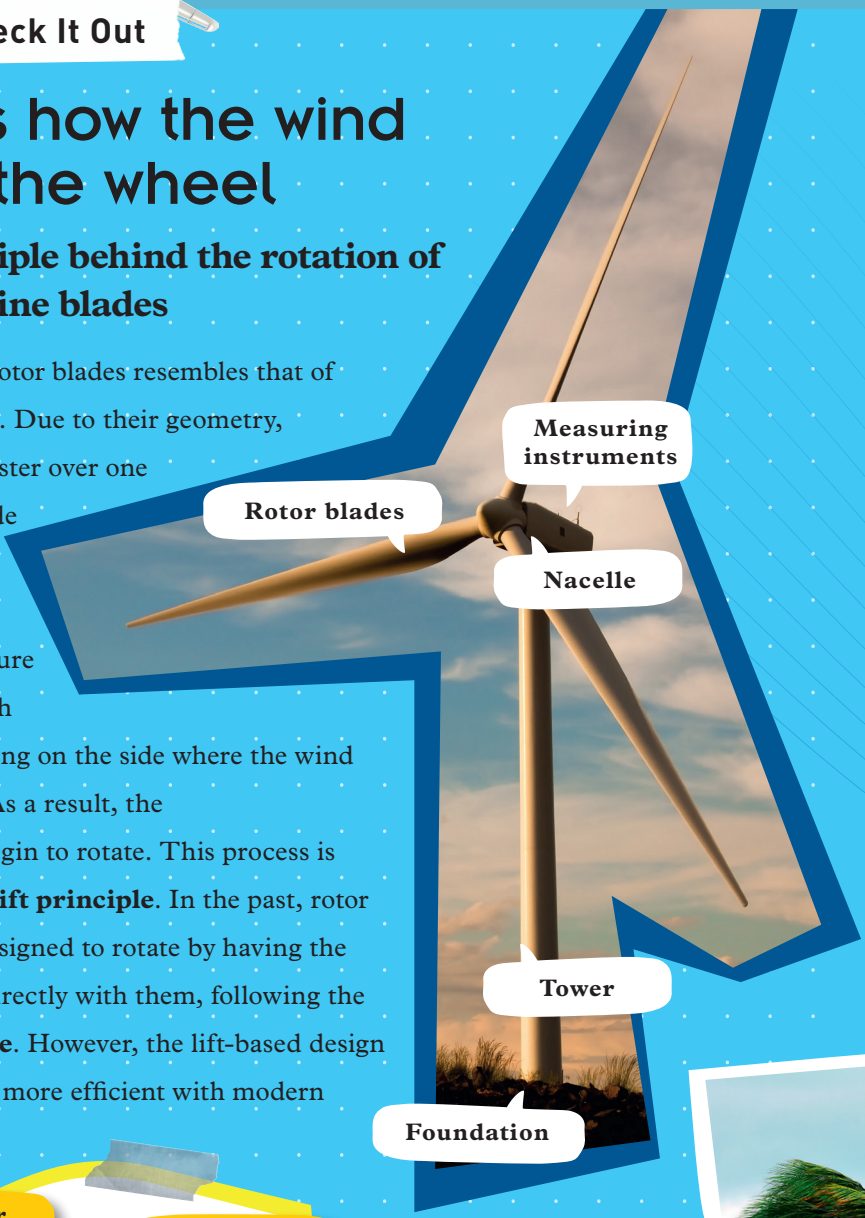
When you are moving quickly, it feels like you create the wind. In reality, it's not true wind, as it's you moving through the air, not the air itself moving. However, the effect is the same: your wind turbine starts to spin.

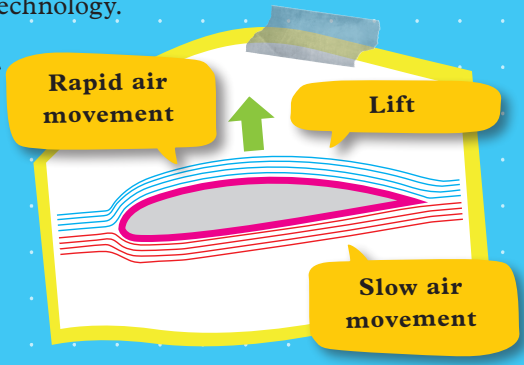
Check It Out

This is how the wind turns the wheel

The principle behind the rotation of wind turbine blades

The shape of rotor blades resembles that of airplane wings. Due to their geometry, wind travels faster over one side of the blade than the other. This creates a pressure difference, with more air pressing on the side where the wind moves faster. As a result, the rotor blades begin to rotate. This process is known as the **lift principle**. In the past, rotor blades were designed to rotate by having the wind collide directly with them, following the **drag principle**. However, the lift-based design is significantly more efficient with modern technology.





Wind

Wind is the movement of air, but what sets this air in motion?

The driving force behind wind is the sun. When sunlight reaches the earth, it heats the air near the ground, causing it to rise. As the warm front ascends, cold front moves in to fill the gap, preventing a void from forming. This flow of air is what we experience as wind.

MEASURING WIND SPEED

When operating wind turbines, as well as in our everyday lives, it can be important to be able to measure and communicate how strongly the wind is blowing. To make sure that this information is standardized and comprehensible to everyone, agencies like the weather service use the Beaufort scale.

The Beaufort Scale

Wind force according to Beaufort scale	Wind speed km/h	Wind speed m/s	Description	Effects on the land
0	< 1	< 0,3	Calm, still air	No air movement. Smoke rises vertically.
1	1 – 5	0,3 – 1,6	Light air, gentle draft	Smoke drifts slightly to the side, but pinwheels and wind vanes do not move.
2	6 – 11	1,6 – 3,4	Light breeze	Rising smoke clearly shows the wind direction. Leaves rustle and you can feel the wind in your face.
3	12 – 19	3,4 – 5,5	Gentle breeze	Pennants, leaves, and thin twigs move gently.
4	20 – 28	5.5 – 8,0	Moderate breeze	Branches move. Loose paper is swept around on the ground.
5	29 – 38	8,0 – 10,8	Fresh breeze	Large branches and small trees sway in the wind. The wind is clearly audible.
6	39 – 49	10,8 – 13,9	Strong breeze	Thick branches move. It becomes difficult to properly hold umbrellas.
7	50 – 61	13,9 – 17,2	High wind, moderate gale	Trees sway and you can feel resistance when walking into the wind.
8	62 – 74	17,2 – 20,8	Gale, gusty wind	Leaves and twigs are torn from trees. Even large trees can be moved around.
9	75 – 88	20,8 – 24,5	Strong/ severe gale	Branches break. Bricks and chimneys can be damaged by the wind.
10	89 – 102	24,5 – 28,5	Storm, whole gale	Trees break or are even uprooted. Garden furniture is blown away and there is heavy damage to houses.
11	103 – 117	28,5 – 32,7	Violent storm	Severe damage to forests (wind breakage), roofs are torn off, vehicles are thrown out of their lanes, and thick walls are damaged.
12	> 117	> 32,7	Hurricane	Most severe storm damage and destruction, especially near the ocean.

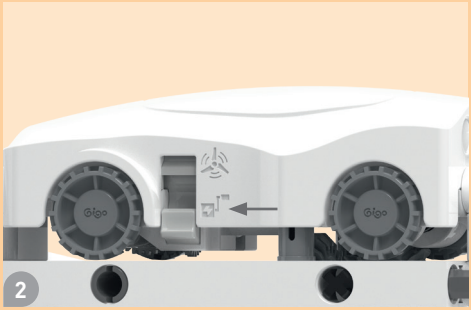
Electric car

The energy harnessed from wind power can be utilized in various ways, such as charging the batteries of electric cars. However, electric cars are only truly emissions-free if their electricity comes from renewable energy sources. If oil or gas is burned to generate electricity, CO_2 emissions are not eliminated—they are simply shifted from the car to the power plant.

Electricity generation via human muscle power

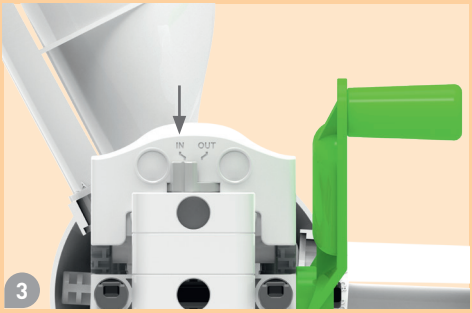
You'll need

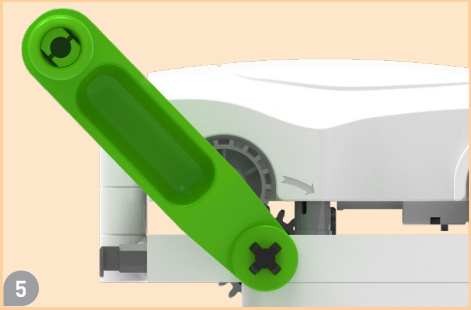
- **Wind turbine**
- **Electric car**



HERE'S HOW

1. Attach the car to the wind turbine.
2. Switch the control on the side of the car to the hand crank symbol.
3. Set the rear switch on the car to "IN."
4. Ensure the wind turbine is unobstructed and can rotate freely.
5. Turn the hand crank to the right, following the direction indicated by the arrow on the car.





TIP!

IF YOU HEAR UNUSUAL SOUNDS OR EXPERIENCE OPERATIONAL ISSUES, REFER TO THE TROUBLESHOOTING TIPS ON PAGE 33.

WHAT'S HAPPENING?

If you turn the crank for long enough, the car's taillights will light up, indicating that the car is being charged with electricity. With the right tools, you can explore different energy conversions, such as transforming kinetic energy into electrical energy in this case.

EXPERIMENT 3

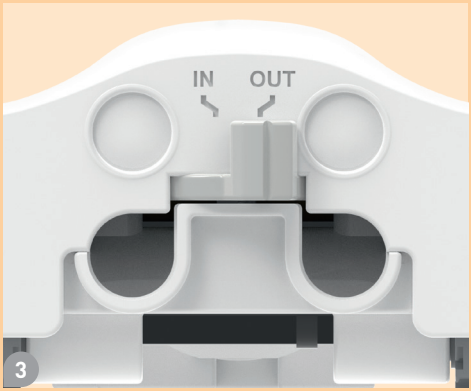
Activate your electric car

You'll need

– Electric car fully charged with electricity

HERE'S HOW

1. Remove the car from the wind turbine.
2. Make sure the control on the side of the car is set to the hand crank symbol.
3. Set the rear switch to "OUT" and place the car on a clean, level surface.



TIP!

YOUR CAR CAN RUN FASTER IF YOU CHARGE IT FOR A LONGER TIME. IF THE CAR DOESN'T RUN, REFER TO THE TROUBLESHOOTING TIPS ON PAGE 33.

WHAT'S HAPPENING?

In Experiment 2, kinetic energy is converted into electrical energy. In this case, the process is reversed: the stored electricity is used to power the car's movement.

MOTOR OR GENERATOR?

You may already know that the motor in your electric car is responsible for driving the vehicle and consuming electricity. Specifically, it converts electrical energy into kinetic energy.

A generator, on the other hand, works in the opposite way. It generates electricity by converting kinetic energy into electrical energy. For instance, when the wind turbine rotates, the generator ensures this energy transformation occurs.

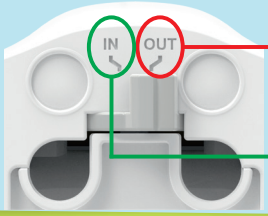
The SUPERCAPACITOR SET labeled with the component number 24 is the core of this wind turbine kit. It consists of an electric motor connected to a circuit board via two wires.

AND WHERE IS THE GENERATOR NOW?

Electric motors have a unique advantage: they can also function as generators. The difference lies in how the component is utilized:

- When an electric current flows through the component, it acts as a motor, causing the axle to rotate.

- When the axle is manually turned, such as with a hand crank or by wind, it functions as a generator, producing electrical energy.

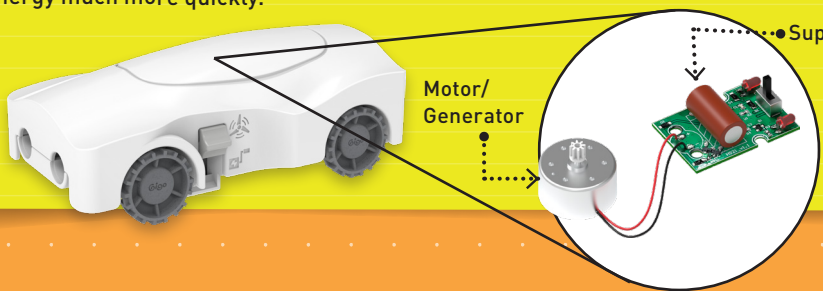


OUT: Motor-Mode
Current flows OUT of the supercapacitor

IN: Generator-Mode
Current flows INTO the supercapacitor

Where does the electricity flow?

You may notice that your wind turbine does not have any batteries. So, where does the electricity generated by the wind turbine flow?
On the circuit board, you'll see a noticeable red component—this is the energy storage. However, it is not a battery but a supercapacitor. A supercapacitor functions similarly to a battery in that it stores energy and can release it when needed. While a battery can store much more energy, a supercapacitor has the advantage of absorbing and releasing energy much more quickly.



Wind Energy Benefits

Wind holds a vast amount of energy. You may have experienced this yourself when riding a bike against a strong breeze. To harness this energy efficiently, there are a few important considerations. If the wind is too strong, it can even damage wind turbines.

Wind power generation

You'll need

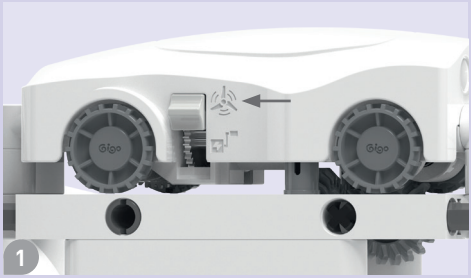
– Wind turbine

– Electric Car

– STAKES *or electric fan*

HERE'S HOW

1. Switch the control on the side of the car to the wind turbine symbol.
2. Place all rotor blades with the marking on the position 3.
3. Set the rear switch on the car to "IN." The electricity generated now flows into your car and is stored there.
4. Outdoors: If the wind speed is between 2 and 4 on the Beaufort scale (see page 21), you can experiment with the wind turbine outside. To set it up in your garden, simply push the three STAKES into the ground through the designated holes. This will provide enough stability.
   Indoors: If there is no wind or if the wind is too strong, you can place an electric fan about half a meter away from the wind turbine and turn it on.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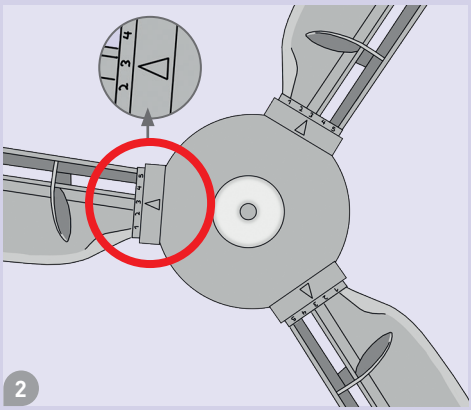

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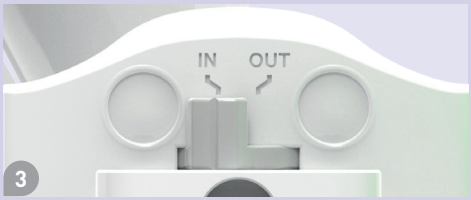

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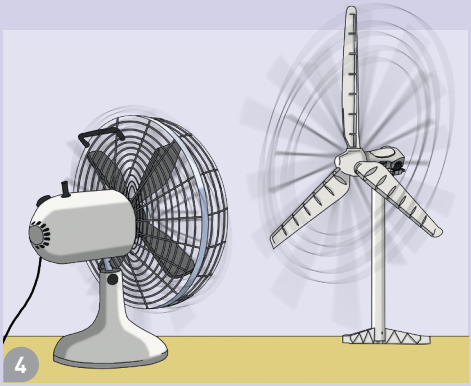
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EXPERIMENT 5

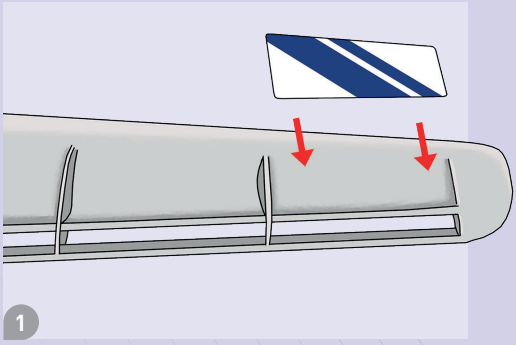
Modifying the wind turbine blades

You'll need

– Wind turbine
– Electric car
– Electric fan
– Tape
– Stopwatch
– Pen and paper

HERE'S HOW

1. Prepare for wind power generation mode by setting everything accordingly and positioning an electric fan in a fixed spot in front of your wind turbine. Attach a small piece of paper to one of the rotor blades to make it easier to count the revolutions per minute (RPM).
2. Adjust the angles of the rotor blades, ensuring all blades are set to the same angle.
3. Conduct a series of tests by recording the RPM for each angle setting. **Identify which angle works best for optimal performance.**
4. Experiment with uneven blade angles to observe what happens when the rotor blades are set at different angles.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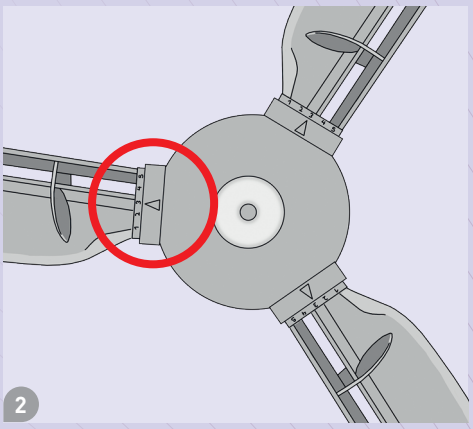
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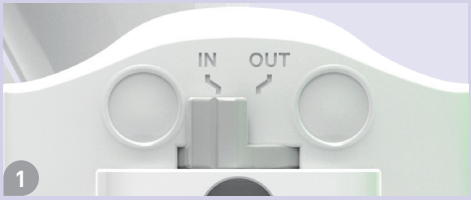
ANGLE POSITION	REVOLUTIONS PER MINUTE
1	
2	
3	
4	
5	

Location optimization

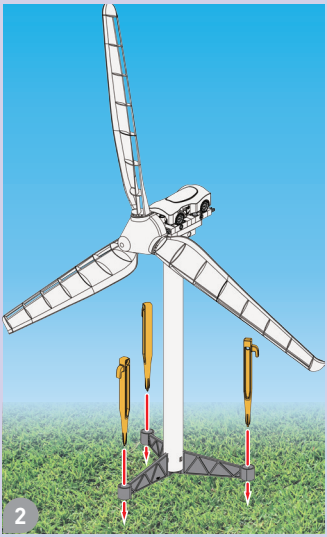


You'll need

– The constructed wind power plant
– Three STAKES

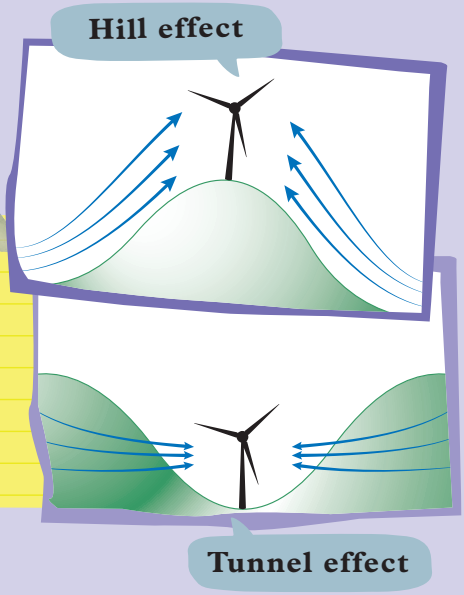
HERE'S HOW

1. Experiment outdoors if the wind speed ranges between 2 and 4 on the Beaufort scale. Set the rotor blades to the position 3, the side switch to the wind turbine symbol, and the rear switch to "IN."
2. Secure your wind turbine by anchoring it firmly in the ground with STAKES to prevent it from being blown over.
3. Think about possible locations for your wind turbine. How about, for example, on the next hill or in a narrow alley between houses? Is it recommended to take it to the nearest forest?



WHAT'S HAPPENING?

In general, the higher the wind turbine is positioned, the more wind it can capture. This is because there are fewer obstacles to block or deflect the wind. However, with the right wind direction, a narrow alley can also amplify wind speeds by channeling and concentrating the airflow.



EXPERIMENT 7

Wind power measurement

You 'll need

– The constructed wind power plant
– The Beaufort scale (page 21)
– A device with internet access
– A compass

How It Works

1. Determine wind direction and strength: Weather stations measure wind direction and strength. Use an internet search engine to find this information, and ask an adult for help if needed.
2. Position the wind turbine correctly: Your wind turbine performs best when it is aligned directly with the incoming wind. Use a compass and online data to adjust it accurately. Alternatively, you can observe the movement of trees or grass to identify the wind direction.
3. Set up the turbine properly: Ensure all switches are correctly configured—rotor blades set to the position 3, the side switch to the wind turbine symbol, and the rear switch to "IN." Then, watch as your wind turbine generates clean energy to charge your electric car.

Check It Out

Energy from wind

— Wind can create a lot of power depending on how fast it moves. We use this moving air to spin the rotor blades of our wind turbine. The next step is to turn this motion into electricity. It works like a bicycle dynamo: a magnet spins inside a coil of wire, and this creates electricity. That's it – you've got power!

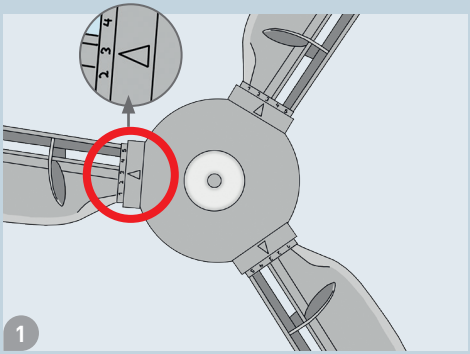
Energy transportation

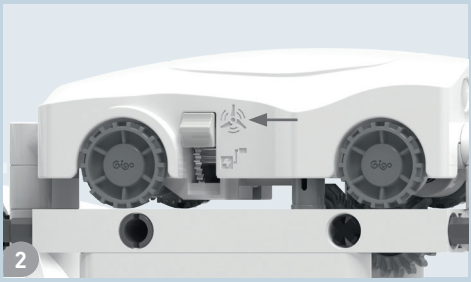
— Unfortunately, not all areas are windy enough to generate electricity on a large scale. To address this, power lines are used to transport electricity to where it is needed. However, the farther electricity travels through these lines, the more energy is lost along the way.

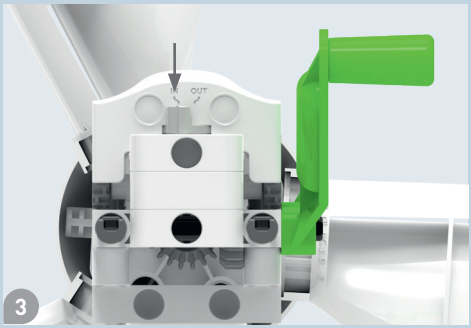
SETTINGS AND TROUBLESHOOTING

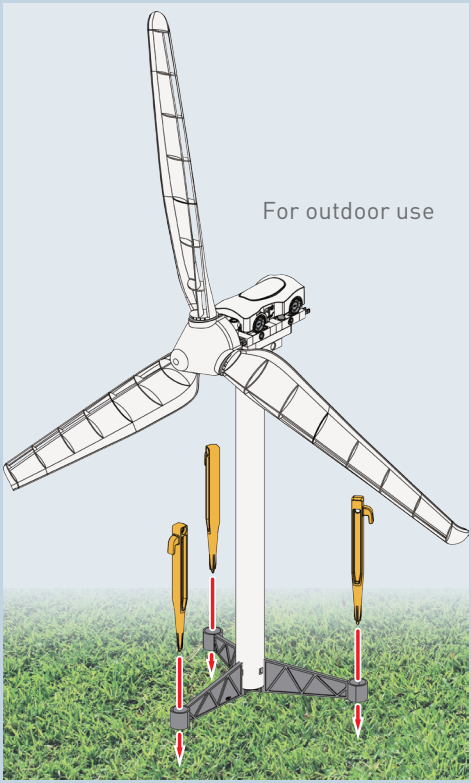
Operation of wind power generation:

1. Rotor Blades:
   Ensure all rotor blades are positioned identically. In most cases, the position 3 delivers the best results.
2. Side Switch:
   For wind operation, set the side switch on the car to the wind turbine symbol.
3. Rear Switch:
   Set the rear switch to "IN" to enable electricity generation and storage.



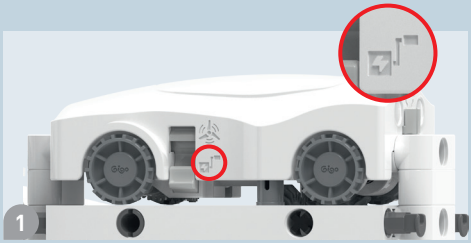


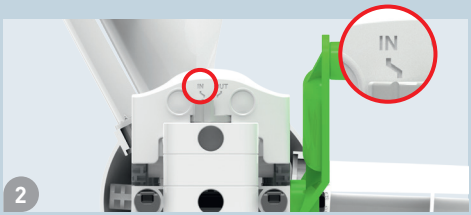


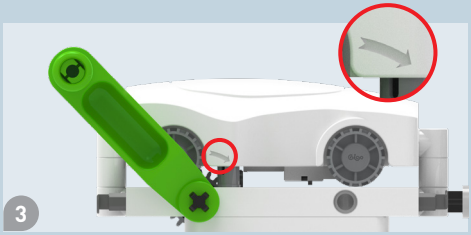


Generating electricity by hand crank:

1. Set the side switch on the car to the hand crank symbol.
2. Adjust the rear switch to "IN."
3. Turn the crank in the direction indicated by the arrow on the car.



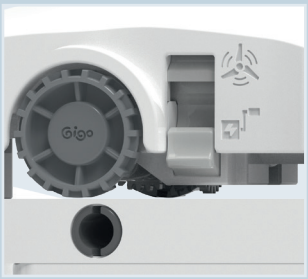




Troubleshooting

Attention: Turning the hand crank in the wrong direction may cause the component inside the car to shift. This can move the side switch to a middle position.

To reset it, first set the side switch to the wind turbine symbol, then press it firmly all the way down.



New Website & Gigo Block Base

More information, including product descriptions, photos and videos, can be found at the official Gigo website. The Gigo Block Base contains a broad range of indexed and searchable information for all our components.

Please browse website

Gigo Website

Gigo Component List

Gigo Block Base

Gigo Blog

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