Energy Card Game

Most forms of energy on Earth come from the Sun

Age: 6 +

Activity Time: 10 min

Prep Time: 30 min

Summary

The energy we encounter in everyday circumstances comes in many forms, from the food we eat to the electricity that powers our devices, but where does this energy come from? In this card game, participants trace back the source of energy for a variety of items to find that they ultimately derive from the Sun. This is a simple activity that lets students move around and discover an aspect of their everyday lives that may not have been apparent to them already.

Credit: Activity created by the Astronomical Society of the Pacific and the NightSky Network
https://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=494

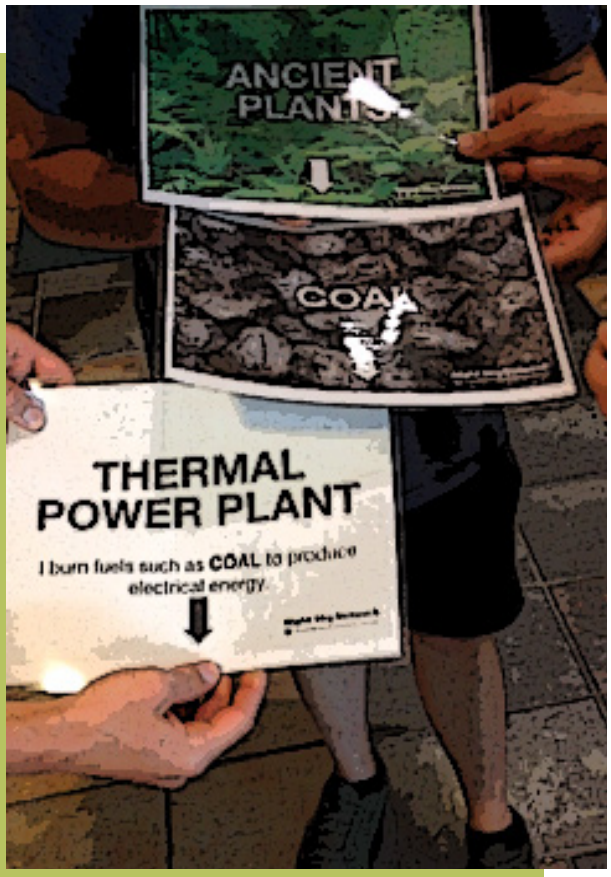
Objectives

- Discover that nearly all energy on Earth derives from the Sun.
- Understand that energy can be transferred from one form to another.
- Allow for a discussion of energy efficiency and renewable energy sources.
- Students speculate and use critical thinking to answer questions about energy.

Materials

- ❑ 30 printed cards (provided at the end of this activity guide).
- ❑ Laminating sheets (optional)
- ❑ Laminating system (required for sheets)

WARNING: Use of lamination equipment may pose a risk to the user. Be sure to follow all instructions provided by the manufacturer.



Science Background

Energy is the ability to do work and it is vital for all living things on Earth. But where do living things get their energy from? An ***autotroph*** *(Greek for "self feeding") is*

a class of organisms creates it's energy directly from the environment, storing it as ***chemical energy****. Plants are the most familiar type of autotroph, using the Sun to drive a sugar-creating reaction chain in a process called* ***photosynthesis****. These sugars can later be broken down, releasing the stored chemical energy.* ***Heterotrophs*** *(Greek for "other feeing") cannot make their own energy from the Sun and must get their energy from other organisms.* ***Herbivores*** *are creatures that eat plants, gaining energy by ingesting the carbohydrates, fats and proteins from autotrophs. A* ***carnivore*** *is an animal that gets its energy by feeding on other animals. The food chain can be thought of as a chain of energy - each carnivore obtaining stored chemical energy from those they eat until you reach an herbivore, which obtains energy from plants, which obtain energy from the Sun. Interestingly, the second law of thermodynamics says that every time energy is transferred from one form to another, some of that energy is lost. So the more steps there are between an energy source and the Sun, the less efficient the process is.*

What about the energy that powers our cars and electronics? At present, much of this energy comes from ***fossil fuels****, which are the remains of plants and animals that lived millions of years ago. Those ancient organisms derived their energy from the Sun, so when we burn fossil fuels, we are releasing stored solar energy. Some our energy derives from* ***solar power****, which uses solar panels to drive a current of electrons. This can be stored in a battery, which is another example of stored chemical energy. While it may not be obvious,* ***wind energy*** *also derives its power from the Sun. Wind occurs when there is a difference in air pressure, which arises from the differential heating heating of the Earth's surface from the Sun. Similarly,* ***hydroelectric power*** *plants create electricity from running water. When water runs downhill, it changes the* ***potential energy*** *of being up high to* ***kinetic energy*** *as it travels down. How does water get to higher elevations? The Sun evaporates water at low altitudes, which rises and falls as rain.*

*So far, in all these examples the Sun has given Earth the energy it uses every day. Is there anything that doesn't ultimately run on solar energy? Certain autotrophs (like bacteria and tube worms that live at the bottom of the ocean) gain energy not from the Sun, but from hydrothermal vents. N****uclear power*** *plants liberate energy from the nuclei of atoms by breaking apart large atoms into smaller ones in a process called fission.With a few exceptions aside, the Sun provides the Earth with all the energy it uses for life and provides us with all the energy we use to drive the modern world.*

Procedure

1. Print out the solar energy cards at the end of this lesson plan. Be careful when printing to make sure that the front of each card with the object matches the back with a corresponding explanation of where that thing gets its energy from.

2. To make the pages into reusable cards, laminate each sheet. Be careful to follow manufacturer instructions while laminating.

3. Each participant in this activity will need a card, so be sure to have one card for each person (there are a total of 30). Additionally, you will need to make sure that all the cards used form a complete energy chain ideally with a variety of types of chains – both technology and life. We recommend that you sort the cards yourself ahead of time to become familiar with which chains might be formed. Each chain has several options, with no single "right answer". Here are some examples of sets of cards for different sized groups:

- 10 participants – Sun, Corn, Ancient Plants, Solar Power Plant, Cow, Burger, Human, Coal, Thermal Power Plant, Light Bulb

- 15 participants – All of the cards for 10 participants, plus: Cereal, Cheese, Petroleum, Automobile, Refrigerator

- 20 participants – All the cards for 15 participants, plus: Oak Tree, Squirrel, Hawk, Computer, Light Bulb (Note: more than 15 participants will require that you print the additional cards found in the manual.)

- 25 participants – All the cards for 20 participants, plus: Wind, Windmill, Soy, Tofu, Human (Vegetarian)

4. You are now ready to begin. You might say, "Who's got a lot of energy today? Who's feeling low energy? Today we are going to talk about energy. Energy is part of everything we do. What have you done today that used energy?" Elicit some activities that took energy, such as getting out of bed, brushing teeth, walking, turning on light, heating water, driving car. Ask where the energy for those things came from. Elicit a discussion of a variety of fuel sources, such as the food we eat, the gasoline in our cars, etc.

Procedure

5. Tell your participants that in this activity, they will find out where all that energy comes from, saying "Energy is stored in many different forms. Energy cannot be created or destroyed. It is transferred or transformed from one form to another. We are going to play a game that explores how energy is transferred in order to provide energy for those things we do in our everyday lives (mention some of the activities that came up). In this game, you will each represent something that uses, transfers, and/or stores energy."

6. Hand the "Human" card to one of the participants. If possible, note that person's name. "For example, [NAME] will be a human being – that should be easy. Have them read the back of their card aloud and say where the energy comes from. In this case, the huma's energy comes from food, which can be plant or animal based.

7. "So, you would be looking for someone with a card that has something you can eat to give you energy. You would then put your hand on that person's back. Then you might have to walk around with that person to find his or her source of energy. You might also end up linking with more than one person."

8. Now, pass out a card to each participant.

9. "Okay, let's see how quickly we can have everyone link up to their energy sources. Be sure to hold your cards up high so everyone can see them. Ready, set, go!"

10. As participants look for their energy sources, make sure that they are holding their cards high enough for everyone to see them, and assist any participants who seem lost. You may also want to help make sure that there is a somewhat even distribution. For example, if all of the electric devices (refrigerator, light bulb, computer) are linking to a particular power plant (solar, wind, thermal), you might want to suggest that some of them go to a different energy source for variety.

11. When all participants have formed chains, you can say, "Good, that was fast!"

Procedure

12. Have each person read the back of their card and then place it on the ground at their feet feet with the arrow pointing towards the energy source.

13. Ask the participatants what else they notice from doing the activity. They should see that they formed chains with the Sun at the center. Deepen the discussion! Ask what else they notice. Following are possible discussion points:

- The vast majority of the energy we use for all of those things we do in our everyday lives comes from the Sun.
- These chains have different lengths. The first step from the Sun for most of the chains is green plants (the other is a solar power plant). Plants convert energy directly from the Sun to energy stored in their cells. Plants are necessary for the rest of life to access the Sun's energy.
- Did you notice that some chains are shorter than others? This is a simplified model, but these shorter chains tend to be more efficient uses of energy.
- What else do we know about these energy sources and their impact on the environment? Some sources of energy are renewable (solar, wind), meaning that we won't ever use them up. Others are non-renewable (petroleum, coal), meaning that we have limited supplies that, once depleted, can no longer be used as sources of energy. Some sources of energy have negative impacts (pollution).
- Are there sources of energy that do not trace back to the Sun? Nuclear plants generate power through nuclear fission. Non-rechargeable batteries generate electricity through a chemical reaction. But the vast majority of energy sources and life forms trace back to the Sun as the ultimate energy source. We could even argue that we would not have the energy to build nuclear power plants or batteries if we did not have the Sun. Tubeworms live at the bottom of the ocean where sunlight does not reach, but even this creature is not totally independent of the Sun. It does not use sunlight as a direct source of energy, instead using a process known as chemosynthesis, however it still relies on free oxygen in the water, which was released through the photosynthesis of organisms closer to the surface of the water.

Watch a video tutorial of this activity on YouTube:
http://bit.ly/EnergyCardGame

Find out more by watching our solar effects webcast:
http://bit.ly/Webcast8-EffectsOfTheSun

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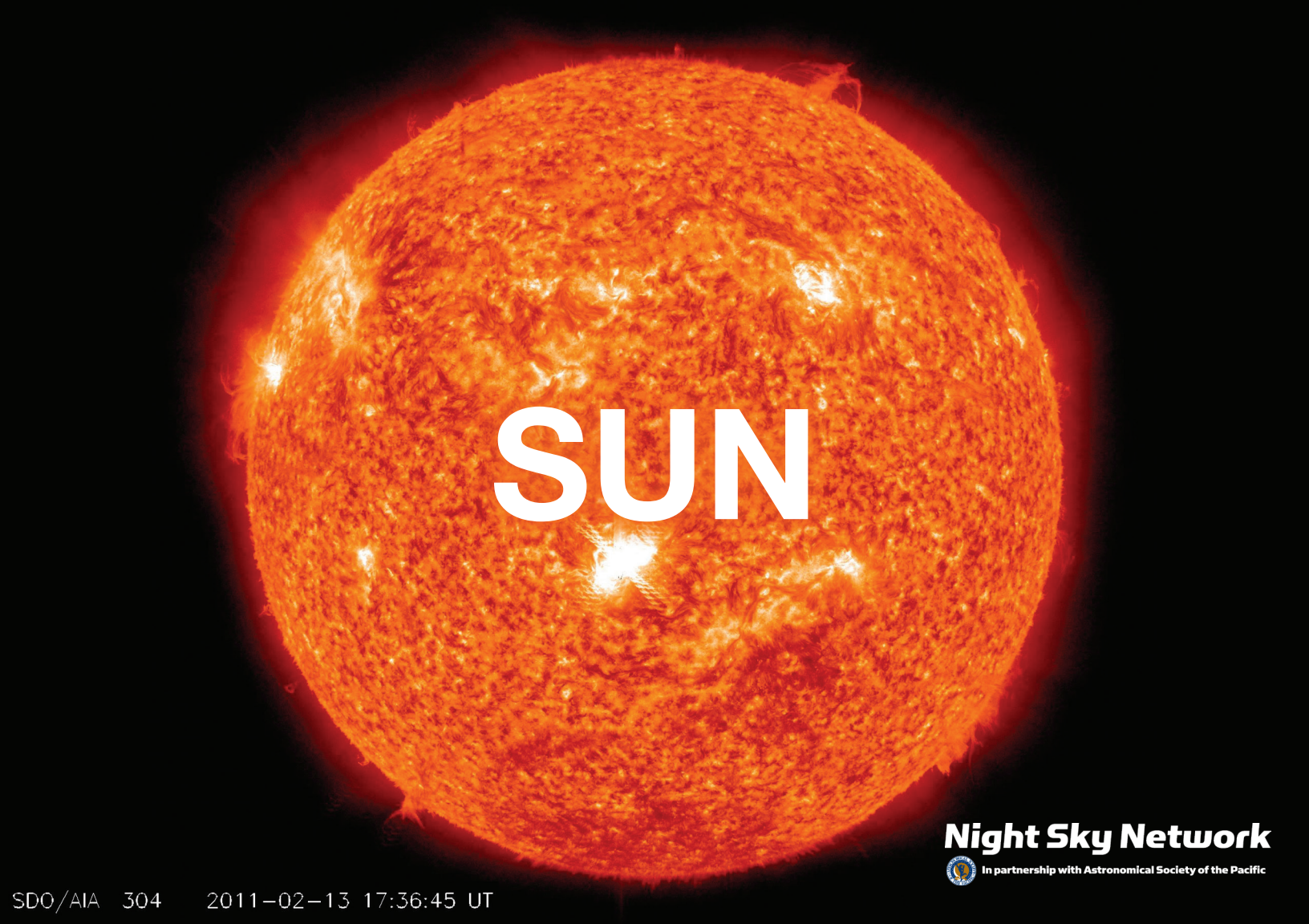
SUN
Night Sky Network
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SUN

I convert hydrogen to helium through the process of **FUSION**, which releases energy. This energy eventually reaches the Earth as heat and light.

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HUMAN
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HUMAN

I get my energy from the **FOOD** I eat. My food can be both *plant*- and *animal*-based.

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CORN
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CORN

Through the process of photosynthesis,
I convert energy from the **SUN** into energy
stored in my cells.

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COW
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COW

I get my energy from the **FOOD** I eat. My food is *plant*-based.

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CEREAL

I am a plant-based food. I have stored energy from the **PLANTS** (**CORN**) used to make me.

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BURGER

I am an animal-based food. I have stored energy from the **ANIMALS** (**COW**) used to make me.

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COAL

The chemical energy stored in me came from the remains of **ANCIENT PLANTS**.

PETROLEUM

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PETROLEUM

The chemical energy stored in me came from the remains of **ANCIENT PLANTS** and animals.

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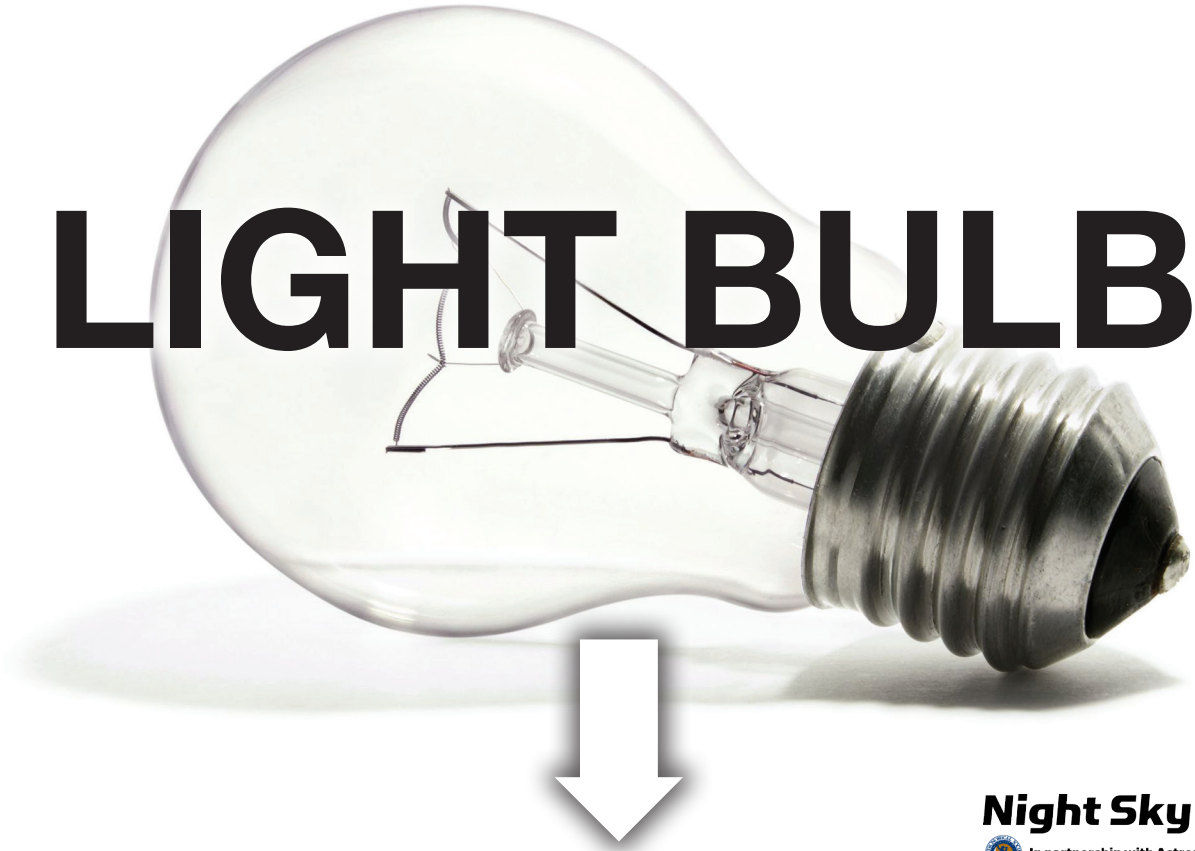
LIGHT BULB



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LIGHT BULB

To produce light, I use electrical energy generated in a **POWER PLANT**.

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THERMAL
POWER PLANT
Night Sky Network
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THERMAL POWER PLANT

I burn fuels such as **COAL** to produce electrical energy.


AUTOMOBILE
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AUTOMOBILE

My energy to move comes from burning the fuel **PETROLEUM**.

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ANCIENT
PLANTS
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ANCIENT PLANTS

Through the process of photosynthesis, I converted energy from the **SUN** into energy stored in my cells.

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SOLAR POWER PLANT
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SOLAR POWER PLANT

I convert energy from the **SUN** into electrical energy.

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REFRIGERATOR

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REFRIGERATOR

I run on electrical energy generated in a **POWER PLANT**.

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CHEESE
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CHEESE

I am an animal-based food. I have stored energy from the **ANIMALS** (**COW**) used to make me.

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OAK TREE
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OAK TREE

Through the process of photosynthesis, I convert energy from the **SUN** into energy stored in my cells.

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SQUIRREL
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SQUIRREL

I get my energy from the **FOOD** I eat. My food is plant-based.

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HAWK
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HAWK

I get my energy from the **FOOD** I eat. My food is animal-based.

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PHYTOPLANKTON
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PHYTOPLANKTON

Through the process of photosynthesis, I convert energy from the **SUN** into energy stored in my cells.

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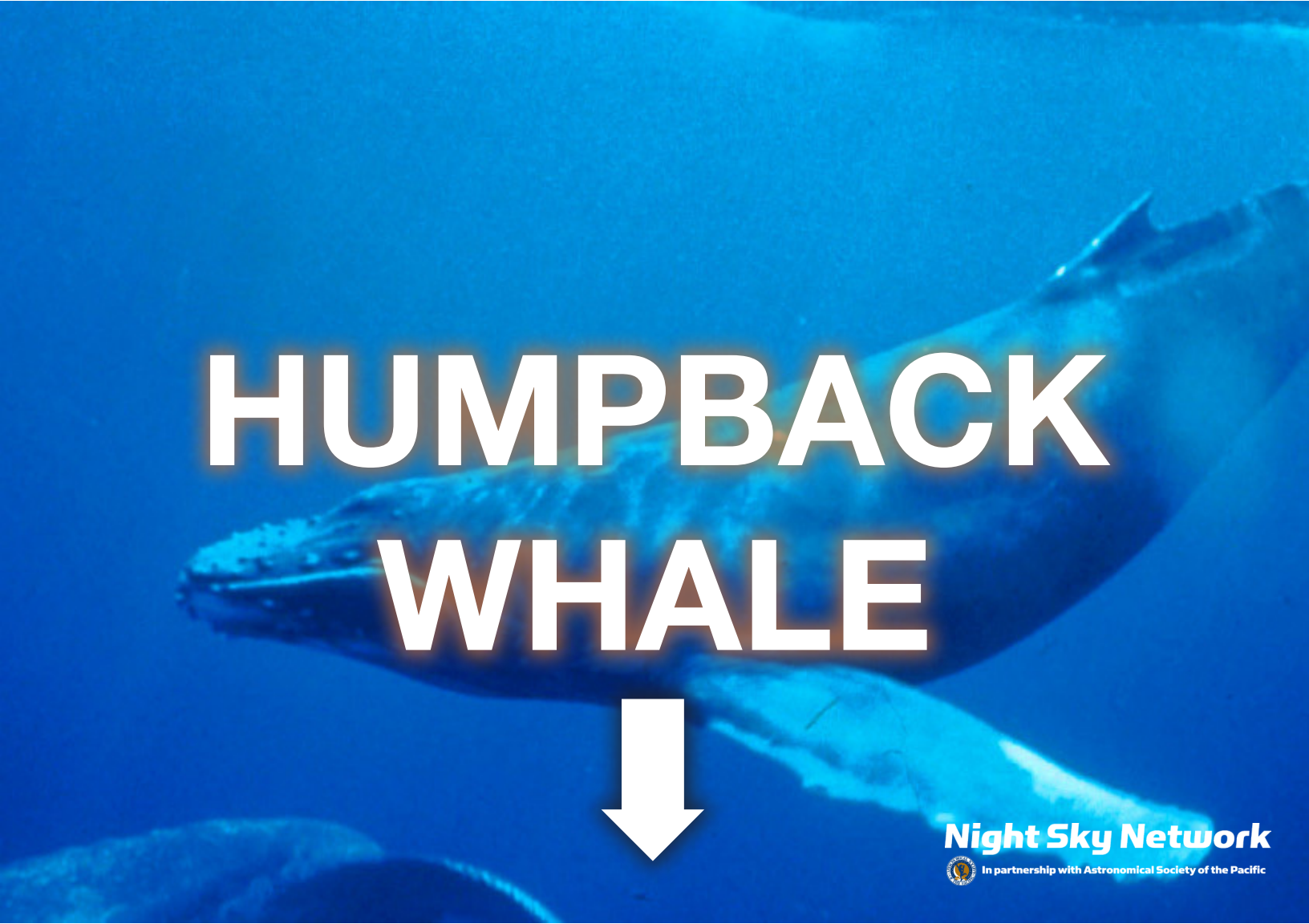
KRILL

I get my energy from the **FOOD** I eat. My food is **PHYTOPLANKTON**.


HUMPBACK
WHALE
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HUMPBACK WHALE

I get my energy from the **FOOD** I eat, such as **KRILL**.

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WIND
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WIND

I am the movement of air caused through heating by the **SUN**.

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WINDMILL
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WINDMILL

I generate electrical energy through movement driven by the **WIND**.

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Night Sky Network

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COMPUTER

I run on electrical energy generated in a **POWER PLANT**.

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Night Sky Network

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LIGHT BULB

To produce light, I use electrical energy generated in a **POWER PLANT.**

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Night Sky Network

In partnership with Astronomical Society of the Pacific

SOY

Through the process of photosynthesis, I convert energy from the **SUN** into energy stored in my cells.


APPLE TREE
Night Sky Network
In partnership with Astronomical Society of the Pacific

APPLE TREE

Through the process of photosynthesis, I convert energy from the **SUN** into energy stored in my cells.

Night Sky Network

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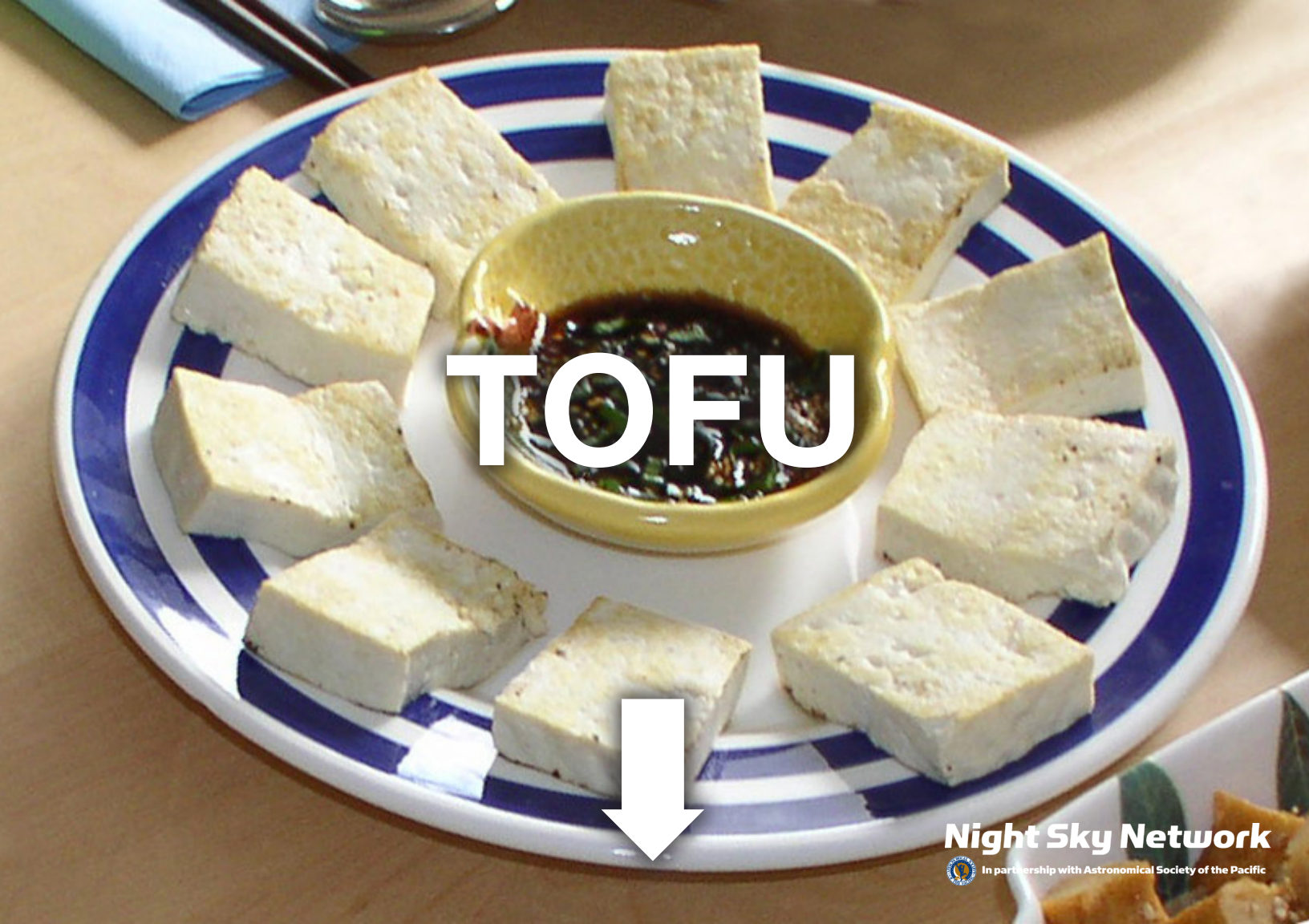

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TOFU

I am a plant-based food. I have stored energy from the **PLANTS (SOY)** used to make me.

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HUMAN (Vegetarian)

I get my energy from the **FOOD** I eat. I am a vegetarian, so my food is plant-based.

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