Final Report by the Subcommittee on Gas and Oil Powered Equipment Judgement Criteria Energy Efficiency Standards Subcommittee The Advisory Committee for Natural Resources and Energy

May 6, 2004

The final report (April 3, 2002) by the Subcommittee on Gas and Oil Powered Equipment Judgement Criteria, Energy Efficiency Standards Subcommittee, the Advisory Committee for Natural Resources and Energy states that, with regard to space heaters (unvented types) and gas cooking appliances (grill section, oven section, and gas rice cookers), "the measuring methods will be further examined by obtaining knowledge and information from experts and discussions regarding setting standards and will be arranged based on the results of such examinations." It also states to "consider including gas water heaters (with space heating functions) to the scope in view of the status of the use and the establishment of the measuring methods." In addition, with regard to the power consumption of gas and oil powered equipment, it states that "manufacturers will be advised to make every effort to reduce power consumption, independent from improving gas and oil fuel's energy consumption efficiency."

In response to these points, this subcommittee, as described below, deliberated and prepared a final report on judgement criteria and others for manufacturers and importers (hereafter referred to as "manufacturers") concerning the improvement of performance of space heaters, gas cooking appliances, and gas water heaters (with space heating functions) in view of the examination results at the study meetings of experts held earlier (the "Study Meeting on Energy Consumption Efficiency Measuring Methods for Gas and Oil Powered Equipment" and the "Study Meeting on Energy Consumption Efficiency Measuring Methods for Heat Cooking Appliances" (chaired by Mr. Toshihisa Ueda, Professor, Department of Science and Technology, Keio University)).

I. Conclusions concerning the Expansion of the Scope [see Attachment 1]

1. Space Heaters

Despite that they account for the majority of the energy consumption by space heaters in total, unvented type space heaters (limited to those using gas or oil as fuel) will continue to be excluded from the scope due to the following reasons:

A) It is technically very difficult to establish a method for measuring the energy consumption efficiency,

B) The heat generated by the burnt fuel is all released into the room, which means the heat efficiency is theoretically 100%. Thus, it is difficult to find disparities in efficiency per appliance.

C) There is very little room for improving the energy consumption efficiency, and

D) There is neither any measuring method for the energy consumption efficiency nor

any regulation established in other countries.

2. Gas Cooking Appliances

Since an appropriate measuring method for gas cooking appliances has been established for the grill sections (the grill sections of gas burners with grills and gas ranges) and the oven sections (the oven sections of gas ranges), as well as gas ovens, they will be newly included in the scope.

On the other hand, gas rice cookers will continue to be excluded from the scope due to the following reasons:

A) Since there are presently only two manufacturers, each of which has only one or two basic models, there is very limited room for improving the energy consumption efficiency,

B) It is unlikely that the number of manufactures and import will increase significantly in the future,

C) JIS S2103 (gas cooking appliances for home use) provides a method for measuring the heat efficiency. However, this measuring method is designed to calculate the heat efficiency when boiling a certain volume of water. This does not reflect the actual status of the use of gas rice cookers. It is therefore considered inappropriate to set the target standard value based on this measuring method.

3. Gas Water Heaters

Since an appropriate measuring method has been established for gas water heaters (with space heating functions), they will be newly included in the scope.

4. The Treatment of the Power Consumption of Gas and Oil Powered Equipment

With regard to the power consumption of gas and oil powered equipment, no target standard values will be set due to the following reasons as continued from the current standard:

A) The power consumption of the gas and oil powered equipment is consumed to ensure the safety functions and others. Thus, it is not desirable to regulate this power consumption under the Top Runner Program.

B) The power consumption of gas and oil powered equipment accounts for approximately 1% of the overall energy consumption. Thus, it is considered that considerable energy conservation may be achieved by setting target standard values regarding the fuel consumption, and

C) It is difficult to integrate the target standard values of the fuel and the power consumption.

However, the power consumption of gas and oil powered equipment is greater than other home appliances and the like. Thus, voluntary efforts to reduce the power consumption will be encouraged under the leadership of the relevant industry (Japan Industrial Association of Gas and Kerosene Appliances). See Reference 1 for the specific activities. In addition, the Japan Industrial Association of Gas and Kerosene Appliances will periodically report to the public the progress and the result of those activities to achieve the reduction of the power consumption.

II. The Judgement Criteria for Gas Cooking Appliances

1. Range of Appliances to be Additionally Included to the Scope

The gas cooking appliances (limited to home use using City Gas 13A or liquefied petroleum gas) shown below will be applied to the range.

-Gas ovens
-Grill sections of gas burners with grills
-Grill and oven sections of gas ranges

Gas burners with grills and the burner sections of gas ranges are currently regulated in the scope under the existing regulations.

2. Items to Serve as Judgement Criteria for Manufacturers

(1) Target Fiscal Year [See Attachment 2]

FY 2008.

However for gas burners with grills and the burner sections of gas ranges, FY 2006 will be applicable as already provided for in the existing regulations.

(2) Target Standard Values [See Attachment 3]

Manufacturers shall comply with the all following standards for the gas cooking appliances that will be domestically shipped in Japan in each fiscal year in and after the target fiscal year:

A) For gas cooking appliances with grills, the weighted average value of the grill section's energy consumption efficiency (Wh) measured by the method provided in (3) shall not exceed the "Standard Grill Section Energy Consumption Efficiency (Wh)" provided in the right column in table 1.

This above weighted average value is calculated by the number of appliances shipped

per category indicated in the left column in table 1.
The above "Standard Grill Section Energy Consumption Efficiency (Wh)" is the value calculated by the formula in the right column in the same table, corresponding to the category indicated in the left column).

Table 1: Standard Grill Section Energy Consumption Efficiency of Gas Cooking Appliances with Grills

Category			Formula for Standard Grill Section Energy Consumption Efficiency [Wh]
Grill Type	Cooking Method	Category Name	
Single-sided	With water	A	$E=25.1V_g+123$
	Without water	B	$E=25.1V_g+16.4$
Double-sided	With water	C	$E=12.5V_g+172$
	Without water	D	$E=12.5V_g+101$

Note 1 E: Standard grill section energy consumption efficiency [Wh]
V_g: Internal volume [l]
Note 2 Internal volume is acquired by multiplying the grill area by the height from the bottom surface of the grill pan to the top of the inlet

B) For gas cooking appliances (with oven sections) and gas ovens, the weighted average value of the oven section's energy consumption efficiency (Wh) measured by the method provided in (3) shall not exceed the "Standard Oven Section Energy Consumption Efficiency (Wh)" provided in the right column in table 2.
This above weighted average value is calculated by the number of appliances shipped per category indicated in the left column in table 2.
The above "Standard Grill Section Energy Consumption Efficiency (Wh)" is the value calculated by the formula in the right column in the same table, corresponding to the category indicated in the left column).

Table 2: Standard Oven Section Energy Consumption Efficiency of Gas Cooking Appliances with Oven Sections (including Gas Ovens)

Category		Formula for Standard Oven Section Energy Consumption Efficiency [Wh]
Installation Type	Category Name	
Tabletop or cabinet/stationary type	A	$E=18.6V_o+306$
Built-in type	B	$E=18.6V_o+83.3$

Note 1 E: Standard oven section energy consumption efficiency [Wh]
V_o: Internal volume [l]
Note 2 Internal volume is acquired by multiplying the bottom surface of the oven area by the height from the bottom surface of to the top

(3) Energy Consumption Efficiency Measuring Methods [See Attachment 4]

A) Energy Consumption Efficiency of the Grill Sections

The energy consumption efficiency of the grill section shall be the volume of the gas consumption [Wh] to raise the temperature of a copper block with heat capacity equivalent to that of a horse mackerel by 100K.

B) Energy Consumption Efficiency of the Oven Sections

The energy consumption efficiency of the oven sections shall be the sum [Wh] of the volume of the gas consumption to raise the temperature inside the oven by 180K and the volume of the gas consumption to subsequently maintain the status for 20 minutes.

(4) Display items, etc.

Display items for the gas cooking appliances with grills and the gas cooking appliances with oven sections shall be as indicated below. Display items for the gas cooking appliances with burner sections shall be the same as continued from the existing regulations.

A) Display items

Manufacturers shall display the information concerning the energy consumption efficiency of gas cooking appliances as follows:

(a) Product name or type
(b) Category name
(c) Energy consumption efficiency of grill sections (limited to the gas cooking appliances with grill sections)
(d) Energy consumption efficiency of oven sections (limited to the gas cooking appliances with oven sections)
(e) Manufacturer's name

B) Obligations

(a) Energy consumption efficiency shall be indicated rounded off to the decimal point as the whole number in watt-hours.
(b) The display items listed in A) shall be printed in catalogs in which the performance data is shown, and indicated on the prominent position of the main unit in order not to be easily worn off. Alternatively, they shall be indicated on metallic or plastic labels affixed to the prominent position of the main unit in order not to be easily come off.

III. Judgement Criteria for Gas Water Heaters

1. Range of Appliances to be Additionally Included to the Scope

Gas water heaters with space heating functions (limited to those for home use with displayed gas consumption of 70kW or lower as stipulated in JIS S2109, using City Gas 13 A or liquefied petroleum gas).

Gas instant water heaters and bath tub gas water heater are currently regulated in the scope under the existing regulations.

2. Items to Serve as Judgement Criteria for Manufacturers

(1) Target Fiscal Year [See Attachment 5]

FY 2008.

However for gas instant water heaters and bath tub gas water heaters, FY 2006 will be applicable as already provided for in the existing regulations.

(2) Target Standard Values [See Attachment 6]

For gas water heaters to be shipped in Japan in each fiscal year in and after the target fiscal year, manufacturers shall ensure that the weighted average value of the energy consumption efficiency (Wh) measured by the method provided in (3) shall not be below the value provided in the right column in the following table.

This above weighted average value is calculated by the number of appliances shipped per category indicated in the left column in table 1.

Category		Energy Consumption Efficiency [%]
Gas Water Heater Type	Category Name	
Water heaters for exclusive use as space heaters	A	83.4
Gas water heaters with dual use as heaters	B	83.0

Note "Gas water heaters with dual use as heaters" include dual purpose bath tub gas water heaters.

(3) Energy Consumption Efficiency Measuring Methods [See Attachment 7]

A) Energy Consumption Efficiency of Space Heater Sections of Water Heaters for Exclusive Use as Space Heaters and Gas Water Heaters with Dual Use as Heaters

The value (heat efficiency)[%] obtained by dividing the calorific value attained

by cold water by the calorific value generated by gas (heat efficiency) shall be applicable.

B) Energy Consumption Efficiency of Water Supply Sections of Gas Water Heaters with Dual Use as Heaters

Same as the existing gas instant water heaters, heat efficiency [%] measured by the heat efficiency test for instant water heaters as provided for in Section 6 "Test Methods" of JIS S2109 shall be applicable.

C) Energy Consumption Efficiency of Gas Water Heaters with Dual Use as Heaters

The energy consumption efficiency of gas water heaters with dual use as heaters shall be the value (heat efficiency)[%] resulting from subjecting the energy consumption efficiency of the space heater and hot water supply sections (paragraphs A) and B) above) to the weighted average at a ratio of 1 to 3, respectively.

(4) Display items, etc.

Display items for the gas water heaters with space heating functions shall be as indicated below. Display items for gas instant water heaters and bath tub gas water heaters shall be the same as continued from the existing regulations.

A) Display items

Manufacturers shall display the information concerning the energy consumption efficiency of gas water heaters as follows:

(a) Product name or type
(b) Category name
(c) Energy consumption efficiency
(d) Manufacturer's name

B) Obligations

(a) Energy consumption efficiency shall be indicated rounded off to two decimal places and indicated in percentage.
(b) The display items listed in A) shall be printed in catalogs in which the performance data is shown, and indicated on the prominent position of the main unit of the gas water heaters in order not to be easily worn off. Alternatively, they shall be indicated on metallic or plastic labels affixed to the prominent position of the main unit in order not to be easily come off.

(c) With regard to the above a) and b), for gas water heaters with dual use as heaters, the energy consumption efficiency measured for each of the space heating sections and hot water supply sections shall be indicated in catalogs in which performance data is shown, in addition to the above mentioned energy consumption efficiency in (a).

IV. Recommendations for Energy Conservation

1. Efforts by Users

(1) Users should try to choose gas and oil powered equipment that have a high degree of energy consumption efficiency and make every effort to use the equipment appropriately and efficiently, thereby reducing energy consumption.

(2) To specifically mention, unvented space heaters were excluded from the scope due to technical reasons. They are used by many households and have a high degree of heat efficiency of nearly 100%, but the fuel consumption depends largely on the heat insulation efficiency and the airtightness of the room. Therefore, users should make every effort to reduce the energy consumption when using unvented space heaters by trying to improve the heat insulation and the airtightness of the room to the extent possible while ensuring appropriate ventilation.

2. Efforts by Vendors

(1) Vendors should try to use “Energy Saving Labels” and provide appropriate information that may help users choose gas and oil powered equipment that have a high degree of energy consumption efficiency, while making effort to market the equipment that have a high degree of energy consumption efficiency. In addition, when implementing Energy Saving Labels, vendors should try to make such labels easy for users to understand and not misleading.

(2) To provide appropriate information at storefronts, vendors should make every effort to collect information about the energy conservation properties of gas and oil powered equipment and to promote education for sales personnel.

(3) Those who sell built-in type gas and oil powered equipment for buildings such as housing complex should also make every effort to select and install the gas and oil powered equipment that have a high degree of energy consumption efficiency. Therefore, those who sell built-in type gas and oil powered equipment for buildings should make an effort to realize the energy efficiency for residents of

such buildings as a result of using highly efficient gas and oil powered equipment.

3. Efforts by Manufacturers

(1) Manufacturers should make every effort to promote the development of technology for the energy conservation of gas and oil powered equipment and develop highly energy efficient products.

(2) To increase the diffusion rate of gas and oil powered equipment that have a high degree of energy consumption efficiency, manufacturers should use "Energy Saving Labels" and provide appropriate information that may help users choose gas and oil powered equipment that are highly efficient in terms of energy consumption. In addition, when implementing Energy Saving Labels, vendors should try to make the labels easy for users to understand and not misleading.

(3) Manufacturers should make every effort to reduce the power consumption of gas and oil powered equipment. In addition, the Japan Industrial Association of Gas and Kerosene Appliances should periodically publish the progress and result of voluntary activities in the industry to ensure the success of such activities.

4. Efforts by the Government

(1) To increase the diffusion rate of highly efficient gas and oil powered equipment, the government should make every effort to take measures such as political support and promotion, which are necessary for facilitating efforts by users and manufacturers.

(2) The government should try to grasp the information display status made by manufacturers on both a periodic and an on-going manner and implement appropriate laws so that accurate and easy-to-understand information about energy consumption efficiency can be provided for users.

(3) The government should take advantage of appropriate opportunities to internationally disseminate energy conservation regulations based on the Top Runner Program as this program is very effective method to promote the energy conservation of appliances.

Attachment 1

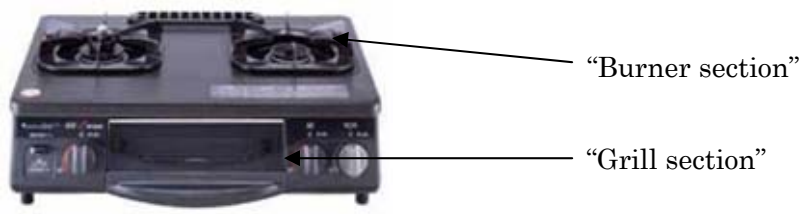
Overview of Appliances Considered to be Included to the Scope

○ Unvented space heaters

An unvented space heater is one that makes use of the air inside the room and releases the gas burned into the room to warm the air by the heat of combustion.

○ Gas burners with grills

A gas burner with grills is a cooking appliance designed to combine gas burners with a gas grill that has a front door. A burner is an appliance used for cooking with heat that is designed to allow such cookware as pans and kettles to be placed over the burners. A grill is an appliance designed to cook food mainly with radiant heat by placing the food on a wire-mesh grill installed above or below the burner.

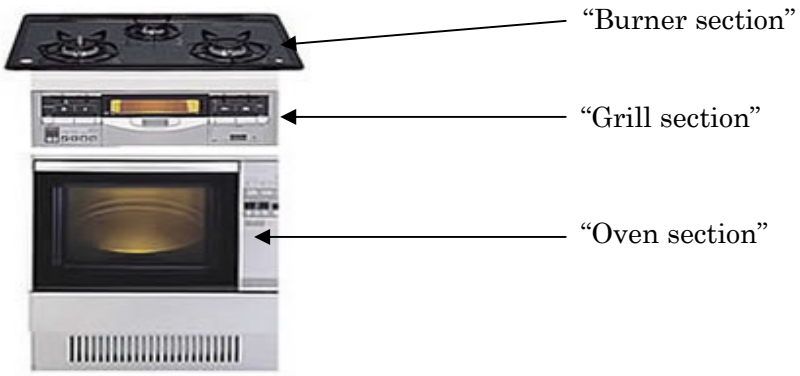


○ Gas oven

A gas oven is an appliance that has a front door with a glass window in it, designed to cook food mainly with convection heat by placing the food into the cabinet-covered interior.

○ Gas range

A gas range is a cooking appliance designed to combine gas burners or gas burners with grills with gas ovens.



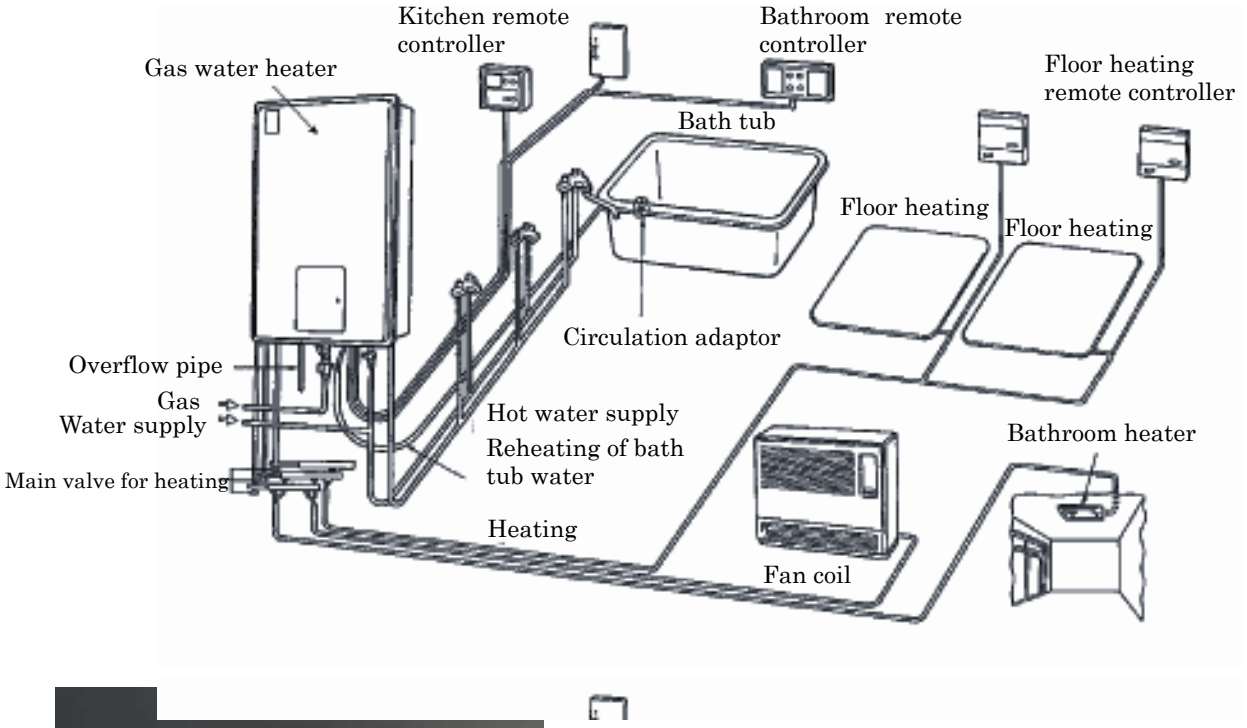
○ Gas rice cooker

A gas rice cooker is a cooking appliance equipped with a burner inside its casing in which an internal pot containing washed rice is set.

○ Gas water heater (either for exclusive use for heating or dual use as heaters)

A gas water heater (for exclusive use for heating) is an appliance that heats water supplied to terminal equipment in order to warm a room via floor heating panels or warm air blowers using hot water heat exchange. A gas water heater (with dual use as heaters) is an appliance that combines heating functions with water supply functions (including bath functions).

Piping Example (System Chart)



Materials courtesy of Rinnai Corporation

Attachment 2

Target Fiscal Year, etc. for Gas Cooking Appliances

1. In general, a significant improvement in the energy consumption efficiency of gas cooking appliances is made when new models are brought out. It usually takes five years or so to develop new gas cooking appliances because a long period of time is required for conducting safety and durability testing in particular. It is necessary to arrange the target fiscal year to be set for five years later or so, so that there will be at least one opportunity for a change in models before the target fiscal year.

   As a measure against global warming on the other hand, it is desirable to achieve the goal as soon as possible so that products that have achieved the target standard values can be sufficiently popularized during the first pledged period of the Kyoto Protocol (2008 through 2012), assuming that gas cooking appliances are normally used for seven years or so.

   In view of the above, it is appropriate to set the target fiscal year for gas cooking appliances, which will be newly included within the scope, to FY 2008, that is, four years after the standards are set.

2. With regard to the burner sections of gas cooking appliances, however, the target fiscal year shall remain to be FY 2006 as provided for in existing laws.

3. The improvement rates of the energy consumption efficiency of individual sections in the target fiscal year are expected to be approximately 27% for the grill section and 20% for the oven section on the assumption that there will be no change in the present number of products shipped (those actually shipped in FY 2002) and in the composition of each category. Incidentally, energy conservation effects in FY 2010 are calculated to be approximately 46,000 kl on the assumption that products shipped in Japan in and after the target fiscal year will be replaced with those having achieved the target standard values.

<Outline of Trial Calculations>

■Grill section

(1) Energy consumption efficiency of the grill section is calculated based on the actual value for grills shipped in FY 2002: 317Wh

(2) Energy consumption efficiency of the grill section is calculated based on the target standard value for grill section to be shipped in the target fiscal year: 230Wh

(3) Improvement rate of energy consumption efficiency of grill section:

$$\frac{317-230}{317}\times 100 = \text{Approximately } 27.4\% \text{ (Approximately } 27\%)$$

(4) Energy consumption calculated based on the actual use of grill section shipped in FY 2002: 54,963 kl

(5) Energy conservation effects of grill sections in 2010:

$$54{,}963\times\frac{27.4}{100}\times 3\,(\text{years}) = 45{,}180\,\text{kl}$$

■Oven section

(1) Energy consumption efficiency of the oven sections is calculated based on the actual value for oven sections shipped in FY 2002: 1,049Wh

(2) Energy consumption efficiency of the oven sections is calculated based on the target standard value for oven sections to be shipped in the target fiscal year: 836Wh

(3) Improvement rate of energy consumption efficiency of oven sections:

$$\frac{1049-836}{1049}\times 100 = \text{Approximately } 20.3\% \text{ (Approximately } 20\%)$$

(4) Energy consumption calculated based on the actual use of oven sections shipped in FY 2002: 605 kl

(5) Energy conservation effects of oven sections in 2010:

$$605\times\frac{20.3}{100}\times 3\,(\text{years}) = 368\,\text{kl}$$

Attachment 3

Target Standard Values and Categories of Gas Cooking Appliances

I. Basic Concept

To promote energy conservation of appliances, it is essential to grasp the energy consumption efficiency of the appliances on the whole. However, since definitions and measuring methods for the energy consumption efficiency of individual functions are different in composite appliances such as gas burners with grills and gas ranges, it is difficult to evaluate them in a unified manner.

Specifically, the energy consumption efficiency of the burner section is defined in terms of heat efficiency [%], while that of the grill and oven sections is defined in terms of energy consumption [Wh]. Taking an example, to evaluate the overall energy consumption efficiency of a gas burner with grills that consists of burners and a grill, it is necessary to integrate the heat efficiency [%] of the burner section and the energy consumption [Wh] of the grill section, taking into account the actual status of the use and other factors. However, it is very difficult to technically integrate these factors using an appropriate conversion method. Even if the energy consumption efficiency of the burner and grill sections can be integrated and evaluated somehow in a unified manner, it is questionable what significance it has by integrating values with different definitions of energy consumption efficiency and it would also lead to complicated categorization. It is highly probable that the resulting standards would be very difficult for users to understand.

In view of such status for composite appliances, target standard values will be set for each category per function, such as burner sections, grill sections, and oven sections, and the achievement of such target values will be evaluated per function.

For burners, as manufacturers have been endeavoring to achieve the existing target standard value, the category and target standard value for burner sections will remain as they are.

II. Categories for Setting Target Values

Categories for setting target standard values for gas cooking appliances will be set based on such elements as grill types, cooking methods, and installation types that influence energy consumption efficiency for each of the functions of burner sections, grill sections, and oven sections.

1. Burner Section

The existing regulations will be applicable.

2. Grill Section

To set target standard values, grill sections will be divided into the two categories of either (1) grill type or (2) cooking type, as described below.

(1) Grill-Type Category

Since the difference between "single-sided" and "double-sided" grills may lead to a significant difference in energy consumption efficiency, these are considered as different categories (see Figure 1).

A) Single-sided Grill

A type of grills that heats and cooks food such as fish from only one direction by placing food on the grill inside it. The person cooking the food needs to check its condition and turn it over at the appropriate time.

B) Double-sided Grill

A type of grills that heats and cooks food such as fish from two directions by placing food on the grill inside it. Usually, this type does not require that the food be turned over.

(2) Cooking-Method Category

Since the difference between cooking methods that use water and those that do not may lead to a significant difference in energy consumption efficiency, these are considered as different categories (see Figure 2).

A) With Water

A type of grill where food is placed on a wire-mesh grill, underneath which is a metal pan containing water.

B) Without Water

A type of grills that cooks food without water in the grill pan.

3. Oven Section

To set target standard values, oven sections will be divided into the following types depending on installation type:

(1) Installation Type Category

Since the difference between "Tabletop or cabinet/stationary type" and "Built-in type" may lead to a significant difference in energy consumption efficiency, these are considered as different categories (see Figure 3).

A) Tabletop or cabinet/stationary type

A tabletop type is one that is placed on a table and has a relatively small internal volume. A cabinet/stationary type is one that is placed on a counter or stands on the floor.

B) Built-in Type

A built-in type is one that is built-in such what is known in Japan as the so-called "system kitchen," etc.

4. Basic Scheme for Setting Categories

In view of the above, the scheme of basic categories will be established as shown in the tables below. The number of models falling under each category is also shown below (based on FY 2002 shipments).

(1) Gas Cooking Appliances with Grill Section

Category Name	Grill Type	Cooking Method	Number of Models
A	Single-sided	With Water	152
B		Without Water	36
C	Double-sided	With Water	14
D		Without Water	67

(2) Gas Cooking Appliances with Oven Section

Category Name	Installation Type	Number of Models
A	Tabletop or cabinet/stationary type	12
B	Built-in type	27

III. Target Standard Value for Each Category

Target standard values will be set for individual functions based on the concept of the Top Runner Program. The specific concept is as shown below.

1. Setting Target Standard Values

Since the gas consumption of grill and oven sections is in positive correlation with their internal volumes*, target standards values (gas consumption) will be expressed in a linear function (formula) with the internal volume as a variable. The specifics of the formula are as shown below.

Since gas cooking appliances are used over a relatively long period of time and there are not many basic models, the data by the company manufacturing the greatest number of models is used to determine the correlation between gas consumption and internal volume. The inclination of the formula (target standard value) is determined by applying linear regression using the internal volume as a variable to the value of an

appliance with excellent energy consumption efficiency according to the company's data. Then under this inclination, the formula is set so that the intercept of the formula will be minimized across all data in each category. Improvement expected over the period up to the target fiscal year has no influence on the correlation between gas consumption and internal volume. Only the Top Runner value is considered for improvement. Therefore, target standard values are determined by translating the initial formula parallel to the downward.

Since no remarkable difference is observed in energy consumption efficiency due to the difference in gas types between city gas and liquefied petroleum gas, no special consideration is given to the difference in gas types in setting target standard values. In deriving the inclination of the formula (target standard value), however, the value for city gas is used as provided for in the existing regulations to obtain a finer correlation.

(* (Note) The internal volume of a grill is acquired by multiplying the grill area by the height from the bottom surface of the grill pan to the top of the inlet. The internal volume of an oven is acquired by multiplying the internal base area by the internal height.)

2. Room for Improving Energy Consumption Efficiency with Technological Improvements in the Future

Technological development for improving the energy consumption efficiency of gas cooking appliances has just begun on the whole, although there are variations among manufacturers. In other words, there is still room for improving the efficiency of gas cooking appliances.

The efficiency of grill sections can be improved by improving the quantity of radiant heat (reviewing burner and heat panel specifications), internal heat insulation performance, airtightness, and so forth. Taking efficiency improvement factors into account comprehensively, target standard values will be 3% higher than the existing Top Runner values. For oven sections, target standard values will also be 3% higher than the existing Top Runner values, taking into account internal heat insulation performance like that of gas grills.

3. Specific Target Standard Values for Individual Appliances

(1) Gas Grills

Target standard values for gas grills will be expressed in a linear function (formula) using internal volume as a variable. Data from the company manufacturing the greatest number of models is used for determining an inclination for each of the "single-sided" and "double-sided" grill types (see Figure 4). An intercept is calculated for each of the "with water" and "without water" types under the above inclination by

translating the formula parallel to the most effective value for energy consumption efficiency plus room for improved efficiency (3%) (see Figures 5 through 8).

For gas grills with fans that belong to the category of "double-sided" and "with water," only a single model is sold by a single company, and that model is a very special product that has added an oven function to the grill. The correlation between its actual cooking performance and the evaluation using copper blocks is not clear. If the energy consumption efficiency of that model were to be used as the Top Runner values in the category of "double-sided" and "with water," it is highly probable that it would greatly distort the product market of that category. Therefore, the energy consumption efficiency of those gas grills with fans is excluded as a special product when setting the target standard value for that category (see Figure 7).

As a result of the above, specific categories and target standard values for grill sections are as shown in the table below.

Grill Type	Cooking Method	Formula for Energy Consumption Efficiency (Top Runner Value)	Room for Improved Efficiency [%]	Formula for Target Standard Value
Single-sided	With water	$E=25.1V_g+127$	3.0	$E=25.1V_g+123$
	Without water	$E=25.1V_g+16.9$	3.0	$E=25.1V_g+16.4$
Double-sided	With water	$E=12.5V_g+177$	3.0	$E=12.5V_g+172$
	Without water	$E=12.5V_g+104$	3.0	$E=12.5V_g+101$

E: Energy consumption efficiency [Wh]
V_g: Internal volume [l]

(2) Gas Ovens

Target standard values for gas ovens will be expressed in a linear function (formula) using internal volume as a variable. Data from the company manufacturing the greatest number of models is used for determining a single inclination (see Figure 9). An intercept is calculated for each of the "Tabletop or cabinet/stationary" and "built-in type" under the above inclination by translating the formula parallel to the most effective value for energy consumption efficiency plus room for improved efficiency (3%) (see Figures 10 and 11).

The majority of gas ovens belong to the forced convection type. Therefore, if the energy consumption efficiency of gas ovens that belong to the natural convection type was used as the Top Runner value in the category of "Tabletop or cabinet/stationary type," it is very likely to distort the product market of that category, because products that belong to the forced convection type would not be able to exist. Therefore, the energy consumption efficiency of natural convection gas ovens is excluded as a special product when setting the target standard value for that category (see Figure 10).

As a result of the above, specific categories and target standard values for oven sections are as shown in the table below.

Installation Type	Formula for Energy Consumption Efficiency (Top Runner Value)	Room for Improved Efficiency [%]	Formula for Target Standard Value
Tabletop or cabinet/stationary	$E=18.6V_o+316$	3.0	$E=18.6V_o+306$
Built-in type	$E=18.6V_o+85.9$	3.0	$E=18.6V_o+83.3$

E: Energy consumption efficiency [Wh]
V_o: Internal volume [l]

(Reference)

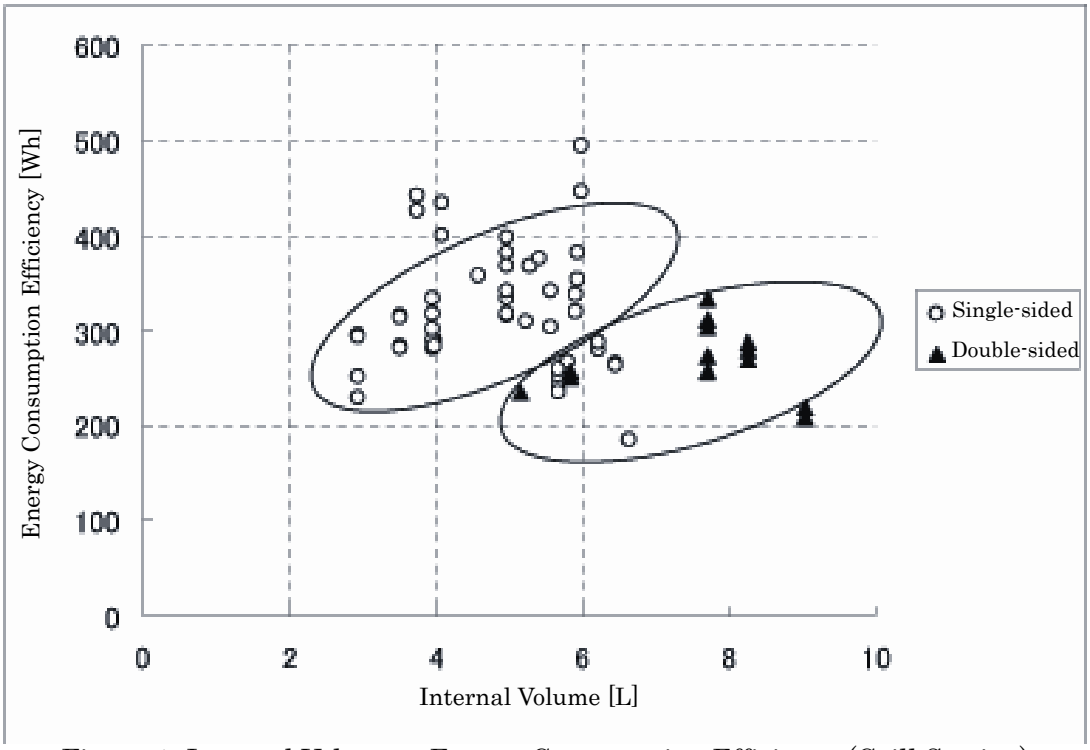


Figure 1: Internal Volume – Energy Consumption Efficiency (Grill Section)

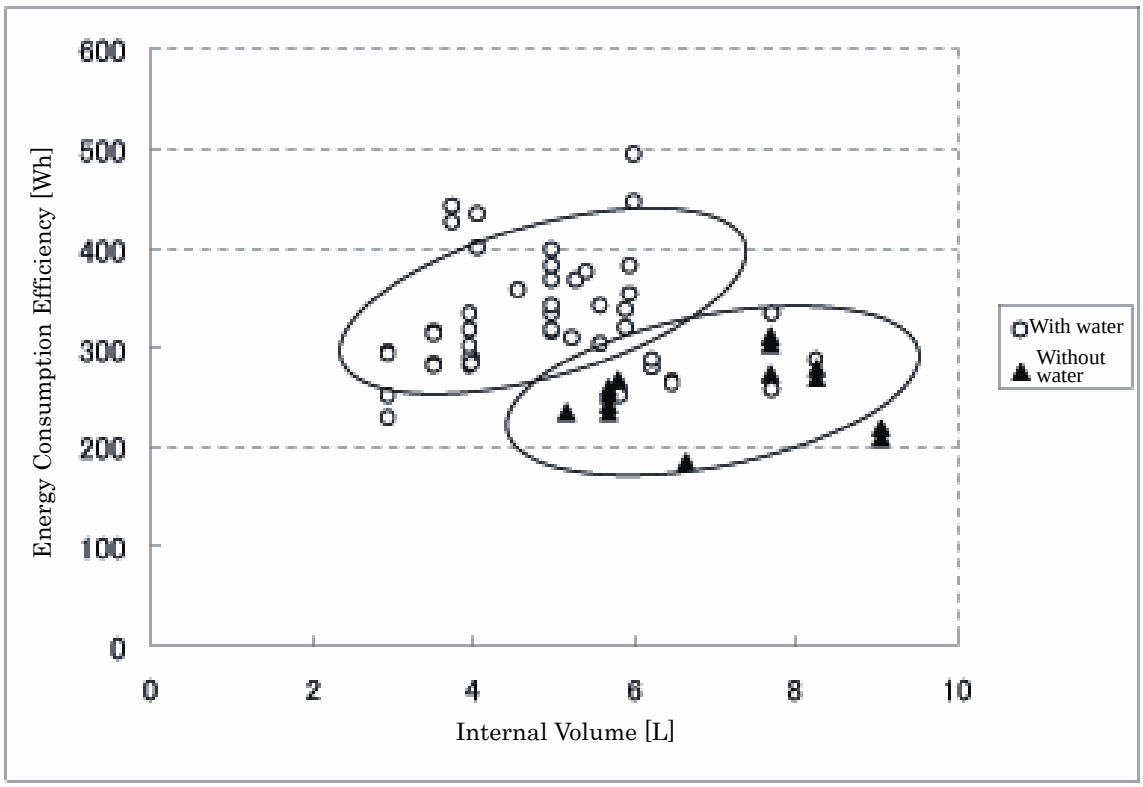


Figure 2: Internal Volume – Energy Consumption Efficiency (Grill Section)

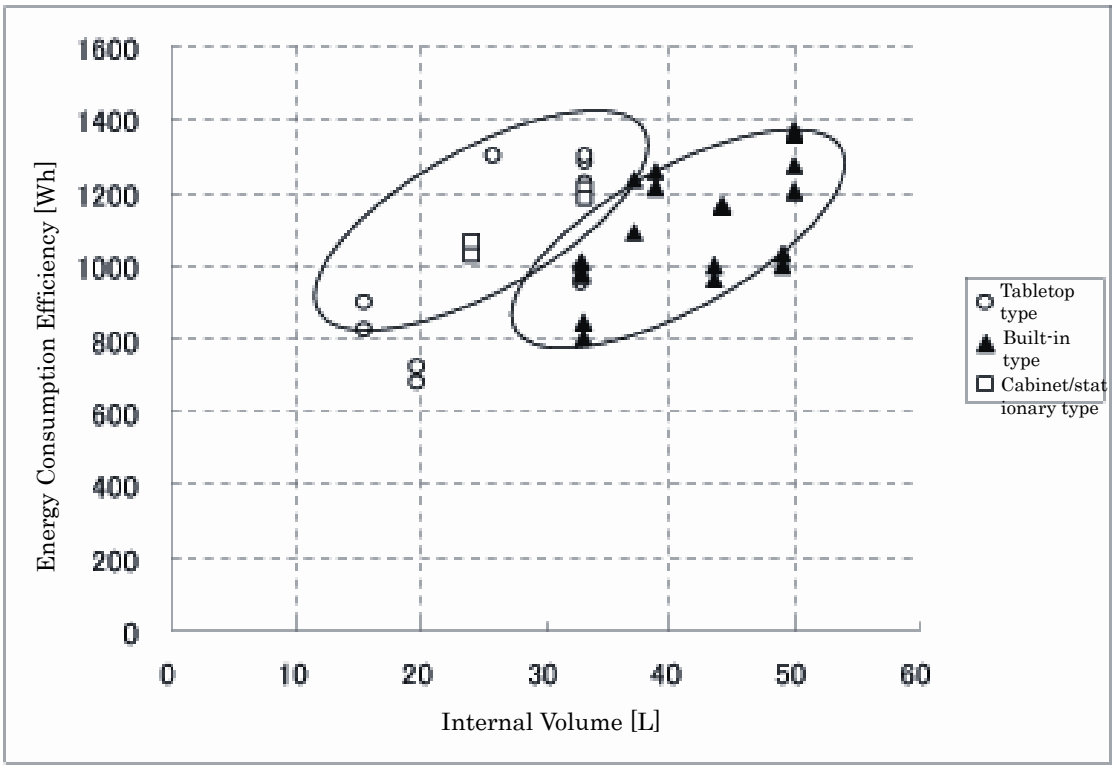


Figure 3: Internal Volume – Energy Consumption Efficiency (Oven Section)

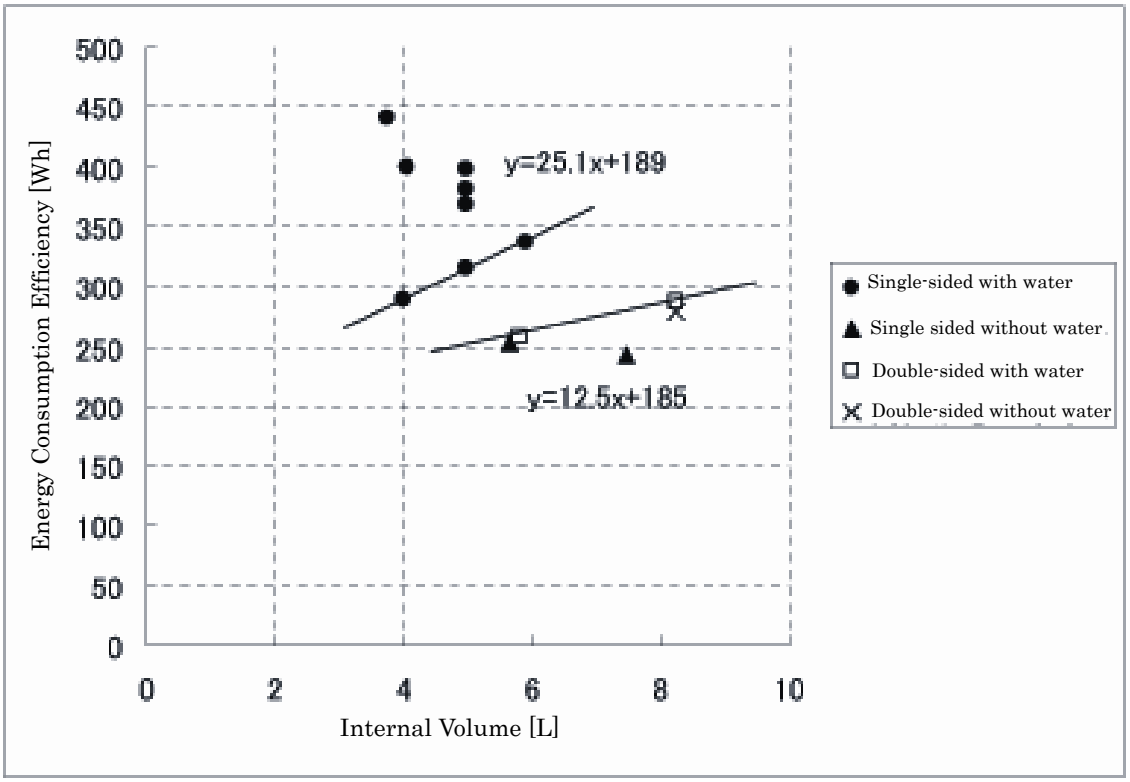


Figure 4: Internal Volume – Energy Consumption Efficiency (Grill Section)

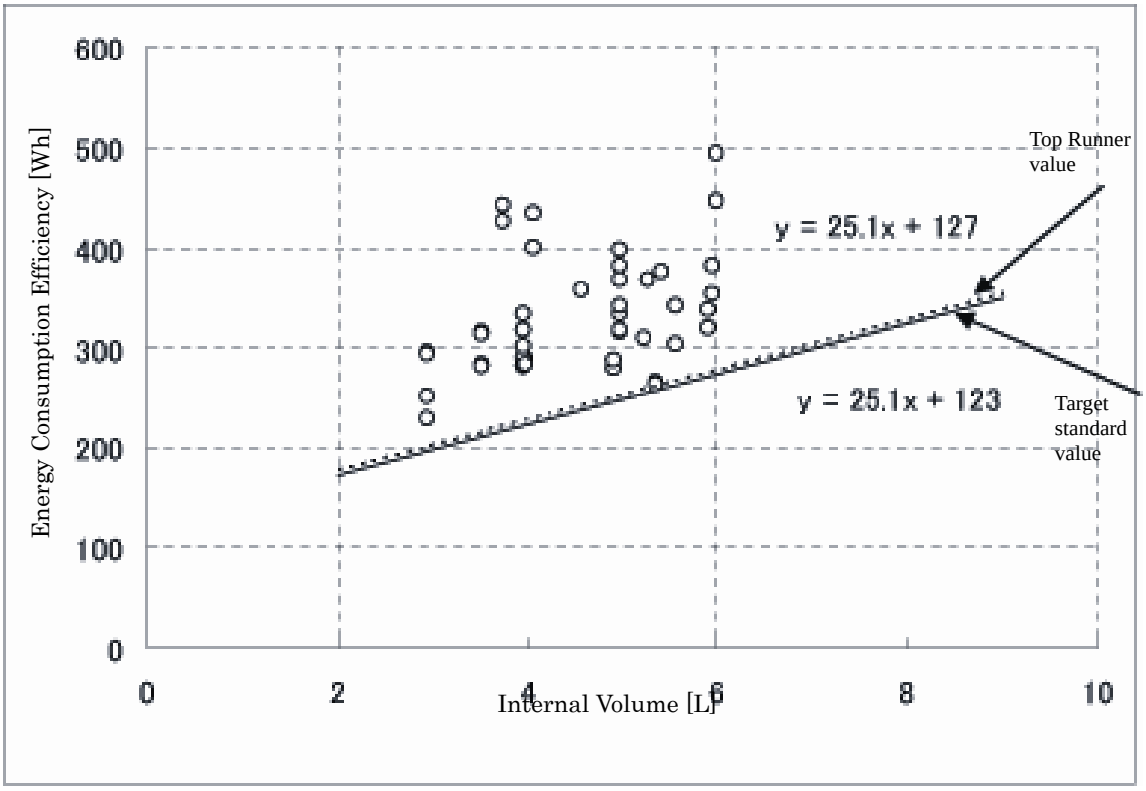


Figure 5: Internal Volume – Energy Consumption Efficiency (Grill Section)
(Single-sided with water)

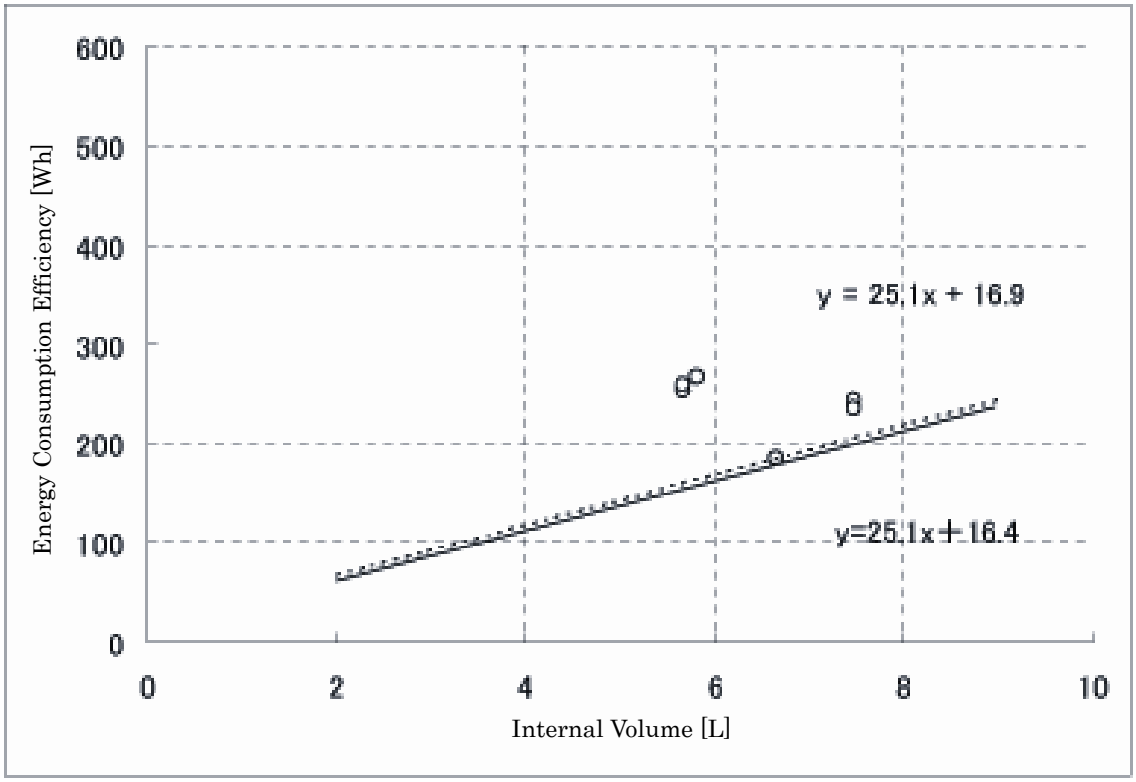


Figure 6: Internal Volume – Energy Consumption Efficiency (Grill Section)
(Single-sided without water)

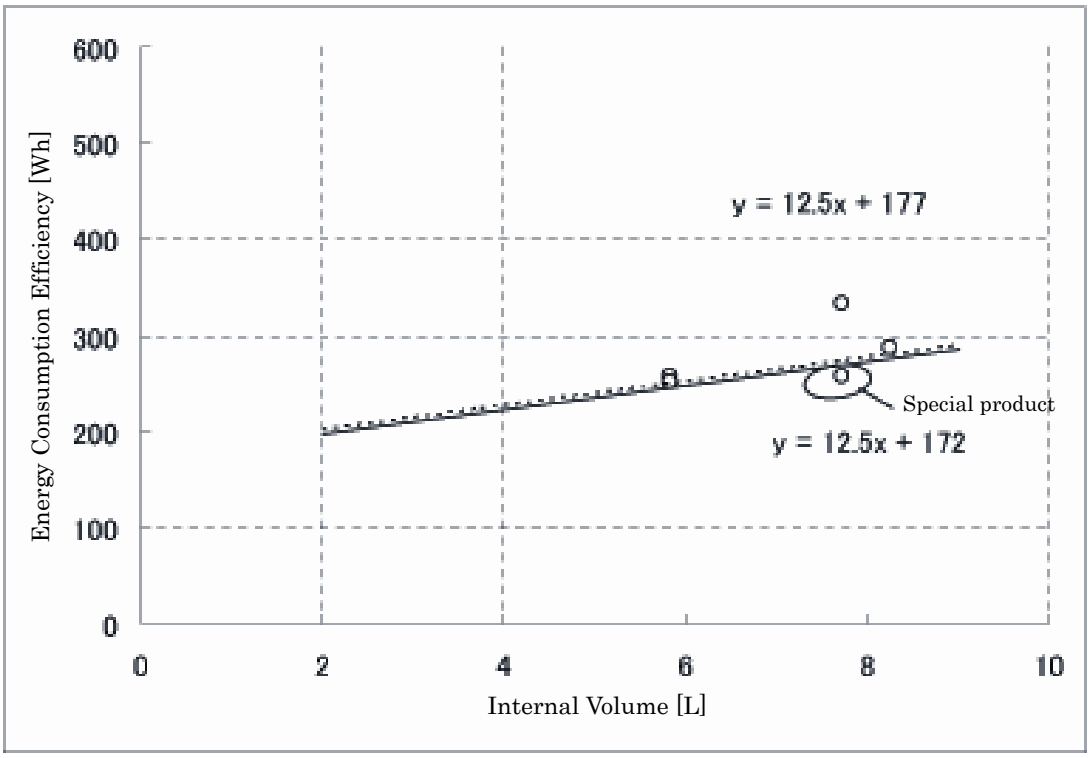


Figure 7: Internal Volume – Energy Consumption Efficiency (Grill Section)
(Double-sided with water)

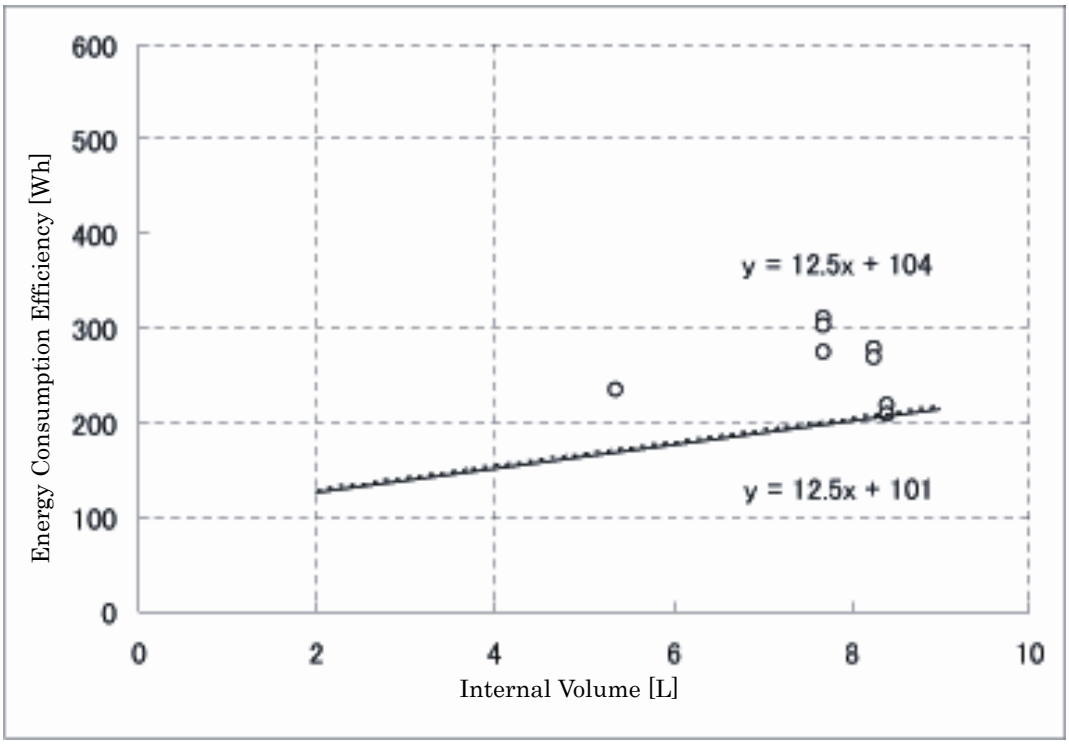


Figure 8: Internal Volume – Energy Consumption Efficiency (Grill Section)
(Double-sided without water)

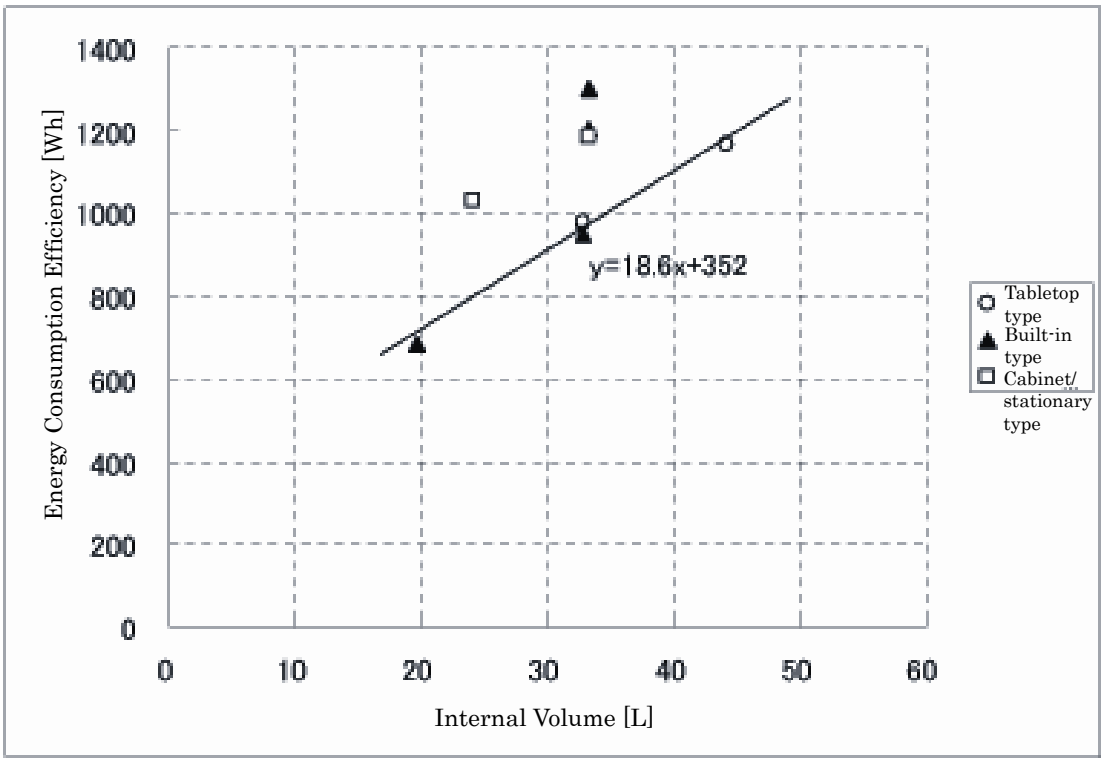


Figure 9: Internal Volume – Energy Consumption Efficiency (Oven Section)

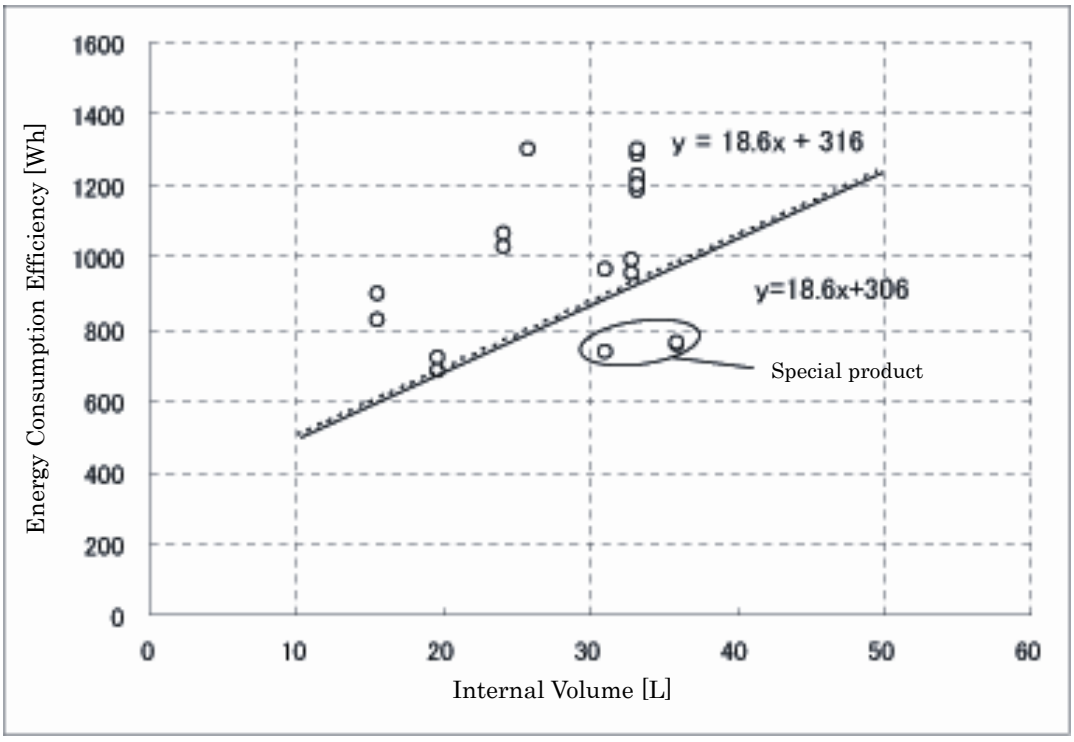


Figure 10: Internal Volume – Energy Consumption Efficiency (Oven Section) (Tabletop and Cabinet/stationary type)

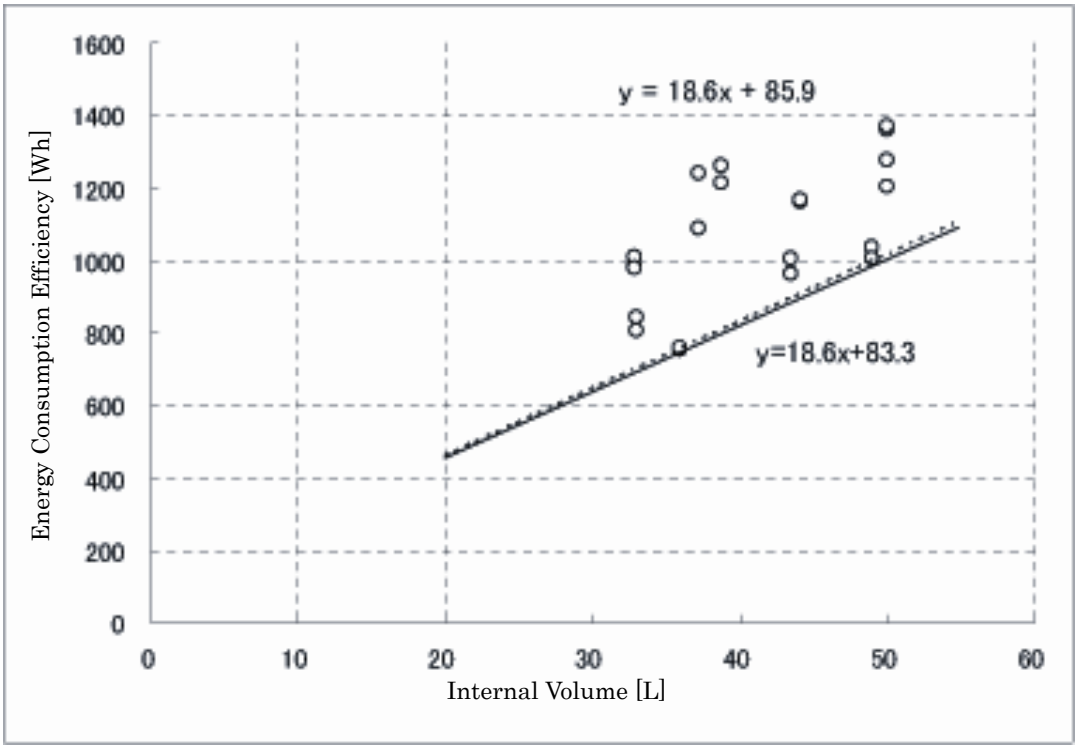


Figure 11: Internal Volume – Energy Consumption Efficiency (Oven Section) (Built-in Type)

Attachment 4

Energy Consumption Efficiency of Gas Cooking Appliances and the Measuring Method

I. Basic Concept

The energy consumption efficiency of the grill and oven sections of gas cooking appliances and the measuring methods is being deliberated based on the results of the examinations by the "Study Meeting on Energy Consumption Efficiency Measuring Methods for Heat Cooking Appliances". The meeting was chaired by Mr. Toshihisa Ueda, Professor, Department of Science and Technology, Keio University) and was set up in the Energy Conservation Center, Japan.

A gas grill is an appliance into which food is placed into its interior at room temperature and the food is then cooked mainly with radiant heat. Thus, its energy consumption efficiency is defined in terms of the volume of gas consumed to give the quantity of heat necessary for cooking the object (food). A copper block is used as a specific measuring method as the object to be heated that has a calorific value equivalent to that of a horse mackerel (fish), a commonly cooked type of food. The gas consumption to raise the temperature of that block by 100K is measured.

A gas oven is an appliance that is first preheated and then food is placed into its interior and the food is cooked mainly by convection heat as the inside of the oven is maintained at a stable temperature. Thus, its energy consumption efficiency is defined in terms of the gas consumption to maintain a stable internal temperature. The gas consumption is measured to raise the temperature of the empty interior by 180K and maintain it for 20 minutes is measured as a specific measuring method.

The above-mentioned two measuring methods are designed to evaluate the energy conservation performance of appliances, taking into account the heat absorption characteristics of the actual food cooked, the heat insulation performance of the appliance, and so forth. Cooking performance, such as the taste and finishing status of the food heated and cooked, is not necessarily taken into account.

II. Specific Measuring Method

1. Grill section

The energy consumption efficiency of grill sections and the measuring method are as described below.

(1) In measuring energy consumption efficiency, a block as specified in (2) will be used as the object to be heated.

(2) The specifications for the block are as shown below.

A) Material: Copper equivalent to C1020 of JIS H3100 (Copper and Copper Alloy Plates and Bars)

B) Dimension: 180±0.1mm, 70±0.1mm, $20^{+0.15}_{0}$ mm

C) Surface: Coated with flat black heat-resistant paint.

D) Thermocouple: Make a groove 1.0 mm wide and 1.1 mm deep on the surface of the block up to its geometric center. Embed a thermocouple into the groove and solder the top surface. Make a hole 1.1 mm in diameter and 10 mm deep at the geometric center of the block. Embed the tip of the thermocouple into the hole until it reaches the bottom of the hole, and fix it into place with solder. Use a thermocouple of "Type: K, Wire Diameter: 1.00 mm" as stipulated in JIS C1602 (Thermocouple) (see Figure 1).

(3) Keep the temperature and humidity of the test room at 20±5°C and 65±20%, respectively. Measure the internal atmospheric conditions and temperature of the test room in accordance with "2.1 Test Room Conditions" of JIS S2093 (Test Methods for Home-Use Gas Combustion Appliances).

(4) Measure gas consumption under the conditions specified in (1) Conditions of Appliances and (2) Test Conditions of 1. Measuring Gas Consumption of "Table 5: Gas Consumption Testing" of "6. Gas Consumption Testing" of JIS S2093.

(5) Keep the temperature of the block and grill interior before the test at 20±5°C.

(6) Adjust the appliance settings in accordance with the provision of "Raising Temperature under Normal Circumstances (Each Section of Appliance)" of "Table 4: Performance and Test Methods" of JIS S2103.

(7) Place the block at the geometric center of the grill, provided, however, that in the case that the user manual specifies a particular position to place the fish, then place the block into that specified position.

(8) The volume of gas is adjusted to the maximum.

(9) Energy consumption efficiency [Wh] is the value calculated based on the following formula after measuring the gas consumption actually consumed as V [m^3] to raise the temperature of the block by 100k.

$$E = \frac{1000}{3.6} \times V \times Q \times \frac{(B + P_m - S)}{101.3} \times \frac{273}{273 + t_g}$$

where E: Energy consumption efficiency [Wh]

V: Volume of gas actually consumed [m^3]

Q: Total calorific value of gas used [MJ/m^3_N]

B: Atmospheric pressure at the time of measurement [kPa]

P_m: Gas pressure in the gas meter at the time of measurement [kPa]

S: Saturated vapor pressure at a temperature of t_g°C [kPa]

t_g: Gas temperature in the gas meter at the time of measurement [°C]

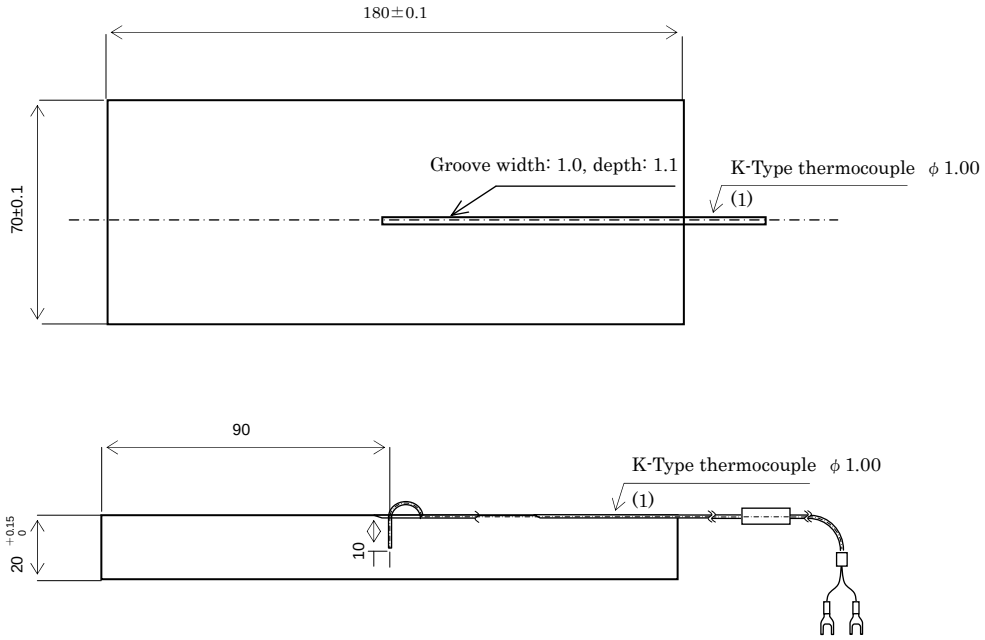


Figure 1: Thermocouple Installation

2. Oven Section

The energy consumption efficiency of oven sections and the measuring method are as described below.

(1) Install a globe thermometer (thermocouple for measuring oven temperature as stipulated in table 4 of JIS S2103) at the geometric center of the oven interior (see Figure 2).

(2) Keep the temperature and humidity of the test room at 20±5°C and 65±20%, respectively. Measure the atmospheric conditions and temperature of the test room in accordance with "2.1 Test Room Conditions" of JIS S2093.

(3) Use power supply conditions in accordance with "2.3 Power Supply Conditions" of JIS S2093.

(4) Keep the temperature of the oven interior before the test at 20±5°C.

(5) Measure gas consumption under the conditions specified in (1) Conditions of Appliances and (2) Test Conditions of 1. Measuring Gas Consumption of "Table 5: Gas Consumption Testing" of "6. Gas Consumption Testing" of JIS S2093.

(6) Adjust the appliance settings in accordance with the provision of "Raising Temperature under Normal Circumstances (Each Section of Appliance)" of "Table 4: Performance and Test Methods" of JIS S2103.

(7) Energy consumption efficiency is indicated as E [Wh]. Use the measured gas consumption actually consumed to raise the temperature of the oven interior by 180k as V_1 [m^3]. Use the measured volume of gas actually consumed to maintain the status for 20 minutes as V_2 [m^3]. Convert the sum of V_1 and V_2 as V [m^3] into energy using the conversion formula used for grills (see 1. (9)) to obtain the value E ($=E_1+E_2$) [Wh] (see Figure 3).

(8) Depending on the model, however, it may be difficult to maintain the above-mentioned temperature due to its temperature setting mechanism. In such a case in principle, measure two threshold temperatures between which the temperature raised from the initial temperature by 180K lies and the volume of gas consumed, and calculate energy consumption efficiency using the value used to calculate, by means of linear interpolation, the volume of gas consumed to raise the initial temperature by 180K.

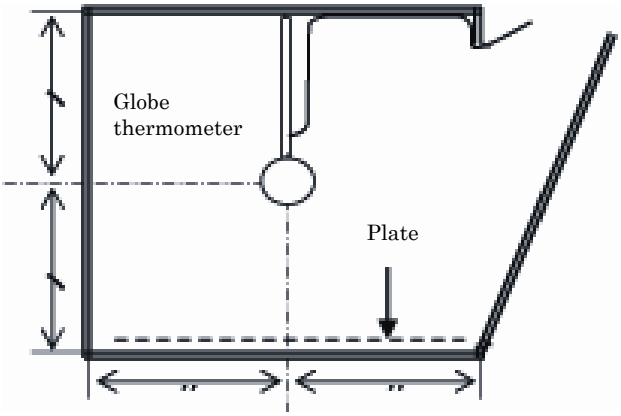


Figure 2: Globe Thermometer Installation

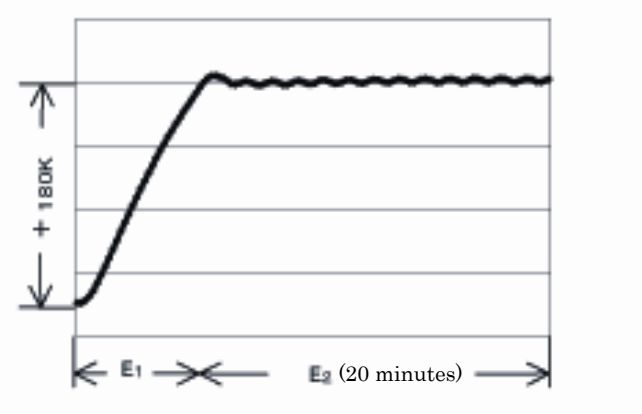


Figure 3: Measuring Method of Energy Consumption Efficiency for Gas Ovens

Attachment 5

Target Fiscal Year, etc. for Gas Water Heaters (with Space Heating Functions)

1. In general, a significant improvement in the energy consumption efficiency of gas water heaters (with space heating functions) is made when new models are brought out. It usually takes five years or so to develop new gas water heaters because a long period of time is required for conducting safety and durability testing in particular. Thus, it is necessary to arrange the target fiscal year to be set for five years later or so, so that there will be at least one opportunity for a change in models before the target fiscal year.

As a measure against global warming on the other hand, it is desirable to achieve the goal as soon as possible. Therefore, products that have achieved the target standard values can be sufficiently popularized during the first pledged period of the Kyoto Protocol (2008 through 2012) based on the assumption that gas water heaters are normally used for seven years or so.

In view of the above, it is appropriate to set the target fiscal year for gas water heaters (with space heating functions), which will be newly added to the scope, to FY 2008, that is, four years after the standards are set.

2. With regard to gas instant water heaters and bath tub gas water heaters, however, the target fiscal year shall remain to be FY 2006 as provided for in existing laws.

3. The improvement rates of the energy consumption efficiency in the target fiscal year are expected to be approximately 3.3% for gas water heaters used exclusively as space heaters and 1.1% for gas water heaters with dual use as heaters. This is on the assumption that there will be no change in the present number of products shipped (those actually shipped in FY 2002) and in the composition of each category. Incidentally, energy conservation effects in FY 2010 are calculated to be approximately 7,000 kl on the assumption that products shipped in Japan in and after the target fiscal year will be replaced with those having achieved the target standard values.

<Outline of Trial Calculations>

■Gas water heaters used exclusively as space heaters

(1) Energy consumption efficiency calculated based on the actual value for gas water heaters used exclusively as space heaters shipped in FY 2002: 80.7%

(2) Target standard value for gas water heaters used exclusively as space heaters to be shipped in the target fiscal year: 83.4%

(3) Improvement rate of the energy consumption efficiency of gas water heaters used exclusively as space heaters:

$$\frac{(83.4-80.7)}{80.7}\times 100 = \text{Approximately } 3.3\%$$

(4) Energy consumption calculated based on the actual use of gas water heaters used exclusively as space heaters shipped in FY 2002: 13,650 kl

(5) Energy conservation effects of gas water heaters used exclusively as space heaters in 2010:

$$13{,}650\times\frac{(83.4-80.7)}{83.4}\times 3(\text{years}) = 1{,}326\text{kl}$$

■Gas water heaters with dual use as heaters

(1) Energy consumption efficiency calculated based on the actual value for gas water heaters with dual use as heaters shipped in FY 2002: 82.1%

(2) Target standard value for gas water heaters with dual use as heaters to be shipped in the target fiscal year: 83.0%

(3) Improvement rate of the energy consumption efficiency of gas water heaters with dual use as heaters:

$$\frac{(83.0-82.1)}{82.1}\times 100 = \text{Approximately } 1.1\%$$

(4) Energy consumption calculated based on the actual use of gas water heaters with dual use as heaters shipped in FY 2002: 175,243 kl

(5) Energy conservation effects of gas water heaters with dual use as heaters in 2010:

$$175{,}243\times\frac{(83.0-82.1)}{83.0}\times 3(\text{years}) = 5{,}700\text{ kl}$$

Attachment 6

Target Standard Values and Categories of Gas Water Heaters (with Space Heating Functions)

I. Basic Concept

The energy consumption efficiency of gas water heaters is measured in terms of heat efficiency [%] same as other gas water heaters. There are two types of water heating systems: heating with gas burners (direct heating) and liquid-to-liquid heating with heat exchangers (indirect heating). The energy consumption efficiency of gas water heaters is considered for both direct and indirect heating systems.

The energy consumption efficiency of gas water heaters other than those used exclusively as space heaters is defined as a value, which is obtained by integrating, at a certain ratio, energy consumption efficiency measured for individual functions, namely the space heating function and hot water supply function, in a way similar to the approach to bath tub gas water heaters (with hot water supply functions) that have already been included in the scope under the existing regulations. Moreover, the heat efficiency of the bath section is not taken into account because of the following reasons:

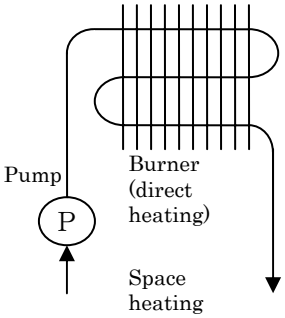
(1) The majority of gas water heaters have structures in which the heat efficiency of the bath section is improved as a consequence of improving the heat efficiency of the hot water supply section, and

(2) The existing measuring method is not applicable to a very special model (a single model manufactured by a single company) that uses the same heat exchanger for the hot water supply section and the bath section for direct heating.

For gas water heaters without space heating functions (gas instant water heaters and bath tub gas water heaters), as manufacturers have been endeavoring to achieve the existing target standard values, these categories and target standard values will remain the same as continued from the current regulations.

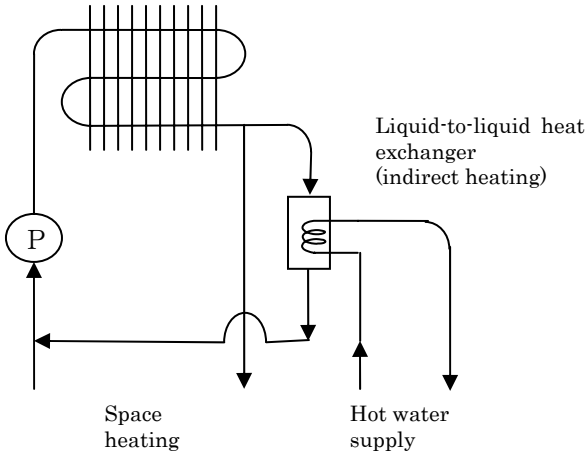
Based on the functions of space heating, hot water supply, and bath sections, gas water heaters can be classified as shown below.

1. Gas water heaters used exclusively as space heaters

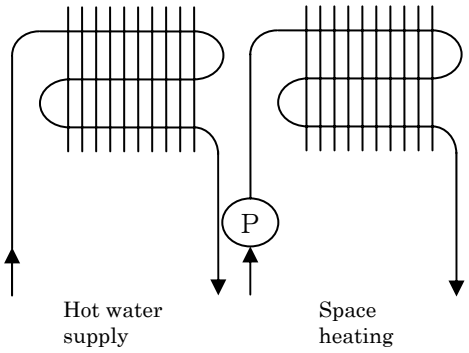


2. Gas water heaters with dual use as heaters

A. One chamber with two flow channels

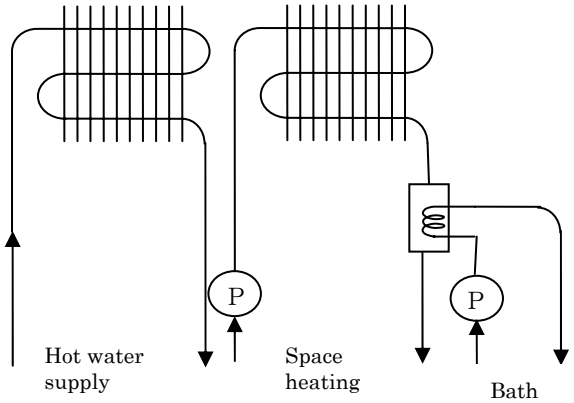


B. Two chambers with two flow channels

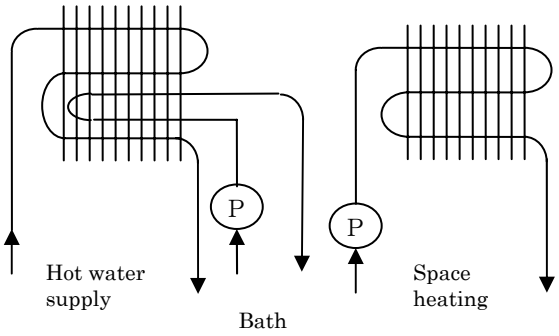


3. Gas water heaters with triple use as heating, hot water supply, and baths

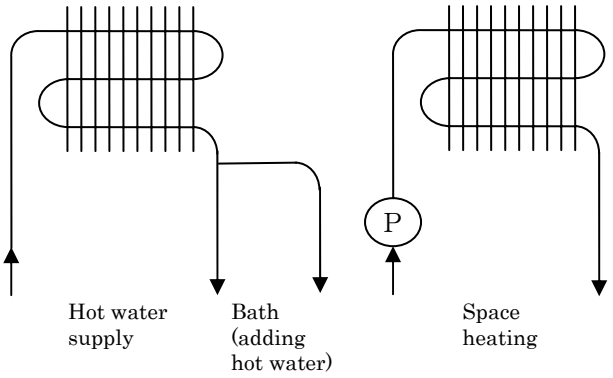
A. Two chambers with three flow channels



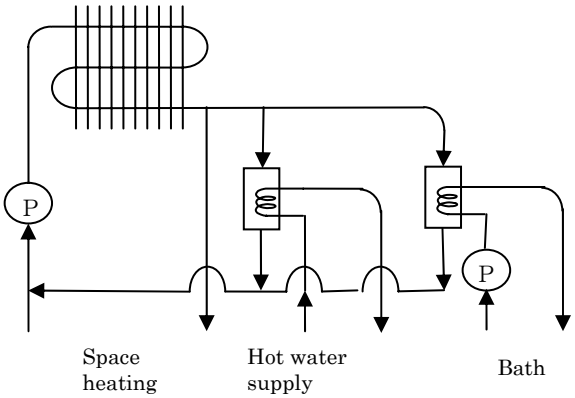
B. Two chambers with three flow channels



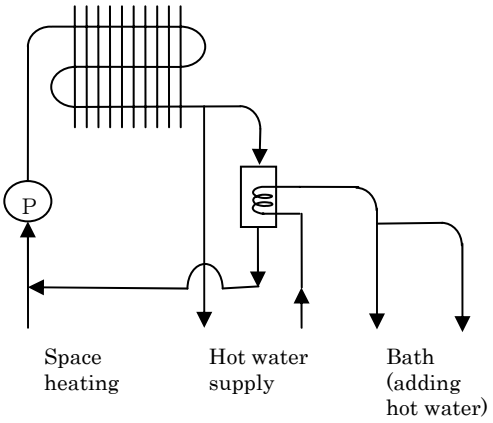
C. Two chambers with two flow channels



D. One chamber with three flow channels



E. One chamber with two flow channels

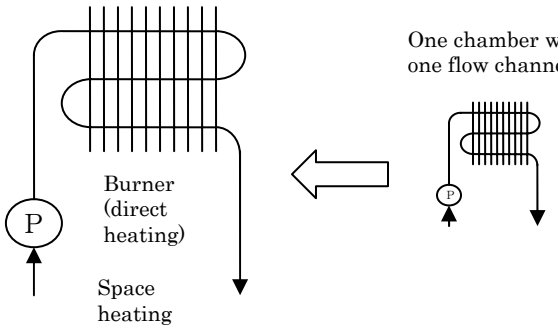


II. Categories for Setting Target Values

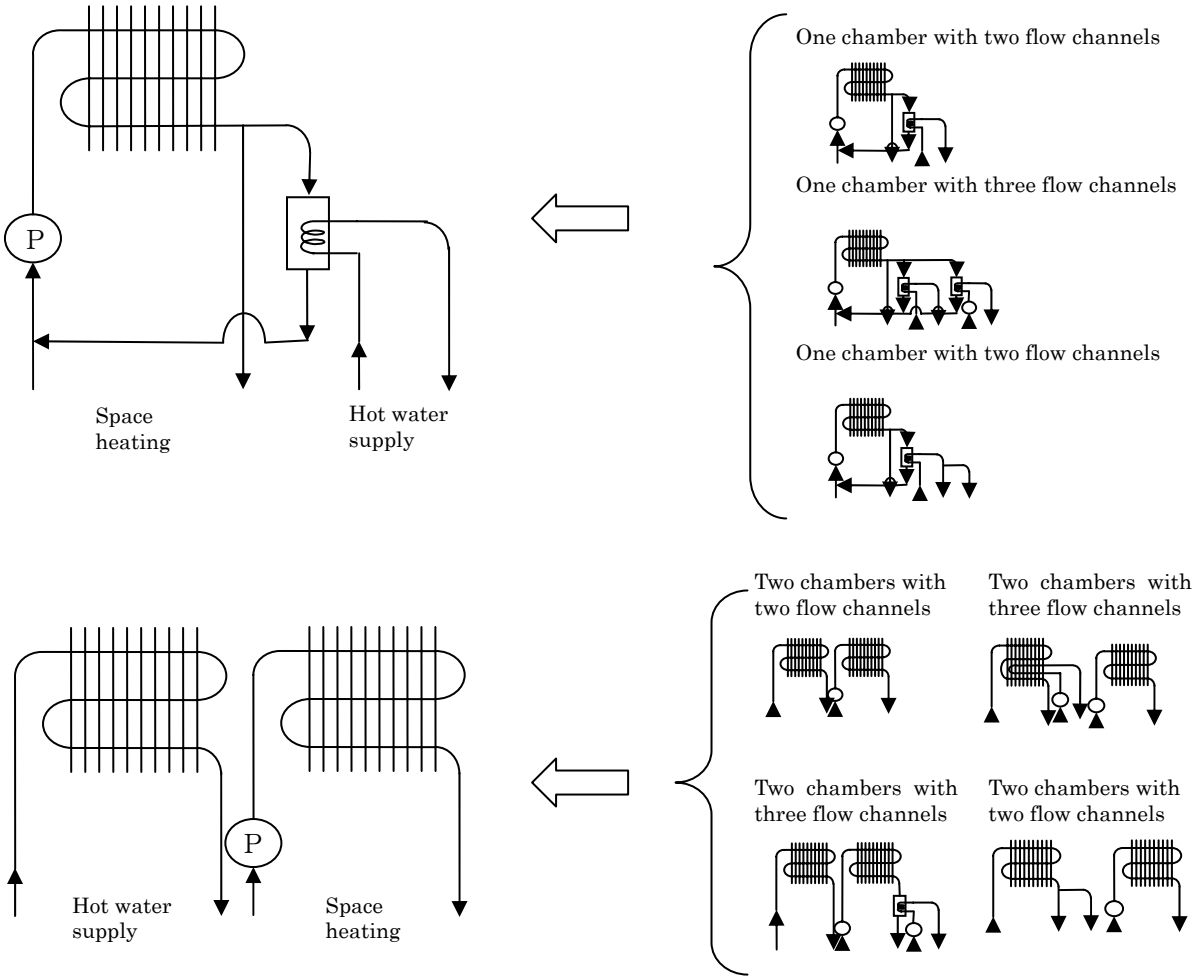
Considering the above classifications provided for in I. and that the heat efficiency of bath sections is not taken into account, categories for setting target standard values for gas water heaters can be integrated into two categories as shown below.

Specifically, they are divided into gas water heaters used exclusively as space heaters (Category A) and gas water heaters with dual use as heaters (Category B).

Category A: Gas water heaters used exclusively as space heaters



Category B: Gas water heaters with dual use as heaters



In view of the above, the basic scheme for categorization will be set as shown in the table below. The number of models falling under each category is also shown below (based on shipments in FY 2002).

Category Name	Gas Water Heater Type	Number of Models
A	Used exclusively as space heaters	19
B	Gas water heaters with dual use as heaters	114

Note 1: Gas water heaters with dual use as heaters include those that are also used for bath tub gas water heaters.

III. Target Standard Value for Each Category

Target standard values will be set for individual functions based on the concept of the Top Runner Program. The specific concept is as shown below.

1. Setting Target Standard Values

No special correlation can be observed between the heat efficiency of the space heating section and the hot water supply section and the indicated gas consumption (see Figure 1). Thus, target standard values (heat efficiency) are indicated in absolute values.

The energy consumption efficiency of gas water heaters with dual use as heaters is subjected to the weighted average of the heat efficiency of the space heating section and the hot water supply section based on the ratio of the average of the indicated gas consumption of the space heating section to that of the hot water supply section in a way similar to the existing approach to the energy consumption efficiency of bath tub gas water heaters (with hot water supply functions). Specifically, from the data collected (by the Japan Industrial Association of Gas and Kerosene Appliances) for this deliberation, the average value of the indicated gas consumption of the space heating section and that of the hot water supply section are 15.3 kW and 45.3 kW, respectively. The resulting ratio is approximately 1 to 3. Incidentally, as a result of calculating annual energy consumption under the average operating conditions of those who own gas water heaters with dual use as heaters based on the questionnaire survey on the actual use of gas water heaters, which was conducted by the Energy Conservation Center, Japan, the annual energy consumption of the space heating section and the hot water supply section is 2,925 kWh/year and 10,123 kWh/year, respectively. The ratio is approximately 1 to 3.5 (see Reference 1). It is therefore considered appropriate to use the ratio of average values for indicated gas consumption so as to ensure consistency with the existing regulations and reflect the actual use. Thus, the energy consumption efficiency of gas water heaters with dual use as heaters shall be the value subjected to

the weighted average using the heat efficiency of the space heating section and the hot water supply section at the ratio of 1 to 3.

In addition, since no remarkable difference can be observed in energy consumption efficiency due to the difference in gas types between city gas and liquefied petroleum gas, no special consideration is given to the difference in gas types in setting target standard values (see Figure 2).

2. Room for Improving Energy Consumption Efficiency with Technological Advancements in the Future

Technological development for improving the energy consumption efficiency of gas water heaters has just begun, although there are variations among manufacturers. In other words, there is still room for improving the efficiency of gas water heaters on the whole. Specifically, the efficiency of gas water heaters can be improved by improving heat exchangers (with improved fins in heat exchange sections), combustion fans (with improved air ratios) and so forth.

In Category B, there are models that collect latent heat. Although there may be a significant difference in energy consumption efficiency between those which collect "sensible heat" and those that collect "latent heat," these will not be separated because latent heat collecting models are considered as being ordinary sensible heat collecting models to which new energy conservation technology has been added. On the other hand, since latent heat collecting models have adopted new energy conservation technology, their prices are considerably higher than those of sensible heat collecting models. If the energy consumption efficiency of latent heat collecting models were to be used as the Top Runner value in setting target standard values, it is highly probable that it would greatly distort the product market because sensible heat collecting models that are widely used presently would not be able to exist in the future. Accordingly, the energy consumption efficiency of latent heat collecting models is excluded as a special product when setting the target standard value for that category. However, the energy consumption efficiency of latent heat collecting models is included in the existing Top Runner values as a factor for raising target standard values because of technological advancements expected in the future. Specifically, energy consumption efficiency is expected to improve, taking into account the ratio of latent heat collecting models to be shipped in the target fiscal year to the total number of models to be shipped in that year.

In view of the above, in determining target standard values, a 0.2% improvement in the energy consumption efficiency of gas water heaters used exclusively as space heaters and a 0.5% improvement in the energy consumption efficiency of gas water heaters with dual use as space heaters (of the improvement, 0.3% is resulted from the

diffusion of the latent heat collecting models) will be added to the current Top Runner values taking into account the future technological advancements

3. Specific Target Standard Values for Individual Categories

(1) Category A

The target standard value for Category A shall be the most effective value in energy consumption efficiency. The above mentioned improved efficiency (0.2%) should be considered for the value (see Figures 4 and 5).

(2) Category B

The target standard value for Category B shall be the most effective value in energy consumption efficiency. The above mentioned improved efficiency (0.5%) should be considered for the value.

As to the Top Runner value for hot water supply sections, manufacturers have been endeavoring to achieve the existing target standard value. Therefore, in setting the Top Runner value, the target standard value (82.0%) for gas water heaters in Category D (gas instant water heaters: forced ventilation type and outdoor type) will be used as the heat efficiency of hot water supply sections, as provided for in the existing regulations (see Figures 6 through 8).

Since no significant difference can be observed in energy consumption efficiency due to the difference between "indoor or direct vent type" and "outdoor type," these types are not divided into individual category (see Figure 9).

As a result of the above, specific categories and target standard values are as shown in the table below.

Category Name	Gas Water Heater Type	Top Runner Value [%]			Improved Efficiency [%]	Target Standard Value [%]
		Space Heating Sections	Hot Water Supply Sections	Total		
A	Used exclusively as space heaters	83.2	-	83.2	0.2	83.4
B	Gas water heaters with dual use as heaters	83.8	82.0	82.5	0.5 (Of the improvement, 0.3 % is resulted from the diffusion of the latent heat collecting models)	83.0

(Reference 1)

Concept behind Integrating the Energy Consumption Efficiency of Gas Water Heaters with Dual Use as Heaters

With regard to gas water heaters with dual use as heaters, it is necessary to evaluate the heat efficiency of each of space heating sections and the hot water supply sections and integrate the results to determine the energy consumption efficiency.

Here, methods are compared and examined in which the weighted average is calculated using annual energy consumption ratios.

1. Energy consumption of the space heating section of a gas water heater with dual use as a heater: 2,925 [kWh/year]

The energy consumption of the space heating section is calculated by adding up each of the annual energy consumption for each function mainly used, namely floor heating, fan coil, panel heater, and bathroom heating.

○ Floor heating: 230 [kcal/mat] x 11.2 [mats] x 0.8 (overlay rate) x 0.6 (operation rate) x 7.1 [h/day] x 194.5 [days/year] x 54.5/100 (use rate) / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Fan coil: 2.9/6 [kW/mat] x 5.7 [h/day] x 9.8 [mats] x 0.6 (operation rate) x 194.5 [days/year] x 14.3/100 (use rate) / 0.8 (heat efficiency)

○ Panel heater: 2.9/6 [kW/mat] x 6.0 [h/day] x 6.4 [mats] x 0.6 (operation rate) x 194.5 [days/year] x 5.2/100 (use rate) / 0.8 (heat efficiency)

○ Bathroom heating: 3.5 [kW] x 2.6 [h/day] x 0.6 (operation rate) x 194.5 [days/year] x 65.4/100 (use rate) / 0.8 (heat efficiency)

2. Energy consumption of the hot water supply section of a gas water heater with dual use as a heater: 10,123 [kWh/year]

The energy consumption of the hot water supply section is divided into its mainly used functions, namely kitchen, washbasin, shower, and bath. Since the actual use varies depending on the season, annual energy consumption is obtained by adding up the energy consumption calculated for spring, summer, fall, and winter.

○ Kitchen (spring and fall): (38-15) [°C] x 5 [L/min] x 65.5 [min/day] x 170 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Kitchen (winter): (38-8) [°C] x 5 [L/min] x 65.5 [min/day] x 84.2 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Wash-basin (spring and fall): (38-15) [°C] x 5 [L/min] x 41.5 [min/day] x 139.8

[days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Wash-basin (winter): (38-8) [°C] x 5 [L/min] x 41.5 [min/day] x 90 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Shower (spring and fall): (42-15) [°C] x 10 [L/min] x 25.7 [min/day] x 163.5 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Shower (summer): (42-20) [°C] x 10 [L/min] x 25.7 [min/day] x 81 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Shower (winter): (42-8) [°C] x 10 [L/min] x 25.7 [min/day] x 81 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Bath (spring and fall): (42-15) [°C] x 180 [L] x 5.3/7 [times/day] x 180 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Bath (summer): (42-20) [°C] x 180 [L] x 4.3/7 [times/day] x 90 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

○ Bath (winter): (42-8) [°C] x 180 [L] x 5.7/7 [times/day] x 90 [days/year] / 860 (calorific value conversion factor) / 0.8 (heat efficiency)

3. Integration Ratio

Based on the above, the integration ratio of the space heating section and the hot water supply section is shown as below.

Space heating section: hot water supply section = 2,925 : 10,123 ≒ 1 : 3.5

(Reference 2)

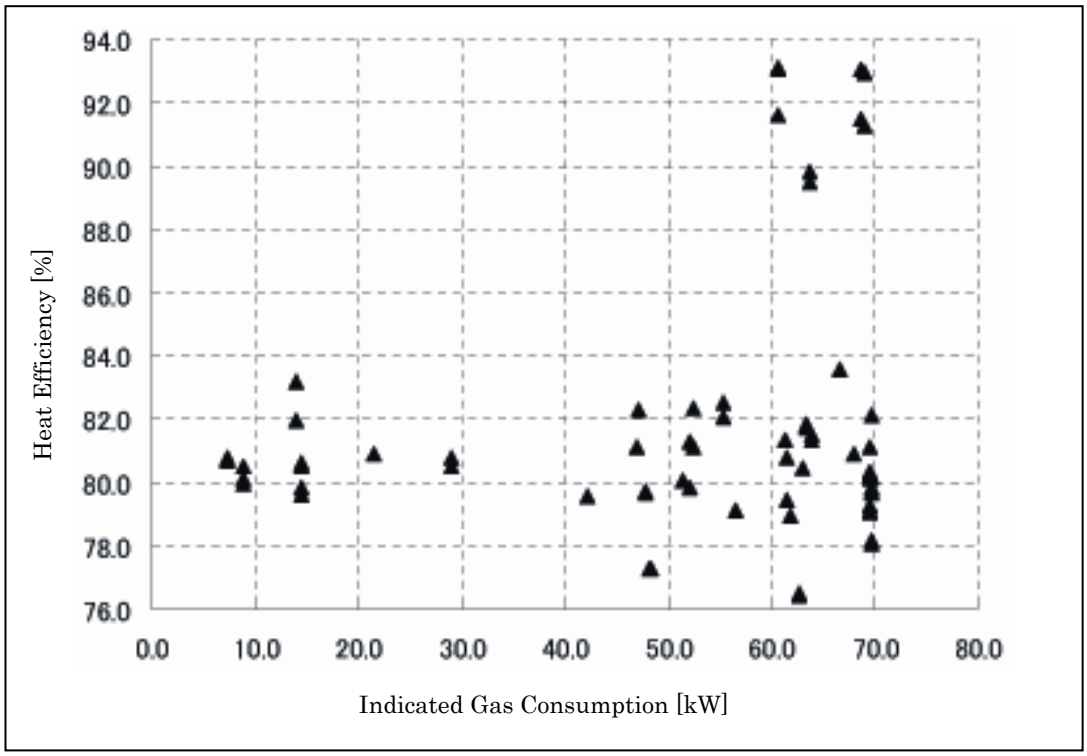


Figure 1: Heat Efficiency Distribution Map

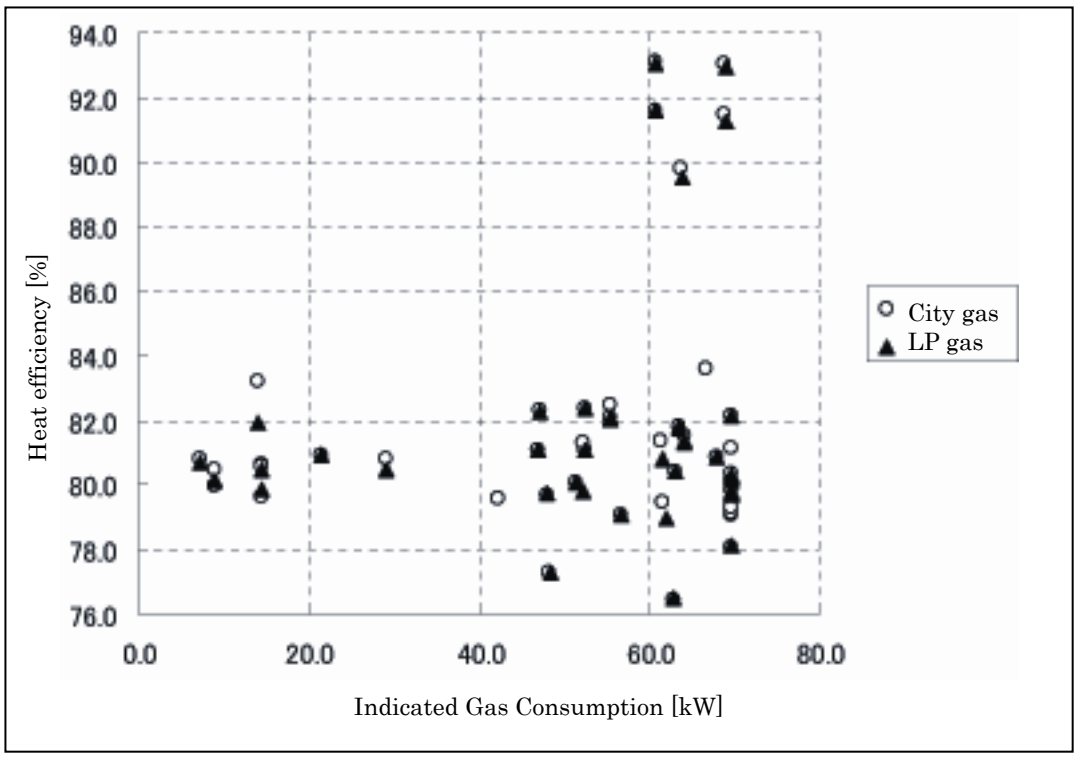


Figure 2: Distribution Map by Gas Type

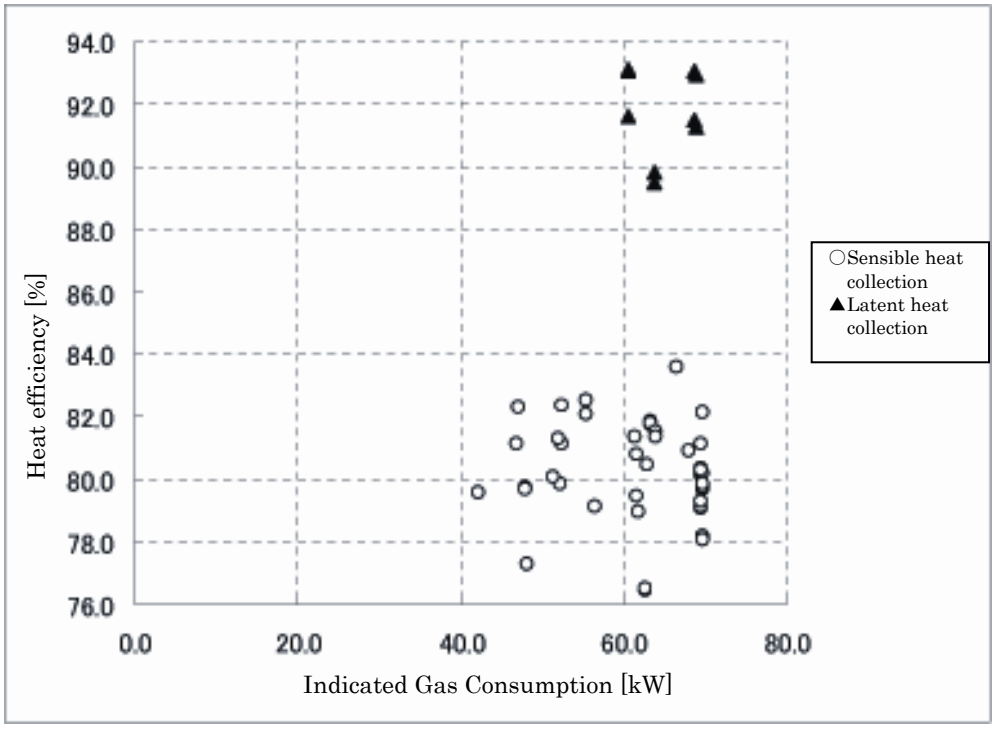


Figure 3: Distribution Map by Collection Type in Category B

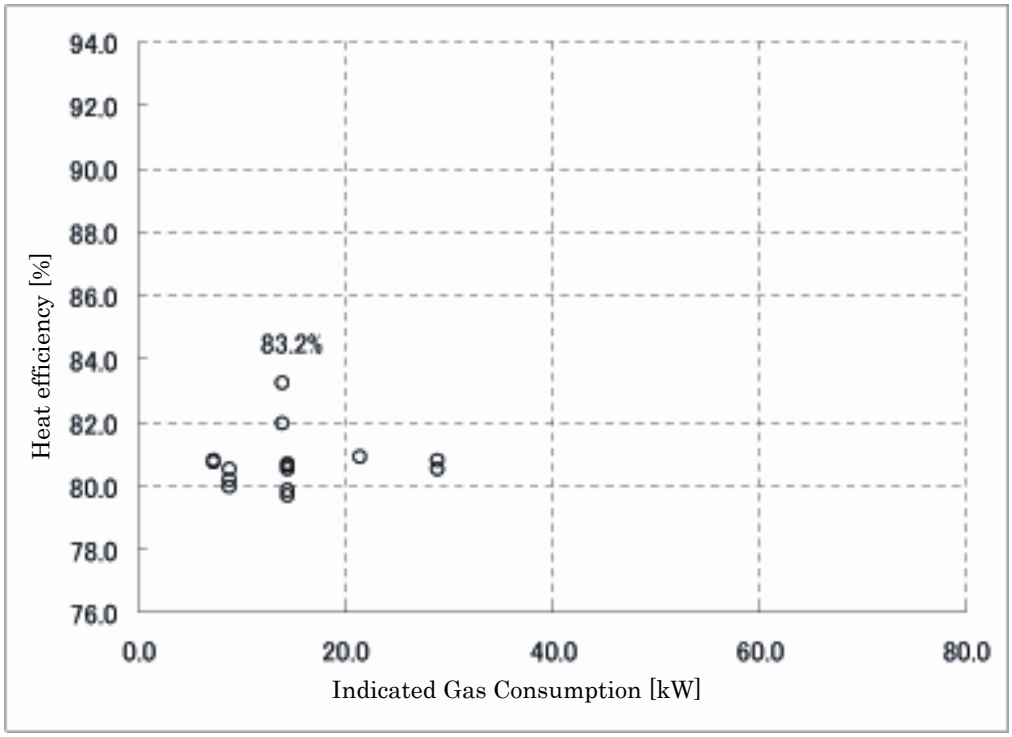


Figure 4: Heat efficiency in Category A

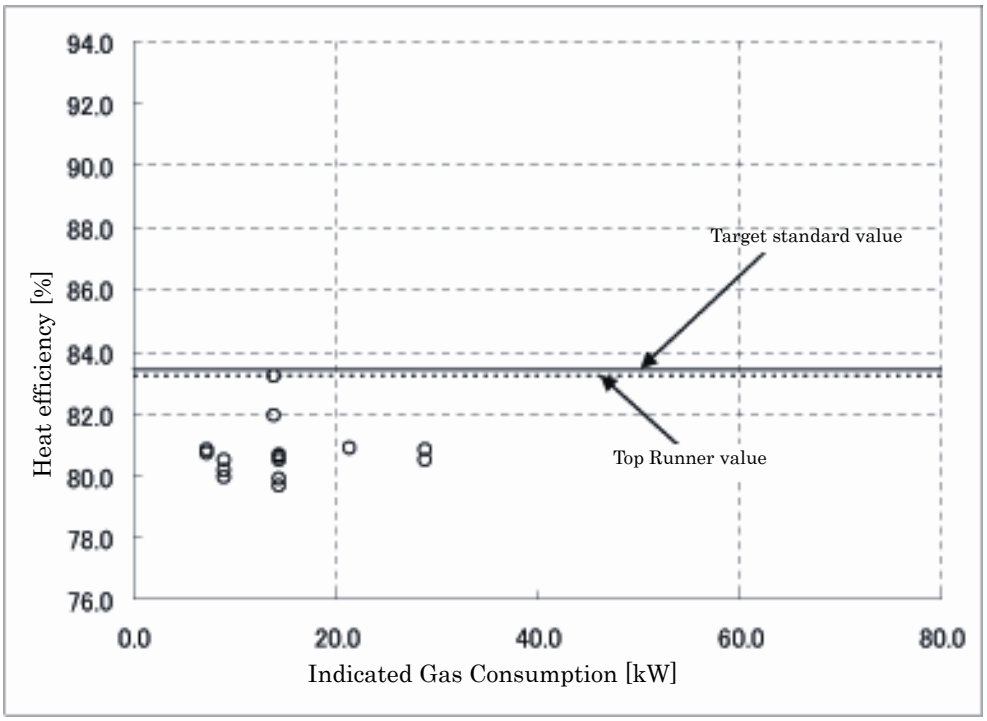


Figure 5: Target Standard Value for Category A

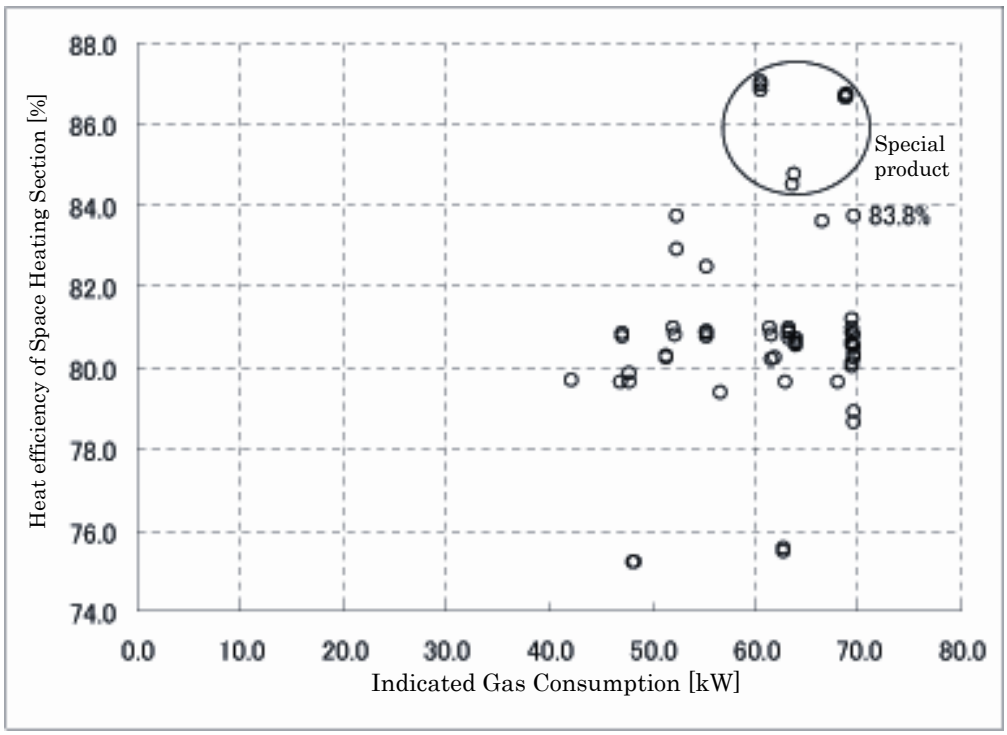


Figure 6: Heat Efficiency of Space Heating Section in Category B

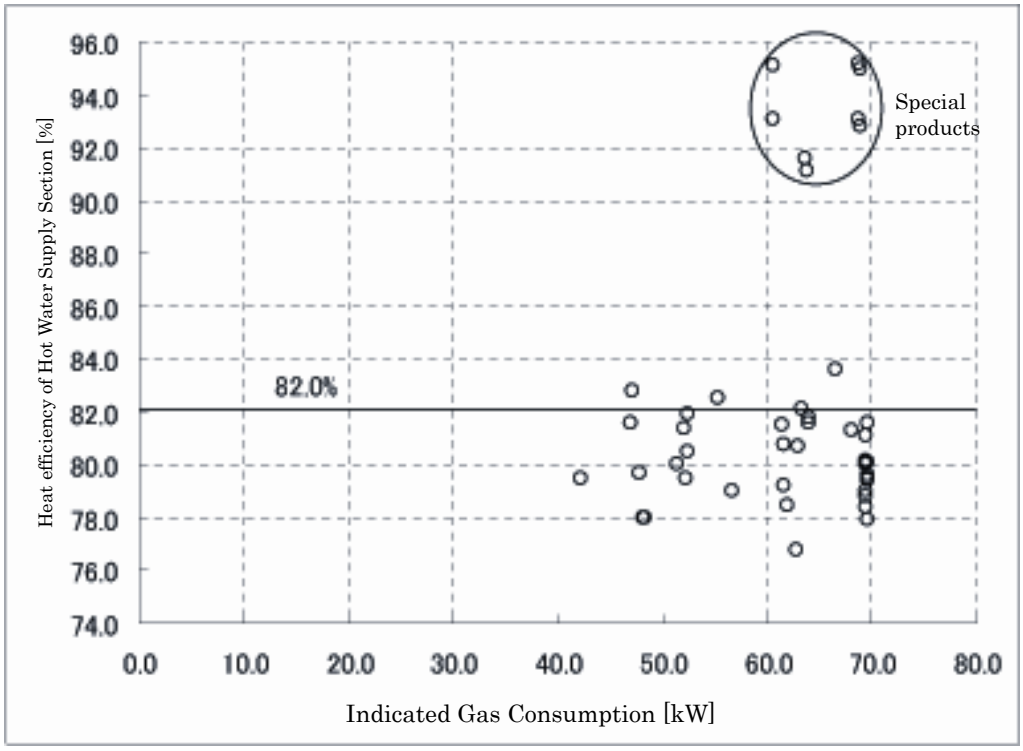


Figure 7: Heat Efficiency of Hot Water Supply Section in Category B

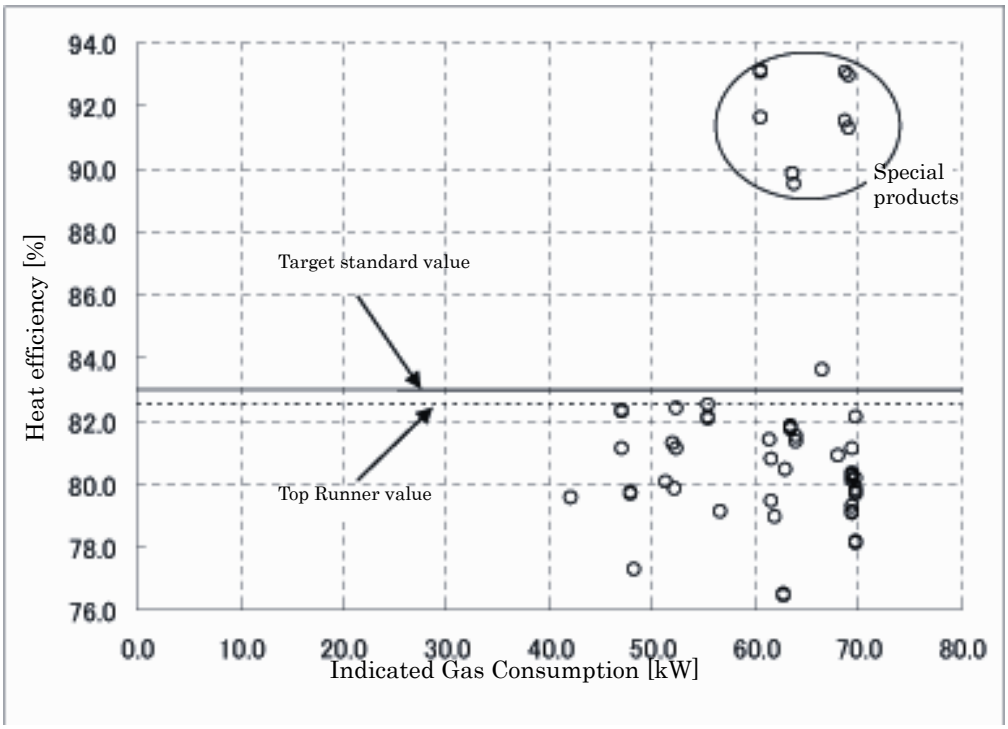


Figure 8: Target Standard Value for Category B

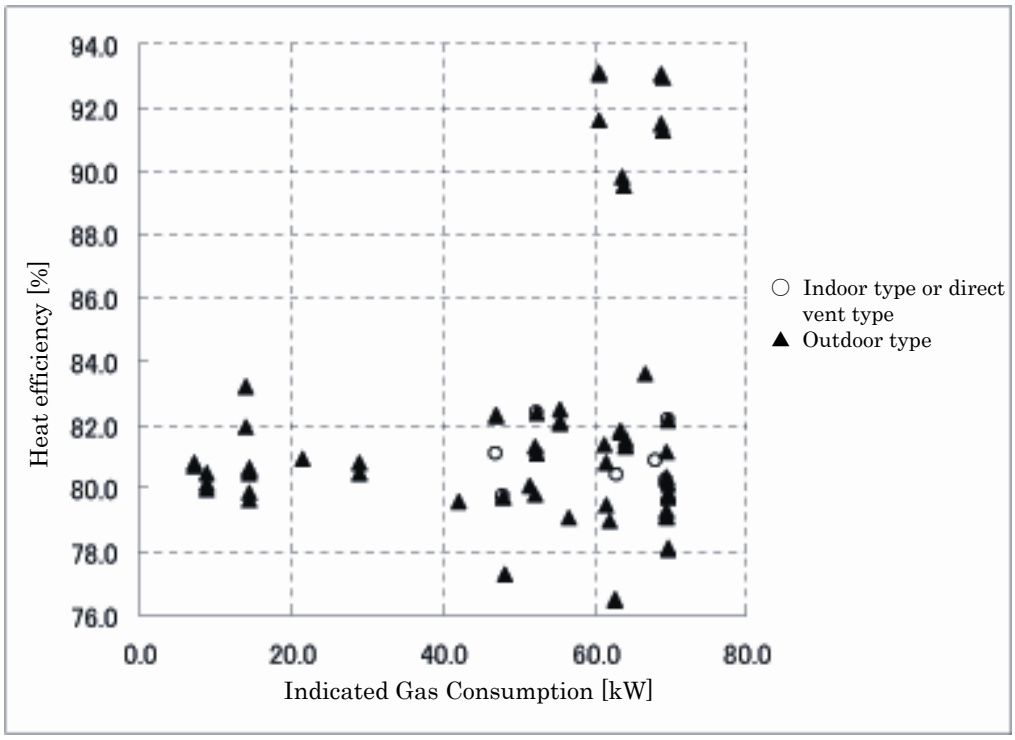


Figure 9: Distribution Map by Installation Type

Attachment 7

Energy Consumption Efficiency of Gas Water Heaters and the Measuring Method

I. Basic Concept

The energy consumption efficiency of the space heating section of gas water heaters is expressed in terms of heat efficiency [%] measured according to the method described in II below, which has been drafted based on "3.13 Heat Efficiency Testing of Space Heating Performance" of JIA C005-99 (Rules for Inspecting Gas Heaters for Space Heating" developed by the Japan Gas Appliances Inspection Association, since no measuring methods have been established by JIS.

The energy consumption efficiency of the hot water supply section is expressed in terms of heat efficiency [%] measured by the heat efficiency testing of instant water heaters as specified in "6. Test Methods" of JIS S2109, the same is applied to the existing gas instant water heaters.

In addition, the energy consumption efficiency of gas water heaters with dual use as heaters shall be the value subjected to the weighted average using the heat efficiency of the space heating section and hot water supply sections at the ratio of 1 to 3.

II. Specific Measuring Method

The energy consumption efficiency of the space heating section of gas water heaters shall be the heat efficiency [%] measured as described below:

(1) Keep the temperature and humidity of the test room at 20±5°C and 65±20%, respectively. Measure the internal atmospheric conditions and temperature of the test room in accordance with "2.1 Test Room Conditions" of JIS S2093 (Test Methods for Home-Use Gas Combustion Appliances).

(2) Connect the appliance as shown in Figure 1. The appliance shall be installed as specified by the manufacturer thereof (as specified in the user manual, etc.) except when test results are not affected by installation status.

(3) The length of the air supply and exhaust tubes of an indoor type gas water heater other than outdoor types shall be the shortest length specified in the user manual.

(4) The hot water circulation channel connecting the appliance with the heat exchanger and the circulation flow control valve shall be insulated with heat insulating materials (heat insulators).

(5) The points for measuring the temperature of return and forward circulating hot

water for space heating shall be set near the return and forward openings of the appliance. The points for measuring the temperature of cooling water at the inlet and outlet of the heat exchanger shall be set near the inlet and outlet of the heat exchanger.

(6) Use a plate heat exchanger suitable for the rated output. Insulate it with heat insulating materials (heat insulators) as appropriate.

(7) Measure gas consumption under the conditions specified in (1) Conditions of Appliances and (2) Test Conditions of 1. Measuring Gas Consumption of "Table 5: Gas Consumption Testing" of "6. Gas Consumption Testing" of JIS S2093.

(8) Operate the pump at its maximum capacity.

(9) Set the temperature of the forward circulating hot water for space heating to 80±3°C (Th_1) and control the flow of circulating hot water (V_1) and the flow of cooling water (V_2), so that the difference (Th_1-Th_2) in the temperature of the return circulating hot water (Th_2) and the temperature of the forward circulating hot water will come between 20K and 30K. Start measuring after the difference in the temperature of the return circulating hot water and the temperature of the forward circulating hot water is stabilized. Let the hot water run until the gas meter revolves more than once in whole numbers. The heat efficiency calculated according to the following formula shall be defined as the "high hot water circulation heat efficiency." Next, set the temperature of the forward circulating hot water to 60±3°C and take measurements in a similar way as described above. The calculated heat efficiency shall be defined as the "low hot water circulation heat efficiency."

$$\eta = \frac{G_h \cdot C_p (Th_3 - Th_4)}{V \cdot Q} \times \frac{101.3(273 + t_g)}{(B + P_m - S) \cdot 273} \times 100$$

where η : Heat efficiency [%]

G_h: Volume of cooling water [kg]

C_p: Average specific heat of water ([kJ/ (kg-K)] = 4.19)

Th_3: Cooling water outlet temperature [°C]

Th_4: Cooling water inlet temperature [°C]

V: Actually measured gas consumption [m^3]

Q: Total calorific value of gas [$kJ/m^3{}_N$]

t_g: Gas temperature in the gas meter at the time of measurement [°C]

B: Atmospheric pressure at the time of measurement [kPa]

P_m: Gas pressure in the gas meter at the time of measurement [kPa]

S: Saturated vapor pressure at temperature t_g [°C] [kPa]

(10) For an appliance using two kinds of circulating water, i.e. high-temperature circulating water (for indoor space heating) and low-temperature circulating water (for floor heating), the value resulting from simply averaging [1] the values representing high and low hot water circulation shall be the heat efficiency of that gas water heater (space heating section). For an appliance using either high or low-temperature circulating water only, its high or low-water circulation heat efficiency shall be the heat efficiency of that gas water heater (space heating section).

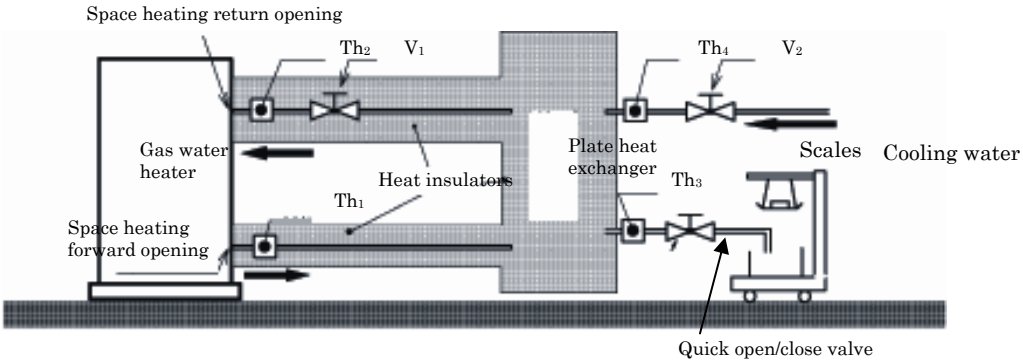


Figure 1: Heat Efficiency Test Device (Example)

[1] The simple average is used because high and low-temperature circulating water is actually used in the ratio of approximately one to one.

Attachment 8

Progress of Meetings of the Subcommittee on Gas and Oil Powered Equipment Judgement Criteria, Energy Efficiency Standards Subcommittee, Advisory Committee for Natural Resources and Energy

1st Subcommittee Meeting (June 11, 2003)

- Regarding the disclosure of the Subcommittee on Gas and Oil Powered Equipment Judgement Criteria
- Regarding the results of examining the measuring method for the energy consumption efficiency of gas and oil powered equipment
- Regarding the examination to additionally include items to the Top Runner Program

2nd Subcommittee Meeting (October 7, 2003)

- Regarding the applicable scope of gas powered equipment (expanded scope)
- Regarding energy consumption efficiency and the measuring method.
- Regarding the integration with the current targeted appliances standards
- Regarding the concept behind setting target standard values
- Regarding the additional inclusion of gas water heaters (with space heating functions)
-Regarding the efforts (scheme) for reducing the power consumption of gas and oil powered equipment.

3rd Subcommittee Meeting (November 27, 2003)

- Regarding the applicable scope of gas cooking appliances (expanded scope)
- Regarding the categories and target standard values for gas cooking appliances
- Regarding the measuring methods for gas water heaters (with space heating functions)

4th Subcommittee Meeting (January 29, 2004)

- Regarding setting target standard values for gas cooking appliances (composite appliances)
- Regarding the summary of the judgement criteria for gas cooking appliances
- Regarding the categories and target standard values for gas water heaters (with space heating functions)
- Regarding the efforts (scheme) for reducing the power consumption of gas and oil powered equipment

5th Subcommittee Meeting (February 27, 2004)

- Regarding the target standard values and target fiscal years for gas water heaters (with space heating functions)
- Regarding the interim report

6th Subcommittee Meeting (March 31, 2004)
- Comment on the interim report; and regarding the final report

Attachment 9

List of Members of the Subcommittee on Gas and Oil Powered Equipment Judgement Criteria, Energy Efficiency Standards Subcommittee, Advisory Committee for Natural Resources and Energy

Chairperson	Kenichi Aika	Professor, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology
	Yoshihiko Adachi	Chairman, Engineering Committee, Oil Powered Equipment Section, Japan Industrial Association of Gas and Kerosene Appliances
	Toshihisa Ueda	Professor, Mechanical Engineering Department of Science and Technology, Keio University
	Shoichiro Ozeki	General Manager, Energy Environment Technology Division, Energy Conservation Center, Japan
	Hideo Kajimura	President, Japan Machinery Importers' Association (1st meeting)
	→Hiroshi Sunohara	President, Japan Machinery Importers' Association (2nd meeting and thereafter)
	Akihito Kanei	Manager, Education Planning Room, Japan Consumers' Association
	Michikata Kawano	Professor, Graduate School of Frontier Sciences, The University of Tokyo
	Junichi Sato	Director, Combustion Society of Japan General Manager, Business Planning Department, Ishikawajima-Harima Heavy Industries Co., Ltd.
	Tsunenori Tokumoto	Member, Technology Development Committee, Japan Gas Association
	Jun Hama	Superintendent, Department of Energy Utilization, National Institute of Advanced Industrial Science and Technology
	Junichi Maeda	Chairperson, Engineering Committee, Gas Powered Equipment Section, Japan Industrial Association of Gas and Kerosene Appliances
	Mitsuyo Mimura	Auditor, Nippon Association of Consumer Specialists
	Chiharu Murakoshi	Director and Chief of Research Room, Jukankyo Research Institute, Inc.

Reference Material 1

Activities to Reduce the Power Consumption of Gas and Oil Powered Equipment

February 27, 2004

Japan Industrial Association of Gas and Kerosene Appliances

1. Standby Power Consumption

We hereby report our activities that we will engage in to reduce the standby power consumption as described below.

We have placed a high degree of significance on and therefore have been endeavoring to achieve the reduction of the standby power consumption regardless of whether or not designated as the specific equipment under the Energy Conservation Law. This reduction has already achieved to a certain degree for some gas and oil powered equipment.

Under the above circumstances, we will further promote the reduction considering the diversity of users and giving the safety the highest priority.

The electric power for sensors listed below is required to ensure the safety while taking into account the diversity.

A. For safety monitoring and control functions:
   Water level sensors, temperature fuses, water flow switch sensors, gas valve sensors, power leakage sensors, freeze prevention sensors, pressure sensors, oil level sensors, CO sensors, etc.
B. To function as power supply for monitoring and control functions:
   Microcomputer power circuits, power supply transformer circuits, etc.
C. To retain communication functions:
   Standby for ON signals from remote controllers, etc.

(1) Target Products

We will make an effort to reduce the standby power consumption targeted for the major home-use gas and oil powered equipment that our industry association covers as follows.

(2) Target Values

A. Space heaters (Gas and Oil)
   a) Fan heater: 1W or less
   b) Direct vent (FF) type and vented type: 3W or less
B. Water Heaters (Gas and oil)

a) Main unit: 2W or less

b) Main unit + 1 remote controller: 3W or less

c) Main unit + 2 remote controllers: 4W or less

d) Main unit + 3 remote controllers: 5W or less

The power for remote controllers is supplied from the main unit.

The standby power consumption for the evaporation section of oil water heaters is required for the equipment to ensure its convenience and the improvement of its performance. Therefore, the standby power consumption is excluded from the scope of the above-mentioned target values. We will make an effort to reduce the power consumption of evaporators by a means such as introducing energy conservation modes.

C. Gas cooking appliances: 1W or less

(3) Target Fiscal Year: End of FY 2008

2. Total Energy Consumption

Regarding the reduction of the power consumption of and appliance during operation, the "Final Report*" dated April 3, 2002 states that "calculating the percentage of the power consumption in the total energy consumption of gas and oil powered equipment resulted in approximately 1%, which is within the range that constitutes no obstacles in comparing energy consumption efficiency."

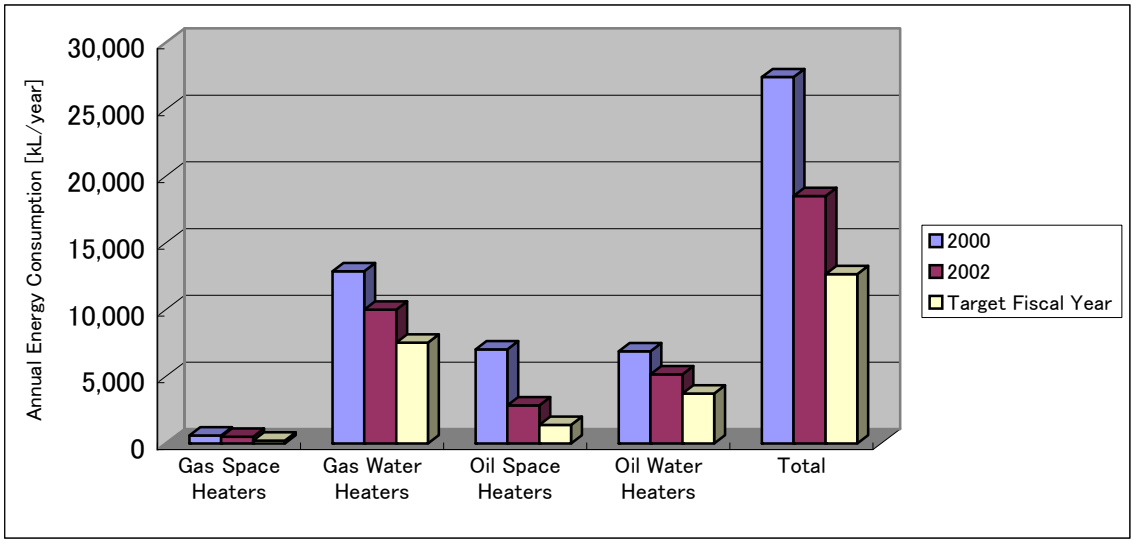
However, to achieve the reduction of the total energy consumption of the appliance is still required. As the criteria defined for the actual use of the equipment have not been developed yet, we should examine the actual use modes and make an effort to achieve the reduction of the energy consumption.

*Note: See I-63 of the Final Report (April 3, 2002) by the Subcommittee on Gas and Oil Powered Equipment Judgement Criteria, Energy Efficiency Standards, Advisory Committee for Resources and Energy

Appendix

Simulation of Reducing Standby Power Consumption

	2000	2002	(Reduction Rate from 2000)	Target Fiscal Year (FY 2008)	(Reduction Amount from 2002)	(Reduction Rate from 2002)
Gas Space Heaters	591	496	(16.1)	211	284	(57.4)
Gas Water Heaters	12,893	10,016	(22.3)	7,547	2,469	(24.7)
Oil Space Heaters	7,044	2,849	(59.6)	1,384	1,464	(51.4)
Oil Water Heaters	6,904	5,170	(25.1)	3,736	1,434	(27.7)
Total	27,431	18,531	(32.4)	12,679	5,652	(30.5)



* The calculation method of crude oil volume for this document: To multiply the per-appliance standby power consumption by the standby period, the number of the units shipped (on the basis of Year 2000), and the crude oil conversion factor.

* [Formula for calculating standby power consumption for each category in terms of crude oil volume]

The standby power consumption in terms of crude oil volume [kL/year] = average standby power consumption [W/appliance] * (365*24-annual operating hours) [h/year] * (1/1000) [kW/W]*the number of appliances shipped in FY 2000* crude oil conversion factor (0.0930×10^{-3}) [kL/kWh]

* The number of appliances shipped: Based on the data (on the basis of Year 2000) available from the subcommittee on gas and oil powered equipment judgement criteria in FY 2001.

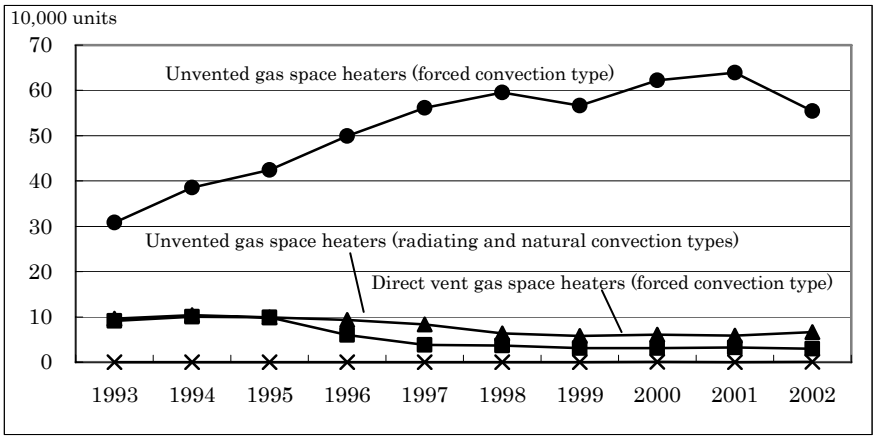
- Values for Year 2000: Calculated based on the 2000 data of the standby power consumption survey conducted (by the Energy Conservation Center, Japan) in FY 2000
- Values for Year 2002: Calculated based on the data available from the study meeting on energy consumption efficiency measuring methods organized (by the Energy Conservation Center, Japan) in FY 2002
- Values for the Target Fiscal Year: Calculated by multiplying the target values proposed here for individual appliances by the number of such appliances shipped in Year 2000.

Reference Material 2

Current Status of Domestic Shipment and Energy Consumption

1. Gas Space Heaters

(1) Changes in the Number of Gas Space Heaters Shipped



(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances

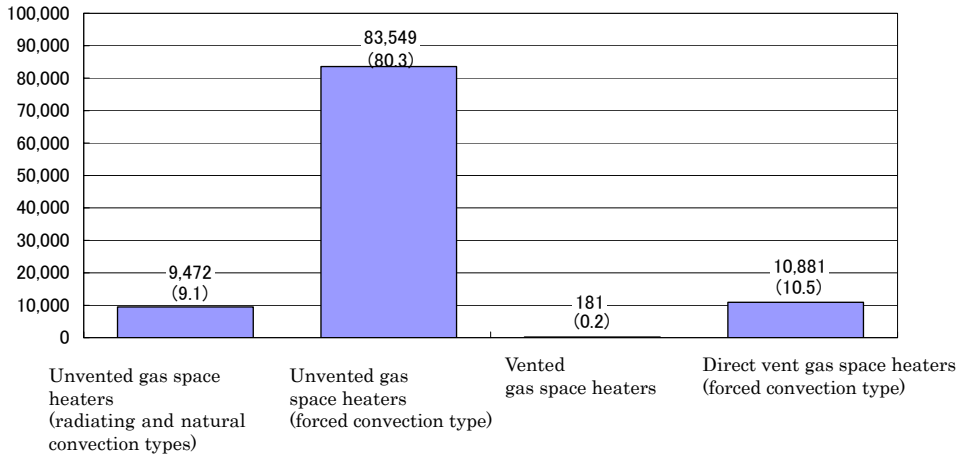
	1993 (H.5)	1994 (H.6)	1995 (H.7)	1996 (H.8)	1997 (H.9)	1998 (H.10)	1999 (H.11)	2000 (H.12)	2001 (H.13)	2002 (H.14)
Gas Space Heaters	496,156	589,490	622,497	652,053	682,462	696,252	655,787	715,275	730,513	650,683
Unvented gas space heaters (radiating type) / Unvented gas space heaters (natural convection type)	96,351	103,814	99,269	93,166	83,107	63,886	57,737	60,887	58,599	66,159
Unvented gas space heaters (forced convection type)	308,539	385,076	424,155	499,075	561,115	595,580	566,367	622,542	639,063	554,150
Vented gas space heaters	-	-	-	-	-	126	303	532	187	504
Direct vent gas space heaters (forced convection type)	91,266	100,600	99,073	59,812	38,240	36,660	31,380	31,314	32,664	29,870

(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances

(Note) Since no statistics are available on vented gas space heaters because only a small number of such space heaters have been shipped, the above values are based on the information from manufacturers.

(2) Energy Consumption (Based on Shipments in FY 2002)

In terms of crude oil (kL)



Unvented gas space heaters (radiating and natural convection types)

Unvented gas space heaters (forced convection type)

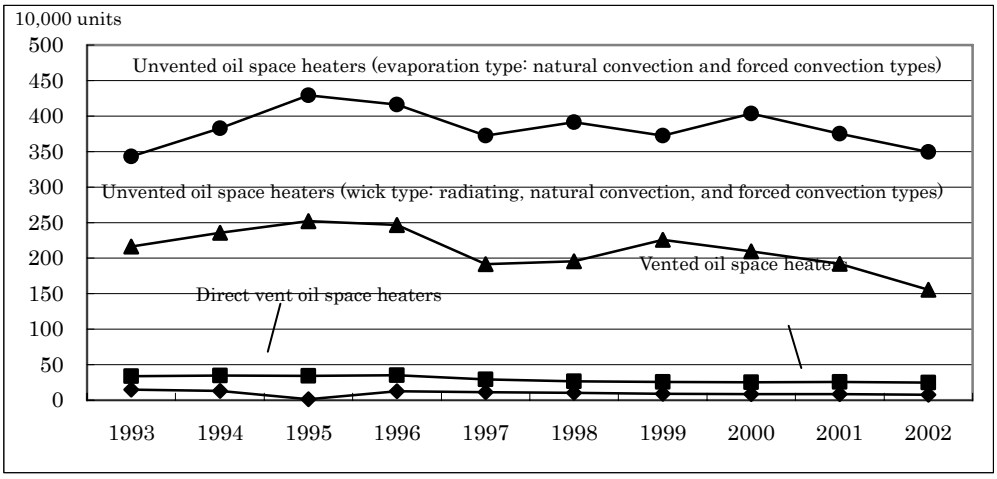
Vented gas space heaters

Direct vent gas space heaters (forced convection type)

(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances
(Note) Values in parentheses represent the percentage among the total (%).

2. Oil Space Heaters

(1) Changes in the Number of Oil Space Heaters Shipped

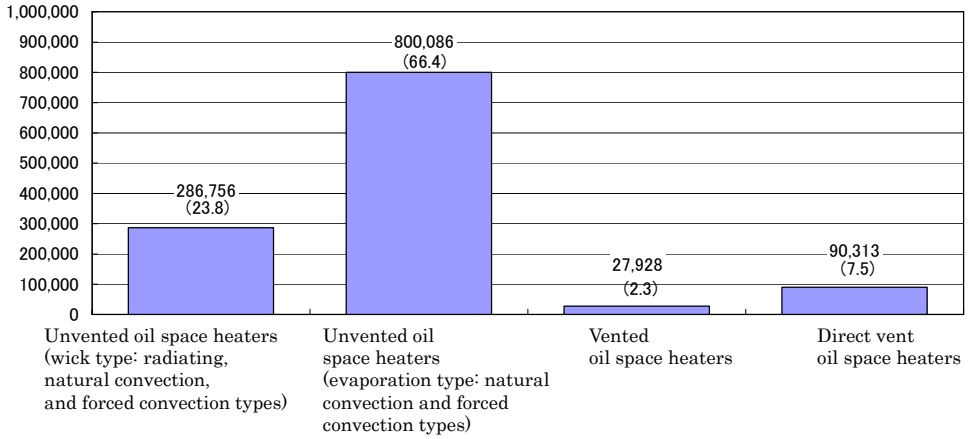


	1993 (H.5)	1994 (H.6)	1995 (H.7)	1996 (H.8)	1997 (H.9)	1998 (H.10)	1999 (H.11)	2000 (H.12)	2001 (H.13)	2002 (H.14)
Oil space heaters	6,081,911	6,665,758	7,279,952	7,107,024	6,042,563	6,236,088	6,329,474	6,473,044	6,016,075	5,376,058
Unvented oil space heaters (wick type: radiating, natural convection, and forced convection types)	2,162,710	2,357,786	2,520,269	2,467,301	1,914,190	1,956,208	2,256,579	2,097,750	1,922,177	1,557,630
Unvented oil spaces heaters(evaporation type: natural convection and forced convection types)	3,431,063	3,827,761	4,291,918	4,162,794	3,723,480	3,912,022	3,725,565	4,035,466	3,752,431	3,492,820
Vented oil space heaters	150,425	131,252	12,575	126,742	113,785	103,803	91,198	85,540	84,280	77,000
Direct vent oil space heaters	337,713	348,959	342,959	350,187	291,108	264,055	256,132	254,288	257,187	248,608

(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances

(2) Energy Consumption (Based on Shipments in FY 2002)

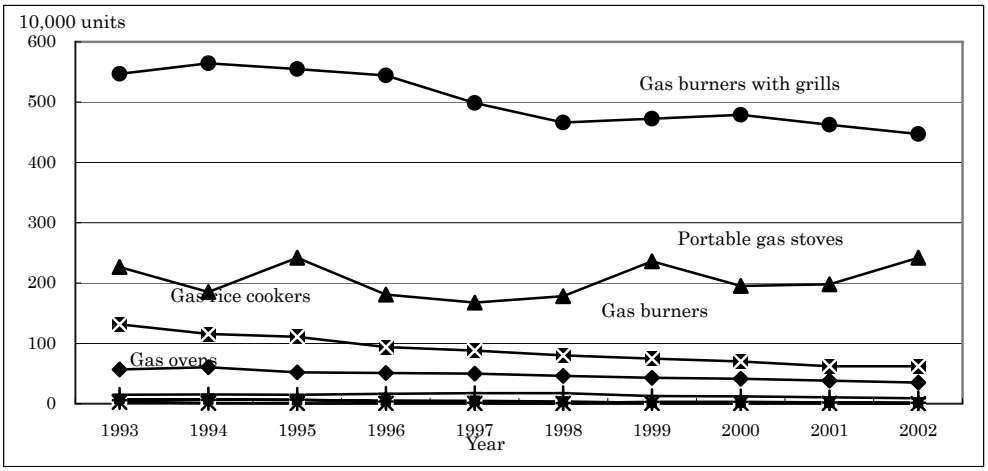
In terms of crude oil (kL)



(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances
(Note) Values in parentheses represent the percentage among the total (%)

3. Gas Cooking Appliances

(1) Changes in the Number of Gas Cooking Appliances Shipped

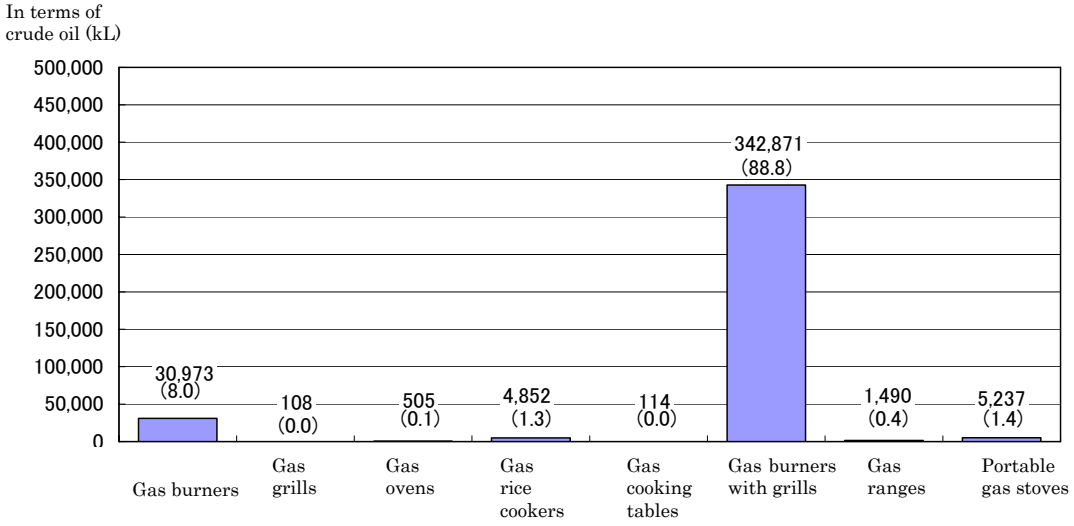


(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances

	1993 (H.5)	1994 (H.6)	1995 (H.7)	1996 (H.8)	1997 (H.9)	1998 (H.10)	1999 (H.11)	2000 (H.12)	2001 (H.13)	2002 (H.14)
Gas cooking appliances	9,929,084	9,556,534	9,878,798	8,965,137	8,295,636	7,942,905	8,452,182	8,033,290	7,753,298	7,986,950
Gas burners	1,316,407	1,154,948	1,107,765	940,736	881,354	803,999	750,594	698,665	622,046	619,800
Gas grills	74,427	66,560	59,142	53,786	46,197	38,756	17,421	14,984	13,509	9,513
Gas ovens	150,092	155,520	149,666	166,846	177,461	174,569	125,624	121,858	106,194	90,453
Gas rice cookers	570,449	604,437	518,033	509,757	500,227	461,475	429,745	413,349	381,157	351,983
Gas cooking tables	24,307	8,072	7,952	6,607	6,267	4,878	6,893	4,451	3,870	2,602
Gas burners with grill	5,470,748	5,645,463	5,546,447	5,443,981	4,986,307	4,663,823	4,728,255	4,790,998	4,624,343	4,471,710
Gas ranges	56,011	65,934	66,481	35,300	17,715	11,580	32,137	32,518	23,715	17,982
Portable gas stoves	2,266,643	1,855,600	2,423,312	1,808,124	1,680,108	1,783,825	2,361,513	1,956,467	1,978,464	2,422,907

(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances

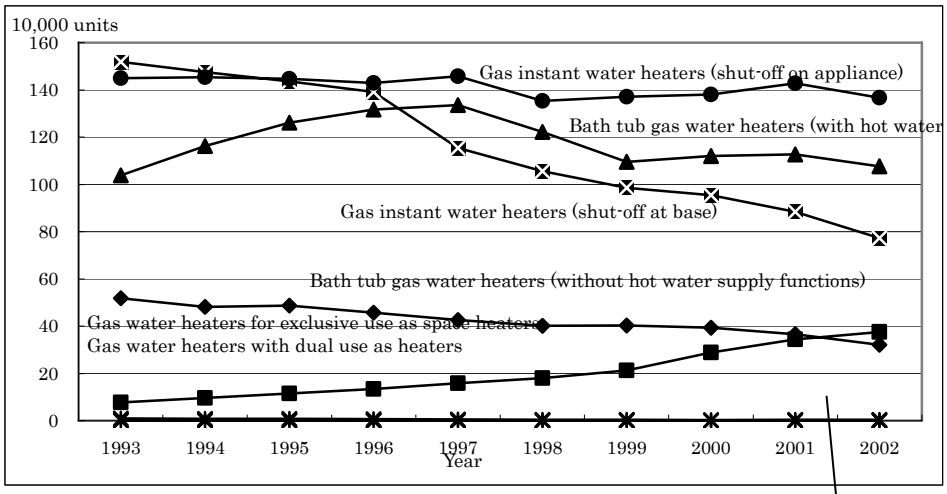
(2) Energy Consumption (Based on Shipments in FY 2002)



Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances
(Note) Values in parentheses represent the percentage among the total (%).

4. Gas Water Heaters

(1) Changes in the Number of Gas Water Heaters Shipped



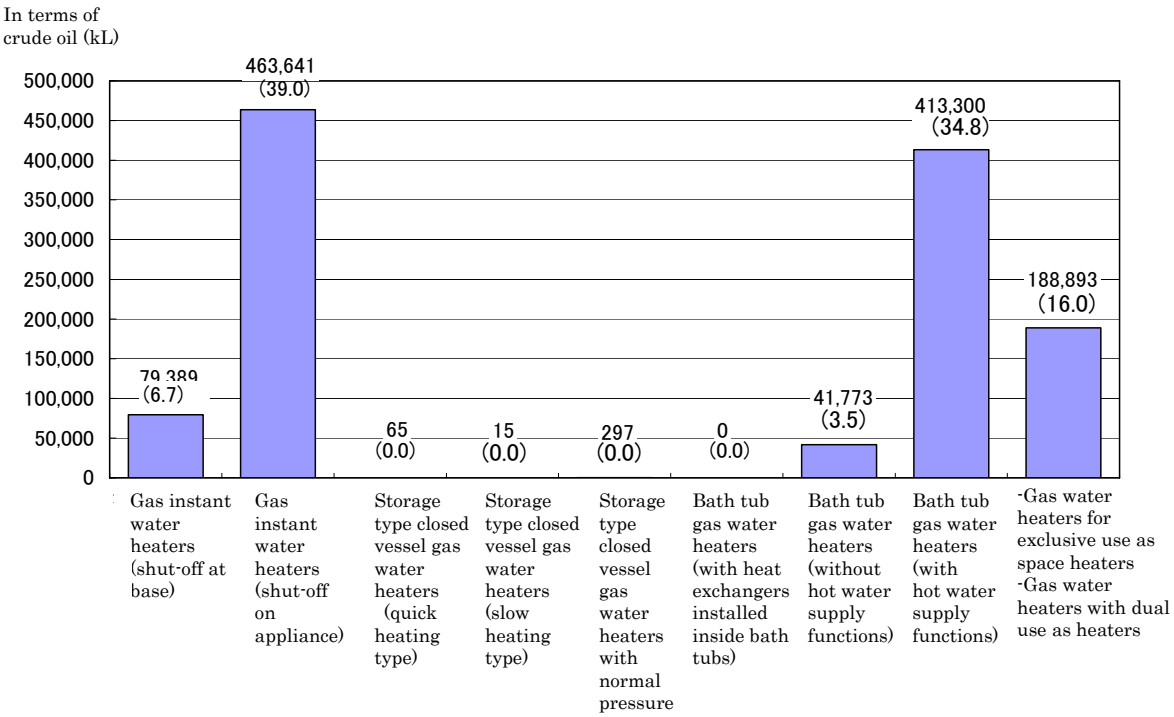
(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene

Bath tub gas water heaters (with heat exchangers installed inside bath tubs)
Storage type closed vessel gas water heaters (quick heating type)
Storage type closed vessel gas water heaters (slow heating type)
Storage type closed vessel gas water heaters with normal pressure

	1993 (H.5)	1994 (H.6)	1995 (H.7)	1996 (H.8)	1997 (H.9)	1998 (H.10)	1999 (H.11)	2000 (H.12)	2001 (H.13)	2002 (H.14)
Gas water heaters	4,616,349	4,680,494	4,756,955	4,738,188	4,539,878	4,217,406	4,074,069	4,142,477	4,154,612	3,918,312
Gas instant water heaters (shut-off at base)	1,518,865	1,475,767	1,436,031	1,390,701	1,153,959	1,056,210	986,177	955,195	883,933	772,984
Gas instant water heaters (shut-off on appliance)	1,449,469	1,453,515	1,446,206	1,428,914	1,457,009	1,353,005	1,370,821	1,380,583	1,428,417	1,366,132
Storage type closed vessel gas water heaters (quick heating type)	2,619	2,127	1,489	594	648	518	519	425	422	321
Storage type closed vessel gas water heaters (slow heating type)	3,004	2,249	2,680	1,982	1,688	1,262	1,123	896	1,284	229
Storage type closed vessel gas water heaters with normal pressure	9,460	8,615	7,671	7,222	6,058	4,155	3,446	3,282	3,750	4,503
Bath tub gas water heaters (with heat exchangers installed inside bath tubs)	132	82	83	47	26	10	0	0	0	0
Bath tub gas water heaters (without hot water supply functions)	517,565	480,960	487,428	456,945	426,349	401,137	402,168	393,858	366,043	321,524
Bath tub gas water heaters (with hot water supply functions)	1,038,435	1,161,442	1,260,468	1,317,249	1,335,310	1,221,114	1,096,264	1,119,462	1,126,413	1,076,349
Gas water heaters with dual use as heaters	76,800	95,737	114,899	134,534	158,831	179,995	213,551	288,776	344,350	376,270

(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances

(2) Energy Consumption (Based on Shipments in FY 2002)



(Source) Statistics compiled by the Japan Industrial Association of Gas and Kerosene Appliances
(Note) Values in parentheses represent the percentage among the total number of units.