



ENERGY STORAGE



ENERGY
EDUCATION
TOOL KIT

BY INSIDE EDUCATION



ENERGY STORAGE

GUIDING QUESTIONS

- How can energy be transformed from one form to another?
- Why would we want to store energy?
- What are some examples of energy storage?

The demand for electricity changes daily and seasonally. Electricity demand tends to be highest in the evening time (*when most people are at home*) and during the coldest and hottest months of the year (*when we need heating and cooling*). One way to avoid overloading the electricity system is to store electricity that we produce when demand is low, and then use it when demand is high.

We can make energy from renewable resources like solar and wind, but what about when the wind isn't blowing or the sun isn't shining? In peak times, unused electricity can be stored to use when needed. Batteries are one way to store excess electrical energy as chemical potential energy, which can then be converted back into electrical energy when it is needed.



Wind turbines. Source: TransAlta Corp (www.transalta.com).

Alberta is working on using large batteries that can store enough power for entire communities. In October 2020, TransAlta powered up Alberta's first wind-powered battery storage facility, called WindCharger, near Pincher Creek.²⁴ This means that any extra power generated from nearby wind turbines can be used to charge up the Tesla Megapack batteries. If the wind dies down, or extra power is needed, the batteries can then resupply that stored energy as electricity back to Albertans!

Batteries charge long and slow (*think about how long you need to plug in a game controller before it is fully charged*), but there are other times where we need to save up a lot of energy very quickly! In these cases, we can use a system called a **flywheel** to rapidly convert rotational mechanical energy into electrical energy! Flywheels are often contained within a vacuum chamber to eliminate air resistance, making them highly efficient! Researchers are analyzing the energy and cost savings of using flywheel technology in light rail transit systems in the future.²⁰

TEST OUT THE ZÉCAR

The Zécar works by storing energy in its flywheel, then transferring it to the wheels when it's placed on the ground. Give the car a push to get the flywheel spinning... hold it and see - then let it go! (You can even try setting it in motion directly on the flywheel!)

- Do you feel "resistance" to your efforts to set the flywheel in motion? If so, why?
- What becomes of the work done by you while setting the flywheel in motion?
- How far can the Zécar go on a level surface? Does the range of the car depend on the surface?
- Is the speed of the car the same from the time of release until it comes to rest? Why or why not?



In this activity you'll get to explore a tiny flywheel on the Zécar, the City of Edmonton is working with much larger ones to speed the charging of its fleet of electric buses.²⁶

TEST OUT THE SOLAR CAR

The solar electric car works by converting solar energy directly into mechanical energy through the small motor.

- What is the limit of this car's ability to go over small obstacles or inclines?
- What are some advantages of this car compared to the Zécar? What are some of the disadvantages?
- Is the speed of the car the same from the time of release until you stop it? Why or why not?
- What happens when there is no/limited sun? What is another natural resource that you can use to power this car?
- **Extension:** Try connecting the battery connector to your motor! What are some of the advantages and disadvantages of connecting your motor with a battery this way?



MATERIALS FROM KIT:

- Zécar
- Solar Car Kit
- Solar Car Instruction Card

MATERIALS FROM CLASSROOM

- Measuring tape
- Different surfaces for the cars
- Stopwatch



CONSIDER ...

Think about how the WindCharger uses extra wind power to charge large storage batteries. What other natural resources could benefit from energy storage?

CONNECT ...

Any time we can save energy by storing it as another form, we are conserving natural resources and reducing our greenhouse gas emissions. The City of Edmonton has added many electric buses to their transit fleet. Have you ever seen an electric car or bus in your community?

LEARN MORE ...

There are other ways to store energy, including batteries, flywheels, supercapacitors, and pumped hydro-power. Learn about pumped hydro by checking out the Canyon Creek Project near Hinton.

> <https://www.tcenergy.com/operations/power/canyon-creek-pumped-storage>

We will also see energy storage come to our homes. Learn about home-based battery storage as one way to save extra solar energy produced during the day to use at night.

> <https://renewablesassociation.ca/energy-storage>