Montague Model V136-5 Heavy Duty 30,000 Btu/h Open Top Gas Range

In-Kitchen Appliance Performance Report

FSTC Report 5011.98.64

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The information in this report is based on data generated at PG&E's Food Service Technology Center.

Acknowledgments

The establishment of a Food Service Technology Center reflects PG&E's commitment to the food service industry. The goal of the research project is to provide PG&E's customers with information to help them evaluate technically innovative cooking appliances and make informed equipment purchases regarding advanced technologies and energy sources. The project was the result of many people and departments working together within PG&E and the overwhelming support of the commercial equipment manufacturers who supplied the cooking appliances for testing.

PG&E's Food Service Technology Center is supported by the National Advisory Group, which includes

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Specific appreciation is extended to the Montague Company, for supplying the Food Service Technology Center with the Model V136-5 Heavy-Duty 30,000 Btu/h per burner, Open Top Gas Range for testing in the production test kitchen.

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Executive Summary

This PG&E Food Service Technology Center (FSTC) research report presents the results of monitoring the Montague Model V-136-5, 30 kBtu/h gas burner range top as it was used for routine menu production in PG&E's production-test kitchen and during tests under controlled laboratory conditions. The Montague range top is separated into 3 heavy-duty ribbed, cast-iron grates with 2 burners per grate totaling 6 gas star burners. Front mounted control knobs regulate each of the 30 kBtu/h burners. Investigated performance indices included the measured peak energy input rate, idle energy rate, idle duty cycle, pilot energy rate, production energy use, appliance on-time, average production energy consumption rate and production duty cycle. The range top was monitored in the production-test kitchen over a seven-month test period. A summary of the test results is presented in Table ES-1.

Table ES-1
Summary of Montague Model 136-5, 30 kBtu/h, Range Top Performance

Rated Energy Input (kBtu/h)	180
Measured Energy Input (kBtu/h)	172
Daily Energy Use[a] (kBtu/d)	240
Daily Production Energy Use[b] (kBtu/d)	206
Pilot Only Energy Use[c] (kBtu/d)	33.6
Appliance On-Time (h/d)	8.0
Production Energy Consumption Rate (kBtu/h)	25.7
Production Duty Cycle (%)	15.0

[a] Includes pilot energy consumption during periods when the range was not in use.

[b] Includes pilot energy over the hours of operations when the range was in use.

[c] Includes total energy consumed by the standing pilot over the full 24-hour day.

To supplement monitoring information acquired during actual production conditions, controlled energy tests were also conducted. The measured peak energy input rate was 172 kBtu/h, which was 4.4% lower than its rated 180 kBtu/h nameplate input, reflecting an average measured input rate of about 29 kBtu/h, per burner.

Executive Summary

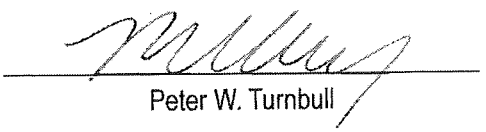
Energy use data for the test period were reduced to include only days that reflected typical range top usage in the production-test kitchen (i.e., days when the range top was used for three-meal periods). Over the typical 8-hour operation, the range top consumed an average of 206 kBtu per day. Based on the aggregate pilot energy rate and cooking energy for the entire day of appliance operation, the average rate of production energy use was 25.7 kBtu/h, resulting in a production duty cycle of 15.0%.

Based on a 5-day per week, 52-week-per-year food service operation, the range top would consume 622,900 kBtu (622.9 therms) annually. The total yearly cost to operate the range top is expected to be $331: production accounts for $285, and pilot use accounts for $46. This calculation is based on PG&E's G-NR1 schedule for commercial gas rates ($0.49867/therm summer months and $0.57867/therm for winter months) effective August 5, 1998, and a year-round, five-day-per-week food service operation.

In addition, energy efficiency and production capacity were compared between the 30 kBtu/h burner and its lower-rated 20 kBtu/h cousin. The laboratory test showed that the 30 kBtu/h burner was 2.3% more efficient than the 20 kBtu/h model at the full input rate. The production monitoring data suggested that the 30 kBtu/h burner range top consumed 12% more energy. The estimated operational cost premium for the high-input burner was only $41 per year. Both tests showed that the higher rated burner out performed the lower input burner with respect to production capacity and food output.

FSTC Manager 

Donald R. Fisher

Senior Program Manager 

Peter W. Turnbull

1 Introduction

Background

PG&E's Food Service Technology Center monitored the Montague gas range top, Model V136-5 featuring six 30 kBtu/h burners for both laboratory and in-kitchen performance evaluation. It was used for routine menu production in PG&E's production-test kitchen for a 7-month period from February through August 1996. This report is the last in a series of production reports documenting the energy use of different Montague gas range tops mounted on the same convection-oven base. The first report documented the Montague Model V136-5 Heavy-Duty open top 20 kBtu/h per burner range top,[1] the second reported on the Montague V136-9E hot top range[2] and the third on the Montague V136-5 combination open top/hot top range.[3] Because the convection-oven base was monitored and reported on in the study for the V136-9E hot-top range configuration, it was not included in this report.

The glossary in Appendix A is provided so that the reader has a quick reference for the terms used in this report.

Objective

The purpose of this appliance performance report is to document the energy consumption characteristics of the Montague 30 kBtu/h burner gas range as it was used in a production kitchen, and furthermore to compare its performance characteristics with a standard 20 kBtu/h burner gas range that was monitored previously in the same facility.

The report summarizes range usage in relationship to its energy consumption while in production. Bear in mind, that this information is specific to PG&E's production-test kitchen, a corporate, cafeteria-style operation.

Introduction

The Production Center

The 1,500-square-foot kitchen is an integral component of the campus-style dining facility at PG&E's Learning Center in San Ramon, California. Ten cooking appliances are centrally located on two sides of a utility distribution system (UDS). The UDS functions as a central "spine" that contains all plumbing, wiring, and natural gas distribution lines. A 16-foot, double-sided canopy exhaust hood ventilates the equipment island at a design air flow of 9,600 cfm. Grilles along the front face of the hood direct makeup air into the kitchen.

The UDS was designed to accommodate quick connection and disconnection of the appliances as they are rolled in or out of the "line," with the flexibility to accommodate either a gas or an electric model in each appliance slot. Gas and electric meters interface with a remote data acquisition and processing system. Appliance monitoring and performance evaluations are conducted by the FSTC research team, independent of the food service operation.

Figure 1-1 is a floor plan of the production-test kitchen and appliance lineup.

Appliance Description and Operation

The Montague Heavy-Duty 30 kBtu/h open top gas range was installed in accordance with the manufacturer's instruction manual. Appliance specifications are summarized in Table 1-1 and the manufacturer's specification sheet is in Appendix B.

Cooking utensils are supported by heavy-duty burner grates above the star burners. Each burner is manually controlled by a front-mounted control knob. Six standing pilots provide burner ignition.

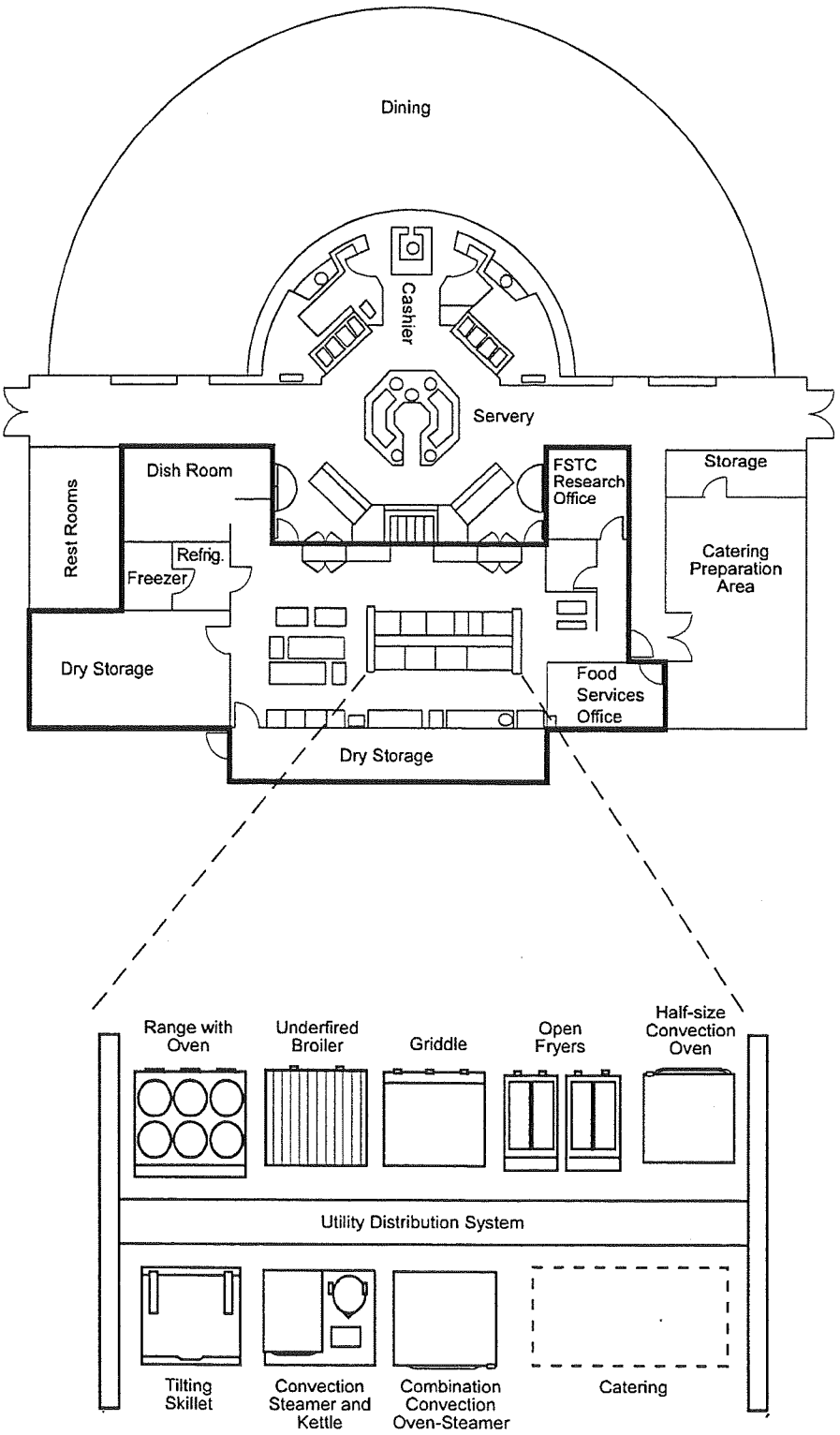


Figure 1-1.
Production-Test Kitchen, PG&E Learning Center.

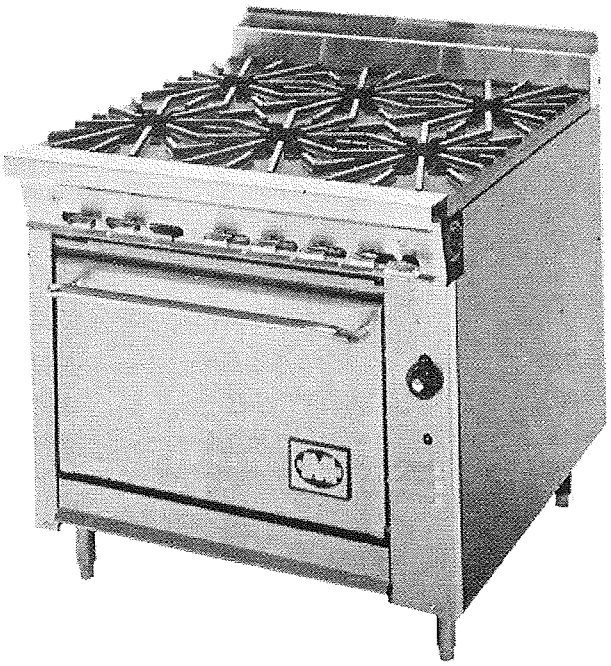


Table 1-1. Appliance Specifications.

Generic Appliance Type:	36" all-purpose open gas range top
Manufacturer:	The Montague Company
Model:	Legend V136-5
Rated Input:	180 kBtu/h (range top only) 30 kBtu/h per star burner
Controls:	Six front-mounted control knobs.
Configuration:	Three 12" wide by 31" deep heavily ribbed cast iron grates. Six open burners rated at 30 kBtu/h each.
Dimensions:	36" wide by 36 5/8" deep by 34 ½" high.

2 Controlled Energy Tests

Purpose

Controlled energy tests under laboratory conditions provide the following data:

1. Verify that the appliance operates at the manufacturer's rated energy input.
2. Characterize the energy input rate of each burner and the six standing pilots.
3. Determine cooking energy efficiency and production capacity as water is heated from 70°F to 200°F.

Methods and Results

FSTC researchers tested the Montague 30 kBtu/h, per burner, range top under controlled laboratory conditions and in accordance with the *ASTM Standard Test Method for the Performance of Range Tops* (Designation F1521-94).[4,5] A revised version of the test method has been published since the 1994 version under the Designation F1521-96.[6] For a detailed discussion of the development of the procedures and test results, refer to PG&E's *Development and Validation of a Uniform Testing Procedure for Range Tops*.[7] A complete application of the Standard Test Method (Designation F1521-94) was applied to the Montague 30 kBtu/h range top.

Energy Input Rate. The six burners were operated at the maximum setting for a 15-minute stabilization period, after which all of the burners operated for a 10-minute test period. At the end of every 10 minutes, one burner was turned off until only the pilots were operating. The left front burner was the first to be turned off, and the pattern continued front-to-back and left-to-right, ending with the right rear burner. The six pilots were operating during the entire test. The test results are summarized in Table 2-1. Figure 2-1 shows the energy consumption rates as the number of burners were reduced from six down to one. The range top does not have a defined preheat time since the burners produce instantaneous heat, which allows immediate heating of a food load.

Table 2-1.
Controlled Energy Test Results of the Montague 30 kBtu/h Burner Range Top.

	Number of Burner(s)					
	6	5	4	3	2	1
Rated Energy Input (kBtu/h)	180	150	120	90	60	30
Measured Energy Input Rate (kBtu/h)	171.7	147.0	116.9	89.2	61.5	30.8
Pilot Energy Input Rate (kBtu/h)	2.1	2.1	2.1	2.1	2.1	2.1

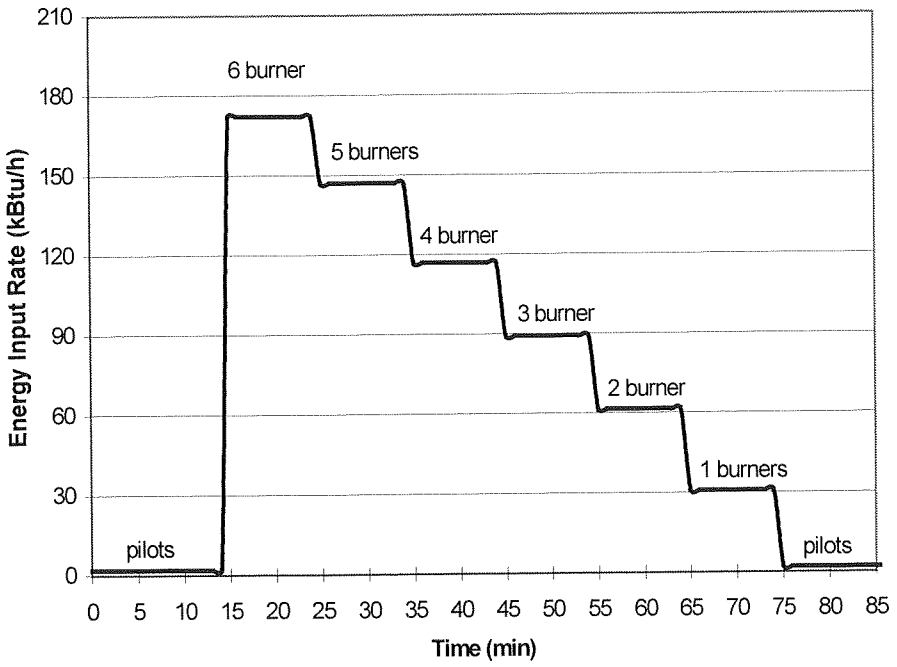


Figure 2-1.
Controlled Energy Test as the Number of "ON" Burners Are Reduced From Six to One.

Cooking Energy Efficiency and Production Capacity. After 30 minutes of stabilization, a sauce pot holding 20 pounds of water was heated on a burner from 70°F to 200°F at half- and full-energy input rates. Energy consumption and time were recorded to calculate cooking energy efficiency and production capacity during this heatup test.

Table 2-2 summarizes a portion of the cooking energy efficiency and production capacity of the 30 kBtu/h burner as well as the 20 kBtu/h burner at full input rate. The 30 kBtu/h burner muscled in a 29.2% energy efficiency and 68.9 lb/h production capacity. Its lower-rated cousin, the 20 kBtu/h burner, delivered a 26.9% energy efficiency and 50.5 lb/h production capacity. The usefulness of a higher rated burner was in question prior to these tests. It was believed that the extra 10 kBtu/h would add to the production capacity but, at the same time, reduce energy efficiency by allowing a greater proportion of the additional input to escape into the kitchen and up the vent. The 30 kBtu/h burner managed a modest 2.3% energy efficiency advantage as well as a whopping 18.4 lb/h increase in production rate. These controlled energy tests proved that the 30 kBtu/h burner design did not sacrifice energy efficiency in return for a greater production capacity.

Table 2-2. ***Comparison of Cooking Energy Efficiency and Production Capacity of 30 kBtu/h and 20 kBtu/h Burner Range Top.***

	30 kBtu/h	20 kBtu/h
Cooking Energy Efficiency (%) (full input rate)	29.2	26.9
Production Capacity per Burner (lb/h)	68.9	50.5

(see reference 1 and 4 for complete ASTM application test results)

3 Production Monitoring

Energy

The dataset from which "typical day" characteristics were quantified covers a 7-month period. All Fridays, Saturdays, Sundays, and holidays were eliminated from the dataset since they were not three-meal food service days typical of this food service operation. The range dataset was reduced to 80 days. The average daily energy performance is summarized in Table 3-1. The energy monitoring system used to collect the data is described in Appendix C.

Table 3-1.
Average Daily Energy Performance.

Rated Energy Input (kBtu/h)	180
Measured Energy Input (kBtu/h)	171
Daily Energy Use[a] (kBtu/d)	239
Daily Production Energy Use[b] (kBtu/d)	206
Pilot Only Energy Use[c] (kBtu/d)	33.6
Appliance On-Time (h/d)	8.0
Production Energy Consumption Rate (kBtu/h)	25.7
Production Duty Cycle (%)	15.0

[a] Includes pilot energy consumption during periods when the range was not in use.

[b] Includes pilot energy over the hours of operations when the range was in use.

[c] Includes total energy consumed by the standing pilot over the full 24-hour day.

The energy consumption profile plotted in Figure 3-1 illustrates the typical day production energy use for this range top as used in the production-test kitchen. This day was selected because the daily energy consumption, operating hours, and average production rate closely matched the average values shown in Table 3-1.

On the typical day, the kitchen staff used at least one of the range top burners shortly after they arrived at 4:30 A.M in the morning and continued to use one or more burners throughout the morning and in preparation of lunch menu items.

The majority of the daily production energy use occurred during these morning "prep" hours, as the cooks prepared stockpots of hot cereal, soups, sauces, gravy and chili for breakfast and lunch. All the burners were turned off between 12 noon and 1pm and were not used again until the afternoon for dinner preparation. During the dinner-meal period, up to three burners were operated as needed for cook-to-order or sauté items.

Energy consumption varied from 134.0 kBtu to 348.0 kBtu per day with appliance on-time varying from 2.75 to 13.75 hours per day. The frequency distributions for daily production energy use and hours of operation for the range top are presented in Appendix D.

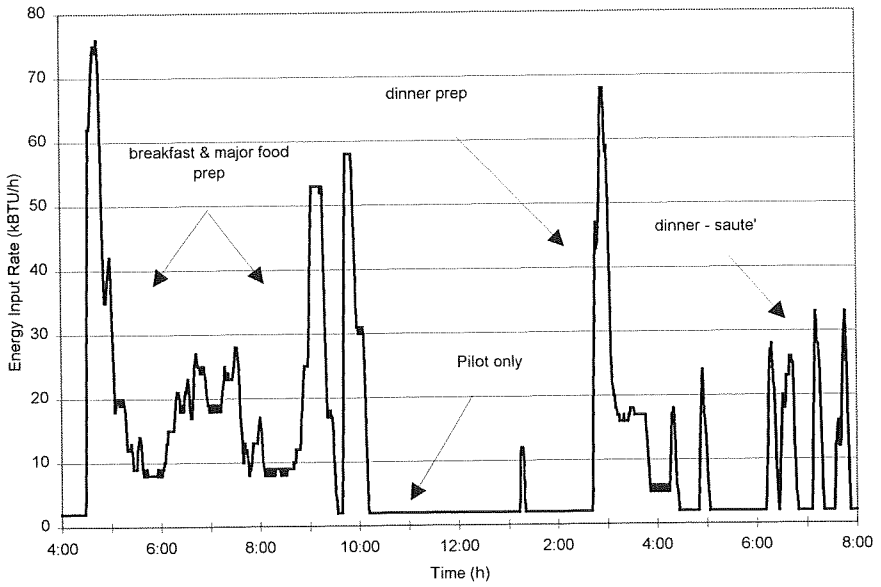


Figure 3-1.
Typical Day Energy Consumption Profile.

Note: The energy consumption profile for the typical day is plotted on a 15-minute average. (see Appendix C).

Estimated Annual Energy Cost

Based on the average daily energy consumption and assuming a 5-day per week, 52-week-per-year food service operation, the range top would consume an estimated 622,900 kBtu (622.9 therms) per year during food production. The pilot only consumption was approximately 87,400 BTU (87.4 therms) per year. At a cost of $0.53174 per therm, the cost to operate the range top would be $331 per year: production energy accounted for $285, pilot energy for $46.

These costs of operation, as shown in Table 3-2, were calculated using a seasonally-weighted average of PG&E's gas rates (Schedule G-NR1) for small commercial customers (Appendix E).

Production Energy Charge for Range Top (206.0 kBtu/d) X (5 d/week) X (52 weeks/yr) = 53,560 kBtu/yr = 535.6 therms/yr [a] (535.6 therms/yr X $0.53174/therm = $285/yr) [b]	$285
Pilot Only Energy Charge (33.6 kBtu/d) X (5 d/week) X (52 weeks/yr) = 8,736 kBtu/yr = 87.36 therms/yr [a] (87.36 therms/yr X $0.53174/therm = $46/yr) [b]	$46
Total Annual Energy Cost for Range Top	$331

Table 3-2. ***Estimated Annual Energy Cost.***

[a] 1 therm = 100 kBtu = 100,000 Btu.

[b] Estimates are based on PG&E's G-NR1 rate schedule in effect on August 5, 1998 (see Appendix E).

The energy consumption for the 20 kBtu/h per burner range top has also been investigated in the production kitchen.[1] The 20 kBtu/h cook top consumed approximately 478 therms/yr during food production and 68 therms/yr during pilot-only operation; the total energy usage would be 546 therms based on a year-round (52 week) five-day per week food service operation. At a cost of $0.53174/therm, total cost to operate the 20 kBtu/h range top would be $290: production accounted for $254 and non-production pilot operation accounted for $36. The average appliance on-time was 9.2 h/d.

As the controlled energy test indicated, the annual energy usage between the 30 kBtu/h and the 20 kBtu/h was not significantly impacted by the difference in the input rates. Even though there is a 50% increase in energy output per burner for the 30 kBtu/h per burner, the difference in the annual projected cost between the two units was only $41 ($331-$290). An equally significant finding is the reduction in daily on-time. The on-time was reduced from an average of 9.2 hours per day for the 20 kBtu/h unit to 8.0 hours per day for the 30 kBtu/h unit, meaning that the food was cooked quicker reducing "the cooking" time by 15%.

Food Production

The Montague range was typically used to simmer, sauté and stir-fry food items. Typical foods cooked included hot cereals, gravies, sauces, soups and chili. An FSTC researcher observed range use during several periods of normal operation and interviewed the cooks. The cooks' daily worksheets were also reviewed to obtain a better understanding of the food items prepared to determine how the range top was used in this particular operation.

Range top usage was often heaviest during the early morning hours, when the cooks heated a large pot of water for cereal and prepared a large pot of gravy. Water was also heated for other uses, such as the steam tables or for poaching eggs. For the rest of the day, the operators would use the range top for a few heavy loads, such as large batches of soup, and various lighter loads, such as glazes or sauces. Depending on the dinner menu, the range top usage might involve sautéing ingredients, such as mushrooms or onions, and preparing dinner items such as pasta and stir-fry to order.

The quantity of food cooked was estimated based on daily worksheets filled out by the cooks. On a typical day, the cooks prepared about 100 pounds of food on the range top for an average customer count of 550 over the three meal periods.

4 Conclusions and Recommendations

Production

The cooks found the range top easy to operate. They noted that the range top was flexible enough to meet their preparation needs, from simmering to sautéing. At some food service operations, especially those with open kitchens, operators have been known to modify the burners by enlarging the orifices to get more gas output. The lazy yellow flames produced by a drilled-out burner direct less heat into the cooking process, wasting energy into the kitchen and up the hood. The cooks also loved the extra power a 30 kBtu/h burner provided—it enabled them to produce more product in a shorter amount of time. One cook remarked that you can always turn down the 30 kBtu/h burner but you can not turn up the 20 kBtu/h. The six, open-burner range top was a good match for this operation; all six burners were needed during peak production. The staff tended to use the front three burners for most short-term cooking tasks and the rear three for longer processes, such as heating a large quantity of soup and holding it to temperature

Energy Consumption and Conservation Potential

The ASTM application and production monitoring data for the 30 kBtu/h and the 20 kBtu/h burner range tops showed that higher energy input rates do not translate to lower efficiency. The laboratory test indicated that the 30 kBtu/h burner was 2.3% more efficient than the 20 kBtu/h model at full input rate. The production monitoring data suggested that the 30 kBtu/h burner range top consumed 14% more energy at an estimated annual cost of $41. Both tests, without a doubt, established that the higher rated burner out performed the lower input burner when it comes to production capacity and food output. In a kitchen where time is of the essence, faster output and customer satisfaction may overshadow a slight increase in energy cost.

5 References

1. Food Service Technology Center. 1993. *Montague Model V136-5 Heavy-Duty (20,000 Btu/h) Open Top Gas Range: Application of ASTM Standard Test Method F 1521-94.* Report 5011.93.7. Customer Energy Management Department. San Francisco, California: Pacific Gas and Electric Company.

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5. American Society for Testing and Materials. *Standard Test Methods for the Performance of Range Tops.* ASTM Designation F 1521-94. In *Annual Book of ASTM Standards.* Philadelphia: American Society for Testing and Materials.

6. American Society for Testing and Materials. *Standard Test Methods for the Performance of Range Tops.* ASTM Designation F 1521-96. In *Annual Book of ASTM Standards.* Philadelphia: American Society for Testing and Materials.

7. Food Service Technology Center. 1995. *Development and Validation of a Uniform Testing Procedure for Range Tops*. Report 1022.95.20. Customer Energy Management Department. San Francisco, California: Pacific Gas and Electric Company.

Appendixes

A Glossary

Appliance On-Time (minute, hour)
Hours of Operation
Operating Period
Operating Time

The total period of time that an appliance is operated (from the perspective of food service staff) from the time it is turned "on" to the time it is turned "off." Appliance on-time excludes any "off" periods between the first and last appliance operation.

Average Daily Production Energy Consumption Rate (kW or kBtu/h)

The average rate of production energy consumption based on the daily production energy consumption and the appliance operating or "on" time.

Average Production Energy Consumption Rate (kW or kBtu/h)
Average Production Energy Rate
Average Production Energy Use Rate

The average rate of production energy consumption based on the production energy consumption and the appliance operating or "on" time for a specified period of appliance operation.

Cooking Energy Consumption (kWh or kBtu)

The total energy consumed by an appliance during the cooking period.

Cooking Energy Consumption Rate (kW or kBtu/h)

The average rate of energy consumption during the cooking period.

Cooking Energy Efficiency

The quantity of energy input to the food products; expressed as a percentage of the quantity of energy input to the appliance during the energy efficiency test.

Cooking Period (minute, hour)

The period of time (derived from in-kitchen monitoring or by interpreting the energy consumption profile) that an appliance is actually used for cooking.

Daily Energy Consumption *(kWh or kBtu)*
Daily Energy Use
Daily Production Energy Consumption
Daily Production Energy Use

The total amount of energy consumed by an appliance as it is used within the Production-Test Kitchen over a 24-hour period.

Duty Cycle (%)
Load Factor
Production Energy Factor
Production Factor

The average production energy consumption rate (based on a specified operating period for the appliance) expressed as a percentage of the measured energy input rate.

Glossary

Energy Consumption Profile
Energy Use Profile

A plot of appliance energy consumption showing energy consumption rate on the Y-axis and time on the X-axis.

Energy Consumption Rate (kW or kBtu/h)
Energy Input Rate
Energy Rate

The rate of appliance energy consumption over a specified period of operation (see Energy Consumption Profile).

Energy Use Data Set

A set of daily energy consumption data compiled in accordance with typical day criteria.

Idle Energy Consumption (kWh or kBtu)
Idle Energy Use

The amount of energy consumed by an appliance operating under an idle condition over the duration of an idle period.

Idle Energy Consumption Rate (kW or kBtu/h)
Idle Energy Input Rate
Idle Energy Rate
Idle Rate

The rate of appliance energy consumption while it is "idling" or "holding" at a stabilized operating condition or temperature.

Idle Duty Cycle (%)
Idle Energy Factor
Idle Load Factor

The idle energy consumption rate expressed as a percentage of the measured energy input rate.

Measured Energy Input Rate
(kW, W or kBtu/h, Btu/h)
Measured Input
Measured Peak Energy Input Rate
Peak Rate of Energy Input

The maximum or peak rate at which an appliance consumes energy, measured during appliance preheat or while conducting a water-boil test (i.e., the period of operation when all burners or elements are "on").

Pilot Energy Consumption (kBtu)
Pilot Energy Use
Standing or Constant Pilot Energy Consumption
Standing or Constant Pilot Energy Use

The amount of energy consumed by the standing pilot of an appliance over a specified period of time.

Pilot Energy Rate (kBtu/h)
Average Pilot Energy Rate
Average Pilot Energy Use Rate
Pilot Energy Consumption Rate

The rate of energy consumption by the standing or constant pilot while the appliance is not being operated (i.e., when the thermostats or control knobs have been turned off by the food service operator).

Production Day
Production Period

The time period when an appliance is used by the kitchen staff, typically between the hours of 5 A.M. and 8 P.M.

Glossary

Production Energy Consumption (kWh or kBtu)
Production Energy Use

The total amount of energy consumed by an appliance as it is used within the Production-Test Kitchen over a specified time period (e.g., 10 A.M. to 1 P.M., dinner period). Production energy consumption is numerically equal to daily energy consumption if the production period is not specified.

Rated Energy Input Rate (kW, W or kBtu/h, Btu/h)
Input Rating (ANSI definition)
Nameplate Energy Input Rate
Rated Input

The maximum or peak rate at which an appliance consumes energy as rated by the manufacturer and specified on the nameplate.

Range Top

A device for cooking food by direct or indirect heat transfer from one or more cooking units to one or more cooking containers.

Typical Day

A selected day of energy usage based on predetermined criteria that will generate a production energy consumption profile reflecting typical production usage for a specific appliance. The typical day criteria may comprise:

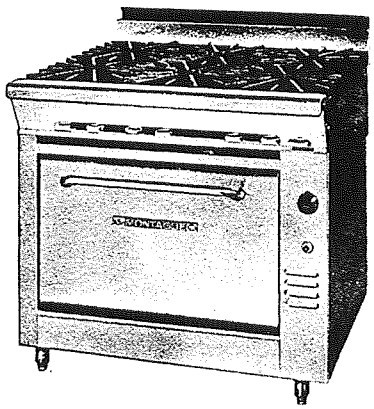
- Typical day energy consumption should approximate average daily energy consumption for energy use data set.
- A specified number of appliance operations and/or cooking periods (e.g., lunch and dinner only).
- A specified range in operating hours.
- A specified mode of operation (or combination of modes) may be associated with a typical day's operation.

B Manufacturer's Product Specifications

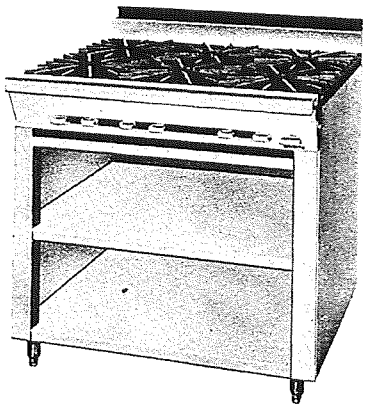
Appendix B contains Montague's product specifications for its model V136-5 Heavy-Duty 30 kBtu/h Open Top Gas Range.

MONTAGUE LEGEND Gas Heavy Duty Range — 136-5

ITEM NO.: JOB I.D. NO.:



Model 136-5



Model 36-5

Model M36-5

Model Variations:
136-5 — Oven model with 6" legs.
36-5 — Cabinet model with 6" legs.
M36-5 — Countertop model with 28" high modular stand with S/S tubular legs.
C36-5 — Counter model

Open Tops: Three 12" wide x 31" deep heavily ribbed cast iron grates. Six each open burners. Each Star burner has individually raised ports to help prevent clogging from spillovers and for better combustion. Burners are rated at 20,000 BTU/HR each, with automatic constant burning pilots. Drip pan under open burners.
Options, *(extra cost):
❑ -59 top(s), rated @ 15,000 BTU/HR each, 12" wide x 31" deep cast iron top with heavily ribbed open burner grate across front and Solid Hot Top section across rear. Located:
❑ 1, right ❑ 1, center ❑ 1, left
❑*Ribbon Grate, cast iron. (In-lieu-of 12" open burner grate.) Note: For use with 20,000 BTU/HR burners. Located:
❑*1, right ❑*1, center ❑*1, left
❑*30,000 BTU/HR Star open burner for use with Natural gas:
❑*3, front ❑*3, back ❑*6, front and back

Oven Interior: The front venting oven is 26" wide x 28" deep x 15" high. Standard interior finish is porcelainized steel.
Options, *(extra cost):

❑*Cast iron oven bottom
The 3-position rack guides and oven bottom are removable for major cleaning. The oven is heated by a cast iron burner rated at 40,000 BTU/HR. The oven cavity is completely encased in high density fiberglass insulation maximizing heat retention. One rack with bright nickel finish is furnished.

Oven Controls: Includes manual burner valve, heavy duty throttling type thermostat, 100% safety pilot and automatic lighting. Controls are located in an insulated and vented compartment for longer life. Thermostat located on front right side. Thermostat dial has a temperature range from low to 500°F (260°C).

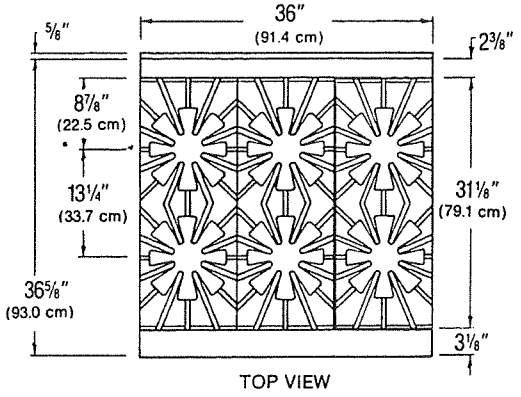
Oven Doors: Weight counterbalanced without the use of springs. One piece offset tubular-type handle is used.

Finish: Satin finish stainless steel front, including 4" flue riser. Remaining exterior black. All painted surfaces have electrolytic zinc undercoating for corrosion protection and longer life. Additional S/S finish available, *(extra cost):
❑*S/S left side ❑*S/S right side ❑*S/S back panel
❑*S/S lower shelves for cabinet base, (2 ea. required)
NOTE: Black finish with S/S trim available.

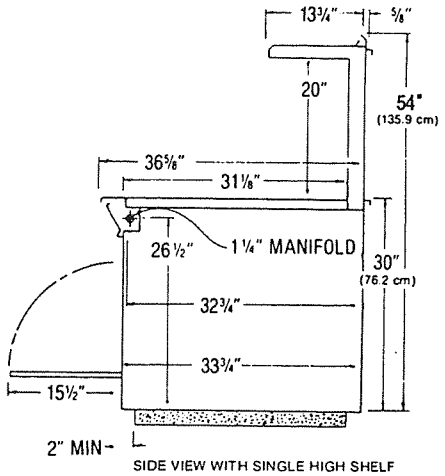
Options, *(extra cost):	S/S front	Black
❑*18" High Back:	❑	❑
❑*Single High Shelf:	❑	❑
❑*Double High Shelf:	❑	❑
❑*Doors for Cabinet Base:	❑	❑

❑*Extra Oven Racks
❑*42" Range Depth, suffix *-40*
❑*Left Rear Manifold with pressure regulator:
❑*3/4" NPT, up to 165,000 BTU/HR
❑*3/4" NPT, up to 320,000 BTU/HR
❑* 1" NPT, up to 500,000 BTU/HR
❑ Cap, Manifold: ❑ left side ❑ right side (Must specify when ordering.)
❑*S/S Cover, Manifold: ❑ left side ❑ right side
❑*Plate Shelf — 6" wide, S/S
❑*Casters — set of 4, 5" wheel, 6" height
❑*Flex Connector Kit — hose, disconnect and restraining device: ❑*3' x 3/4" ❑*4' x 3/4" ❑*5' x 3/4"
❑*Security Options — i.e., prisons. Consult factory.

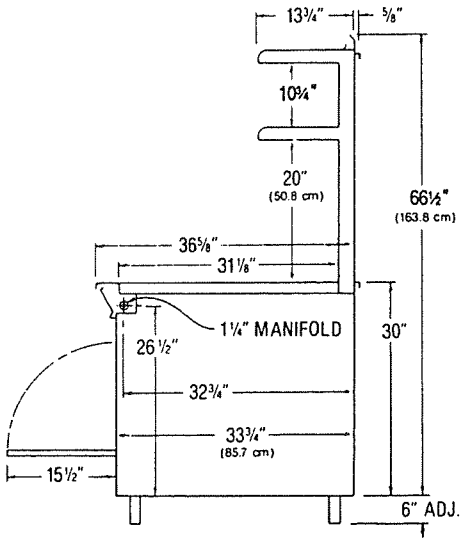
Exterior Dimensions: 36" wide x 36-5/8" deep. See drawing on reverse side for heights. For 42" depth add 6" to overall depth of range.



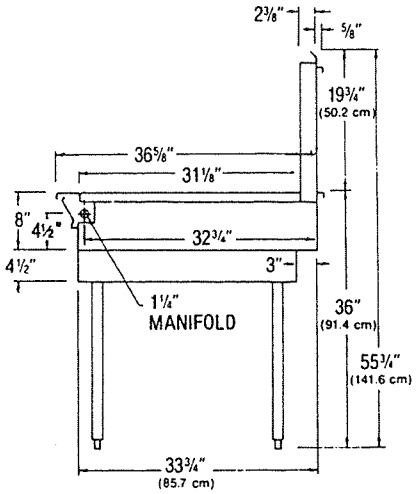
TOP VIEW



SIDE VIEW WITH SINGLE HIGH SHELF AND CURB MOUNT



SIDE VIEW WITH DOUBLE HIGH SHELF AND ADJUSTABLE LEGS



SIDE VIEW MODULAR MODEL WITH HIGH BACK

IMPORTANT:

Ranges must be installed in accordance with local codes or, in the absence of local codes, with the National Fuel Gas Code ANSI Z223.I. Compliance with codes is the responsibility of the Owner and Installer.

Adequate Ventilation System required. Refer to the National Fire Protection Association Standard No.96, "Vapor Removal from Cooking Equipment".

AGA Design Certified: in accordance with ANSI Z83.11 Gas Foodservice Equipment — Ranges. (Note: These appliances are intended for commercial use by professionally trained personnel. *NOT Intended For Household Use.*)

Minimum Clearances:	**Combustible Construction**	**Noncombustible Construction**
Back Wall:	**2"**	**0"**
Left & Right Side:	***6"**	**0"**
With 6" legs: suitable for installation on combustible floors. Without legs: For use only on noncombustible floors.		
***15" when installed with 30,000 BTU/HR burners.**		
Counter models: For use on noncombustible counters only.		

TYPE OF GAS		**Natural 4.0" WC**	**Propane 10" WC**
Model	**# burners**	**BTU/HR**	**BTU/HR**
136-5	7	160,000	160,000
36-5	6	120,000	120,000
C36-5	6	120,000	120,000
M36-5	6	120,000	120,000
Add 10,000 BTU/HR for each 30,000 BTU/HR burner used. Deduct 5,000 BTU/HR for each -59 Open/Hot Top used.			

GAS INLET SIZE (for all models):
1-1/4" front manifold with 1/2 union on each end provided for battery connection. Properly sized gas pressure regulator must be *Furnished By The Installer.*

Note: Specify type of gas ❑ Natural ❑ Propane
Specify elevation if installing above 2000 feet.

SHIPPING WEIGHT: *Class 77-1/2 **Class 85
136-5. . . . . *536 lbs. C36-5. . . . . **300 lbs.
36-5. . . . . **352 lbs. M36-5. . . . . **320 lbs.
ENTRY CLEARANCE: 30", all models, uncrated.
APPROX. CUBIC FT., (crated):
Cabinet base models. . . 27 Counter Models. . . 13

Montague's sole commitment to quality/product improvement can cause specification and design changes without prior notice.

THE MONTAGUE COMPANY
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C Energy Monitoring System

Energy data are collected once each minute, which means that the highest resolution measurement of energy rate is a 1-minute average. Short periods of full input are not reflected as full input. Heating elements and burners are usually either full on or off. A plot of 1-minute data may show some less-than-full-on 1-minute values because the elements or burners operate on full for only part of the minute.

Long periods of constant input rate are usually reflected as a sawtooth pattern. Electronic pulses are generated by the meter, which measures the flow of electricity or gas to the appliance. Each pulse corresponds to a specific quantity of electric or gas energy consumed. The system stores the number of pulses for each minute, but it only stores an integer value for the number of pulses even though the actual energy consumed during the period corresponds to a non-integer value. For example, if the actual consumption during a 1-minute period corresponds to 6.6 pulses, only the integer "6" will be stored for that minute. The "0.6" will be carried forward and added to pulses generated during the next minute. If the energy consumed during the next minute is also 6.6 pulses, then the pulse value stored will be the integer portion of 7.2 (6.6 + 0.6) and the 0.2 will be carried to the next time interval.

D Frequency Distribution of Dataset

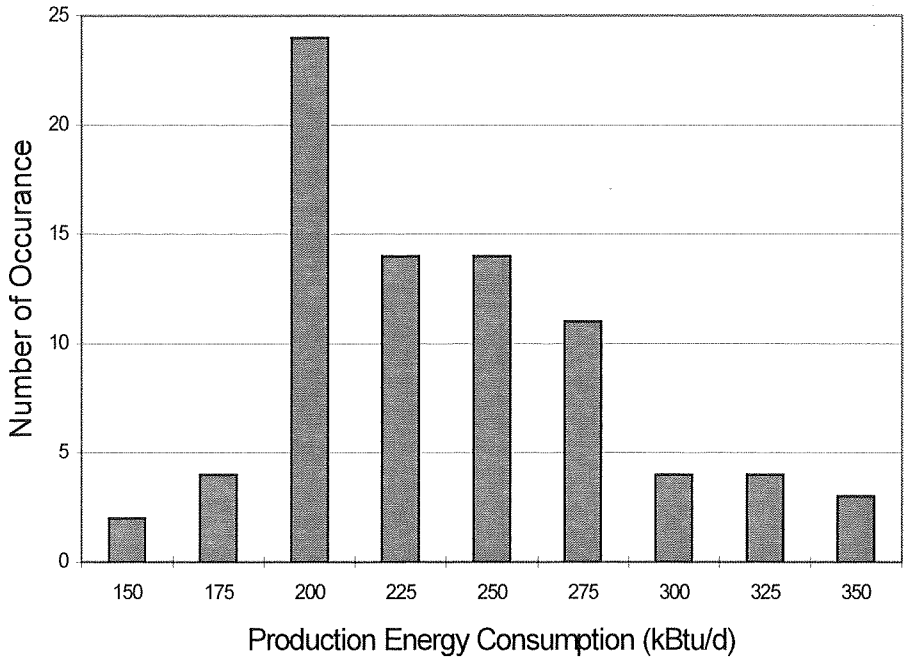

Figure D-1.
Frequency of the Range Top Daily Production Energy Consumption.

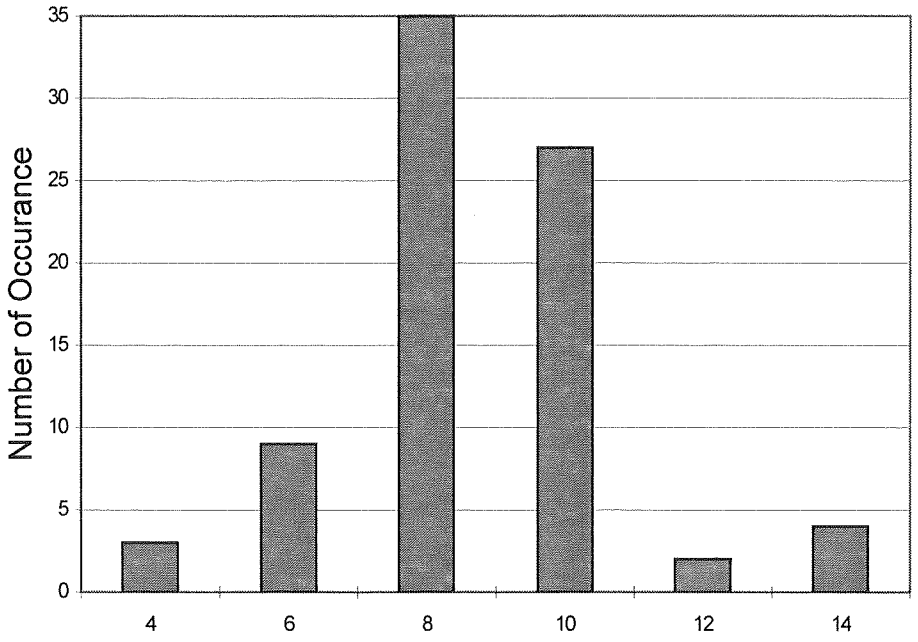

Figure D-2.
Frequency of the Range Top Daily On-Time.

E PG&E Energy Rates

Appendix E contains Schedule G-NR1, PG&E's gas rate schedule for small commercial customers.

Baseline Territories and Quantities

Winter

(November 1 - April 30)

TERRITORY	INDIVIDUALLY METERED		MASTER METERED (GM & GML only)	
GAS	Monthly	Daily	Monthly	Daily
P	*58	*1.9	*32	*1.1
Q	*59	*2.0	30	1.0
R	56	1.9	69	2.3
S	59	2.0	*28	*0.9
T	*51	*1.7	42	1.4
V	*52	*1.7	*43	*1.4
W	56	1.9	*37	*1.2
X	*59	*2.0	30	1.0
Y	*58	*1.9	*32	*1.1

Summer

(May 1 - October 31)

TERRITORY	INDIVIDUALLY METERED		MASTER METERED (GM & GML only)	
GAS	Monthly	Daily	Monthly	Daily
P	15	0.5	12	0.4
Q	20	0.7	21	0.7
R	14	0.5	*17	*0.6
S	15	0.5	12	0.4
T	20	0.7	21	0.7
V	*22	*0.7	*20	*0.7
W	15	0.5	12	0.4
X	17	0.6	14	0.5
Y	*25	*0.8	*22	*0.7

*Changed May 1, 1998

Core Commercial Gas Rates

(Rates Below Are Effective August 7 through August 31, 1998)

Small Commercial: G-NR1

	Per Month	Per Therm	
		Summer	Winter
Customer Charge	$13.42		
Procurement Charge		$.19652	$.19652
Transportation Charge		$.30215	$.38209
Total Charge		**$.49867**	**$.57861**

Note: The gas procurement charge and total rates generally change on the 5th business day of each month. (Transportation rates do not change monthly).

Large Commercial: G-NR2

	Per Month	Per Therm	
		Summer	Winter
Customer Charge	$150.72		
Procurement Charge		$.19534	$.19534
Transportation Charge		$.19140	$.23346
Total Charge		**$.38674**	**$.42880**

Note: The gas procurement charge and total rates generally change on the 5th business day of each month. (Transportation rates do not change monthly).

Gas Price Hotline

Schedule G-NR1 and G-NR2 gas procurement charges may also be obtained by calling PG&E's Gas Price Hotline at 1-800 343-4743, Menu 3, Option 1.

G-NR1 and G-NR2 Seasons:

Summer:
April 1 through Oct. 31

Winter:
Nov. 1 through March 31