

# Energy Can

## A Kinetic and Potential Energy Drink

By Eric Muller

### Introduction:

This is a new twist on the classic “Roll-Back can” (also know as a “Come-Back Can” or Magic Can”). Use any aluminum can to build this device, but an Energy drink can makes the best prop for a physics class.

By inserting a rubber band and counter-weight into a rolling aluminum can, the energy of its rotational motion can be stored and re-released.

### Ingredients:

- An empty cola or Energy drink can
- A Rubber band
- A small nut with several bolts. Make sure the length of your bolt doesn't exceed half the diameter of the aluminum can.
- A large nail
- Paper clips, one large and one small (jumbo and standard size)
- Tape – clear tape will look the best
- A Hammer
- A pair of pliers (needle nose pliers are best)

### Assembly:

For a good method of how to build this device, please see the video located at:

[http://www.youtube.com/watch?v=QYVRTLhB\\_co](http://www.youtube.com/watch?v=QYVRTLhB_co)

### To do and notice:

On a flat tabletop, roll the can horizontally and away from your body. After traveling a short distance (a meter or two), the can should come to a stop.

Amazingly, if constructed correctly, the can will roll back towards you.

Note: When doing this activity for an audience, don't “let on” that your can is rigged or empty of liquid. First, pretend to drink from the can and then roll it.

### What's going on?

When you give your “Energy Can” a shove, you are giving it kinetic energy. As the can rolls, the rotational kinetic energy of motion twists the counter weighed rubber band inside. The more the rubber band twists, the more potential energy that is stored. After the can decelerates to a complete stop, it releases the stored potential energy by unwinding and rolling backwards.

(See the cut-away view of the inside of the can above and right)



Math extension:

You can measure the amount of kinetic energy given to the can as well as figure out how much energy is stored as potential energy in the rubber band.

To calculate the kinetic or potential energy:

1. Weigh your can in kg.
2. Determine its deceleration as it rolls away from you.

To do this, you will need to measure the time of travel from its starting point to where it stops rolling (away from you).

Here's are helpful equations to use:

$$A = (V_f - V_i) / T$$

Where:

**A** is acceleration

**V<sub>f</sub>** is final velocity (which would be zero because the can stops)

**V<sub>i</sub>** is the initial velocity when released.

**T** is the time the can rolled

3. Calculate the force of the rolling can.

Use the equation:

$$F = MA$$

Where:

**F** is force

**M** is the mass you measured in step 1.

**A** is acceleration (you can use the negative of the deceleration from step 2 above)

4. Calculate the energy of the rolling can.

$$\text{Energy} = \text{Force} \times \text{Distance}$$

This is the kinetic energy of motion (at the start of rolling) or potential energy stored in the rubber band (at the maximum distance away from the person that rolled the can). All units are calculated in Joules!

5. If you want to go further, you can even figure out the spring constant of your rubber band inside the can (caused by rotational twisting). Just have someone count the number of rolls of the can before it stops then use the equation below:

$$U = \frac{1}{2} \kappa \theta^2$$

**U**, is energy in **joules**, stored in a torsion spring (your rubber band).

Use the energy you calculated above in step 4.

**θ** is the angle of twist from starting position to stopping in **radians**.

**κ** is the spring constant of your rubber band

References:

[http://en.wikipedia.org/wiki/Torsion\\_spring](http://en.wikipedia.org/wiki/Torsion_spring)