

Report on Energy-Saving Survey by medium voltage inverter

February 23, 2010 In Singapore
February 25, 2010 In Thailand

TMEiC



グリーンIT推進協議会
Green IT Promotion Council



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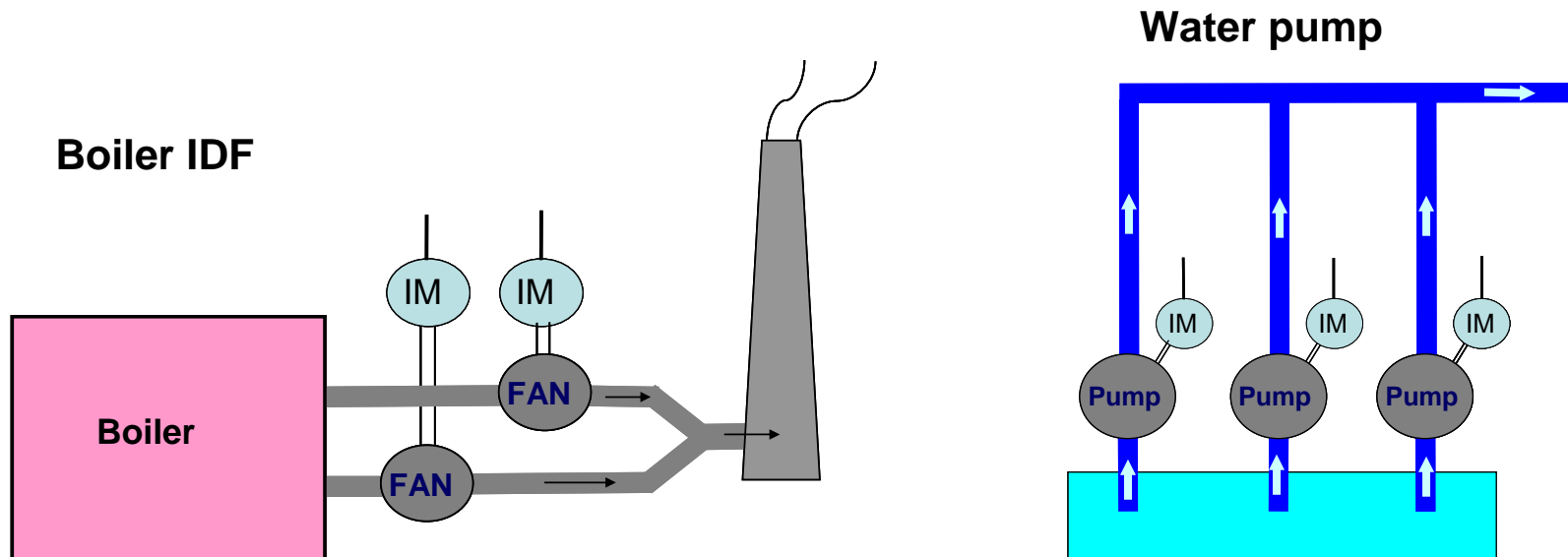
Background and objective

Approx 70% of electric power consumption in a factory is used for motor operation (for manufacturing, for air conditioning etc).

Therefore, energy saving in motor operation is important.



Motor speed control by inverter realizes energy saving !!





Introduction of Surveyed Company 1

Rayong Olefins Co., Ltd. (ROC)

- One of the leading petrochemical company in Rayong Thailand who produces 1.2 million ton olefin product annually.
- Main energy consumer within the Siam Cement Group (SCG) Chemicals.
- Aggressively pursue 'KAIZEN' through quality management program and conscious of safety and environment issue.





Introduction of Surveyed Company 2

Thai Acrylic Fibre Co., Ltd. (TAF)

- Top 3 quality fiber producers globally with 100,000 Ton annual acrylic fiber products in Saraburi Thailand.
- One of the top service providers of acrylic application development.





Introduction of Survey Company

TMEiC
We drive industry

-Green Factory Innovation-

TMEiC (the joint-venture of Toshiba & Mitsubishi-electric) strives to support customers to evolve towards “Green Factories” by following solutions and technologies.

1) Motor & Drive systems for Energy Saving

Medium voltage inverter, High speed drive, PMSG/M

2) Renewable energy systems

Photovoltaic power, Wind power

3) Energy control & management systems



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Summary of the survey

Survey Process

Result of the Survey

Current Status

Energy-Saving Plan and Its Effect

November 30, 2009: ROC

December 2, 2009: TAF

- **Survey motor and other electrical equipment (Rating, characteristic and operation data)**

Speed control (inverter) not applied to motors for pumps, especially medium voltage motors.

– **Selected target item and recommend speed control by inverter**



Survey Process (Summary)



Date

November 30, 2009: ROC

December 2, 2009: TAF

Action

- **Motor data review**
- **Plant site survey**
- **Electrical room survey**
- **Power distribution equipment review**

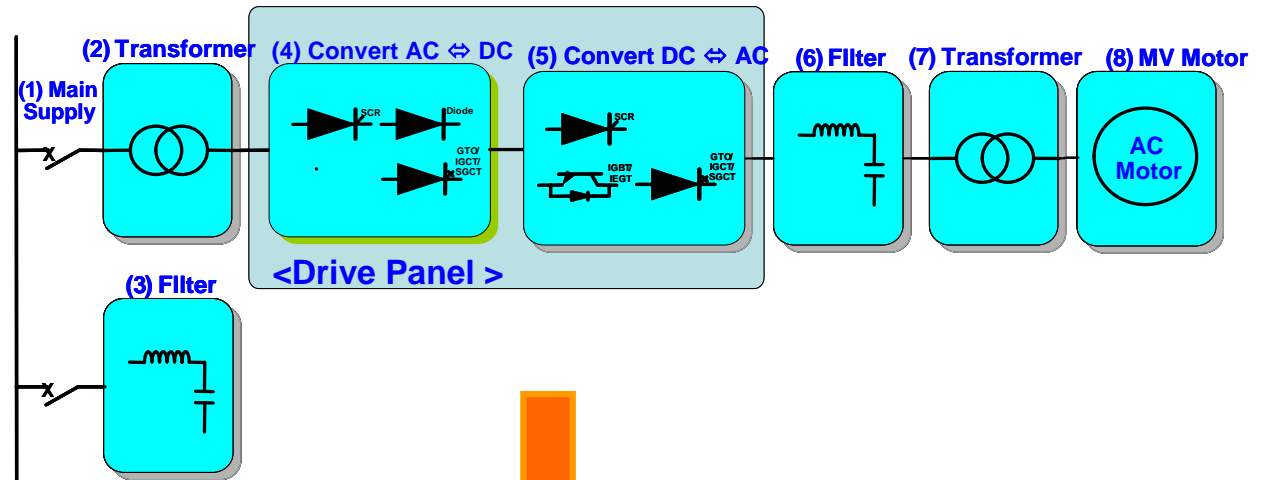
- **Selection of survey target**
- **Selection of inverter capacity**
- **Confirmation of installation space**
- **Energy saving calculation**



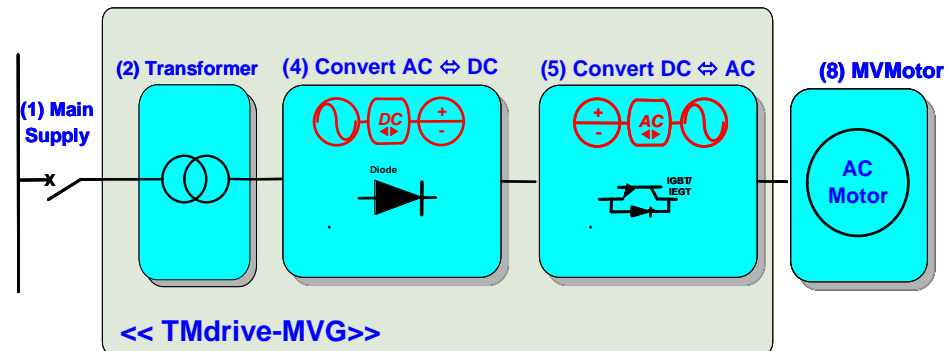
Survey Process (Detail)①

Inverter system

Conventional type



Desirable type





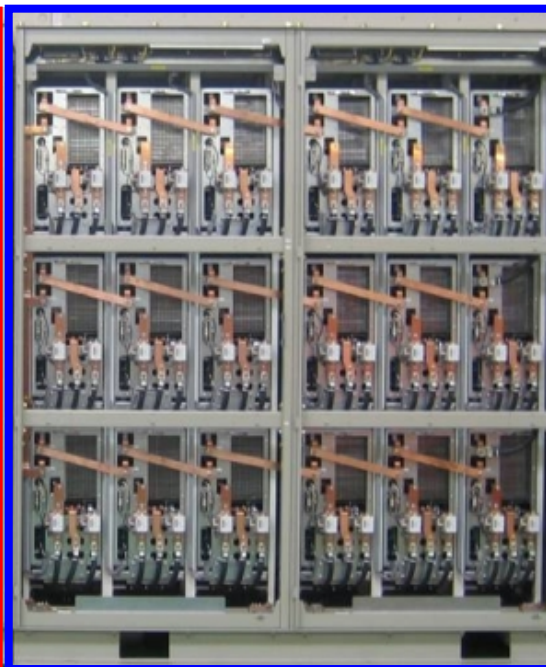
Survey Process (Detail)②

Panel outline

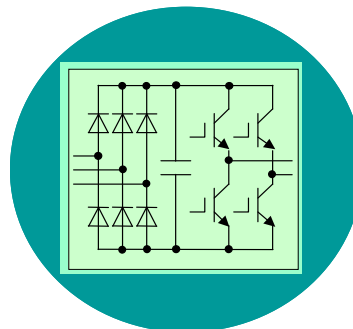
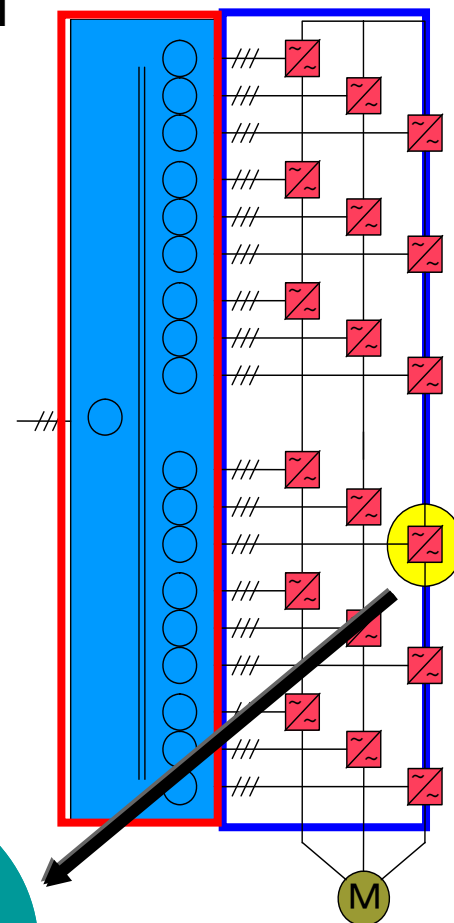
Input Transformer



Inverter panel



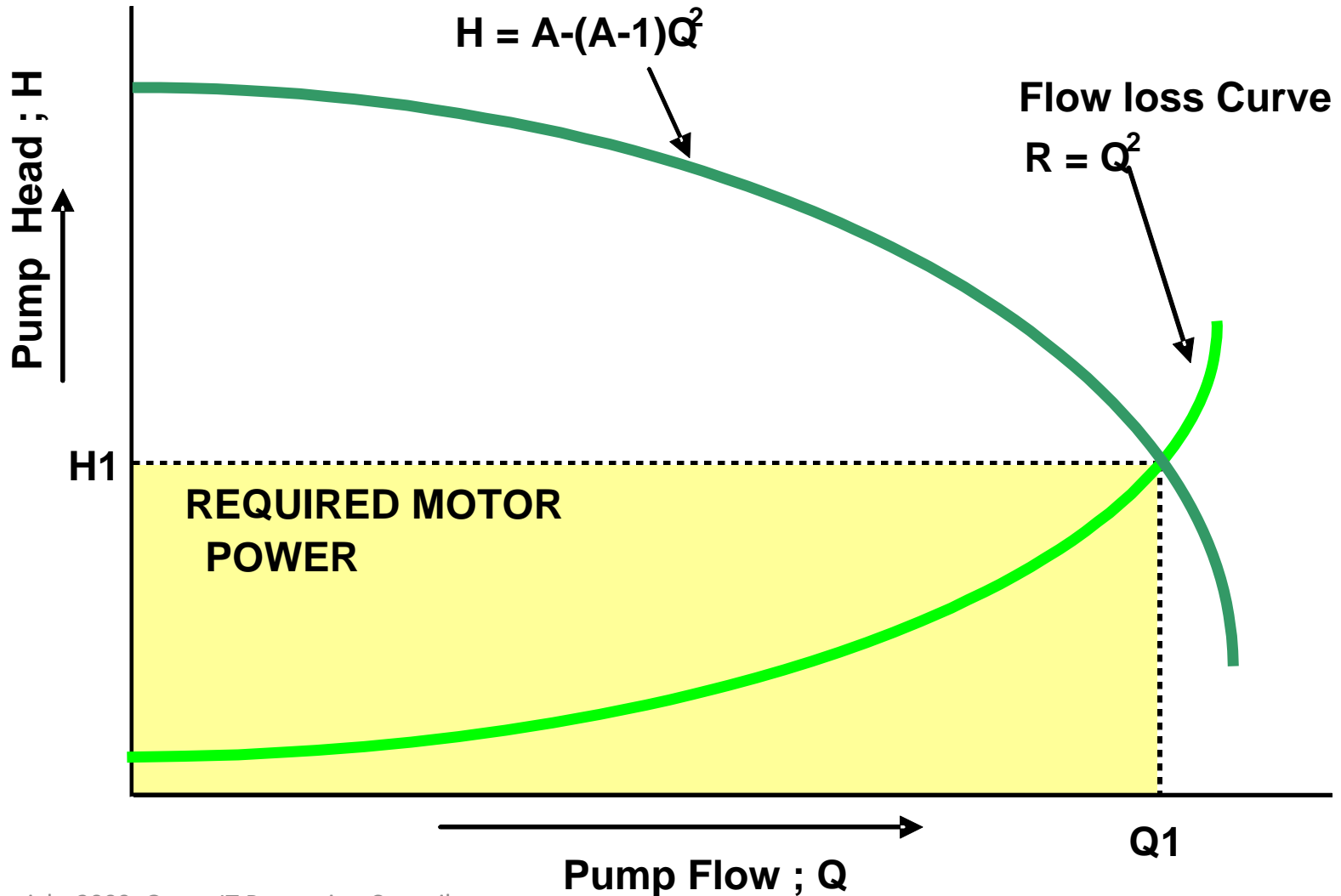
Control Panel





Survey Process (Detail)③

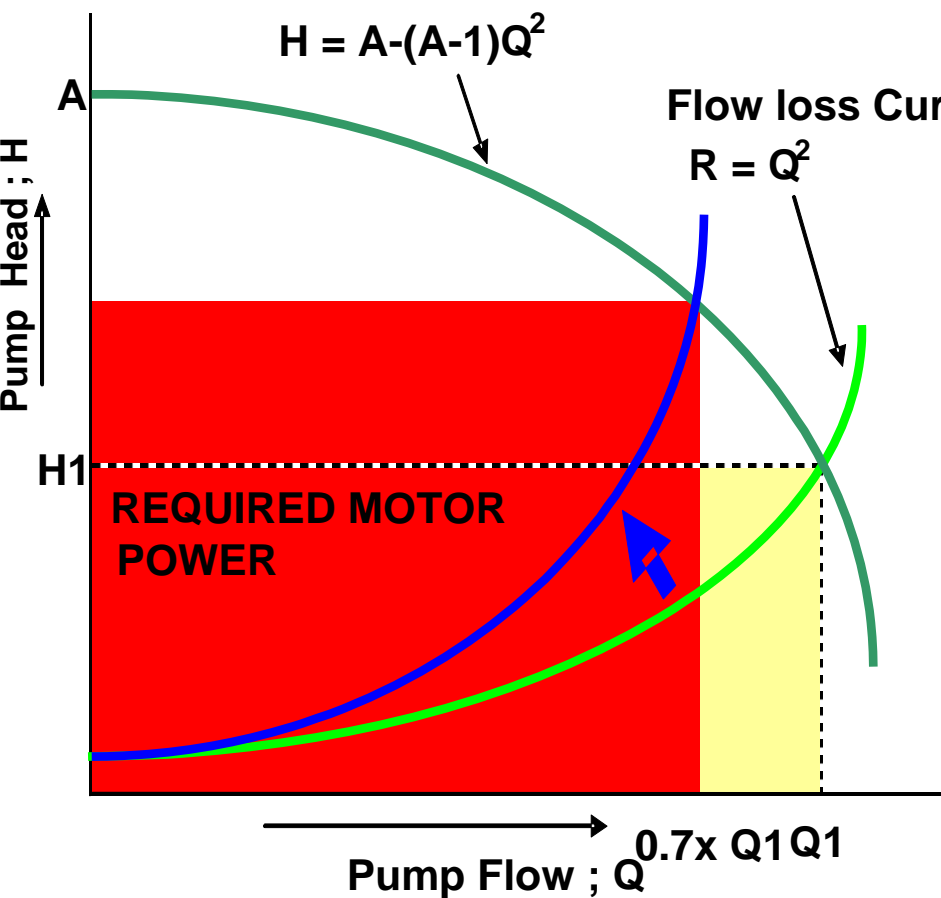
PUMP Q-H Curve



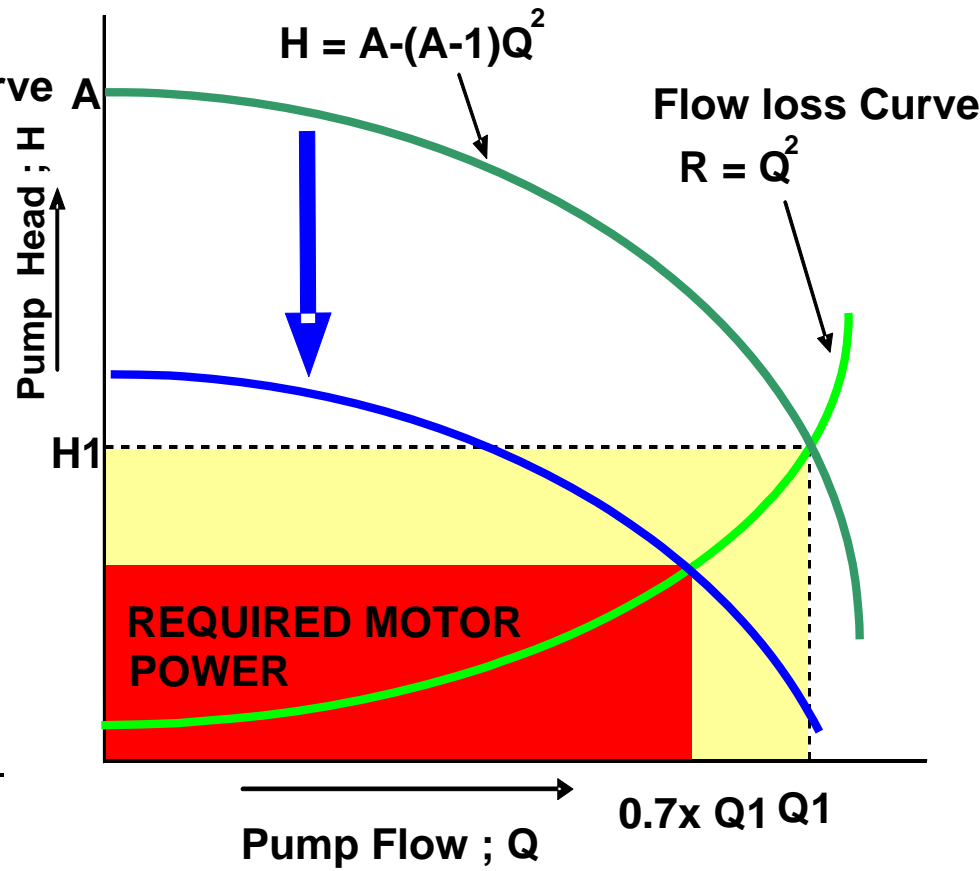


Survey Process (Detail)④

Valve Control vs Speed control



Valve Control



Speed Control



Current Status and issues of Energy Efficiency (Summary)

Item

Current Status and issues of Energy Efficiency

ROC

Cooling water pump etc

Speed control (inverter) not applied to motors for pumps, especially medium voltage motors

TAF

Water pump for chiller etc

Speed control (inverter) not applied to motors for pumps, especially medium voltage motors

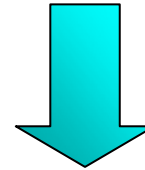


Current Status and issues of Energy Efficiency (Details)② ROC Detail of target item

Item No. : PM-2400C

Equipment : Cooling water pump

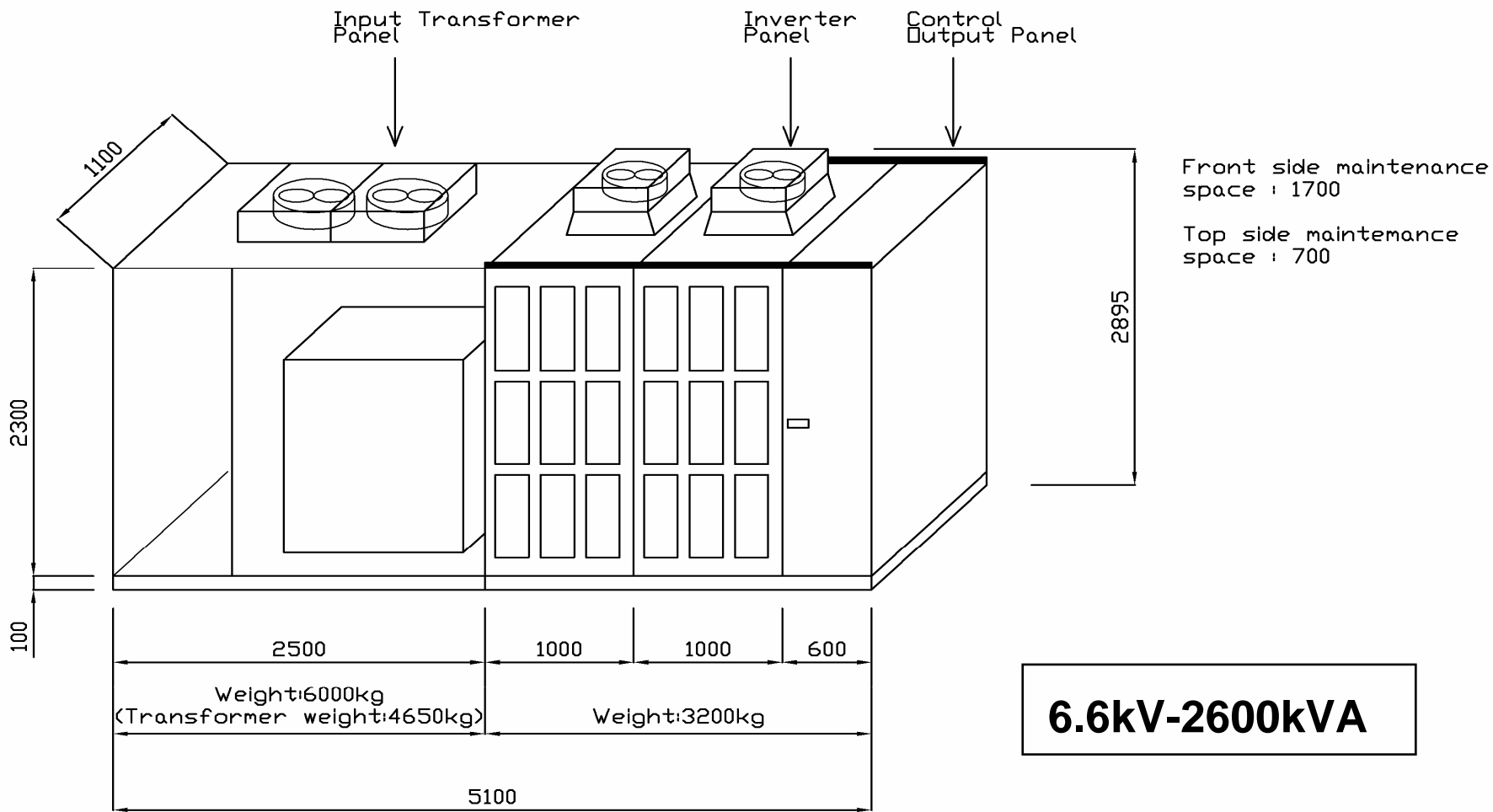
Motor rating : 10P-1850kW-6600V-50Hz-F eG3



**6.6kV-2600kVA TMdrive-MVG is applicable.
(*The existing eG3 motor shall be replaced
with a new explosion-proof motor (Exn) in
order to get variable speed motor explosion-
proof certificate.)**



Current Status and issues of Energy Efficiency (Details)③ ROC Outline dimension

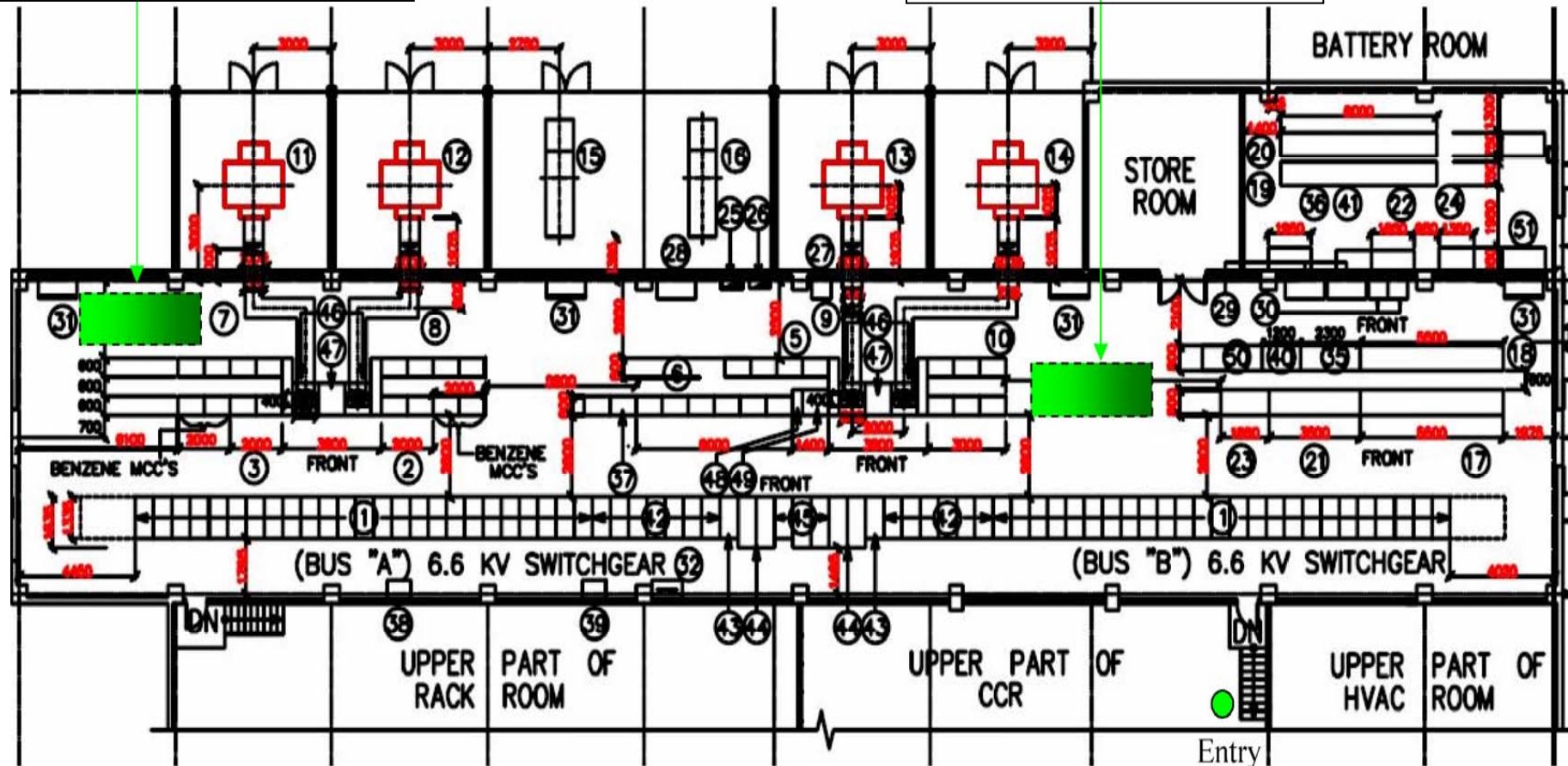




Current Status and issues of Energy Efficiency (Details)④ ROC Panel layout

Primarily selected

Optional selected

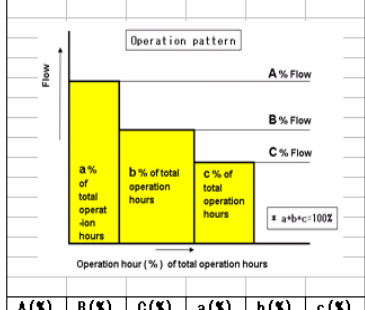
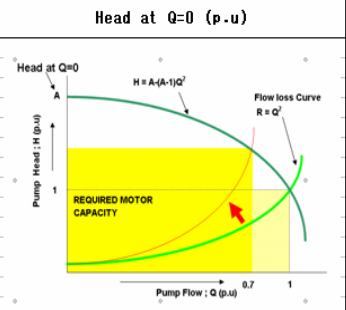




Current Status and issues of Energy Efficiency (Details)① TAF Motor data

No	Equipment name	Item No.	Q'ty	Motor specification							Explosion proof	Character of load	Operation pattern	Remarks				
				Output (kW)	No. of pole	Voltage (V)	Frequency (Hz)	Efficiency	Starting	Operation hour per year (hours)					A (%)	B (%)	C (%)	a (%)
	Water pump for chiller	3631-II-A	1	450	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	8500	100	-	-	100	-	-
	Water pump for chiller	3631-II-B	1	450	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	6500	100	-	50	20	-	80
	Water pump for chiller	3631-II-C	1	450	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	2000	100	-	25	-	-	100
	Water pump for chiller	3631-III-A	1	377	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	4000	100	70	-	-	100	-
	Water pump for chiller	3631-III-B								Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-
	Water pump for chiller	3631-III-C								Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-
	Water pump for chiller	3631-IV-A								Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-
	Water pump for chiller	3631-IV-B	1	377	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-
	Water pump for chiller	3631-IV-C	1	377	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-
	Water pump for chiller	3631-V-A	1	377	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-
	Water pump for chiller	3631-V-B	1	377	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-
	Water pump for chiller	3631-V-C	1	377	2	6600	50	0.95	DOL	Non-exp	1.4 (p.u)	8000	100	-	-	100	-	-

Target item for
Inverter operation



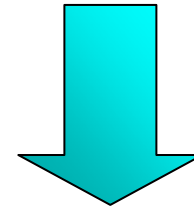


Current Status and issues of Energy Efficiency (Details)② TAF Detail of target item

Item No. : 3631- II -B

Equipment : Water pump for chiller

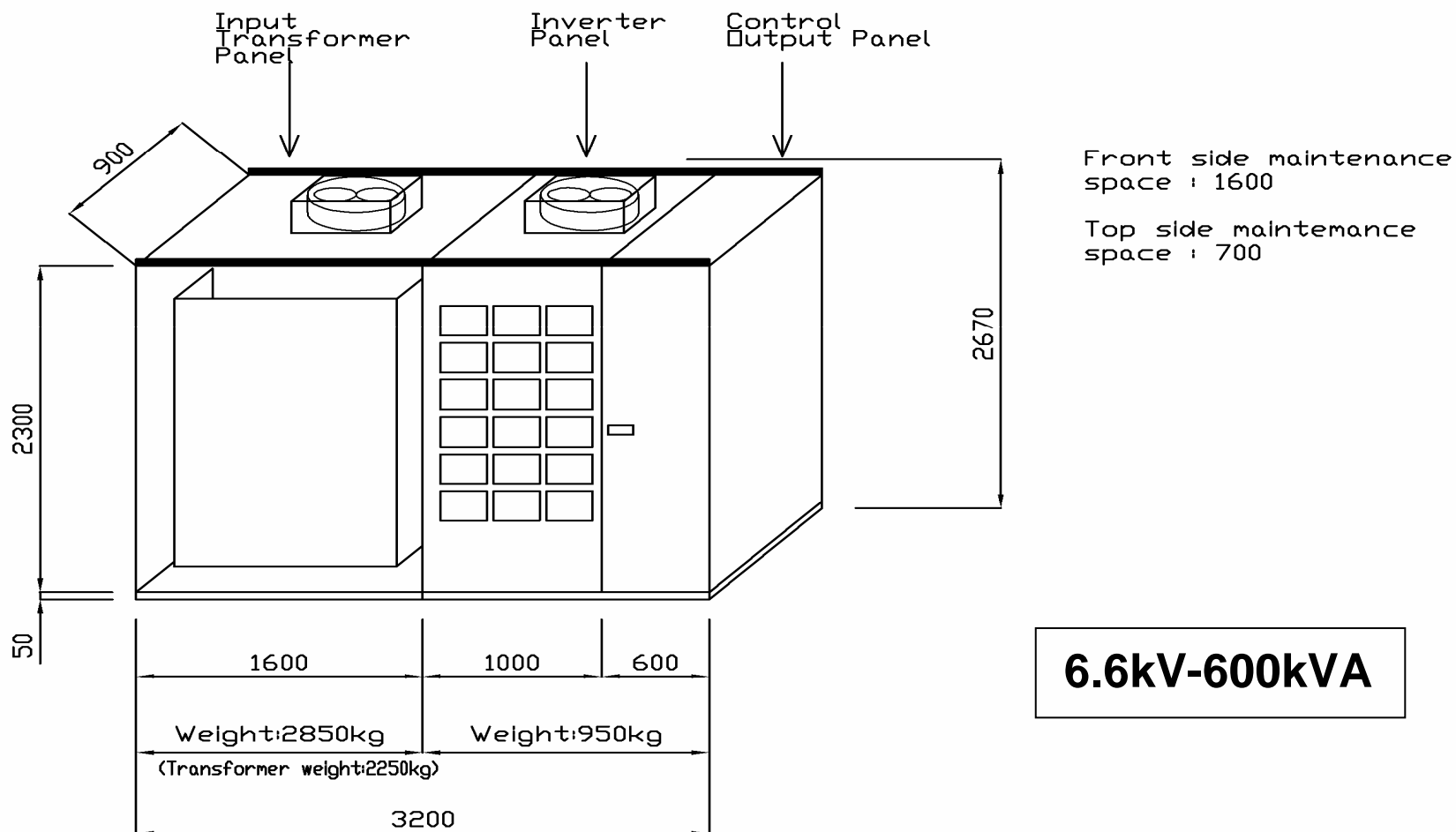
Motor rating : 2P-450kW-6600V-50Hz-F Non-exp



**6.6kV-600kVA TMdrive-MVG
is applicable**



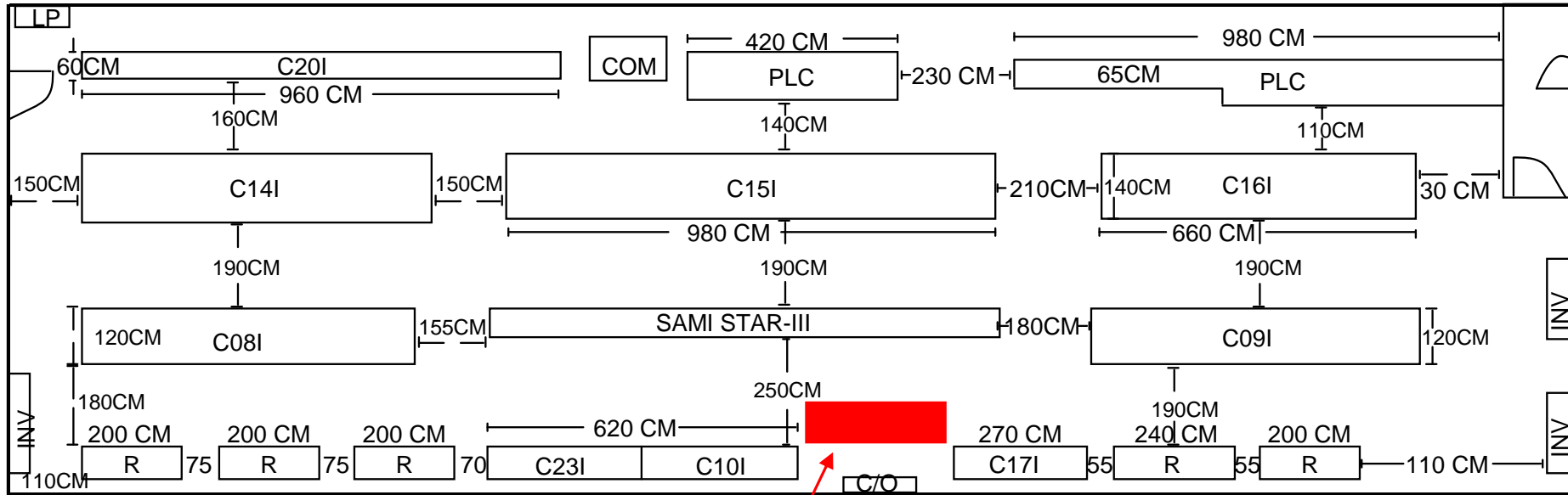
Current Status and issues of Energy Efficiency (Details)③ TAF Outline dimension





Current Status and issues of Energy Efficiency (Details)④ TAF Panel layout

INVERTER ROOM SUB-4



The height of the ceiling is 3.95 meter.

6.6kV-600kVA
TMdrive-MVG

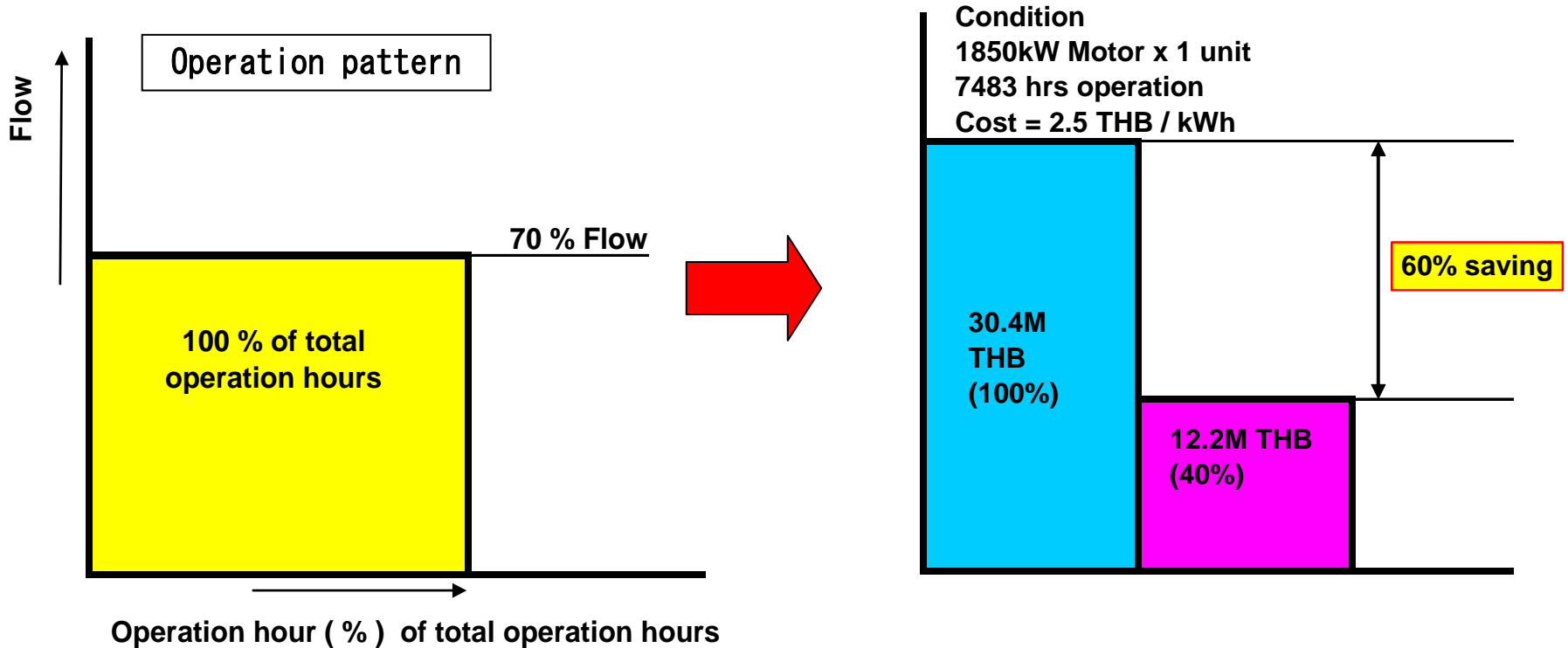


Energy-saving Plan and Its Effect (Summary)

Expected Total Effect	Proposals	
	Energy-saving Plan	Effect (per year)
Application of inverter <ul style="list-style-type: none">• Energy saving, CO₂ reduction• Cost saving	ROC Application of inverter (2600kVA)	Electricity -- 60% saving CO ₂ reduction -- 4032t
	TAF Application of inverter (600kVA)	Electricity -- 57% saving CO ₂ reduction -- 668t



Energy-saving Plan and Its Effect (Details) ① ROC Cost comparison



Estimated payback period: 1.0 Year

*Cost of inverter and new Exn motor are included.

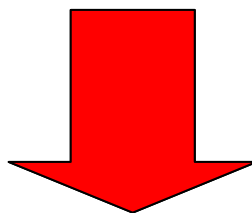
*Cost of construction, modification of existing equipments are not included.



Energy-saving Plan and Its Effect (Details) ② ROC CO₂ Reduction

Energy Comparison

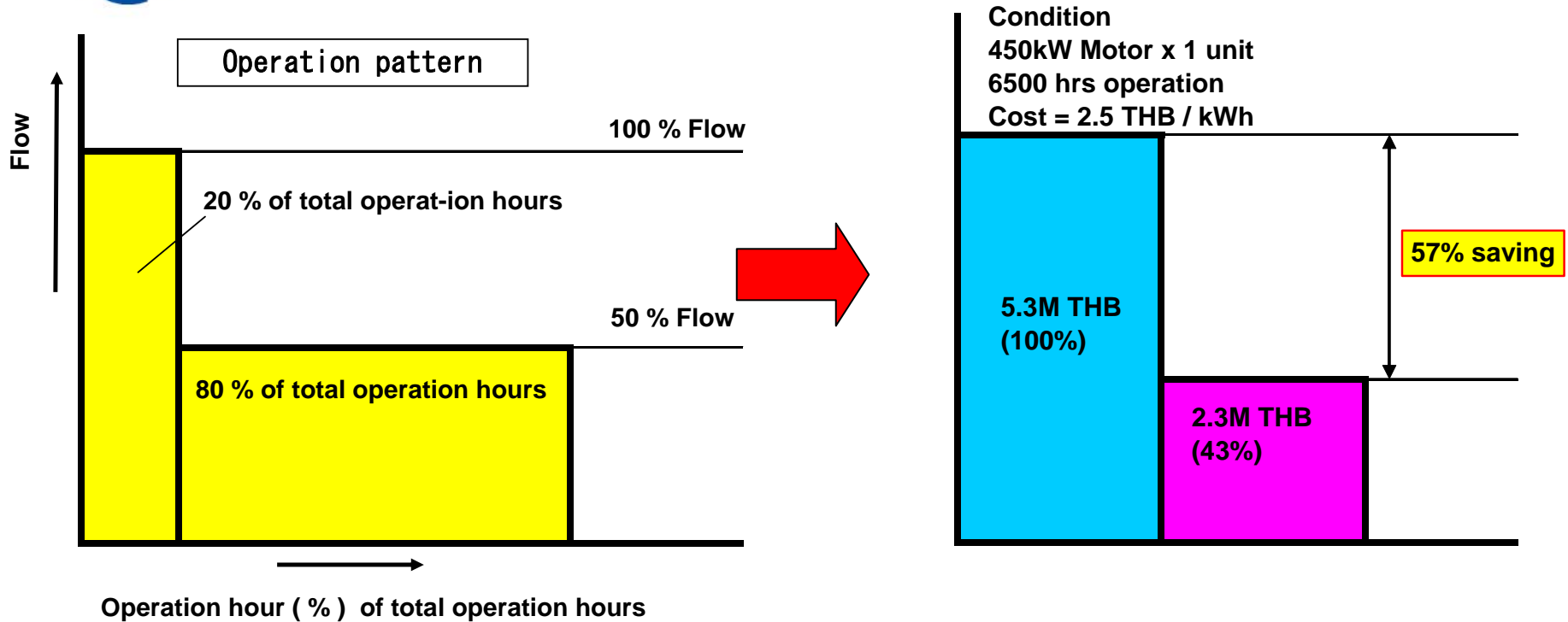
Valve control	12, 159, 875 kWh
Inverter control	4, 893, 882 kWh
Energy saved per year	7, 265, 993 kWh



CO₂ Reduction : 4032t per year
(* 0.000555t – CO₂/kWh)



Energy-saving Plan and Its Effect (Details) ① TAF Cost comparison



Estimated payback period: 1.7 Year

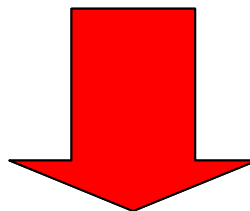
***Cost of construction, modification of existing equipments and temperature signal transmitter system are not included.**



Energy-saving Plan and Its Effect (Details) ② TAF CO₂ Reduction

Energy Comparison

Valve control	2,108,600 kWh
Inverter control	904,800 kWh
<hr/>	
Energy saved per year	1,203,800 kWh



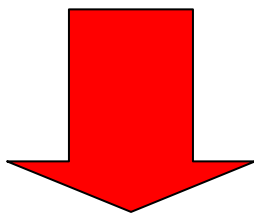
CO₂ Reduction : 668t per year
(* 0.000555t – CO₂/kWh)



Suggestions

Application of inverter

- 1) Friendly to motor, friendly to power source
- 2) Energy saving, CO₂ reduction
- 3) Cost saving



Create green factory