Final Report
Electric Toilet Seats Evaluation Standard Subcommittee,
Energy Efficiency Standards Subcommittee of
the Advisory Committee for Natural Resources and Energy

The evaluation standards for the manufacturers of electric toilet seats were presented in the "Final Criteria Summary by the Sub-committee for Judgment Criteria for Electric Heating/Warming Appliances, the Energy Conservation Standards Working Group, the Research Committee for Total Energy (April 3, 2002)" , and its target year was fulfilled in FY 2006.

While each manufacturer has been making efforts to develop new products pursuing better energy efficiency, such as a toilet seat that is instantaneously warmed only when it is used, the current measurement method is not necessarily appropriate for measuring products with new system according to their usage reality.

To review the current measurement method and target scope and then determine new target standard values, Electric Toilet Seats Evaluation Standard Subcommittee was assembled. The subcommittee had deliberations on the evaluation standards for manufacturers and importers (hereinafter referred to as "manufacturers") and adopted the following final report.

1. Evaluation of Current Standard

As for electric toilet seats whose target fiscal year was fulfilled in FY 2006, the weighted average of energy consumption efficiency was 240 kWh/year. It is improved by 14.6 % from 281 kWh/year which is the value of those (shipped in FY 2000) before Top Runner standards are introduced. In addition, the result is better than originally assumed efficiency of 253 kWh/year and assumed improvement of 10.0 %, which are the estimates when the Top Runner standards are achieved.

In the light of the above, the energy saving of electric toilet seats has been progressing as a result of the manufacturers' efforts, and it can be recognized that the current standards based on the Top Runner method are working effectively.

2. Target Scope [See Attachment 1]

The target scope covers electric toilet seats except the followings: those to which the warm water is supplied from other hot-water supply equipment (central hot-water supply system), those equipped with a warm-water-shower function only, those produced for the use in portable toilets, and those for the use at specific places such as in vehicles.

3. Details of the Evaluation Standards for Manufacturers

(1) Target fiscal year [See Attachment 2]

FY 2012

(2) Target standard values [See Attachments 3 and 4]

Concerning electric toilet seats to be shipped by a manufacturer for the domestic market in the target fiscal year, for each category in the table below, the manufacturer has to make sure that the value obtained by weighting and averaging energy consumption efficiency (annual energy consumption) calculated according to (3) with the number of shipped units shall not exceed the target standard value.

Category	Availability of Shower Function	Availability of Warm-Water Tank	Target Standard Value (kWh/year)
I	Warm toilet seat (Without shower function)	-	141
II	Warm-water-shower toilet seat (With shower function)	Warm-water storage type (With warm-water tank)	183
III		Instantaneous type (Without warm-water tank)	135

(3) Measurement method of energy consumption efficiency [See Attachment 5]

Energy consumption efficiency shall be a value (kWh/year) calculated by the following formula.

$$P=\{(P_{WA}+P_{SA}+P_{CA}) \times T_1 + (P_{WB}+P_{SB}+P_{CB}) \times T_2 + (P_{WC}+P_{SA}+P_{CA}) \times T_3\} \times 365 / 24 \times 10^{-3}$$

where P, P_{WA}, P_{SA},, P_{CA}, T_1, P_{WB}, P_{SB}, P_{CB}, T_2, P_{WC} and T_3 express the following values:

P: Annual energy consumption (kWh/year)

T_1: Operating time (h)

T_2: Power-saving time (h)

T_3: Recovery time to normal operation (h)

P_{WA}: Energy consumption of water warmer unit in normal operation (A water warmer unit is a structural part of an electric toilet seat and warms up supplied water. Hereinafter the same definition applies.) (It is applicable only to warm-water-shower toilet seats.) (Wh/day)

P_{SA}: Energy consumption of toilet seat unit in normal operation (Wh/day)

P_{CA}: Energy consumption of control & operation unit in normal operation (A control & operation unit is a structural part of an electric toilet seat, which controls each structural part and operates every function. Hereinafter the same definition applies.) (Wh/day)

P_{WB}: Energy consumption of water warmer unit in power-saving mode (It is applicable only to those having a power-saving function for a water warmer unit.) (Wh/day)

P_{SB}: Energy consumption of toilet seat unit in power-saving mode (It is applicable only to those having a power-saving function for a toilet seat unit.) (Wh/day)

P_{CB}: Energy consumption of control & operation unit in power-saving mode (It is energy consumption of a control & operation unit with power-saving functions activated for a water warmer unit and a toilet seat unit.) (Wh/day)

P_{WC}: Energy consumption of water warmer unit when recovering to normal operation (It is applicable only to those having a power-saving function for a water warmer unit among warm-water-shower toilet seats with warm-water tank.) (Wh/day).

(4) Display items and others

(a) Display items shall be as follows.

a) Product name and type
b) Category
c) Energy consumption efficiency (annual energy consumption)
d) Name of manufacturer

(b) Compliance items

a) Energy consumption efficiency shall be indicated as an integer value rounded at the first decimal place and expressed in "kWh/year".
b) When displaying energy consumption efficiency, annual energy consumption without using power-saving functions (measured and calculated according to the measurement method described in (3), with the T_2 and T_3 values set to 0) shall also be displayed in parenthesis.
c) At consumer's selection, the display items shall be clearly displayed in prominent position in catalogs and instruction manuals which describe the product performance.
d) It shall be noted that energy consumption efficiency is annual energy consumption measured in accordance with the measurement method specified in the Energy Conservation Law and also noted that annual energy consumption when not using power-saving functions is displayed as well.

e) Since the measurement method to measure energy consumption efficiency is revised, the display items shall be updated as soon as possible. When displaying the information in accordance with the new measurement method, it shall be noted so.

(Reference) Example of Display

Target fiscal year FY 2012	Energy Conservation Standard Achievement Rate 100%	Annual Energy Consumption 135 (169) kWh/year

(Note 1) Energy conservation standard achievement rate and Annual energy consumption are the values measured in accordance with the new standards (Standards for FY 2012).
(Note 2) The value in parenthesis indicates annual energy consumption when not using energy-saving functions.

4. Proposals for Energy Saving

(1) Actions of users

(a) Efforts shall be made to select electric toilet seats with excellent energy consumption efficiency by effectively using information such as “Energy-Saving Label”. When using electric toilet seats, energy saving effort shall also be made through appropriate and efficient usages (e.g. lowering temperature setting and deactivating warming function when not needed such as during summer).

(b) Particularly, if electric toilet seats have power-saving functions, efforts shall be made to utelize them.

(c) When electric toilet seats are installed at the time of the construction of housings or buildings, efforts shall be made to select those with excellent energy consumption efficiency.

(2) Actions of retailers

(a) Sales of electric toilet seats with excellent energy consumption efficiency shall be promoted, and efforts shall be made to provide appropriate information by use of “Energy-Saving Label”, etc., so that users are able to select such electric toilet seats. Also, in utilizing Energy-Saving Label, it shall be displayed clearly so that users can understand it easily without misconception.

(3) Actions of manufacturers

(a) Technical development for energy saving of electric toilet seats shall be promoted, and efforts shall also be made to develop products of excellent energy consumption efficiency.

(b) Aiming at the spread of electric toilet seats with excellent energy consumption efficiency, effort shall be made to provide appropriate information by means of “Energy-Saving Label”, etc. so that users are able to select such electric toilet seats. Also, in utilizing Energy-Saving Label, it shall be displayed clearly so that users can understand it easily without misconception.

(c) To promote the use of power-saving modes by users, manufacturers shall make efforts to develop products having a leaning control function and the like, so that users can easily select the power-saving modes, and also they shall make effort to provide users with appropriate information on power-saving.

(4) Actions of Government

(a) Aiming at the spread of electric toilet seats with excellent energy consumption efficiency, efforts shall be made to take necessary measures, such as spread and enlightenment activities, so as to promote actions of users and manufacturers.

(b) Implementation of the display items by manufacturers shall be checked periodically and continuously. Also, appropriate law management shall be made so as for correct and easy-to-understand information provision for users concerning energy consumption efficiency.

(c) Energy conservation standards based on the Top Runner method is a very effective means for energy-saving of products; therefore, efforts shall be made to promote better understanding about the Top Runner method and to have it spread internationally by catching appropriate opportunities. .

Attachment 1

Scope of Electric Toilet Seats

The evaluation standards are applied to all types of electric toilet seats except for the following:

(1) Electric toilet seats to which warm water is supplied from other hot-water supply equipment (central hot-water supply system)

These products are used for specific applications such as in hotels and have no established measurement method to measure energy consumption efficiency, and thus they are excluded.

* Shipment volume (FY 2005): Approximately 33,000 units

(2) Electric toilet seats equipped with a warm-water-shower function only

Their production volume is extremely small, and thus they are excluded.

* Shipment volume (FY 2005): Approximately 40 units

(3) Electric toilet seats produced for the use in portable toilets

These products are portable type and mounted on chairs for nursing care purposes. Their production volume is extremely small, and thus they are excluded.

* Shipment volume (FY 2005): Approximately 1,300 units

(4) Electric toilet seats for the use at specific places such as in vehicles

These products are placed in vehicles or the like and mostly used with non-commercial power supply for specific purposes. There is no established measurement method to measure energy consumption efficiency, and their shipment volume is extremely low; thus, they are excluded.

* Shipment volume (FY 2005): Approximately 20 units

Attachment 2

Target Fiscal Year for Electric Toilet Seats and Related Matters

1. In general, a considerable improvement in energy consumption efficiency of electric toilet seats is made when a model change takes place, and a typical development period of these new products is 4 to 5 years. For this reason, consideration should be given so that manufacturers can take at least one to two opportunities of bringing out new models before a target fiscal year.
   With the above in mind, for electric toilet seats, it is appropriate to set the next target fiscal year to be FY 2012, which is five years after the revision of standards.

2. In addition, the improvement rate of energy consumption efficiency in the target fiscal year is expected to be 9.7% based on the assumption that there will be no change in shipment volume and composition of each category from the current status (the result in FY 2006).

<Overview of Estimation>

(1) Energy consumption efficiency calculated from the actual achievement values of electric toilet seats shipped in FY 2006: 186 kWh/year

(2) Energy consumption efficiency estimated from the target standard values for electric toilet seats to be shipped in the target fiscal year: 168 kWh/year

(3) Improvement rate of energy consumption efficiency:

$$\frac{(186-168)}{186}\times 100 = 9.7\%$$

<Overview of Estimation: Warm Toilet Seats>

(1) Energy consumption efficiency calculated from the actual achievement values of warm toilet seats shipped in FY 2006: 158 kWh/year

(2) Energy consumption efficiency estimated from the target standard values for warm toilet seats to be shipped in the target fiscal year: 141 kWh/year

(3) Improvement rate of energy consumption efficiency:

$$\frac{(158-141)}{158}\times 100 = 10.8\%$$

<Overview of Estimation: Warm-water-shower Toilet Seats (Warm-water Storage Type)

(1) Energy consumption efficiency calculated from the actual achievement values of warm-water-shower toilet seats (warm-water storage type) shipped in FY 2006: 204 kWh/year

(2) Energy consumption efficiency estimated from the target standard values for warm-water-shower toilet seats (warm-water storage type) to be shipped in the target fiscal year: 183 kWh/year

(3) Improvement rate of energy consumption efficiency:

$$\frac{(204-183)}{204}\times 100 = 10.3\%$$

<Overview of Estimation: Warm-water-shower Toilet Seats (Instantaneous Type)

(1) Energy consumption efficiency calculated from the actual achievement values of warm-water-shower toilet seats (instantaneous type) shipped in FY 2006:
144 kWh/year

(2) Energy consumption efficiency estimated from the target standard values for warm-water-shower toilet seats (instantaneous type) to be shipped in the target fiscal year:
135 kWh/year

(3) Improvement rate of energy consumption efficiency:

$$\frac{(144-135)}{144}\times 100 = 6.3\%$$

Attachment 3

Categories of Electric Toilet Seats for Setting Target Standards and Related Matters

1. Current Categories of Electric Toilet Seats

Electric toilet seats are categorized as below based on the two parameters that will have impact on annual energy consumption (energy consumption efficiency). Concerning warm-water-shower toilet seats (warm-water storage type), since annual energy consumption correlates with warm-water storage capacity, the standard is expressed in a linear function with warm-water storage capacity as a variable.

(a) Categorization by the availability of shower function
(b) Categorization by the availability of warm-water tank
- Warm-water storage type (with warm-water tank):
  Water is warmed up by a heater in a warm-water tank in advance and stored there.
- Instantaneous type (without warm-water tank):
  Water is heated instantaneously at the time of spout.

Table 1. Current Categories of Electric Toilet Seats

Current Categories (Electric Toilet Seats)	
Warm toilet seats (without shower function)	
Warm-water-shower toilet seats (with shower function)	Warm-water storage type (with warm-water tank)
	Instantaneous type (without warm-water tank)

2. Categorization Method for Electric Toilet Seats

Electric toilet seats shall be categorized according to the current categorization method.

Concerning warm-water-shower toilet seats of warm-water storage type, the current standard is expressed in a linear function with warm-water storage capacity as a variable. However, instead of using a relational expression, a constant value shall be adopted as the standard value for these products, taking into account that their energy saving has progressed due to downsizing of warm-water tanks and aiming at further promotion of downsizing of the tanks.

Attachment 4

Target Standard Values for Electric Toilet Seats

1. Basic Concept

The target standard values are determined based on the idea of the Top Runner method. Specific concepts are as follows:

(a) Target standard values shall be set for every category that has been appropriately defined.

(b) As for the categories where efficiency improvement due to future technological advances is certainly expected by the target fiscal year, the target standard values shall allow for the improvement as much as possible.

(c) Target standard values shall not conflict among categories.

2. Products to be Treated as Special Products

When target standard values are determined based on the Top Runner method, certain products shall be treated as special products and considered as exceptions. These special products are those which employ special technologies, whose current market share is fairly low and which are considered to have many uncertain factors now and in future. If an energy consumption efficiency of a product using such technology is taken as a target standard value, products that employ widely used technologies could not exist, resulting in an extreme market distortion and causing disturbance in improvement and innovation of other technologies. Therefore, such products shall be treated as special products and excluded in the process of determining Top Runner values.

In this revision, the following products are defined as specially treated products for each category:

(a) Warm toilet seats

- Those having a power-saving function
  Due to their product characteristics, many of the warm toilet seats are low priced products. Although there are four models which have an electronically controlled power-saving function, their shipment volume accounts for only 8.8%. Thus, they shall be treated as special products.

(b) Warm-water-shower toilet seats (warm-water storage type)

- Those produced for public use
  The maximum temperature of the public use is lower than that of the home use because the public use products are used in a relatively comfortable and stable ambient temperature. Thus, they are treated as special products.

(c) Warm-water-shower toilet seats (instantaneous type)

- Those employing a system which instantaneously warms up toilet seat at the time of use, while keeping it at lower temperature usually
  These products are of a special type using a lamp heater and produced only by a specific group company. Thus, they are treated as special products.
- Those whose toilet bowls are made of a plastic material having low heat conductivity

Ordinary toilet bowls are made of ceramics to provide durability against chemicals and abrasion for the sake of cleaning convenience. In contrast, toilet bowls of this type of products are made of a specially processed plastic material, and thus they treated as special products.

3. Room for Improvement in Energy Consumption Efficiency by Future Technological Advancement

Concerning the improvement in energy saving performance of electric toilet seats, technological development has been conducted to achieve the current Top Runner standards, and each technology has already reached close to its limit.

[Examples of Main Technologies for Efficiency Improvement of Electric Toilet Seats]

(a) Power-saving control technology

- Power shutdown by timer or learning control
- Heat-retention at a low temperature with use of learning control, human sensing, or closed-toilet-lid sensing
- Adoption of toilet seats which raise the temperature instantaneously at the time of use, while keeping it at low in standby.

(b) Heat loss prevention technology

- Improvement of the shape of toilet lid to prevent heat release from the periphery of toilet seat
- Improvement from the non-uniform distribution of toilet seat temperature to provide comfortable and uniform sensory temperature when seated
- Reduction in the surface area of warm-water tanks, and adoption of insulating materials to warm-water tanks
- Application of heat loss prevention technologies, e.g. insulating materials, to toilet seats
- Adoption of toilet bowls that are made of a low heat release plastic material

While some of these technologies have already been applied to the current Top Runner equipment, each manufacturer is making efforts for further efficiency improvement; therefore, it can be said that there remains room for efficiency improvement in each individual element of technological development.

[Warm Toilet Seats]

An improvement from the Top Runner value by 3% is anticipated, resulting from the improvement of the shape of toilet lids, the spread of products having a power-saving function (10% or so), etc.

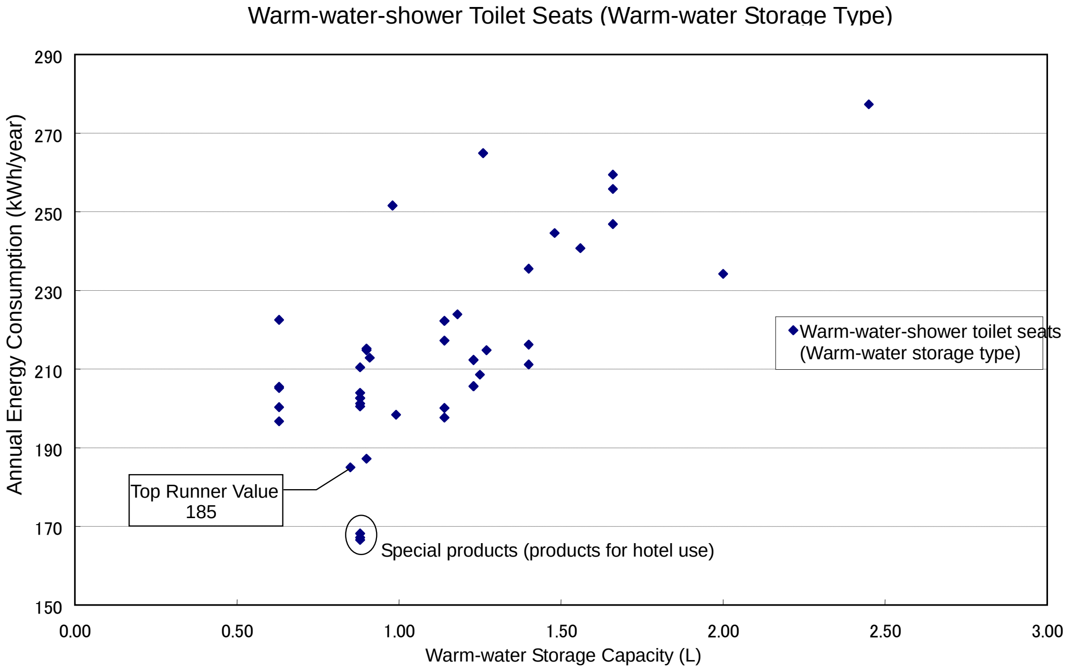
[Warm-water-shower Toilet Seats (Warm-water Storage Type)]

An improvement from the Top Runner value by 5% or so can be expected, resulting from the application of heat loss prevention technologies, e.g. insulating materials, to toilet seats, the enhanced adoption of insulating materials to warm-water tanks, etc.

The current standard is expressed in a linear function with warm-water storage capacity as a variable. However, instead of using a relational expression, a constant value shall be adopted as the standard value for this type of products, taking into account that their energy-saving has progressed due to downsizing of warm-water tanks and aiming at further promotion of downsizing of the tanks. Meanwhile, in the diversified consumer needs for shower function, a solid preference still remains for products that spout a certain amount of warm water or have a warm-water tank of a certain capacity. Thus, even though the standard is not defined as a linear function with warm-water storage capacity as a variable, the effect from these factors needs to be taken into consideration when estimating the future efficiency improvement.

The Top Runner product has a warm-water tank capacity of 0.85 L, while an average capacity of current warm-water tanks is 1.1 L. With an assumption that further downsizing of warm-water tanks will result in an average tank capacity of 1.0 L or so, the effect from the difference in warm-water storage capacity due to the diversified consumer needs for shower function can be estimated as an increase of approximately 7 kWh/year (4% or so).

From the above discussion, for warm-water-shower toilet seats (warm-water storage type), an improvement by 1% from the Top Runner value shall be anticipated.



[Warm-water-shower Toilet Seats (Instantaneous Type)]

An improvement from the Top Runner value by 6% is anticipated, resulting from the application of heat loss prevention technologies, e.g. insulating materials, to toilet seats and the introduction of innovative technologies such as those seen in toilet seats which instantaneously heat the seat unit and in toilet bowls made of plastic.

4. Specific Target Standard Values

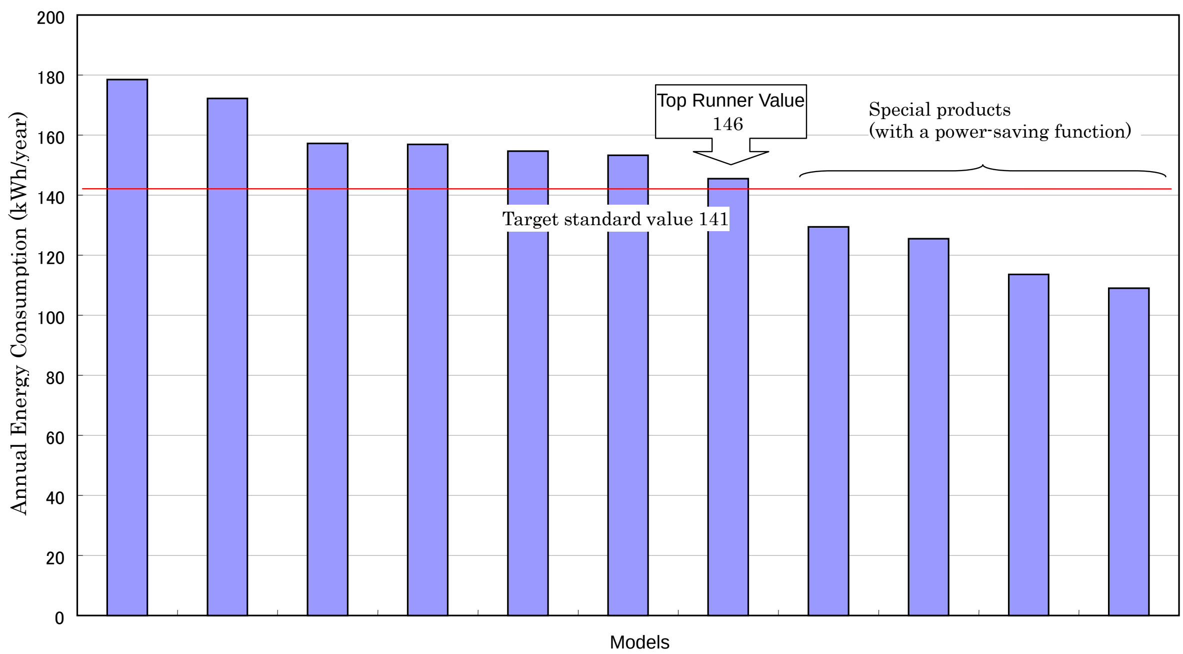
Adding anticipated improvement by the future technological development to the Top Runner value, target standard value is determined for each category as follows. With these target values, efficiency improvement by 9.7% can be expected for electric toilet seats as a whole, compared to the weighted average values of annual energy consumption in FY 2006.

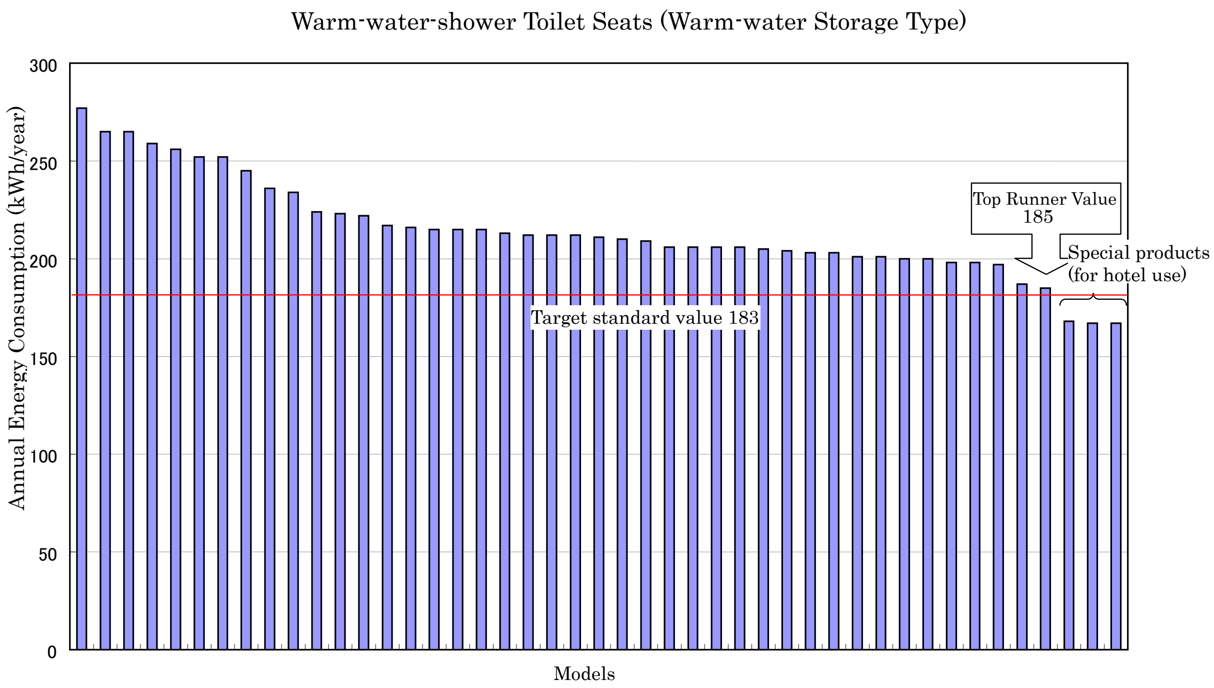
Table 1. Target Standard Values for Electric Toilet Seats

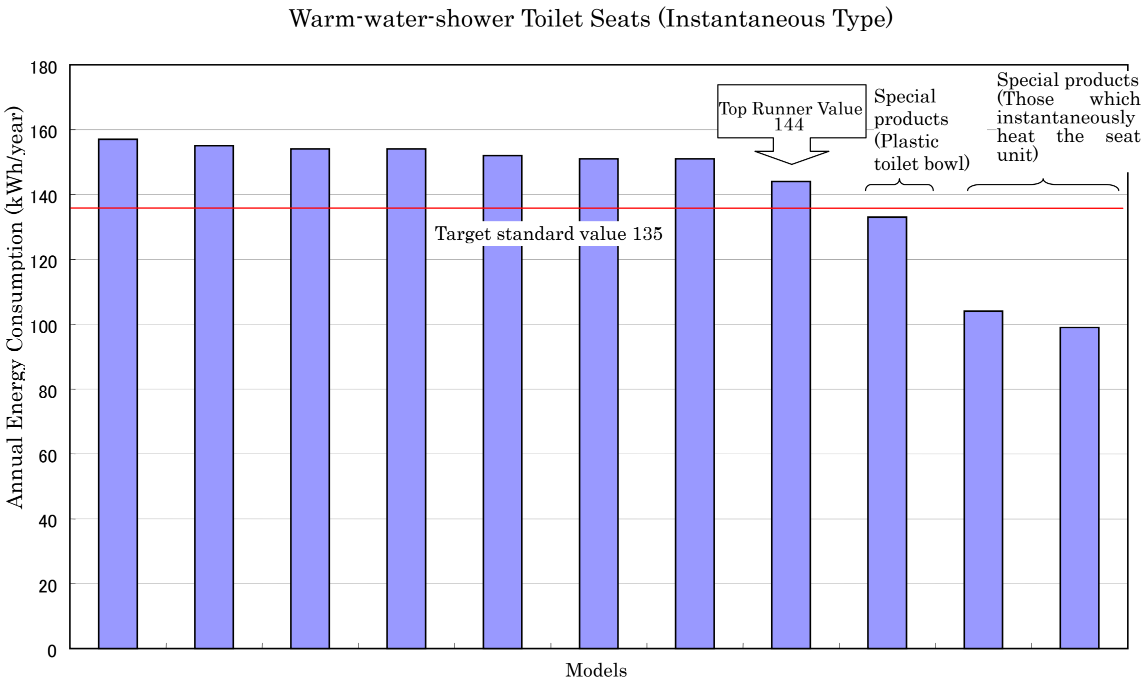
Category	Availability of Shower Function	Availability of Warm-water Storage Tank	Target Standard Value (kWh/year)	Top Runner Value (kWh/year)	Improvement Rate from the Top Runner Value (%)	Weighted Average of Annual Energy Consumption (note) in FY 2006 (kWh/year)	Improvement Rate on the Basis of Weighted Average (%)
I	Warm toilet seats	-	141	146	3	158	10.8
II	Warm-water-shower toilet seats	Yes (Warm-water storage type)	183	185	1	204	10.3
III		No (Instantaneous type)	135	144	6	144	6.3

Note: Special products are included when calculating weighted average values.

Warm Toilet Seats




Warm-water-shower Toilet Seats (Warm-water Storage Type)
Annual Energy Consumption (kWh/year)
300
250
200
150
100
50
0
Top Runner Value
185
Special products
(for hotel use)
Target standard value 183
Models


Warm-water-shower Toilet Seats (Instantaneous Type)
Annual Energy Consumption (kWh/year)
180
160
140
120
100
80
60
40
20
0
Top Runner Value
144
Special products (Plastic toilet bowl)
Special products (Those which instantaneously heat the seat unit)
Target standard value 135
Models

Attachment 5

Energy Consumption Efficiency of Electric Toilet Seats and the Measurement Method

1. Basic Concept

Energy consumption efficiency of electric toilet seats currently defined under the Energy Conservation Law is annual energy consumption (kWh/year), which is obtained by summing up energy consumption measured for each function of water warmer unit, toilet seat unit, and control & operation unit

Meanwhile, instead of existing toilet seats that are constantly warmed except in power-saving mode, new products have been developed in pursuit of the energy-saving performance, such as a product whose toilet seat is usually kept at a lower temperature and instantaneously warmed up at the time of use. According to the current measurement method for toilet seat unit, power consumption is measured with the toilet seat lid kept closed; thus, it does not include a procedure to measure the startup power consumption at the time of use of the toilet seat.

Considering these situations, the measurement method which reflects the actual status of the usage shall be established, by introducing the toilet lid open/close process, etc.

2. Specific Definition and Measurement Method of Energy Consumption Efficiency

Energy consumption efficiency is defined as annual energy consumption and calculated by the following formula.

$$P = \{(P_{WA}+P_{SA}+P_{CA}) \times T_1 + (P_{WB}+P_{SB}+P_{CB}) \times T_2 + (P_{WC}+P_{SA}+P_{CA}) \times T_3\} \times 365 / 24 \times 10^{-3}$$

where P, P_{WA}, P_{SA},, P_{CA}, T_1, P_{WB}, P_{SB}, P_{CB}, T_2, P_{WC} and T_3 express the following values:

- P: Annual energy consumption (kWh/year)
- T_1: Operating time (h)
- T_2: Power-saving time (h)
- T_3: Recovery time to normal operation (h)
- P_{WA}: Energy consumption of water warmer unit in normal operation (A water warmer unit is a structural part of an electric toilet seat and warms up supplied water. Hereinafter the same definition applies.) (It is applicable only to warm-water-shower toilet seats.) (Wh/day)
- P_{SA}: Energy consumption of toilet seat unit in normal operation (Wh/day)
- P_{CA}: Energy consumption of control & operation unit in normal operation (A control & operation unit is a structural part of an electric toilet seat, which controls each structural part and operates every function. Hereinafter the same definition applies.) (Wh/day)
- P_{WB}: Energy consumption of water warmer unit in power-saving mode (It is applicable only to those having a power-saving function for a water warmer unit.) (Wh/day)

P_{SB}: Energy consumption of toilet seat unit in power-saving mode (It is applicable only to those having a power-saving function for a toilet seat unit.) (Wh/day)

P_{CB}: Energy consumption of control & operation unit in power-saving mode (It is energy consumption of a control & operation unit with power-saving functions activated for a water warmer unit and a toilet seat unit.) (Wh/day)

P_{WC}: Energy consumption of water warmer unit when recovering to normal operation (It is applicable only to those having a power-saving function for a water warmer unit among warm-water-shower toilet seats with warm-water tank.) (Wh/day).

(1) T_1: Operating time (h)

A value subtracting T_2 and T_3 from 24

(2) T_2: Power-saving time (h)

T_2 shall be the longest settable time for the power-saving function of each electric toilet seat. If the power-saving duration can be set to 7.7 hours or longer, T_2 shall be 7.7.

Supplement 1: Power-saving function may include power shutdown function, heat-retaining function at low temperature, etc. If a product has multiple power saving functions, the one that provides the greatest power reduction (power shutdown function if available) shall apply.

Supplement 2: While various types of power saving functions are available including those with timer control, learning control, and on/off switching, this measurement method covers only a timer-controlled auto-recovery type power saving function, which is thought to be highly utilized by users.

Supplement 3: Concerning the models for hotel use which are lacking a temperature adjustment function, for the purpose of energy conservation of a hotel, power supply in each room including that for a electric toilet seat is often controlled by the centralized power control system or key interlocking system installed in a hotel room; therefore, rooms are mostly in power shutdown during unoccupied hours. It can be assumed that power-saving state is maintained better in hotels than at homes. The hotel use products are thus treated as those having a power shutdown function even if they are not equipped with any power-saving function.

(3) T_3: Recovery time to normal operation (h)

1 hour (It is applicable only to those having a power-saving function for a water warmer unit among warm-water-shower toilet seats with warm-water tank.)

Supplement 4: For the instantaneous type warm-water-shower toilet seats and those having no power-saving function, T3 shall be 0 because no recovery phenomenon occurs.

(4) P_{WA}: Energy consumption of water warmer unit in normal operation (Wh/day)

For warm-water-shower toilet seats with warm-water tank, energy consumption of water warmer unit in normal operation shall be the value obtained by multiplying energy consumption in 6 hours measured as specified in (11) by 4; whereas, for those without warm-water tank, it shall be the value obtained by multiplying energy consumption per warm-water spout measured as specified in (11) by 12.

(5) P_{SA}: Energy consumption of toilet seat unit in normal operation (Wh/day)

Energy consumption of toilet seat unit in normal operation shall be the value calculated by the following formula using the measurements obtained as specified in (12). (A calculated value shall be further multiplied by 1.06 if the vertical length of the opening of toilet seat is less than 280 mm, and by 1.03 if it is 280 mm or greater and less than 300 mm.)

$$P_{SA} = \{(P_{S1M} \times K_M / 2 + P_{S1W} \times K_W / 4) \times T_4 + (P_{S2M} \times K_M / 2 + P_{S2W} \times K_W / 4) \times T_5\} / (T_4 + T_5)$$

where

P_{SA}: Energy consumption of toilet seat unit in normal operation per day (Wh/day)

P_{S1M}: Energy consumption in operation (not in use) at ambient temperature of 15ºC ± 1ºC (Wh/day)
[Energy consumption per hour measured as specified in (12)] × 24

K_M: Actual usage factor at ambient temperature of 15ºC ± 1ºC: 0.7

P_{S1W}: Energy consumption in operation (not in use) at ambient temperature of 5ºC ± 2ºC (Wh/day)
[Energy consumption per hour measured as specified in (12)] × 24

K_W: Actual usage factor at ambient temperature of 5ºC ± 2ºC: 0.9

P_{S2M}: Energy consumption in operation (in use) at ambient temperature of 15ºC ± 1ºC
[(Energy consumption per single use in Mode A) × 13 + (Energy consumption per single use in Mode B) × 3] × 24 / T_5

P_{S2W}: Energy consumption in operation (in use) at ambient temperature of 5ºC ± 2ºC (Wh/day)
[(Energy consumption of single use in mode A) × 13 + (Energy consumption of single use in Mode B) × 3] × 24 / T_5

T_4: Operating time (not in use) ($T_1 + T_3 - T_5$) (h)

T_5: Operating time (in use) 16 (h)

Supplement 5: Taking account of seasonal change in the ambient temperature, seasonal weighting is applied assuming that the ambient temperature is 15ºC in spring and autumn (2/4 year) and 5ºC in winter (1/4 year) and that the toilet seat is not warmed in summer (1/4 year).

Supplement 6: Mode A refers to a case of use where a user is seated on a toilet seat, whereas Mode B refers to a case of use where a user is standing. Mode weighting is applied assuming that the average use frequencies in mode A and B are respectively 13 and 3 in a general household.

(6) P_{CA}: Energy consumption of control & operation unit in normal operation (Wh/day)

Energy consumption of control & operation unit in normal operation shall be the value obtained by multiplying energy consumption per hour by 24, where energy consumption per hour shall be measured with a display unit in a normally selectable minimum display mode.

(7) P_{WB}: Energy consumption of water warmer unit in power-saving mode (Wh/day)

Energy consumption of water warmer unit in power-saving mode shall be the value obtained by multiplying energy consumption per hour measured as specified in (11) by 24, with a water warmer unit's power-saving function set to provide the maximum energy reduction.

(8) P_{SB}: Energy consumption of toilet seat unit in power-saving mode (Wh/day)

Energy consumption of toilet seat unit in power-saving mode shall be obtained as follows. First, energy consumption per hour is measured at each of the specified ambient temperatures of 15ºC ± 1ºC and 5ºC ± 2ºC as specified in (12) (when not in use) with the toilet seat power-saving function set to provide the maximum energy reduction. By dividing the measurements at 15ºC ± 1ºC by 2 and the measurements at 5ºC ± 2ºC by 4, two values are obtained. Then, these two values are summed and multiplied by 24 to be the energy consumption of toilet seat unit in power-saving mode. (It shall be further multiplied by 1.06 if the vertical length of the opening of toilet seat is less than 280 mm, and by 1.03 if the length is 280 mm or greater and less than 300 mm.)

(9) P_{CB}: Energy consumption of control & operation unit in power-saving mode (Wh/day)

Energy consumption of control & operation unit in power-saving mode shall be the value obtained by multiplying energy consumption per hour of a control & operation unit by 24, where energy consumption per hour shall be measured with power-saving functions activated for a water warmer unit and a toilet seat unit.

(10) P_{WC}: Energy consumption of water warmer unit when recovering to normal operation (Wh/day)

Energy consumption of water warmer unit when recovering to normal operation shall be the value obtained by multiplying energy consumption per hour measured as specified in (11) by 24. Prior to the measurement, a water warmer unit's power-saving function shall be set to provide the maximum energy reduction, and water temperature in the warm-water tank shall be in a stable state. Then, the measurement is made right after the cancellation of the power-saving setting.

Supplement 7: For the warm-water tank type, while recovering time of water warmer unit varies depending on heater capacity, tank capacity, etc., most of the current models restore the specified temperature within one hour in general. Thus, the measurement time is specified as one hour.

(11) For energy consumption values defined in (4), (7) and (10) shall be measured under the following conditions.

(a) Ambient temperature and temperature of water supplied to electric toilet seats shall be set to 15ºC ± 1ºC.
(b) Water supply pressure shall be set to 0.2MPa.
(c) Temperature of spouting warm water shall be set to 38ºC (applicable only to the measurement of energy consumption defined in (4) and (10)).

Supplement 8: For some models, the mechanism of temperature setting makes it difficult to maintain warm water at this temperature. In such a case, as a basic rule, warm water temperature and energy consumption shall be measured at two temperature points which are over and below 38ºC to estimate energy consumption at 38ºC by linear interpolation, and the estimated value is defined as the energy consumption efficiency of this model. If the model cannot be set at two temperature points over and below 38ºC, such as temperature selection allowing only high (40ºC) and low (38.5ºC), the energy consumption at 38ºC shall be estimated by extrapolating the measurements at two selectable temperatures closest to 38ºC. For the models without any temperature adjustment function, the measurement shall be performed at the temperature predetermined in each model.

(d) Spouting amount of warm water shall be 400 cc ± 5% for the models with warm-water tank, and 200 cc ± 5% for the models without the tank (applicable only to the measurement of energy consumption defined in (4)).
(e) For the models with warm-water tank, single warm-water spouting shall be made when starting the measurement, and two additional spouting follows with an interval of 30 minutes (total 3 times of warm-water spouting). As a result, energy consumption is measured for 6 hours (applicable only to the measurement of energy consumption defined in (4)).
(f) Electric toilet seat shall be placed under a wind-free condition by, for example, surrounding it with a box.

(12) The measurement of energy consumption defined in (5) and (8) shall be performed under the following conditions.

[When not in use]

(a) Toilet seat lid shall be closed.
(b) Ambient temperature shall be set to 15ºC ± 1ºC and 5ºC ± 2ºC, and the measurement shall be performed at each temperature.
(c) Temperature of toilet seat unit shall be set to the maximum level selectable in each model.
(d) Electric toilet seat shall be placed under a wind-free condition by, for example, surrounding it with a box.

[When in use]

(a) Toilet seat lid shall be treated as follows:

(Mode A)

At 60 seconds after the beginning of measurement, an operator enters a room equipped with a toilet (activates a human sensor); open the toilet seat lid completely.

At 75 seconds after the beginning of measurement, the operator sits down on the toilet seat (turns on a seat-occupied switch).

At 225 seconds after the beginning of measurement, the operator leaves the seat; close the toilet seat lid completely (turns off the seat-occupied switch).

At 250 seconds after the beginning of measurement, the operator leaves the room (deactivates the human sensor).

At 1 hour after the beginning of measurement, the measurement is terminated.

(Mode B)

At 60 seconds after the beginning of measurement, an operator enters a room equipped with a toilet (activates a human sensor); open the toilet seat lid completely.

At 65 seconds after the beginning of measurement, open the toilet seat completely.

At 160 seconds after the beginning of measurement, close the toilet seat and lid completely.

At 180 seconds after the beginning of measurement, the operator leaves the room (deactivates the human sensor).

At 1 hour after the beginning of measurement, the measurement is terminated.

(b) Ambient temperatures shall be set to 15°C ± 1°C and 5°C ± 2°C, and the measurement shall be performed at each temperature.

(c) Temperature of toilet seat unit shall be set to the maximum level selectable in each model.

(d) Electric toilet seat shall be placed under a wind-free condition by, for example, surrounding it with a box.

(13) In (11) and (12), power supply voltage shall be 100 ± 2 V and power supply frequency shall be 50 Hz or 60 Hz.

Reference for Attachment 5

Supplemental Remarks on the Revision of Measurement Methods

1. Water Warmer Unit

(1) Rationale for setting the supply water temperature at 15°C

In the voluntary standards by the Association of Living Amenity and the Japan Electrical Manufacturers' Association, the supply water temperature is specified depending on the season as follows:

Winter season: 5°C Spring and autumn seasons: 15°C Summer season: 25°C

According to this method, the environment temperature needs to be changed in three ways for each measurement; therefore, the following issues arise from the standpoint of measurement simplicity:

- It takes an extremely long time to adjust the temperature of an environmental test room from that of external air to the above 3 stable environmental temperature settings, resulting in inefficiency of measurements.
- Each model needs to be measured in three different environmental temperatures, resulting in a long measurement time.

It is important to improve the accuracy of energy consumption efficiency. Whereas, it is also important to simplify the measurement method taking account of the time and cost that it requires, without the comparison of energy consumption efficiency being impaired. From these perspectives, it is desirable if a logical reason justifies the single-value setting for the supply water temperature. Comparison was made for two sets of measurement results on the power consumption of representative models: measurements only at 15°C ± 1°C and measurements with the supply water temperature changed in three ways according to the industry's voluntary standards. It was found that all the measurements were extremely close; therefore, the single value setting is thought to be sufficient for the purpose of comparing energy consumption efficiency.

Thus, in this measurement method, the supply water temperature shall be defined as to 15°C ± 1°C.

The comparison results are shown below for two representative models measured at three different supply water temperatures and only at 15°C ± 1°C.

Table 1. Vendor A, Warmth-Retention Temperature: 37.0°C,
Shower Duration: 30 Seconds

Season	Energy consumption for warming water for single shower	Energy consumption for warming water in each season (3 months) (estimated by assuming 4 washes per day)
Spring	15.52 Wh	5.67 kWh
Summer	7.78 Wh	2.84 kWh
Autumn	15.52 Wh	5.67 kWh
Winter	25.31 Wh	9.24 kWh
	Total (one year)	23.41 kWh
	One month average	1.95 kWh
	One month average in spring and autumn	1.89 kWh

<Room temperature> Summer: 28°C Spring and autumn: 15°C Winter: 5°C

Table 2. Vendor B, Warmth-Retention Temperature: 37.5°C,
Shower Duration: 30 Seconds

Season	Energy consumption for warming water for single shower	Energy consumption for warming water in each season (3 months) (estimated by assuming 4 washes per day)
Spring	21.55 Wh	7.87 kWh
Summer	10.94 Wh	3.99 kWh
Autumn	21.55 Wh	7.87 kWh
Winter	29.78 Wh	10.87 kWh
	Total (one year)	30.59 kWh
	One month average	2.55 kWh
	One month average in spring and autumn	2.62 kWh

<Room temperature> Summer: 28°C Spring and autumn: 15°C Winter: 5°C

The measurements were carried out in two situations: changing the supply water temperature in three ways to simulate seasonal temperature variation and fixing it to one temperature to simulate spring and autumn. The values of energy consumption per month in both situations are extremely close with the difference within 3%. Considering the complexity of the measurement with the supply water temperature being adjusted 3 times, it is rational to set the supply water temperature to 15°C ± 1°C.

Example of Vendor A: 1.95 / 1.89 ∗ 100 = 103 (%)
Example of Vendor B: 2.55 / 2.62 ∗ 100 = 97 (%)

(2) Rationale for setting the temperature to 38ºC

The usage reality of shower temperature control shown in the chart below indicates that 63% of the users set the controller to the middle setting, and thus the middle setting is thought to be appropriate for the measurement at a warm-water heat-retention period.

Although the middle setting temperature varies among models, 38ºC (average of 3 representative models of 3 vendors) was adopted based on the survey on those having the middle setting for the temperature control.

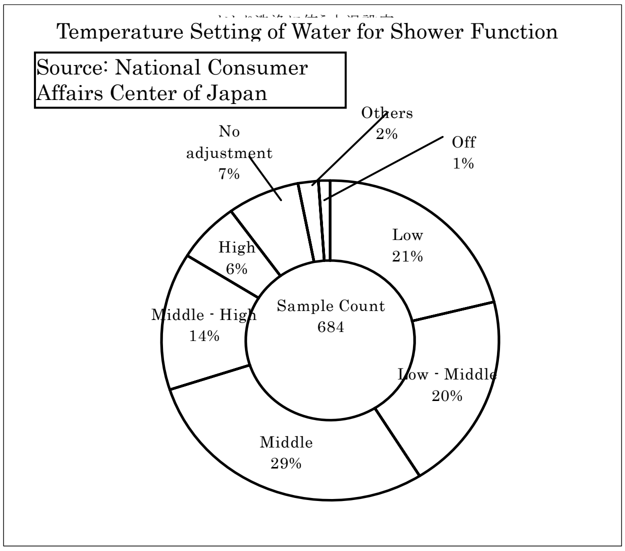


Figure 1

Actual Warm-Water Temperatures at the "Middle" Setting by Various Vendors

Vendor A	37.5ºC
Vendor B	38.0ºC
Vendor C	38.0ºC
Average of 3 vendors	37.8ºC

2. Toilet Seat Unit

(1) Seasonal ambient temperature setting

In the current measurement method, considering the efficiency of measurement as well as the proportional relation between ambient temperature and energy consumption, average annual temperature is defined as 15°C ± 1°C.

In this revision, considering the models that keep the toilet seat unit at 15°C or below but instantaneously warm it up at the time of use, the individual ambient temperature was decided for each season. Specifically, the seasonal ambient temperatures provided in the voluntary standards by the Association of Living Amenity and the Japan Electrical Manufacturers' Association shall be adopted. For summer season, however, the toilet seats are not warmed, and thus no measurement is performed.

Spring and autumn (March – May, September – November):	15 ± 1°C
Winter (December – February):	5 ± 2°C
Summer time (June – August):	28 ± 1°C.

(2) Revision of usage reality coefficient

In the current measurement method, energy consumption efficiency is measured with the maximum toilet seat temperature, whereby an obtained value is multiplied by the usage reality coefficient of 0.75. In response to the adoption of seasonal ambient temperatures as described above, this coefficient shall also be revised.

Based on the survey results as shown below, the usage reality coefficient for spring/autumn (K_M) is defined as 0.7 and that for winter (K_W) as 0.9. However, these coefficients shall not be multiplied for the models without a temperature control mechanism or those with temperature control mechanism but no temperature change.

(a) Survey on the actual status of toilet seat temperature setting by season

Table 3. Survey Results on Actual Status of Temperature Settings in Spring and Autumn (Survey by 3 major vendors, members of the Warm-Water-Shower Toilet Seat Council)

Season	Spring and Autumn (March – May, September – November)			
Vendor	A	B	C	Average of 3 vendors
High	4.9%	3.6%	1.5%	3.3%
Middle	32.0%	59.8%	18.3%	36.7%
Low	57.3%	32.6%	61.2%	50.4%
Off	5.8%	3.9%	19.0%	9.6%
			Total	100.0%

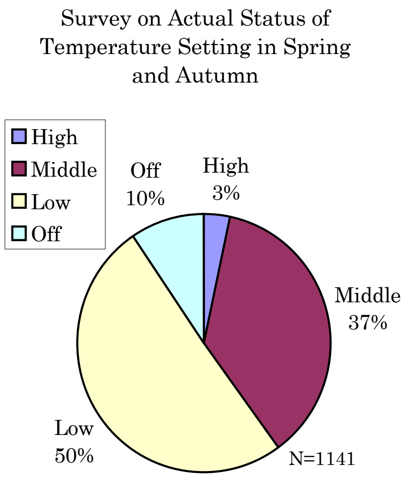
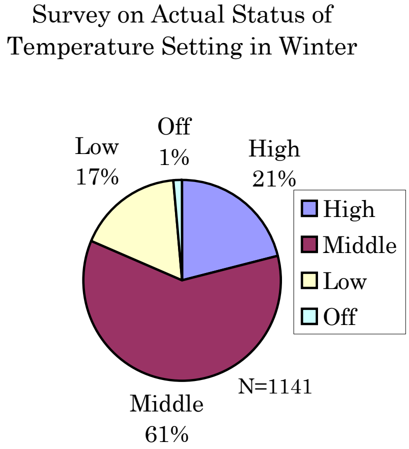


Table 4. Survey Results on Actual Status of Temperature Setting in Winter
(Survey by 3 major vendors, members of the Warm-Water-Shower Toilet Seat Council)

Season	Winter (December – February)			
Vendor	A	B	C	Average of 3 vendors
High	23.3%	22.0%	17.7%	21.0%
Middle	60.2%	70.4%	50.3%	60.3%
Low	15.5%	7.0%	29.7%	17.4%
Off	1.0%	0.6%	2.3%	1.3%
			Total	100.0%



(b) Energy consumption measurements on representative models with various temperature settings

Table 5 shows average values of seasonal energy consumption measured on 5 representative models at various temperature settings.

Table 5. Energy Consumption by Season and Temperature Setting Position
(Survey by 3 major vendors, members of the Warm-Water-Shower Toilet Seat Council)

Spring and Autumn	
Temperature	Energy Consumption (Wh/h)
High	23.94
Middle	20.49
Low	14.68
Off	0

Winter	
Temperature	Energy Consumption (Wh/h)
High	33.51
Middle	29.99
Low	23.69
Off	0

(c) Usage reality coefficient

From (a) and (b) above, the usage reality coefficient K are determined as follows

(Spring & Autumn) K_M = (23.94 × 0.033 + 20.49 × 0.367 + 14.68 × 0.504) / 23.94
= 0.66
= 0.7 (rounded up at the second decimal point)

(Winter) K_W = (33.51 × 0.21 + 29.99 × 0.603 + 23.69 × 0.174) / 33.51
= 0.87
= 0.9 (rounded up at the second decimal point)

(3) Number of days in each season

For the calculation purpose of energy consumption of toilet seat units, the number of days in each season shall be specified as follows. As shown in Table 6, warm toilet seat and the like are used approximately for 9 months, and thus the toilet seat units are assumed to be powered off during summer.

Spring and autumn: 183 days = 6 months
Winter: 90 days = 3 months

Table 6. Period of Use of Warm Toilet Seats

Duration of use (months)	Average months
Use of warmed toilet seat unit of warm-water-shower toilet seats	9.3
Warm toilet seat being connected to an electric outlet	8.6

N=918

(Source: Standby Power Study Report FY 2005, The Energy Conservation Center, Japan)

(4) Frequency of toilet use

For a four-member household (two men and two women), the frequency of toilet use shall be set to the following values:

Defecation frequency: 4 (times a day) (one time each for all family members)
Urination frequency: 12 (times a day) (women: 8 times, men: 4 times)

(Supplement: Rationale for the use frequency setting (Source: Report by Study Committee on the Information Provision for the Energy Conservation and Security in Detached Housings, March 2005))

(a) Concept for the defecation frequency

Defecation frequency in a household is set to 1 (time / person a day) for all of the four family members. (For three members who go out during the day, the frequency becomes 2 (times/day), if combining those made away from home (office). However, for simplicity, it shall be set to 1 (time/day) at home.)

(b) Concept for the urination frequency

Urination frequency is set to 6 times per day per person (which is the upper of the general daily urination frequency according to the urological data.)

- During the day, 3 out of the 4 family members urinate 4 times away from home, and thus the frequency at home shall be set to 2.
- One person out of the 4 family members is the housewife and always urinates at home, and thus the frequency at home shall be set to 6.

From the above, the frequency of toilet use for urination becomes:

(2 times × 3 persons + 6 times × 1 person) / 4 persons = 3 (times / person day)

(5) Styles when using toilet

When urinating, an increasing number of men sit on a toilet seat because of "its comfortable position," "prevention of urine splash (easy to clean)," etc. According to the survey conducted in 2004 by vendor A, approximately 23.7% of men sit on a toilet seat at the time of urination. Another survey conducted by vendor B also indicates that approximately 30% of men sit on a toilet seat (including those who sometimes do) at the time of urination.

To reflect this trend, it shall be included in this measurement method that 1 (time/day) out of the 4 (times/day) urination frequency of men is considered as a case in which men sit on a toilet seat for urination.

Table 7. Survey Result on Styles of Men during Urination
(Survey by Vendor A , June 2004)

Styles of men when urinating	(Persons)	Composition ratio (%)
Standing and facing against the sitting-on type toilet bowl	1512	65.4
Sitting on the sitting-on type toilet seat	548	23.7
Standing and facing against the Japanese style toilet	100	4.3
Squatting over the Japanese style toilet	10	0.4
Others	142	6.1
Total	2312	

(n = 2312)

Table 8. Survey Result on Styles of Men during Urination
(Survey by Vendor B, 2004)

Styles of men when urinating	(Persons)	Composition ratio (%)
Always sitting on	51	17
Sometimes sitting on	39	13
Always standing	210	70
Total	300	

(n = 300)

(6) Mode of using toilet

Table 9 shows the survey result on time duration required for each style of toilet use.

Table 9. Survey Result on the Time Duration Required
(Survey by the Warm-Water-Shower Toilet Seat Council)

	Use style	Frequency (time/day)	Single mode		
			Enter the room – Ready in a position (Sec.)	Using toilet (Sec.)	Leave toilet – Leave the room (Sec.)
Mode A	Man (Defecation)	2	10	282	23
	Woman (Defecation)	2	10	240	25
	Woman (Urination)	8	11	96	23
	Man (Urination 1)	1	11	96	22
Mode B	Man (Urination 2)	3	8	78	16

Note 2: Mode A (sitting), Mode B (standing)

However, it takes time and is inefficient to carry out the measurement for each use style. For this reason, measurements for the same mode are weighted and averaged by the frequency of use, and they are combined into one set of data.

Table 10. Combined Mode

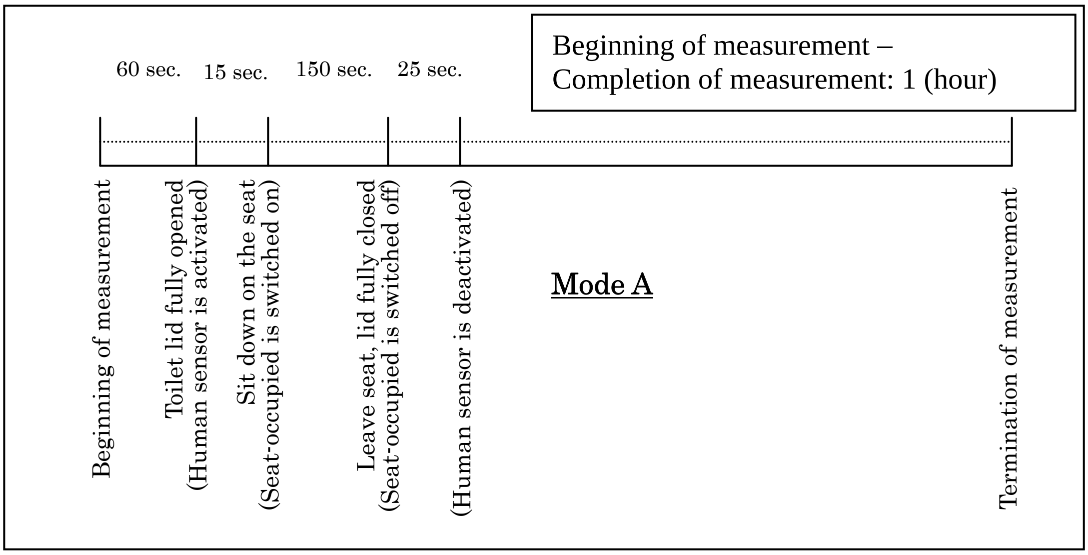
<table>
<tr><th rowspan="2"></th><th rowspan="2">Use style</th><th rowspan="2">Frequency (time/day)</th><th colspan="3">Single mode</th><th colspan="3">Combined mode (Weighted average)</th><th rowspan="2">Total (Sec.)</th></tr>
<tr><th>Enter the room – Ready in a position (Sec.)</th><th>Using toilet (Sec.)</th><th>Leave toilet – Leave the room (Sec.)</th><th>Enter the room – Ready in a position (Sec.)</th><th>Using toilet (Sec.)</th><th>Leave toilet – Leave the room (Sec.)</th></tr>
<tr><td rowspan="4">Mode A</td><td>Man (Defecation)</td><td>2</td><td>10</td><td>282</td><td>23</td><td rowspan="4">11</td><td rowspan="4">147</td><td rowspan="4">23</td><td rowspan="4">181</td></tr>
<tr><td>Woman (Defecation)</td><td>2</td><td>10</td><td>240</td><td>25</td></tr>
<tr><td>Woman (Urination)</td><td>8</td><td>11</td><td>96</td><td>23</td></tr>
<tr><td>Man (Urination 1)</td><td>1</td><td>11</td><td>96</td><td>22</td></tr>
<tr><td>Mode B</td><td>Man (Urination 2)</td><td>3</td><td>8</td><td>78</td><td>16</td><td>8</td><td>78</td><td>16</td><td>102</td></tr>
</table>

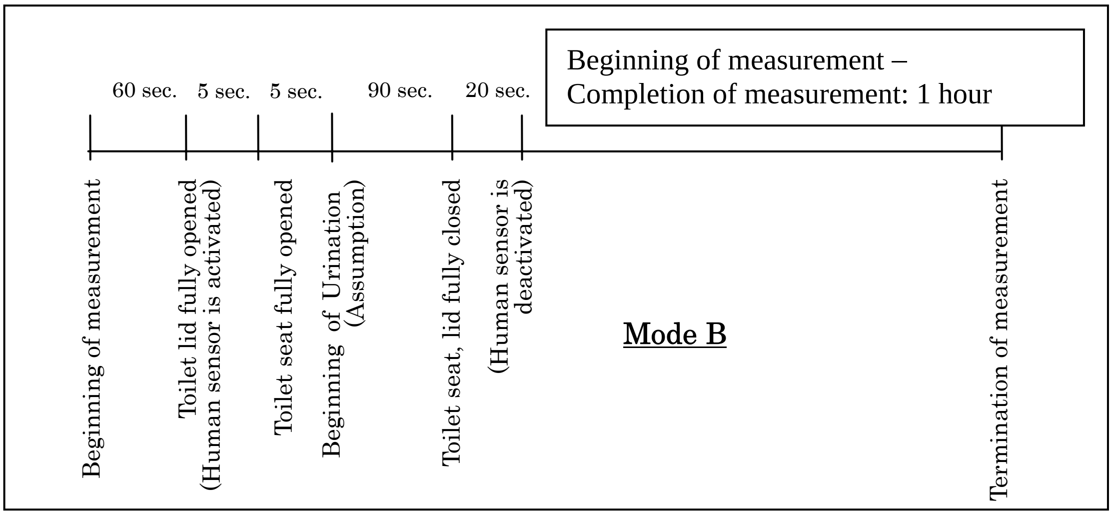
In addition, to prevent erroneous measurements, figures are rounded as tabulated in Table 11, without the total time in Table 11 falling below the total time in Table 10 above.

Table 11 Measurement Mode

	Frequency (time/day)	Enter the room – Ready in a position (Sec.)	Using toilet (Sec.)	Leave toilet – Leave the room (Sec.)	Total (Sec.)
Mode A	13	15	150	25	190
Mode B	3	10	90	20	120

Above described modes can be illustrated as follows.





Note 1: If no human sensor or seat-occupied switch is installed, the corresponding steps can be omitted. However, the total measurement time shall be unchanged.

Note 2: When the timing has arrived for the seat-occupied switch to be turned off (leaving the seat), if the toilet seat temperature is still rising to reach the pre-set degree, the switch shall not be turned off until the temperature rising is completed. However, the total measurement time shall be unchanged.

3. Timer Controlled Power-Saving

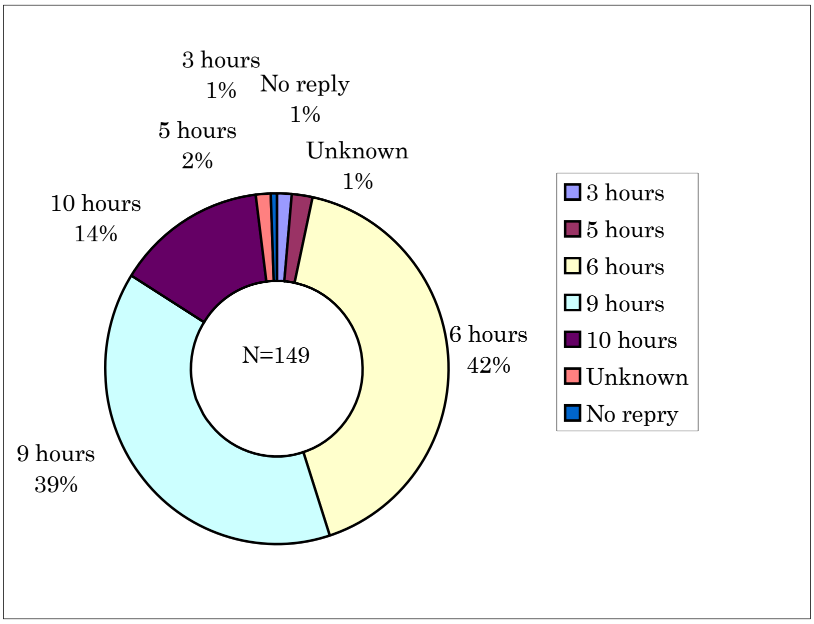
The power-saving time is based on the survey of actual status of usage which was conducted at the determination of the current standards. Although the setting of power-saving time varies among models, it is defined as an average hours of use. The actual power-saving time varies depending on the family structure and life pattern; however, it is considered as an average value reflecting actual status of usage.

In the current standards, the power-saving time is defined as 3.5 hours, which is obtained by multiplying the average power-saving time, 7.7 hours, by the usage rate of power-saving function, 0.45. However, for consumers who use the power-saving function, the power-saving time is in fact 7.7 hours on average. In order to give incentive for the models having a power-saving function, an evaluation with the full span of the 7.7-hour period shall be made.

To further spread the consumers' use of power-saving functions, energy consumption values without using power-saving functions shall also be indicated.

Table 12. Actual Status of Power-Saving Time

(Power-saving time)	(Persons)	(Ratio %)	Weighted average hours
3 hours	2	1.3	0.04
5 hours	3	2.0	0.10
6 hours	62	41.6	2.50
9 hours	58	38.9	3.50
10 hours	21	14.1	1.41
Unknown	2	1.3	0.08
No reply	1	0.7	0.04
Total	149	100.0	**7.7**



4. Additional Functions

(1) Warm-air-dry function

Figure 3 shows the shipment volume ratio by additional functions in FY 2005. The shipment ratio of those having a warm-air-dry function is 45.9% in FY 2002, which drastically decreases down to 30.5% in FY 2005.

Presumably, the low price orientation and the change in consumer needs for this function are reflected in this trend. Figure 4 shows the usage ratio of the warm-air-dry function among the users who purchased the models with this function. As shown in this figure, the percentage of users who always or sometimes use this function remains at approximately 36%.

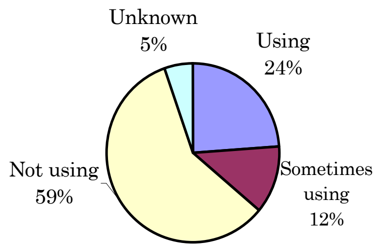
In addition, its energy consumption is low, and thus this additional function is exempted.

Table 13. Shipment Volume Ratio by Additional Functions in FY 2005
(Survey by the Warm-Water-Shower Toilet Seat Council)

	Equipped		Not equipped		Total shipments
	Shipped units	Ratio	Shipped units	Ratio	
Deodorant function	2,535,152	78.8%	680,237	21.2%	3,207,823
Warm-air-dry function	979,911	30.5%	2,235,478	69.5%	3,207,823
Room heating function	74,421	2.3%	3,140,968	97.7%	3,207,823

Table 14. Usage Ratio of Warm-air-dry Function
(Survey by two major vendors, members of the Warm-Water-Shower Toilet Seat Council)

Usage status	(Persons)	Ratio (%)
Using	272	23.9
Sometimes using	140	12.3
Not using	665	58.5
Unknown	60	5.3
Total	1137	100.0



(2) Room heating function

As shown in Table 13, for the room heating function, the shipment ratio also drastically decreases down to 2.3% in FY 2005 from 6% in FY 2002. Because of this extremely small shipment ratio, this function is also exempted as at present.

(Reference: Summary of Final Criteria, the Sub-Committee for Judgment Criteria for Electric Heating/Warming Appliances (extract))

Since other additional functions are equipped in response to the consumers needs, they are exempted from the determination of standard values. For your reference, current shipment ratio and average power consumption of the models having the additional functions are as follows.

Function	Shipment ratio	Basis of estimation of average energy consumption
Dry function	45.9%	Heater capacity: 300 – 470 W Hours of use per day/energy consumption 12 times ∗ 0.5 min. = 0.1 h/day 350 W ∗ 0.1 h = 35 Wh/day (3 model average) 35 Wh/day ∗ 365 days = 12.8 kWh/year (3 model average)
Deodorant function	86.5%	Motor capacity: approximately 3 W Hours of use per day/energy consumption 3 min./time ∗ 12 times = 36 min./day 3 W ∗ 0.6 h = 1.8 Wh/day (3 model average) 1.8 Wh/day ∗ 365 days = 0.7 kWh/year (3 model average)
Room heating function	6.0%	Heater capacity: 210 – 500 W Hours of use per day/energy consumption 6 h/day (used in winter season only) 357 W ∗ 6 h = 2142 Wh/day (3 model average) 2142 Wh ∗ 90 days = 193 kWh/year (3 model average)

* Survey by 3 major vendors

Note: Hours of use and frequency of use are taken from the industry's voluntary standard.

As listed above, the shipment ratio of the models with dry/deodorant function is high. However, these functions are made with only a Nichrome heater and a fan, which has no room for technological improvement. In addition, daily energy consumption of the dry/deodorant functions is low, and thus they are exempted. Concerning the room heating function, although its daily energy consumption is somewhat high, the shipment ratio is low at 6.0%, and thus it is also exempted.

Attachment 6

Electric Toilet Seats Evaluation Standard Subcommittee,
Energy Efficiency Standards Subcommittee of
the Advisory Committee for Natural Resources and Energy
Background of Holding

1st Subcommittee Meeting (December 1, 2006)

- Public opening of Electric Toilet Seats Evaluation Standard Subcommittee
- Current status of electric toilet seats
- Target scope of electric toilet seats
- Definition of energy consumption efficiency and the measurement method

2nd Subcommittee Meeting (February 13, 2007)

- Definition of energy consumption efficiency and the measurement method

3rd Subcommittee Meeting (April 25, 2007)

- Categories of electric toilet seats for target setting
- Concept of the target standard values for electric toilet seats

4th Subcommittee Meeting (May 8, 2007)

- Target standard values for electric toilet seats
- Interim report (draft)

Interim report was open for public comments during the period from May 9, 2007 through June 7, 2007; then, three comments were received from three stakeholders. Thus, it was adopted as the final report after necessary modifications were made.

Attachment 7

Overview of Comments on Interim Report by Electric Toilet Seats Evaluation Standard Subcommittee and Response by the Administrative Office

○ Interim report by the Subcommittee was open for public comments for 30 days from May 9, 2007; then, three comments were received.
○ Overview of these comments and responses by the administrative office are as follows.

<table>
<tr><th>Item</th><th>Submitter</th><th>Overview of Comment</th><th>(Reference) Concept in “Interim Report”</th><th>Proposal by the administrative office</th></tr>
<tr>
<td>Categorization method for electric toilet seats</td>
<td>General (2 cases)</td>
<td>
As for warm-water-shower toilet seats, the warm-water storage type and the instantaneous type shall be treated within single category.
(Reason)

According to the basic principle of Top Runner method, categories shall be determined, taking account of “1) basic physical quantity, etc. of the target products, which are closely related to energy consumption efficiency of the products, and 2) factors representing consumers’ needs”. The interim report states that “in the diversified consumers’ needs for shower function, a solid preference still remains for products that spout a certain amount of water or have warm-water tanks of a certain capacity”. However, in the interim report, consumers’ needs for shower function are not indicated; meanwhile, consumers’ dissatisfaction for the maximum water-spouting ability of instantaneous type is not revealed either. There is a possibility that consumers select more warm-water storage type than the other simply due to its cheaper price. In light of the above, it is not appropriate to categorize electric toilet seats further than the availability of shower function.
In addition, the basic principle of Top Runner method states that products shall be assigned different categories, in case that “there is a high probability that price increase of product due to incorporated advanced energy-saving technologies cannot be recovered by reducing the running costs in a certain period based on the actual status of use”. Compared to the status in 5 years ago, the price difference between the warm-water storage type and the instantaneous type has decreased, as the instantaneous type spreads. Therefore, it is highly possible to recover the price increase of the instantaneous type in a certain period of use.

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(Attachment 3)
Categories of Electric Toilet Seats for Setting Target Standard and Related Matters
<u>1. Current Categories of Electric Toilet Seats</u>
Electric toilet seats are categorized as below based on the two parameters that will have impact on annual energy consumption (energy consumption efficiency). Concerning warm-water-shower toilet seats (warm-water storage type), since annual energy consumption correlates with warm-water storage capacity, the standard is expressed in a linear function with warm-water storage capacity as a variable.
(a) Categorization by the availability of shower function
(b) Categorization by the availability of warm-water tank

Warm-water storage type (with warm-water tank):
Water is warmed up by a heater in a warm-water tank in advance and stored there.
Instantaneous type (without warm-water tank):
Water is heated instantaneously at the time of spout.

Table 1. Current Categories of Electric Toilet Seats
<table>
<tr><th colspan="2">Current Categories (Electric Toilet Seats)</th></tr>
<tr><td colspan="2">Warm toilet seats (without shower function)</td></tr>
<tr><td rowspan="2">Warm-water-shower toilet seats (with shower function)</td><td>Warm-water storage type (with warm-water tank)</td></tr>
<tr><td>Instantaneous type (without warm-water tank)</td></tr>
</table>
<u>2. Categorization Method for Electric Toilet Seats</u>
Electric toilet seats shall be categorized according to the current categorization method.
Concerning warm-water-shower toilet seats of warm-water storage type, the current standard is expressed in a linear function with warm-water storage capacity as a variable. However, instead of using a relational expression, a constant value shall be adopted as the standard value for these products, taking into account that their energy-saving has progressed due to downsizing of warm-water tanks and aiming at further promotion of downsizing of warm-water tanks.
(Attachment 4)
Target Standard Values for Electric Toilet Seats
<u>3. Room for Improvement in Energy Consumption Efficiency by Future Technological Progress</u>
[Warm-Water Shower Toilet Seats (Warm-water Storage Type)]
An improvement from the Top Runner value by 5% or so can be expected, resulting from the application of heat loss prevention technologies, e.g. insulating materials, to toilet seats, the enhanced adoption of insulating materials to warm-water tanks, etc.
The current standard is expressed in a linear function with
</td>
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Price difference between the instantaneous type and the warm-water type is about 20,000 yen, and it is highly probable that the price increase due to the adoption of energy-saving technology cannot be recovered by reducing the running costs in a certain period based on the actual status of use (48 kWh/year: difference in target standard values for the instantaneous type and the warm-water storage type).
Price difference: approximately 20,000 yen
Reduction in running cost:
48 kWh/year ≈ 1056 yen
In addition, at this moment, the warm-water storage type accounts for about 80% of total shipment volume of warm-water-shower toilet seat. Such high percentage reveals that there is a market needs for lower-priced products.
Therefore, in the development of standards this time, warm-water-shower toilet seats shall be categorized into either instantaneous type or warm-water storage type.
However, compared to the warm-water storage type, instantaneous type of warm-water-shower toilet seats has better energy-saving capability; thus, to increase the penetration rate of the instantaneous type may lead to the reduction of energy consumption of Japan. In future, when the price difference in these types of toilet seats decreases and when the market needs for lower-priced products is weakened, it is considered to be desirable to treat them in single category.
By the way, the point that “a solid preference still remains for products that spout a certain amount of water or have warm-water tanks of a certain capacity” was taken into consideration, when reviewing a room for efficiency improvement due to technical advancement but not when setting categories.
</td>
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</table>

			warm-water storage capacity as a variable. However, instead of using a relational expression, a constant value shall be adopted as the standard value for this type of products, taking into account that their energy-saving has progressed due to downsizing of warm-water tanks and aiming at further promotion of downsizing of warm-water tanks. Meanwhile, in the diversified consumers' needs for shower function, a solid preference still remains for products that spout a certain amount of water or have warm-water tanks of a certain capacity. Thus, even though the standard is not defined as a linear function with warm-water storage capacity as a variable, the effect from these factors needs to be taken into consideration when estimating the future efficiency improvement. The Top Runner product has a warm-water tank capacity of 0.85 L, while an average capacity of current warm-water tanks is 1.1 L. With an assumption that further downsizing of warm-water tanks will result in an average tank capacity of 1.0 L or so, the effect from differences in warm-water storage capacity due to the diversified consumers needs for shower function shall be estimated as an increase of approximately 7 kWh/year (4% or so). From the above discussion, for the warm-water shower toilet seats (warm-water storage type), an improvement by 1% from the Top Runner value shall be anticipated.	In some cases, the instantaneous type models cannot be used because the power consumption for the simultaneous use of plural units may over the contract demand of electricity.
Room for energy efficiency improvement due to future technological development	General (1 case)	"Instantaneous toilet seat" shall be corrected as "toilet seat which instantaneously heat the seat unit". (Reason) ● In general, when sales staffs at shops explain to consumers, they often use the word "instantaneous type" toilet seat to refer to those which instantaneously heat up water for shower; thus, it may cause misunderstanding.	(Attachment 4) Target Standard Values for Electric Toilet Seats 3. Room for Improvement in Energy Consumption Efficiency by Future Technological Progress [Warm-water-shower Toilet Seats (Instantaneous Type)] An improvement from the Top Runner value by 6% is anticipated resulting from the application of heat loss prevention technologies, e.g. insulating materials, to the toilet seat and the introduction of innovative technologies such as those seen in instantaneous heating toilet seats and in plastic toilet bowls.	Correction shall be made as pointed out.

Attachment 8

Electric Toilet Seats Evaluation Standard Subcommittee,
Energy Efficiency Standards Subcommittee of
the Advisory Committee for Natural Resources and Energy
List of Members

Chairman:	Tetsuji Oda	Professor, Graduate School of Engineering, The University of Tokyo
Members	Hitoshi Aida	Professor, Graduate School of Frontier Sciences, The University of Tokyo
	Shoichiro Ozeki	General Manager, Energy Environment Technology Division, Energy Conservation Center, Japan
	Tamaki Kamata	Assistant to Director, Products Testing Department, National Consumer Affairs Center of Japan
	Toshikazu Kenmostu	Executive Director, Japan Consumer's Association
	Fumio Takemura	Senior Researcher, Thermal and Fluid System Group, Energy Technology Research Institute, National Institute of Advanced Industrial Science and Technology
	Akio Tanaka	Director of Research Office, Jyukankyo Research Institute Inc.
	Kiyoshi Fujino	Advisor, Energy Conservation Promotion Committee, Warm-Water-Shower Toilet Seat Council

Reference

Current Status of Electric Toilet Seats

1. Market Trend of Electric Toilet Seats

1－1 Domestic Shipment Volume of Electric Toilet Seats

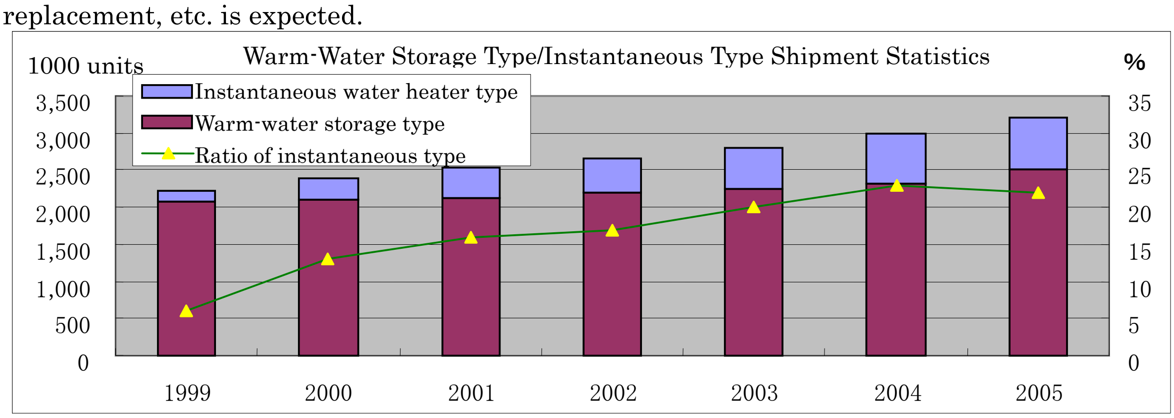
Electric toilet seats are categorized into two groups: warm-water-shower toilet seats having a shower function and warm toilet seats for seat warming function only. Figure 1 shows the shipment volume of electric toilet seats in the previous seven years. Because of the increase in warm-water-shower toilet seats, the total number of electric toilet seats has been increasing every year. On the other hand, warm toilet seats are expected to continue decreasing in number, as they are replaced by warm-water-shower toilet seats.

	Fiscal Year	1999	2000	2001	2002	2003	2004	2005
Shipment volume (1000	Warm-water-shower toilet seat	2,220	2,391	2,532	2,648	2,805	2,988	3,208
	Warm toilet seat	530	500	462	519	512	492	466
	Total	2,750	2,891	2,994	3,167	3,317	3,480	3,674

Figure 1. Changes in Total Domestic Shipment Volume
(Survey by the Warm-Water-Shower Toilet Seat Council and Association of Living Amenity)

1－2 Domestic Shipment Volume of Warm-water-shower Toilet Seats

The domestic shipment volume of warm-water-shower toilet seats has been increasing every year, along with the increased consciousness about cleanliness/amenities among Japanese people and the improved functionality of the products by the efforts of manufacturers. According to the survey by the Cabinet Office (results from a research conducted in March 2006), the penetration rate has reached 62.7% in FY 2005 as shown in Figure 3, coming closer to that of fan heaters (67.5%) and personal computers (68.3%). From now on, demand for this product due to replacement, etc. is expected.



	Fiscal year	1999	2000	2001	2002	2003	2004	2005
Shipment volume (1000 units)	Warm-water storage type	2,086	2,091	2,136	2,204	2,245	2,313	2,503
	Instantaneous water heater type	134	300	396	444	560	675	705
	Total	2,220	2,391	2,532	2,648	2,805	2,988	3,208

Figure 2. Changes in the Shipment Volume of Warm-Water-Shower toilet seats
(Survey by the Warm-Water-Shower Toilet Seat Council)

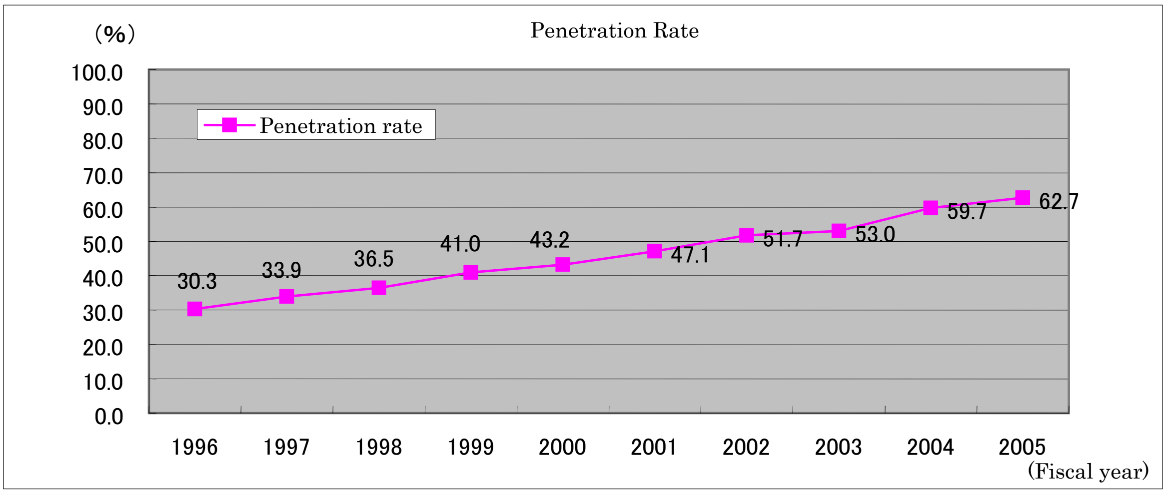
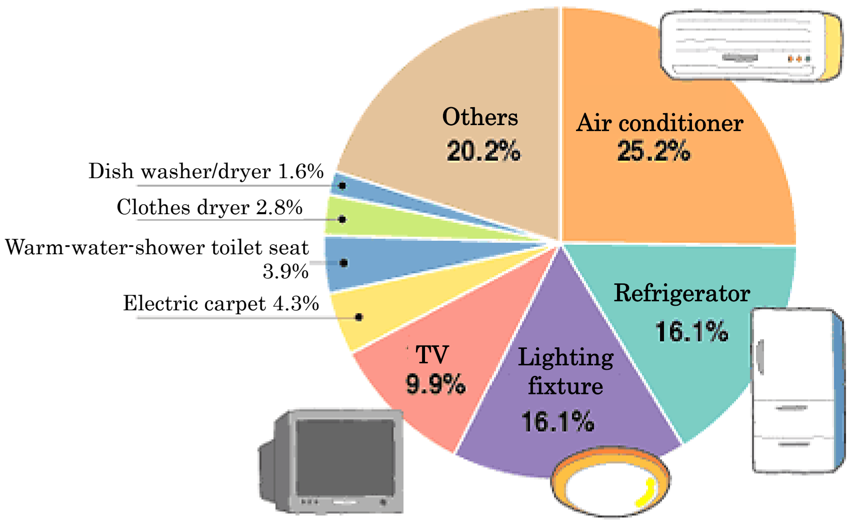


Figure 3. Penetration Rate of Warm-Water-Shower Toilet Seats
(Consumer Trend Survey conducted by the Cabinet Office in March 2006)

1－3 Energy Consumption of Electric Toilet Seats

Composition ratio of the household energy consumption is as illustrated below. Electric toilet seats account for approximately 4% of the total household energy consumption.



Source: Outline of Electric Power Supply and Demand in FY 2004,
Agency for Natural Resources and Energy (Estimation for FY 2003)

1－4 Major Domestic Manufacturers (in Alphabetical Order)

Major domestic manufacturers are as follows.

AISIN SEIKI Co., Ltd., Asahi Eito Co., Ltd., Hitachi Housetec Co., Ltd., INAX Corporation, Janis Ltd., Matsushita Electric Industrial Co., Ltd., Matsushita Electric Works, Ltd., SAN-EI Faucet Mfg Co., Ltd., Tega SANYO Industry Co., Ltd, TOTO Washlettechno Co., Ltd.

2. Achievement Status of Energy Conservation Standards of Electric Toilet Seats

2 − 1 Categories of Evaluation Standards under the Energy Conservation Law

Current categories of electric toilet seats specified by the Energy Conservation Law are as shown in Table 1.

This fiscal year (2006) is the target fiscal year for them, and it is mandatory to achieve the standards based on the actual shipment volume of this fiscal year. For each manufacturer and each category, a weighted average value obtained with the shipment volume shall not exceed the value listed in the right column of Table 1.

Table 1. Categories under the Energy Conservation Law

Category	Standard energy consumption efficiency or the calculation formula
Warm toilet seat	162 (kWh)
Warm-water-shower toilet seat without warm-water tank (Instantaneous type)	189 (kWh)
Warm-water-shower toilet seat with warm-water tank (Warm-water storage type)	$P = 38.3 \times L + 243$ (kWh)

L: Warm-water storage capacity (unit: liter)

2 − 2 Achievement Status of Standards Specified under the Energy Conservation Law

Table 2 shows the achievement status of the overall industry in the first quarter of FY 2006. (Weighted average of achievement rate shown in row B is used for the evaluation of achievement.)

Table 2 Achievement Status of Energy Conservation Standards of Electric Toilet Seats
(Survey by the Warm-Water-Shower Toilet Seat Council, April – June, 2006)

	Item	Warm toilet seats	Warm-water-shower toilet seats	
			Warm-water storage type	Instantaneous type
A	Sales volume (units) (April – June, 2006)	89,590	583,722	128,495
B	Weighted average of achievement rate (%)	100.5 (4 vendors)	104.7 (9 vendors)	104.2 (4 vendors)
C	Number of models sold	11	142	25
D	Number of models achieving the standards	11	104	22
E	Percentage of models achieving the standards (%) (D/C × 100)	100.0	73.2	88.0

Concerning the warm-water-shower toilet seats, as shown above, the industry as a whole has already achieved the standards. In addition, a further shift from old models of before the measures to new energy efficient type models is expected. Thus, it is almost certain that the standards will be achieved.

In contrast, the weighted average of achievement rate indicates that the warm toilet seats have just cleared the target standards because of the shrinking market size and the limited adoption of energy-saving technologies due to the cost problem.

3. Efforts for Energy Saving Technologies

Core technologies for the energy saving of electric toilet seats are "power-saving control technology" and "heat loss prevention technology," and the efforts have been made to reduce power consumption taking into consideration the safety, cost and usability as an electric heating appliance.

3－1 Power Saving Control Technology

The nature of electric toilet seat is that the timing of use during the day or night is unpredictable, and thus technology has long been focused on keeping the toilet seat warm. However, coupled with electric toilet seats being designated as the designated machineries and products of the Energy Conservation Law and coupled with the consumers' growing interests in energy conservation, as a result of manufacturers' voluntary efforts, products are now equipped with various types of usable energy-saving technologies (e.g. timer controlled power-saving, functions concerning users' life pattern, functions maintaining warmth at low-temperature when not in use) which can minimize sacrifice of comfort; and, such products have already been introduced to the market. In this way, the efforts have been made for electric toilet seats to reduce energy consumption.

Condition	Method of power-saving control	Power Saving Method, Description	Characteristics
Power shutdown	(a) Timer (Micro-computer)	・While users are not using a toilet, e.g. at night, power supply to a heater of toilet seat is automatically shutdown for a certain period of time every day. ・Power-saving time is selectable from 1 – 3 settings. ・In case of being used during the power-saving period, power supply to the heater is activated at the time when the user is seated, etc.	・The maximum power-saving effect is provided every day for a certain period of time. ・To increase the frequency of use of power-saving function is an issue to be tackled. ・Toilet seat is cold at the time of use during a power-saving period (e.g. night).
	(b) Learning control (Micro-computer)	By learning a toilet usage pattern, power supply to a heater of toilet seat is shutdown during hours of the least frequency of use.	・The maximum power-saving effect is provided every day for a certain period of time. ・To increase the frequency of use of power-saving function is an issue to be tackled. ・Power saving is automatically carried out. ・Toilet seat is cold at the time of use outside the pattern.
Heat-Retention at low temperature	(c) Learning control (Micro-computer)	By learning a toilet usage pattern, power supply to a heater of toilet seat is controlled to keep the seat unit at a low temperature during hours of the least frequency of use.	・Power saving is automatically carried out. ・Easy to match the users life pattern. ・The seat is cold at the time of use outside the pattern.
	(d) Human sensor (Sensor)	While nobody is present (= not in use), the temperature is kept low; and upon the detection of human entry, the temperature is raised to the preset level.	・Power saving is effective while being not used. ・The temperature at the time of being seated is an issue to be tackled.
	(e) Toilet-lid-closed sensor (Sensor)	While the toilet lid is closed (= not in use), the temperature is kept low; and upon the opening of the lid, the temperature is raised to the preset level.	・Power saving is effective while being not used. ・The temperature at the time of being seated is an issue to be tackled.

Figure 13. Power saving control for electric toilet seats

Recently, in addition to the timer controlled power-saving function [method (a)], increasing number of models are equipped with other power-saving functions [(b) through (e)] considering users' life and usage patterns. To ask users to fully utilize the functions according to their life patterns, the industry is actively performing promotion activities.

(Reference: See attached materials)

3 – 2 Heat Loss Prevention Technology

Efforts have been made to improve the prevention of heat loss from the toilet seat unit and water warmer unit in heat-retention state.

3 – 2 – 1 Toilet Seat Unit

Example of improvement on the shape of toilet lid

It is well known that “closing the toilet lid” is one action item for improving the energy saving effect.

If the toilet seat is warmer than the room temperature, heat is continuously released from the toilet seat. The closed toilet lid prevents the heat loss and improves the energy saving effect. Compared to when the lid is open, the closed lid provides a reduction of annual energy consumption by approximately 10% (in the case of warm-water storage type).

To improve this effect, for example, the toilet lid is shaped to cover the toilet seat periphery. In this case, heat release from the periphery is prevented whereby the heat from the toilet seat is held in the space created between the toilet seat and the lid. However, this design needs additional raw materials, and thus the resource saving issue still remains.

In addition, since a toilet lid determines the exterior appearance and affects the product design as well, it is also necessary to fully consider the consumers’ needs for design.

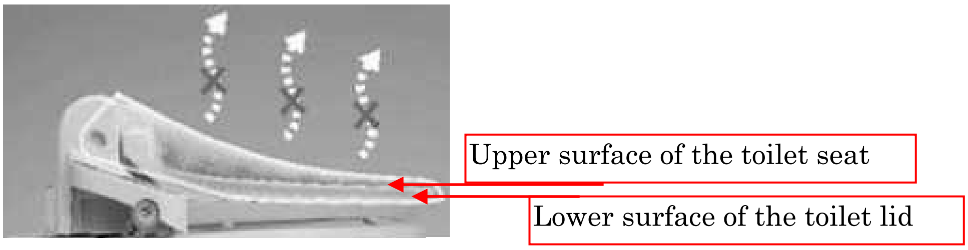


Figure 14. Product with the toilet lid closed

3 – 2 – 2 Example of Improvement on Temperature Distribution in the Toilet Seat

On the overall surface of the toilet seat, temperature distribution shows a complex pattern as shown in Figure 15. It is important, when seated, for the sensory temperature to be comfortable and uniform.

By leveling out the non-uniform areas (high-temperature area) with a close investigation into temperature distribution, energy consumption can be reduced. Therefore, meticulous considerations are given in designing with respect to the surface temperature distribution (fine tuning of the heater pattern, etc.).

[Example of Improvement]

If the condition on the left is modified to the condition on the right, energy consumption of the toilet seat unit can be reduced by approximately 2% (in the case of this toilet seat).

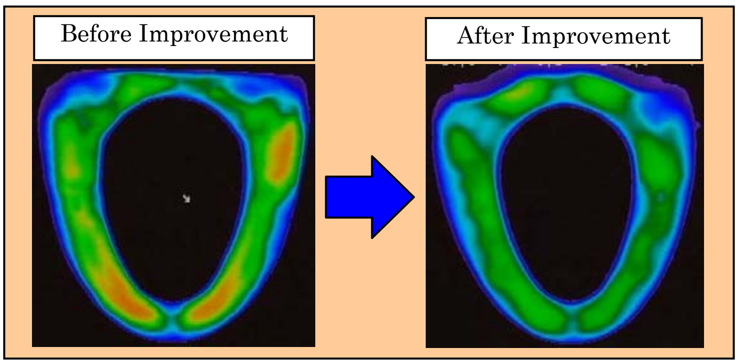


Figure 15. Improvement of temperature distribution on the toilet seat

3 − 2 − 3　Water Warmer Unit

In a warm-water storage type product, a heater is immersed in the water and directly heats it up; thus, there remains little room for improvement in energy conversion efficiency. This is the same for the instantaneous type products in which the water is heated up at the time of use.　However, for the warm-water storage type products, the following efforts have been made to improve the prevention of heat loss at a water warmer unit in a heat-retention state.

(1) Example of the reduction in the surface area of warm-water storage tank

In addition to the improvement as described in 1, for further reduction of the surface area, ribs (protruding parts) on the outer surface are removed as much as possible without interfering with its essential function.　By doing so, prevention of heat loss is attempted.

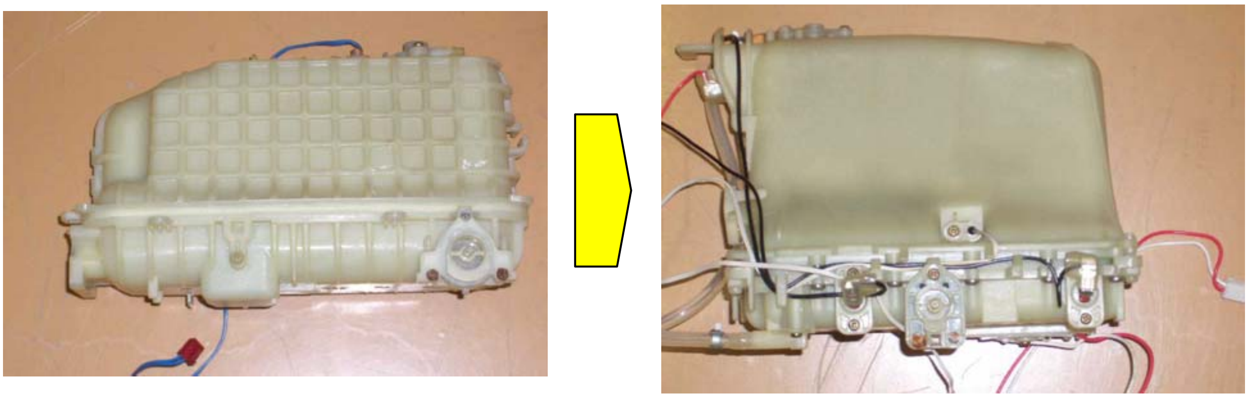


Figure 16. Example of the reduction in the heat releasing surface area

(2) Example of attachment of insulation materials to warm-water tank

In a warm-water storage type product, warmed water is maintained at around 38°C. Heat release occurs at a warm-water tank due to the difference with the ambient temperature.　To reduce the heat loss, the outer surface of the storage tank is covered with insulation materials without interfering with the safety and merchantability of the product (e.g., compactness).

However, an insulation effect as great as in electric hot water pots cannot be expected because of the warm-water storage temperature being near body temperature and its storage capacity of around 1 L.　In addition, the attachment of materials seen in this example raises the issue of saving resources.

Figure 17. Example of insulation materials attached to the warm-water tank

3 – 3　Various Power Saving Systems

Power-saving technologies adopted in currently commercialized products are as follows.

3 – 3 – 1　Timer Controlled Power Saving

The user sets up the power-saving time (e.g., 6 hours or 8 hours) which is a not-in-use period, e.g. at night, whereby the power supply to the water warmer unit and toilet seat unit is shut down for the preset hours everyday.

[Advantage] Maximum power saving effect is provided by single switch operation to shut down the power supply to the heater.

[Disadvantage] On rare occasions, the seat is cold at the time of use during the power saving period (e.g. at midnight).

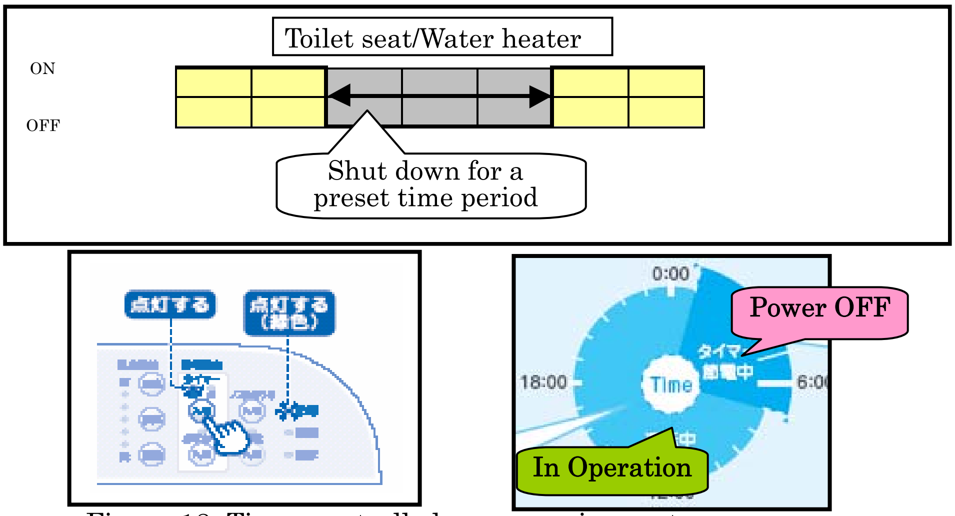


Figure 18. Timer controlled power saving system

3 – 3 – 2　Learning Control System

The toilet seat automatically learns the user's toilet usage pattern and predicts the hours of the least frequency of use.　During the hours, the water warmer unit and toilet seat unit are kept at a low temperature (heat-retention at low temperature), or the power supply is shut down.　Usage in a more stable life pattern brings about a greater effect.

[Advantage] Power saving is automatically carried out according to the user's life pattern.

[Disadvantage] On rare occasions, the seat is cold at the time of use outside the usage pattern.

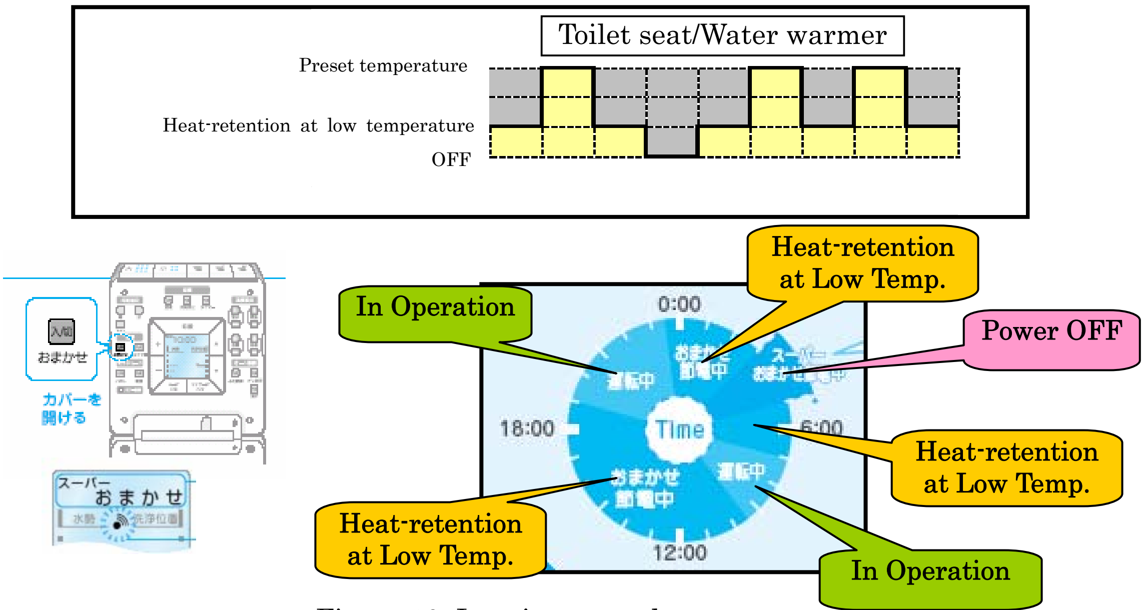


Figure 19. Leaning control system

3 − 3 − 3 Human Detection/Closed-toilet-lid Detection System

This is a power saving method that is to lower the temperature of water warmer unit and/or toilet seat unit or to shut down the power supply when detecting the not-in-use condition (where nobody is present).

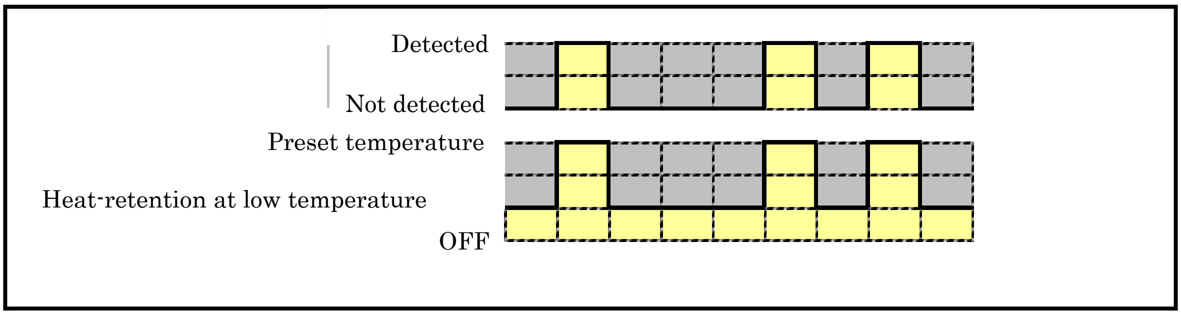


Figure 20. Closed-toilet-lid Detection system

[Advantage] Low temperature is maintained or power supply is shut down while not in use (the toilet lid is closed), resulting in greater power saving effect.
[Disadvantage] In case of a low capacity heater, it is difficult to sufficiently warm up the seat unit by being seated.

Power-saving methods described the above are currently available, and manufacturers have equipped their products with multiple power-saving methods. They can be activated in parallel (combination of timer controlled power-saving system and other systems); therefore, further energy-saving effect can be achieved.

3 − 4 Improvements Achieved by Efforts for Energy Saving Technologies

Energy-saving improvement effect as a result of utilization of technologies described in "3. Efforts for Energy Saving Technologies" are as follows.

1) Instantaneous type

When Top Runner standard was developed (April 2002)			in 2006 *
Annual average energy consumption	208 (kWh/year)	⇒	189 (kWh/year)
			Approx. −9%

2) Warm-water storage type

When Top Runner standard was developed (April 2002)			in 2006 *
Annual average energy consumption	348 (kWh/year)	⇒	277 (kWh/year)
			Approx. −20%

3) Warm toilet seats

When Top Runner standard was developed (April 2002)			in 2006 *
Annual average energy consumption	183 (kWh/year)	⇒	156 (kWh/year)
			Approx. −15%

* Source: The Energy Conservation Center, Japan

4. New Warm Toilet Seat System

In addition to the conventional system that keeps the toilet seat warm at the use temperature, products with a new warm toilet seat system are emerged. In that system, a new technology is employed that is to heat up the toilet seat only when it is used but otherwise maintain it below the use temperature.

Structural differences are compared in the illustration below.

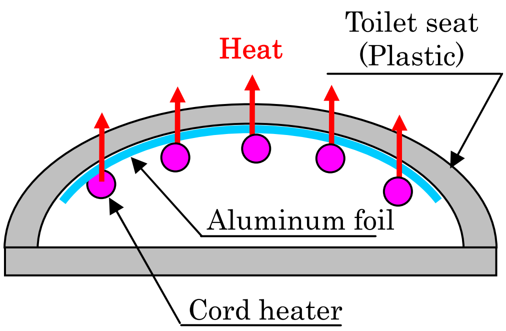
<table>
<tr><th>Conventional Technology</th><th>New Technology</th></tr>
<tr><td>- Heating with a cord heater
A toilet seat heater is made of a cord heater, which is adhered to aluminum foil. Using the adhesives on the reverse side of the aluminum foil, the seat heater is then adhered to the inner surface of the upper part of the toilet seat (plastic).
The energized toilet seat heater generates heat, which is then diffused through the highly heat conductive aluminum foil to warm the upper surface of the toilet seat.


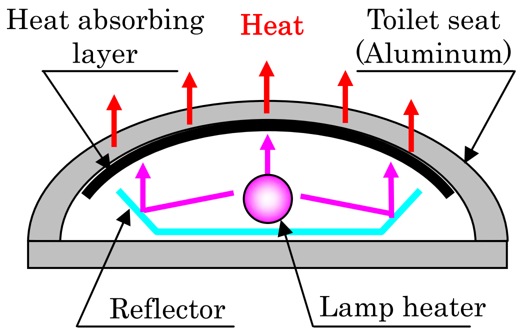
Figure 1</td><td>- Heating with a lamp heater
A lamp heater and a reflector are installed inside the toilet seat. The upper part of the toilet seat is made of aluminum with a heat-absorbing layer attached to the inner surface.
Radiation heat from the energized lamp heater is efficiently transferred to the upper part of the toilet seat with a use of reflector and then diffused through the highly heat conductive aluminum body to warm the upper surface of the toilet seat.


Figure 2</td></tr>
</table>

Conventional technology employs a structure as illustrated in Figure 1. With this structure, it takes a certain time for the toilet seat surface to reach the preset temperature after the heater starts warming up the seat; hence it needs to be always kept warm near the preset temperature while usage is expected, although the users sit on the toilet seat only for a short time in a day. To satisfy both energy saving and the consumers' needs, various power saving control technologies are employed such as the power shutdown and the heat-retention at a low temperature during not-in-use hours (e.g. night time).

With the new technology, the toilet seat surface is warmed up in a short time upon detecting the user, whereby the seat temperature can be maintained at low in a heat-retention state, resulting in a significant reduction in the power consumption used for keeping the toilet seat warm. As for the specific structure shown in Figure 2, radiation from a lamp heater is converted to heat through a heat-absorbing layer attached to the inner surface of the toilet seat body (aluminum material), and the heat is then transferred to the surface of the toilet seat. Whereby, the temperature rise-time of the toilet seat is reduced down to approximately 6 seconds, which is 1/30th of the conventional rise-time of approximately 3 minutes (data by Matsushita Electric Industrial Co., Ltd.).

This result has been realized by integrating two technologies: (a) a lamp heater having an extremely fast start-up as a high-temperature radiation source and whose filament has much smaller heat capacity than those of other heat sources; and (b) a toilet seat made of highly heat-conductive aluminum material which is able to homogenize the radiation heat from the lamp heater and quickly create a comfortable surface temperature distribution.

A human detection sensor is used as a means for detecting the user. The sensor is installed facing to the restroom door, so that an entering person can be immediately detected when the door is opened, ensuring enough time for the toilet seat to be warmed to the level which does not allow for any cold sensation.

Figure 3 shows a relationship between the surface temperature of toilet seat made with aluminum and the degree of comfortableness when the user is seated. As the toilet seat temperature rises, the comfort level also increases; and it reaches the comfortable zone when the surface temperature becomes 29°C or higher. Figure 4 shows a survey result on the time elapsed from the activation of human detector by opening the restroom door to when the user is seated on. While the time varies depending on the clothes worn, age, gender, etc., the result shows that the average time is 8 seconds, and the fastest time is 6 seconds. Based on these results, the new warm toilet seat system is designed to keep the toilet seat unit warm at a low temperature while it is not being used and to warm it up to the cold sensation threshold temperature, i.e. 29°C, within 6 seconds only when being used. Due to this new technology, a warm toilet seat achieves excellent energy saving while providing a level of comfort unchanged from the conventional warm toilet seats.

It is desirable that effort will be made for the further penetration of this new warm toilet seat system through working on the cost reduction.

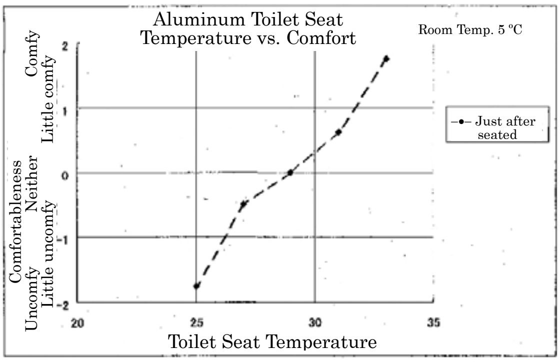


Figure 3
(Data by Matsushita Electric Industrial Co., Ltd.)

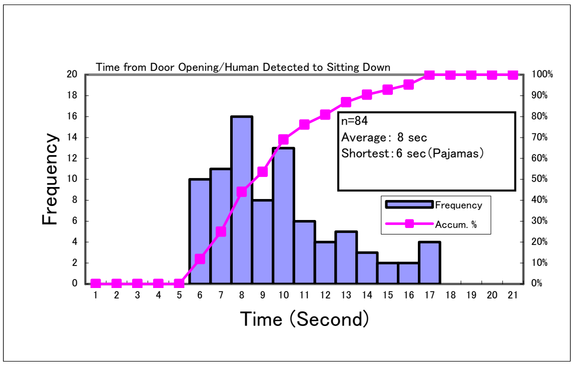


Figure 4
(Data by Matsushita Electric Industrial Co., Ltd.)

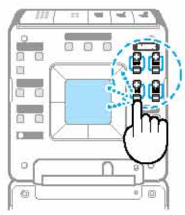
A comparison between conventional and new technologies for miscellaneous items

No.		Conventional Technologies	New Technologies
1	Goal	- Warm and comfortable toilet seat at any time when seated - Safety, cleanliness, corrosion resistance and energy saving	- Warm toilet seat only when seated - Safety, cleanliness, corrosion resistance and energy saving
2	Warm-up system	Heating with a cord heater	Heating with a lamp heater
3	Rated power	Approximately 50 W	Approximately 1200 W
4	Safety device	Temperature fuse	Radiation thermostat, Temperature thermostat
5	Toilet seat materials	Upper and lower surface of the toilet seat: Plastics Toilet seat heater: Cord heater, Aluminum foil, Thermistor, Temperature fuse, etc.	Toilet seat upper surface: Aluminum Toilet seat lower surface: Polypropylene Toilet seat heater: Lamp heater, Reflector, Thermistor, Thermostat, etc.
6	Power supply system	Temperature proportional control, or on/off switch control	Temperature proportional control, or on/off switch control
7	Energy saving effect	- Further homogenized temperature distribution on the toilet seat - Reduction in the power consumption for heat-retention during not-in-use period by means of power shutdown/power supply control	- Drastic reduction in power consumption for heat retention by means of lowering the temperature of the toilet seat in standby - Further homogenized temperature distribution on the toilet seat
8	Technical challenge	- Further energy saving	- Capability to raise the toilet seat temperature faster (Further energy saving by further lowering the temperature in a heat-retention state)

Reference (Examples of operation manual)

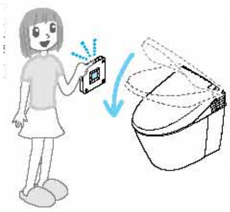
Set the temperature adjustment to a lower level

Save electricity by adjusting the preset temperature to a lower level within a range that does not cause a cold sensation. (Page 18)



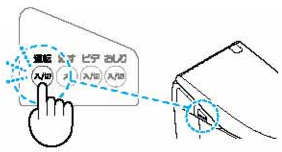
Keep the toilet lid closed

Save electricity by keeping the toilet lid closed to reduce heat loss from the toilet seat surface.



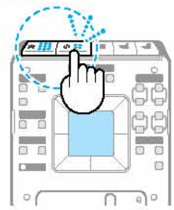
When not in use for a long time, set the "Operation On/Off" switch to the "Off" position

Save electricity by setting the "On/Off" switch to the "Off" position when going out.



Select the appropriate switch, "Large" or "Small" (feces/urine) on the "Toilet wash remote control"

Save water by appropriately selecting the "Large" or "Small" switch.



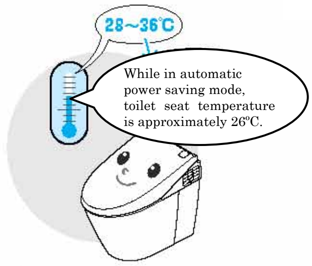
Save power, save water, and protect the global environment

Timer controlled power saving
(Page 38)

Once you set a timer, the toilet seat heater is switched off every day at the preset time, and you can save power. The power saving time can be preset to 3, 6 or 9 hours.

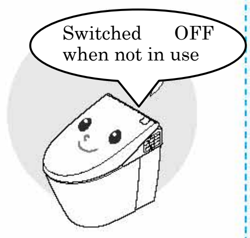
Automatic power saving
(Page 38)

The least frequently used hours are memorized to automatically lower the toilet seat temperature, and you can save power.



Super Automatic power saving
(Page 38)

While performing the automatic power saving, the toilet seat heater is automatically switched off when not in use.



"Timer controlled power saving" and "(Super) Automatic power saving" can be simultaneously used.