TOMATOES FARM TO TABLE

Overview

The life cycle of a tomato from a seed to the plate requires labor, energy and many materials. This process is similar to many foods that we eat everyday. Through this lesson, students will understand the ins and outs of tomato production, from the garden to the plate.

Suggested Grade Level:
3rd-5th

Time:
50 minutes

Subjects:
Life Science
Measurement & Data
Energy

Objectives

1. Create a food/energy sequencing model.
2. Identify the different forms of energy.
3. Discuss how energy changes forms throughout food processing.

Background Information

Energy is the ability to do work, to make things happen and to cause changes. Energy cannot be made or destroyed. It can only change forms. Electricity, heat, light and sound are just a few examples of energy. Think about a light bulb. When you flip a light switch, electricity powers the bulb. After a little while, the bulb becomes hot. This is electrical energy being changed to heat energy.

Energy is used throughout the United States food supply chain, from the manufacture and application of agricultural products, such as fertilizers and irrigations to crop and livestock production, processing, and packaging. Energy is also used in distribution services, storage, food service and marketing.

There are several forms of energy that are used while growing tomato plants. Radiant Energy is energy that travels in transverse waves, such as sunlight. All living things need energy to grow. As the sun's energy falls to the Earth, it is changed into chemical energy. This process is called photosynthesis. The sugar is stored in their roots and leaves. The energy from the sun helps the tomato plant grow and produce fruit. When a human eats a fruit, such as a tomato, we consume the chemical energy stored in the plant cells. This chemical energy gives us the energy in the form of calories to grow and move.

Oil and natural gas are called fossil fuels. They are created by plant and animal remains. The soils around them harden, and over time, the fossils break down. Fossil fuels are one form of chemical energy. We can drill to extract these as oil and gas. Fossil fuels are used to power machinery and equipment, such as tractors that are used to plant crops like tomatoes. They also power the harvest machinery needed to retrieve the fruit from the fields. Fossil fuels are converted from chemical energy to mechanical energy during transportation needed to distribute food to local stores and markets.

TOMATOES FARM TO TABLE

Background Information Continued

After the tomatoes are picked and shipped, they are processed and packaged. Tomatoes can be used to make different products such as salsa or ketchup. To package these different products, machines use energy. Different types of energy are used to weigh, package, ship, and store the product.

Energy is an important part of the food growing process. Energy from the sun works to produce food for the plant through photosynthesis. Energy from fossil fuels or renewable fuels is used in machines. Human energy derived from food energy is used to farm, harvest, and process food, completing the energy cycle.

IMPORTANT FACTS

Tomatoes are the fourth most popular fresh vegetable and the largest commercially produced vegetable crop in the United States.

Tomato plants are self-pollinating. Each flower contains both male and female parts, and the wind transfers the pollen between the two.

Early names for tomatoes included “love apples” and “wolf peaches.”

George Washington Carver authored a bulletin in 1918 titled, “How to Grow the Tomato and 115 Ways to Prepare it for the Table.”

Worldwide, China is the top tomato-producing country, followed by the United States.

One medium-sized tomato provides 40 percent of the recommended daily allowance of vitamin C and 20 percent of the recommended daily allowance of vitamin A.

TOMATOES
FARM TO TABLE

Vocabulary

Calorie: The energy needed to raise the temperature of 1 gram of water through 1 °C (now usually defined as 4.1868 joules).

Chemical Energy: Stored in bonds of atoms and molecules. Ex: batteries, petroleum, natural gas, coal.

Electrical Energy: Energy from charged electrons moving through a wire or space. Ex: electrical outlet in home, lightening.

Food Energy: A chemical energy derived from food and molecular oxygen during cellular respiration.

Gravitational Energy: Stored in an object's height. Ex: hydropower, moving objects down a hill.

Hydroponics: The process of growing plants in sand, gravel, or liquid, with added nutrients but without soil.

Irrigation: The supply of water to land or crops to help growth, typically by means of channels.

Kinetic Energy: The motion of waves, electrons, atoms, molecules, substances and objects.

Mechanical Energy: Stored in the tension between objects. Ex: compressed springs, stretched bands.

Motion Energy: Energy that is stored in the movement of objects. Ex: A wrecking ball releasing stored energy as it breaks a building.

Nuclear Energy: Stored in the nucleus of an atom and generated in nuclear power plants.

Photosynthesis: The process by which green plants and some other organisms use sunlight to synthesize foods from carbon dioxide and water. Photosynthesis in plants generally involves the green pigment chlorophyll and generates oxygen as a byproduct.

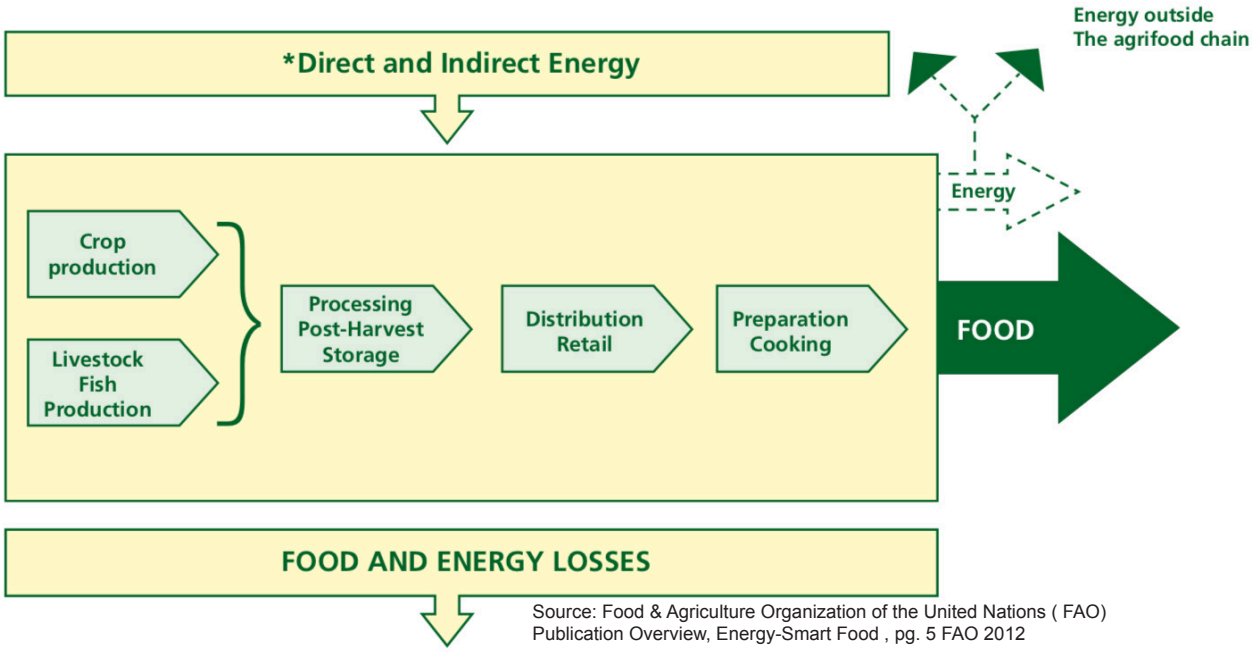
Radiant Energy: Energy that travels in transverse waves. Ex: sunlight, X-rays, radio waves.

Sound: Energy that trace is in longitudinal waves.

Thermal Energy: Heat energy from the movement of atoms. Ex: energy from fire.

TOMATOES
FARM TO TABLE

Direct and Indirect Energy in the Agribusiness Food Chain



Source: Food & Agriculture Organization of the United Nations (FAO) Publication Overview, Energy-Smart Food , pg. 5 FAO 2012

An average tomato provides energy in the form of 2% carbohydrates or 25 calories.

Nutrition Facts

Serving Size 1 Medium Tomato (148g)

Amount Per Serving	
Calories 25	Calories from Fat 0
	% Daily Value*
Total Fat 0g	0%
Saturated Fat 0g	0%
Trans Fat 0g	0%
Cholesterol 0mg	0%
Sodium 20mg	1%
Total Carbohydrate 5g	2%
Dietary Fiber 1g	4%
Sugars 3g	
Protein 1g	

Vitamin A 20%	Vitamin C 40%
Calcium 2%	Iron 4 %

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less Than	65g	80g
Saturated Fat	Less Than	20g	25g
Cholesterol	Less Than	300mg	300mg
Sodium	Less Than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 Carbohydrate 4 Protein 4

TOMATOES
FARM TO TABLE

Name:_____ Date:_____

Directions: Cut and paste the pictures and descriptions(page 6) to the correct steps in the energy flow chart. Choose the type of energy from the vocabulary sheet and label the energy used in the food chain.

Step 1	Step 2	Step 3	Step 4
_____ Energy Type Used	_____ Energy Type Used	_____ Energy Type Used	_____ Energy Type Used
Step 5	**Step 6**	**Step 7**	**Step 8**
_____ Energy Type Used	_____ Energy Type Used	_____ Energy Type Used	_____ Energy Type Used

KFAC

TOMATOES
FARM TO TABLE

Cut out the pictures and descriptions on the dotted line and attach them to the correct step in the energy flow chart on page one.

Photosynthesis: The sun is a renewable energy resource that tomato plants use for photosynthesis.

Transportation: Trucks are used to transport final products to retail stores or restaurants. Energy is a big cost of transporting products.

Planting: Tractors and equipment consume energy to plant tomatoes into the field.

Irrigation: Energy is used to power and operate irrigation systems that serve as an additional water source for plants.

Processing: Energy is consumed to power equipment that sorts, grades and processes fruit after it is removed from the field.

Canning: Machines use energy to mix and can tomatoes and other ingredients into consumer products.

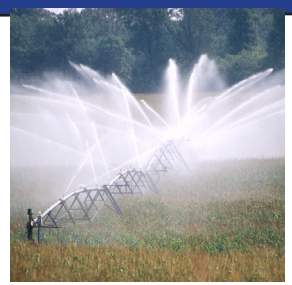
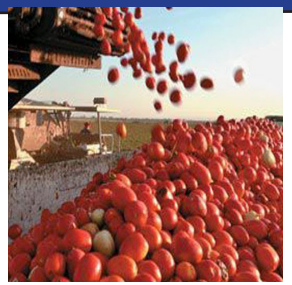
Retail: Final products are found in retail stores or used at restuarants. Energy is used to refrigerate and store these products.

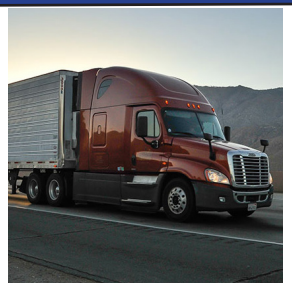
Harvesting: Machinery removes the fruit from the plant. These machines require a constant source of energy to operate.

TOMATOES FARM TO TABLE

Answer Key

Directions: Match the pictures and descriptions to the correct steps in the energy flow chart.

Step 1	Step 2	Step 3	Step 4
			
Planting: Tractors and equipment consume energy to plant tomatoes into the field.	Irrigation: Energy is used to power and operate irrigation systems that serve as an additional water source for plants.	Photosynthesis: The sun is a renewable energy resource that tomato plants use for photosynthesis.	Harvesting: Machinery removes the fruit from the plant. These machines require a constant source of energy to operate.
Mechanical	Chemical	Radiant	Chemical, Motion, Mechanical
Energy Type Used	Energy Type Used	Energy Type Used	Energy Type Used

Step 5	Step 6	Step 7	Step 8
			
Processing: Energy is consumed to power equipment that sorts, grades and processes fruit after it is removed from the field.	Canning: Machines use energy to mix and can tomatoes and other ingredients into consumer products.	Transportation: Trucks are used to transport final products to retail stores or restaurans. Energy is a big cost of transporting products.	Retail: Final products are found in retail stores or used at restuarants. Energy is used to refrigerate and store these products.
Chemical, Motion, Mechanical	Chemical, Motion, Mechanical	Chemical	Electric, Kinetic
Energy Type Used	Energy Type Used	Energy Type Used	Energy Type Used

KFAC

TOMATOES FARM TO TABLE

Types of Energy

Identify the types of energy used in each part of the sequence. Use this guide to promote discussion and deeper thinking.

Photosynthesis for plant growth:
- Sun - Radient Energy
- Energy to produce oxygen and food for the plant

Hydroponic or irrigation system:
- Fuel to pump water and run irrigation motor - Chemical Energy
- Energy to power artificial light in hydroponics system - Chemical Energy
- Labor to fix and manage hydroponics and irrigation system

Harvest transportation and harvest machinery:
- Fuel for engines - Chemical Energy
- Human labor to hand pick
- Labor for repairs and machine upkeep

Crushing or processing plant:
- Electricity to power processing plant and machines - Electrical Energy
- Power for computers and food safety probes - Electrical Energy
- Food Safety - Radiant Energy

Packaging or canning:
- Electricity to run machines - Electrical Energy
- Power to make cans or jars - Chemical Energy, Electrical Energy and Mechanical Energy
- Electricity used to store product in cooler until distribution - Electrical Energy

Distribution:
- Fuel for truck - Chemical Energy
- Power to refrigerate products in transport - Electrical Energy

Grocery stores and storage:
- Human power
- Power to run store and maintain proper storage - Electrical Energy

Transportation to restaurants or home:
- Fuel for car or van - Chemical Energy

Kitchen to dinner table:
- Kitchen appliances - Electrical Energy
- Human power

Consumption:
- Energy in the form of calories