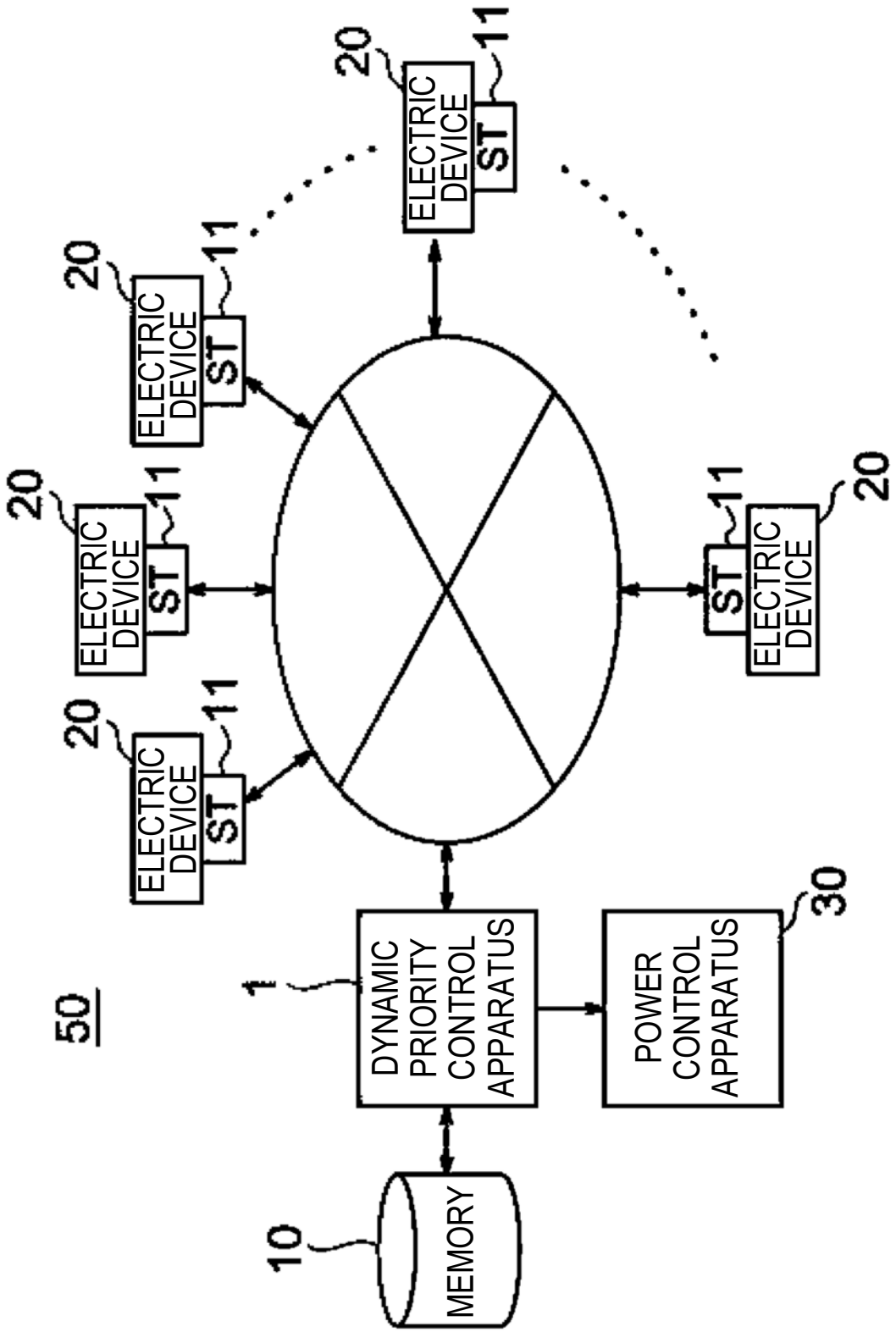
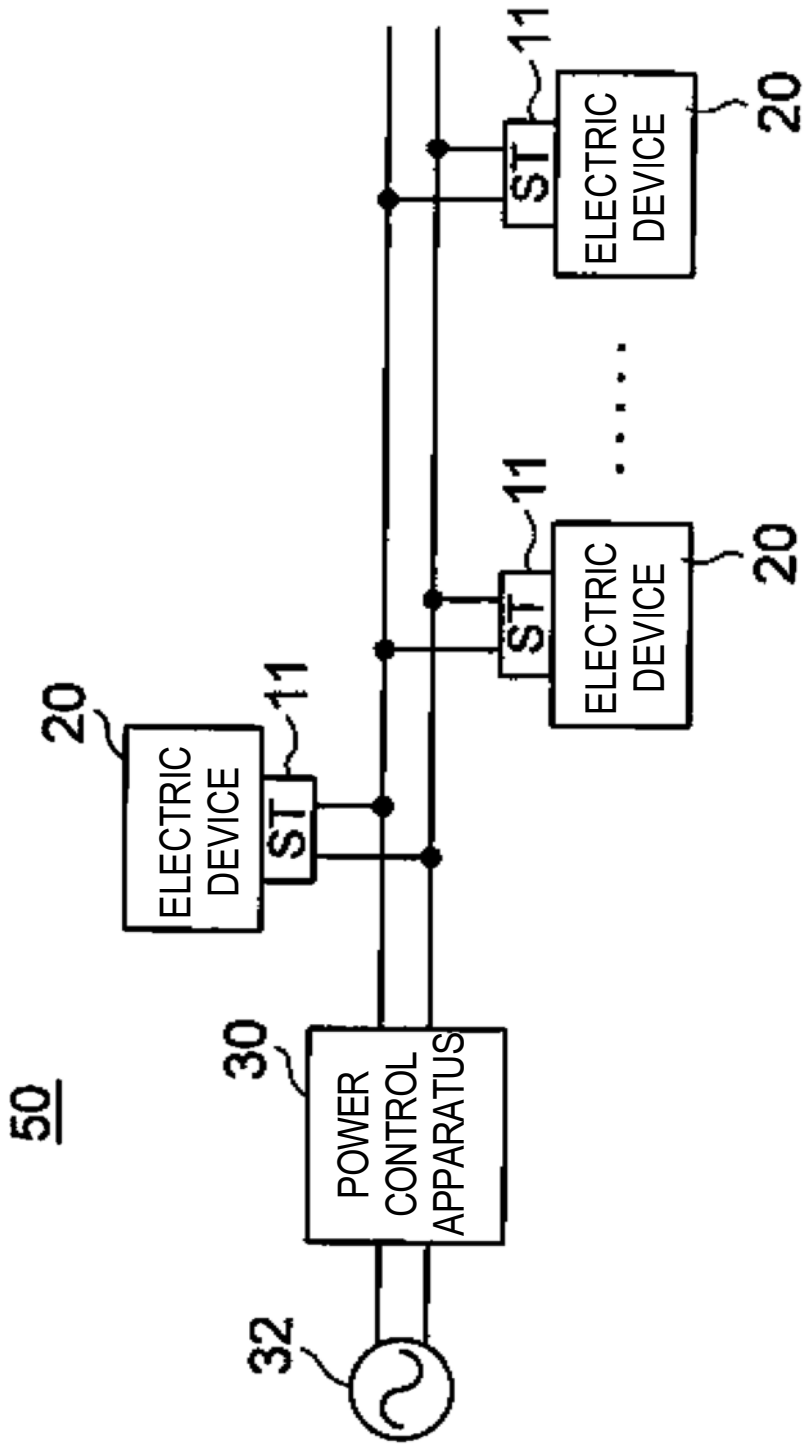
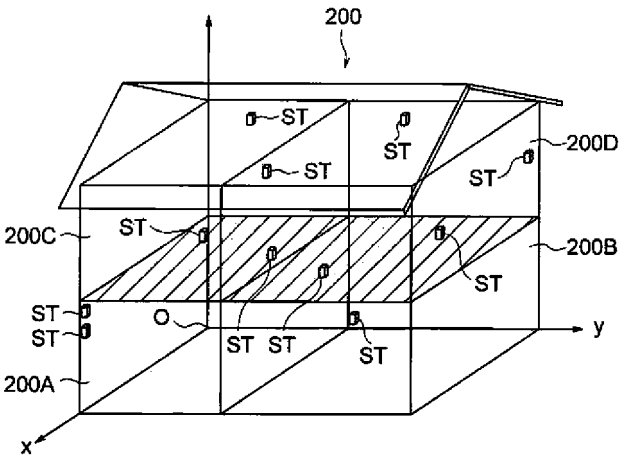
[Figure 1]


50
1
DYNAMIC PRIORITY CONTROL APPARATUS
POWER CONTROL APPARATUS
30
10
MEMORY
20
ELECTRIC DEVICE
11
ST

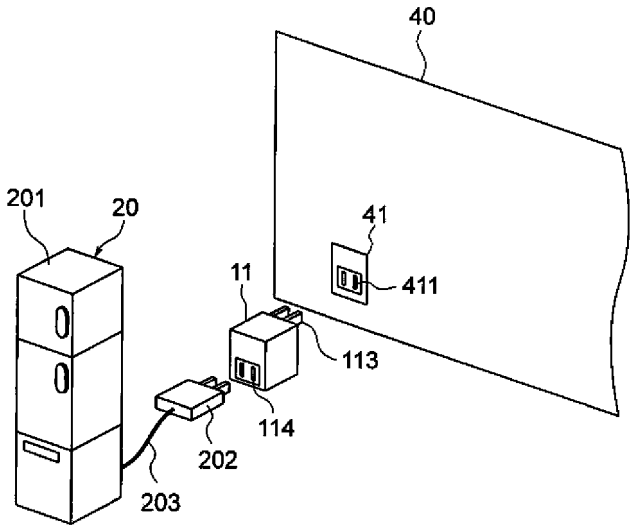
[Figure 2]


50
30
POWER CONTROL APPARATUS
32
20
ELECTRIC DEVICE
11
ST
20
ELECTRIC DEVICE
11
ST
20
ELECTRIC DEVICE
11
ST

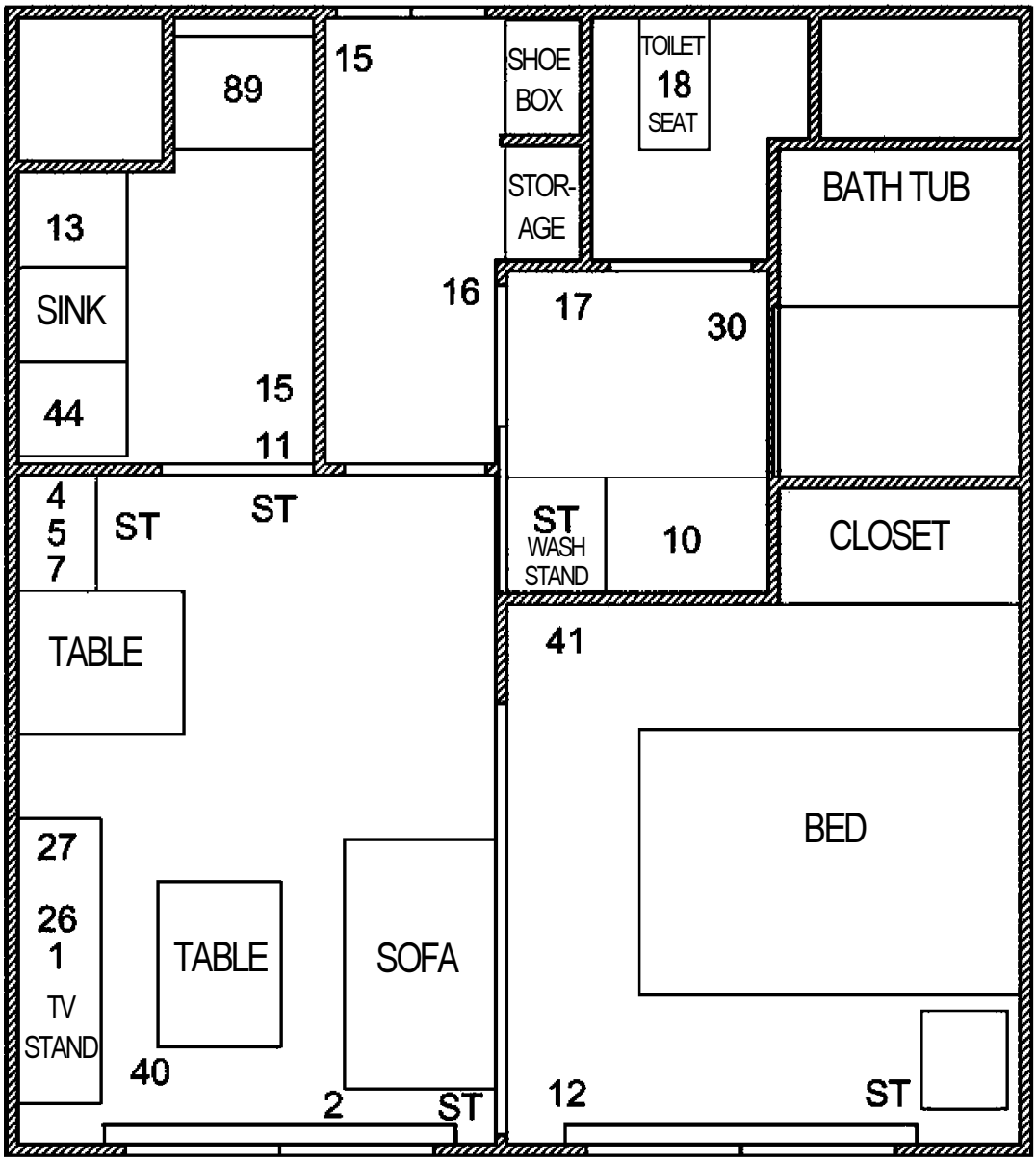
[Figure 3]



[Figure 4]

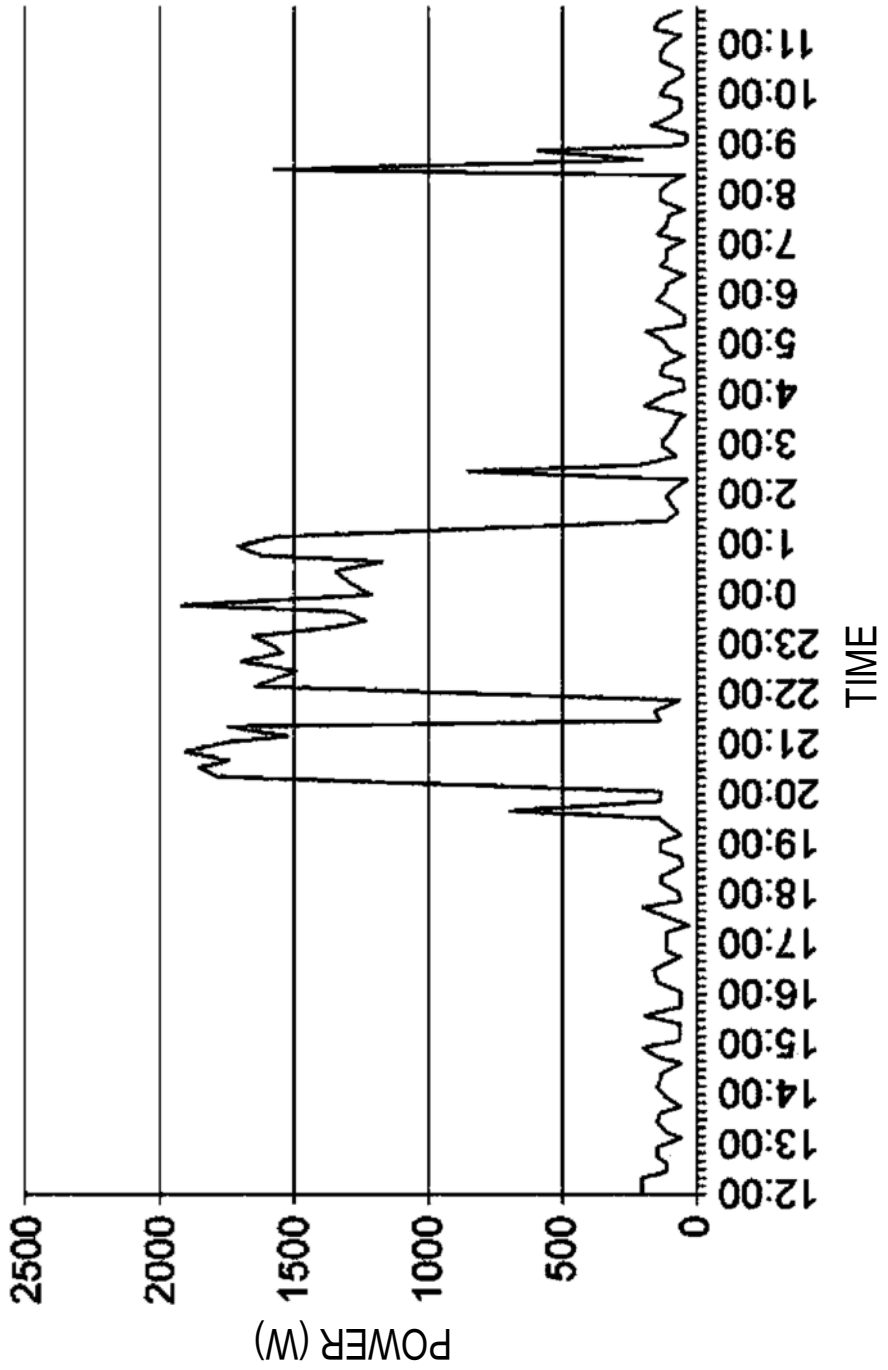


[Figure 5]

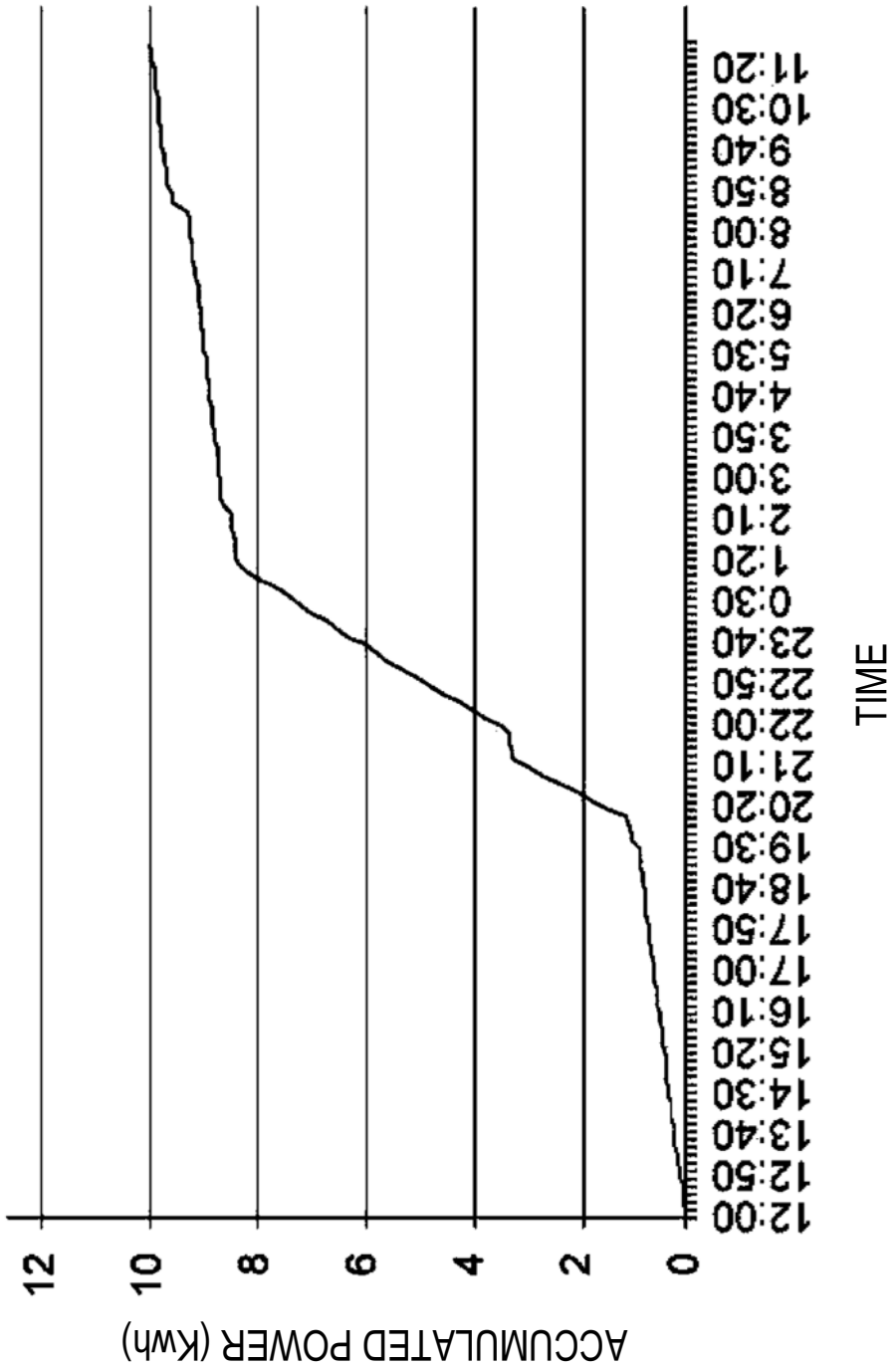


ARRANGEMENT OF APPLIANCES

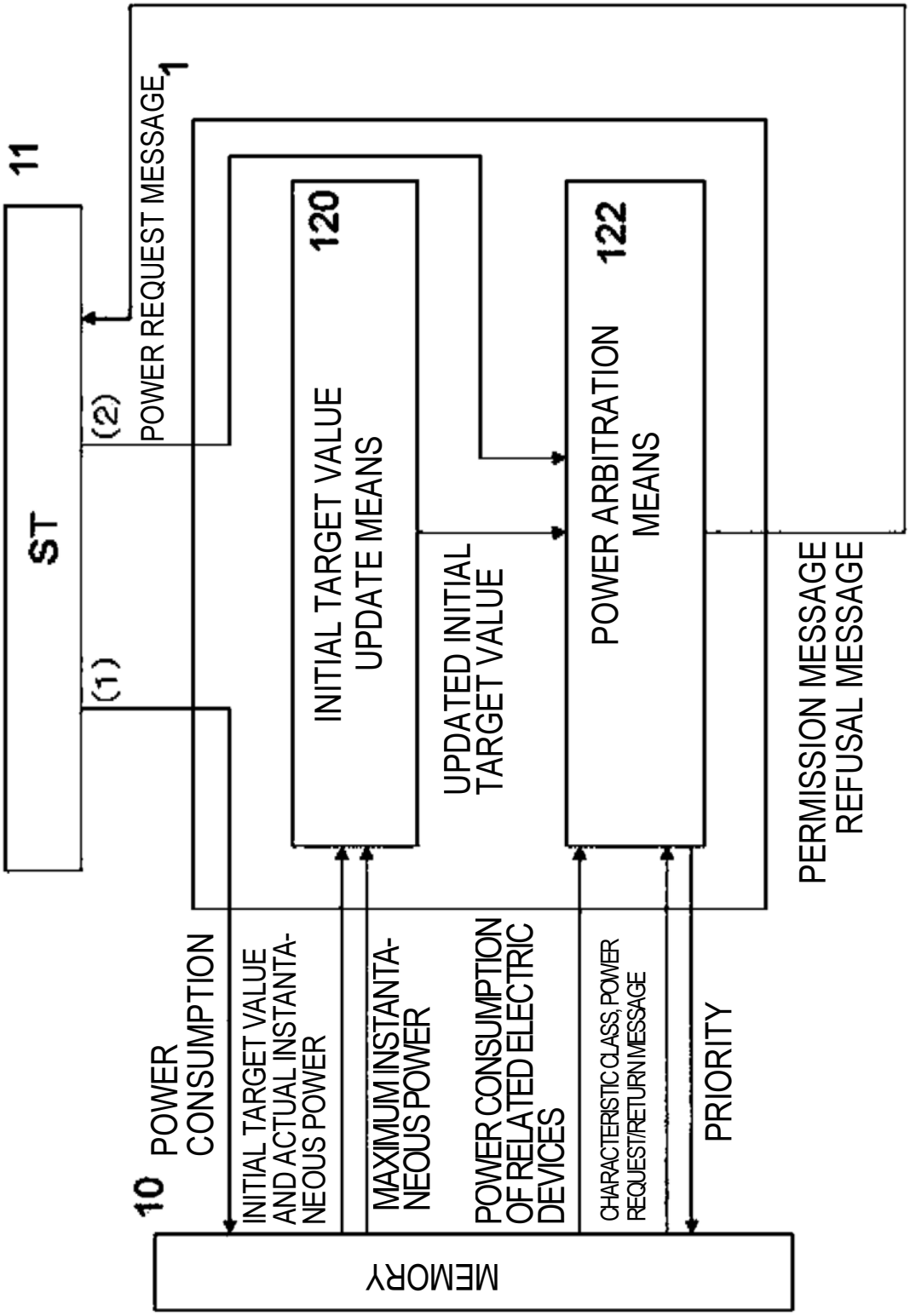
[Figure 6]


POWER (W)
2500
2000
1500
1000
500
0
TIME
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00

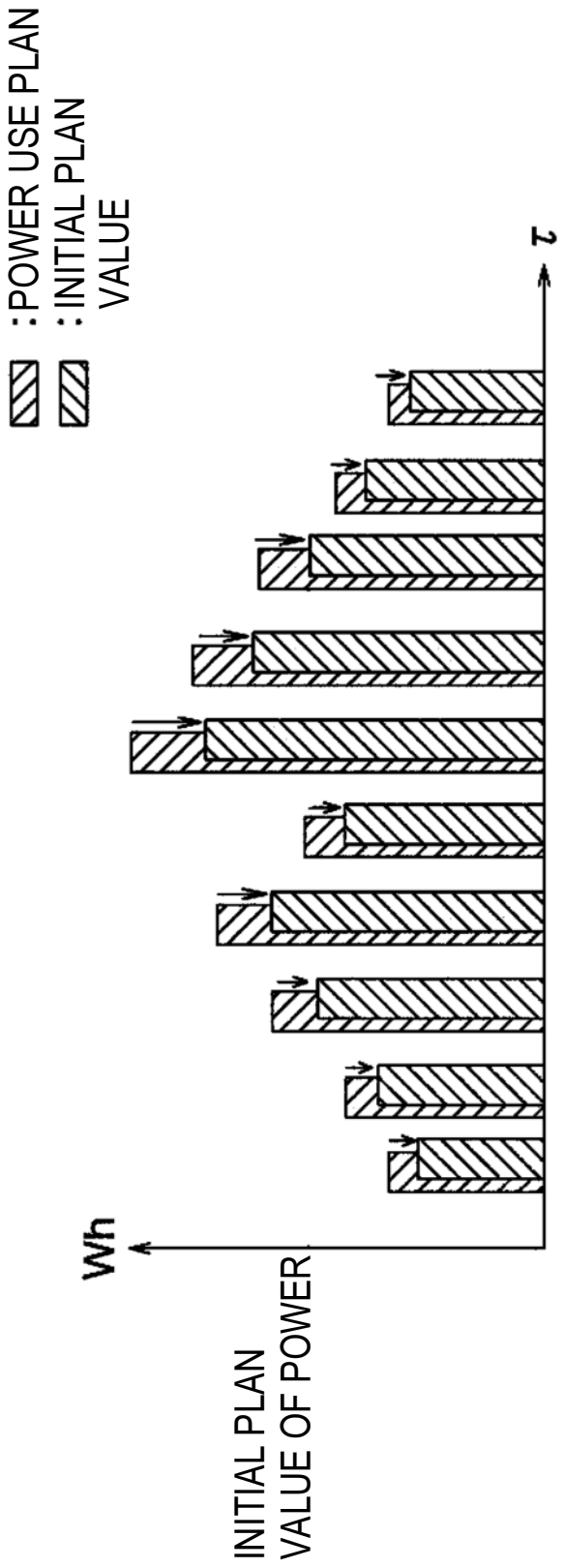
[Figure 7]


ACCUMULATED POWER (kwh)
0
2
4
6
8
10
12
TIME
12:00
12:50
13:40
14:30
15:20
16:10
17:00
17:50
18:40
19:30
20:20
21:10
22:00
22:50
23:40
0:30
1:20
2:10
3:00
3:50
4:40
5:30
6:20
7:10
8:00
8:50
9:40
10:30
11:20

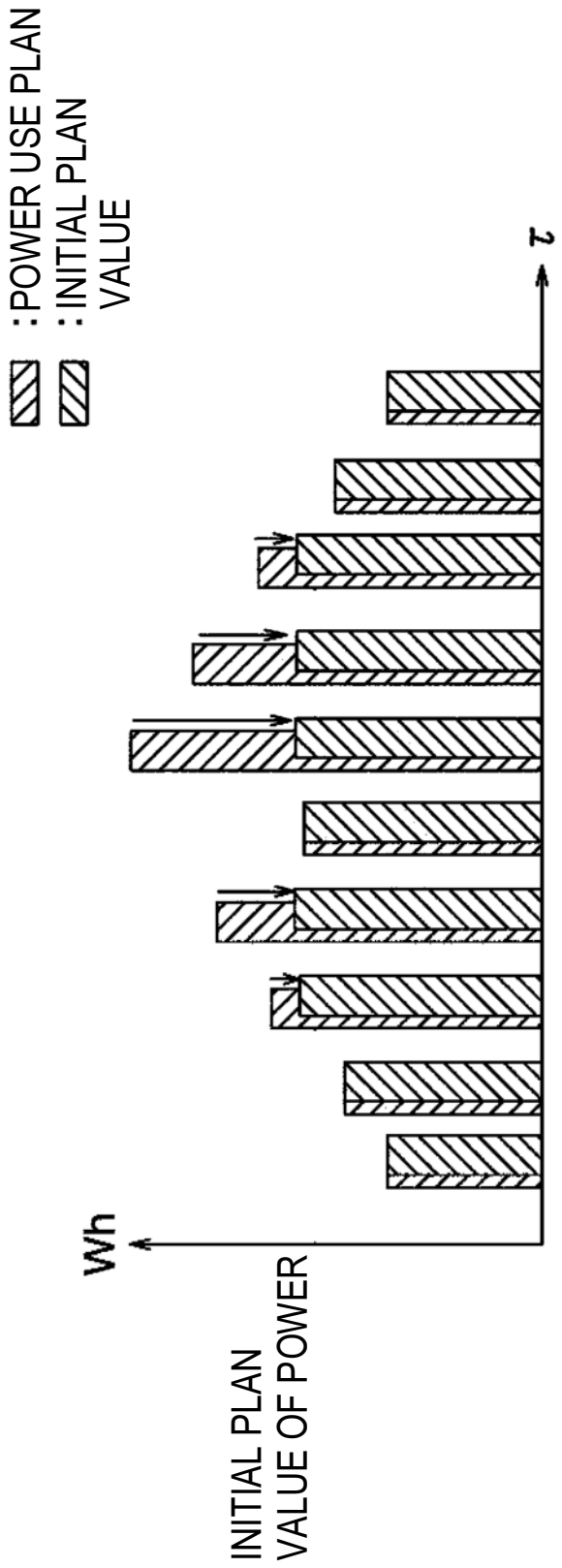
[Figure 8]


1
11
ST
(1)
(2)
POWER REQUEST MESSAGE
120
INITIAL TARGET VALUE UPDATE MEANS
122
POWER ARBITRATION MEANS
UPDATED INITIAL TARGET VALUE
PERMISSION MESSAGE
REFUSAL MESSAGE
10
POWER CONSUMPTION
INITIAL TARGET VALUE AND ACTUAL INSTANTA-NEOUS POWER
MAXIMUM INSTANTA-NEOUS POWER
POWER CONSUMPTION OF RELATED ELECTRIC DEVICES
CHARACTERISTIC CLASS, POWER REQUEST/RETURN MESSAGE
PRIORITY
MEMORY

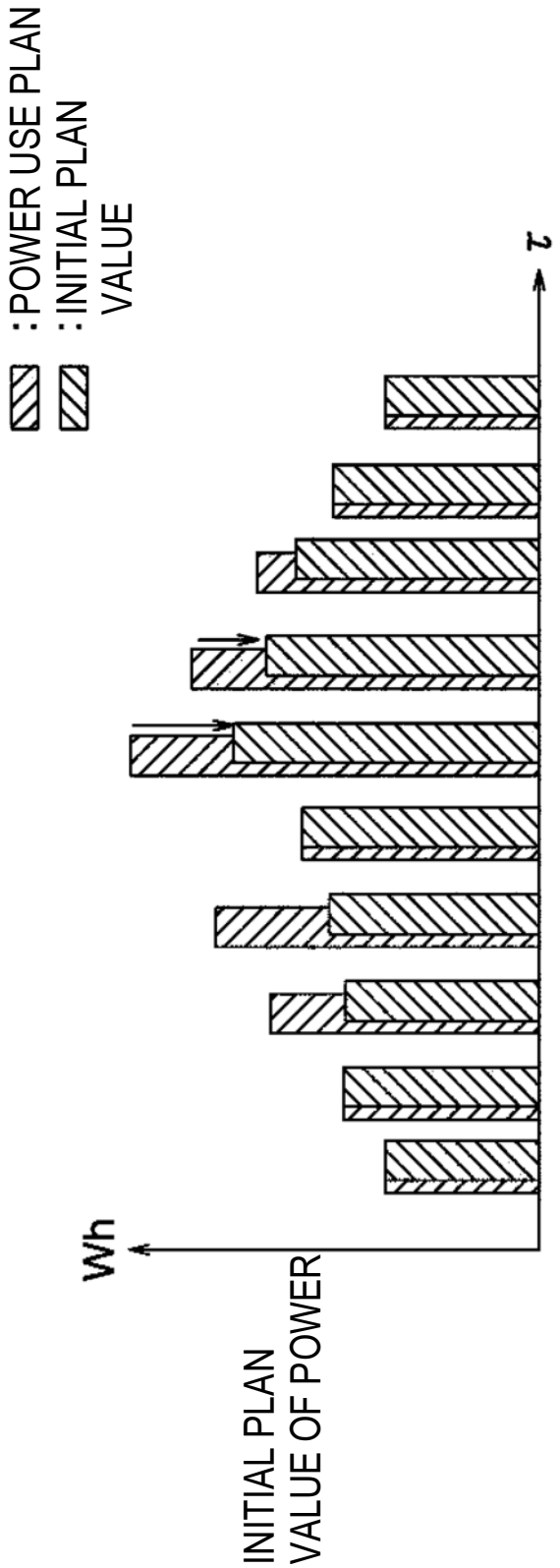
[Figure 9-1]


:POWER USE PLAN
:INITIAL PLAN VALUE
Z
Wh
INITIAL PLAN VALUE OF POWER

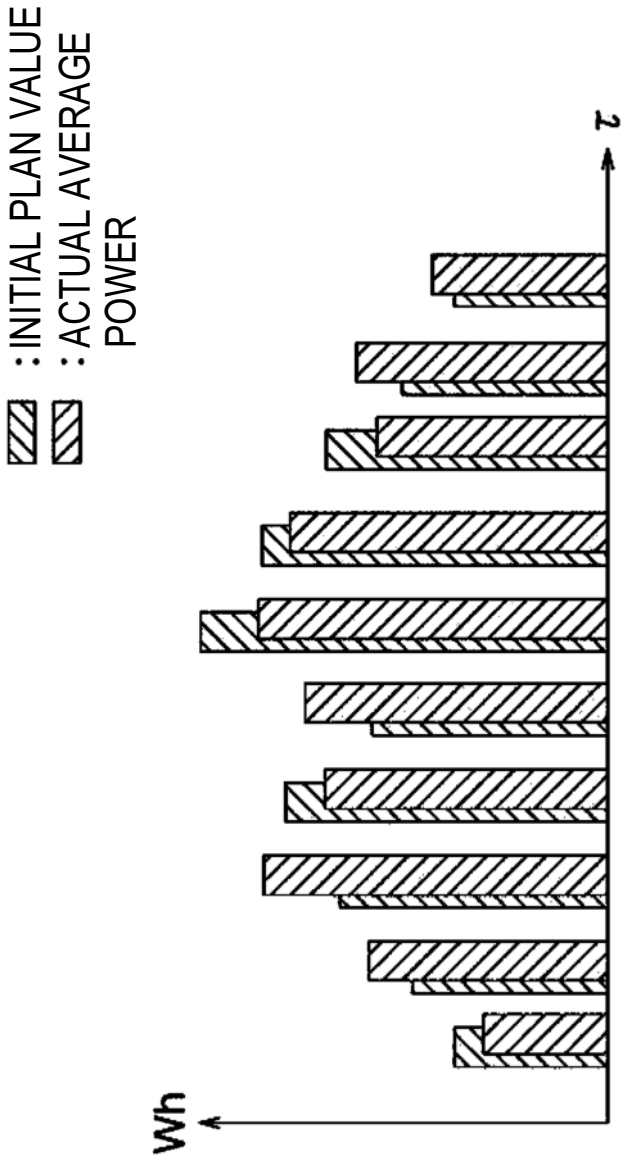
[Figure 9-2]


:POWER USE PLAN
:INITIAL PLAN VALUE
t
Wh
INITIAL PLAN VALUE OF POWER

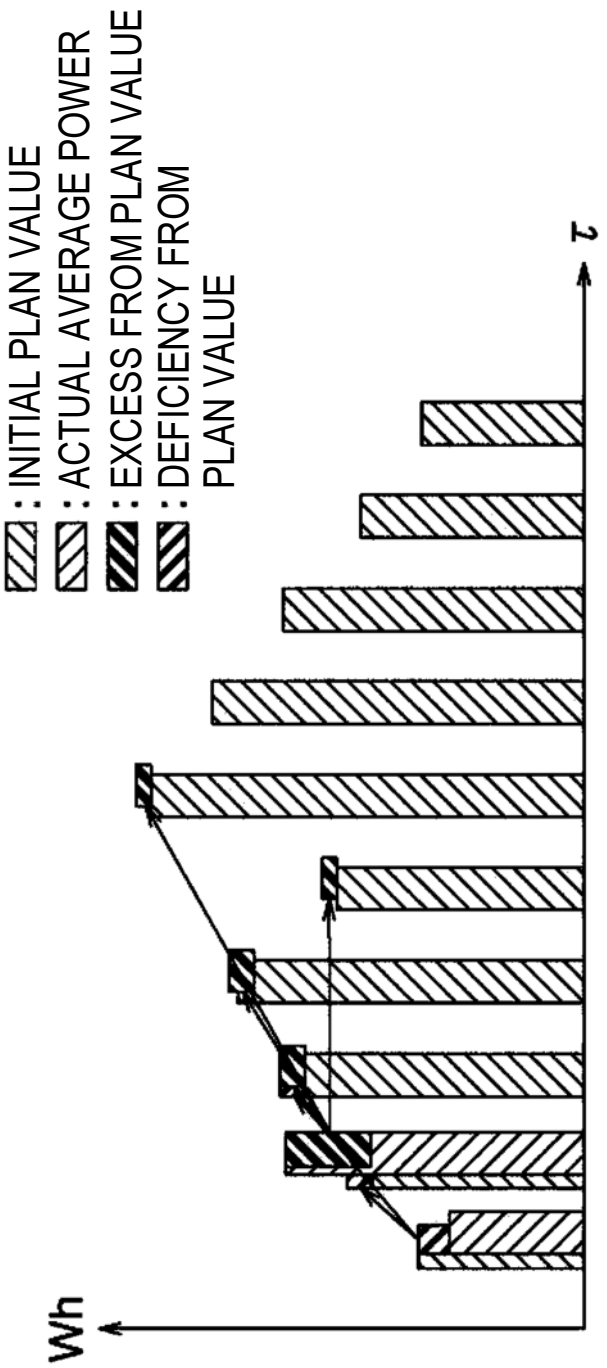
[Figure 9-3]


:POWER USE PLAN
:INITIAL PLAN VALUE
τ
Wh
INITIAL PLAN VALUE OF POWER

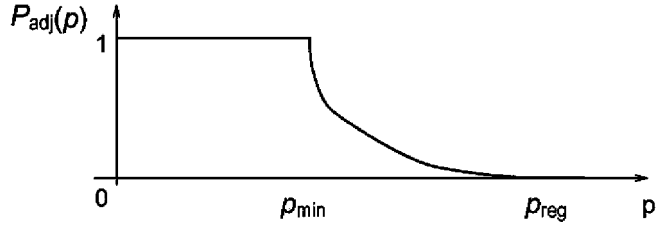
[Figure 10]



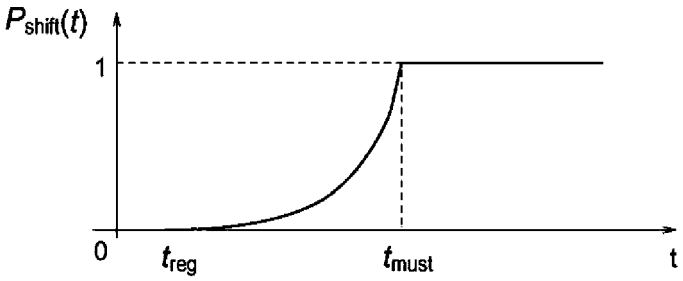
[Figure 11]


: INITIAL PLAN VALUE
: ACTUAL AVERAGE POWER
: EXCESS FROM PLAN VALUE
: DEFICIENCY FROM PLAN VALUE
Wh
z

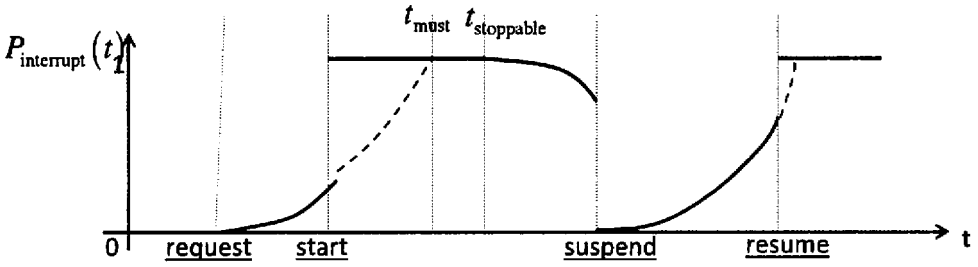
[Figure 12]



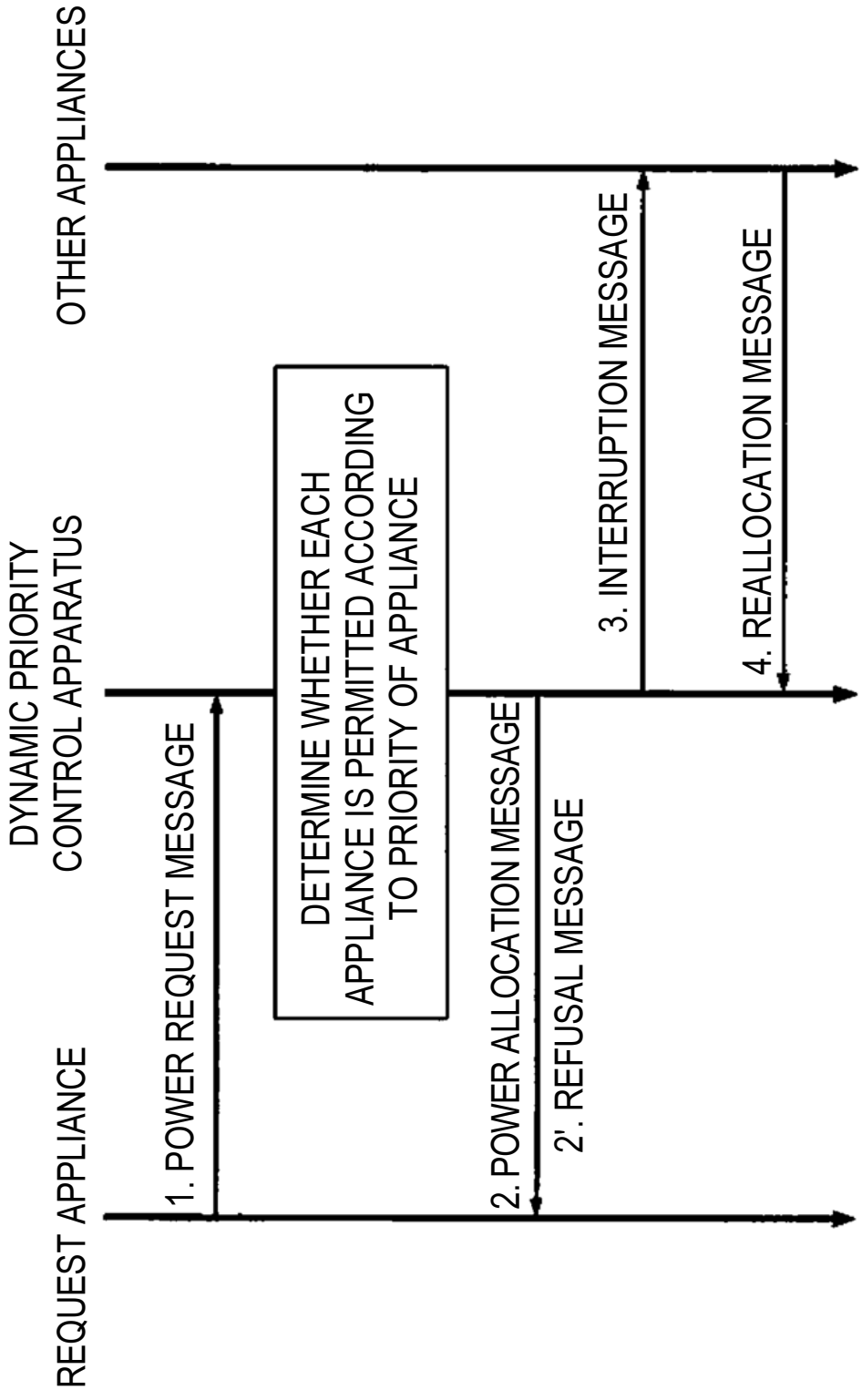
[Figure 13]



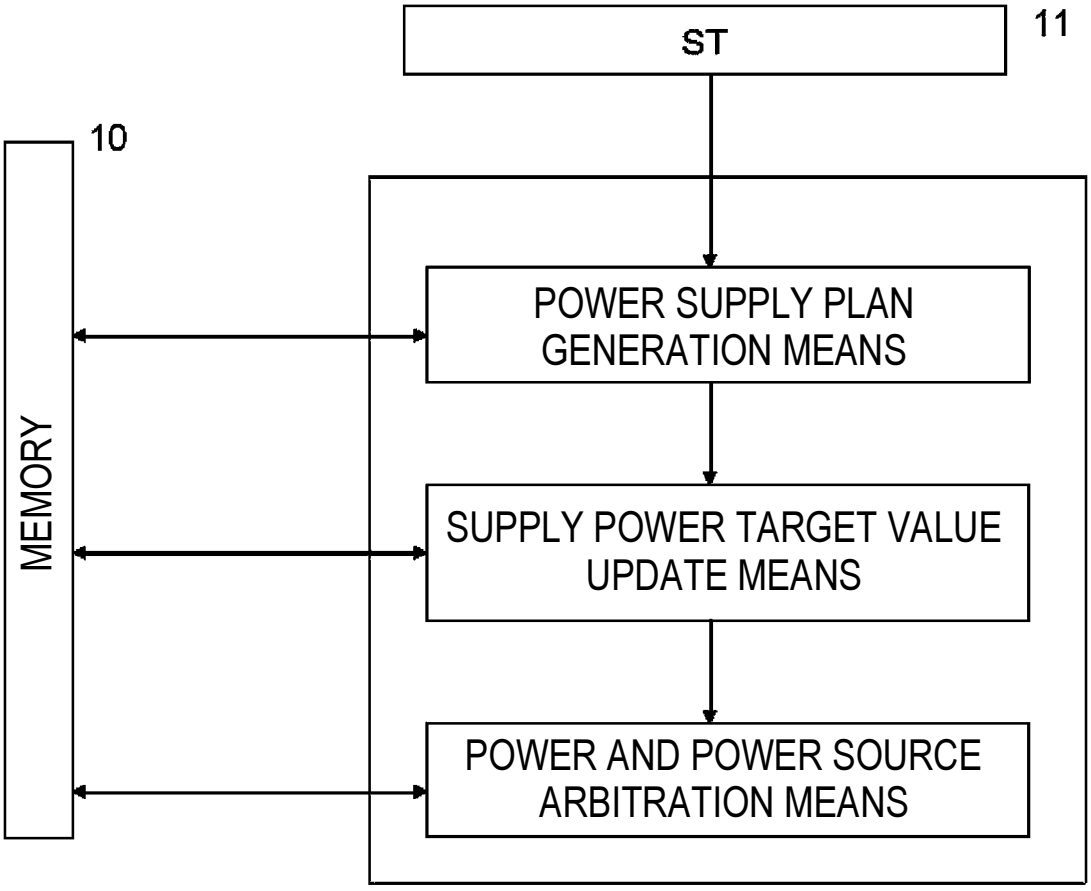
[Figure 14]



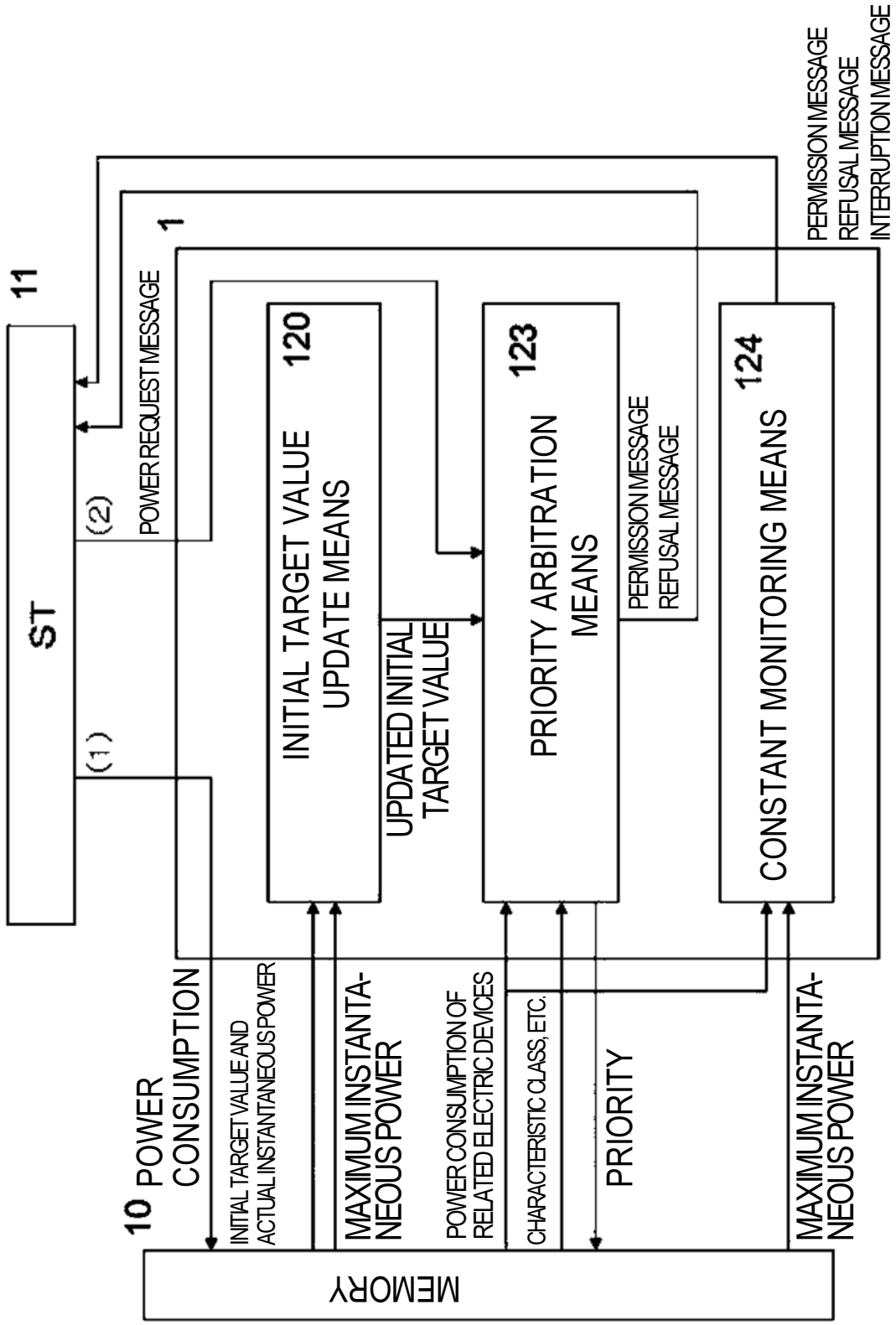
[Figure 15]


REQUEST APPLIANCE
DYNAMIC PRIORITY CONTROL APPARATUS
OTHER APPLIANCES
1. POWER REQUEST MESSAGE
DETERMINE WHETHER EACH APPLIANCE IS PERMITTED ACCORDING TO PRIORITY OF APPLIANCE
2. POWER ALLOCATION MESSAGE
2'. REFUSAL MESSAGE
3. INTERRUPTION MESSAGE
4. REALLOCATION MESSAGE

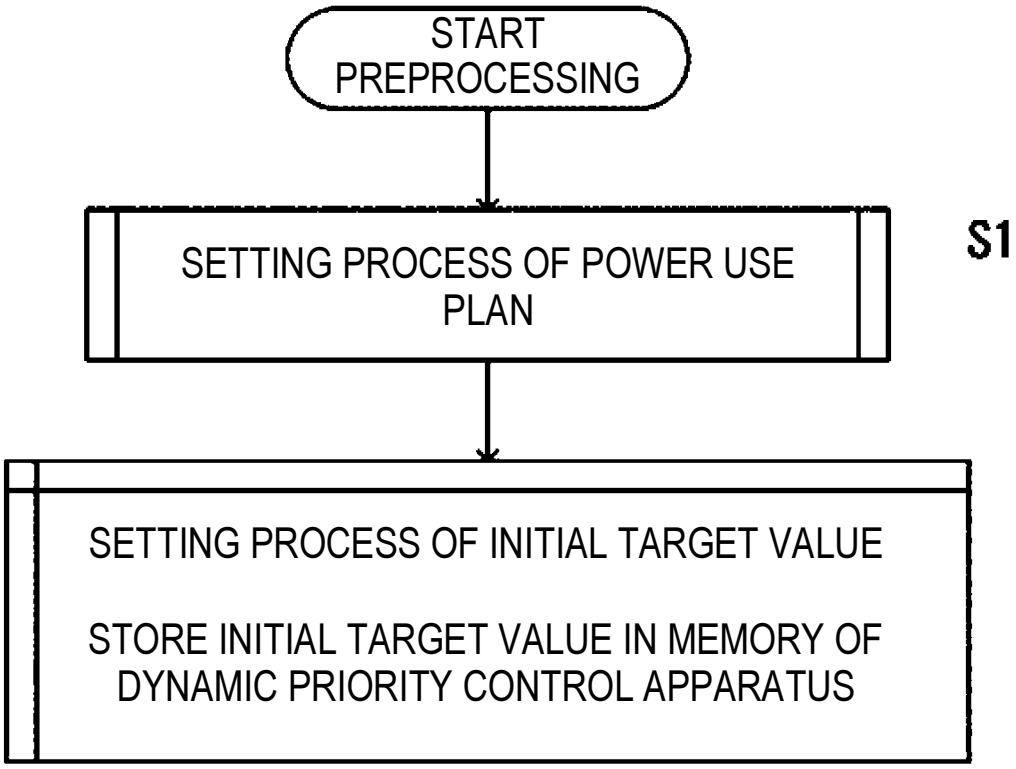
[Figure 16]


ST
11
10
MEMORY
POWER SUPPLY PLAN GENERATION MEANS
SUPPLY POWER TARGET VALUE UPDATE MEANS
POWER AND POWER SOURCE ARBITRATION MEANS

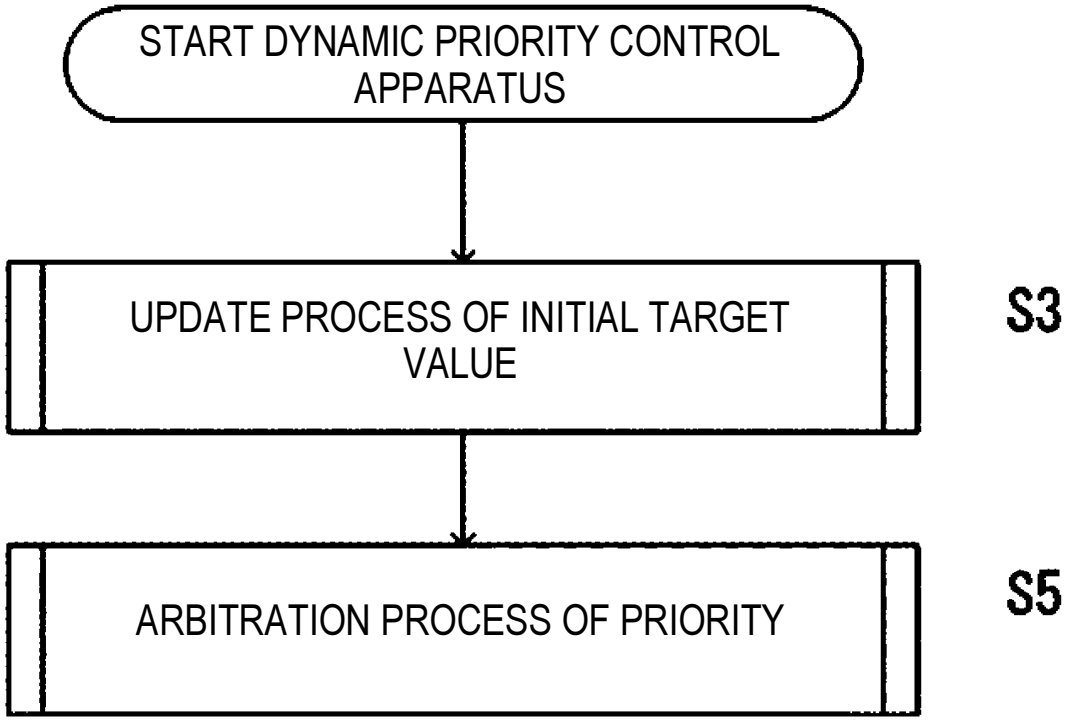
[Figure 17]


11
ST
(1)
(2)
POWER REQUEST MESSAGE
1
PERMISSION MESSAGE
REFUSAL MESSAGE
INTERRUPTION MESSAGE
120
INITIAL TARGET VALUE UPDATE MEANS
UPDATED INITIAL TARGET VALUE
123
PRIORITY ARBITRATION MEANS
PERMISSION MESSAGE
REFUSAL MESSAGE
124
CONSTANT MONITORING MEANS
10 POWER CONSUMPTION
INITIAL TARGET VALUE AND ACTUAL INSTANTANEOUS POWER
MAXIMUM INSTANTA-NEOUS POWER
POWER CONSUMPTION OF RELATED ELECTRIC DEVICES
CHARACTERISTIC CLASS, ETC.
PRIORITY
MAXIMUM INSTANTA-NEOUS POWER
MEMORY

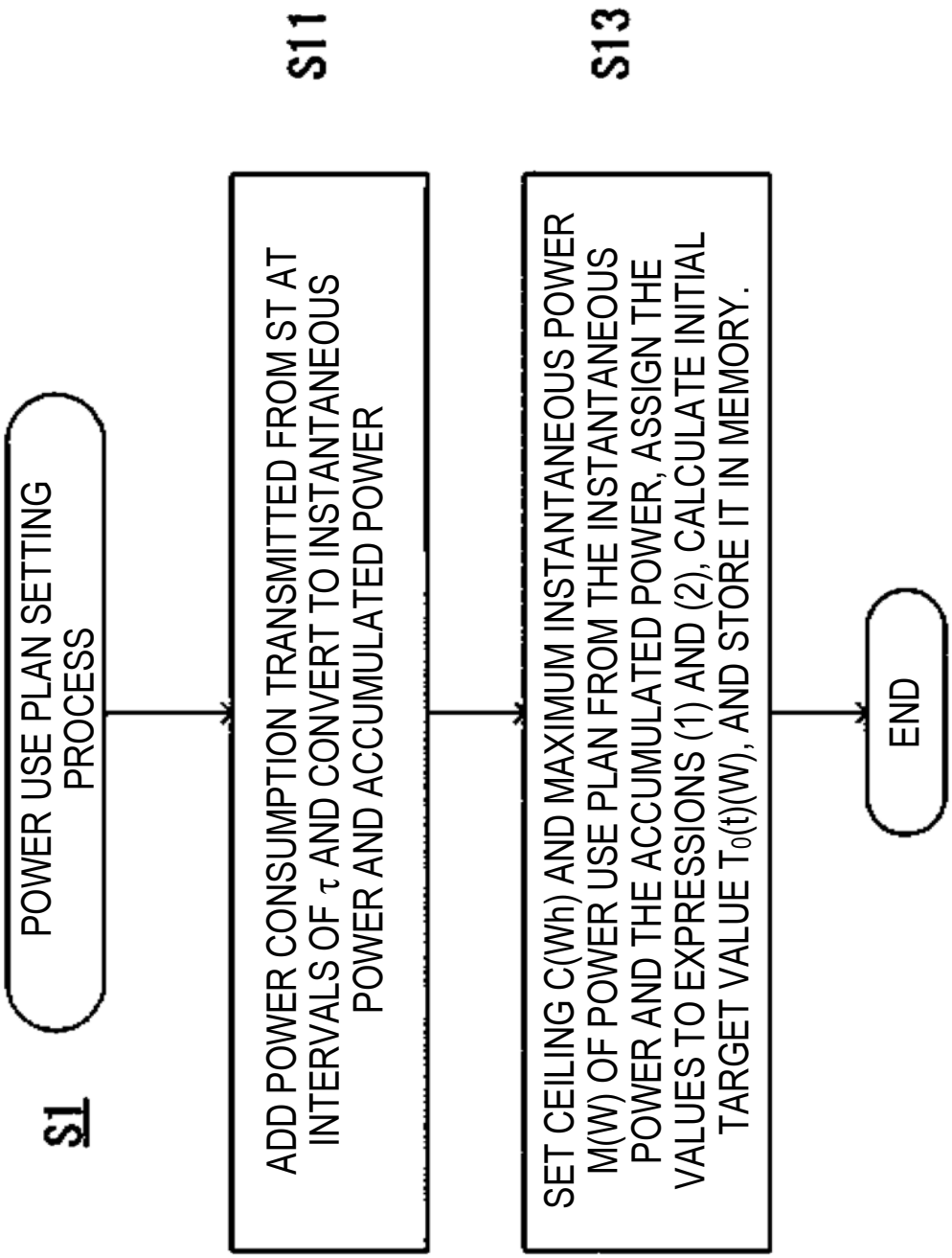
[Figure 18]


START PREPROCESSING
SETTING PROCESS OF POWER USE PLAN
S1
SETTING PROCESS OF INITIAL TARGET VALUE
STORE INITIAL TARGET VALUE IN MEMORY OF DYNAMIC PRIORITY CONTROL APPARATUS

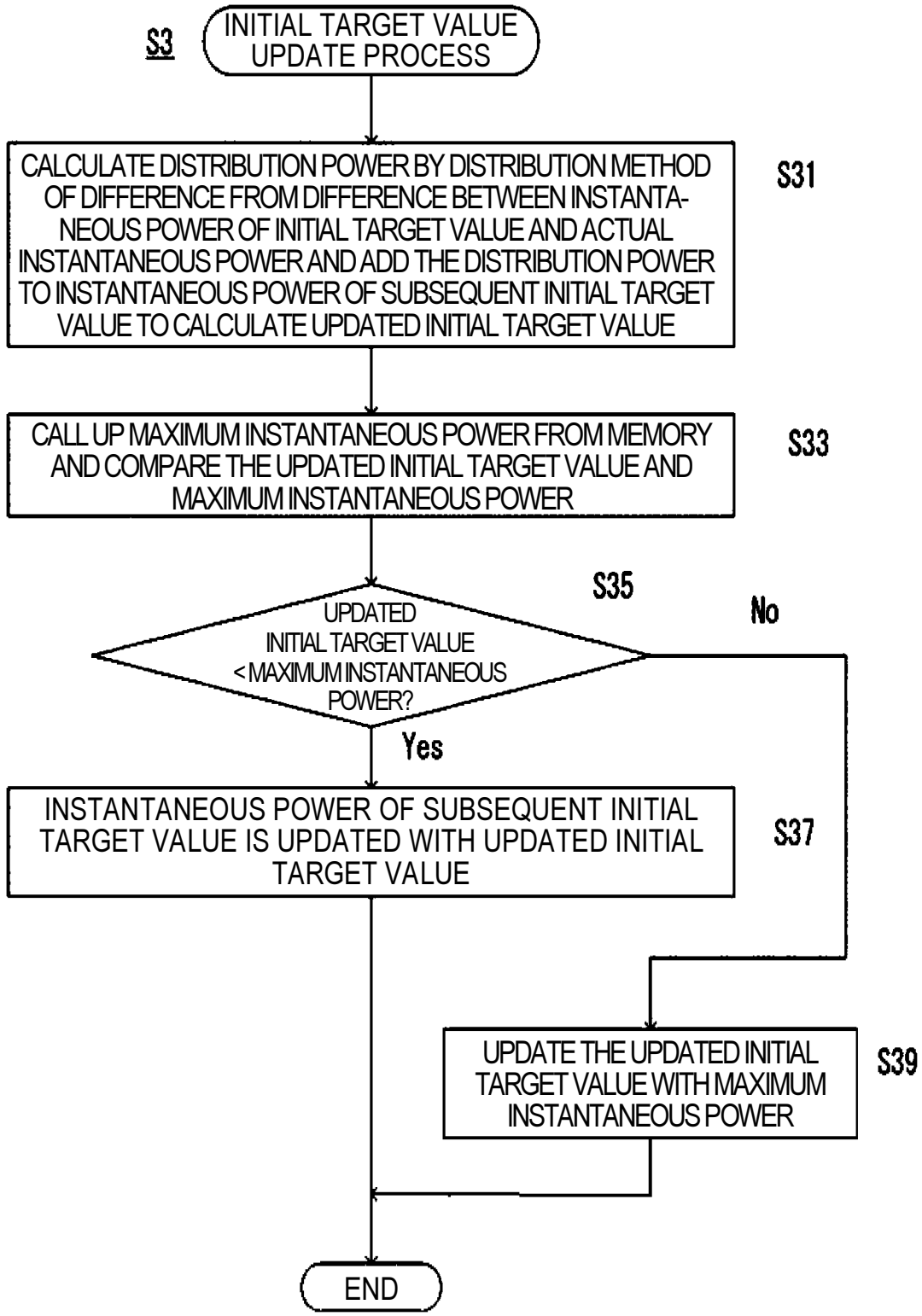
[Figure 19]


START DYNAMIC PRIORITY CONTROL APPARATUS
UPDATE PROCESS OF INITIAL TARGET VALUE
S3
ARBITRATION PROCESS OF PRIORITY
S5

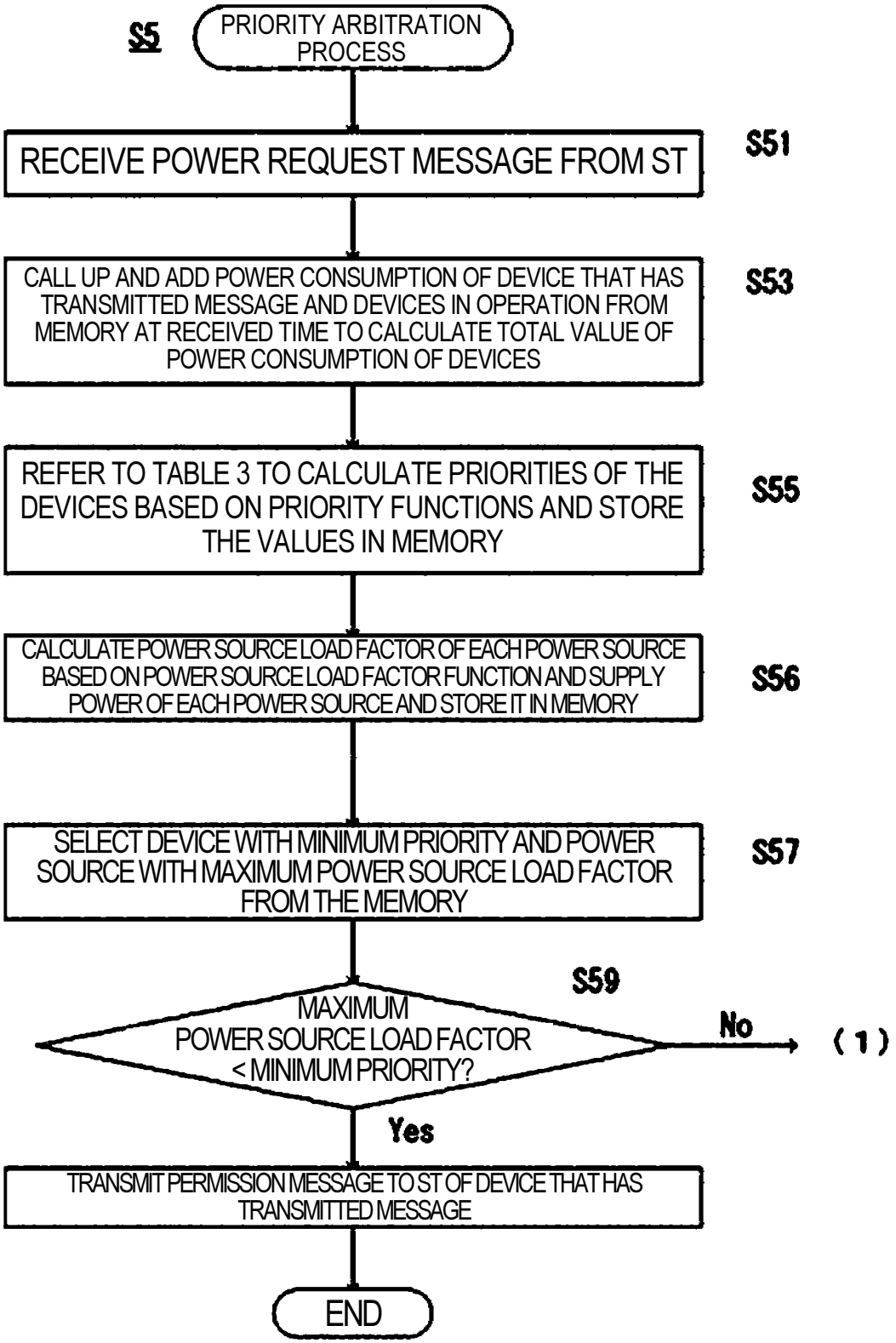
[Figure 20]


S1
POWER USE PLAN SETTING PROCESS
S11
ADD POWER CONSUMPTION TRANSMITTED FROM ST AT INTERVALS OF τ AND CONVERT TO INSTANTANEOUS POWER AND ACCUMULATED POWER
S13
SET CEILING C(Wh) AND MAXIMUM INSTANTANEOUS POWER M(W) OF POWER USE PLAN FROM THE INSTANTANEOUS POWER AND THE ACCUMULATED POWER, ASSIGN THE VALUES TO EXPRESSIONS (1) AND (2), CALCULATE INITIAL TARGET VALUE T0(t)(W), AND STORE IT IN MEMORY.
END

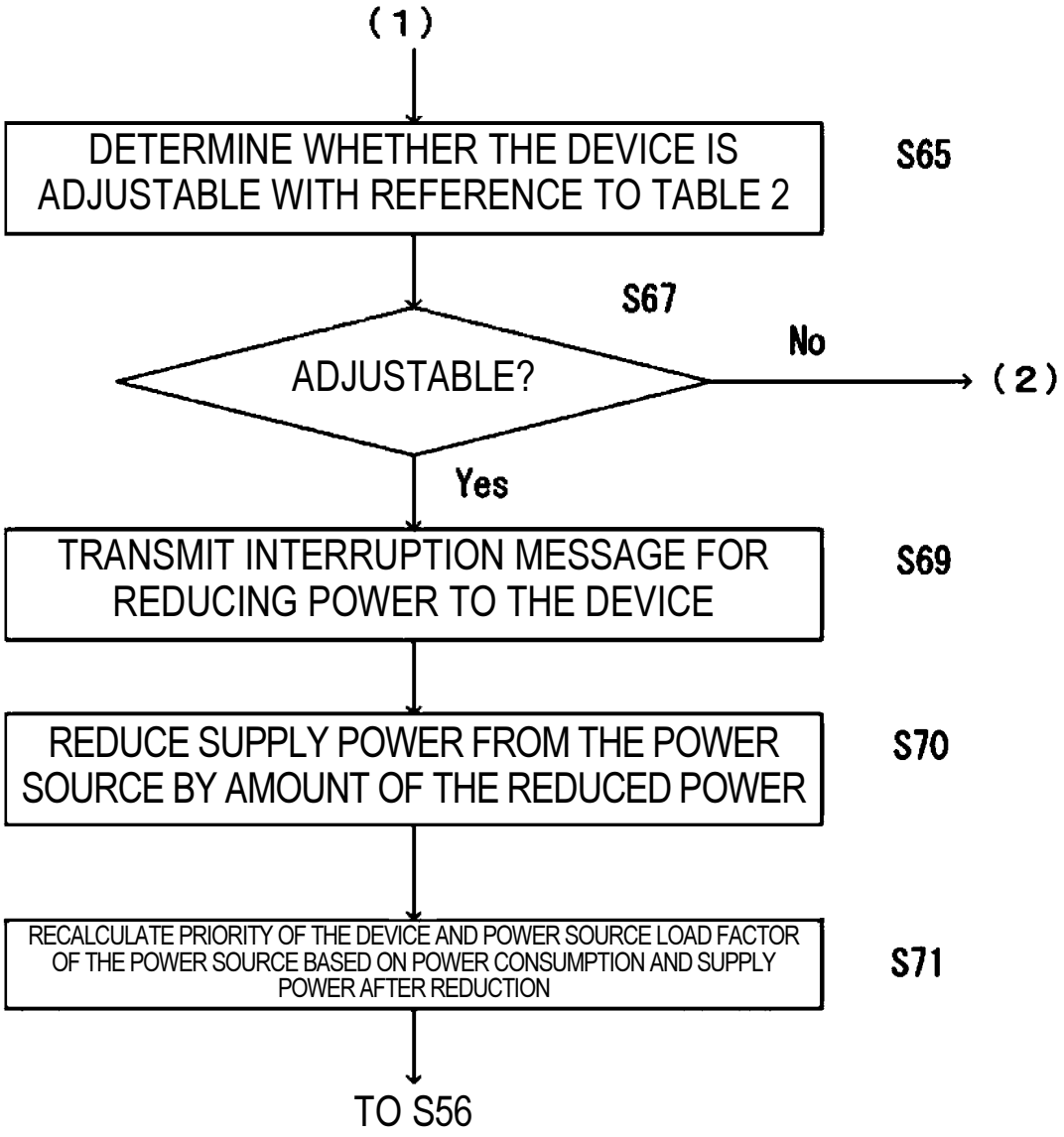
[Figure 21]


S3
INITIAL TARGET VALUE UPDATE PROCESS
CALCULATE DISTRIBUTION POWER BY DISTRIBUTION METHOD OF DIFFERENCE FROM DIFFERENCE BETWEEN INSTANTA-NEOUS POWER OF INITIAL TARGET VALUE AND ACTUAL INSTANTANEOUS POWER AND ADD THE DISTRIBUTION POWER TO INSTANTANEOUS POWER OF SUBSEQUENT INITIAL TARGET VALUE TO CALCULATE UPDATED INITIAL TARGET VALUE
S31
CALL UP MAXIMUM INSTANTANEOUS POWER FROM MEMORY AND COMPARE THE UPDATED INITIAL TARGET VALUE AND MAXIMUM INSTANTANEOUS POWER
S33
S35
UPDATED INITIAL TARGET VALUE < MAXIMUM INSTANTANEOUS POWER?
No
Yes
INSTANTANEOUS POWER OF SUBSEQUENT INITIAL TARGET VALUE IS UPDATED WITH UPDATED INITIAL TARGET VALUE
S37
UPDATE THE UPDATED INITIAL TARGET VALUE WITH MAXIMUM INSTANTANEOUS POWER
S39
END

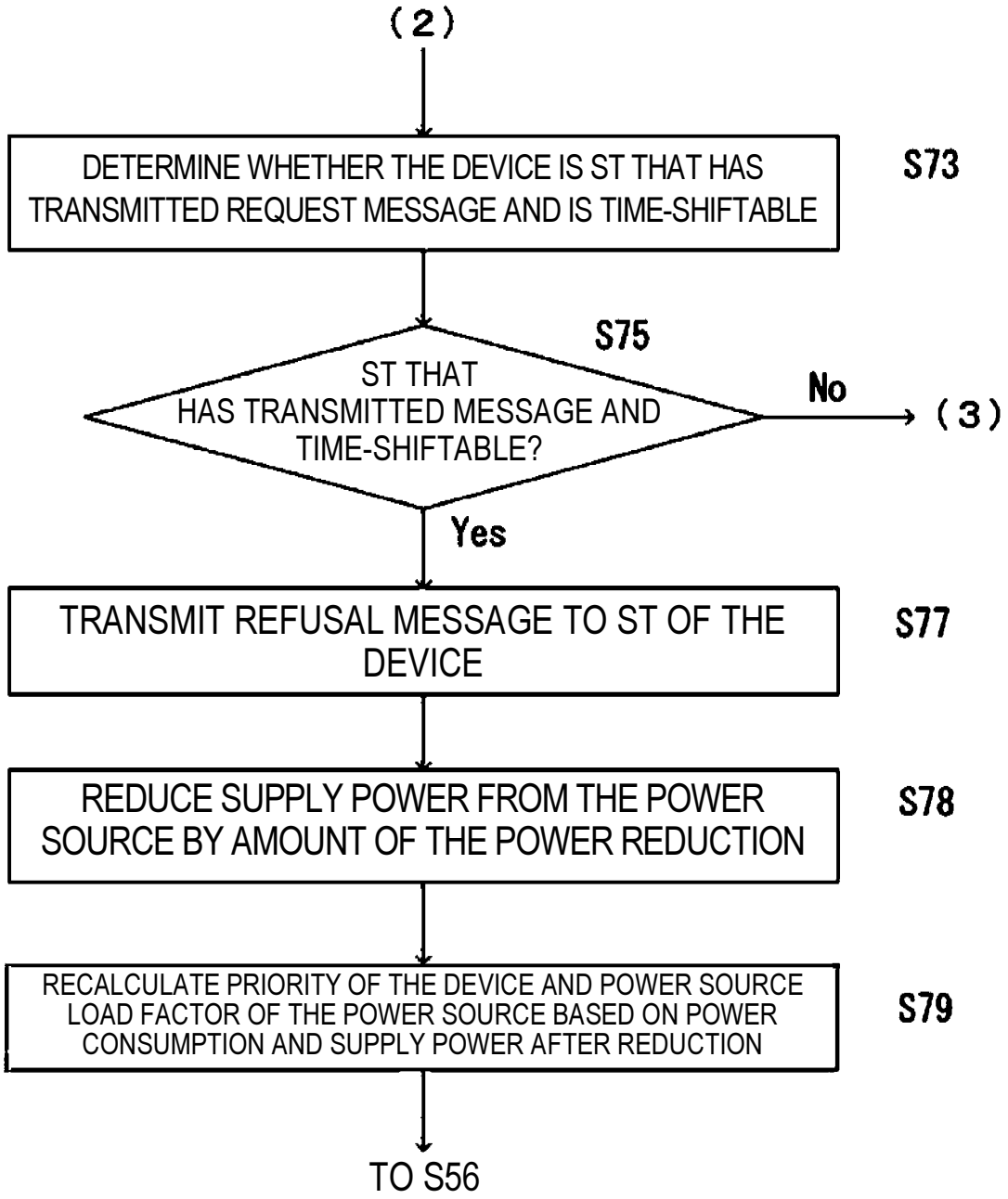
[Figure 22-1]


S5
PRIORITY ARBITRATION PROCESS
RECEIVE POWER REQUEST MESSAGE FROM ST
S51
CALL UP AND ADD POWER CONSUMPTION OF DEVICE THAT HAS TRANSMITTED MESSAGE AND DEVICES IN OPERATION FROM MEMORY AT RECEIVED TIME TO CALCULATE TOTAL VALUE OF POWER CONSUMPTION OF DEVICES
S53
REFER TO TABLE 3 TO CALCULATE PRIORITIES OF THE DEVICES BASED ON PRIORITY FUNCTIONS AND STORE THE VALUES IN MEMORY
S55
CALCULATE POWER SOURCE LOAD FACTOR OF EACH POWER SOURCE BASED ON POWER SOURCE LOAD FACTOR FUNCTION AND SUPPLY POWER OF EACH POWER SOURCE AND STORE IT IN MEMORY
S56
SELECT DEVICE WITH MINIMUM PRIORITY AND POWER SOURCE WITH MAXIMUM POWER SOURCE LOAD FACTOR FROM THE MEMORY
S57
S59
MAXIMUM POWER SOURCE LOAD FACTOR < MINIMUM PRIORITY?
No
(1)
Yes
TRANSMIT PERMISSION MESSAGE TO ST OF DEVICE THAT HAS TRANSMITTED MESSAGE
END

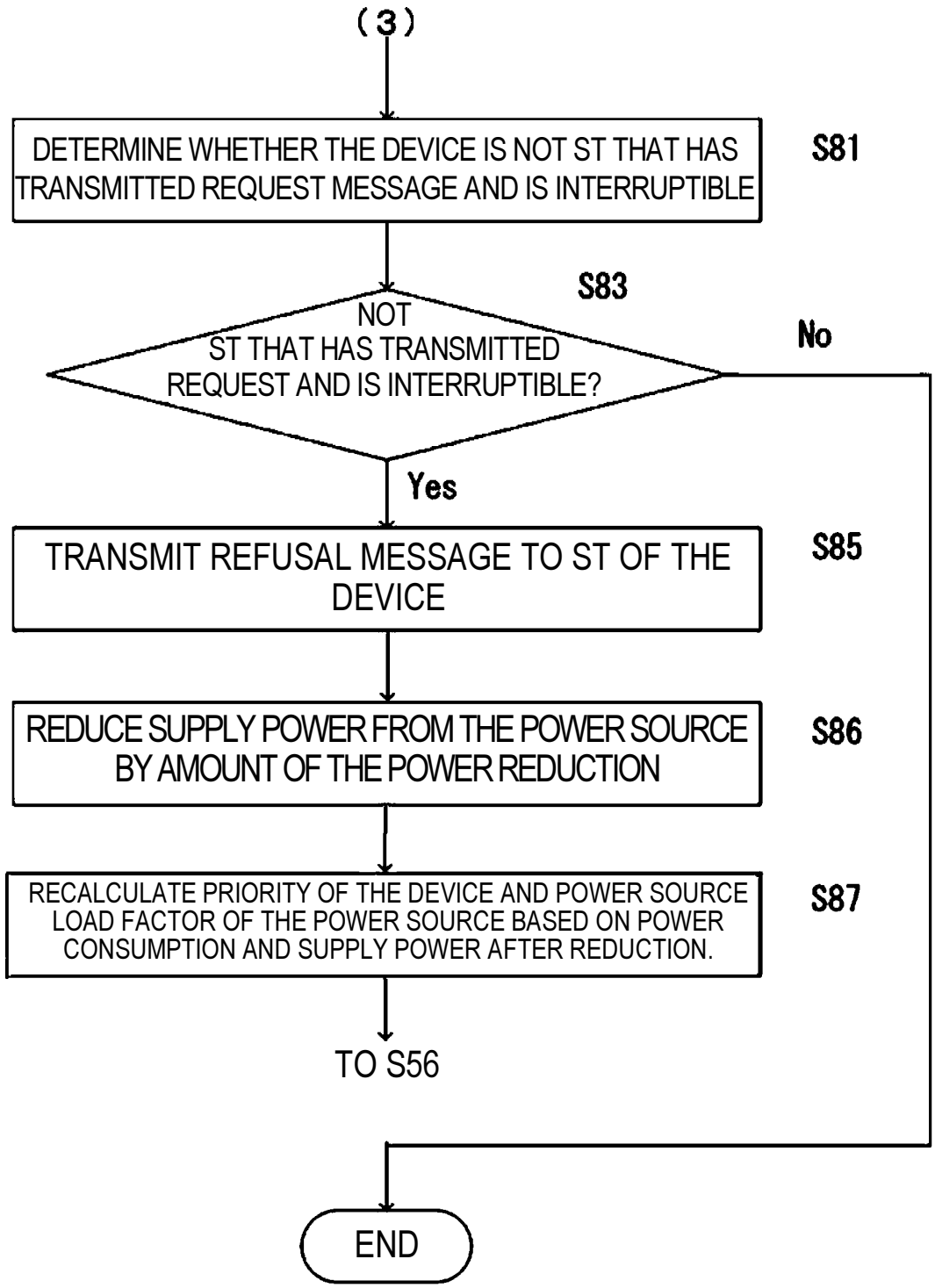
[Figure 22-2]


(1)
DETERMINE WHETHER THE DEVICE IS ADJUSTABLE WITH REFERENCE TO TABLE 2
S65
S67
ADJUSTABLE?
No
(2)
Yes
TRANSMIT INTERRUPTION MESSAGE FOR REDUCING POWER TO THE DEVICE
S69
REDUCE SUPPLY POWER FROM THE POWER SOURCE BY AMOUNT OF THE REDUCED POWER
S70
RECALCULATE PRIORITY OF THE DEVICE AND POWER SOURCE LOAD FACTOR OF THE POWER SOURCE BASED ON POWER CONSUMPTION AND SUPPLY POWER AFTER REDUCTION
S71
TO S56

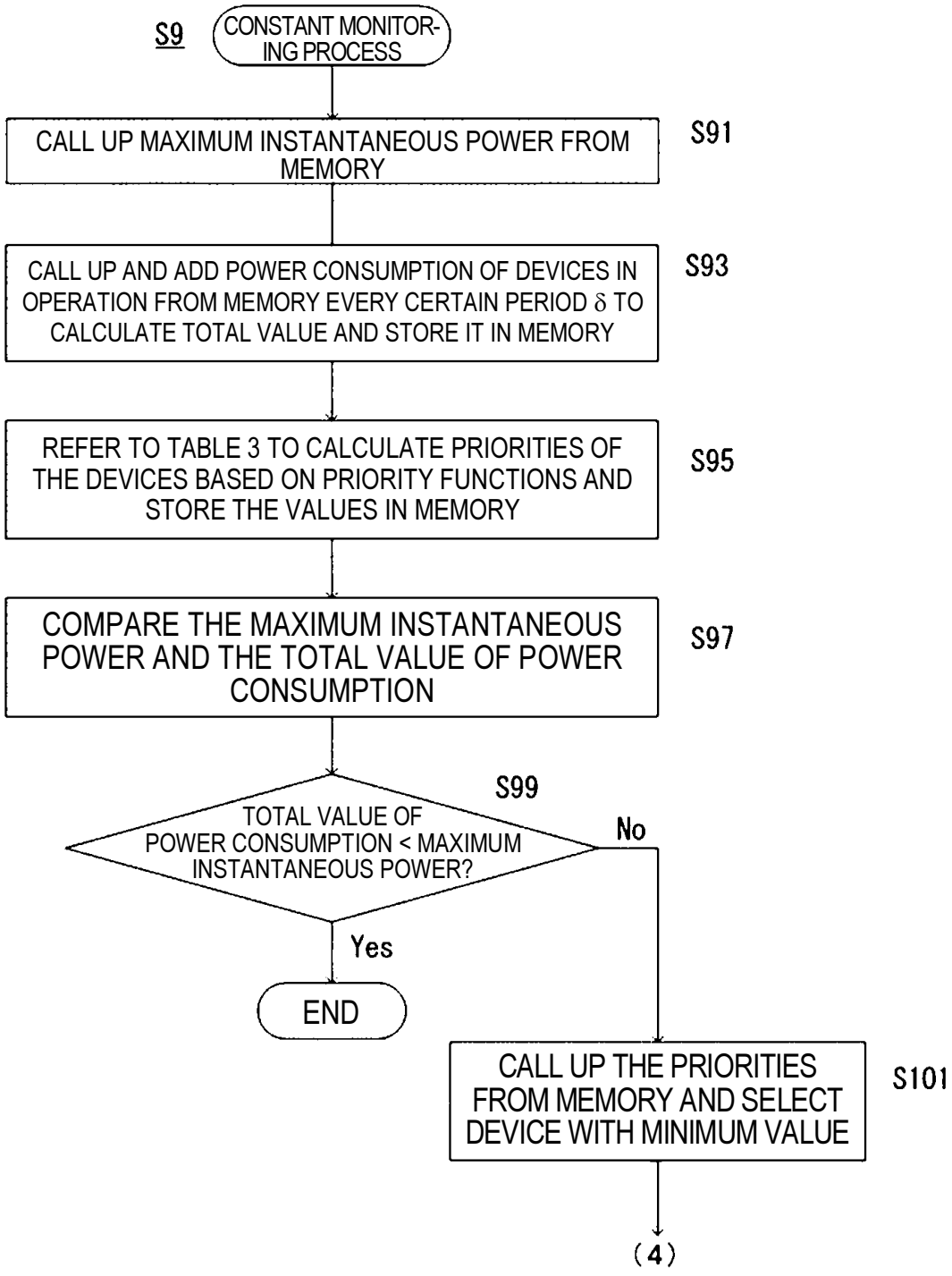
[Figure 22-3]


(2)
DETERMINE WHETHER THE DEVICE IS ST THAT HAS TRANSMITTED REQUEST MESSAGE AND IS TIME-SHIFTABLE
S73
S75
ST THAT HAS TRANSMITTED MESSAGE AND TIME-SHIFTABLE?
No
(3)
Yes
TRANSMIT REFUSAL MESSAGE TO ST OF THE DEVICE
S77
REDUCE SUPPLY POWER FROM THE POWER SOURCE BY AMOUNT OF THE POWER REDUCTION
S78
RECALCULATE PRIORITY OF THE DEVICE AND POWER SOURCE LOAD FACTOR OF THE POWER SOURCE BASED ON POWER CONSUMPTION AND SUPPLY POWER AFTER REDUCTION
S79
TO S56

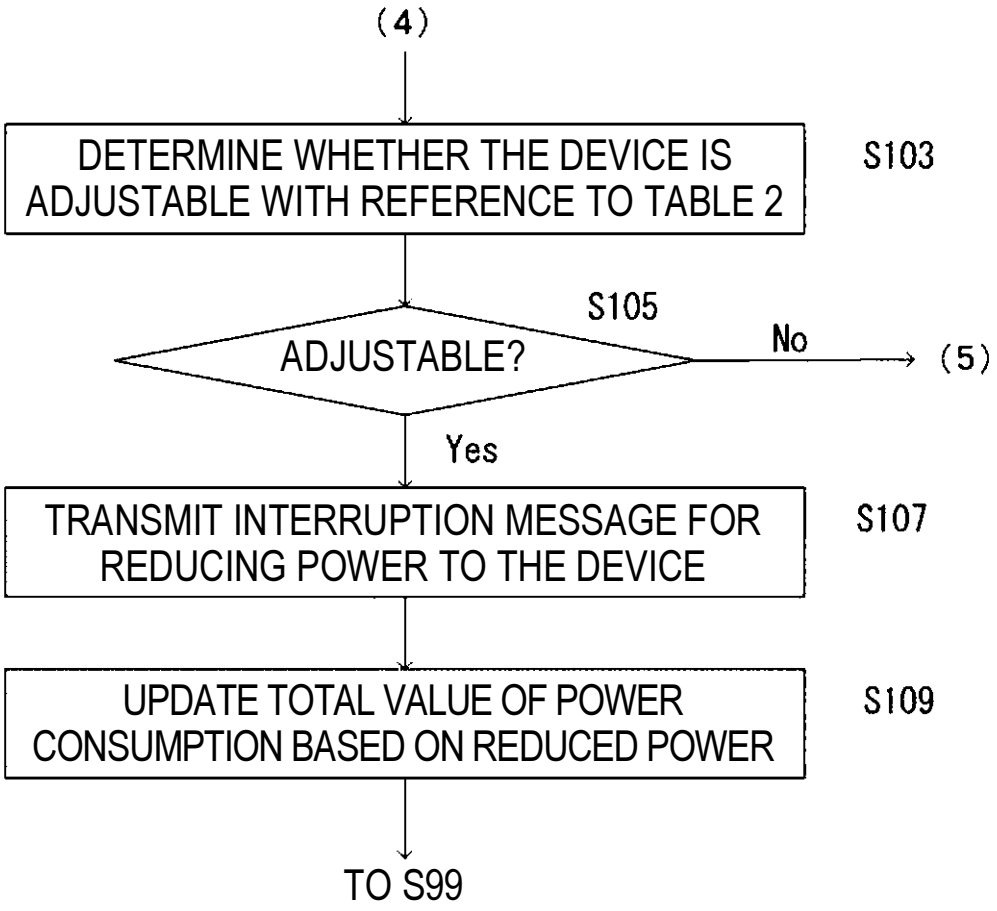
[Figure 22-4]


(3)
DETERMINE WHETHER THE DEVICE IS NOT ST THAT HAS TRANSMITTED REQUEST MESSAGE AND IS INTERRUPTIBLE
S81
S83
NOT ST THAT HAS TRANSMITTED REQUEST AND IS INTERRUPTIBLE?
No
Yes
TRANSMIT REFUSAL MESSAGE TO ST OF THE DEVICE
S85
REDUCE SUPPLY POWER FROM THE POWER SOURCE BY AMOUNT OF THE POWER REDUCTION
S86
RECALCULATE PRIORITY OF THE DEVICE AND POWER SOURCE LOAD FACTOR OF THE POWER SOURCE BASED ON POWER CONSUMPTION AND SUPPLY POWER AFTER REDUCTION.
S87
TO S56
END

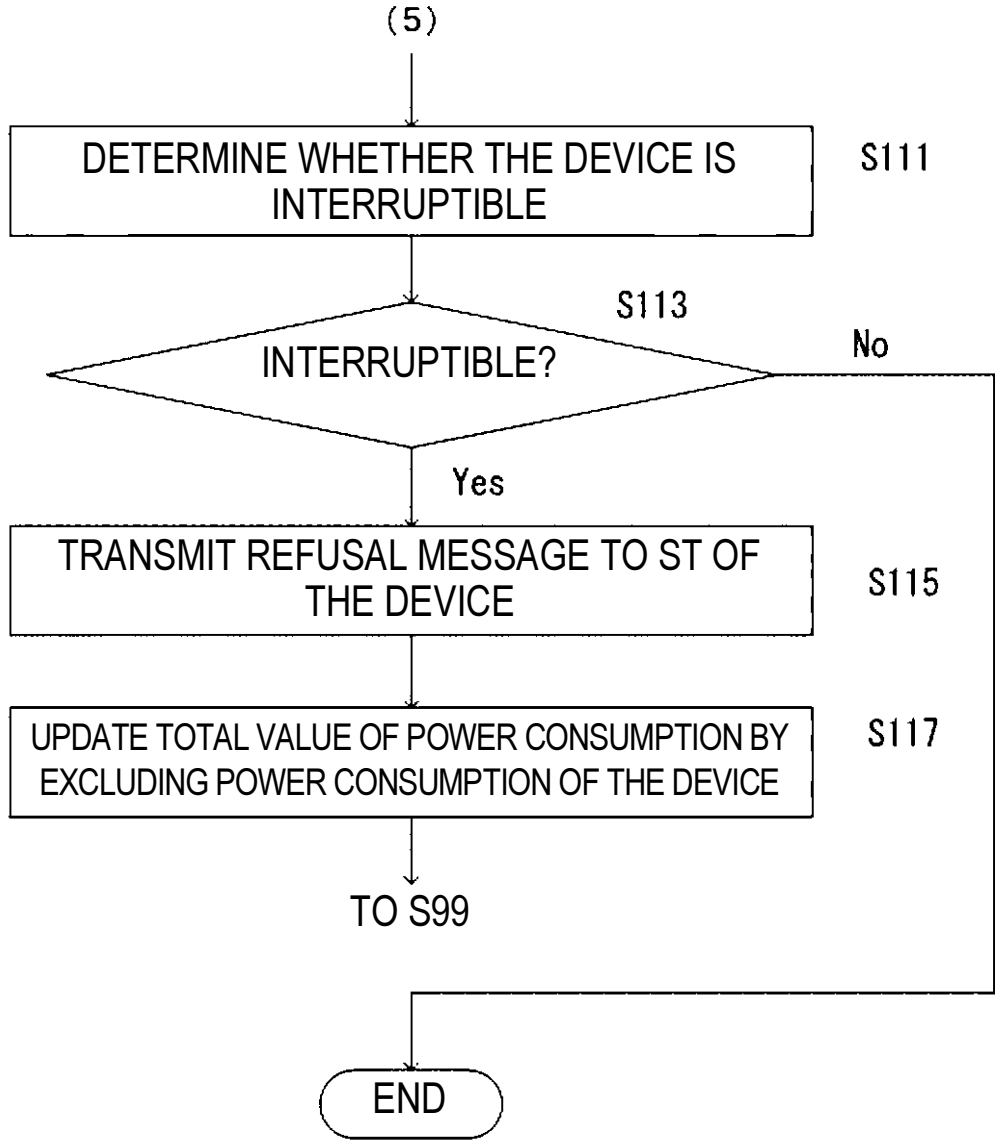
[Figure 23-1]


S9
CONSTANT MONITOR-ING PROCESS
CALL UP MAXIMUM INSTANTANEOUS POWER FROM MEMORY
S91
CALL UP AND ADD POWER CONSUMPTION OF DEVICES IN OPERATION FROM MEMORY EVERY CERTAIN PERIOD δ TO CALCULATE TOTAL VALUE AND STORE IT IN MEMORY
S93
REFER TO TABLE 3 TO CALCULATE PRIORITIES OF THE DEVICES BASED ON PRIORITY FUNCTIONS AND STORE THE VALUES IN MEMORY
S95
COMPARE THE MAXIMUM INSTANTANEOUS POWER AND THE TOTAL VALUE OF POWER CONSUMPTION
S97
S99
TOTAL VALUE OF POWER CONSUMPTION < MAXIMUM INSTANTANEOUS POWER?
No
Yes
END
CALL UP THE PRIORITIES FROM MEMORY AND SELECT DEVICE WITH MINIMUM VALUE
S101
(4)

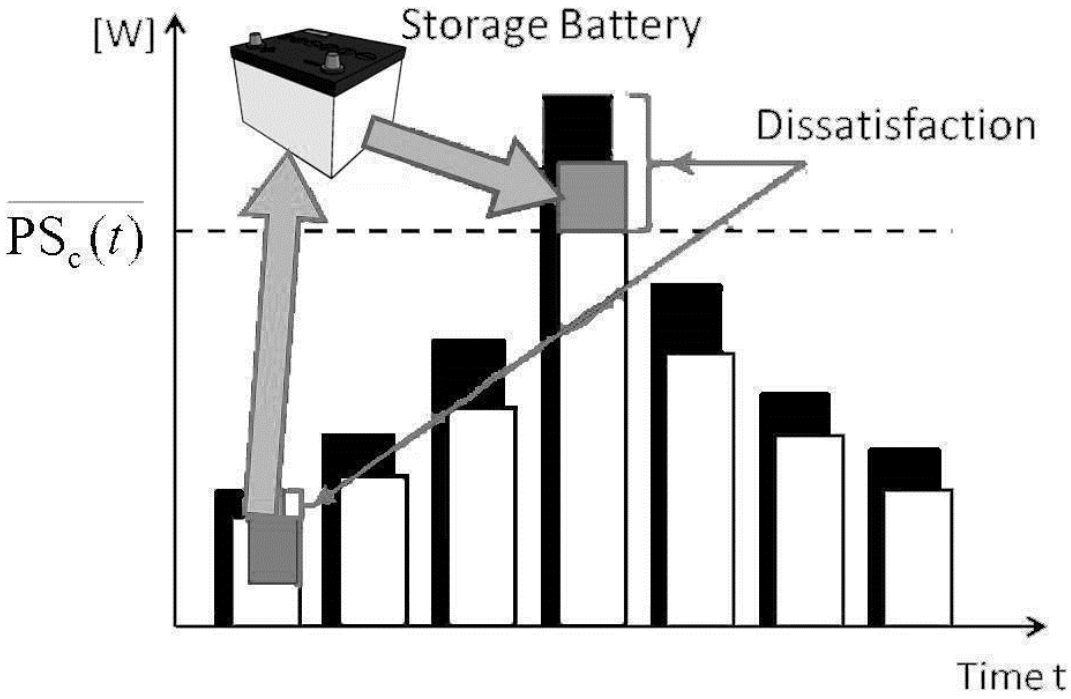
[Figure 23-2]


(4)
DETERMINE WHETHER THE DEVICE IS ADJUSTABLE WITH REFERENCE TO TABLE 2
S103
S105
ADJUSTABLE?
No
(5)
Yes
TRANSMIT INTERRUPTION MESSAGE FOR REDUCING POWER TO THE DEVICE
S107
UPDATE TOTAL VALUE OF POWER CONSUMPTION BASED ON REDUCED POWER
S109
TO S99

[Figure 23-3]

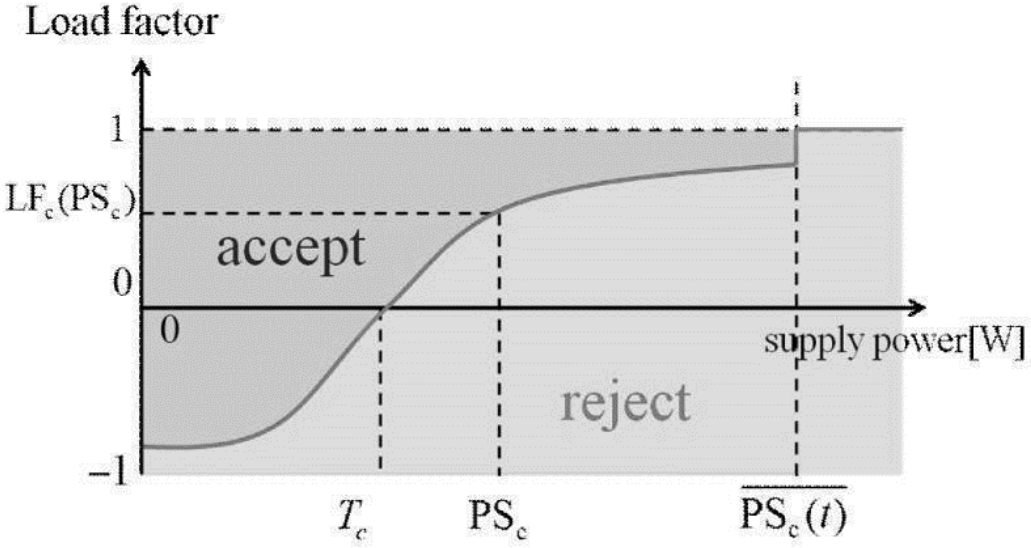

(5)
DETERMINE WHETHER THE DEVICE IS INTERRUPTIBLE
S111
S113
INTERRUPTIBLE?
No
Yes
TRANSMIT REFUSAL MESSAGE TO ST OF THE DEVICE
S115
UPDATE TOTAL VALUE OF POWER CONSUMPTION BY EXCLUDING POWER CONSUMPTION OF THE DEVICE
S117
TO S99
END

[Figure 24]

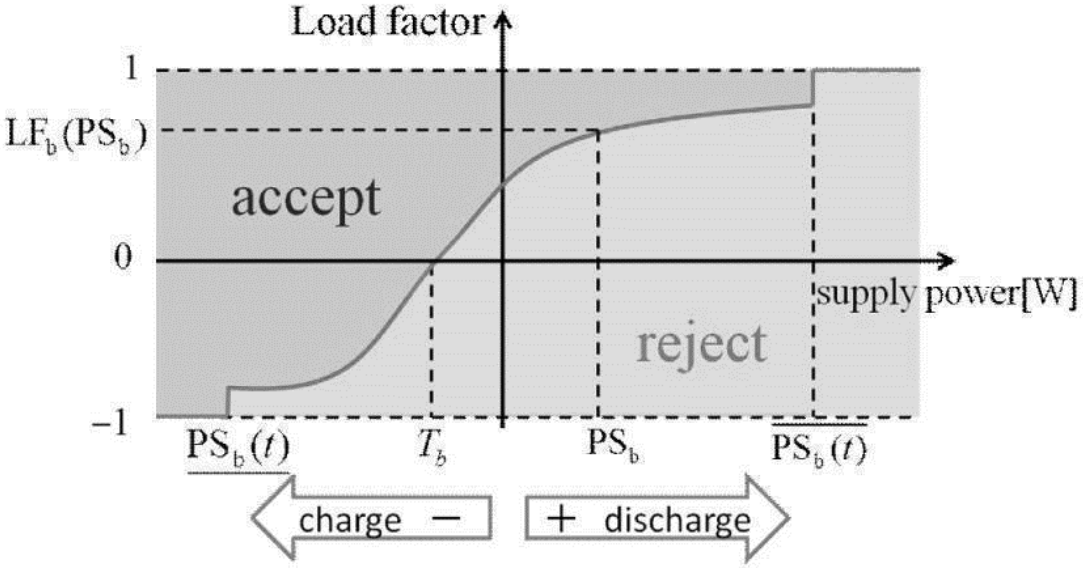


[Figure 25]

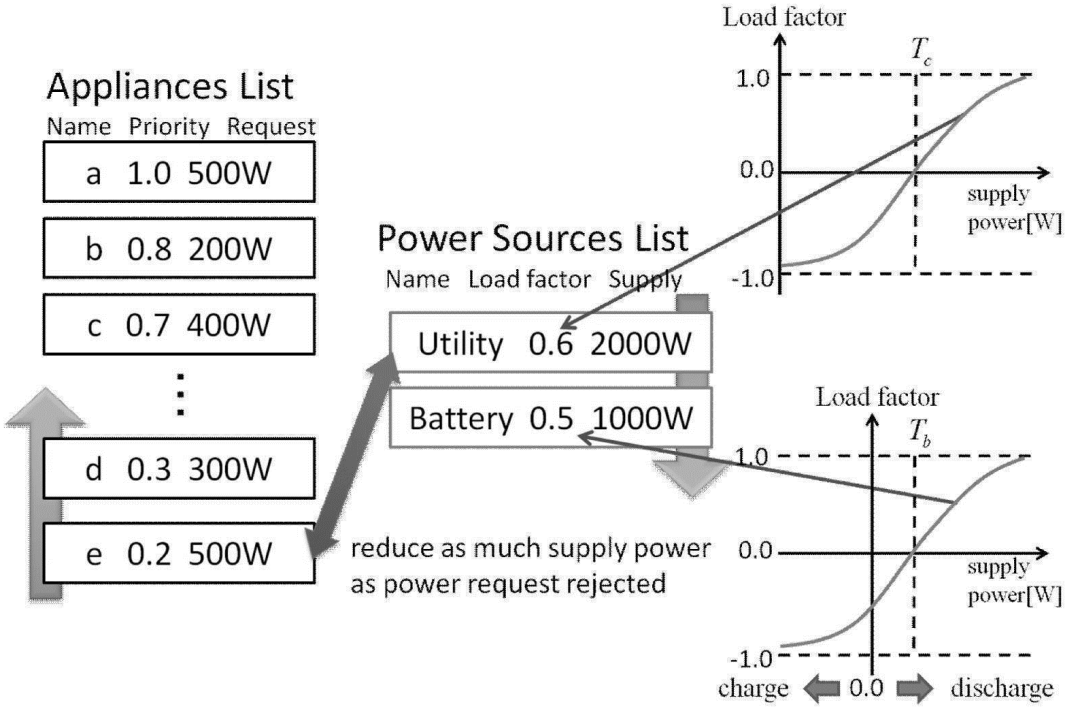
(a)


Load factor
1
$LF_c(PS_c)$
accept
0
0
supply power[W]
reject
−1
T_c
PS_c
$\overline{PS_c(t)}$

(b)


Load factor
1
$LF_b(PS_b)$
accept
0
supply power[W]
reject
−1
$\underline{PS_b(t)}$
T_b
PS_b
$\overline{PS_b(t)}$
charge −
+ discharge

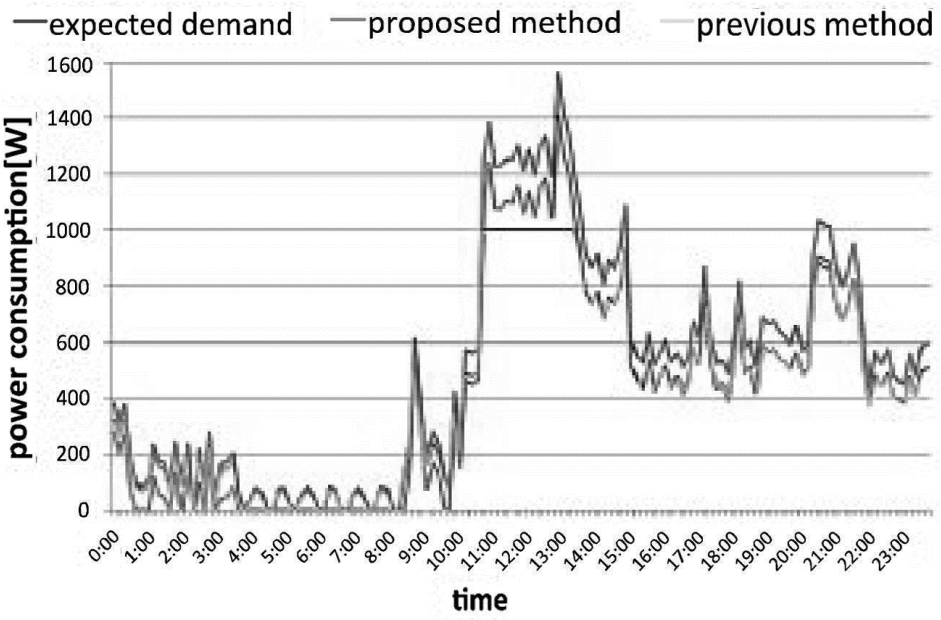
[Figure 26]



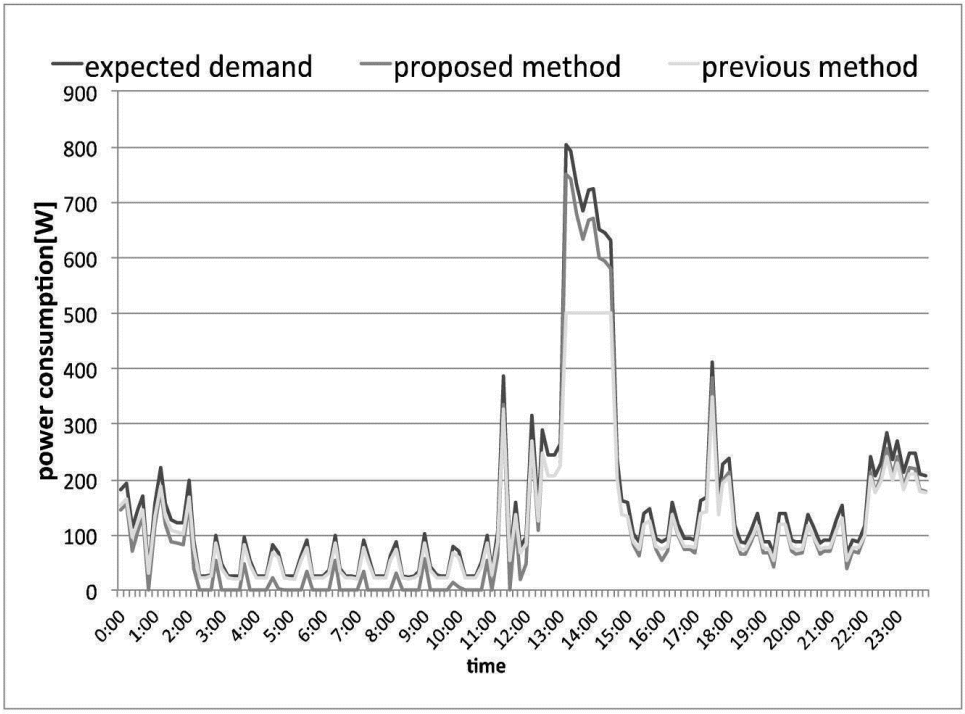
[Figure 27]

Controllability	Appliance
Adjustable Time-shiftable Interruptible	pot
Adjustable Interruptible	air conditioner, heater
Adjustable	lighting (Living room, Bed room, kitchen, corridor, toilet, bathroom), TV (adjust brightness), electric carpet
Time-shiftable Interruptible	Coffee maker
Interruptible	refrigerator
Time-shiftable	Rice cooker, washing machine
Non-controllability (priority stays 1)	DVD player, microwave oven, bidet -toilet, IH cooking heater

[Figure 28]

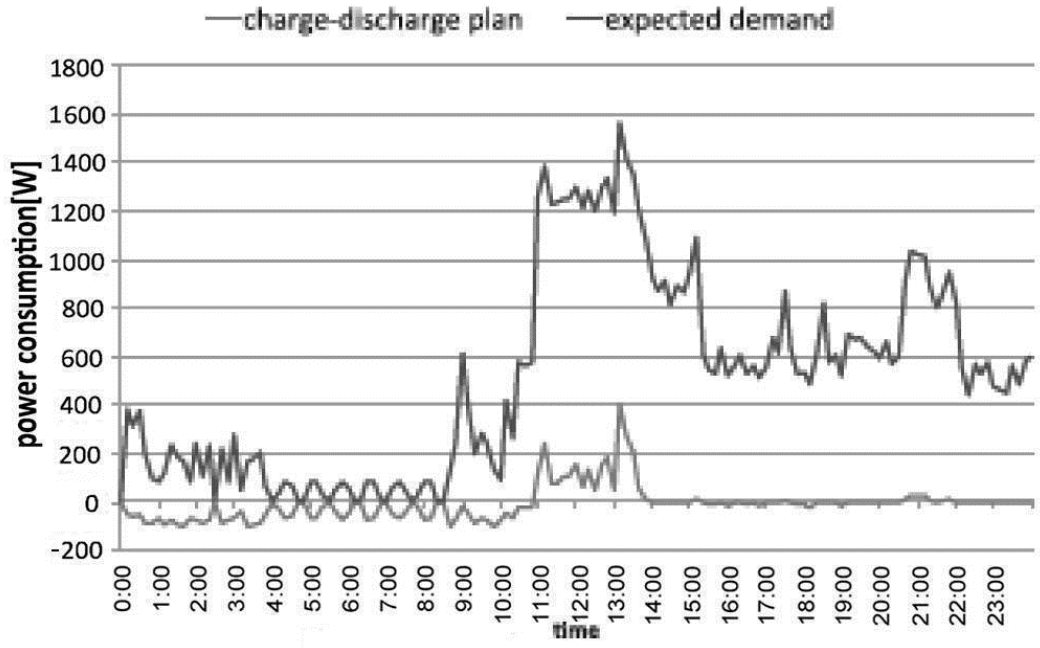


(a) Couple.

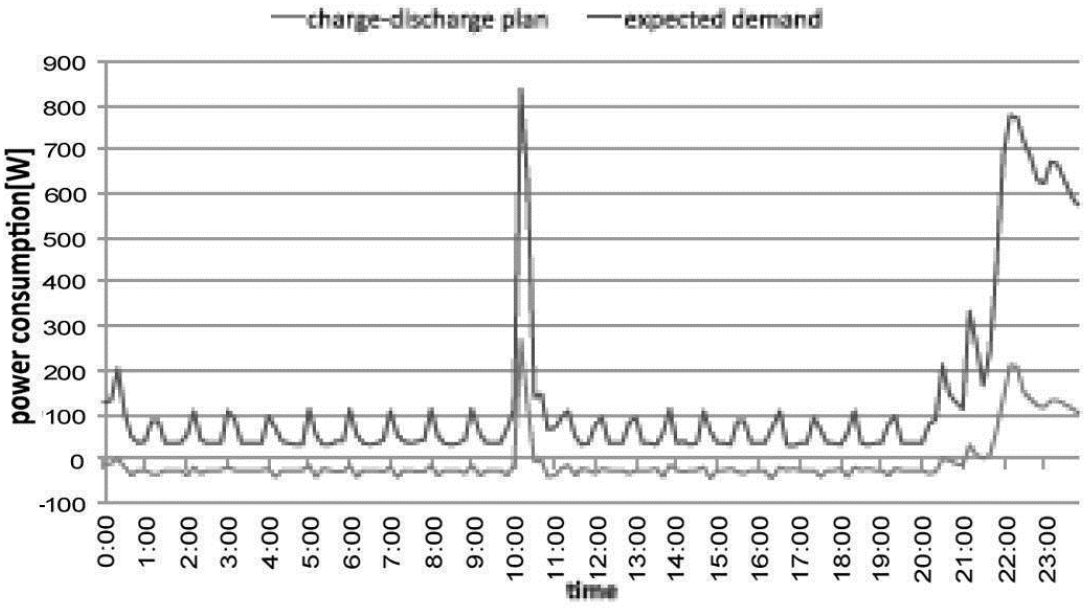


(b)Single

[Figure 29]

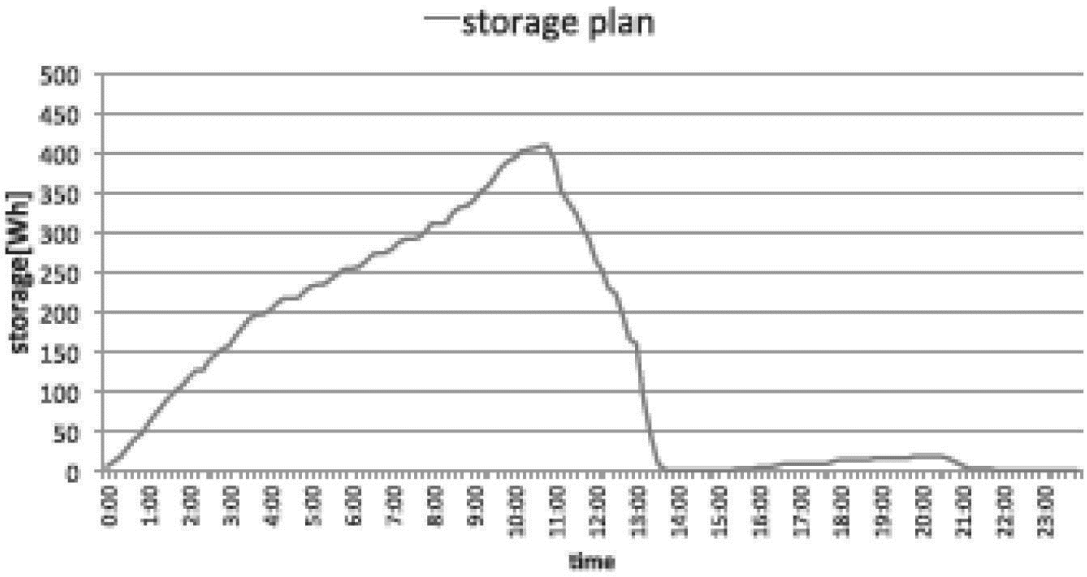


(a) Couple.

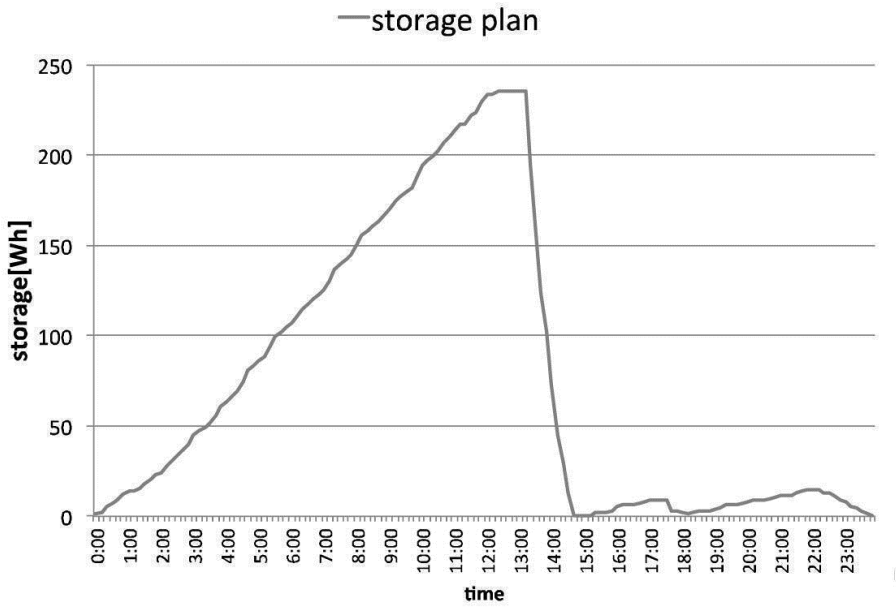


(b) Single.

[Figure 30]

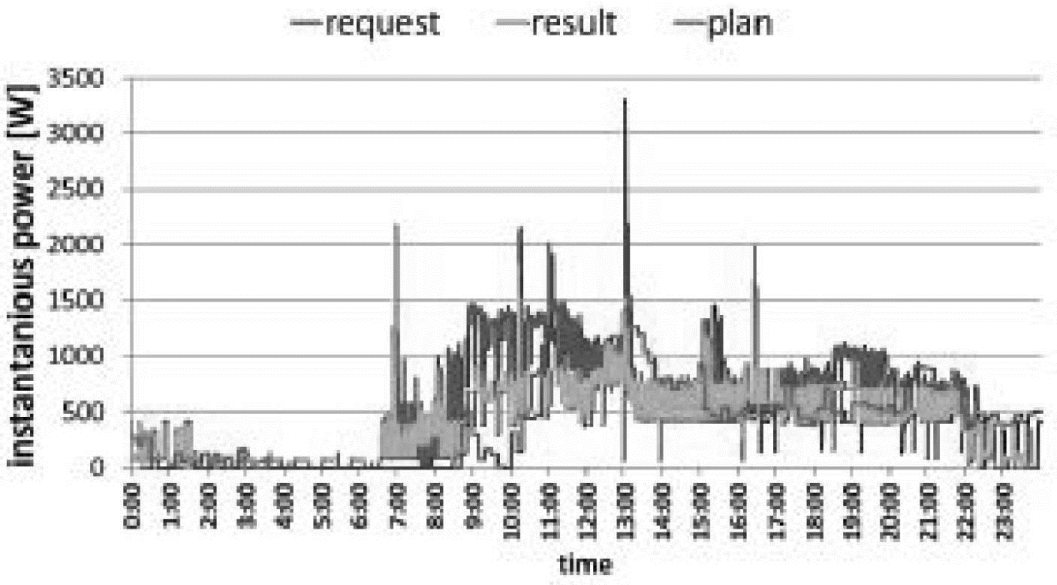


(a) Couple.

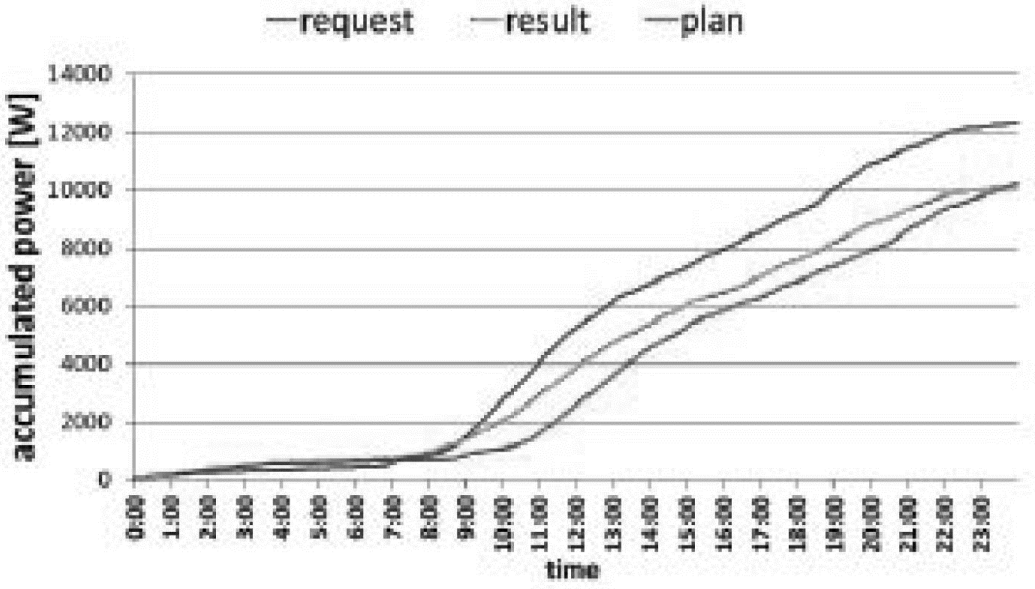


(b)Single

[Figure 31]

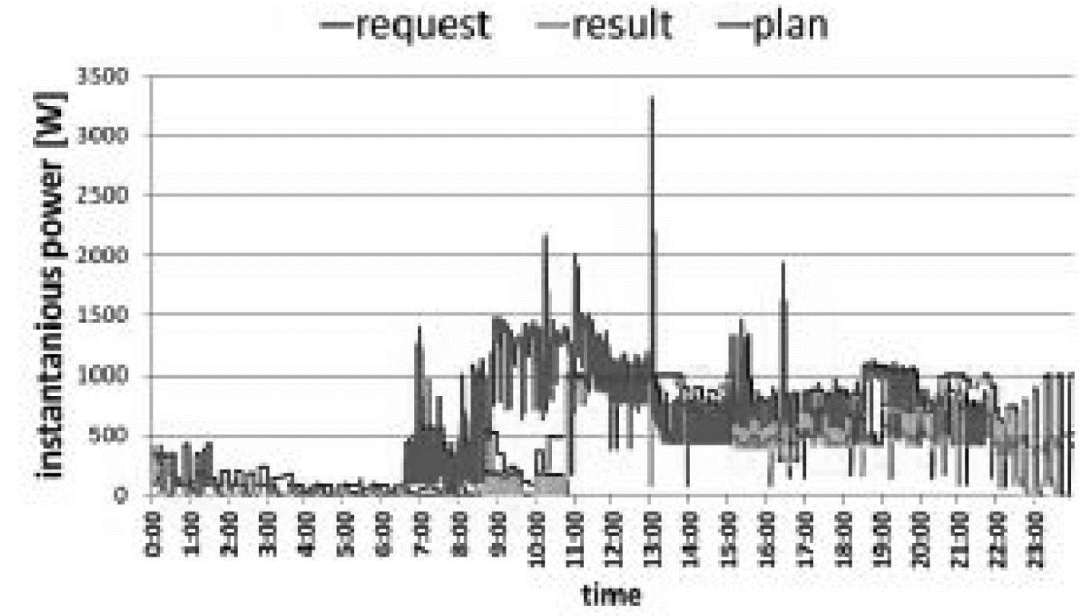


(a) Instantaneous power consumption.

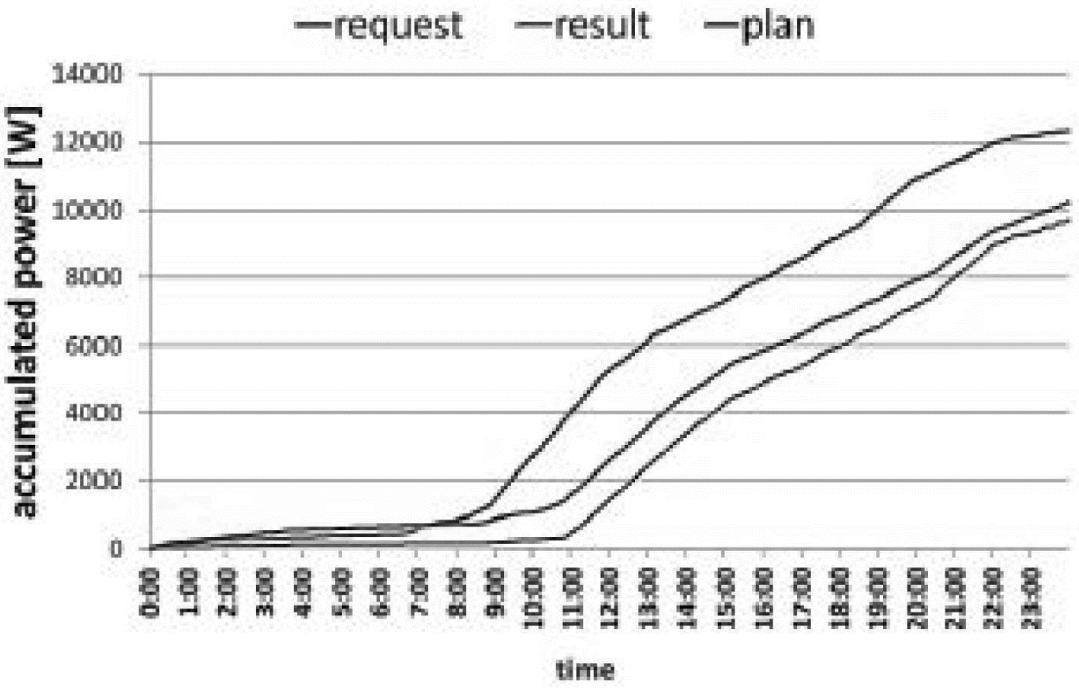


(b) Accumulated energy consumption.

[Figure 32]

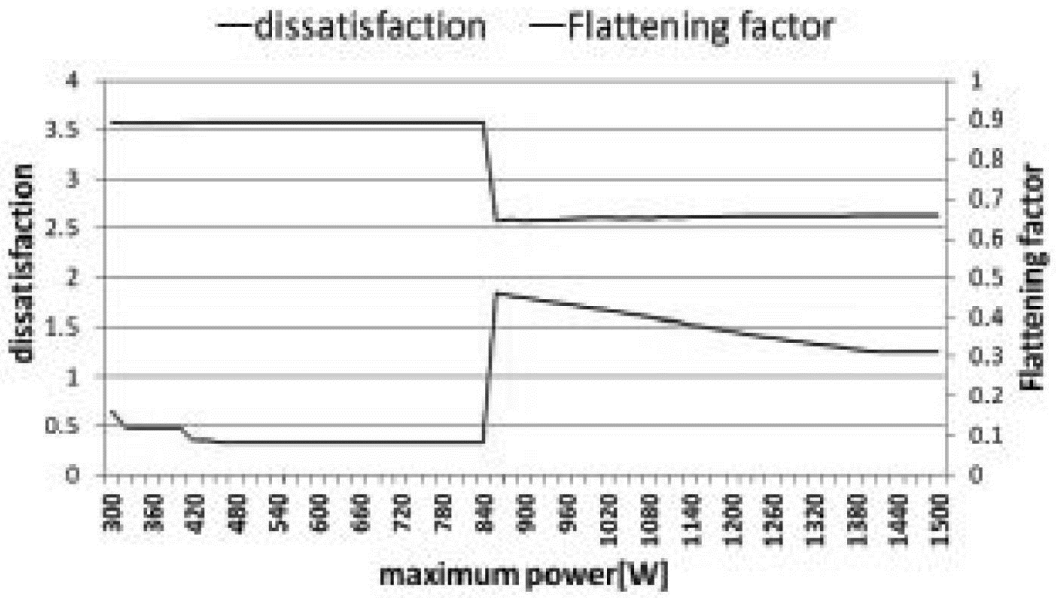


(a) Instantaneous power consumption.

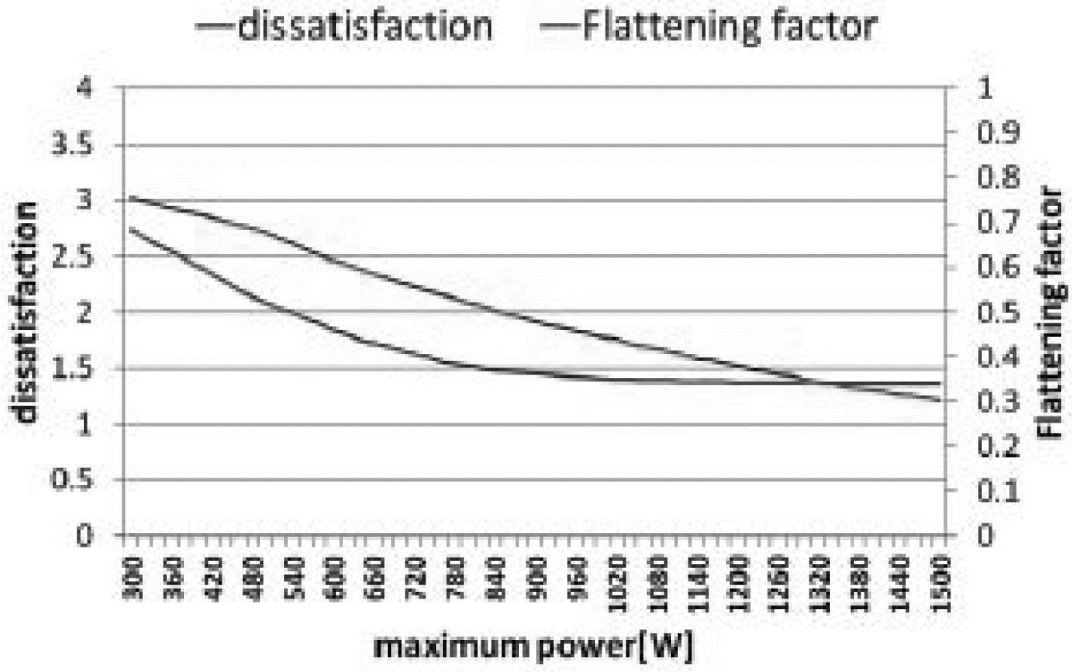


(b) Accumulated energy consumption.

[Figure 33]

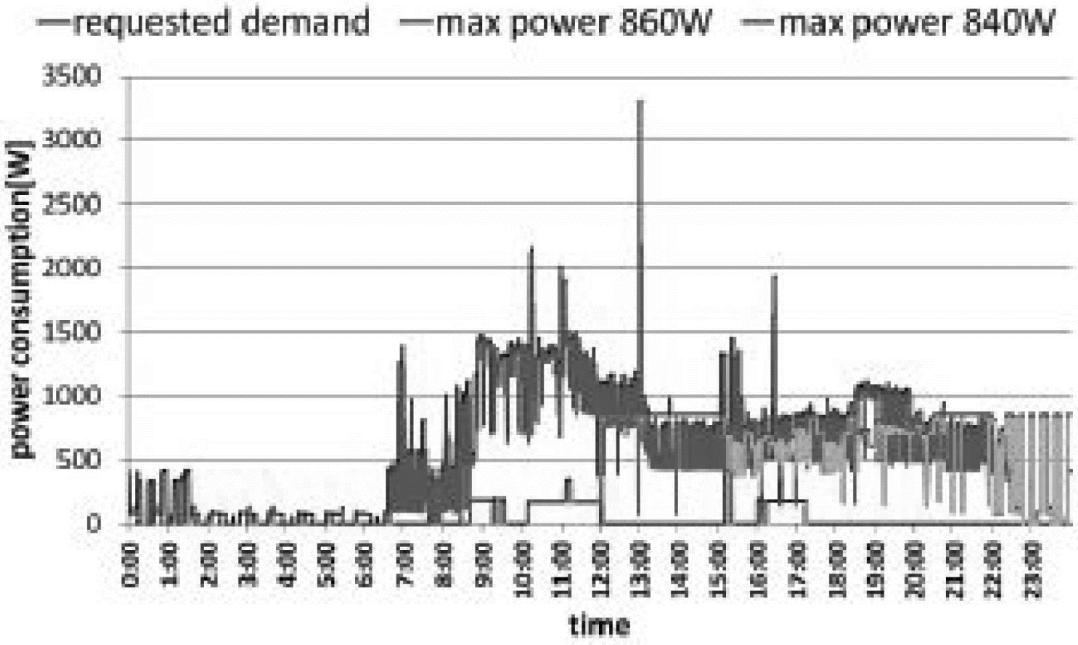


(a) Previous EoD system.

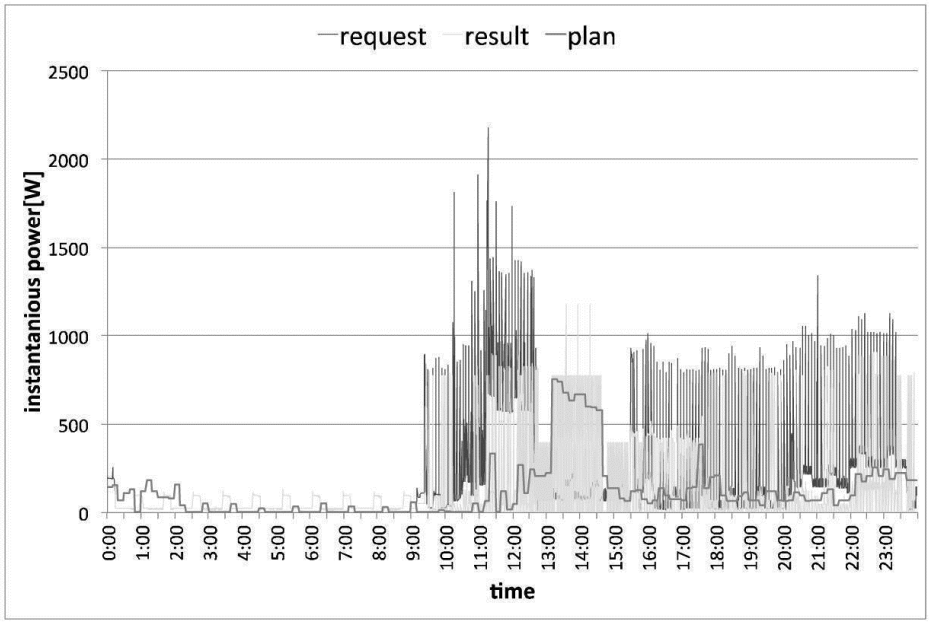


(b) Augmented EoD system.

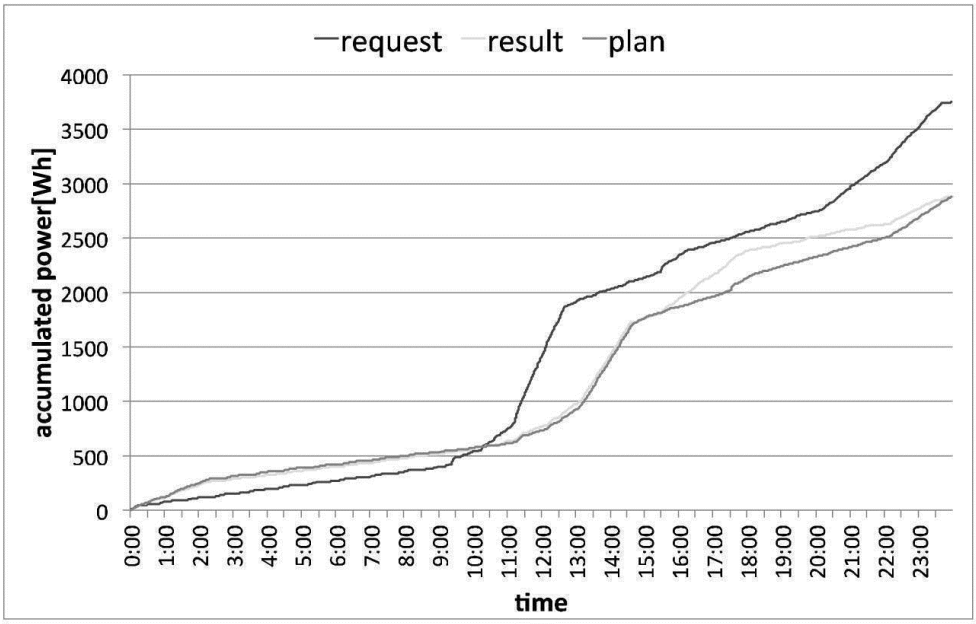
[Figure 34]


—requested demand
—max power 860W
—max power 840W
power consumption[W]
3500
3000
2500
2000
1500
1000
500
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
time

[Figure 35]

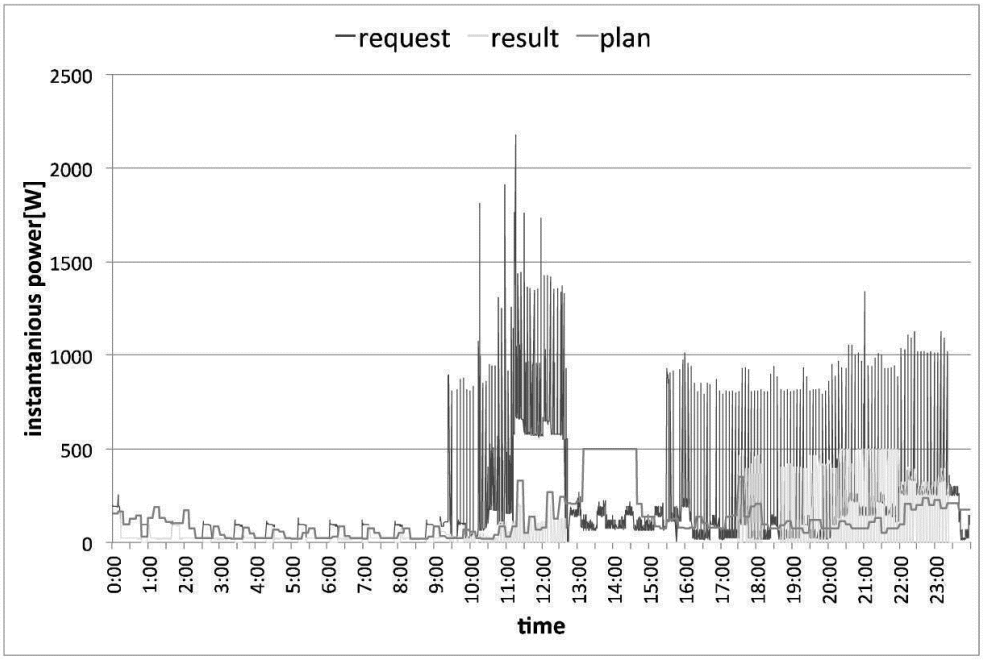


(a)Instantaneous power consumption

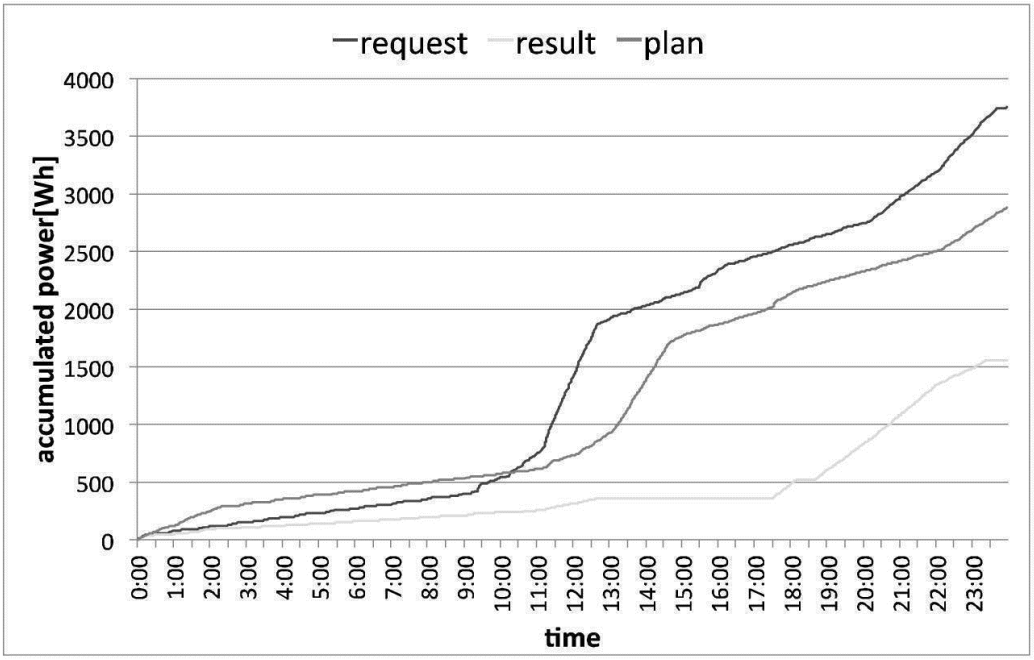


(b)Accumulated energy consumption

[Figure 36]

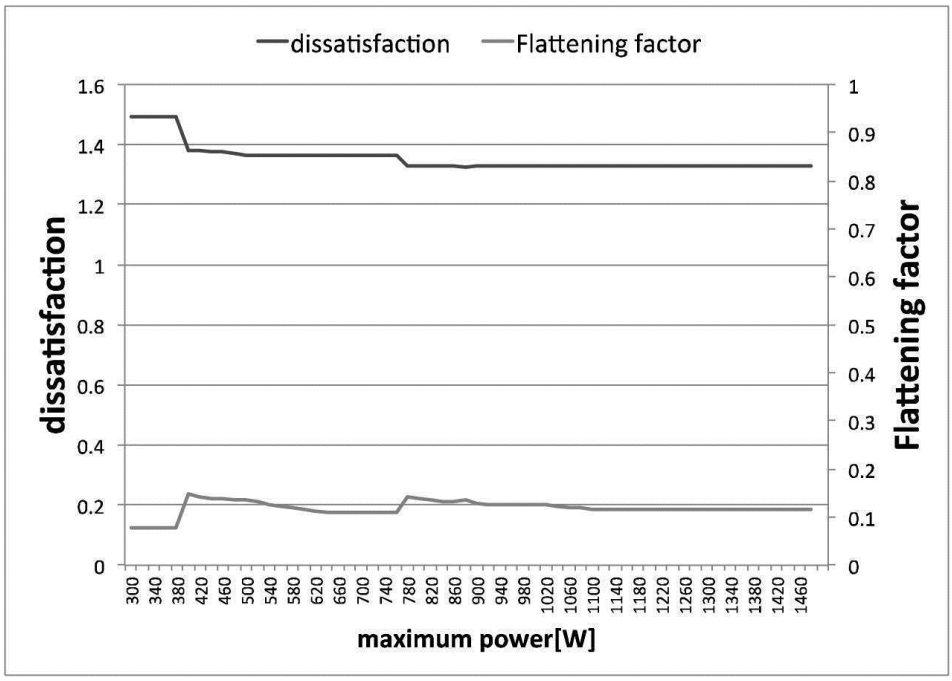


(a)Instantaneous power consumption

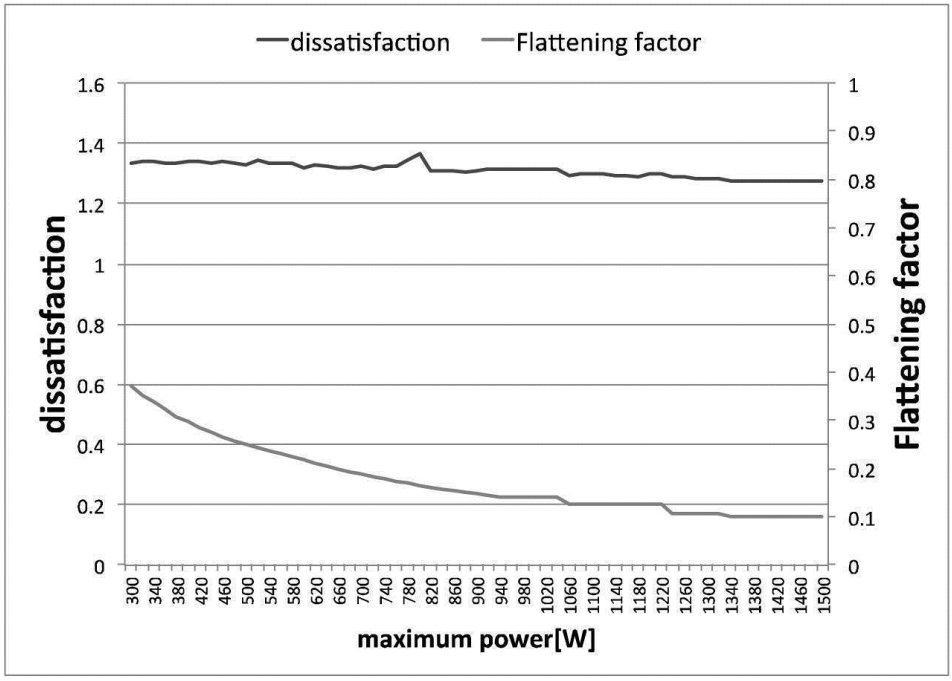


(b)Accumulated energy consumption

[Figure 37]

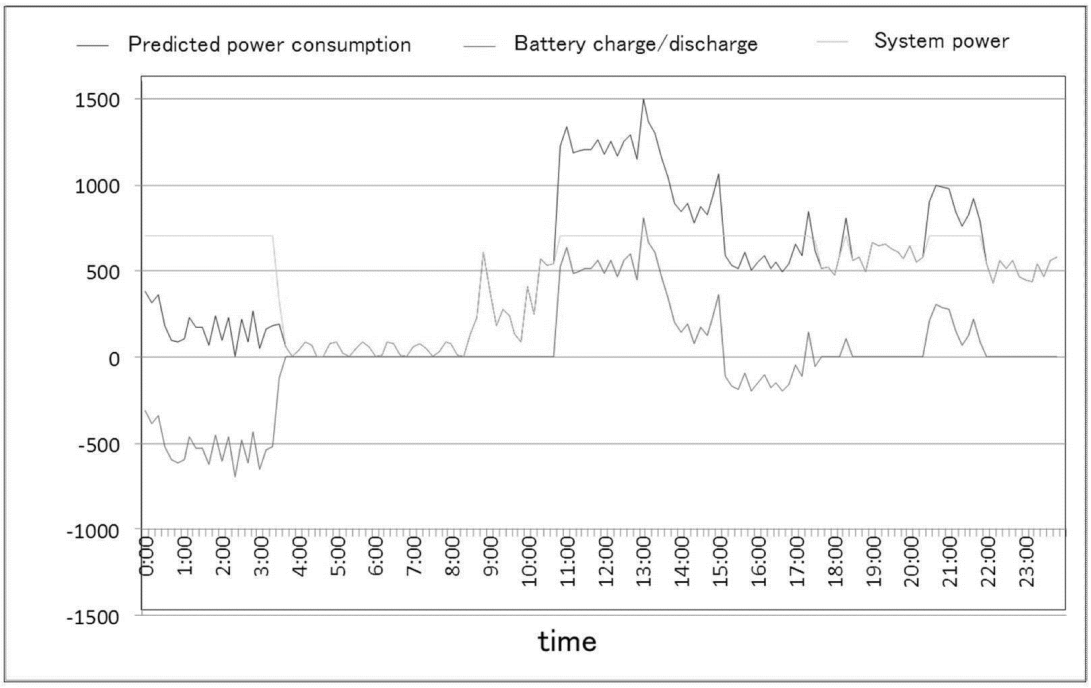


(a)Previous EoD system

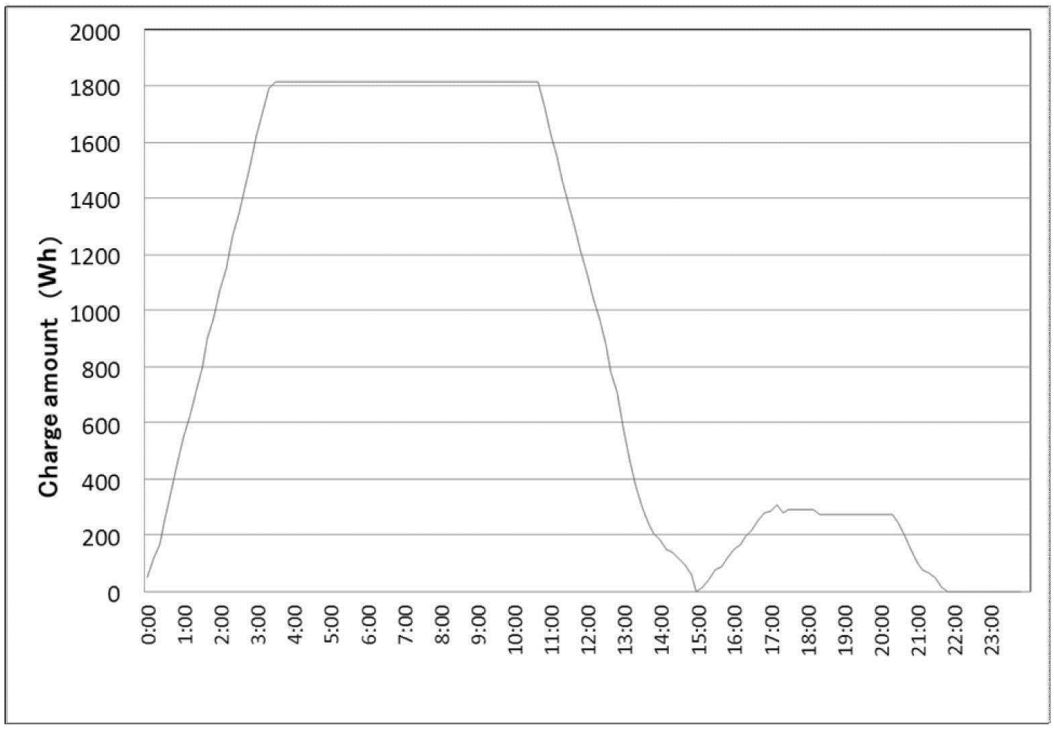


(b)Augmented EoD system

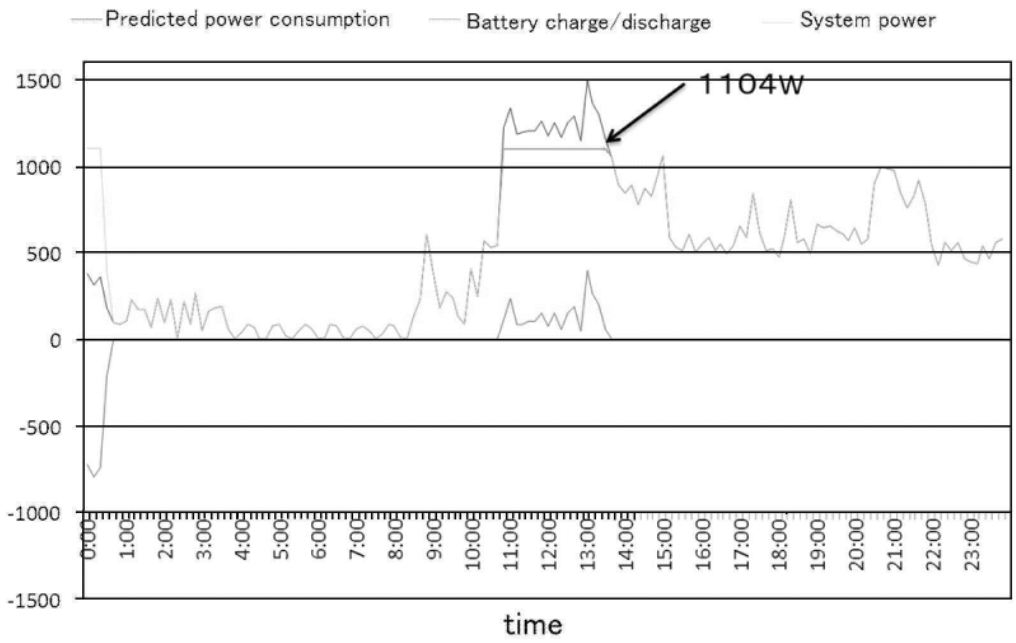
[Figure 38]



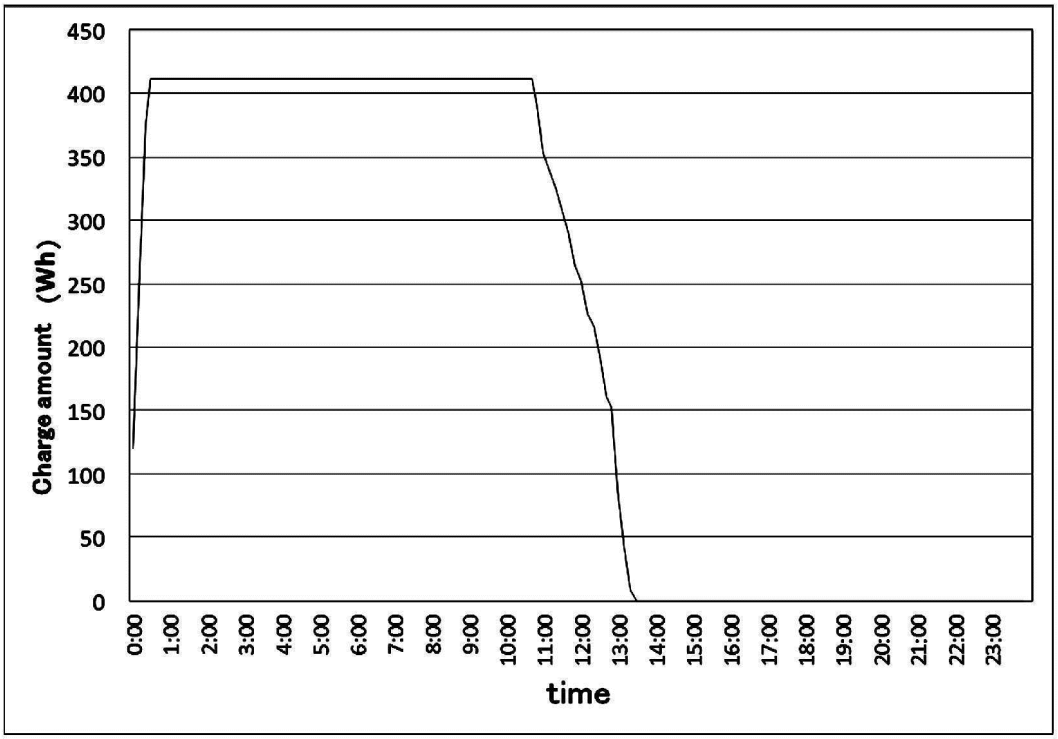
[Figure 39]



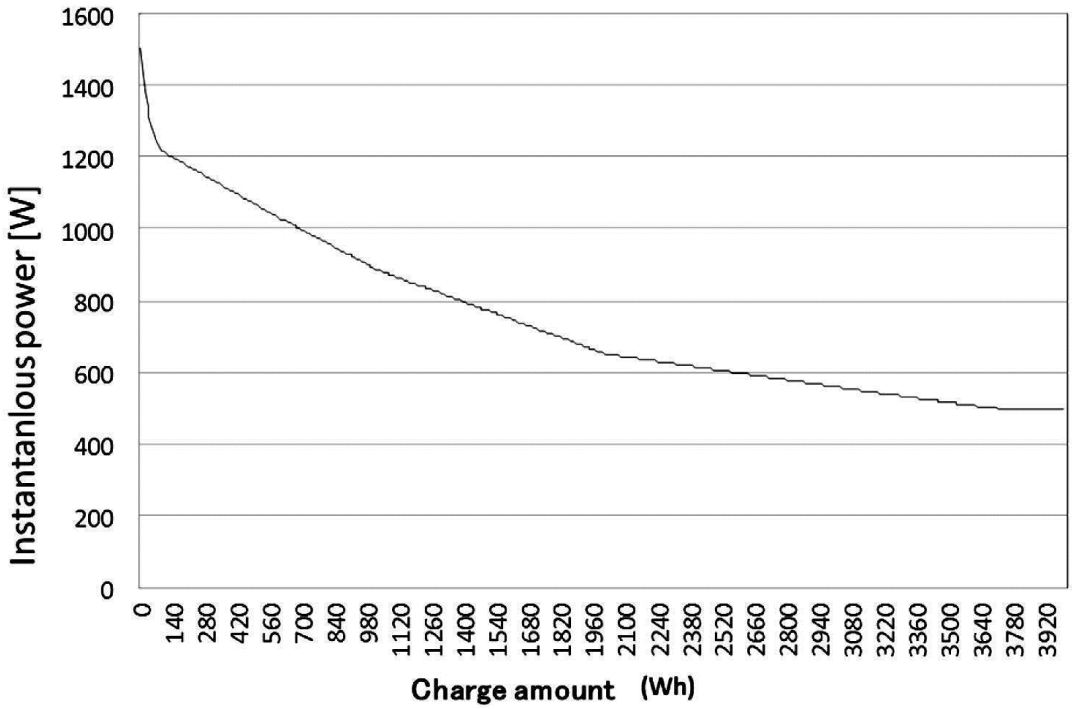
[Figure 40]



[Figure 41]



[Figure 42]


1600
1400
1200
1000
800
600
400
200
0
Instantanlous power [W]
0
140
280
420
560
700
840
980
1120
1260
1400
1540
1680
1820
1960
2100
2240
2380
2520
2660
2800
2940
3080
3220
3360
3500
3640
3780
3920
Charge amount (Wh)