Document 3-7

Final Report by Copying Machine Criteria Standard Subcommittee, Energy Efficiency Standards Subcommittee of the Advisory Committee on Energy

The Subcommittee undertook deliberations on the matters that should serve as criteria of copying machines with respect to energy efficiency for manufacturers or importers (hereinafter referred to as "manufacturers"), and made a final summary as follows:

1. Scope of application

The summary shall cover a dry type indirect electrostatic copying machine. However, it shall exclude a copier whose copying speed is 86 copies/minute or higher, a copier for large-sized paper such as A2 size or larger, and a color-copying machine. In addition, it shall cover a multifunctional device that is only equipped with the copying function before shipment, and any multifunctional device having the copying function, capabilities of a facsimile and printer, etc. before shipment (See Attachment 1) shall not be included.

2. Items of standard criteria for the manufacturers.

(1) Target fiscal year: fiscal year 2006

(2) Target standard value

The manufacturers, etc. of each copying machine shall ensure that for copiers to be shipped to the domestic market in the target fiscal year, a numeric value that is to be obtained by taking weighted averages of energy efficiency measured according to the method defined in (3) below, with shipments for every category of the following table will not go beyond the target standard value.
(See Attachments 2 and 3.)

	Segment by Copying Speed (CPM)	Target Standard Value (Wh/h)
A-4 size copier	～10	11
	11～20	17
	21～30	69
	31～40	88
	41～50	123
	51～60	144
	61～70	180
	71～80	200
	81～85	258
B-4 size copier	～10	17
	11～20	20
	21～30	85
	31～40	108
	41～50	151
	51～60	176
	61～70	221
	71～80	246
	81～85	317

	Segment by Copying Speed (CPM)	Target Standard Value (Wh/h)
A-3 size copier	～10	19
	11～20	55
	21～30	99
	31～40	125
	41～50	176
	51～60	205
	61～70	257
	71～80	286
	81～85	369
A-3Y size copier	～10	27
	11～20	77
	21～30	139
	31～40	175
	41～50	246
	51～60	287
	61～70	383
	71～80	433
	81～85	483

Note) Copying speed: Number of copies that can be made in a minute (CPM)

Energy efficiency: Energy consumption per hour (Wh/h)

A3Y machine: A copier with the maximum copying size (maximum sheet width) is the width of A3 size, portrait-format.

(3) Measuring method

1) The unit of energy efficiency shall be “Wh/h”.

2) The energy efficiency shall be a value of energy consumption per hour that is determined by measuring energy consumption A (Wh) of power measurement pattern A and energy consumption B (Wh) of the pattern B, and then calculating them with the following expression (See Attachment 4):

Energy consumption per hour = (A+7B)÷8 (Wh/h)

(4) Display items

1) The following items shall be displayed:

・ Product name and model name

・ Copying speed

・ Energy efficiency

・ Name or appellation of a manufacturer, etc.

2) Unit of energy efficiency to be displayed shall be “Wh/h”.

3) The display items shall be displayed in a catalogue or an instruction manual. (See Attachment 5)

3. Recommendations toward energy conservation

(1) Efforts to be made by Users

Users shall not only make efforts to select a copier with better energy efficiency but also try to take energy saving measures by using a copier appropriately and efficiently.

(2) Efforts to be made by Manufacturers

1) Manufacturers shall promote technological development toward energy conservation of copiers, and attempt to develop a copier with better energy efficiency.

2) In order to promote widespread use of a copier with good energy efficiency, manufacturers shall attempt to encourage users to have better understanding on this.

(3) Efforts to be made by the Government

In order to promote widespread use of a copier with good energy efficiency, the government shall make efforts to take necessary measures such as political assistance and enlightenment activities for prevalence, etc to encourage users to have better understanding and manufacturers to have better approach.

4. Background of review, etc.

(1) History of the subcommittee meetings that have been held so far (See Attachment 6).

(2) List of names of committee members (See Attachment 7).

(Attachment 1)

Target Scope

1. Definition of equipment

It shall be a dry type indirect electrostatic copying machine.

Reason: Mainly, copiers that are generally used in offices, etc., shall be covered.

2. Items to be excluded

(1) Copiers whose copying speed is 86 copies per minute or higher

Reason: A copier whose copying speed is 86 copies per minute or higher is mainly used for special applications at a printer, and its market share is very small (1 percent or less). In addition, since most of the copiers in this category are difficult to use with a general power supply, etc., they shall be excluded.

(2) Copier for large-sized paper such as A2 size or larger

Reason: A copier whose maximum copying size (maximum sheet width) is A2 or larger is mainly used for special application at a designer, and its market share is very small. In addition, most of the copiers in this category are difficult to use with a general power supply, etc., they shall be excluded (See Reference 2).

(3) Color copying machine

Reason: As its market share is small and measurement method and evaluation method have not been established, they shall be excluded (See Reference 2).

Note) For color copying machines, we should attempt to keep track of use thereof, review the number of installations, progress in establishment of the measurement/evaluation methods, etc., and consider the possibility of including them to this target scope, as necessary.

(4) Multifunctional devices (excluding those only equipped with the copying function at shipment)

Reason: Since a multifunctional device has combined capabilities of a copier, facsimile, or printer, etc., and its definition and methods of measuring/evaluating have not been established, it shall be excluded (See Reference 2).

Note) For multifunctional devices, we should attempt to keep track of use thereof, review the number of installations, progress in establishment of the measurement/evaluation methods, etc., and consider, as necessary, the possibility of including them to this target scope as promptly as possible in the future.

Reference 1

Copier Shipment Trend

1. Transition of production volume, etc.

(Unit: million yen)

	1992	1993	1994	1995	1996	1997
Value of production	552,737	518,584	537,233	539,500	546,003	632,577
Value of export	346,659	316,196	309,924	296,790	306,179	394,528
Value of import	3,890	5,265	11,385	19,408	24,374	26,948
Domestic market	209,968	207,653	238,694	262,118	264,198	264,997

(Value of production: Survey of industrial production by the Ministry of International Trade and Industry, Value of export/import: Foreign trade statistics by the Ministry of Finance)

(Domestic market = Value of production – Value of export + Value of import)

2. Transition of shipment volume, etc.

(Unit: 1,000 units)

	1992	1993	1994	1995	1996	1997
Volume of production	2,377	2,208	2,144	1,957	1,903	2,202
Volume of export	1,701	1,518	1,415	1,274	1,168	1,386
Volume of import	22	62	153	262	286	308
Domestic shipment volume	698	752	882	945	1,021	1,124

(Volume of production: Survey of industrial production by the Ministry of International Trade and Industry, Volume of export/import: Foreign trade statistics by the Ministry of Finance)

(Domestic shipment volume = Volume of production – Volume of export + Volume of import)

Reference 2

Estimated Energy Consumption of Copiers

Estimated number of copiers installed in the market 1,000 units

	Analog copier	Copier for large-sized sheets	Digital copiers	Multifunctional devices	Color copying machine	Total of PPC
Number of installations	2,989	157	102	921	154	4,323
Composition ratio	69.1%	3.6%	2.4%	21.3%	3.6%	100.0%

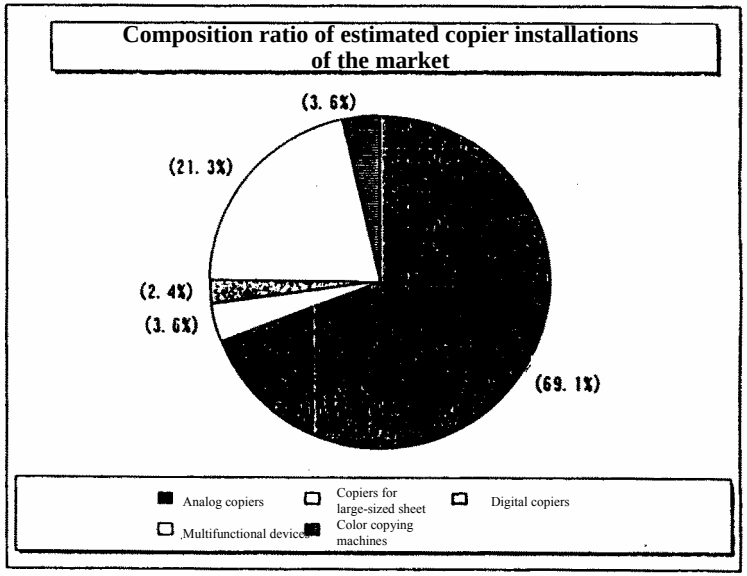
Estimated energy consumption

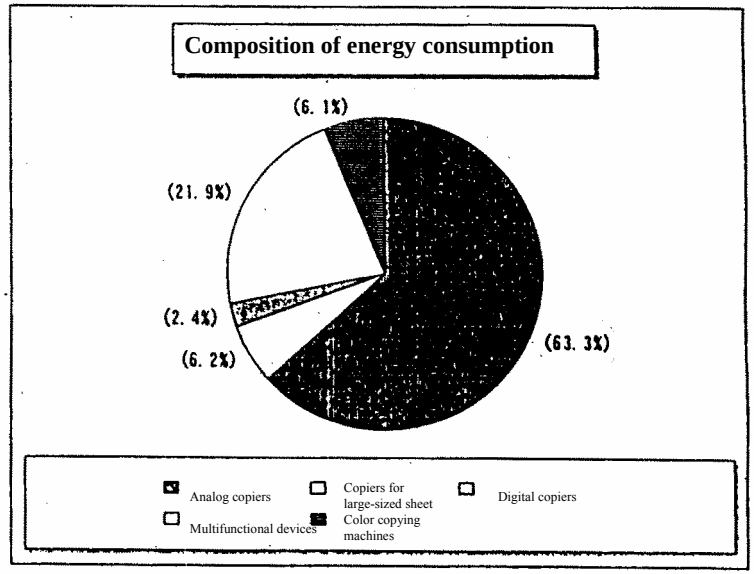
Energy efficiency (Wh/h)	160	300	180	180	300	
Annual energy consumption (kWh/unit)	307	576	346	346	576	
Annual total energy consumption (million kWh)	918	90	35	318	89	1,451
Composition ratio	63.3%	6.2%	2.4%	21.9%	6.1%	100.0%

Energy converted into crude oil

Annual total energy consumption (kl)	85,395	8,410	3,278	29,602	8,249	134,934

Note) The number of copiers installed in the market was estimated from the statistics voluntarily prepared by the Japan Business Machine Makers Association.
The energy efficiency was estimated on typical models.
Annual energy consumption = energy efficiency x 8 (hours) x 20 (days) x 12 (months)
Annual total energy consumption = annual energy consumption x total number of copiers
To convert the energy into crude oil, we used 1kWh = 0.0000930kl.





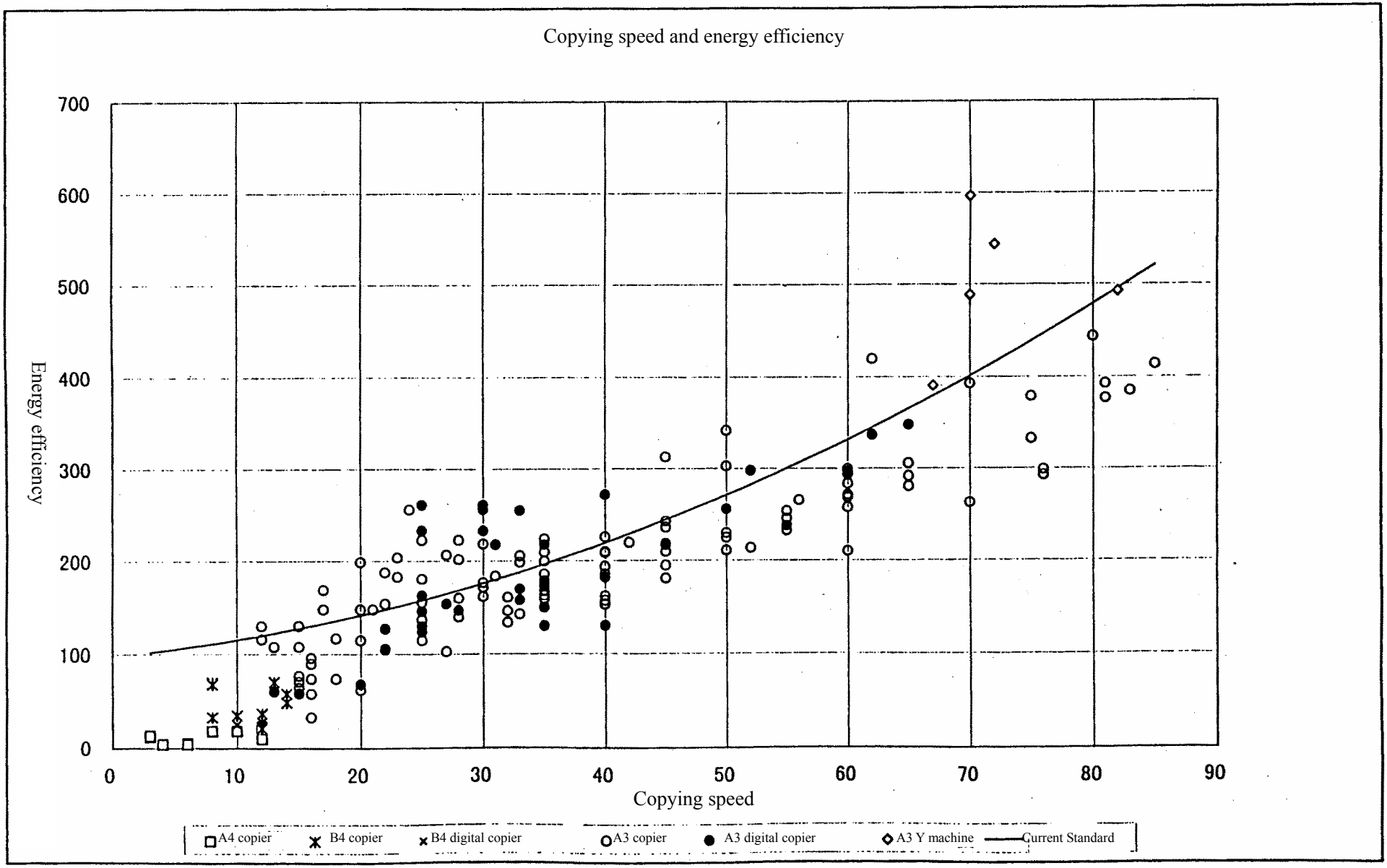
(Attachment 2)

Segmentation for Setting Targets

1. Measures of energy efficiency

(1) A basic measure shall be the copying speed (copies/minute), as with the conventional standard.

(2) Distribution of data on the energy efficiency of copiers (not including excluded items) that have been shipped as of April 1, 1998 is as follows:


Copying speed and energy efficiency
Energy efficiency
Copying speed
0
100
200
300
400
500
600
700
0
10
20
30
40
50
60
70
80
90
A4 copier
B4 copier
B4 digital copier
A3 copier
A3 digital copier
A3 Y machine
Current Standard

Features of Copiers

Category	Number of Models	Features	Main Users
A4 Copier	16	- Copiers of this category have slow copying speed, such as 3 to 12 copies/minute. When a user presses COPY button, predetermined fixing temperatures are reached before a copy sheet reaches a fixing unit. Thus, the copiers often enter OFF mode after completion of copying. - A narrow fixing width and thinning of the thermal roller of the fixing unit shorten warm-up time. - Therefore, power consumption at standby is extremely low, thus substantially improving the energy efficiency.	Homes, family type business, small offices, etc.
B4 Copier	14	- This type has a faster copying speed than an A4 copier, such as 8 to 14 copies/minute, and larger fixing width than the A4 copier. - Although it is smaller compared with the A4 copier, its energy efficiency has substantially increased because of thinning of the thermal roller of the fixing unit.	Small offices, family type business, etc.
A3 Copier	138	- The copying speeds widely range from 12 to 85 copies/minute. - Looking at averages, we can see that energy efficiency has increased because of improvements in respective parts of a copier, such as the fixing unit.	Offices in general
A3 Y Machine	6	- The copying speed is fast, such as 67 to 82 copies/minute. - Although users' needs for copiers of this category is high because they can copy large-sized sheets faster than an A3 copier, improvement of the energy efficiency is difficult to achieve compared with the 3 models described above, due to large width of the fixing unit.	Offices in general, copying center

2. Segmentation

(1) Copiers shall be sorted into A4, B4, A3, and A3Y, depending on the maximum copy size (maximum sheet width):

Reason: The maximum copy size (maximum sheet width) is related to longitudinal width of the fixing component or length of an illumination lamp, and is the important physical quantity that is correlated with the energy efficiency.

Therefore, as differences in such the maximum copy size (maximum sheet width) lead to changes in the energy efficiency, the copiers shall be sorted according to this.

(2) The sorting according to the copying speed shall be performed for the above categories:

Then, the copiers shall be sorted in consideration of the possibility of product shipment in the future:

- For A4 and B4 copiers up to the copying speed of 20 copies/minutes, they shall be sorted by the speed of 10 copies/minute. In addition, although products having the copying speed of 21 copies/minute or faster are not shipped at present, they shall also be sorted by 10 copies/minute, with possible future shipments in mind.
- For A3 copiers, copiers with the copying speed from 0 to 85 copies/minute shall be sorted by 10 copies/minute (those with the speed of 81 copies/minute or faster shall be sorted by 81 to 85 copies/minute).
- For A3Y copiers, copiers with the copying speed of 61 to 85 copies/minute that are currently marketed shall be sorted by 10 copies/minute (those with the speed of 81 copies/minute or faster shall be sorted by 81 to 85 copies/minute). In addition, although products with the copying speed of 60 minutes/minute or less are not marketed at present, they shall also be sorted by 10 copies/minute, with possible future shipments in mind.

Note) Copies have varying outside diameters and thickness of the thermal roller of the fixing unit, depending on the copying speed. In general, the outside diameter and thickness increase as the copying speed increases by 10 copies/minute; thus, the higher speed the copier has, the larger and the thicker they are.

This is because we believe it appropriate to basically sort the copiers by 10 copies/minute, based on such the technological factor of the fixing unit.

(Attachment 3)

Target Standard Value and Target Fiscal Year

1. Setting a Target Standard Value

We shall set respective standard values by taking into account performance of a product that has the best energy efficiency, according to each segment set based on 2 of Attachment 2.
A target reference value for each segment shall be set according to specific numeric values:

(1) Concept for setting the target standard values

1. Concept for setting

As described in the attachment 2, the sorting is based on the technological factors of the fixing unit. In addition, the majority of energy consumption of copiers is consumption at the fixing unit (approximately 60-70%). Thus, when setting a target standard value of each segment, energy consumption of the fixing unit should be considered a basis. In addition, energy consumption of any parts other than the fixing unit account for approximately 30 to 40% and is relatively small. It is thus believed that effects due to its fluctuation will be minor within the same segment, and thus can be eliminated.

Therefore, we believe it appropriate to set target standard values in respective segments according to specific numeric values, based on the energy consumption of fixing unit.

2. Surf fixing method

In a surf fixing method, a heater concentrates heat on a sheet by way of a thin film, and the method is only applied to low-speed copiers at present.

Copiers with this method is specified as specific products and excluded from the consideration for setting target standard values, because this method is:

1. A single company owns not only the base patent of the relevant technology, but also surrounding patents.
2. It seems to be almost impossible that the energy efficiency achieved with the current thermal roller fixing method and other method can exceed that of the surf fixing method.
3. Thus, in the segment in which copiers of surf fixing method are shipped, products that adopt a widely used technology other than the corresponding method (so called thermal roller fixing method) cannot exist, and a single company monopolizes the said category, which might extremely skew the market.

(2) Approach to target setting based on trend in technological development

1) Trend in Technological Development

In order to improve technological development related to energy conservation in the copiers, research and development in the wide areas of low melting toner, improved sensitivity of photoreceptors, reduced electric power of an illuminated light source, reduced torque of a drive system, increased efficiency of a motor transformer and a power source, and introduction of energy-saving mode, etc. as well as improvement of a fixing unit having great power consumption are undertaken.

In this section, we summarized the trend of technological development related to improvement of energy efficiency.

1) Fixing Unit

(Thermal roller fixing method)

The method has been used in areas ranging from low-speed copiers to high-speed copiers. The method is in general use because of reliability of the fixing and sheet transport capabilities.

As far as energy conservation is concerned, in the area of low-speed copiers, thinning of the fixing rollers has subsequently improved energy-saving in a standby state. In the area of medium- and high-speed copiers, although we have promoted not only thinning of the fixing rollers but also improvement of fixing process technology including low melting toner, it has almost reached the end of its improvement, and thus believe that it will be difficult to achieve further improvement.

(Surf Fixing Method)

Thin film is used in the surf fixing method. Hence, we believe it is quite difficult to apply the method to the medium- and high-speed copiers because there are a number of technical challenges to overcome, in view of reliability in heat supply and sheet transport.

(Other Methods)

From patent information, the methods such as radiative heating, resistance heating, induction heating, etc. have been proposed. However, practical application thereof still faces a number of problems (fixing capability, thermal efficiency, durability, safety, etc.). Thus, the methods are not adopted at the current moment, and we believe that the future prospects are not necessarily bright.

2) Low melting toner

Since low melting toner has a profound effect on energy conservation, its improvement thereof coupled with the fixing unit has continued. However, due to the problem of keeping quality of toner components (powder) (i.e., toner should not become massed), we believe that further improvement is almost difficult.

3) Improved sensitivity of photoreceptors

Since there have been substantial improvement in the area of sensitivity of photoreceptors till now, we believe that further improvement is almost difficult.

4) Reduced power of an illuminated light source

Lamps of illuminated light sources have been purchased from component manufacturers. Since there have been substantial improvement in the area of power reduction till now, we believe that further improvement is almost difficult.

5) Reduced torques of a drive system

As miniaturization and weight saving of the drive system have advanced in response to the market needs for small footprint copiers, reduction of torques has also been pursued. We believe that further improvement is almost difficult, however.

6) Increased efficiency of a motor transformer and a power supply

Although a motor transformer and a power supply rely on component manufacturers, they have been gradually improved so far. We expect that they will also be improved in the future, although there will be little improvement.

Taking into consideration the current trend of technological development related to improvement of energy efficiency, we believe that substantial improvement in the energy efficiency cannot be expected.

On the one hand, although it is difficult to seek quantitative improved values of individual technologies, hardworking efforts to respective parts of copiers contributed to minimal technological improvement. Thus, further increase, although it may be little, is also expected in the energy efficiency.

For this reason, assuming that improvement of the energy efficiency through technological development will steadily proceed in the future as well, we shall reflect possible improvement of efficiency in setting the target standard values.

2) Possible increase in efficiency expected in the future because of future prospects of technological development, etc.

Based on the idea of 1), in the table below, we list the ratios by applying possible improvement of when steady efforts toward improvement of energy efficiency through technological development is assumed, to Top Runner value of each segment.

Ratio applying to Top Runner value as possible increase in efficiency expected in the future

Segment by Copying Speed (CPM)	Ratio of Application	Description of Application
～10	Approximately 5%	Prospects of technological development
11～20	Approximately 5%	Prospects of technological development
21～30	Approximately 4%	Prospects of technological development
31～40	Approximately 4%	Prospects of technological development
41～50	Approximately 3%	Prospects of technological development
51～60	Approximately 3%	Prospects of technological development
61～70	Approximately 2%	Prospects of technological development
71～80	Approximately 2%	Prospects of technological development
81～85	Approximately 2%	Prospects of technological development

Note) As for technical trend in energy saving efforts of the copiers, it is considered that energy conservation will advance more easily in areas of the low- and medium-speed copiers, because they do not require larger outside diameter and thicker the thermal roller as so the high-speed copiers. We prepared the above ratios based on such a trend.

(3) Setting target standard values

Shown below are target standard values that have been set based on (1) and (2):

1) A4 Copier

Segment by Copying Speed (CPM)	Target Standard Value (Wh/h)	Top Value (Wh/h)	Improvement (Wh/h)
～10	11	12	1 (Approximately 5 %)
11～20	17	18	1 (Approximately 5 %)
21～30	69	No corresponding copier	－
31～40	88	No corresponding copier	－
41～50	123	No corresponding copier	－
51～60	144	No corresponding copier	－
61～70	180	No corresponding copier	－
71～80	200	No corresponding copier	－
81～85	258	No corresponding copier	－

・ The segment of the speed of 21 copies/minute or higher has no product. Therefore, as a target standard value, we set a value obtained by multiplying a value of an A3 copier with 0.70.

2) B4 Copiers

Segment by Copying Speed (CPM)	Target Standard Value (Wh/h)	Top Value (Wh/h)	Improvement (Wh/h)
～10	17	18	1 (Approximately 5 %)
11～20	20	21	1 (Approximately 5 %)
21～30	85	No corresponding copier	－
31～40	108	No corresponding copier	－
41～50	151	No corresponding copier	－
51～60	176	No corresponding copier	－
61～70	221	No corresponding copier	－
71～80	246	No corresponding copier	－
81～85	317	No corresponding copier	－

・ Segment of the speed of 21 copies/minute or higher has no product. Therefore, as a target standard value, we set a value obtained by multiplying a value of an A3 copier with 0.86.

3) A3 Copier

Segment by Copying Speed (CPM)	Target Standard Value (Wh/h)	Top Value (Wh/h)	Improvement (Wh/h)
～10	19	No corresponding copier	－
11～20	55	58	3 (Approximately 5 %)
21～30	99	103	4 (Approximately 5 %)
31～40	125	130	5 (Approximately 4 %)
41～50	176	181	5 (Approximately 4 %)
51～60	205	211	6 (Approximately 3 %)
61～70	257	263	6 (Approximately 3 %)
71～80	286	293	7 (Approximately 2 %)
81～85	369	377	8 (Approximately 2 %)

・ Segment of the speed of ～10 copies/minute has no product. Therefore, as a target standard value, we set a value to be obtained by multiplying a value of an B4 copier with 1.14.

4) A3Y Copier

Segment by Copying Speed (CPM)	Target Standard Value (Wh/h)	Top Value (Wh/h)	Improvement (Wh/h)
～10	27	No corresponding copier	－
11～20	77	No corresponding copier	－
21～30	139	No corresponding copier	－
31～40	175	No corresponding copier	－
41～50	246	No corresponding copier	－
51～60	287	No corresponding copier	－
61～70	383	391	8 (Approximately 2 %)
71～80	433	544	111 (Approximately 20 %)
81～85	483	493	10 (Approximately 2 %)

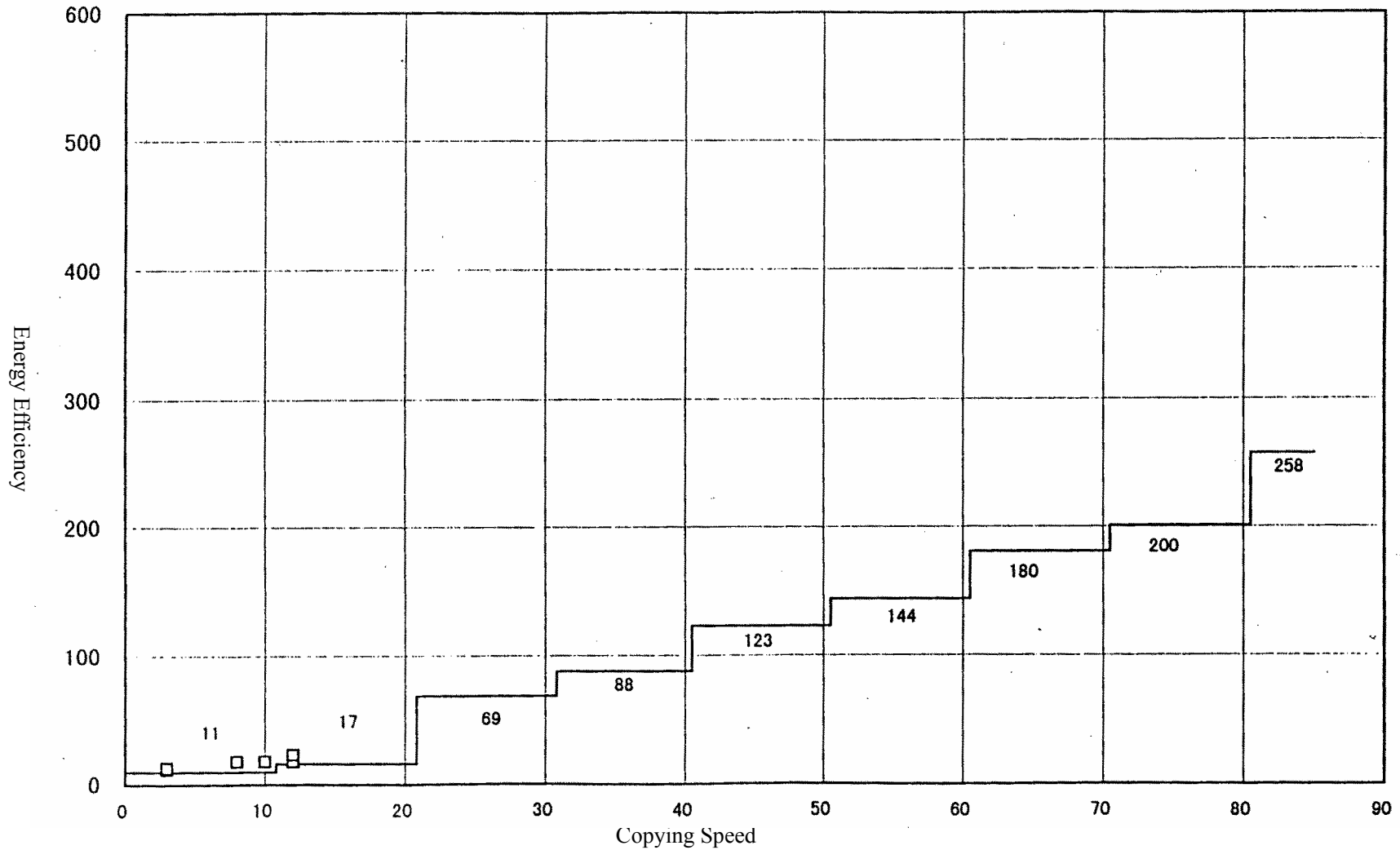
・ Segment of the speed of 60 copies/minute or lower has no product. Therefore, as a target standard value, we set a value to be obtained by multiplying a value of an A3 copier with 1.4.

・ For the category of 71 to 80 copies/minute, an average value (433) of the target standard value (383) of the segment of 61 to 70 copies/minute and that (483) of the segment of 80 to 85 copies/minute was taken.

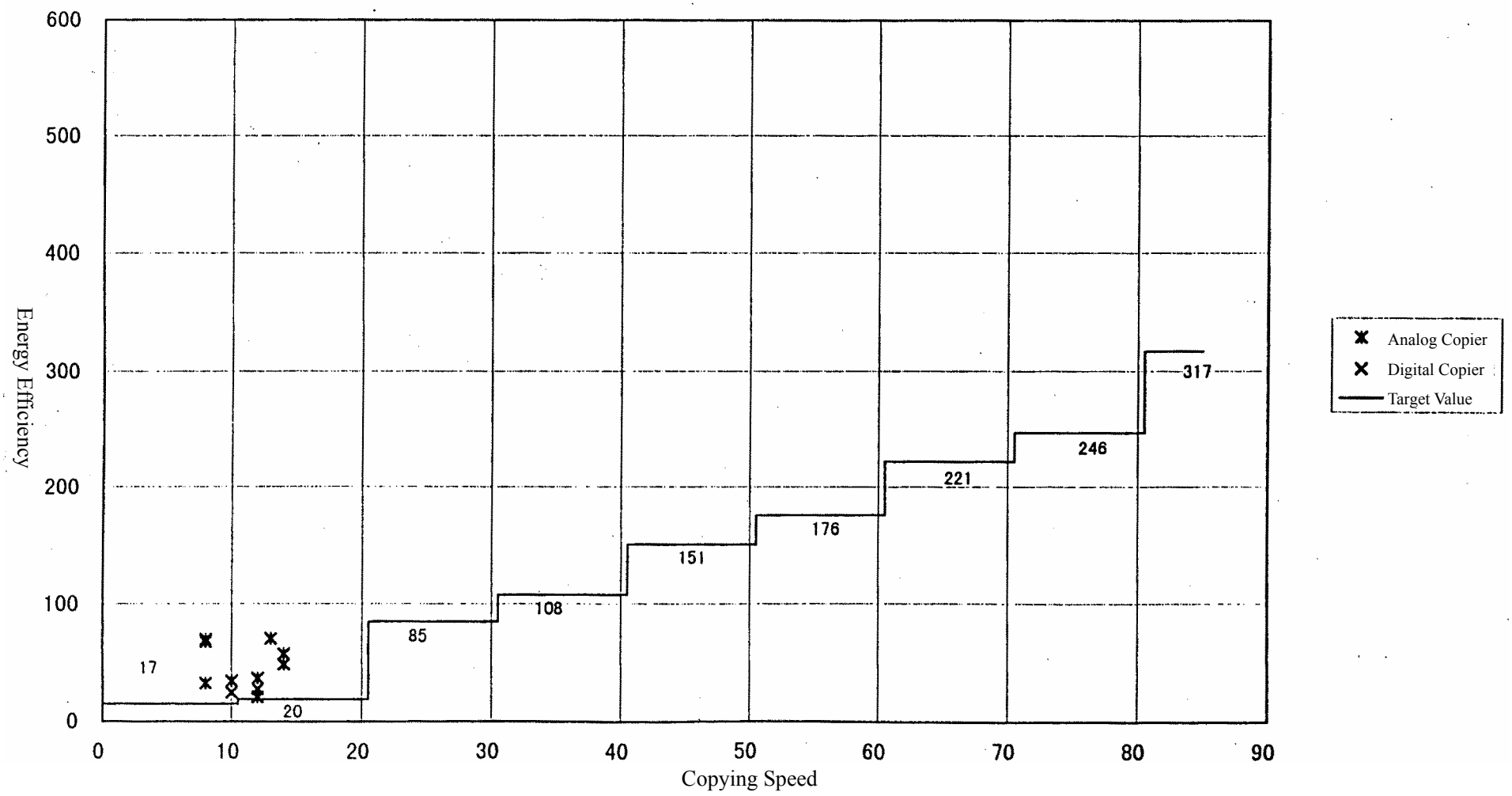
2. Improvement of the Energy Efficiency

For the energy efficiency of copiers in the target fiscal year (fiscal year 2006) based on the "target standard values" described above, it is estimated that the energy efficiency will improve by approximately 30%, compared with actual values of fiscal year 1997 based on certain conditions. (See Reference 3.)

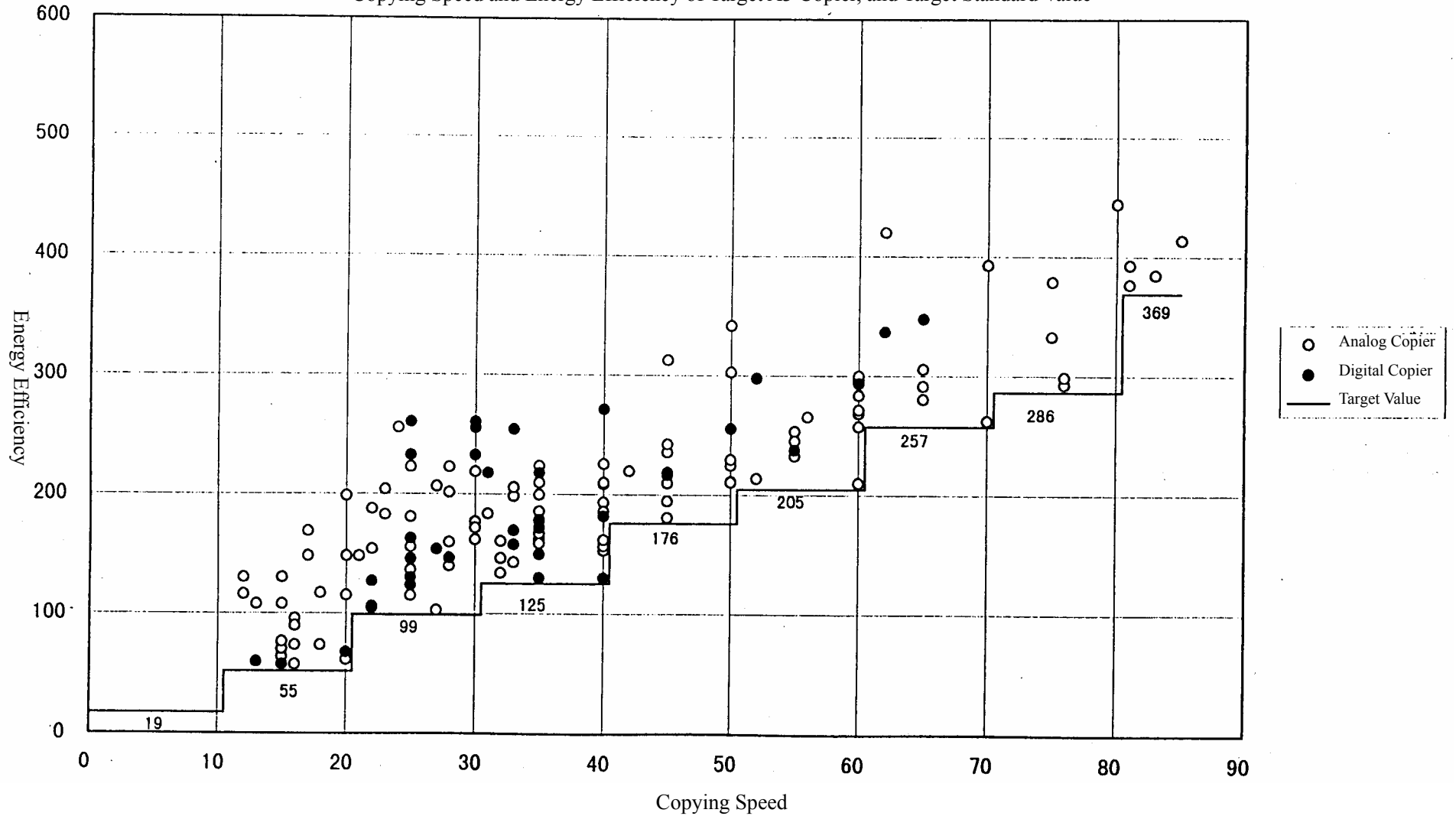
Copying Speed and Energy Efficiency of Target A4 Copier, and Target Standard Value

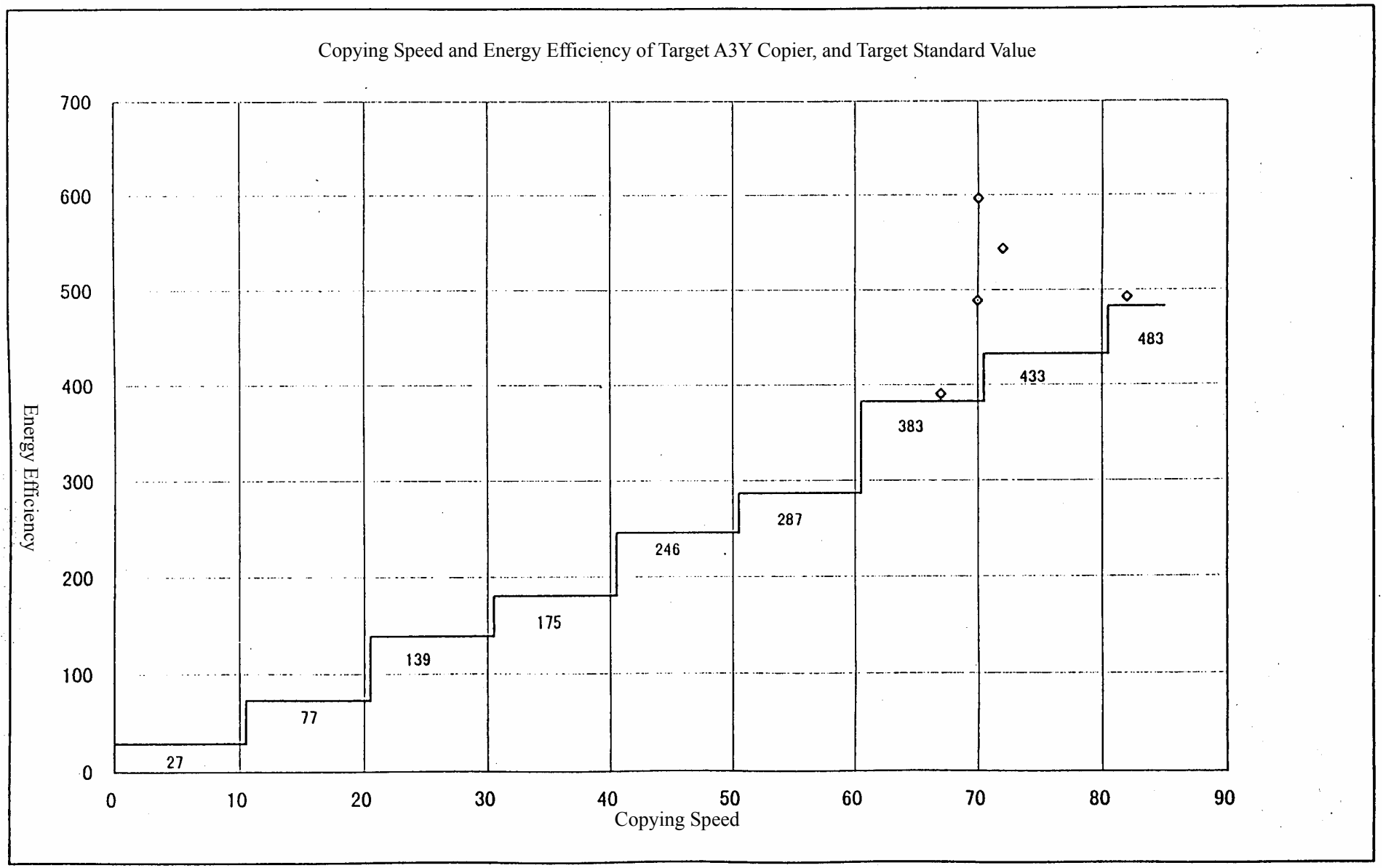


Copying Speed and Energy Efficiency of Target B4 Copier, and Target Standard Value



Copying Speed and Energy Efficiency of Target A3 Copier, and Target Standard Value

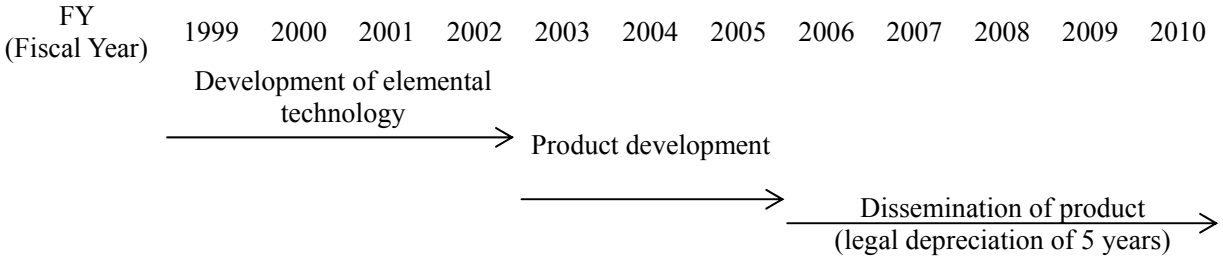



Copying Speed and Energy Efficiency of Target A3Y Copier, and Target Standard Value
Energy Efficiency
Copying Speed
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
27
77
139
175
246
287
383
433
483

3. Setting Target Fiscal Year

We shall apply the target to copiers scheduled to be shipped in and after fiscal year 2006, taking into consideration development period of elemental technology for copiers, product development period, and subsequent state of dissemination (the lead time shall be 7 years).

Table for Setting Fiscal Year



Estimate Related to Improvement of Energy Efficiency

1. The following was estimated from the actual values of the copiers that were shipped in FY 1997:
   Energy Efficiency: 155Wh/h

2. The following was estimated from the target standard values for copiers to be shipped in the target fiscal year (FY 2006):
   Energy Efficiency: 107Wh/h
   * As a precondition, we considered that the shipment volume and its composition are same as those of the fiscal year 1997.

3. Ratio of improvement of energy efficiency

$$\frac{(155\mathrm{Wh/h} - 107\mathrm{Wh/h}) \times 100}{155\mathrm{Wh/h}} = \underline{30.97\%}$$

(Attachment 4)

Measuring Method of Energy Efficiency

The measuring method of energy efficiency shall be based on the measuring method adopted in current Law concerning the Rational Use of Energy, and considers modes for reducing power consumption in standby state, etc. (See the next page.)

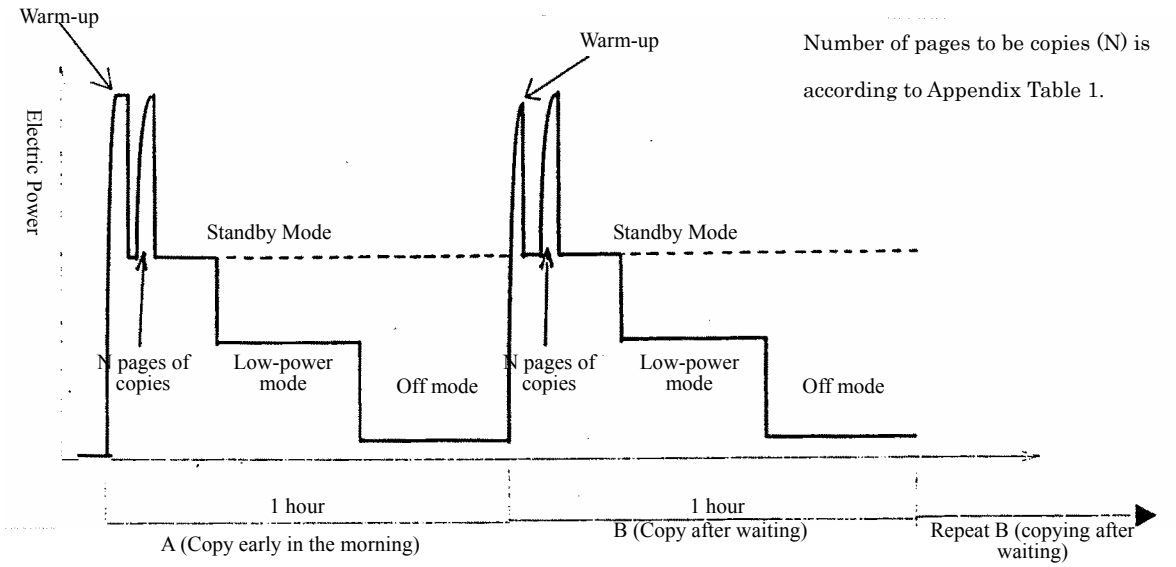
Measuring method of energy consumption

(1) Measuring Conditions

1) Environment: 20±2 °C, 65±10%RH
2) Power Supply: 100/200V, within ±3% of rated voltage to load fluctuation.
   50/60 Hz, within ±0.5Hz of rated frequency
3) Paper: Recommend paper of A4 size
4) Temperature and humidity regulation: Both a copier and paper shall be left under the measuring environment for one hour or longer.
5) Measuring equipment: Accuracy ±0.5% (when the power factor is 1)
6) Test chart: Image ratio 4-7%
7) Conditions for copy setting: Magnification: Same size
   Exposure: Automatic or appropriate
   Others: Factory default basic setting
   Copying shall be in basic mode (place a sheet on the glass surface).
8) Equipment configuration: Only basic configuration as a copier shall be accepted, and no peripheral device such as a sorter, automatic sheet feeder, etc. shall be included.
   Note, however, that in the case in which peripheral devices are attached according to the standard specification, and when power required for basic control lies on the copier side, it shall be measured with the peripheral devices attached.

(2) Measuring Method

1) Measuring Pattern



* The energy saving mode functions such as low-power mode and off mode for power reduction in a standby shall be added to the current measuring method.

2) Calculating Method

Measure energy consumption A (Wh) of the power measurement pattern A and energy consumption B (Wh) of the pattern B and calculate energy consumption per hour, by using the following expression:

Energy Consumption per Hour = (A+7B)÷8 (Wh/h)

Appendix Table 1

・ Measuring conditions (Number of pages to be copied vs. copying speed)

	Low Speed 1	Low Speed 2	Medium Speed 1	Medium Speed 2	High Speed 1	High Speed 2
Copying Speed (CPM)	～10	11～20	21～30	31～40	41～60	61～85
Number of pages to be copied (copy/hour)	2	10	30	50	100	300
Average of monthly number of pages to be copied (copy)	320	1,600	4,800	8,000	16,000	48,000

CPM: COPY PER MINUTE

The number of pages to be copied shall be calculated from the average of monthly number of pages to be copied (Estimation by Japan Business Machine Makers Association), assuming that the copier works 20 days in a month and that working hour of a day is 8 hours.

International Energy Star Program

International Energy Star Program is an voluntary registration program which is mutually recognized by the Japanese government and U.S. government.

1. Voluntary Registration

A manufacturer or a vendor who wishes to participate can arbitrarily participate in this program and register their product, by having themselves or any third-party assessment body ensure that a corresponding product has cleared the specification, and by self-declaration of the conformity.

2. US-Japan Mutual Recognition

Any registered product shall be equally handled as having been registered in its home country, through mutual information exchange between the US and Japanese governments.
For instance, even if a product destined for the US market is registered in Japan, use of the logo in the US is accepted.

3. Registration

In order to register a product, an application is filed to Energy Conservation Center, Japan through respective associations that product manufacturers/vendors belong to. However, it is also possible to directly apply to Energy Conservation Center, Japan. (Energy Conservation Center, Japan is an institute for implementing a designated task, commissioned by the Ministry of International Trade and Industry.)

4. Energy Conservation Standard Uniform to both US and Japan

International Energy Star Program is aimed to control power consumption in standby mode of office equipment that often works for a long period of time with switches turned ON. It is from a standpoint of energy conservation that “necessary energy should be efficiently used when necessary”.
Target products: computers, monitors, printers, facsimiles, and copiers

5. Specification for Copiers

Table 1: Copiers (excluding those for large-sized paper) [After July 1, 1997]

Copying Speed (CPM: Number of pages to be copied per minute)	Power consumption in low-power mode	Default time to low-power mode	Recovery time from lower-power mode	Power consumption in off mode	Default time to off mode	Duplex copying function
0<CPM≤20	Not considered.	Not considered.	Not considered.	≤5W	≤30 minutes	Not considered.
20<CPM≤44	≤3.85×CPM+5W	≤15 minutes	≤30 seconds	≤15W	≤60 minutes	Option
44<CPM	≤3.85×CPM+5W	≤15 minutes	≤30 seconds (Recommended)	≤20W	≤90 minutes	Option

Table 2: Copier for large-sized paper [July 1, 1997 to June 30,1999]

Copying Speed (CPM: Number of pages to be copied per minute)	Power consumption in off mode	Default time to off mode
0<CPM≤40	≤20W	≤30 minutes
44<CPM	≤40W	≤90 minutes

Table 3: Copiers for large-sized paper [After July 1, 1999]

Copying Speed (CPM: Number of pages to be copied per minute)	Power consumption in low-power mode	Default time to low-power mode	Recovery time from lower-power mode	Power consumption in off mode	Default time to off mode
0<CPM≤40	Not considered.	Not considered.	Not considered.	≤10W	≤30 minutes
44<CPM	≤3.85×CPM+5W	≤15 minutes	≤30 seconds (Recommended)	≤20W	≤90 minutes

Table 4: Copier [Before June 30, 1997]

Copying Speed (CPM: Number of pages to be copied per minute)	Power consumption in off mode	Default time to off mode	Duplex copying function
0<CPM≤20	<5W	≤30 minutes	Not considered.
20<CPM≤44	<40W	≤60 minutes	Option
44<CPM	<40W	≤90 minutes	Default

In Table 4, the specification of which the copying speed is 20 copies/minute or low is applicable to the copier for large-sized paper.

(Attachment 5)

Display Items

Conventionally, the following items shall be displayed:

(1) Display items
- Product name and model name
- Copying speed
- Energy efficiency
- Name or appellation of a manufacturer, etc.

(2) Items to be complied
- As copying speed, a number of copies per minute, when continuous copying onto A4 size plain paper takes place, shall be expressed by an integer.
- A numeric value of energy efficiency (Wh/h) shall be indicated by an integer.
- Display these display items listed in (1) above in a catalog or instruction manual.

(Attachment 6)

History of Copying Machine Criteria Standard Subcommittee

First committee (July 29, 1998)

- Current status of copiers
- Target scope
- Measuring method of energy efficiency
- Segmentation to set targets

Second committee (August 24, 1998)

- Target scope
- Measuring method of energy efficiency
- Segmentation to set targets
- Target value and target fiscal year
- Display items

Third committee (September 11, 1998)

- Interim report (draft)

Fourth committee (October 1, 1998)

- Interim report

Fifth committee (November 26, 1998)

- Final report

(Attachment 6)

Copying Machine Criteria Standard Subcommittee, Energy Efficiency Standards Subcommittee of the Advisory Committee on Energy: Member List

Chairman:	Ken'ichi Akiga	Professor of Graduate School of Science and Engineering, Tokyo Institute of Technology
	Hitoshi Aida	Assistant Professor of Department of Electronic Information, Graduate School of Engineering, the University of Tokyo
	Jun Akizawa	Assistant Professor of Department of Technology Systems, Faculty of Engineering, Tokyo University of Agriculture & Technology
	Shinji Sawata	Specialist in Energy Conservation Center, Japan
	Yasumasa Tsutsui	Manager of Energy Department, Mechanical Engineering Laboratory, Agency of Industrial Science and Technology
	Yasuhiko Nakane:	Executive Director of Japan Machinery Importers' Association
	Yoshihiko Nakamura:	Professor of Department of Machinery and Information Engineering, Graduate School of Engineering, the University of Tokyo
	Nobuyuki Miyake	Project General Manager of Copier Technology Section Meeting, Japan Business Machine Makers Corporation
	Chiharu Murakoshi	Director and Research General Manager of Jyukankyo Research Institute Inc.
	Nobuyuki Yanagawa	Councilman of Japan Electrophotography Association

Laws Concerning Streamlining of Energy Use
Existing Related Government and Ministerial Ordinance (Abstract)

(Specified Equipment)

Government Ordinance Article 7

Machinery and appliances defined by the government ordinance of Section 1, Article 18 of the law shall be as follows:

1. Passenger cars (Limited to cars that run on volatile oil and have the riding capacity of 10 persons or less, and whose model has been designated by Section 1, Article 74 of the Road Trucking Vehicle Law (Law No. 185 instituted in 1951). Excluding two-wheel barrows (including those with a sidecar) and those of endless track type.)
2. Air conditioner (Including those that can be offered for heating, and excluding air conditioners the cooling capacity of which is greater than 27 kilowatts, air conditioners of water cooling type, and other air conditioners defined by the ministerial ordinance of the Ministry of International Trade and Industry.)
3. Lighting equipment using only fluorescent lamps as main light sources (Excluding lighting equipment of explosion proof type and other lighting equipment defined by the ministerial ordinance of the Ministry of International Trade and Industry.)
4. Television receiver (Limited to television receivers having a cathode ray tube and to be used for AC (alternating current) electric circuits. Excluding those for industrial purposes)
5. Copiers (Limited to indirect electrostatic photocopiers of dry type, and excluding color copying machines or other copiers defined by the ministerial ordinance of the Ministry of International Trade and Industry.)
6. Electronic calculators (Electronic calculators having high processing power and excluding those defined by the ministerial ordinance of the Ministry of International Trade and Industry.)
7. Magnetic disk devices (Excluding magnetic disk devices whose memory capacity is 200 megabytes or less.)
8. Motor trucks (Limited to motor trucks that run on volatile oil and have gross weight of 2.5 tons or less specified in No.3, Article 40 of the Road Trucking Vehicle Law, and whose model has been designated by Section 1, Article 74 of the Road Trucking Vehicle Law (Law No. 185 instituted in 1951). Excluding two-wheel barrows (including those with a sidecar) and those of endless track type.)
9. Video tape recorders (Limited to video tape recorders to be used for AC electric circuits. Excluding video tape recorders for industrial use and other video tape recorders defined by the ministerial ordinance of the Ministry of International Trade and Industry.)

(Specific Equipment Exempted from Application)

Ministerial Ordinance, Article 12: The air conditioners defined by No.2, Article 7 of the ordinance of the Ministry of International Trade and Industry shall be those listed below:

1. Air conditioners structured without a motor for compression
2. Air conditioners structured to use energy other than electricity as source for heating
3. Air conditioners intended to maintain performance of the machinery and appliances and to perform air conditioning for sanitary supervision, and structured to be capable of temperature control and dust removal.
4. Air conditioners structured to exclusively cool down air outside of the room and send the air into the room
5. Spot air conditioner
6. Air conditioners designed for vehicles and other vehicles
7. Air conditioners structured to have ducts placed at a suction port and a vent of a heat exchanger on outdoor side
8. Air conditioners of a discrete type and structured to be used by connecting more than one indoor equipment to the outdoor equipment of 1

2) The lighting equipment using only fluorescent lamps as main light sources defined by No.3, Article 7 of the ordinance of the Ministry of International Trade and Industry shall be those listed below:

1. Lighting equipment of heat proof type
2. Lighting equipment having dustproof construction
3. Lighting equipment of corrosion proof type
4. Lighting equipment designed for vehicles and other transportation
5. Lighting equipment using a fluorescent lamp of type 40 or less (Excluding fluorescent lights of hanging type for household use and for desk lamps)

3) The copiers defined by No.5, Article 7 of the ordinance of the Ministry of International Trade and Industry shall be those as listed below:

1. Copiers structured to be capable of copying sheets of A2 size or larger
2. Copiers structured to be callable of copying 86 sheets or more per minute
3. Copiers constructed integrally with a printer
4. Copiers constructed integrally with a facsimile

4) The electronic calculators defined by No.6, Article 7 of the ordinance of the Ministry of International Trade and Industry shall be those composite theoretical performance (for the electronic calculators listed in the upper column of Table 2, data shall be listed in the lower column of the same table) of which exceeds 3,000 mega operations or more per second.

5) The video tape recorders defined by No.9, Article 7 of the ordinance of the Ministry of International Trade and Industry shall be those as listed below:

1. Video tape recorders structured to digitally process electric signals for voice and video
2. Video tape recorders structured to process electric signals for videos whose number of scanning line exceeds 1,125
3. Video tape recorders structured to process electric signals for videos whose horizontal resolution exceeds 400 lines and not to be capable of receiving satellite broadcasting
4. Video tape recorders structured to have more than one actuators of video tapes
5. Video tape recorders structured to have the playback capability only

Criteria of Manufacturers, etc. Concerning Improvement of Performance of Copiers

(Notice of the Ministry of International Trade and Industry, No.451 issued on July 26, 1994
Notice of the Ministry of International Trade and Industry, No.8 revised on January 9, 1995)

1. Criteria

(1) A manufacturer or importer (hereinafter referred to as "manufacturers, etc.") of the copiers listed in No.5, Article 7 of the law enforcement order concerning streamlining of energy use (Ordinance No.267, 1979) (hereinafter referred to as "copiers") shall ensure that a numeric value to be obtained by average weighting, with the volume of shipments, a value determined by subtracting the basic energy consumption efficiency (numeric values corresponding to the category in the upper column of the table below, according to the copying speed of said equipment) from the energy consumption efficiency (numeric values measured by the method defined in 3. Same as above.) for the copiers to be shipped to domestic market in FY 2000 will be 0 or less.

Copying Speed (copies/minute)	5	6	7	8	9	10	11	12	13
Basic Energy Consumption Efficiency	106	107	109	111	113	116	118	120	122

14	15	16	17	18	19	20	21	22	23	24	25	26
125	128	130	133	136	139	142	145	148	151	155	158	162

27	28	29	30	31	32	33	34	35	36	37	38	39
165	169	173	176	180	184	189	193	197	201	206	210	215

40	41	42	43	44	45	46	47	48	49	50	51	52
220	225	230	235	240	245	250	255	261	266	272	277	283

53	54	55	56	57	58	59	60	61	62	63	64	65
289	295	301	307	313	319	326	332	339	345	352	359	366

66	67	68	69	70	71	72	73	74	75	76	77	78
373	380	387	394	401	409	416	424	431	439	447	455	463

79	80	81	82	83	84	85
471	479	487	496	504	512	521

(2) The copying speed mentioned in (1) shall refer to a number of pages to be copied in a minute when continuous copying onto A4 size plain paper takes place. Note, however, that in the copier capable of copying onto A3 size portrait and landscape sheets, it shall refer to a numeric value to be obtained by multiplying the number of pages to be copied in a minute when continuous copying onto A4 size plain paper takes place by 1.18 and then truncating.

2. Items to be Indicated, etc.

2-1 Items to be Indicated

Concerning the energy consumption efficiency of a copier, the manufacturer, etc. shall indicate the following items:

a. Product name and model

b. Copying speed

c. Energy consumption efficiency

d. Name of the manufacturer, etc.

2-2 Items to be Conformed

(1) As copying speed, a number of copies per minute when continuous copying onto A4 size plain paper takes place shall be expressed by an integer.

(2) As the energy consumption efficiency, a numeric value listed in the lower column of Table 3 of the law enforcement regulation concerning streamlining of energy use (Ordinance No.74 of the Ministry of International Trade and Industry of 1979) shall be indicated by an integer.

(3) The items listed in 2-1 above shall be indicated by describing them in a catalog or instruction manual.

(Notice of the Ministry of International Trade and Industry No.8 of 1995. Partially amended.)

3. Method of Measuring Energy Consumption Efficiency

(1) The energy consumption efficiency shall be calculated with the following expression:

$$E=(A+7\times B)\div 8$$

where E, A and B shall represent the following numeric values:

E: Energy consumption efficiency (unit: watt-hour)

A: Power consumption for an hour after power input (unit: watt-hour)

Note that after the power input, using a test chart and according to the copying speeds of the copiers listed in the left column of the table below, copying for a number of sheets listed in the right column of the same table shall take place, and the copied sheets shall be left untouched after copying.

B: Power consumption for an hour after measurement of A (unit: watt-hour)

In addition, immediately following the measurement of A, copying of sheets the number of which should be identical to that of the sheets copied in A shall take place, and the copied sheets shall be left untouched after copying.

Copying Speed of Copiers (Copies/minute)	Number of Pages to be Copied (Sheets)
10	2
11-15	10
16-25	30
26-40	50
41-60	100
61-85	300

(2) The measurements of A and B shall be conducted under the conditions defined below:

1. The ambient temperature shall be 20±2°C.
2. The ambient humidity shall be 65±10%.
3. Variations of input voltage shall be within ±3% of rated voltage.
4. The image magnification shall be same magnification, exposure shall be automatic or appropriate, and other settings shall be basic settings of the factory default.
5. The test chart shall be A4 size, with the image ratio of 4 to 7%.

Additional Clause

This notification shall take effect on the date of publication. Note, however, that the stipulation 2 shall take effect as of January 1, 1996.

Present State of Copiers

1) Product Categories of Copiers

(1) The product categories to be used in import/export shall be as follows:

Import Product HS Code	Item Name
90.09	Photosensitive copiers (Limited to those having an optical mechanism and being of contact type) and thermal copying machines
9009.11	Photosensitive copiers of electrostatic type Copiers that directly copy an original image onto a photosensitive surface (direct type)
9009.12	Copiers that copy an original image onto a photosensitive surface by way of a medium (indirect type)
9009.21	Other photosensitive copiers Those having an optical mechanism
9009.22	Those being of contact type
9009.30	Thermal copying machines

(2) Categories in the Japan standard commodity classification used in various statistical surveys that require data by product including industrial statistics surveys and current surveys of industrial production, and related standards shall be as listed below:

Classification No.	Product Item Name	Related Standard
59 11	Copiers	JIS B 0117:91
59 111	Electrostatic copiers	Terminology for business machines
59 1111	Electrostatic copiers of direct type	JIS B 0137:85
59 1112	Electrostatic copiers of indirect type	Terminology for copiers
59 112	Diazo copying machines	JIS B 0139:93
59 1121	Diazo copying machines of liquid development type	Copiers Graphic symbols
59 1122	Diazo copying machine of gas development type	JIS B 9504:77
59 1123	Diazo copying machines of thermal development type	Copying width of a diazo copying machine
59 113	Photo-copying machines	JIS B 9505:77
59 114	Thermal copying machines or thermal transfer copiers	Specification format of diazo copying machine
59 1141	Thermal copying machines	JIS B 9506:77
59 1142	Thermal transfer copiers	Performance test method for a diazo copying machine
59 115	Full-color copiers	JIS B 9523:87
59 1151	Electrostatic full-color copiers	Test chart for a copier
59 1152	Full-color photocopiers	JIS B 9524:89
59 1153	Full-color copiers of thermal transfer type	Test chart for a full-color copier
59 116	Handy type copiers	
59 1161	Handy type photocopiers	
59 1162	Handy type thermal copying machines	

(3) Domestic Shipments and Number of Copiers in Widespread Use

1) Shipments

(Unit: 1,000 units)

	1992	1993	1994	1995	1996	1997
Volume of manufacture	2,377	2,208	2,144	1,957	1,903	2,202
Volume of imports	1,701	1,518	1,415	1,274	1,168	1,386
Volume of exports	22	62	153	262	286	308
Domestic shipments	698	752	882	945	1,021	1,124

(The volume of manufacture shall be according to machinery statistics of the Ministry of International Trade and Industry, and volume of imports and that of exports shall be according to the Japan monthly trade returns of the Ministry of Finance.)

(The volume of manufacture shall be for domestic market, and the domestic shipments = volume of manufacture – volume of exports + volume of imports)

2) Installations on the Market

It shall be approximately 4.3 million units, and the copiers subject to the energy-saving laws shall be approximately 3.1 million units (excluding color copying machines, copiers for large-sized paper, and complex machines).

3) Distribution by Segment of Sales of Copiers (Estimated by the Association)

Segment Copying Speed	Low Speed 1 -10	Low Speed 2 11-15	Medium Speed 1 16-25	Medium Speed 2 26-40	High Speed 1 41-60	High Speed 2 61-
Distribution	33%	13%	21%	21%	7%	6%

(4) Copy Volume on the Market (Estimated by the Association)

Segment	Low Speed 1	Low Speed 2	Medium Speed 1	Medium Speed 2	High Speed 1	High Speed 2
Monthly copy volume Sheets/unit	320	1,600	4,800	8,000	16,000	48,000

2) Market Trend

(1) Value of production, Producing Companies, etc.

1) Transition in Value of production

(Unit: 1 million yen)

	1992	1993	1994	1995	1996	1997
Value of production	552,737	518,584	537,233	539,500	546,003	632,577
Export value	346,659	316,196	309,924	296,790	306,179	394,528
Import value	3,890	5,265	11,385	19,408	24,374	26,948
Domestic market	209,968	207,653	238,694	262,118	264,198	264,997

(The value of manufacture shall be according to machinery statistics of the Ministry of International Trade and Industry, and import and export value shall be according to the Japan monthly trade returns of the Ministry of Finance.)

(The value of manufacture shall be for domestic market, and the domestic shipments = value of manufacture – export value + import value)

2) Producing Companies and Sales Companies

- Ricoh Co., Ltd.
- Mitaq Co., Ltd.
- Sanyo Electric Co., Ltd.
- Matsushita Electric Industrial Co., Ltd.
- Canon Sales Co., Inc.
- Konica Corporation
- Sharp Corporation
- Minolta Co., Ltd.
- Fuji Xerox, Co., Ltd.
- Copyer Co., Ltd.
- Toshiba Corporation

3) Importers

Most of imports shall be from overseas manufacturing plants of the producers listed above.

(2) Transition in Domestic Volume of Manufacture

(Unit: 1,000 units)

	1992	1993	1994	1995	1996	1997
Total of Domestic Volume of Manufacture	2,377	2,208	2,144	1,957	1,903	2,202
Electrostatic type	2,218	2,048	1,952	1,774	1,651	1,808
Low speed	1,143	1,000	984	679	547	580
Medium speed	883	853	755	854	840	932
High speed	192	195	213	241	264	296
Diazo, etc.	159	160	192	183	252	394

Note: Figures in the brackets of the categories “Low speed”, “Medium speed” and “High speed” represent the number of copies/minute.

(Machinery statistics of the Ministry of International Trade and Industry)

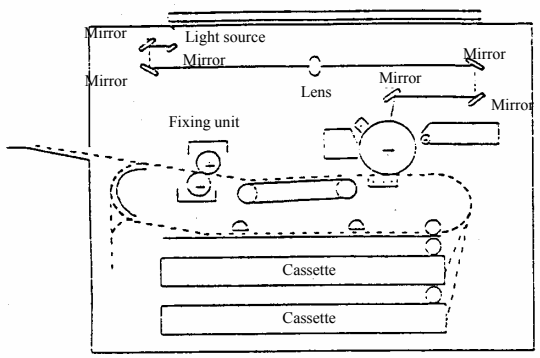
3) Present Situation and Future Outlook of Energy Consumption Efficiency

(1) Result of Energy Conservation

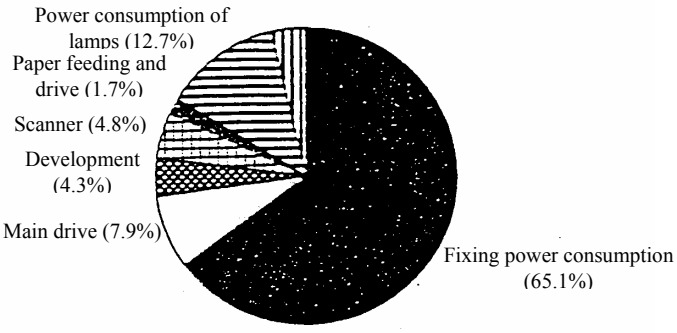
1) Performance

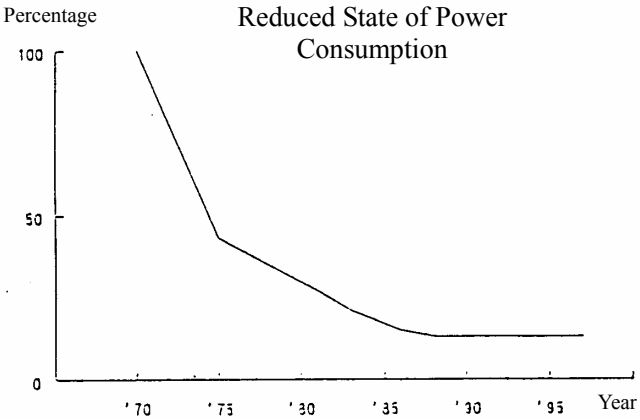
The power consumption per copy of a copier represents performance of the copier, and in general, the best performance is approximately 80 copies/minute (A4 size) within the limits of an ordinary wall plug socket (100V, 15A). Although the performance had been considerably improved, compared with 8 copies/minute of the early copier when it was marketed domestically for the first time, there has been no further improvement for the last few years.

Example of Structure of Copier



Comparison of Power Consumption
(Power Distribution of Respective Mechanisms)





・ The left graph shows the transition in power consumption for one copy made by a copier.
Here, the copier of 1970 is considered 100. Then, it shows the percentage of the most energy-saving copier (the copier with least power consumption when making 1 copy) among the models released every year (from the same manufacturer).

The history of energy conservation in the area of copiers mostly overlaps with the history of efforts to improve heat efficiency of the fixing unit that accounts for 50 to 70% of power consumption thereof (W) and to improve the lighting efficiency of the illumination system of the optical component that accounts for 10 to 15%.

In the fixing unit, among a number of methods, the thermal roller method that softens toner through the most efficient heat conduction and fixes it onto a sheet is the present mainstream.

In the optical component, improvements have been made in increased efficiency of a halogen light (lm/W), lighting efficiency of a reflecting shade, and reduction of exposure in a mirror, optical lens, etc., as well as improvement of photoreceptor sensitivity for reducing power consumption (W) of illuminated light sources.

Therefore, as described above, improvement of the copying speed (copy/minute) has been achieved within limited electric power.

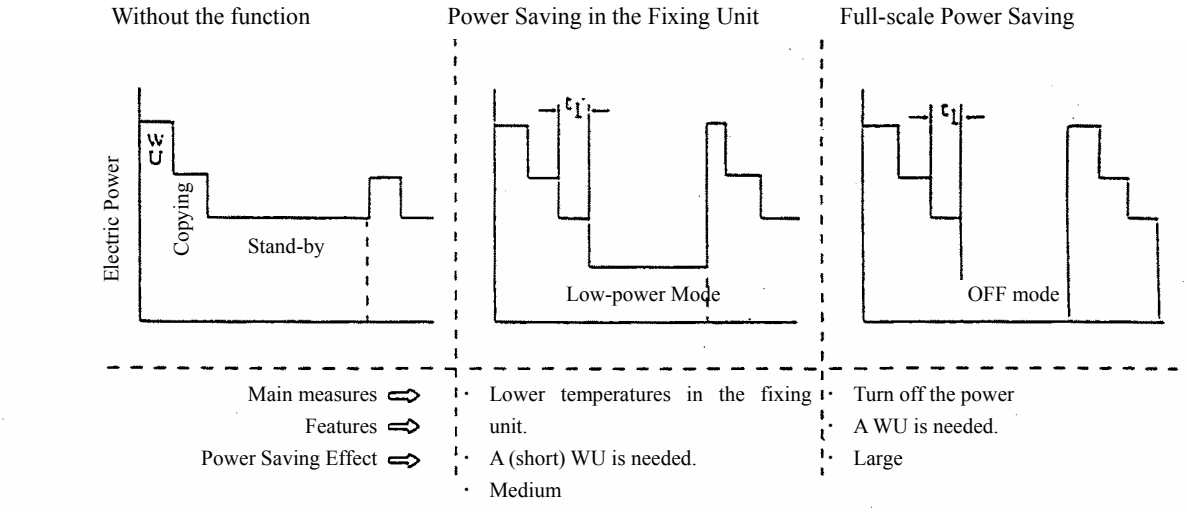
2) Energy Conservation in a Standby Sate (Improvement from Data of 1992)

In the thermal roller method, the roller is warmed and kept at predetermined temperatures at all times, even while waiting (this is called a standby mode), so that a user can make copies immediately when he/she wishes. Estimates of actual usage reveals, however, that a copier tends to be unexpectedly in a standby state more often than being in copying action.

For instance, in the case of a copier with the copying speed of 30 copies/minute, its average monthly copy volume is estimated to be 8000 copies, which means approximately 50 copies per hour, assuming that the copier runs 8 hours a day and for 20 days every month. Then, the operating time necessary for this volume is about mere 1 minute and 40 seconds if copies are made continuously. Even if it is assumed that copies are made one by one rather than by continuous copying, the operating time of copying will be about 5 minutes (assuming that it takes 6 seconds to make one copy), and the copier is in a standby mode for the rest of its operation.

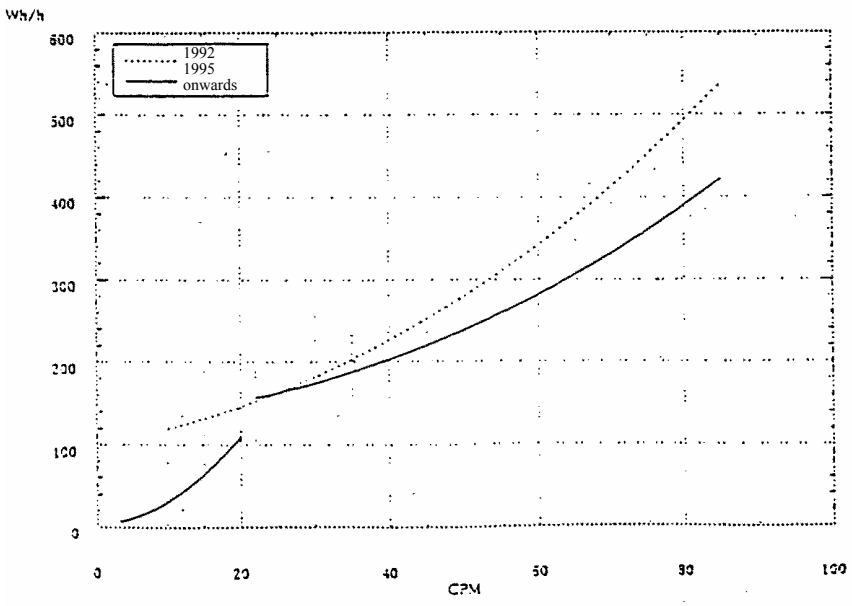
Therefore, we can see that power consumed while waiting constitutes a significant fraction of the total power consumption (Wh), and thus find it important to reduce power consumption in a standby state. Coupled with efforts to improve the energy consumption efficiency through designation of the specific equipment under the energy-saving laws and participation in the International Energy Star Program that was launched in 1995, copiers equipped with such a power saving function as off mode or low-power mode has entered the mainstream.

Power Saving Function



t_t is specified by the International Energy Star Program.

Energy Consumption Efficiency (1992 vs. 1996 onwards)



・ In the left graph, the dashed line represents the secondary recursion line from the product data of 1992 when the current standard was established, while the solid line represents the secondary recursion line from the product data of 1996 onwards.

(2) Future Outlook (Technical Tend, Patents)

1) It is considered that efforts to minimize the energy consumption in a standby state will also continue in the future. In particular, in the area of the low-speed copiers with the copying speed of 10 CPM or less, some copiers have emerged that do not compromise user-friendliness even though they incorporate the off mode that is expected to bring about energy saving effects in a standby mode, by shortening the warm-up time through thinning of the fixing roller. Also in the areas of medium- and high-speed copiers, the energy saving measure by thinning the fixing roller is believed to be the inevitable requirement, and thus breakthrough is needed in the fixing process technology including toner.

Moreover, we notice from the patent information that in addition to the thermal roller fixing method, some older methods have been proposed in view of energy conservation: the pressure fixing method that does not use thermal energy at all (1966), or flash fixing (1966)/induction heating and fixing (1976), etc., namely, so-called on-demand type, that uses thermal energy only for the fixing operation. Nevertheless, in view of overall performance, the thermal roller method has consequently entered the mainstream. As the proverb “taking a lesson from the past” suggests, we believe that unless there is a further big breakthrough, no new development can be expected in this area. The only possibility would be SURF fixing as on-demand type. In this method, instead of the fixing roller, an endless fixing film made of belt-shaped thin film is used, and, by having the heater directly abut the fixing film, only a fixing nip is intensively heated. However, since the method uses the thin film, it is far from being suitable for the medium- and high-speed copiers. (Refer to the supplementary information.)

2) Until now the copier industry has been trying to save energy, through, for instance, reduction of torques of the drive system, increase in efficiency of the motor transformer, as well as power reduction of illuminated light sources, enhancement of photoreceptor sensitivity, introduction of low melting toner, etc., and is committed to continue its efforts in the future as well.

3) In response to the movement of digitalization in recent days, copiers have become more and more multifunctional and complex. It is expected that use of a single equipment that was once independent separate devices (increased operating rate) could lead to reduction of the standby mode, thereby enabling energy conservation of an office as a whole.

Supplementary Information

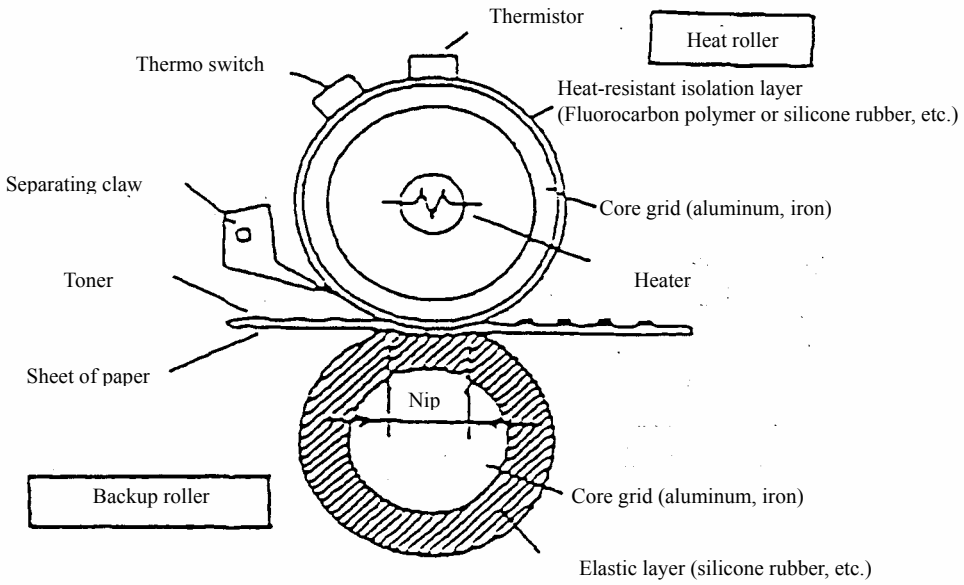


Figure 1 Configuration of Heat Roller Fixing Unit

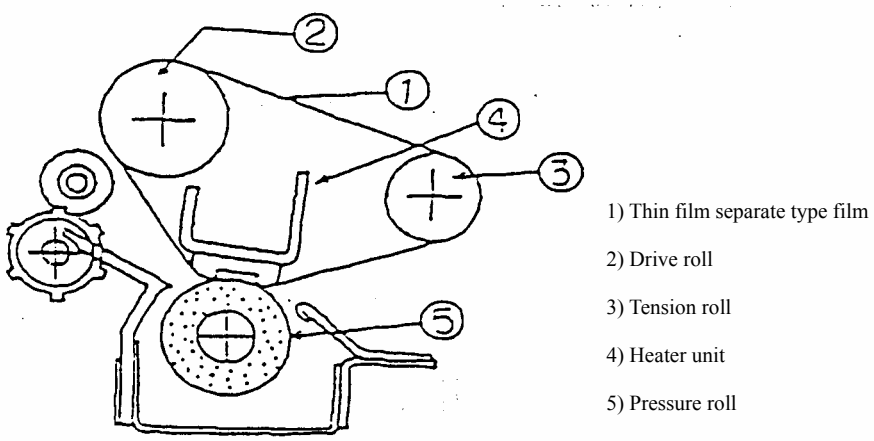


Figure 2 Schematic View of SURF Method

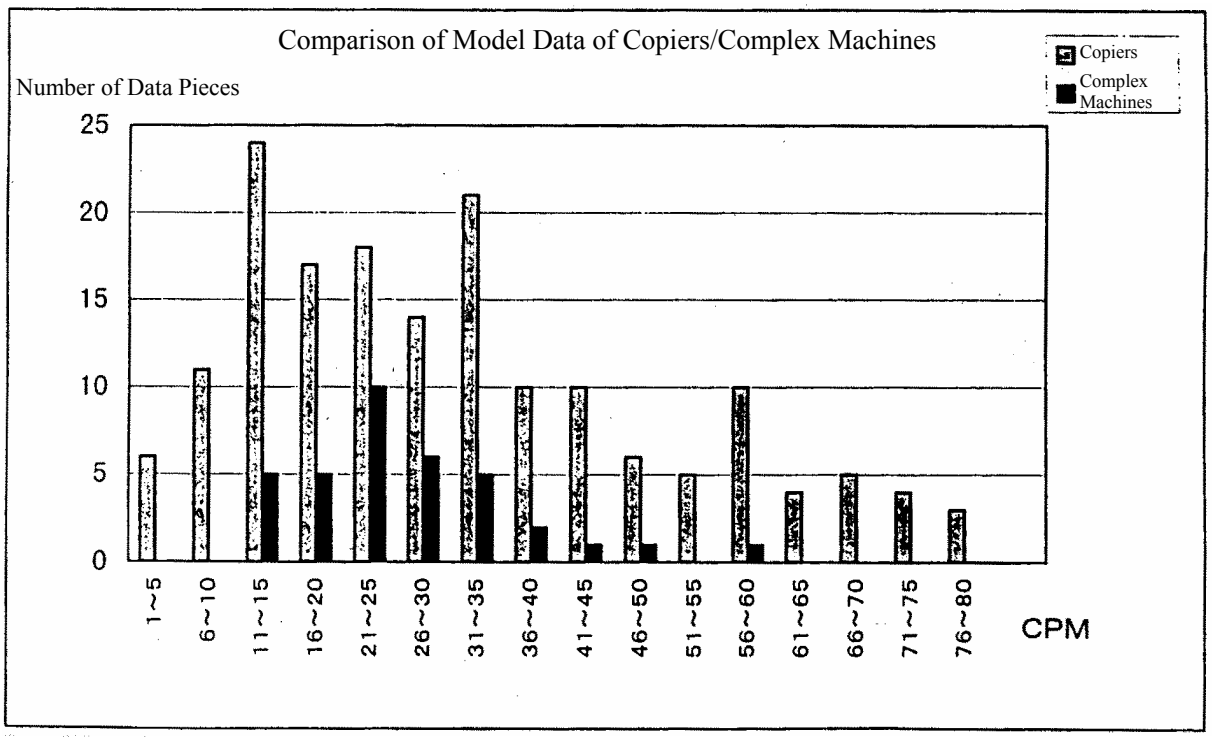
The above were quoted from the data of the lecture sponsored by Japan Electrophotography Association in 1995.

Reference Data

Color Copier

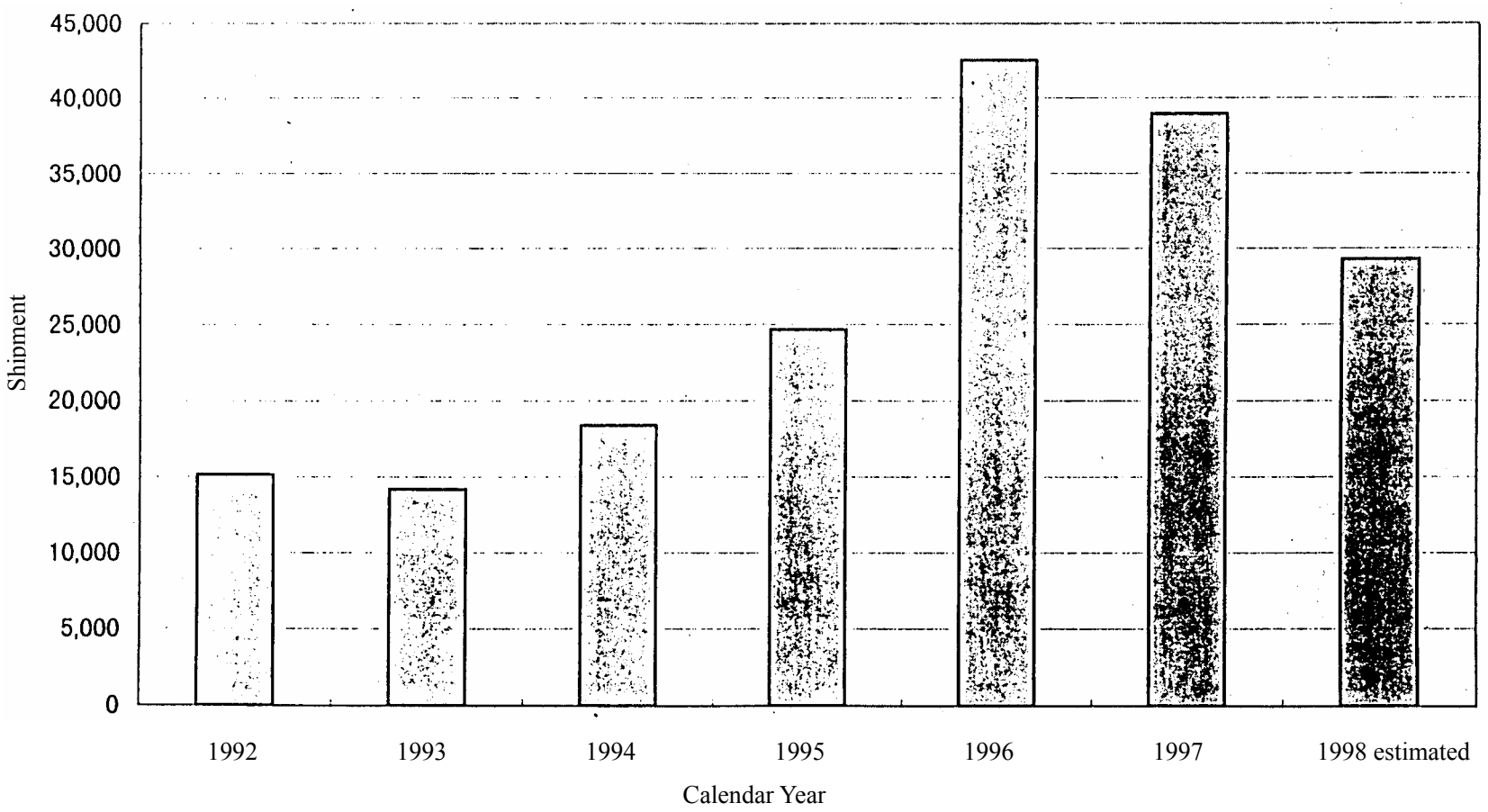
Manufacturer	Model	Full-color	Monochrome	Remarks
Canon	CLC320	5	20	
	CLC950	7	28	200V 3.0Kw
	CLC1000	31	31	
Ricoh	PRETER365	3	21	
	PRETER660	6	31	
Xerox	Acolor620	6	24	
	Acolor936	9	36	
	Docucolor4040	40	40	200V 3.3Kw
Minolta	CF900L	6	23	

Reference Data



Reference

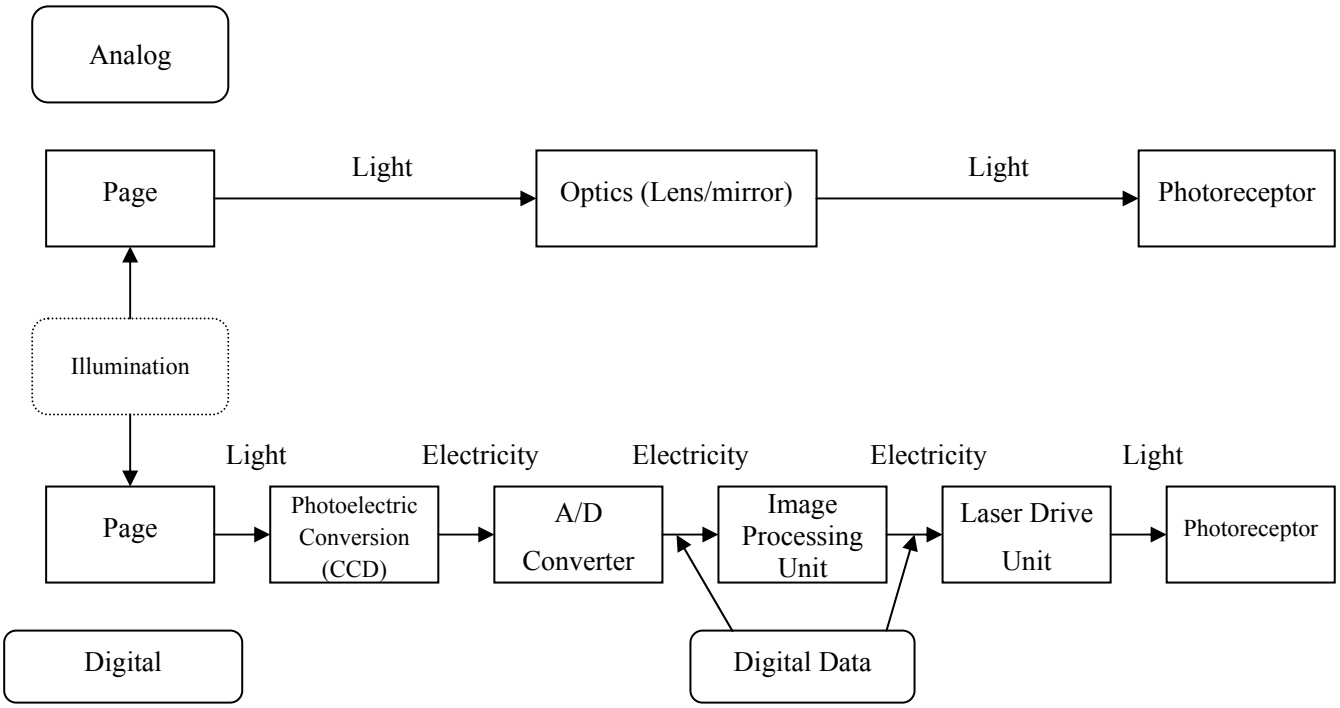
Transition in Shipments of Color Copiers

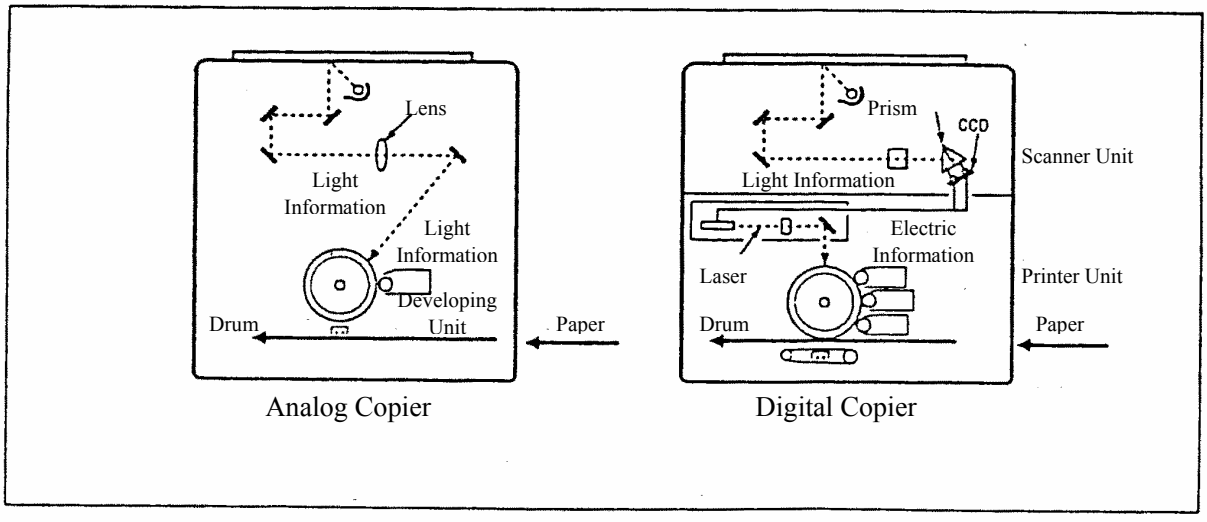


Digital Copiers

1. Configuration

A digital copier comprises a reader (scanner), an image processing unit, and a writer (printer). In an analog copier, image information on a page is directly illuminated onto a photoreceptor through mirror optics, while in the digital copier the image information is converted into an electric signal at the reader, passing through the image processing unit, and is illuminated onto the photoreceptor by laser beam at the writer.

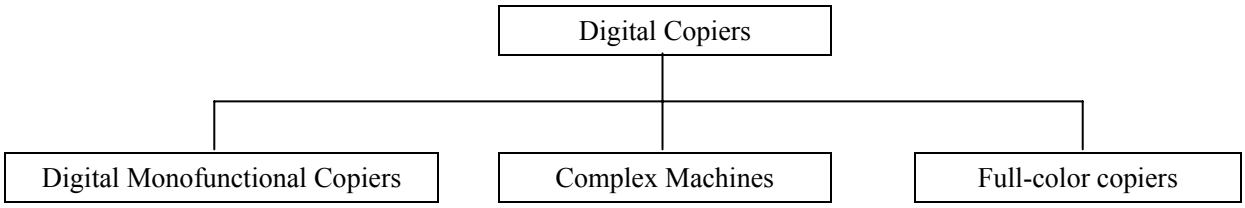




2. Features

Since it has the image processing unit, the digital copier is superior to the analog copier in terms of image tuning (tone) and image editing (trimming, masking, etc.) capabilities, etc. Enhancement is possible as an electronic memory or function of transmitting/receiving external signals can be added.

3. Classification of Digital Copiers



1) Digital Monofunctional Copiers

Although they have only functions as a copier, some of them use the electronic memory, thus having improved copying workability such as gathering, etc. or can improve content of 1-point color by utilizing the image editing capability.

2) Complex Machines

With the capability of transmitting/receiving external electric signals, some have incorporated the functions of a facsimile or a printer, thus becoming available on a network.

In the digital copiers with extensibility, customers can select the above capabilities as optional equipment based on the copying function.

3) Full-color Copiers

Compared with analog color copiers, they can tune images more precisely, thus achieving dramatic improvement in the picture quality. Consequently, the full-color copiers now on the market are digital copiers only.