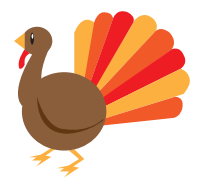


# Cost of a Thanksgiving Meal



### Grade Levels:

**Elem** Elementary

**Int** Intermediate

**Sec** Secondary

### Subject Areas:

Science

Math



# What Will You Eat?

Before you can calculate the cost of your Thanksgiving meal, you must plan your menu. Every family has its own traditional foods they serve. Create a menu for your meal and list the ingredients for each menu item. For example, if you make pumpkin pie, you may need pie crust, pie filling, spices, and whipped cream.

## THANKSGIVING MENU

## THANKSGIVING SHOPPING LIST

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# Cost of Purchasing your Meal

In order to determine how much your delicious feast is going to cost, you need to first determine how much the food itself will cost. Make a list of the things your family will buy. You do not need to include things typically stocked in the average pantry, like salt, pepper, spices, etc.

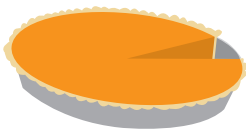
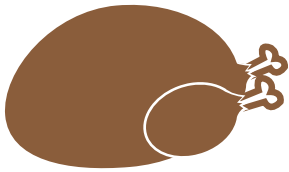
ITEM TO BUY	NUMBER TO BUY	COST PER ITEM	TOTAL COST





# The Cost of Cooking a Thanksgiving Meal

It also costs money to prepare your menu. What appliances will you need in order to store, prepare, bake, roast, and warm all of the items on your menu? On the chart below, list your menu item, and the appliances that will be involved from start (storing items in the refrigerator) to finish (running the dishwasher to clean up).



MENU ITEM	APPLIANCE(S) NEEDED

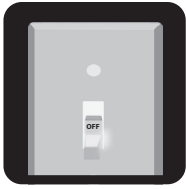


# Thanksgiving Meal Appliance Inventory

It often takes many appliances to make a Thanksgiving meal. Make a list of every electrical appliance you will be using to store, prepare, cook, and clean everything that will be on your Thanksgiving table. If you've completed the list on page 4, add these appliances here. Did you use a computer or other electronic device to find and print recipes? Don't forget to include those machines as well! You may also cook with a natural gas stove or oven. Make sure you know if each appliance is powered by natural gas or electricity.

Some appliances use more energy than others to accomplish the same task. Appliances that are very energy efficient are approved by the government's ENERGY STAR® program and have the ENERGY STAR® label on them. This means they have met high standards set by the government for energy efficiency. Look for the ENERGY STAR® label on appliances you will be using to prepare, cook, and store your Thanksgiving meal. Check off appliances that include this label, and make notes about settings or modes that are more efficient.

MACHINE OR APPLIANCE	GAS OR ELECTRIC?	ENERGY STAR® LABEL



# Electric Nameplate Investigation

Every machine that runs on electricity has an electric nameplate on it. The nameplate is usually a silver sticker that looks like the picture below. The nameplate has information about the amount of electricity the machine uses. Sometimes, the current is listed. The current is measured in amperes (A). Sometimes, the voltage the machine needs is listed. The voltage is listed in volts (V). Sometimes, the wattage is listed. The wattage is measured in watts (W). If the wattage isn't listed, then the current and voltage are both listed.

If the wattage is not listed, you can calculate the wattage using the following formula:

$$\begin{aligned} \text{Power} &= \text{current} \times \text{voltage} \\ \text{Watts} &= \text{A} \quad \times \quad \text{V} \\ \text{Watts} &= \text{1.0A} \quad \times \quad \text{5V} \\ \text{Watts} &= \text{5W} \end{aligned}$$



Often, the letters UL are on the nameplate. UL stands for Underwriters Laboratories, Inc., which conducts tests on thousands of machines and appliances. The UL mark means that samples of the machines and appliances have been tested to make sure they are safe.

You can find out how much it costs to operate any appliance or machine if you know the wattage. Let's take a look at some of the appliances on your list. The nameplate is usually located on the bottom or back. See if you can find the nameplates on the devices you'll be using to prepare, cook, store, and clean up your meal. Put the information in the chart below and figure out the wattage for each one.

MACHINE	CURRENT	VOLTAGE	WATTAGE	UL TESTED



# Cost of Cooking Your Thanksgiving Meal

## ELECTRICITY

Using the information from the nameplate investigation, calculate how much it costs to operate only the electrical appliances in your home to prepare your Thanksgiving meal. You need to know the wattage, the cost of electricity, and the number of hours each appliance or machine was used.

Electricity is measured in kilowatt-hours, or energy used in a period of time. You will need to change the watts to kilowatts. One kilowatt is equal to 1,000 watts. To get kilowatts, you must divide the watts by 1,000. Using Grandma's old oven as an example, divide like this:

$$\text{kW} = \text{W}/1,000$$

$$\text{kW} = 9,600/1,000 = 9.6$$

The average **cost of electricity for residential customers in the U.S. is roughly 13 cents (\$0.127)** per kilowatt-hour. You can use this rate or find out the actual rate from your electric bill. Using the average cost of electricity, we can figure out how much it costs to run Grandma's old oven by using this formula:

$$\text{Thanksgiving Meal Cost} = \text{Hours used} \times \text{Kilowatts} \times \text{Cost of electricity (kWh)}$$

$$\text{Thanksgiving Meal Cost} = 10 \text{ hours} \times 9.6 \text{ kW} \times \$0.127/\text{kWh}$$

$$\text{Thanksgiving Meal Cost} = 10 \text{ hours} \times 9.6 \text{ kW} \times \$0.127 = \$12.19$$

Perhaps you have a much newer oven. Fill in your own appliances and calculate the cost to use the appliances using the chart below. You may need to go on to the next page as well.

MENU ITEM	MACHINE OR APPLIANCE	HOURS USED	WATTS (W)	KILOWATTS (kW)	RATE (\$/kWh)	THANKSGIVING MEAL COST
Turkey	Oven	10	9,600 W	9.6 kW	\$0.127	\$12.19

MENU ITEM	MACHINE OR APPLIANCE	HOURS USED	WATTS (W)	KILOWATTS (kW)	RATE (\$/kWh)	THANKSGIVING MEAL COST







# Cost of Cooking Your Thanksgiving Meal

## NATURAL GAS

Many people have ovens and cook tops that use natural gas. If that is the case in your house, this worksheet will help you figure how much it costs to cook the foods that use these appliances. Furthermore, many homes heat their water with natural gas, so we have included a place for you to calculate the cost of heating the water to wash your dishes, as well.

Using your menu, determine which items require cooking in the oven or on the cook top. Determine the time each requires and list the items and time in the table below. Then complete the calculations.

**Gas ovens use about 25,000 Btu per hour**

**Gas cook tops use about 9,000 Btu per hour**

**Heating water for dishwasher use requires about 10,000 Btu per hour**

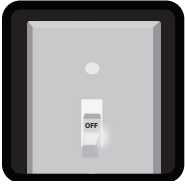
The average **cost of natural gas for residential customers** in the U.S. is about \$1.04 per hundred cubic feet (Ccf). To convert Btu to Ccf, multiply by  $9.69 \times 10^{-6}$ , or 0.00000969. An example has been done for you.

<b>Thanksgiving Meal Cost =</b>	<b>Time</b>	<b>x</b>	<b>Btu/hour</b>	<b>x</b>	<b>Conversion factor</b>	<b>x</b>	<b>Cost/Ccf</b>
<b>Roast Beast =</b>	<b>2.5</b>	<b>x</b>	<b>25,000</b>	<b>x</b>	<b>0.00000969</b>	<b>x</b>	<b>\$1.04 = \$0.63</b>

Keep in mind that different areas of the country pay different amounts for the energy they used, based on what is available nearby. If you know the amount you pay for the natural gas you use at home, use that cost per Ccf rather than the national average to get a better idea of how much it costs to cook that delicious feast.

MENU ITEM	MACHINE OR APPLIANCE	TIME (HOURS)	BTU/hour	TOTAL COST
<i>Roast beast</i>	<i>Oven</i>	2.5	25,000	\$0.63





# The Environment and You

## ELECTRICITY

When we breathe, we produce carbon dioxide. When we burn fuels, we produce carbon dioxide too. Carbon dioxide (CO<sub>2</sub>) is a greenhouse gas. Greenhouse gases hold heat in the atmosphere. They keep our planet warm enough for us to live. Since the Industrial Revolution, we have been producing more carbon dioxide than ever before, and CO<sub>2</sub> concentrations in the atmosphere have risen by over 40 percent.

Research shows that greenhouse gases are trapping more heat in the atmosphere. Scientists believe this is causing the average temperature of the Earth's atmosphere to rise; this is called global climate change or global warming. Global warming refers to an average increase in the temperature of the atmosphere, which in turn causes changes in climate. A warmer atmosphere may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans. When scientists talk about the issue of climate change, their concern is about global warming caused by human activities.

Driving cars and trucks produces carbon dioxide because fuel is burned. Heating homes by burning natural gas, wood, heating oil, or propane produces carbon dioxide too.

Making electricity can also produce carbon dioxide. Some energy sources—such as hydropower, solar, wind, geothermal, and nuclear—do not produce carbon dioxide, because no fuel is burned. About 33.1 percent of our electricity, however, comes from burning coal. Another 35.5 percent comes from burning natural gas, petroleum, and biomass.

The general rule is that, on average, every kilowatt-hour of electricity produces 1.5 pounds of carbon dioxide. Let's use this rule to figure out how much carbon dioxide is produced by the machines and electrical devices used during your Thanksgiving meal. You can put the figures from the earlier worksheets in the boxes below. Use the figures for Grandma's old oven as an example:

$$\begin{array}{rclclcl} \text{CO}_2 \text{ a year} & = & \text{wattage} & \times & \text{hours of use} & \times & \text{rate of CO}_2/\text{kWh} & & \\ \text{CO}_2 \text{ a year} & = & 9.6 \text{ kW} & \times & 10 \text{ hours} & \times & 1.5 \text{ lb/kWh} & = & 144 \text{ lbs} \end{array}$$

MACHINE OR APPLIANCE	KILOWATTS (kW)	TOTAL HOURS USED	RATE OF CO <sub>2</sub> /kWh	CO <sub>2</sub> /YEAR (LBS)
<i>Oven</i>	<i>9.6 kW</i>	<i>10 hours</i>	<i>1.5</i>	<i>144</i>



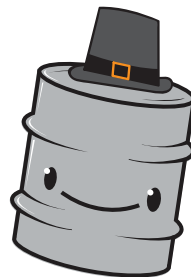
# The Environment and You

## NATURAL GAS

If you cook with natural gas, the energy you use for these appliances also results in the release of carbon dioxide. Burning natural gas produces CO<sub>2</sub> and water vapor (steam). That CO<sub>2</sub> contributes to climate change just like the CO<sub>2</sub> produced by generating electricity.

When natural gas is burned, 0.117 pounds of CO<sub>2</sub> are released for each thousand Btu. Calculate the CO<sub>2</sub> produced by cooking your Thanksgiving meal with natural gas using the same BTU/hour as listed on page 9. An example has been done for you.

MENU ITEM	APPLIANCE	TOTAL HOURS	BTU/HOUR	TOTAL BTU	THOUSAND BTU	RATE OF CO <sub>2</sub> /TBTU	CO <sub>2</sub> PRODUCED (LBS)
<i>Roast beef</i>	<i>Oven</i>	<i>2.5</i>	<i>25,000</i>	<i>62,500</i>	<i>62.5</i>	<i>.117</i>	<i>7.13</i>

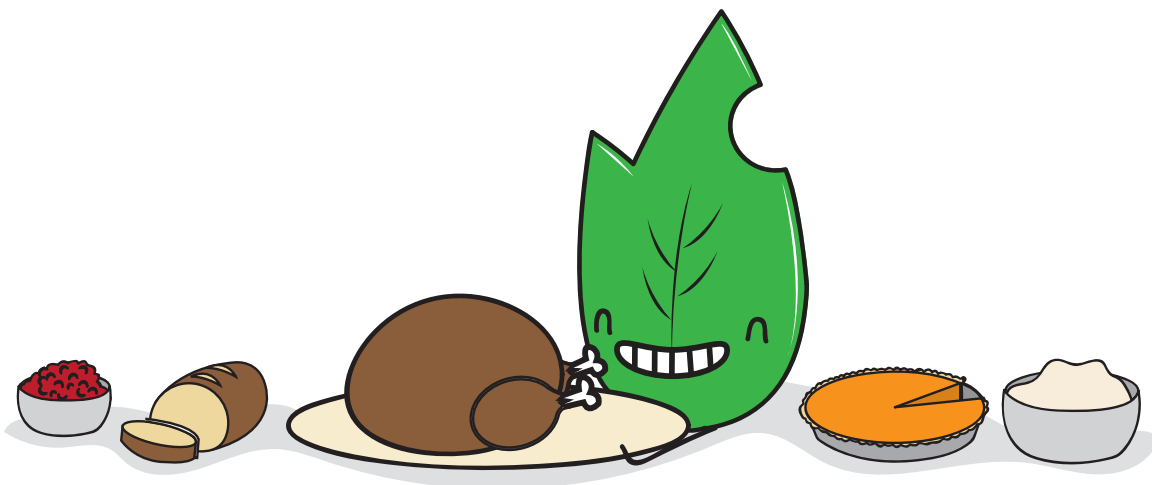




# NEED's Thanksgiving Meal

NEED has created a sample menu that you may use to calculate costs. Listed below are the items on the menu, the ingredients, and the approximate cost to purchase those ingredients. The approximate costs are based on the American Farm Bureau Federation's 30th annual informal price survey of classic items found on most Thanksgiving menus.

MENU ITEM	INGREDIENT	NUMBER NEEDED	COST PER ITEM	TOTAL COST
Turkey	16 lb. turkey	1	\$23.04	
Pumpkin pie	Pumpkin pie mix	1	\$3.20	
Pumpkin pie	Pie crust	1 pkg of 2	\$2.47	
Pumpkin pie	Whipping cream	One ½ pint carton	\$1.94	
Green bean casserole	Green beans	1 pound	\$1.52	
Green bean casserole	Cream of mushroom soup	1 can	\$1.69	
Cranberry sauce	Fresh cranberries	12 oz. package	\$2.29	
Rolls		1 package of 12	\$2.25	
Mashed potatoes	Raw potatoes	3 pounds	\$0.79/lb	
Gravy		1 jar	\$1.79	
<b>TOTAL COST</b>				














# Cost of Cooking NEED's Thanksgiving Meal

## ELECTRICITY

Look at the chart below and complete the calculations to help NEED analyze the cost to cook their meal. NEED is using the average U.S. cost per kWh, or \$0.127/kWh.

NEED's kitchen has just been remodeled and has several newer, more efficient appliances. If you recall, Grandma's old stove used 9,600 watts when baking at 350°. NEED's stove is more efficient, using only 3,500 watts when baking. The burners on NEED's stove use approximately 1,500 watts when put on their "high" setting. NEED's refrigerator is large with side-by-side doors, and an ice maker. NEED only uses its dishwasher with the "energy saver" feature turned on and the "heat dry" setting turned off.

How do your appliances compare? Consider the variables involved with certain appliances when calculating meal costs. For example, the settings used (high, medium, low), the features of the appliance (convection or broil), the number of burners or heat elements, and the age of the appliance will all affect the wattage they use and the cost of cooking your meal.

	MACHINE OR APPLIANCE	HOURS USED	WATTS (W)	KILOWATTS (kW)	RATE (\$/kWh)	COST	TOTALS
 turkey	Oven	4	3,500		\$0.127		
 pie	Oven	1	3,500		\$0.127		
 green bean casserole	Oven	.5	3,500		\$0.127		
 cranberry sauce	Stove	.33	1,500		\$0.127		
 rolls	Oven	.25	3,500		\$0.127		
 mashed potatoes	Stove	.5	1,500		\$0.127		
 gravy	Stove	.25	1,500		\$0.127		
 clean up	Dishwasher	1.25	1,600		\$0.127		
 preservation	Refrigerator	24	725		\$0.127		

MACHINE OR APPLIANCE	KILOWATTS (kW)	RATE OF CO <sub>2</sub> /kWh	TOTAL HOURS USED	CO <sub>2</sub> /PRODUCED (LBS)
Oven	3.5 kW	1.5		
Stove	1.5 kW	1.5		
Fridge	.725 kW	1.5		
Dishwasher	1.6 kW	1.5		



# Cost of Cooking NEED's Thanksgiving Meal

## NATURAL GAS









Let's assume you're going to cook NEED's sample menu using a gas stove. Look at the chart below and complete the calculations to help NEED analyze their meal cost. NEED is using the average U.S. cost of \$1.04/Ccf for natural gas.

To calculate total BTU, multiply the hours used by the BTU/hour for each appliance.

To convert from BTU to hundred cubic feet or Ccf, multiply by  $9.69 \times 10^{-6}$  or 0.00000969.

To calculate total cost, multiply Total Ccf by the average cost of natural gas, \$1.04/Ccf.

You will still need to use the calculations for electricity to run the refrigerator and dishwasher from the previous activity to determine the total cost of a meal and total CO<sub>2</sub> produced when cooking with natural gas.

	MACHINE OR APPLIANCE	HOURS USED	BTU/HOUR	TOTAL BTU	TOTAL Ccf	TOTAL COST
 turkey	Oven	4	25,000			
 pie	Oven	1	25,000			
 green bean casserole	Oven	0.5	25,000			
 cranberry sauce	Cook Top	0.33	9,000			
 rolls	Oven	0.25	25,000			
 mashed potatoes	Cook Top	0.5	9,000			
 gravy	Cook Top	0.25	9,000			
 clean up	Dishwasher (hot water)	1.25	10,000			

MACHINE OR APPLIANCE	TOTAL BTU (hour used x BTU/hr)	THOUSAND BTU (TBTU)	RATE OF CO <sub>2</sub> /TBTU	CO <sub>2</sub> PRODUCED (LBS)
Oven	143,750	143.750	.117	16.82
Cook Top	9,720	9.720	.117	1.14
Dishwasher	12,500	12.500	.117	1.46

APPLIANCE	CO <sub>2</sub> FROM NATURAL GAS	CO <sub>2</sub> FROM ELECTRICITY	TOTAL CO <sub>2</sub>
Fridge	x	26.10	26.10
Dishwasher	1.46	3.00	4.46
Oven	16.82	x	16.82
Cook Top	1.14	x	1.14



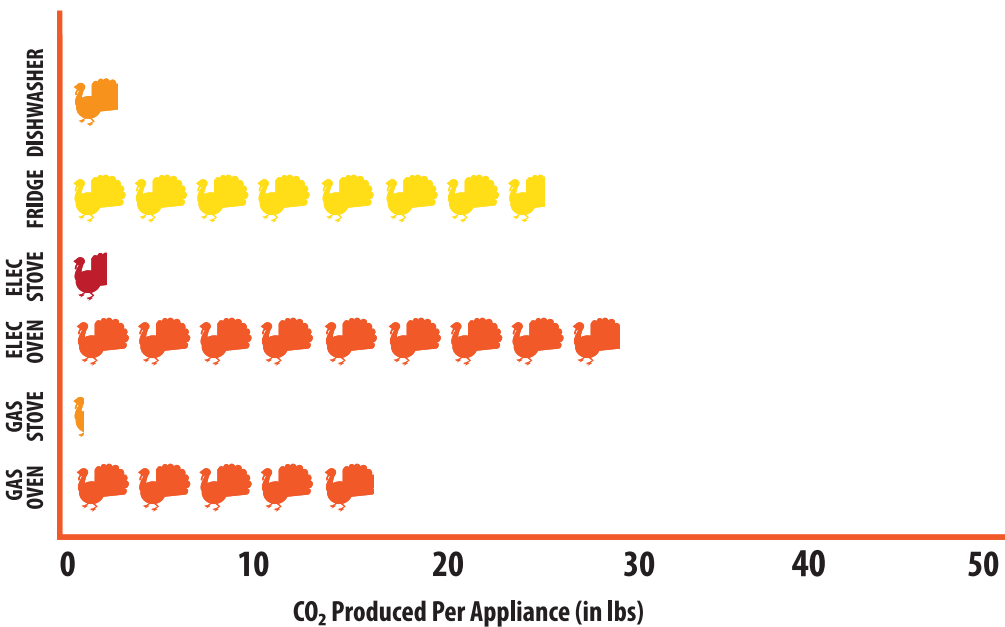
# Analyzing NEED's Thanksgiving Meal

How much does it cost in total to purchase, prepare, eat, and clean up after NEED's Thanksgiving meal? Let's break down all the costs.

Menu item	Total cost to purchase ingredients	Total energy cost, cooking with electricity	Total energy cost, cooking with natural gas	Total cost
Turkey				
Pumpkin pie				
Green bean casserole				
Cranberry sauce				
Rolls				
Mashed potatoes				
Gravy				
Refrigeration*	-----			
Clean up**	-----			

\* Only count refrigeration once, since multiple items can be stored in the refrigerator at a time.

\*\* When calculating the cost of clean up, add both electricity and natural gas costs, because NEED's dishwasher uses both.



**TOTAL ENERGY COST (electricity)**

**\$5.22**

**TOTAL ENERGY COST (gas)**

**\$3.89**

**TOTAL CO<sub>2</sub> PRODUCED (electricity)**

**61.65 lbs**

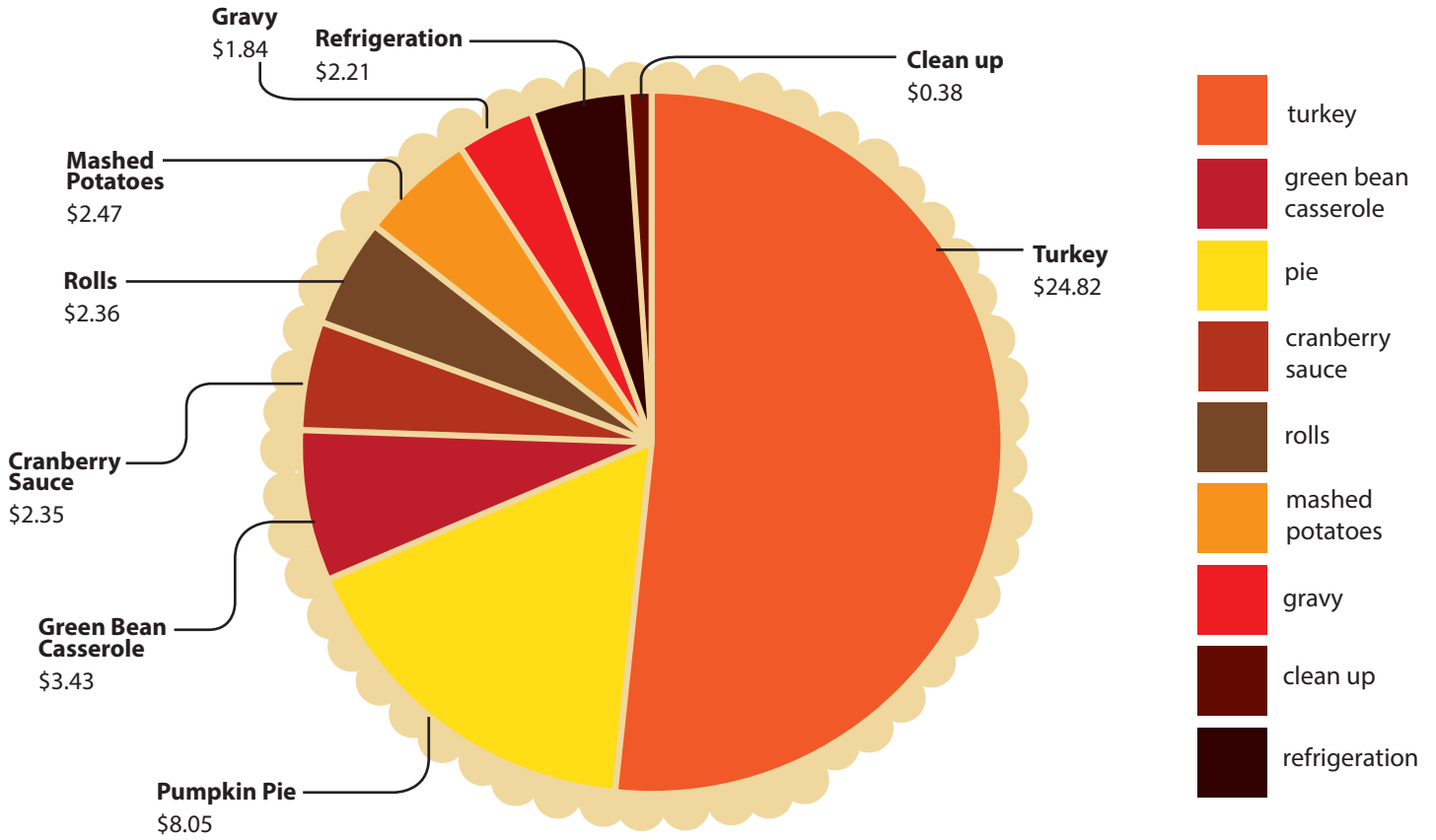
**TOTAL CO<sub>2</sub> PRODUCED (gas)**

**48.52 lbs**

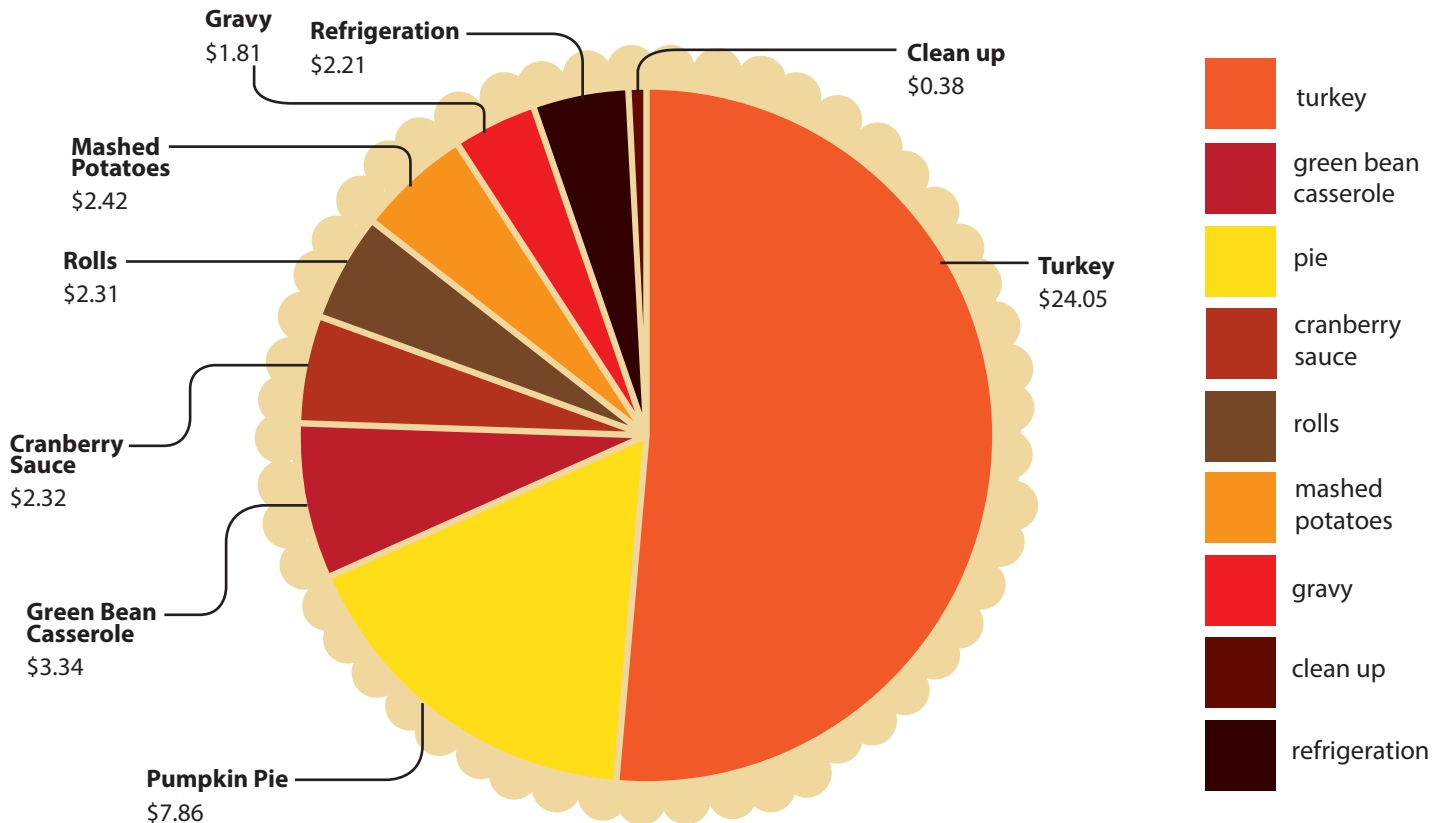


The graphs below summarize the total cost for NEED's entire Thanksgiving Day feast, including clean up.

### TOTAL COST COOKING WITH ELECTRICITY



### TOTAL COST COOKING WITH NATURAL GAS



# Chart Your Results

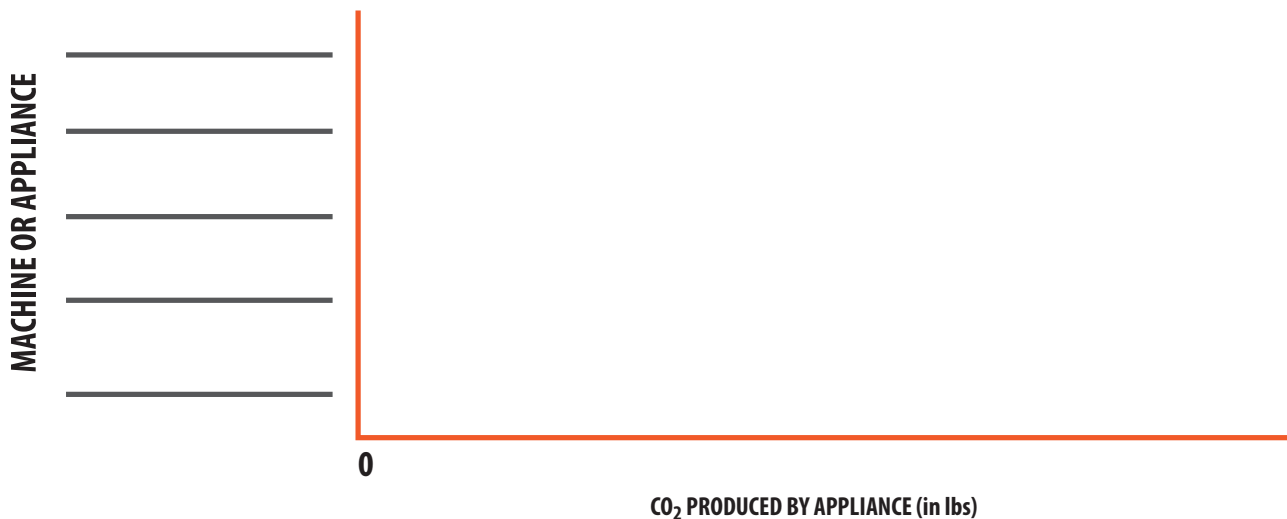
Now that you have analyzed your own menu, devices, and NEED's menu, it's time to calculate and analyze all of your totals. Use the *Cost of Cooking NEED's Thanksgiving Meal* to guide you in your total calculations. It can be tricky when adding costs together. Think about how you might use some appliances together and separately. For instance, you might use 3 burners at a time for different amounts of time and on different settings. Therefore, these must be calculated separately and added together in your total. However, you might put several dishes in the oven at the same time, and thus do not need to count them individually. Also, you may wish to research your local electricity rate by contacting your utility company, or looking at your electricity bill.

In order to think more clearly about how much you're using an appliance and what the total costs are, it might be helpful to create some charts and graphs. Use NEED's graphs as an example of how to create your own graphs. Choose colors and symbols that you like and fill in all of the graphs to represent your data. Compare your data to the data of others in your class. What might account for differences in your graphs and totals? What could you do to make your meal more energy efficient? What kind of cost might be associated with cooking meals like this every day?

Menu item	Total cost to purchase ingredients	Total energy cost, cooking with electricity	Total energy cost, cooking with natural gas	Total cost
Refrigeration*	-----			
Clean up**	-----			

\* Only count refrigeration once, since multiple items can be stored in the refrigerator at a time.

\*\* When calculating the cost of clean up, add both electricity and natural gas costs, because NEED's dishwasher uses both.

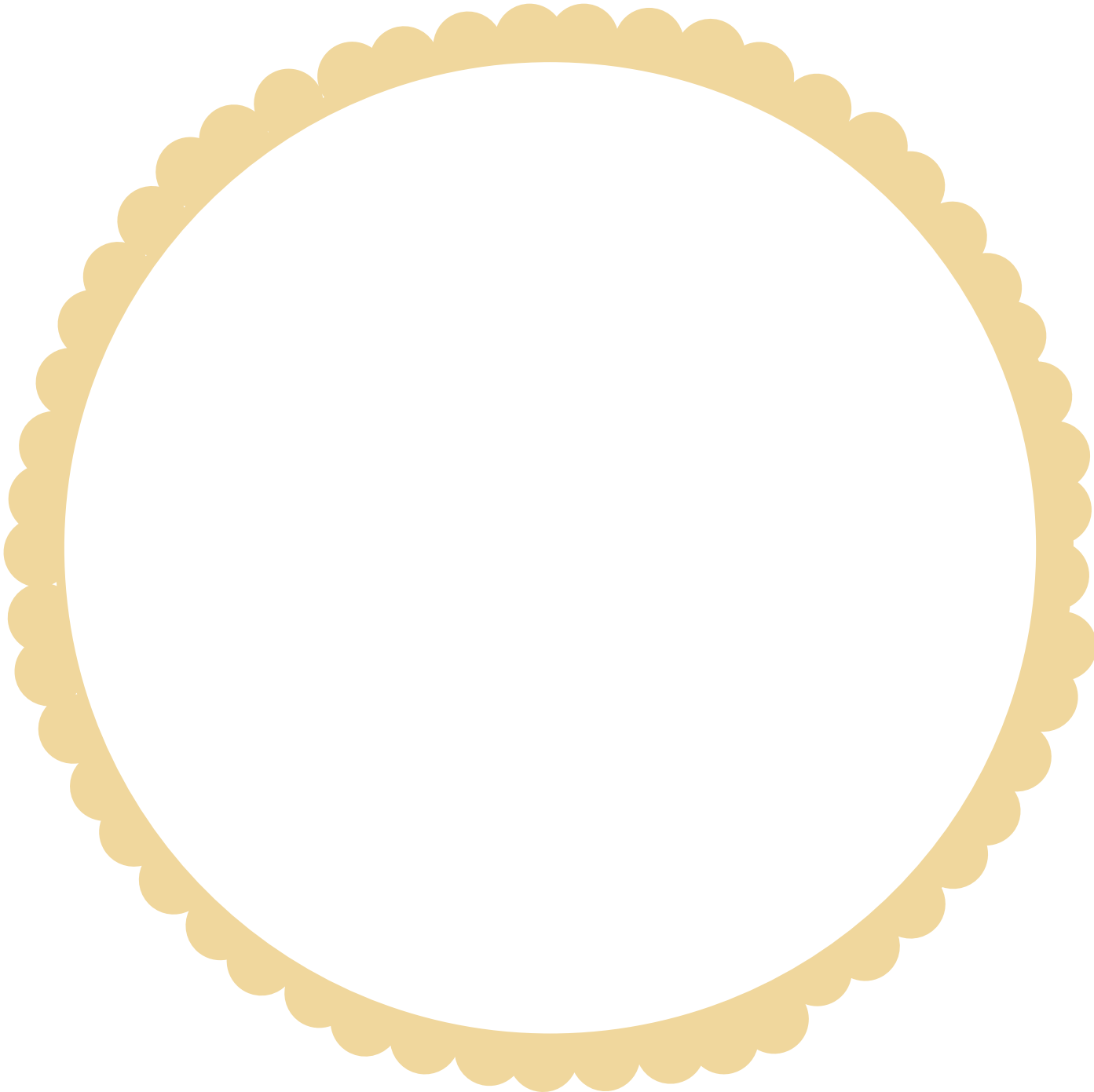


TOTAL COST

\$

TOTAL CO<sub>2</sub> PRODUCED

lbs





# More to Think About

Your Thanksgiving Day meal didn't magically appear in your refrigerator. You, or someone in your family, had to go to the store to purchase the items. How did you get to the store? \_\_\_\_\_

Some people use public transportation to go from place to place, but many of us use cars to drive to the store to buy the things we need. That driving requires energy in the form of gasoline, or perhaps diesel fuel. Let's look at the energy used to drive to the store.

1. Use a map or a mapping app to determine how far it is from your home to the store.

Distance from your home to the store: \_\_\_\_\_ miles

2. Determine the round trip distance—need to drive back home, too. \_\_\_\_\_ miles

3. Use [www.fueleconomy.gov](http://www.fueleconomy.gov) to determine how many miles your car can travel on one gallon of fuel. You may also be able to ask a family member for this information, too.

Average fuel efficiency for your family's car: \_\_\_\_\_ miles per gallon

4. Calculate the number of gallons of fuel used to drive to your store in your family's car.

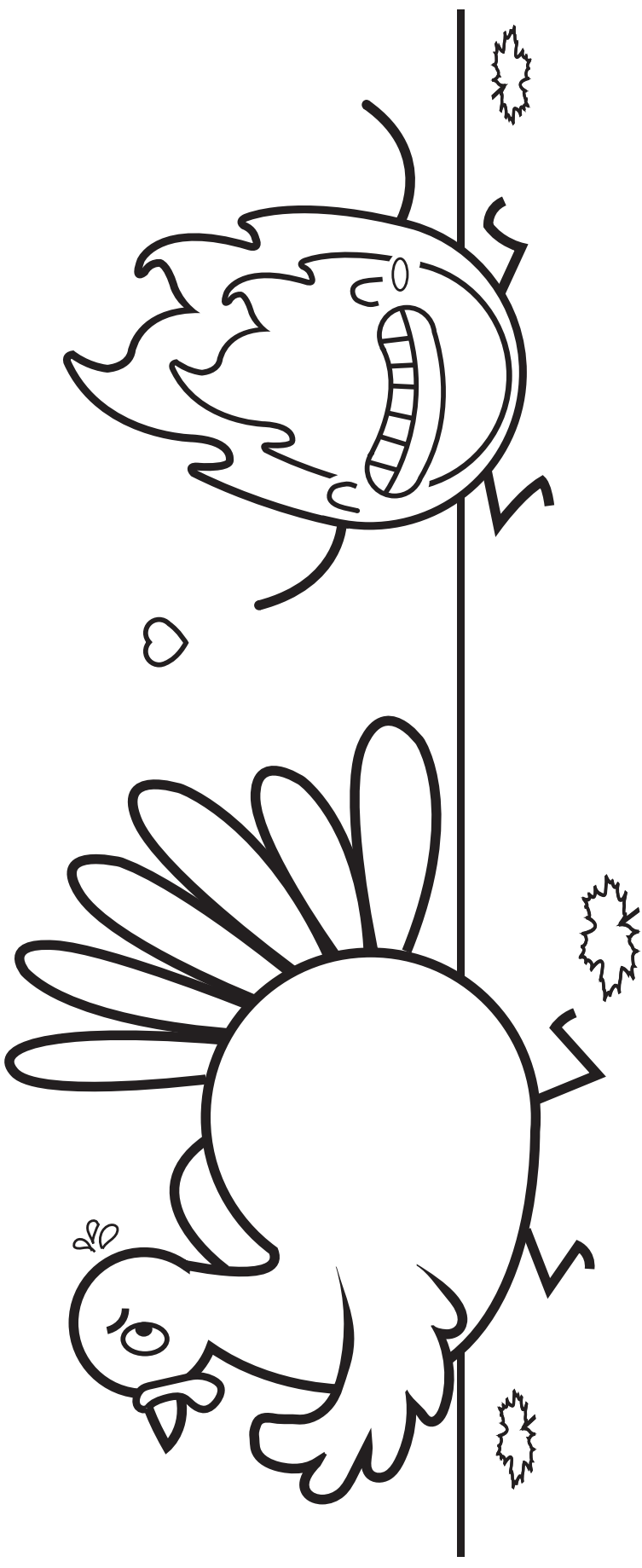
\_\_\_\_\_ miles to the store and back  $\div$  \_\_\_\_\_ miles per gallon = \_\_\_\_\_ gallons fuel used.

5. According to the U.S. Department of Energy, one gallon of gasoline releases about 20 pounds of carbon dioxide into the atmosphere. One gallon of diesel fuel releases approximately 22 pounds of carbon dioxide. How many pounds of carbon dioxide did you release driving to and from the store?

\_\_\_\_\_ gallons  $\times$  \_\_\_\_\_ pounds per gallon = \_\_\_\_\_ pounds CO<sub>2</sub> Released

Now let's think about how the items you purchased got to the store themselves. If you shop at a supermarket, you probably went to one place to buy everything you needed. Most people do their grocery shopping this way. Getting those items to the store requires a lot of energy, too, in the form of diesel fuel to run trains and semi-tractor trucks from the farms and processing facilities to your store.

Some people, though, prefer to shop at farm markets or purchase their foods from local farmers rather than shop at supermarkets. You may want to investigate this further. Does driving from one farm market to another for each item that is produced locally save energy? Which is better, buying items at one store where the items are shipped in from all over, or driving to individual farms to buy different items like turkey, milk, vegetables, and eggs? Write a paragraph or two stating your opinion. You might want to do some research first, or you may have an idea about what is available in your community already.



## **WE USE NATURAL GAS EVERY DAY**

Almost everyone uses natural gas.

Most homes use natural gas for heat.

So do schools and hospitals.

Many stoves and water heaters use natural gas, too.