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Cooking Appliance Selection and Operation: Contemporary Views on Function and Efficiency¹

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Every person has special talents when it comes to cooking. Therefore, discussion on what to cook and how to cook will be limited. The purpose of this guide is to provide the reader with suggestions on what to consider when selecting, operating, and maintaining cooking equipment, with particular emphasis placed on saving energy

TYPES OF COOKING APPLIANCES

There are a wide variety of cooking appliances available to the consumer. Many are very specific in their use; others can be used for a wide variety of cooking functions.

The two major categories of cooking appliances are gas and electric. Electric appliances can be broken down into three sub-categories: electric resistance, electric induction, and electric microwave cooking.

Gas Appliances

Gas cooking appliances use either liquid petroleum (LP) gas or natural gas. The function and characteristics are the same; the only difference is the size of the orifice that allows the gas to flow to the burners. Most gas appliances can be easily modified

to accommodate either LP or natural gas. If there is an option on which fuel to select, natural gas is generally cheaper, and because it is lighter than air, safer than LP gas. Both gases can burn clean and efficiently. Most gas cooking appliances are considerably more efficient and cheaper to operate than electric resistance cooking appliances of the same type, particularly if the gas appliances are fitted with an electric ignition rather than a pilot light.

When using the top burner elements on a gas range, heat is transferred directly to the pot or pan by conduction and convection.

Advantages of gas appliances

- There are an exceptionally wide variety of heat selections for gas burners.
- The size of the flame can be easily controlled to fit the skillet or pot selected.
- The on/off heat is almost instantaneous--cooking begins almost immediately when the flame is turned on and ends when the flame is turned off.
- The heat exchange between the flame and the pot or skillet is very efficient if the flame is adjusted correctly.

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Disadvantages of gas appliances.

- Not all areas are served by natural gas, and is sometimes inconvenient to obtain LP gas.
- Because of the open flame, extra care is required to prevent kitchen fires (grease).
- Because they do not lend themselves to flat surfaces, cleaning the burner tops and surfaces may be slightly more difficult than cleaning electric ranges.

Operation of Gas Appliance

When using gas appliances, the size of the pot or pan selected should match the quantity of food to be cooked. While this may seem over-simplified, selecting too large a pot will waste energy, and selecting too small of a pot can result in spillage and splatter.

Care should be taken to adjust the flame properly to fit the bottom of the pot or pan. An excessive flame will not only waste energy, but could result in uneven cooking and actually slower cooking, than a flame fitting the bottom surface of the pot or pan.

In the summer, when using more than one burner of the oven, the range exhaust vent should be used. The speed selected for this exhaust fan should be based upon the heat being generated by the oven or burners. In the winter, this operation is not as critical, although it might be desirable to carry off cooking odors and fumes.

Maintenance of Gas Appliances

Gas appliances are relatively easy to maintain because they have no moving parts. The burner surfaces should be kept clean, and the gas ports open. The flame should be adjusted so that it is clean and blue. A yellow flame is both dirty and inefficient, and indicates there is not enough air for combustion. On the other hand, a very light blue flame that is sputtering, and hissing indicates there is too much combustion air. The optimum amount of air produces a blue, quiet flame and will leave no residue on the pan.

Generally, once the settings and adjustments are made, very little, if any, readjustment is necessary. If the stove is equipped with a pilot light, the pilot light should be adjusted so it is as small as possible to accomplish the function intended. An excessive pilot light will tend to warm the room and use more gas than necessary.

Some gas and electric ovens have self-cleaning features. These are very energy consuming and should be used with discretion. The extra effort taken to prevent spilling and splattering in the oven will pay off in energy savings. A liner of aluminum foil can protect some of the Oven surface and cooking trays. Liners can be used a number of times before they have to be replaced. If the self-cleaning feature is used, it should be used right after cooking a meal in order to take advantage of the heat that is already contained in the oven.

Electric Cooking Appliances**Resistance electric appliances**

Resistance electric ranges are probably the most widely used cooking appliance. Usually there are four or five resistance top elements and an electric resistance oven. The most common configuration has the oven below the burners. There are usually four to ten heat settings for the top cooking elements, with the lowest setting having the least amount of current going through the element to produce the smallest amount of heat. As voltage increases, more current flows, the resistance produces heat, and the elements can get red-hot.

Most of the heat is transferred directly by conduction to the pot or pan being used. Depending on the heat selected, there is some amount of heat transferred to the pot or pan by radiation from shiny reflectors underneath the burners, although this is usually small.

Advantages of resistance electric appliances.

- Electric ranges are clean and easy to maintain.
- There is less risk of fire because of no exposed flame.
- Some electric ranges have smooth ceramic tops making cleaning convenient.

Disadvantages of resistance electric appliances.

- Electric ranges are not as efficient as gas.
- There are lag times when turning the electric appliance on and off
- The reflector elements are often difficult to clean.
- The resistance elements themselves are usually self-cleaning with a high heat setting.

Selection of resistance electric appliances

Probably the optimum choice for a surface cooking top would be one with four elements--one large for accommodating large pots and frying pans, two intermediate to be used for smaller pots, and one small element for heating small quantities of water for coffee or tea, or where other small quantities of food are cooked.

In terms of energy-efficiency, the range with the oven underneath the burners generally offers a more compact unit and is more efficient because of the way insulation is applied. However, it presents the problem of being hit in the face with a blast of heat when the oven is opened. Care should be taken when opening the oven door. A range with the oven on the top offers eye-level viewing convenience and less discomfort when opening the door. Although a window in the oven door does provide some convenience for viewing food to be cooked, it is generally less efficient than an oven door without a window. An experienced cook knows when to open an oven door at the optimum time and does not need a viewing window.

Some electric resistance ranges come with a ceramic top with the burner underneath the ceramic portion. These ranges are generally less efficient and use more energy than ranges with the resistance elements exposed. They do offer convenience in terms of cleaning.

Although most people like to supervise their cooking directly, range timers do offer some convenience, particularly when a person is doing multiple tasks within the house. Some timers can provide selective control over each cooking element and the oven.

Ovens with self-cleaning features are generally more energy efficient than those without because they have more insulation.

Operation of Resistance Electric Appliances

Because of the thermal lag in electric resistance ranges, additional time should be allowed for preheating the oven and the surface cooking elements. When preheating an oven for baking usually five to eight minutes is sufficient. There is no need to preheat for broiling or roasting. Opening an oven to peek at the food will waste some energy, although this is not as significant as once thought. An

experienced cook knows when to check the food and when the oven should be opened in order to baste or turn the cooking food. The air temperature does drop 25 to 50 degrees every time it is opened. Remember also that both the surface elements and the oven will continue to provide heat after they are turned off because of the heat stored in the elements themselves.

The self-cleaning cycle should be activated on an electric oven only for major cleaning jobs. Small spills and splatters should be cleaned with a damp cloth. When cleaning is necessary, start the cleaning cycle right after cooking, while the oven is still hot.

Cooking utensils should have flat bottoms, straight sides, and tight-fitting lids. The pan selected should be sized to match the burner element.

Maintenance of Resistance Electric Appliances.

The cooking elements, the surrounding area, and the reflectors should be kept clean to avoid fires and maximize cooking efficiency. Defective cooking elements should be replaced by an experienced electrician.

Exhaust vents over the oven and cooking surfaces should be cleaned when grease builds up. Non-disposable filters should be cleaned as necessary, and disposable filters should be replaced.

Induction Ranges

Induction ranges employ a very energy-efficient technique for heating up the cooking utensil. A rapidly changing magnetic field is generated within the appliance, which causes the molecules in specially selected metal pots and pans to heat up. Most of the energy that is generated is transferred directly to the utensils, and little heat is expended in heating up the appliance itself. While not quite as efficient as microwave ovens, induction ranges do offer the special advantage of being able to cook conventionally while using a smooth surface appliance. Induction ranges usually have conventional electric or gas ovens.

Advantages of induction ranges.

- Induction ranges are energy efficient.
- Having flat surfaces, they are generally easy to clean.

Disadvantages of induction ranges.

- Induction ranges are usually very expensive.
- They require special cooking utensils.

Operation of induction ranges

Most induction ranges come with detailed instructions on operation and maintenance. Operation is relatively easy and is similar to a conventional electric or gas range. They are fairly easy to clean and maintain.

Electric Microwave Cooking Appliances

Microwave cooking appliances have excellent potential for saving energy, compared to electric resistance appliances, because most of the energy generated by the microwave is transferred directly into the food. A relatively small amount goes to heating up the appliance or the utensil or plate the food is cooked on.

When microwaves generated in the magnetron hit food items containing water or fat, these molecules become agitated. This generates heat, resulting in thorough and complete cooking in a much shorter period of time than using conventional cooking appliances.

Advantages of microwave ovens.

- Microwave ovens are convenient because food can be cooked and served on the same plate.
- Cooking can also be done on paper plates. Heat is transferred directly to the food, generally making a microwave more efficient for servings of four or six.
- Microwave ovens are especially useful for heating up leftover items, and they have a unique feature of making bakery products soft and fresh when reheated. Microwaves are great for reheating beverages such as coffee.
- They take much less space than a conventional oven.
- When cooking a relatively small amount of food they use approximately 50 percent of the energy that an electric resistance element or oven would use.

Disadvantages of microwave ovens.

- There is some small danger when using microwave ovens around people who wear heart pacemakers. If the door does not fit properly for any reason, microwave leakage could affect the pacemaker. (Most modern microwave ovens are

carefully designed and constructed to minimize this.)

- Special precautions need to be taken when cooking some foods in a microwave to keep them from splattering or exploding.
- Microwave ovens should be used only for cooking purposes, and not for drying.

Selection of Microwave Ovens

Microwave ovens, because of their convenience and quick-cooking capabilities, are a very popular selling major appliance. Several factors should be considered when purchasing a microwave oven.

Because it is very difficult to direct microwaves evenly throughout the microwave oven, selection of an oven that has a rotating carousel is an attractive option. Using this rotating carousel will provide even cooking.

Although microwave ovens are offered with a wide variety of control settings, which include dual times and many cooking levels, most consumers will not use or need all these features. The microwave features most used include the defrost cycle and a full cook cycle with a timer of at least 30 minutes. Most cooking functions will take place within these control ranges. A cost premium will be paid for additional control functions such as more temperature settings, electronic touch and temperature probes.

Another feature that should be considered is the size of the microwave oven and the output wattage. For one or two people, a smaller microwave such as 0.6 cubic feet and 600 watts is generally sufficient. For a larger family (four or more), a microwave with an output of 1,000 watts and a capacity of 1.0 cubic feet or larger should be considered.

Since microwaves do not brown as well as convection ovens, some have these convection oven features added. These features generally are not as cost effective or energy efficient as conventional electric or gas ovens. So if browning is needed, it might be better to precook the item in the microwave and then brown it in a conventional oven, rather than buying an integrated unit.

Operation of microwave ovens

Most microwave ovens have detailed cooking instructions that should be used when operating the microwave. As a general precaution, some food such as unbroken eggs and other foods having membranes

might explode and soil the interior of the microwave unless they are punctured prior to cooking. (There is generally no physical danger.)

Food items containing both water and grease have a tendency to splatter, and should be covered with a cloth, paper, or lid when cooking. A person becomes quite skilled at using a microwave through experience. For example, experience may show that a certain sized mug of coffee will take 1 1/2 minutes to heat at an ideal temperature.

Maintenance of microwave ovens. Most microwaves are easy to maintain and clean. Splatterings and spills should be cleaned as they occur to prevent drying.

There is some danger of burning if metal objects are placed in the microwave. This should be avoided.

SAFETY WHEN USING COOKING APPLIANCES

Common sense will usually prevail when cooking items containing grease. Heat levels should be selected to avoid splattering and spillage, minimizing the potential for fires. A good carbon dioxide or dry powder fire extinguisher is a must in the kitchen. It should be conveniently located for extinguishing fires on the range. The electric exhaust fan located over the appliance should be used when cooking with grease and other volatile foods.

All gas ranges should be installed according to code and tested carefully for gas leaks prior to use. They should have enough air available for proper combustion.

Electric ranges should be properly grounded and installed by a qualified electrician.

Combustibles such as towels, paper products and cleaning fluids should be kept away from cooking appliances.

If small children are present, they should be cautioned of the dangers associated with cooking hot pots and pans, and potential spillage. Pot handles should be turned inward so they don't stick out where a child could reach out and grab them.

ENERGY-SAVING FOOD PREPARATION TIPS

For top-of-the-range cooking, high heat should be used only to bring a liquid to a boil. After boiling begins, then the lowest heat setting should be selected to maintain boiling or simmering. Applying additional heat will only make it boil faster, but not cook faster. Once a liquid begins to boil, its temperature will not increase no matter how much heat is added.

Defrost food first. Frozen foods require more energy than completely thawed foods, whether you are cooking in the oven, under the broiler, or on top of the range. (A roast that has been defrosted requires 33 percent less cooking time than one that is still frozen.)

Rather than using the oven for preparing small quantities of food, consider cooking in one of the small, portable, electric appliances, such as a frying pan, grill, or toaster/broiler. On the average, these use only about one-third the electric power of the oven broiler.

Other tips include the following.

- Use as little liquid as possible to conserve both energy and food nutrients.
- Cutting food such as potatoes, other vegetables and meat into small pieces will decrease their cooking time.
- Use pressure cookers and microwave ovens if you have them. They can save energy by reducing cooking time.
- Plan one-pot meals to save on cooking and cleanup.
- Water will boil faster in a kettle or covered pan.