

CHAPTER 5

Planning and Equipping the Kitchen

LEARNING OBJECTIVES

After reading and studying this chapter, you should be able to:

- Identify factors to consider when planning a kitchen's layout.
- Discuss the benefits and drawbacks of an open kitchen.
- Explain selection factors for purchasing kitchen equipment.
- Identify various cooking techniques.



This chapter states principles of kitchen planning and the selection of kitchen equipment. Kitchen planning involves the allocation of space within the kitchen based on equipment needs, spatial relationships within the kitchen, and the need to keep traffic flows within the kitchen to a minimum. In the kitchen, food is received and processed (prepared) before cooking, and cooked food is moved to a serving station.

The second part of the chapter presents examples of the most commonly used kitchen equipment, their use, and their performance characteristics.

When an existing restaurant is bought, the buyers are often too concerned with survival to think much about changing the layout or the equipment. If they have the capital, they may ask a restaurant equipment dealer to evaluate the current equipment and suggest kitchen layout changes. Some restaurant equipment dealers are quite knowledgeable about layout planning. Others are not.

Restaurant companies and institutions such as hospitals usually turn to experienced, professional planners to draw up plans for building a new or modifying existing kitchen configurations of large, complicated kitchens.

An overall objective of layout planning is to minimize the number of steps waitstaff and kitchen personnel must take. In quick-service restaurants, equipment is placed so that servers take only a few steps. The same principle applies in fine-dining restaurants, even though a particular dish may pass through five hands before being picked up by waitstaff.

Full-service restaurants are usually laid out so that the kitchen flow is from the receiving area to the cold and dry storage spaces to the pre-prep area, where bulk ingredients are measured and cans opened, to the prep area, where vegetables are washed and peeled and fish, meat, and poultry is cut. The flow continues to the cooking area, where soups and stocks are prepared and other cooking takes place. The last station is where final prep takes place (food is finished, plated, and readied for pickup by staff).

Baking and pantry areas (desserts and sandwiches) may be set off by themselves. If feasible, dishwashing and pots and pans are best kept off to one side, out of the traffic flow. The restaurant configuration and limitations often require special layout and design. Ventilation and necessary airflow and building codes may pose special problems.

Figure 5.1 illustrates the flow of a kitchen where food is received, stored, prepped, cooked, and plated.

Arriving at the best layout for complicated kitchens is a highly sophisticated skill and art. John C. Cini, president and CEO of Cini Little, an international food-service and hospitality business and also a design consulting firm headquartered in Rockville, Maryland, comments, “Great thought is put into every one of our

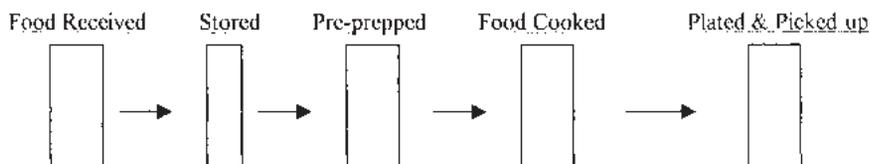


FIGURE 5.1: Kitchen flow
 Courtesy of The American Gas Association

designs, taking into consideration the activities that actually occur during the food preparation, cooking, and serving processes.”¹

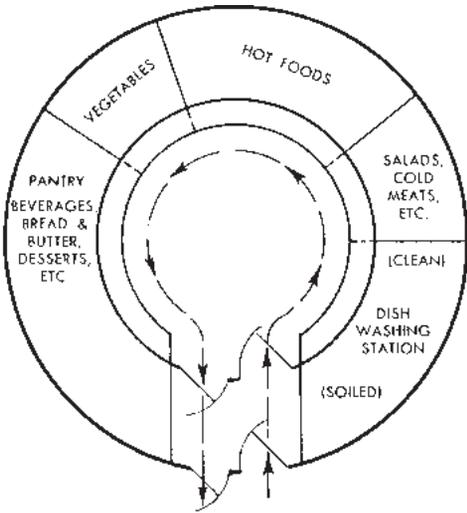
A designer with experience in operations has the advantage of being able to relate to and anticipate the behaviors of the personnel who will utilize the facility. For example, one cannot assume that staff members will understand or obey the design intent of a facility. The designer must realize that servers typically take the shortest and most convenient route from any one place to another. Chefs want their work organized in a manner that minimizes excess activity and unnecessary steps. If these concepts are not incorporated into a design, the workers may implement their own makeshift accommodations to satisfy their needs. This diminishes the value of the design and decreases the efficiency of the operation. The efficiency and comfort of the staff is important to the operation. Recent trends, such as ergonomics (the applied science of equipment design intended to reduce staff fatigue and discomfort), influence foodservice facility design. This may include lowering counter heights to make the task of slicing deli meats easier or providing a floor covering that does not tire the body as quickly.

Outside pressures in the form of legislation and public policy also affect foodservice design. For example, compliance with the provisions of government plays a major role in maintaining standards to accommodate the needs of workers and customers who are disabled. These influences are responsible for widening aisles and making equipment more readily accessible. Sanitation is another large factor in foodservice equipment. Designers must understand National Sanitation Foundation standards and apply them to the actions of the workers. By providing a safe work environment, the restaurant benefits by limiting injuries, maintaining morale, and reducing employee turnover. Customers benefit from a decrease in food-borne illness, better service, and an overall higher-quality dining experience.

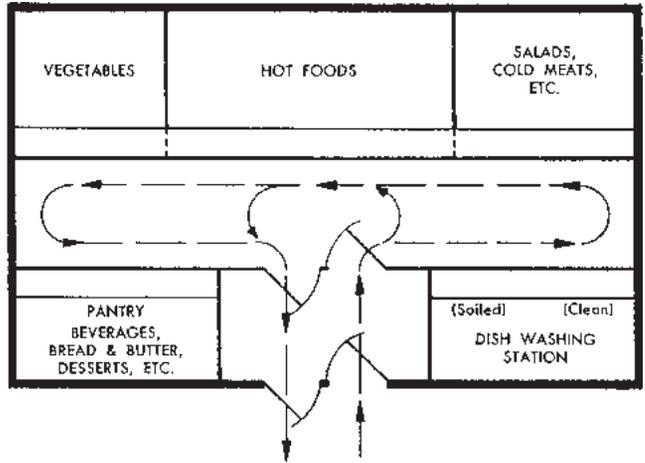
Cini lists trends in kitchen equipment and their use:

- New equipment combines refrigerated bases with kitchen ranges and grill tops. This enables chefs to have raw foods at hand, so that they need not turn around to open a refrigerator.
- Self-cleaning hoods and ventilators that trap odors and fumes can be automatically controlled by pumps that spray hot water and detergent on the hoods during off hours, thereby limiting grease buildup.
- Combination oven/steamers allow cooks to use either moist or dry heat, or a combination of both. Vegetables can be steamed, cookies can be baked, and meat can be braised with one piece of equipment.
- Induction heating, which has been used in the past for exhibition cooking and in cafeterias, allows chefs to prepare food in full view of customers while eliminating wild heat, excess grease, and noisy ventilators.
- Kitchen equipment now includes computers that automatically control ovens. A bakeshop worker can program the oven to bake different breads at different temperatures and levels of humidity for specific times. Desired oven temperatures can be saved in the computer’s memory.²

The American Gas Association has published examples of kitchen plans to show the work flow within a typical kitchen layout (see Figure 5.2). The plans

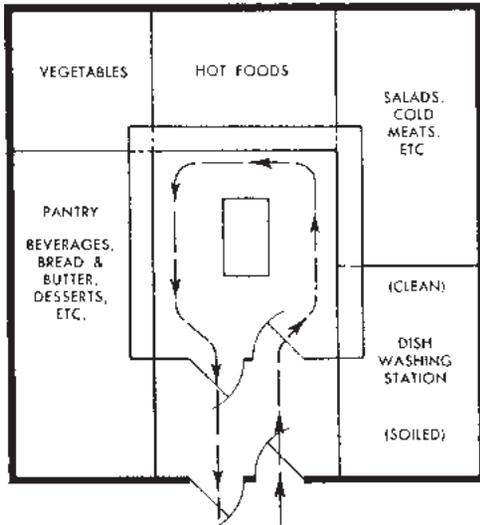


CIRCULAR
Ideal but impractical

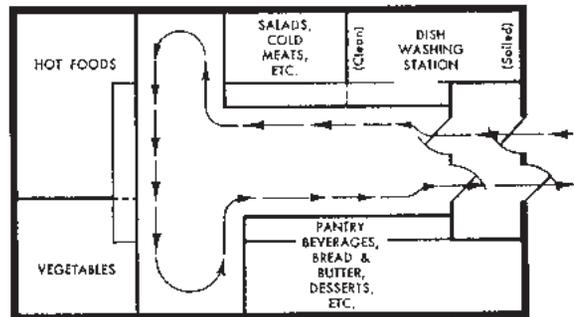


RECTANGULAR
Kitchen Entrance on Long Side

This is usually the preferred layout of the serving area of a restaurant kitchen. The shortened paths indicate the travel if all stations need not be contacted.



SQUARE
Design approximates a circle but usually wastes space in the center of the serving area



RECTANGULAR
Kitchen Entrance on Short Side
Hot foods must be carried considerable distances and waiters at the various stations may be obstructing traffic to and from the dining area.

FIGURE 5.2: Serving area
Courtesy of The American Gas Association, Washington, D.C.

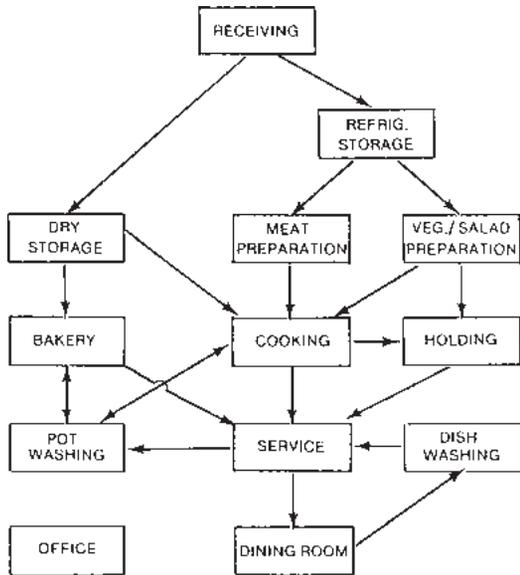


FIGURE 5.3: Arrangement of work centers

Courtesy of Dr. Arthur C. Avery, Professor Emeritus, Purdue University

show the movement of food from delivery through the various workstations and on to the guest. As the diagram shows, circular work flow patterns are not efficient. Square designs also waste space in the center of the service area. The preferred kitchen plan is rectangular in shape, providing the shortest paths when not all stations within the kitchen are contacted.

Dr. Arthur C. Avery, professor emeritus at Purdue University, studied kitchen efficiency and created arrangements of *work centers* in a typical service restaurant that has a fairly limited menu. A flowchart (see Figure 5.3) traces the movement of food from storage and preparation areas to the center of the kitchen, where the food is cooked. From the cooking area, the food goes to the service area, and from there into the dining room. System elements are interdependent; cooking is dependent on meat preparation, meat prep on refrigeration, refrigeration on receiving.

Avery suggests these methods of increasing kitchen efficiency:

- Use purveyors that have a wide base of supply (so that fewer deliveries are needed).
- Use conveyors to take food to service areas.
- Place service stations in the dining room with silver, beverages, soups, and other items to reduce back-and-forth traffic to the kitchen.
- Use automatic conveyors to take racks from the dining room through the dishwasher and then back to the dining room.³

Back of the House Green

Given the high and increasing cost of electricity, gas, and water, it is smart to cut utility costs without sacrificing service, quality, style, or comfort. Induction cooking, which is generally more energy efficient than gas or conventional electrical heat, is one way of greening the back of the house; another is by using the innovative high-speed ovens. This new variety of hybrid equipment has been developed to meet the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, a voluntary building certification program.⁴

According to Energy Star, a branch of the U.S. Environmental Protection Agency, as much as 80 percent of the \$10 billion annual energy bill for the commercial foodservice industry does no useful work. These lost energy dollars

are often wasted in the form of excess heat, ventilation, and refrigeration, or generated by inefficient appliances.⁵

Restaurants that purchase their equipment wisely can cut their energy costs 10 to 30 percent. Energy Star estimates that by outfitting a kitchen with equipment they currently qualify, the typical restaurant owner would save approximately \$2,500 annually in gas and electric bills.⁶ One often overlooked high-energy user is the hood because it sucks up all the air you just spent lots of dollars to cool down. Thankfully, there is now a new generation of super-efficient exhaust hoods. These new exhaust ventilators use high-efficiency filters to take advantage of the flow of thermal air currents to keep the amount of air wasted to a minimum. Some have the addition of a real energy saving switch or computer program to vary the speed and amount of air extraction. Exhaust ventilators do not need to be on at full speed all the time.⁷

Open Kitchen

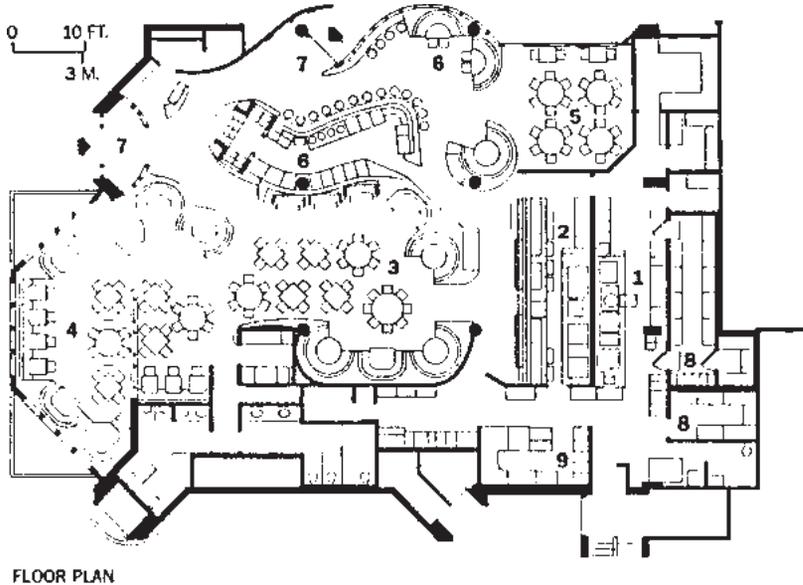
Open kitchens (also called exhibition kitchens) have their own equipment and are growing in popularity. By taking down the walls that separate chefs from diners, restaurants are creating more interactive and upbeat atmospheres. According to Roland Passot, chef/owner of the highly regarded La Folie in San Francisco and owner and chief culinary officer of the Bay Area's Left Bank restaurants, "The benefits of having an open kitchen are that it brings energy to the dining room, creates a show for the customer, like watching a performance, and it gives the customer a sense of being on the 'inside,' similar to a reality TV show."⁸

Sometimes an open design focuses on highlighting the kitchen; other times it could highlight a piece of equipment. A steakhouse focuses on the cooking of meat, an Italian restaurant on pizza. These focal points are highlighted by lighting the dining room slightly less than the kitchen. Standard kitchen equipment, such as refrigerators, are placed in other parts of the kitchen that are not visible. Standard food preparation is not usually featured.

The open kitchen is reserved for what is glamorous: bright, shiny ladles, stainless steel and copper utensils—perhaps a stainless-steel counter where food is picked up by staff. A hole in the counter can be used for dropping garbage into a container. A few exhibition kitchens cook by induction coils. Some open kitchens use under-the-counter refrigeration units to conserve space and expedite work. The area set aside for open kitchens costs about 25 percent more than in a standard kitchen. Figure 5.4 shows the floor plan of an open kitchen.

There are also some drawbacks to having an open kitchen. The noise level of a completely open kitchen must be reduced with washable acoustic tile in the ceiling. The dining room and banquet rooms must feature carpet, upholstered chairs, and washable window drapes, plus acoustic ceilings. A few visually open kitchens are enclosed in glass, which eliminates the noise problem. The fact that chefs and cooks are completely exposed to guests means that every word and every gesture is visible. Cooks and chefs must be able to control themselves

The California Café Bar & Grill in Schaumburg, Illinois, by Engstrom Design Group, serves California cuisine. The open kitchen, visible from all 200 seats in the restaurant, directs views away from the adjacent Woodfield Mall and its huge parking area. The kitchen is divided with a granite-topped pass shelf that is clad in wood veneer on the restaurant side. Work counters are maple butcher block or stainless steel. The back wall of the open kitchen is covered in ceramic tile and stainless steel, and acid-etched copper panes hide the exhaust hood. The floors are quarry tile. Actual cooking ingredients are set on metal shelves on the wall behind the pantry. Noise is mitigated in the dining room with a combination of drop-in acoustical ceiling tiles, carpeting, fully upholstered booths, and heavy draperies dividing open, private, and semiprivate dining areas.



- FLOOR PLAN**
- | | | | | |
|------------|-----------------|------------------|-----------------------|-------------------|
| 1. Kitchen | 2. Open kitchen | 3. Dining area | 4. Semiprivate dining | 5. Private dining |
| 6. Bar | 7. Entry | 8. Refrigeration | 9. Dishwasher | |

FIGURE 5.4: Open kitchen floor plan

Courtesy of the California Cafe Bar & Grill, Schaumburg, Illinois

under pressure. Guests may also feel that since they can see the chefs and/or cooks, it is all right to talk to them. Complaints or praise could pose problems on a busy shift.

Costas Katsigris and Chris Thomas, in their book *Design and Equipment for Restaurants and Foodservice: A Management View, Third Edition*, assembled a number of tables that show the range in space needed for various restaurant activities.⁹ (See Figures 5.5 to 5.9.) The tables can be used as reference when buying, building, or modifying a restaurant. In general—there are many exceptions, depending on the restaurant service—kitchens are about half the size of the dining room, and the space needed for seating varies:

- Deluxe—15 to 20 square feet per seat
- Medium—12 to 18 square feet per seat
- Banquet—10 to 15 square feet per seat

Type of Service	Kitchen Square Footage per Dining Room Seat	Total Square Footage in the Back of the House per Seat
Cafeteria/commercial	6–8	10–12
Coffee shop	4–6	8–10
Table service restaurant	5–7	10–12

FIGURE 5.5: Dimensions for commercial foodservice kitchens

Source: Jay R. Schrock

Meals Served per Day	Receiving Area Square Footage
200–300	50–60
300–500	60–90
500–1,000	90–130

FIGURE 5.6: Space dimensions for receiving areas

Source: Carl Scriven and James Stevens, *Food Equipment Facts* (New York: John Wiley & Sons, 1999)

Meals Served per Day	Dry Storage Square Footage
100–200	120–200
200–350	200–250
350–500	250–400

FIGURE 5.7: Space dimensions for dry storage

Number of Doors	Height (inches)	Width (inches)	Depth (inches)	Cubic (feet)
1	78	28	32	22
2	78	56	32	50
3	78	84	32	70–80

FIGURE 5.8: Full-door reach-ins

Source: Carl Scriven and James Stevens, *Food Equipment Facts* (New York: John Wiley & Sons, 1999)

Size of Unit	Square Footage	Cubic Feet
5'9" × 7'8"	35.7	259.9
6'8" × 8'7"	47.4	331.8
7'8" × 7'8"	49.0	340.2
8'7" × 11'6"	86.4	604.8

FIGURE 5.9: Walk-ins (all 7-foot 6-inches height)

Source: Carl Scriven and James Stevens, *Food Equipment Facts* (New York: John Wiley & Sons, 1999)

The space needed in the back of the house varies as well:

- Deluxe—7 to 10 square feet per seat
- Medium—5 to 9 square feet per seat
- Banquet—3 to 5 square feet per seat¹⁰

Kitchen Floor Coverings

Kitchen floors are usually covered with quarry tile, marble, terrazzo, asphalt tile, or sealed concrete—materials that are nonabsorbent, easy to clean, and resistant to the abrasive action of cleaning chemicals. In areas where water is likely to accumulate (for example, near the dishwasher), neoprene matting provides traction, making walking and standing less stressful than they are on hard surfaces. In all kitchen areas, the surfaces should be covered with nonskid material. The number-one cause of restaurant accidents is slipping and falling. Older employees who fall may break bones or suffer a concussion. The same rule applies in dining rooms with even more urgency. Plaintiffs who have fallen and broken bones have won large lawsuits against restaurants.

Building codes do not permit carpeting in kitchens. Coving—the curved, sealed edge on kitchen perimeters that eliminates sharp corners and gaps—is essential. Perhaps the most effective way to prevent slips and falls in kitchens and elsewhere in a restaurant is to enforce a rigid rule that anything spilled, including water, be wiped up at once.

Kitchen Equipment

Selection of *kitchen equipment* may seem simple or complex, depending on your level of experience. Independent restaurants may be copies of existing restaurants, more or less duplicating kitchen layout and equipment. Operators taking over an existing restaurant are likely to continue using the equipment already there. Equipment dealers are ready to make recommendations. Figure 5.10 shows one suggested layout. Restaurant shows, where dozens of equipment manufacturers display their wares, are staged each year; the largest is one managed by the National Restaurant Association in Chicago. Each year a similar one is held in New York City and another in California. Tens of thousands of foodservice operators attend these shows to see new developments in food and equipment.

Today, there are advancing trends in sustainable kitchen equipment. The Energy Star program is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. They help homes and businesses save money and protect the environment through energy-efficient products and practices.¹¹ “EPA provides an innovative energy performance rating system which businesses have already used for more than 30,000 buildings across the country.”¹² Ideas for conservation of energy and water include the installation of Energy Star kitchen appliances, Energy Star compact fluorescent lamps, low flow prerinse spray nozzles at the dish machine, and flow restrictors on faucets.

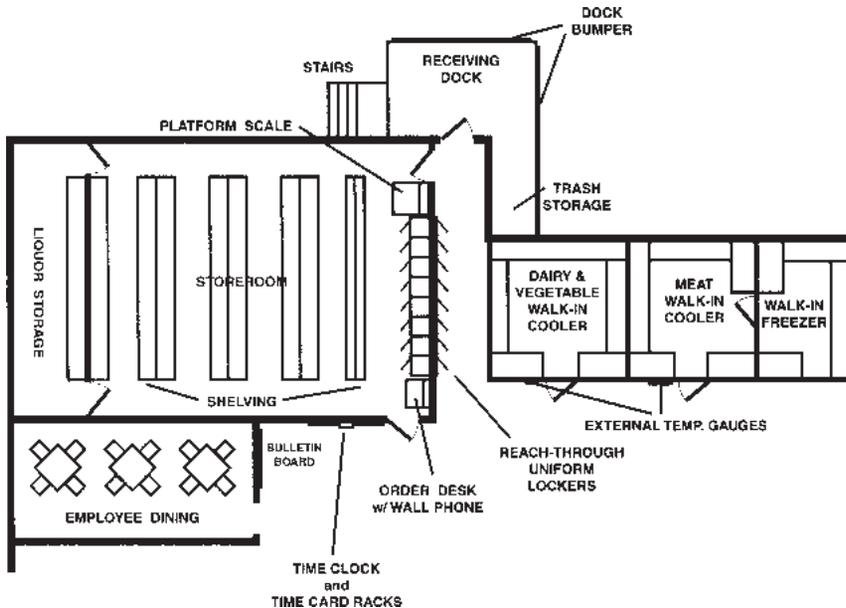


FIGURE 5.10: The back of the house

The National Restaurant Association recommends the following for reducing water waste:

- Thaw frozen foods in the refrigerator
- Purchase a water-efficient dishwasher and wash only full loads
- Soak pots and pans before hand washing
- Cook vegetables with a minimum amount of water and use cooking water for soup stock
- Train your staff to turn off the water promptly¹³

In addition, the National Restaurant Association recommends the following for reducing electricity waste:

- Use fluorescent lighting for indoor and outdoor fixtures
- Install timers or occupancy sensors
- Focus light on areas where it's most needed
- Reduce the burden on your electrical system, don't turn on all electrical equipment at the same time
- Make sure the size of an appliance suits your needs (and reduce size where possible)
- Reduce the number of times a day you adjust your thermostat
- Change dirty air filters on air conditioners¹⁴

As previously discussed, professional restaurant planners are available for a fee to plan, lay out, and recommend restaurant equipment. They can also help in developing, changing, or modifying concepts.

CATEGORIES OF KITCHEN EQUIPMENT

The standard equipment needed in restaurant kitchens can be divided according to purpose or *categories of kitchen equipment*:

- Receiving and storing food
- Fabricating and preparing food
- Preparing and processing food
- Assembling, holding, and serving food
- Cleaning up and sanitizing the kitchen and kitchenware

SELECT THE RIGHT EQUIPMENT

Anyone selecting kitchen equipment, beginner or veteran, faces some common questions:

- Of the equipment available, which will be the most efficient for the menu, item by item, and for menu items contemplated in the future?
- What is the equipment's purchase cost and operating cost?
- Should the equipment be gas fired or electric?
- Will the equipment produce the food fast enough to meet demand?
- Is it better to buy a large unit or two or more smaller units?
- Are replacement parts and service readily available?
- Is reliable used equipment available?
- Is more energy-efficient equipment available?

MATCH EQUIPMENT WITH MENU AND PRODUCTION SCHEDULE

The menu determines the equipment (see Figure 5.11). Look at the menu, item by item. What equipment is needed to prepare each item? Other variables include:

- *The projected volume of sales for each menu item*: What size of equipment or how many pieces of equipment will be needed? Do not overequip. Market conditions may force menu changes.
- *Fixed or changing menu*: A fixed menu needs fewer kinds of equipment.
- *Menu size*: Large menus may call for a greater variety of equipment.
- *Speed of service desired*: Fast service may call for equipment of larger capacity. Reduced cooking time translates into higher seat turnover in the dining room.

STORAGE		
Cold storage reach-in units	Cold storage walk-in units	
FABRICATION AND PREPREPARATION		
Breading machines	Cutters and slicers	Mixers
Can openers	Knife sharpeners	Peelers
PREPARATION AND PROCESSING		
Broilers	Hot dog cooking equipment	Revolving tray ovens
Cheese melters	Hot plates	Steamers
Convection ovens	Microwave ovens	Steam-jacketed kettles
Display cooking equipment	Mobile mini-kitchens	Steam boilers
Egg cookers	Ovens	Tilting fry pans
Frying equipment	Proof cabinets	Ventilators
Griddles and grills	Ranges	Waffle bakers
ASSEMBLY, HOLDING, AND SERVING		
Beverage equipment	Dispensing equipment	Mobile buffet and banquet equipment
Coffee brewers	Food reconstitutors	Shake and soft-serve equipment
Coffee ranges	Hot serving equipment	Toasters
Cold serving equipment	Infrared warmers	Dish-dispensing equipment
CLEANUP AND SANITATION		
Cleaning and sanitizing	Dishwashing equipment	Glass washers
Compactors	Disposers	Water-heating equipment

FIGURE 5.11: Electric equipment found in restaurants

- *Nutritional awareness and equipment selected:* Interest in nutrition brings an increased interest in the method of food preparation used. Frying is avoided to cut down on consumption of fats. Baking, broiling, and steaming are more healthful ways to prepare meat, fish, and fowl.

Multiple uses for equipment means less kitchen space must be allocated to equipment. *Slow cooking* with ovens can be done during the night, freeing up oven space for daytime use. Small-quantity, staggered cooking for vegetables can be done with a relatively small piece of steam-pressure equipment.

TOTAL COST VERSUS ORIGINAL COST

The initial cost of equipment is but one factor in the cost equation. What about life expectancy and parts replacement? How often must the magnetrons in a microwave be replaced? How long do the infrared lamps last? The thermostatic controls in the fryer? Even more important is the cost of energy each piece of equipment consumes. In most locations, gas is much less expensive than electricity, sometimes dramatically so. Electric equipment requires warm-up time. Gas heat is immediate. Cost of warm-up time is considerable on equipment that is used intermittently. Over the period of a year, the operational cost differential becomes an important factor in the choice of equipment. The initial cost of upgrading to

energy-efficient equipment may be high in the beginning, but over time you earn that money back in lower utility bills.¹⁵

SELECT THE MOST EFFICIENT EQUIPMENT FOR THE PEOPLE AND SKILLS AVAILABLE

Too often a kitchen is loaded with equipment that is seldom or never used. Select only those pieces of equipment that are most efficient and necessary for the menu. Many European kitchens and small restaurant kitchens in the United States prepare outstanding food using only a stovetop burner, pots and pans, a few knives, and other small equipment. A few seafood restaurants produce a high volume of food using only deep fryers. McDonald's restaurants are built around a griddle and deep fryers. Several other large hamburger chains revolve around a conveyor-type broiler.

DE-SKILLING THE JOB WITH EQUIPMENT

Much of the new kitchen equipment is designed to reduce or eliminate cooking skills. One of the best examples of this type of equipment is the conveyor broiler used by several fast-food hamburger chains. The employee needs only to place frozen patties of hamburger on the conveyor belt, which carries the patties through flames directed from above and below. The movement of the conveyor belt is timed so that when the patties drop out at the other end of the broiler, they are done. There is no need for the employee to know when to turn the patties, how to control the griddle temperature, or how to clean the griddle. The same is true of the new conveyor pizza ovens.

Automatic crepe-making machines are controlled so that a perfect crepe is produced automatically, without timing or turning.

The grooved griddle de-skills broiling. The griddle maintains a constant temperature, and meat is merely placed on it. There is no need to raise or lower a rack to control temperature, as must be done with traditional broilers.

The quartz-fired griddle produces heat from above as well as from below and eliminates the need for turning the food.

Cook-chill and *sous vide* are two techniques that have gained in popularity. The cook-chill process enables chefs to safely (and efficiently) prepare large amounts of food for long-term storage in a refrigerated environment. Food is prepared and rapidly chilled to prevent bacterial growth and is available in portions of various sizes. Consistent quality and substantial reduction in labor cost and stress levels are the result in the kitchen. Food is prepared to restock inventory rather than to order. One of the best applications of cook-chill is when cooking batches of food in a centralized kitchen for later use in a satellite facility. This method not only extends shelf life, it also lowers production costs. For example, the cook-chill system processes about 70 percent of the food made at Morongo Casino, Resort & Spa thus allowing the kitchen to operate with approximately 30 percent fewer employees.¹⁶

Sous vide is popular in Europe, especially in France, where it was developed. With this technique, food is prepared in the restaurant kitchen, often during slack times. It is then individually vacuum packed and refrigerated for future use. Perhaps the best application of sous vide is for à la carte menu restaurants and for a group of restaurants that share a centralized production kitchen. Sous vide requires refrigeration equipment and a vacuum-packing machine, but these costs may be recovered by labor savings and more effective portion control. Sous vide cooking is becoming increasingly popular among professional and amateur chefs who are taking advantage of its many benefits and using it to experiment with new dishes.¹⁷

Equipment Stars

The principal pieces of cooking equipment—the stars—are selected to best prepare the principal menu items. The other equipment is arranged around the stars and constitutes the supporting cast. In older kitchens, saving money and reducing waste means replacing outdated equipment. Again, the cost is high in the beginning, but over time you earn that money back in lower utility bills.¹⁸

The stars of a hamburger restaurant are the griddle (or broiler) and the deep-fat fryers. The same is true for coffee shops and pancake restaurants. In a full-service restaurant, stovetops, ovens, and broilers dominate the scene. In a Chinese restaurant, the star is the wok, a large basinlike pan around which the supporting equipment is arranged.

In planning a kitchen and selecting equipment, think of the dominant menu items, those expected to have the highest volume of sales. Place the cooking equipment for these items to support the cooking stations. Preparation of these foods can take place elsewhere, but preferably close by.

STOVE/OVEN

Probably the most prominent piece of equipment in the full-service kitchen is the traditional range, the combination stove and oven, fired by gas or electricity. These are often also the biggest energy users in the restaurant. For a shortcut to the biggest energy and cash savings, attention should be focused on what are likely to be the kitchen's biggest energy users: broilers, hot top ranges, boiler-based steamers, pasta cookers, conveyor ovens, and combination ovens.¹⁹ Take broilers, for example. Cutting out only one hour each day of broiler “on” time can translate to a savings of around \$450 annually. If your restaurant operates with a profit margin of around 5 percent, you'll need about \$9,000 worth of sales to earn \$450.²⁰

The kitchen is often planned around the stove/oven. With the availability of *convection ovens*, steam-jacketed kettles, and *tilting skillets*, some kitchen planners deliberately eliminate the range, regarding it as cumbersome and inefficient. Newer equipment that transfers heat more efficiently than the old space-consuming



Stoves with burners and griddles sell for about \$1,750 to \$2,500

Courtesy of the Vulcan Hart Company

range is preferred. Important pieces of cooking equipment are the oven, tilting skillet, *combination convection and microwave oven*, *convection steam cooker*, the microwave oven, and the deep fryer. The range top stove, however, is still probably the workhorse of a full-service restaurant kitchen.

The sectionalized griddle, whose surface has sections separately controlled for temperature, can cook different foods at different temperatures at the same time: 300°F for eggs, 350°F for sausages, and 400°F for small steaks. The sectionalized griddle provides flexibility. If only hamburgers are to be cooked, all sections can be set at the same temperature, or one section can be set at a lower temperature for slower cooling in case customer demand is unpredictable.

Griddle tops are usually made of steel boilerplate, 1/2 to 1 inch thick. The thicker ones are less likely to warp. Some tops are made of sheet aluminum, and one brand is made of steel with a chromium surface. The griddle surface itself can be on a stand, mounted on a table, or set as part of a range top. To achieve even temperature across the griddle surface, a heat pipe has been introduced.

To determine the size of griddle needed, planners project the volume of food to be cooked during peak periods and the time required for each item to cook. If a hamburger requires four minutes to cook and 100 are needed during the peak hour, 25 hamburgers must be cooked at one time. One griddle is needed. Suppose that eggs, pancakes, and other foods will also be ordered during the peak period. Two griddles are called for. Two griddles, placed side by side, enable two cooks to work simultaneously. Two griddles also permit a trainee cook to watch, work, and learn alongside an experienced cook. Most coffee shops install two griddles side by side, even though both may be needed at the same time only an hour or two each day. Alternatively, a sectionalized griddle with separate controls for each griddle may do the job.

To maximize the griddle during peak periods, some foods may be precooked in a steamer, and then finished quickly on the griddle during mealtime. Steamer technology has come a long way in recent years. Today, they can rank among the more energy-efficient kitchen appliances.²¹

Griddles require adjacent worktables for holding and getting food ready. In purchasing a griddle, Professor Avery recommends buying only those that preheat to 350°F or 400°F in 7 to 12 minutes. To conserve energy, he recommends covering a griddle not in use with a metal or, preferably, a pressed-foam cover.

Griddles serve multiple purposes. They can substitute for a solid-top range; perhaps one part is used as a griddle, the other as a stovetop. Griddles are used for browning and cooking meat, cooking pancakes and eggs, and toasting buns and sandwiches.

More recently, the grooved griddle has been widely used for cooking steaks. In many fast-food restaurants, it has replaced the broiler. The ridges in the griddle produce marks on a steak similar to a broiler's, and the grooves allow fat and juices to drain off, avoiding most of the smoke created by the conventional broiler. Another consideration: The grooved griddle uses less fuel than a broiler. The grooved griddle is popular with chain operators because much less skill is required to cook meat. Hamburgers cooked by a grooved griddle are less likely to be burned. With a hot broiler, if the cook looks away for a minute or two, the hamburger becomes a charburger.

DEEP-FRYING EQUIPMENT

Manufacturers produce fryers designed for water boiling with thermostats that go up to 212°F (as opposed to 390°F for deep-fat fryers). Operators use these *deep fryers* to boil seafood, vegetables, and pasta products.

Pressure fryers are fryers whose lids, when closed, act to create pressure within the fry kettle. Increased pressure reduces the cooking time by as much as one-half, mainly because less evaporative cooling occurs. Some pressure fryers include moisture injection systems. The water injected turns to steam.

Deep-fat fryers can act as cooking pots; when filled with water, they can be used for quick-cooking vegetables, cooking hams or frankfurters, reheating foods, hard-boiling eggs, cooking macaroni or spaghetti, or holding canned or containerized foods. (Electric fryers cannot be so used; water will affect the heating element.)

A number of restaurants that serve fresh vegetables blanch them in a deep fryer, remove them, and immediately cover them with ice to stop the cooking process. Blanched vegetables can be held in a refrigerator for later service. Final preparation is done by sautéing the vegetables and serving them immediately.

LOW-TEMPERATURE OVENS

Low-temperature ovens that permit low-temperature roasting and baking are widely used in the restaurant business to reduce shrinkage of meat and to hold meat so that it can be served to order from the oven. One such oven, the electric-fired Auto Sham, is popular for roasting beef. A large coffee shop chain buys 2- to 3-pound tips (meat cut in chunks near the sirloin). The tips are cooked for four hours at 250°F and held at 140° to 150°F. All of the meat is cooked to the rare stage or a little above. If medium beef is called for, the ends are used. When well done is ordered, a hot au jus is poured over the meat to bring it to the well-done stage.



Deep-frying equipment. Electric or gas-fired kettle for holding fat or oil in which baskets can be immersed for frying food. Temperature usually can be controlled in a range of 325° to 400°F
Courtesy of the Vulcan Hart Company

FORCED-AIR CONVECTION OVENS

A *forced-air convection oven* is similar to a conventional oven except that a fan or rotor, usually located in the back, makes for rapid circulation of the air and quicker heating of the food. Preheating and cooking times are considerably less than with the conventional oven. Directions for baking with a convection oven must be followed exactly; otherwise some foods, such as sheet cakes, will dry out excessively on top. A pan of water is placed in the oven when baking some foods to humidify the oven air and reduce moisture loss in the food.

MICROWAVE OVENS

The cooking chamber of the microwave oven is usually small and of lesser capacity than that of larger conventional or other types of ovens. Magnetrons in the top of the oven emit microwaves. These electromagnetic waves of 915 or 2,450 megacycles penetrate foods in the chamber and are absorbed by food materials containing water, agitating the water and fat molecules to produce heat, which is conducted to other kinds of molecules surrounding them. Cooking by microwave relies completely on radiated energy to penetrate food and set up intermolecular friction, which heats the food.

There is no preheating time, because once the microwaves are produced, they travel at the speed of light and enter the food almost instantaneously. Compared with standard ovens, relatively small quantities of food can be prepared at one time in microwave ovens. However, they are excellent for reheating small quantities of food.

Strangely, some materials are transparent to the waves and are not heated by them. Glass, china, and paper containers do not absorb the waves. Metal reflects the waves, so metal containers are not used in microwave ovens.

Because microwaves are absorbed preferentially by water, cooking is not uniform. Instead of heat being applied to the surface of the food, then being conducted slowly into the interior, microwave energy heats the food under the surface as well. The surface is left uncooked and relatively cool, unless the oven contains a special browning unit with infrared heating elements.

Advantages and Disadvantages of Microwave Cooking Microwave cooking has several advantages over conventional methods of cooking. The energy can be directed; there is no heat loss to the kitchen from the oven; and the speed of cooking is amazingly fast for small quantities of food.



A conventional oven. Standard or range ovens heat food by heating the air in a chamber. This air surrounds food and cooks it
Courtesy of the Vulcan Hart Company



A grill is now a popular piece of restaurant equipment, predominately used for meats and fish

Courtesy of the Vulcan Hart Company

Without a browning unit and used correctly, there is no spillage or spluttering, which makes for easy cleaning. There is little fire hazard.

The principal disadvantage of the microwave oven for commercial kitchen use is its relatively low capacity. It is usually the fastest-cooking device available for heating, defrosting, or cooking one or a few small items, such as a single casserole, hot dog sandwich, lobster tail, or trout. All of these are high-moisture items. As additional items are placed in the oven, heating or cooking time may increase by 75 percent or more per item. A microwave oven can bake a single Idaho potato in five to seven minutes, compared with an hour for a conventional oven. Two potatoes almost double the baking time in the microwave oven. The conventional oven bakes two or perhaps 50 potatoes in the same one-hour period.

The second major disadvantage of the microwave oven is a result of its very advantage: its speed. A few seconds short or long, and the food is under- or overdone. Different food materials heat at different rates. For example, bread in a frozen sandwich heats faster and is overheated before the filling is thawed; fat and water heat faster than muscle. Also, microwaves

do not evenly distribute in a food, which results in uneven heating and cooking. Other variables are involved, making microwave ovens the most complex to use of all cooking equipment in the present-day kitchen. In restaurants, microwave ovens are mostly used to heat finished food items. When a quantity of over 8 pounds of food is to be cooked, the microwave oven cooks no faster than a conventional oven. Some practical uses for microwave ovens are:

- Reheating previously cooked foods
- Quickly heating desserts
- Defrosting
- Special-request orders
- Precooking

The principal use for the microwave oven is probably for reheating frozen foods that have already been cooked. It has little value for producing baked-dough items or any food that involves a leavening action.

INFRARED COOKING EQUIPMENT

Like microwave energy, infrared waves, transmitted at the speed of light, can penetrate the vapor blanket that surrounds moist food when heated. Infrared

wavelengths used for cooking are only microns in length. Wavelengths of about 1.4 to 5 microns are said to be the most effective for cooking foods. Several specialized infrared ovens are marketed for the purpose of reheating frozen foods. Infrared broilers and ovens, which reduce cooking time, are also being produced.

Relatively new equipment on the market uses infrared emitters above and below a conveyor belt or in compartments resembling a standard oven. Electrically fired, the emitters can be temperature controlled separately, depending on the product being cooked. An 8-ounce filet mignon, for example, can be cooked in 10 minutes using 700°F temperature on both the top and bottom deck. A 9-inch deep-dish pizza takes 14 minutes using 575°F on the lower deck and 650°F on the upper deck. A 12-ounce soufflé is done in 12 minutes using 530°F for both decks. Cookies are done in seven minutes using 500°F.

HOT-FOOD HOLDING TABLES

Food being held almost always loses quality, but in many restaurants there is little choice but to hold some of it prior to service. Hot tables constitute the serving containers in cafeteria service; here, warming tables patterned after the old bain-marie (water bath) are used. The bain-marie is simply a tank holding heated water in which hot foods in pots or crocks are placed to keep food warm and to avoid cooking. The modern steam table is heated by gas, electric, or steam elements controlled by a thermostat.

The more sophisticated warming tables are sectionalized to permit specific temperatures for particular foods: soup at 180°F, meats at 145° to 150°F, and vegetables at 140°F. Those tables containing heated water keep the foods moist and delay their drying out. The typical hot-food table holds a number of steam table pans 12 by 12 inches in size.

It should be remembered that although hot tables are not cooking appliances, foods held above 140°F are still cooking. Foods to be held any length of time should, therefore, be slightly undercooked.

REFRIGERATORS AND FREEZERS

A *refrigerator or freezer* can be thought of as two boxes, one inside the other, separated by insulation. Heat is withdrawn from the inside box by a cooling system. The insulating material is usually polyurethane foam. The cooling system consists of a compressed gas that is allowed to expand within the cooled interior. An expansion valve permits the gas to expand into an evaporator. As it expands, the gas absorbs heat and is returned to the compressor where, under pressure, it becomes a liquid.

Refrigerators require a minimum of 2 inches of polyurethane insulation; freezers require 3 inches.

Large restaurants need considerable refrigerator and freezer space, usually large enough for a person to walk into; such coolers are called walk-in boxes. Refrigerator drawers and under-counter refrigerators permit storage at point of



A reach-in refrigerator is used for storage of prepared food prior to service

use. Reach-in refrigerators conserve energy. Multiple-rack units on wheels permit maximum storage and save energy in moving food in and out of refrigerators. See-through glass or Plexiglas doors reduce the need for opening. Kitchen planners recommend this amount of refrigerator space on a per-meal basis for a luxury restaurant:

Meat/poultry	.030 cubic feet
Dairy products	.015 cubic feet
Produce	.040 cubic feet

Walk-in boxes are often placed adjacent to food-receiving areas. Doors can be installed on two sides, one on the receiving side and one on the exit side toward the preparation area. Food can then be received at one side of the box and taken out on the other when needed.

Compressors should be located away from the kitchen or in the basement so that heat generated by their use is not dumped into the kitchen itself and so that the noise of the compressors is unobtrusive.

For efficient functioning, coils within the refrigerator must be kept defrosted and free of ice. If the coils are icy, the cooling system cannot pick up heat within the box and transport it away.

ICE MACHINES

Restaurants need at least one ice machine for producing ice for ice water and for such beverages as soft drinks, iced tea, and—if liquor is served—a variety of alcoholic drinks. Machines are available for producing small-size cubes ideal for tall drinks, which make a tall drink look even taller. A survey conducted by equipment manufacturer Enodis found the most frequent purchase of restaurant operators was an energy-saving ice machine.²² This shows that energy savings is on the restaurant owners' minds. A broader survey, conducted by the National Restaurant Association, found that slightly more than half of all operators had purchased energy-saving equipment in the past two years.²³

Ice cubes are good for beverages served at banquets. The larger size melts more slowly and lasts longer. Crushed ice lowers the temperature of a beverage quickly and is also used as part of a salad bar, oyster bar, or juice display.

The hotter the climate, the more ice capacity is needed. A bar often has its own ice machine. A 100-seat restaurant with a bar probably needs an ice machine capable of producing 400 pounds of ice during the hours of operation and having a storage capacity of 540 pounds (see Figure 5.12).

Restaurant Type	Realistic Average	Production/Storage Recommendations
Informal (with soft drinks)	0.5–1 lb person	400–540 lb for 125–200 seats
Formal (no liquor)	0.5 lb person	300–540 lb for 100–125 seats
Formal (with liquor)	1.5 lb person	800–750 lb for 200 seats
Drive-ins	0.5 lb person	—
Fast food	0.25 lb person	800–750 lb per \$1 million of sales
Cafeterias (iced salad bar)	0.5 lb person	—
	10 sq ft display	200–400 lb crushed ice
Cocktail lounges (with restaurant)	1 lb person	400–540 lb for 125 seats
Bar (no food)	0.5 lb person	200–170 lb avg. or 300/235 lb
Taverns (mostly beer with limited food)	Small 100 lb/day	100 lb/65 lb (for possible under-bar application)
	Medium 200 lb/day	200/170 lb
	Large 300 lb/day	300/235 lb

FIGURE 5.12: Ice-sizing guide suggested for temperate climate

Some experts advise against buying one central machine, which, if broken, leaves the restaurant without ice. Rather, purchasing two or more smaller machines and locating them near their points of use is recommended.

PASTA-MAKING MACHINES

A number of restaurants that feature pasta have purchased their own pasta-making machines and each week produce various types of pasta: macaroni, vermicelli, fettuccine, and the like. With the low cost of flour, and if volume of sales warrants, the purchase of such a machine pays for itself in a short time. Operation of the machine is fairly simple. Different pasta products are produced simply by changing an extruder head through which the dough is forced.

OTHER SPECIALTY COOKING EQUIPMENT

As might be expected, special foodservice equipment has been developed for special menus. Hot food items on a Mexican menu, for example, are best served at higher than average temperatures. Some Mexican restaurant operators use convection ovens. Characteristically, a chili sauce or a cheese sauce covers entrées, which are placed under a cheese melter for a short time just prior to service. A cheese melter is an overhead, broiler-type piece of equipment, usually several feet long and just wide enough to hold a plate. It is used for toasting, browning, and finishing. It is recommended for preparation of lobster, garlic bread, and au gratin potatoes.

Restaurants that feature salads may have a spin drier in which centrifugal force whips off excess moisture from salad greens. Places that use frozen entrées may use a special quartz-fired oven for quick reheating.

Special spaghetti cookers, dough mixers, pasta-making machines, pizza ovens, and an array of other special cooking equipment are available. Old equipment is constantly being adapted to new uses.

New forms of energy are also being developed. Stovetops that use magnetic induction coils for energy are a novelty at this time but could be commonplace in the future.

Several chains have developed special equipment for producing featured items in front of the patron. Crepe-making machines are a good example; the machines are located near the restaurant entrance or other focal point, where patrons can watch the crepes being made.

None of the heavy-duty electrical equipment operates on the standard 110/120 volts installed for residential use. A revolving-brush glass washer may operate on 110-volt wiring, but equipment calling for large amperage needs the heavy-duty wiring carrying 208, 240, or 480 volts. Heavy-duty motors may call for 208/240-60, one-phase current; others call for 440/480-60, three-phase current. Booster heaters call for as much as 550 volts. Rewiring a kitchen to fit a particular piece of equipment can be costly.

Natural gas requires a different size jet and different settings from that for LP (low-pressure) gas. The heating qualities of the two are quite different.

EVAPORATIVE COOLERS

Evaporative coolers installed in kitchens reduce the cost of cooling considerably where humidity in the outside air is low, as in desert areas. The coolers take in outside dry air and pass it through loosely woven pads. Water from the regular water supply is either dripped or pumped over the pads. As the fresh air is drawn by a blower through the pads, it is cooled and filtered. Water in the wetted pads evaporates and, as it does so, absorbs the heat as it changes from water to vapor. This is evaporative cooling, known as the heat of fusion energy involved when matter changes from one form to another.

Evaporative cooling, although inexpensive, is not usually satisfactory for the dining room because the air brought in from the outside absorbs moisture. On muggy days or in climates with high humidity, moisture accumulates in the dining room. The kitchen, however, is a different matter. There air movement to the outside is usually rapid, air being pulled up the exhaust ducts to rid the kitchen of noxious fumes, odors, and accumulated heat from the cooking equipment. Evaporative coolers are used even in St. Louis, known for its high humidity.

Because evaporative coolers have no need of compressors, they operate at approximately 25 percent of the cost of operating a refrigerated air-conditioning unit of similar cooling capacity.

Evaporative coolers can be used in combination with refrigerated air-conditioning, relying on evaporative cooling except on the hottest, most humid days. Evaporative cooling is a relatively inexpensive way of making the kitchen a much more pleasant and efficient place to work, provided outside humidity is low.

OTHER EQUIPMENT

Numerous other small kitchen items are available that may be useful for a particular menu. Such items include ice cream holding units, display cases,

cream dispensers, meat patty-making machines, garbage disposals, infrared heating lamps, drink dispensers, dough dividers, and bakers' stoves.

Because so many restaurants go out of business, used equipment is almost always available from equipment dealers. Few items fall more drastically in value after purchase. Once bought, restaurant equipment may drop as much as 80 percent in value. Restaurant equipment auctions may offer excellent used equipment. Used items without moving parts are about as good used as new. Examples are sinks, wire shelving, worktables, steam tables, cutting boards, kitchen utensils, and cooling racks. Refrigeration units may need only compressor replacement. Old mechanical equipment, however, may not be a bargain, because of the difficulty of locating replacement parts.

Maintaining Kitchen Equipment

Maintenance of equipment is a little like preventive medicine. By following certain practices, major problems can be avoided. Moving parts, when properly oiled, last longer. Removing grease and dirt from compressors helps ensure that they are not overworked. Clean griddles operate better than those with grease deposits on their surfaces. Gas burners adjusted for gas-air mixtures provide more heat. Checking electric wires for loose connections or frayed insulation can avert fires and equipment breakdown.

Restaurant equipment is generally thought to have a life expectancy of about 10 years. When properly cared for, however, equipment can last much longer. For best maintenance information, consult the instructions provided by the manufacturer. The old quip "When everything else fails, read the instructions" is just too true. Restaurant operators are likely to be more people-oriented, sales-oriented, and food-oriented than mechanically inclined. A schedule of maintenance helps and is one of those details that make a good restaurant both a work of art and a nuts-and-bolts business.

Often restaurant operators give little thought to regular maintenance of kitchen equipment. They are too involved in other problems and in keeping up with the demands of the day-to-day operation—purchasing and receiving food, replacing personnel, handling complaints, and seeing to it that the operation moves smoothly. Knowing this, chain operators often employ a full-time mechanic who moves from restaurant to restaurant performing maintenance checks or who can be called to handle breakdowns of equipment. Because every piece of equipment eventually breaks down or deteriorates, especially if it has moving parts, it pays to establish and follow a system of maintenance that forestalls breakdowns or emergency situations.

The place where most equipment headaches occur is in the dish machine. It is not uncommon for the hot-water booster heater, used to raise the temperature to the 180°F needed for dish sanitation, to break down. As a result, thousands of dishes are washed without the benefit of sanitization. As water is heated in the booster, minerals in the water tend to precipitate out and be deposited on the walls and in the pipes of the heater. These deposits can be removed by periodic flushing; open the drain valve and drain 2 to 5 gallons of water from the tank,

then run the water until it flows clear. If the local water contains a high percentage of lime or other minerals, the heater may need to be drained monthly.

Repair of dish machines is usually beyond the capacity of the manager or kitchen personnel. This means that a mechanic must be brought in. In the time that it takes to repair the machine, the dish machine room can become bedlam. Inevitably, dishware breakage is high.

If the dish machine water is heated by steam, there is usually a steam trap through which the condensate flows. The condensate, which is in the form of water, then flows back into the boiler, where it is reheated and converted to steam again. The steam trap is intended to permit the condensate—but not the steam—to pass out of the heater. The trap blocks the steam and frees it to condense into water before it leaves the heater. The trap can jam shut or open. If it jams open, the steam blows through the trap, wasting energy and causing problems in other parts of the system. If it jams shut, neither steam nor condensate can pass through, and no water will be heated. Many installations include a test valve that can be operated to see if the trap is working. Follow the instruction sheet provided by the manufacturer.

Because the steam trap prevents steam from passing out into the heater, one way to determine if it is operating is to put on canvas-type work gloves and simultaneously grasp the pipe leading into the trap and the one leading out. If the trap is working, there will be a marked temperature difference. The trap should allow only condensation and the steam that has condensed to flow back to the heater. If steam is blowing through the trap, both the entering pipe and the exit pipe will be at the same temperature. The trap is probably stuck open, wasting steam.

When the dish machine breaks down or there is no hot water, dishes can be washed in cold water and sanitized by using diluted Clorox or other compounds used for cold water sanitization. (Bar glassware is usually sanitized in cold water.) The spray nozzles inside the dish machine are there to provide a forceful spray onto the ware being washed. Lime deposits build up in the nozzles, which must be cleaned periodically by inserting a wire in the openings.

Low-temperature dishwashing machines may be leased. In this case, the leasing company assumes responsibility for maintenance and operation. The lessor may also offer to train new dish machine operators. In the traditional dish machines, wash water is raised to 140°F and rinse water to 180°F—a considerable expense. The low-temperature machines operate with water temperatures as low as 100°F. Germicidal chemicals, rather than heat, are used to kill the germs. Some restaurant chains that have shifted to low-temperature dishwashing have cut ware-washing costs in half.

Meeting with the Health Inspector

Before a restaurant can officially operate, it must pass a rigorous examination by a public health official. Public health officials and planning boards, quite rightly, want to assure the public that eating in restaurants under their jurisdiction is safe.

To this end, local health officers draw up extensive requirements for floor covering, number of toilets, foodservice equipment, lighting, fire exits, and other factors that bear on the hazards associated with restaurant operation. Requirements vary from place to place. One community may insist on toilet stalls for the handicapped and impermeable floor covering in toilet stalls and in kitchens; another jurisdiction may not. Floor drainage systems, exhaust ductwork, distances between dining room tables, number of seats permitted, number of parking spaces required, number of entrances and exits to the parking area and to the restaurant—all must meet safety requirements.

Even if a building has been used as a restaurant for years, a new owner must pass the health and building inspector's close scrutiny. A new owner or lessee may find that a number of changes are required. All proposed building modifications must be approved. Often the eager operator is astonished and frustrated to learn that the linoleum floor installed in the rest rooms must be taken up and replaced. The delays can be extremely costly because a number of people may already be on the payroll, interest expenses continue, and the cash flow expected is delayed. There is no way the restaurant can open until it passes the health inspection and the building inspection. Approval for building equipment and modifications must be secured beforehand. It can be hazardous for the operator to assume that approvals will be forthcoming.

Summary

Kitchen planning precedes equipment purchasing. Some restaurant equipment dealers also assist in laying out a kitchen and selecting equipment. The kitchen plan helps ensure an easy flow of food in and out of the kitchen. The idea is to place the equipment in such a way that the distance between it and the staff members who use it is minimized. Professional planners, assisted by drafters, are available for a fee. Planners may also recommend equipment that fits the menu and the restaurant's clientele and make sure that the chef and kitchen crew have the knowledge and skills to operate the kitchen. The purposes, uses, limitations, and prices of restaurant equipment are discussed. Decreasing energy use is another result of good kitchen planning and equipment selection.

Key Terms and Concepts

Broilers	Deep fryer
Categories of kitchen equipment	Forced-air convection oven
Combination convection oven and microwave	Freezer
Convection oven	Kitchen equipment
Convection steam cooking	Low-temperature dishwasher
Cook-chill	Low-temperature ovens
	Refrigerator

Slow cooking
Sous vide

Tilting skillets
Work centers

Review Questions

1. Before equipment selection takes place, what factors must you evaluate? Use at least three examples of equipment in your discussion.
2. What are the advantages of microwave ovens? Why are they not used more widely in restaurant kitchens?
3. Why are low-temperature dishwashing machines growing in popularity?
4. Why is it important that service persons stack tableware according to size on a soiled-dish table?
5. What conditions favor purchasing a tilting skillet for your kitchen? A vertical cutter/mixer? A convection oven?
6. In starting a restaurant, what used equipment would you consider buying? What equipment would you want to buy new?
7. Will you install gas or electric kitchen equipment, or both? What factors will affect your decision?
8. Kitchens are generally becoming smaller in relation to dining areas. Why?
9. You forecast your restaurant to gross \$1 million per year in sales. Will you include a bakery section in your kitchen? Explain.
10. What are these pieces of kitchen equipment used for?
 - a. Bain-marie
 - b. Ridged griddle
 - c. Infrared broiler
 - d. Charbroiler
 - e. Convection oven
11. What are two advantages of reach-in refrigerators and under-shelf refrigerators over the bigger walk-in boxes?
12. Explain the statement, “The menu determines the kitchen equipment.”

Internet Exercise

Search the Internet for restaurant equipment sites and cost out your kitchen equipment needs.

Endnotes

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