YASKAWA

CII 16th Energy Efficiency Summit 2017- Low Harmonic Drives For Industrial Applications

YASKAWA INDIA PVT LTD

YASKAWA Total Industrial System Solutions

Master of Robotics, Motion and control

Profile

Corporate Name: YASKAWA Electric Corporation

Founded: July 16, 1915

Head Office Location: 2-1 KurosakiShiroishi, Yahatanishi-ku, Kitakyushu Fukuoka Japan

Capital: 30.5 billion yen

Number of Employees: Consolidated 14,319
(Including temporary employees / As of March 20, 2016)

Consolidated Net Sales: 394.9 billion yen (FY 2016*)

Main Business: Motion Control
(AC servomotors, controllers and AC drives)
Robotics
System Engineering

Head office

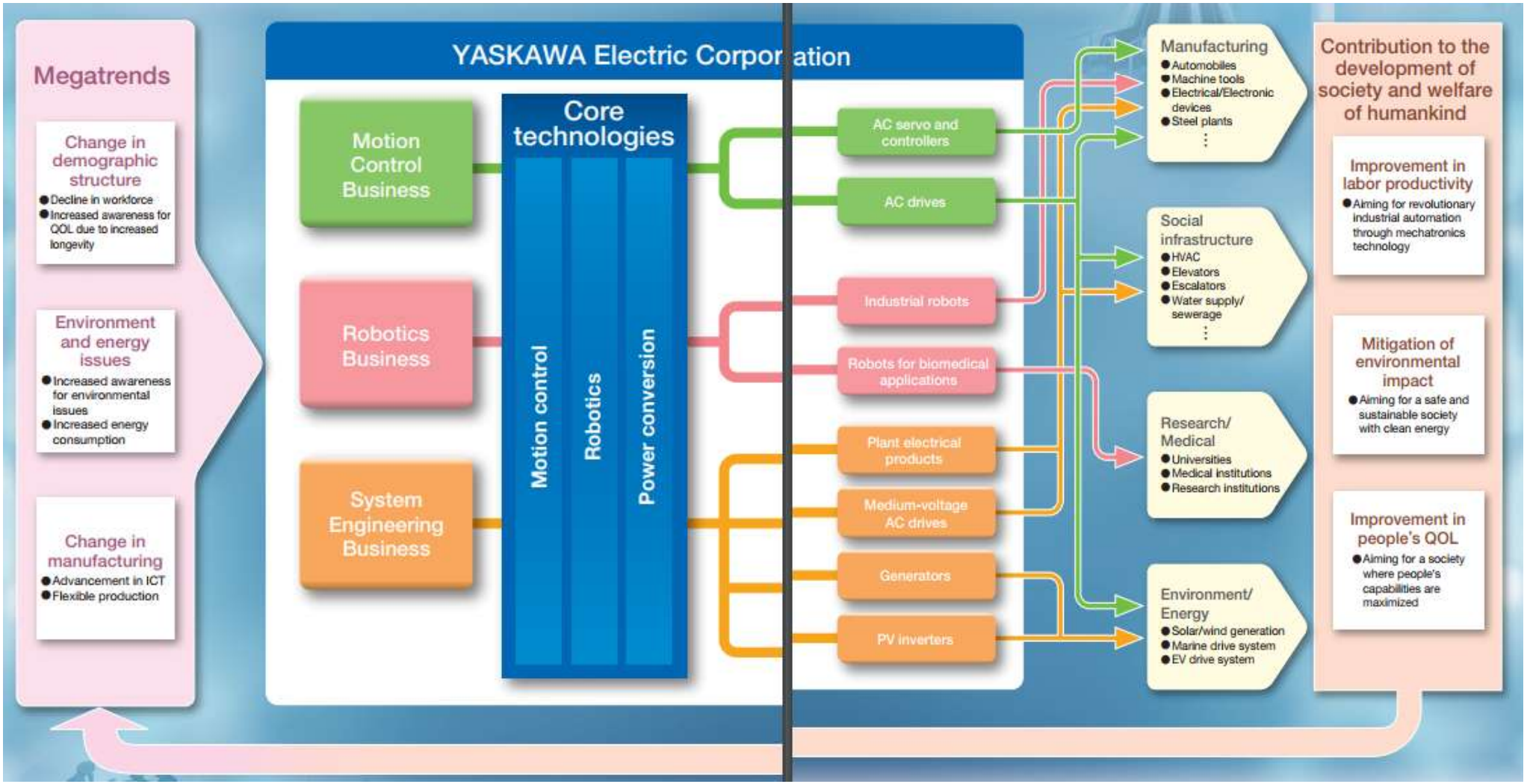
*FY 2016 means the consolidated fiscal year from March 21, 2016 to March 20, 2017.

(As of March 20, 2017)

Facts

	YASKAWA Electric Corporation	YASKAWA India Private Limited
Corporate Name		
Establishment Date	July 16 1915	August 31 2010
Head Office Location	2-1 Kurosaki Shiroishi, Yahatanishi-ku, Kitakyushu Fukuoka Japan	17/A, 2nd Main, Electronic City, Phase1, Hosur Road, Bangalore
Capital	31 Billion Yen (As of March 20, 2016)	270 MINR (As of March 31, 2016)
Number of Employees	Consolidated 14,319 (As of Mar 20, 2016)	210 employees (As of Mar 31, 2017)
Sales	**395** Bn Yen (As of March 20, 2017)	> 2.8 BINR (FY 2016-17)
Main Business	• Motion Control (AC Servomotors and AC Drives) • Robots • System engineering • Information Technologies	• AC Drives • Robotics • Motion Control

Business Segments



Strategies for Vision 2025

Mechatronics

Pursue World #1 in Core Business

- Pursue and achieve global No.1 share in motion control and robotics segments

Mechatronics

Deliver Revolutionary Industrial Automation

- Combine world' s leading edge mechatronics and ICT technology in order to provide a brand new solution to automation

Clean Power

Establish Energy Creation/Storage/Application Business

- While globally expanding the renewable energy business, electric drivetrain business will be developed in order to establish a new core business domain

Humatronics

Challenge in Medical/Welfare Market

- Reinforce human capabilities and develop devices that will raise people' s quality of life, creating opportunities to enter new markets

Strategy 1- Pursue world #1 in core business

Servo

Develop integrated controller

Tap into actuator market development

Design combined components

Robot

Create robot and human cooperative model for manufacturing industry

Enhance application and integration

Develop robot for assembly application

Drive

Offer energy saving/storage solution

Develop harmonic-less/ regeneration application market

Enter and capture market the volume zone

Internet of Things (IoT) Supported

Leading the Innovation

3 World's Best Products

"AC servo drives", "AC drives" and “Industrial robots". These are the three products of Yaskawa Electric boasting the world's highest level of performance and market share. We conduct global business with these world’s top competitive products.

Cumulative shipments surpassing 300,000 (Sep.2014)

India more than 4200 robots in last 10 years

Cumulative shipments* surpassing 10 million (Mar.2012)

More than 5000 units in India

AC Drives

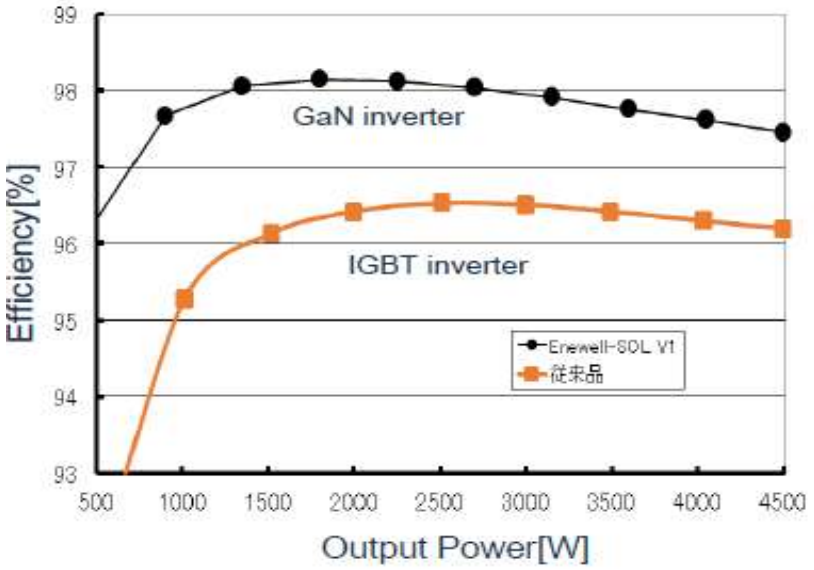
Cumulative shipments surpassing 20 million (Feb.2014)

India more than 1.1Mn Drives since 1990

VS-626 the world's first vector control AC drive (1979)

PV Inverter with GaN semiconductor – New Technology

Features
- High Efficiency (Max 98%)
- Compact (12L)
- Silent (< 30dB)



GaN HEMT 2 in 1 Module
Supplied by Transphorm. Inc

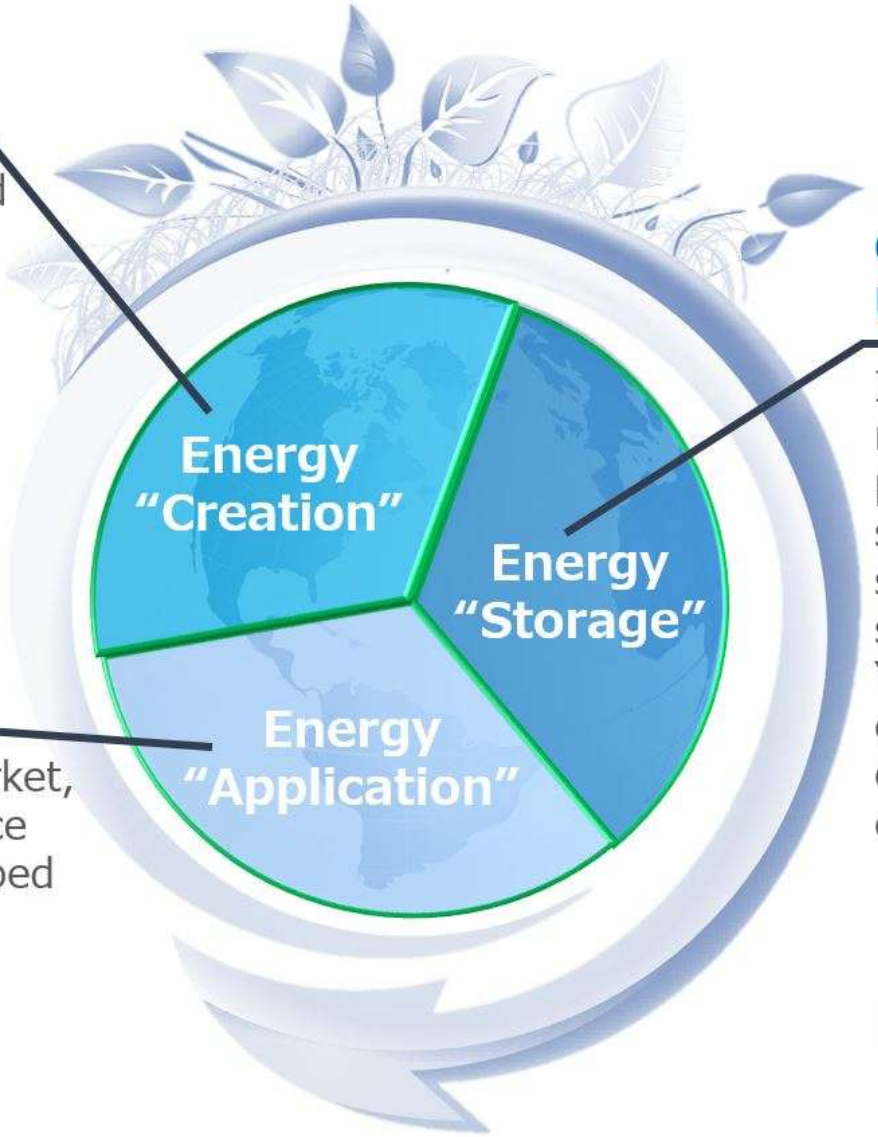
Strategy 2 - Energy “Creation”/ “Storage”/ “Application”

Clean Power Across the World!

Strengthen solar power and large-scale wind power generation, in order to accelerate global business expansion.

Into the Electric Drivetrain Market!

New electrical mobility market, which will eventually replace fossil fuels, is to be developed through the use of open innovation.

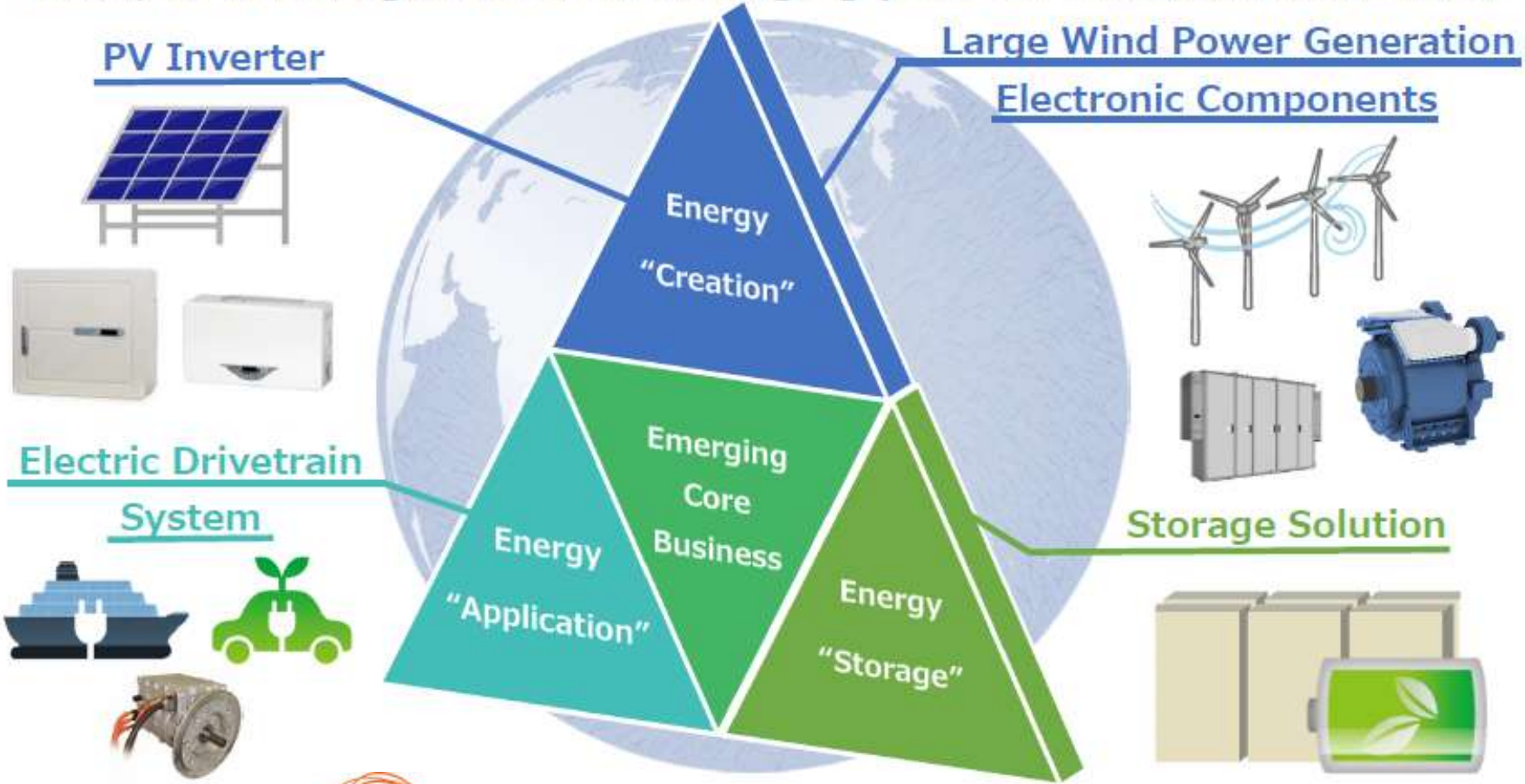


Optimize Electric Power Usage!

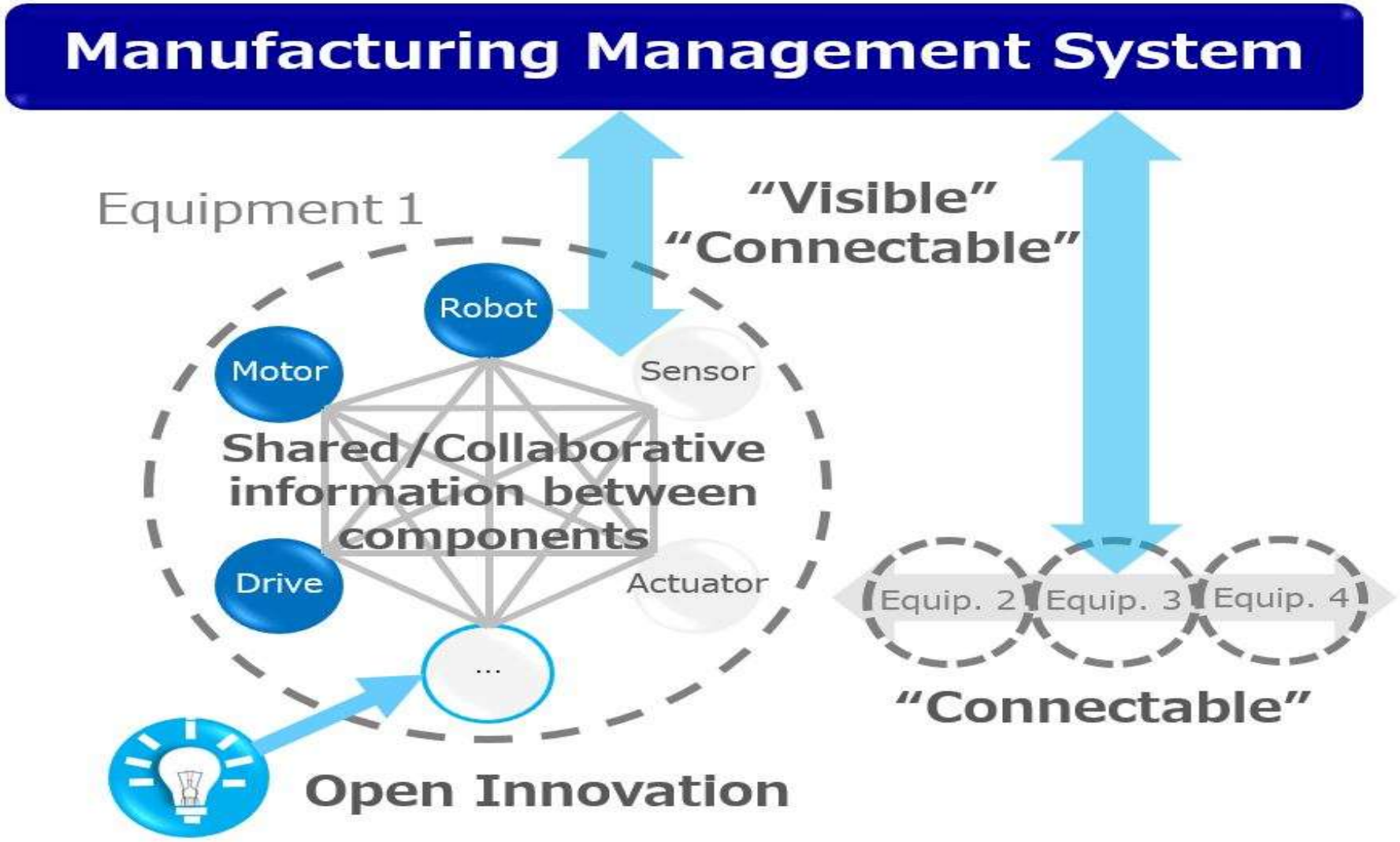
Increase in introduction of renewable energy is likely to promote consumer’s need for systems, such as peak-cut systems and grid power stability.
Yaskawa will work on electricity storage systems and contribute to further expansion of renewable energy.

Enterprise Strategy – Grow Clean Power into Core Business

Global development of Energy "Creation" and "Application" business fields, to be recognized as an emerging pillar of YASKAWA's business



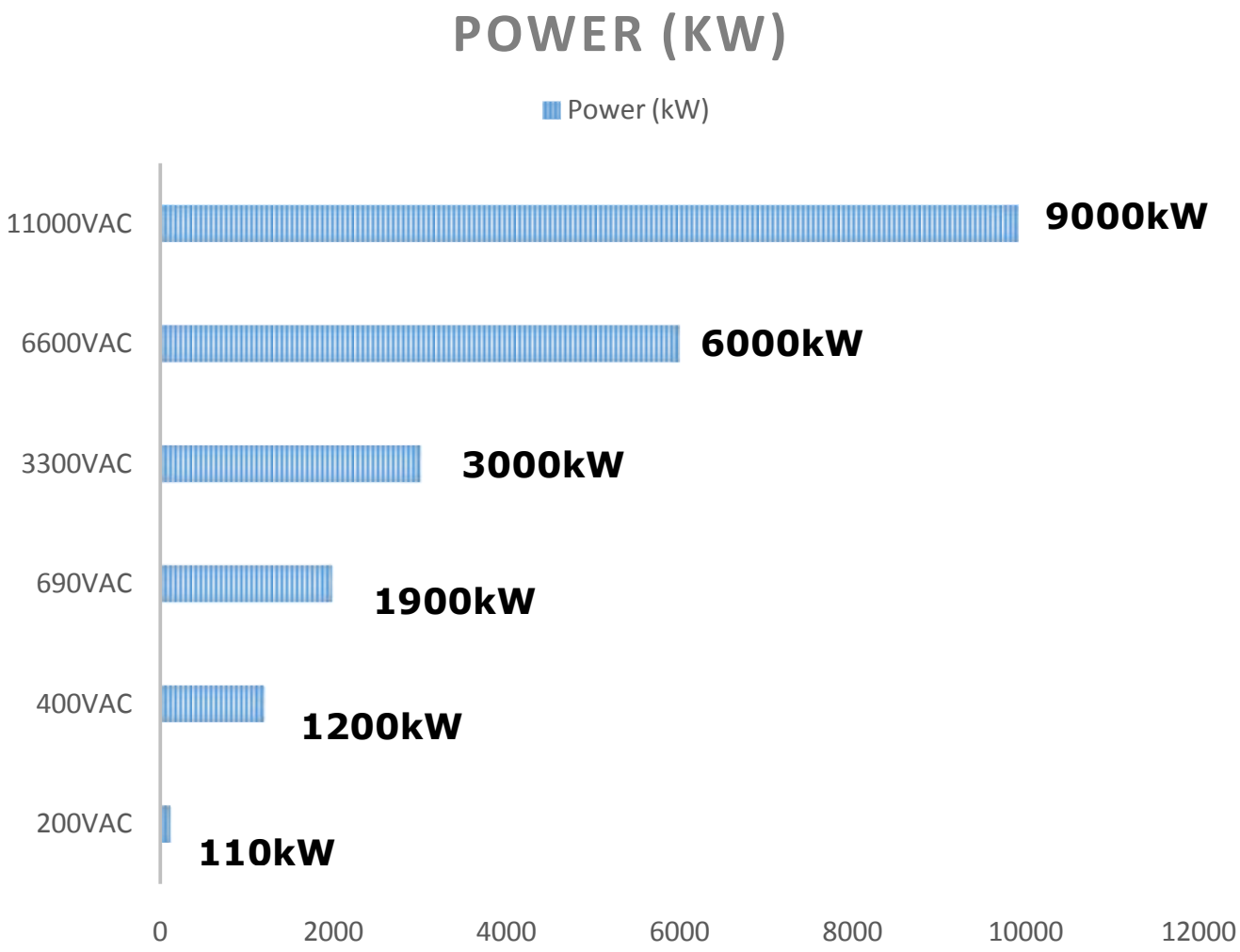
Strategy 3 - Revolutionary Industrial Automation



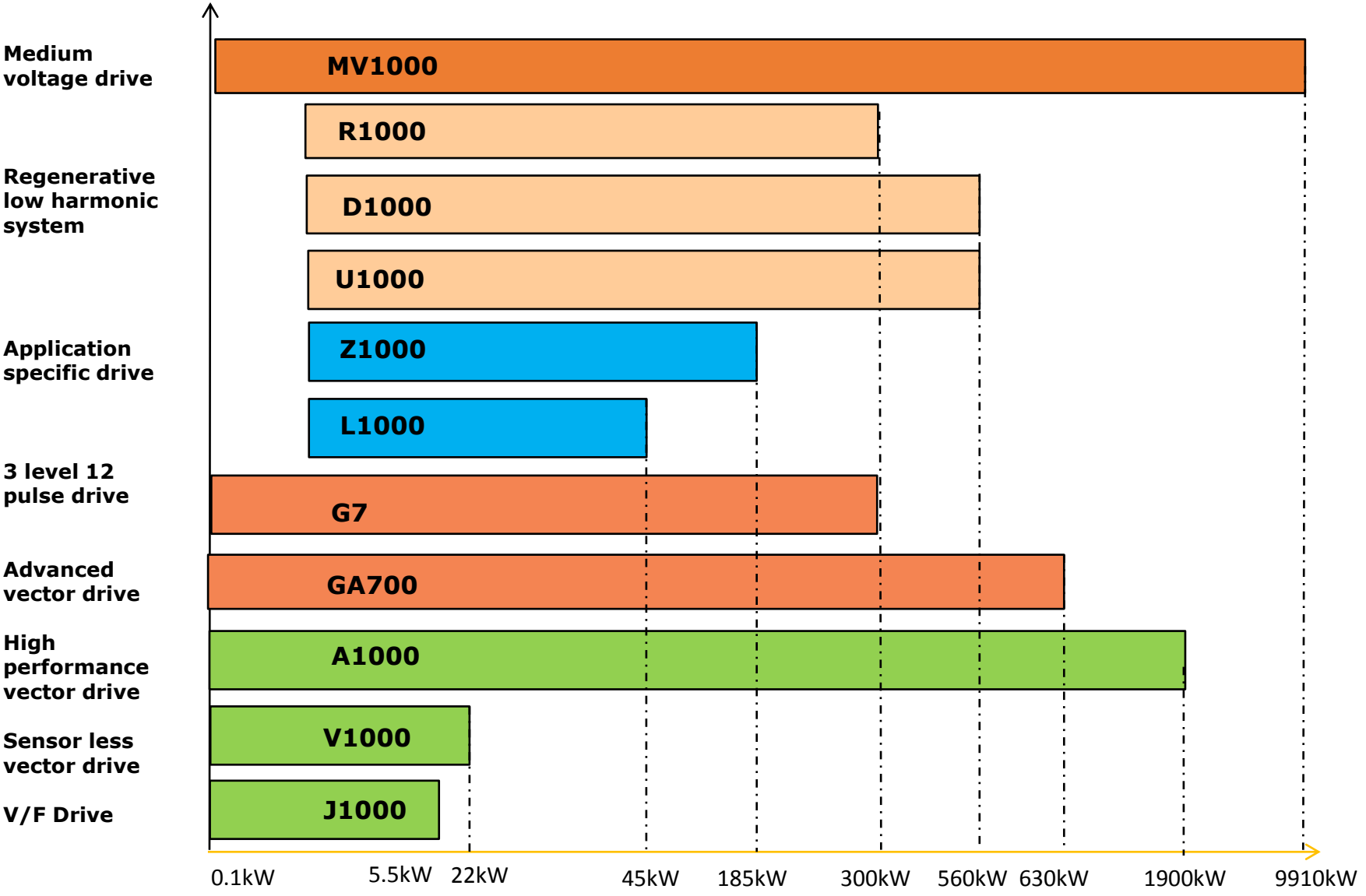
Strategy 4 - Challenge in Medical/Welfare Market

Robot technology from past experience in field of industrial automation and alliances including industry-academia-government collaboration, will be applied to create a visionary market for medical/welfare devices. We define a device that can enhance quality of life through combining Yaskawa's Mechatronics technology and human capabilities as "Humatronics Device".

Product power range in AC drives

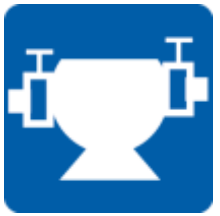


Product series range in AC drives



Segments and Applications

- Sugar
- Cement
- Metal and Mining
- Elevators and Lifts
- Rubber and Plastic
- Automobile
- HVAC
- Textile
- Cranes and Hoists
- Oil and Gas
- Machine tools
- Paper and Pulp
- Power


Pump

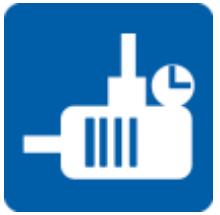

Belt Synchronization


Machine Tool


Sealing


Extruder


Conveyors


Compressor


HVAC


Fan

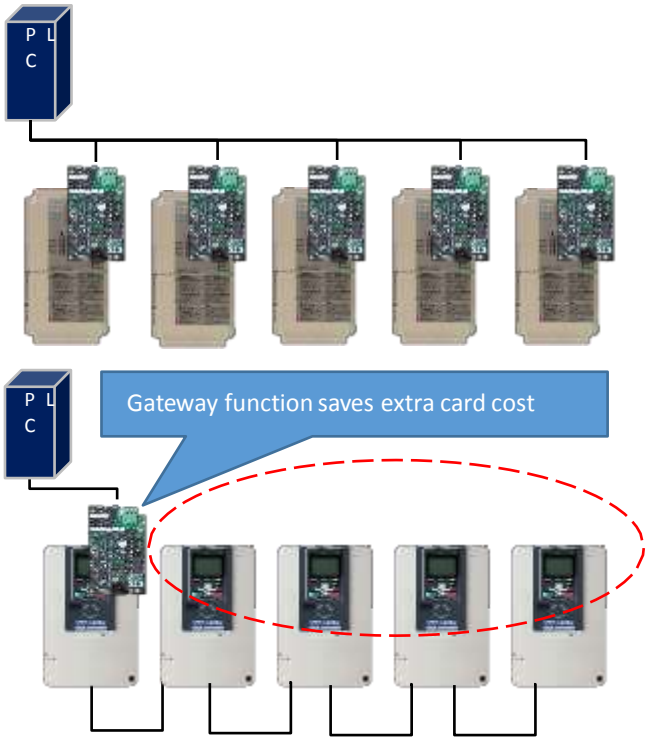

Hoist


Winder


Filling

YASKAWA Unique features

- 3 decades of experience in offering solution to Indian industry.
- Unique Matrix technology for low harmonic regenerative drives.
- 3 level control in G7 model made unique for retrofitting with old motor and long distance cable operation up to 1kM without any filters.
- Ambient temperature 50 DegC and derating up to 60 DegC.
- Conformal coating of 3C1, 3C2, 3C3 for PCB's and separate coated drives for Oil (N class), Gas (K class), Sticky dust (M).
- Anti vibration feature (S class).
- Intelligent terminal board.
- MTPA function ensures the maximum torque generation.
- Maintenance monitors will reduce the downtime.
- Network Gateway Function- One fieldbus option card can network up to 5 drives.
- YASKAWA patented tuning less EZ vector control technology.
- Application macros make the drive integration much faster.



Bluetooth technology & IOT system

YASKAWA Low Harmonic Drives

G7

D1000

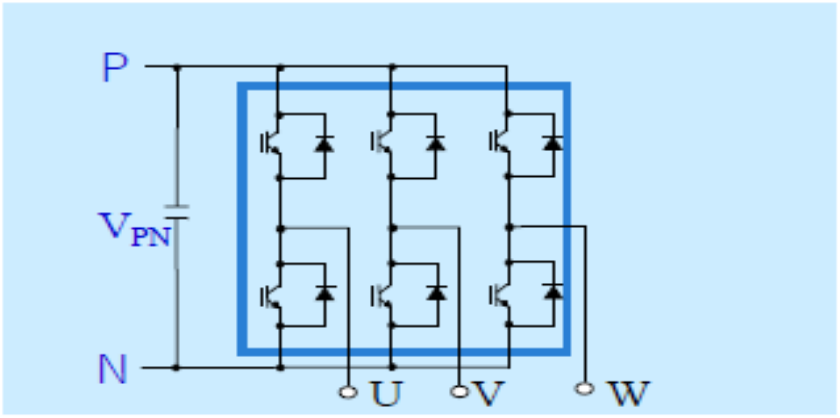
R1000

U1000

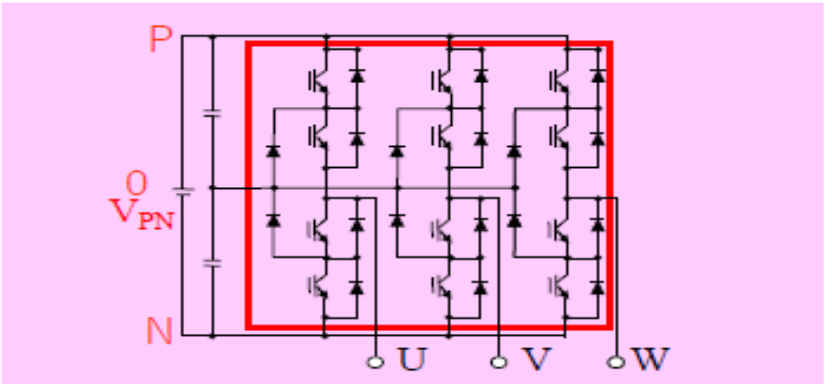
G7 - 12 Pulse Three Level Converter

- Low surge voltage- It will supress the surge voltage to motor which is caused due to long distance cables.
- Up to 1km no need of output reactor/ sin filter outside the VFD.
- Reduce the common mode voltage.
- Reduce the bearing current of the motor.
- Electrical noise generated is less comparted to conventional drives.
- Reduces the insulation breakdown of the motor.

Conventional Model
【2-level Control】



G7
【3-level Control】



G7 : Reduction of Harmonic Current

All models of 18.5kW or more come equipped with DC reactors to improve the power factor, and support 12-pulse input.

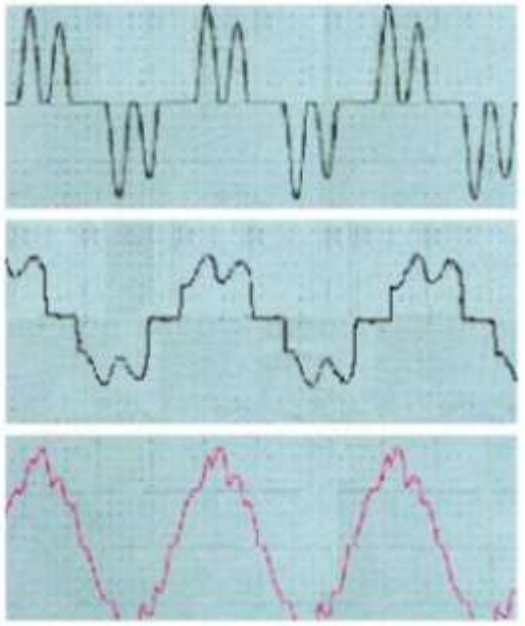
※ Option for models of 15kW or smaller

Conventional type
6-pulse Input
Without reactor

Conventional type
6-pulse Input
With DC reactor

12-pulse Input
With 3-winding transformer

※ For 12-pulse input, a transformer with a star-delta secondary is required for the input power supply



Input Current Waveform

Current Distortion Factor

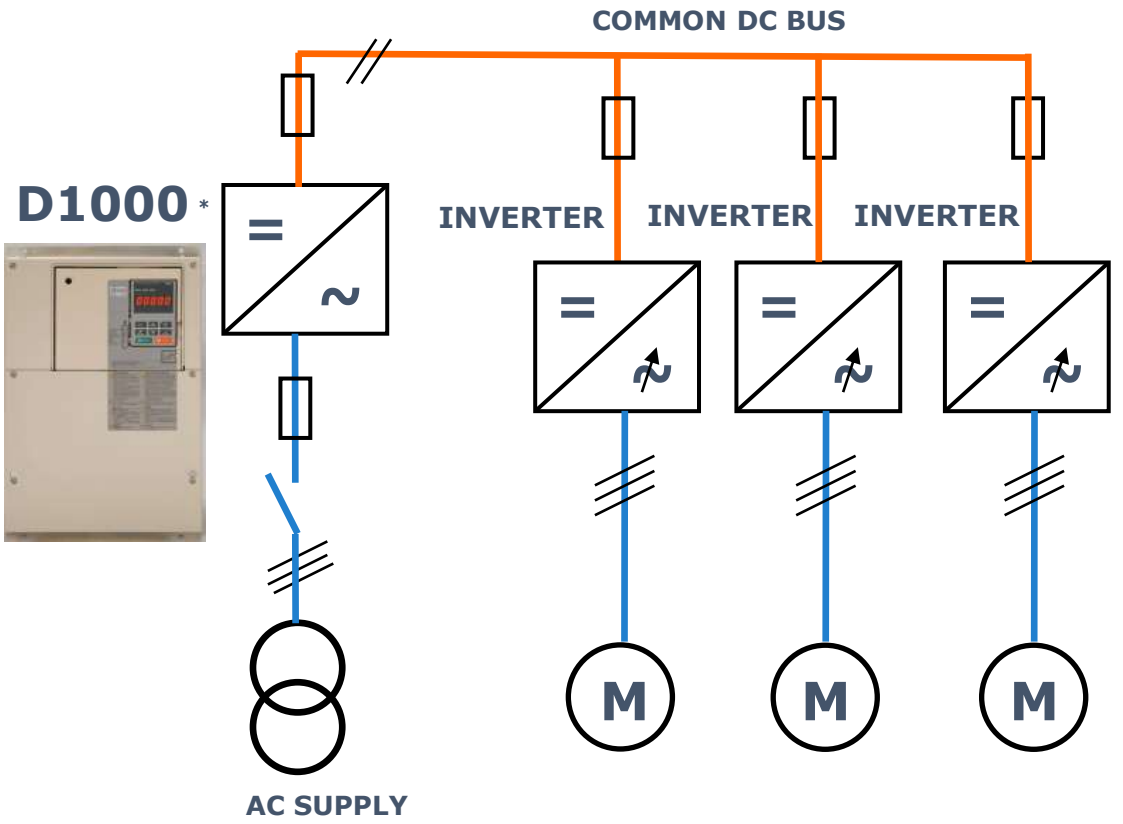
88%

40%

12%

D1000- The Active front end unit.

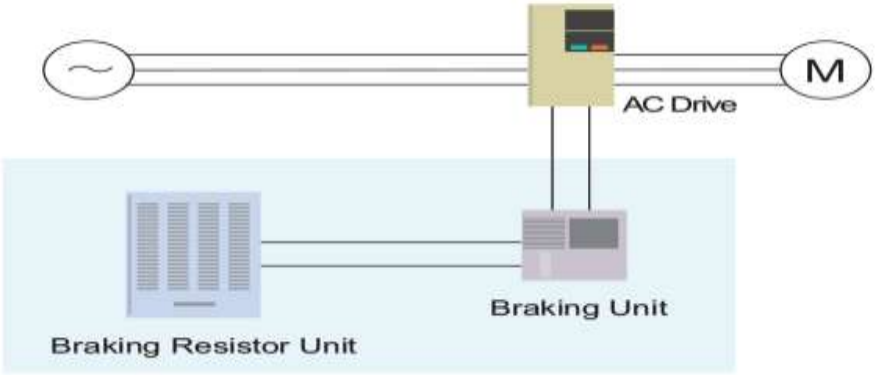
- Energy Savings
- Power Regeneration
- Power Factor Improvement
- Reduction of power line harmonics
- Easy monitoring –Power consumption, Saved Energy, Electricity cost
- Easy Maintenance
- Compact Design
- Support Global Field bus network



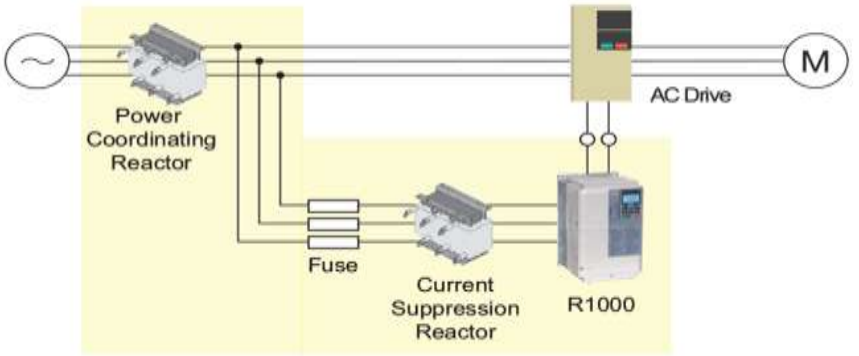
R1000 – Regenerative braking unit

- Compactable with any make of drives.
- Improved process time by reducing the braking time
- Will replace the dynamic braking unit and dynamic braking resistors.
- High braking torque of 150% for 30sec.
- Energy saved which is currently wasted at Dynamic braking resistors.
- Monitor the amount of energy saved.
- Improved operational efficiency by reduced down time.

Dynamic Braking System (wasted energy)



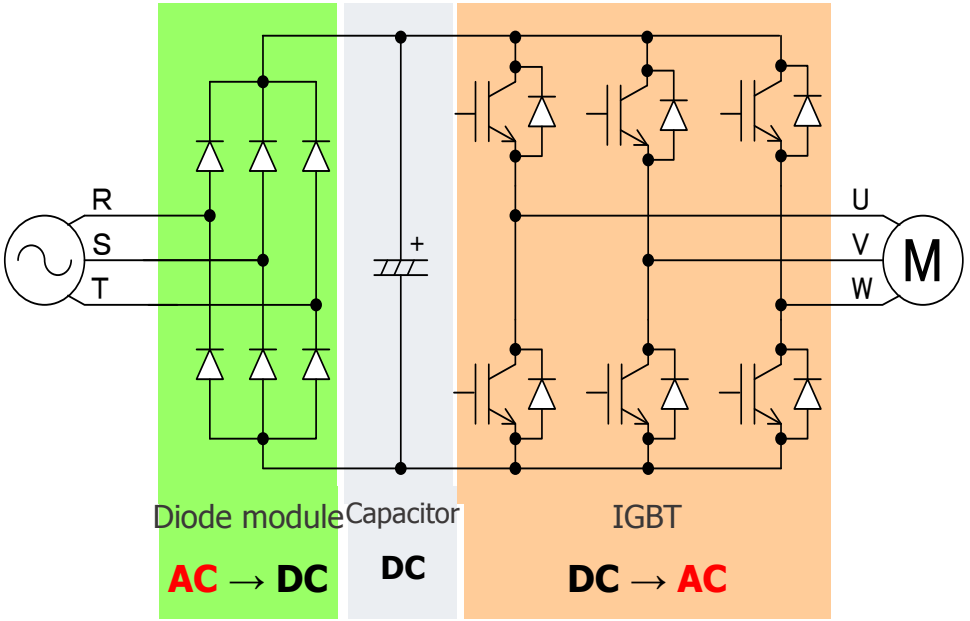
Regenerative Braking System (recovered energy)



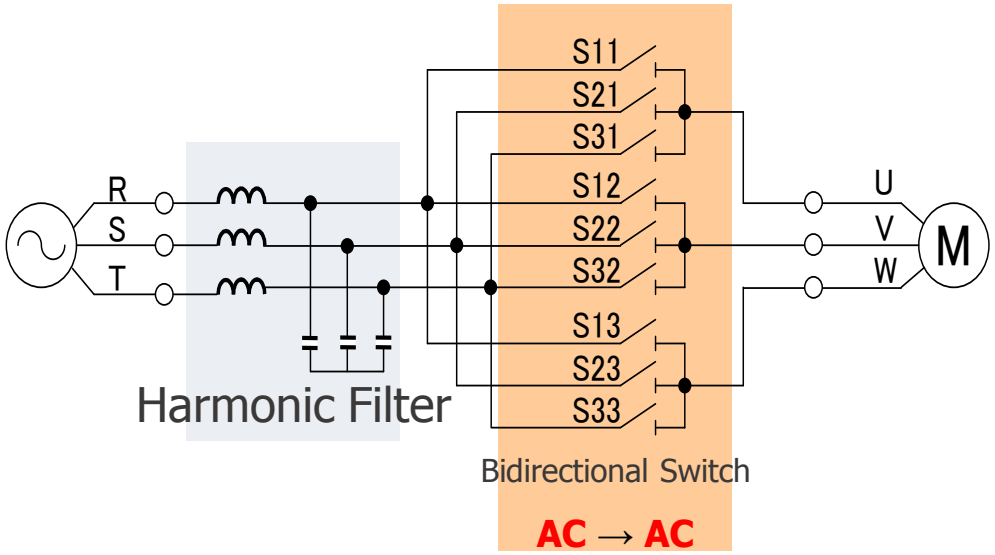
U1000- The Matrix drive.

U1000 : Configuration

Less Harmonics.

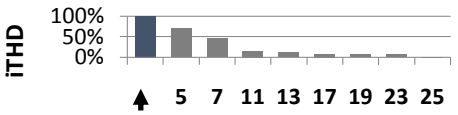
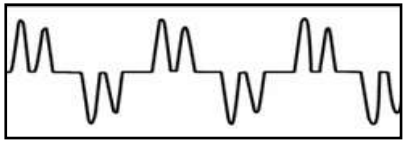
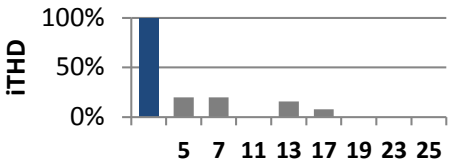
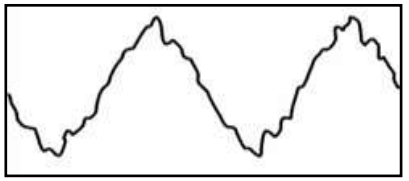
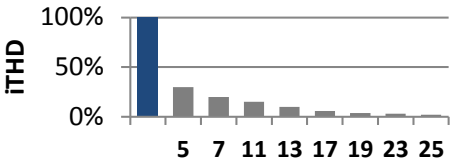
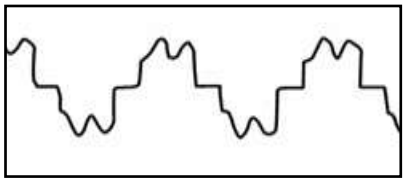
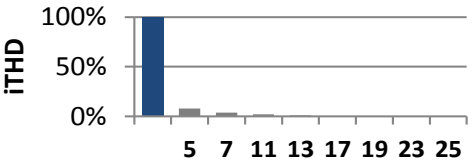
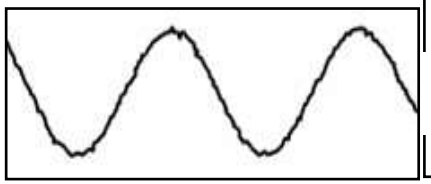


Conventional drives



Matrix drive

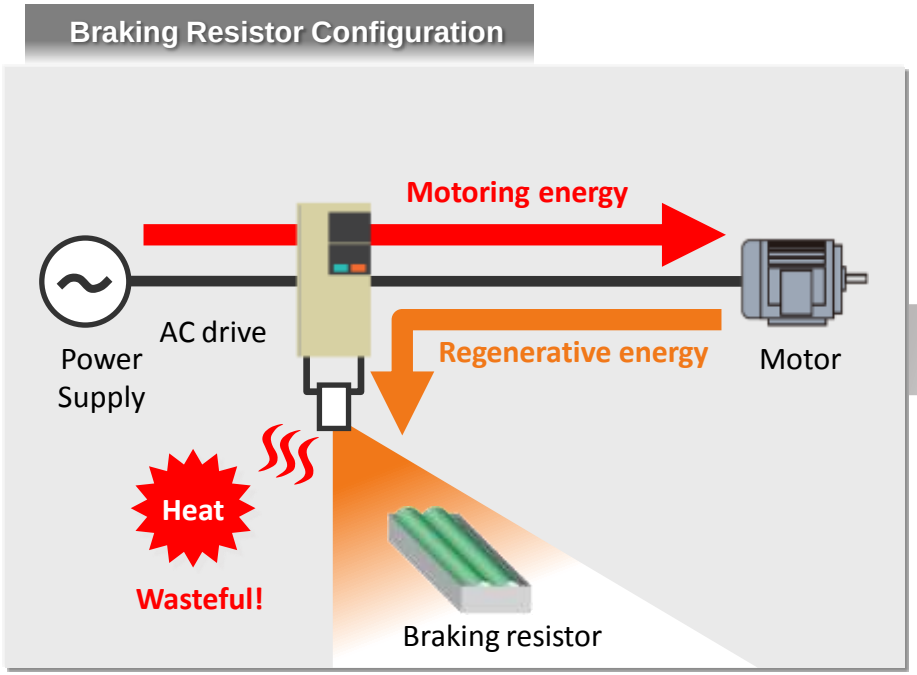
U1000 – Low Harmonic AC drive

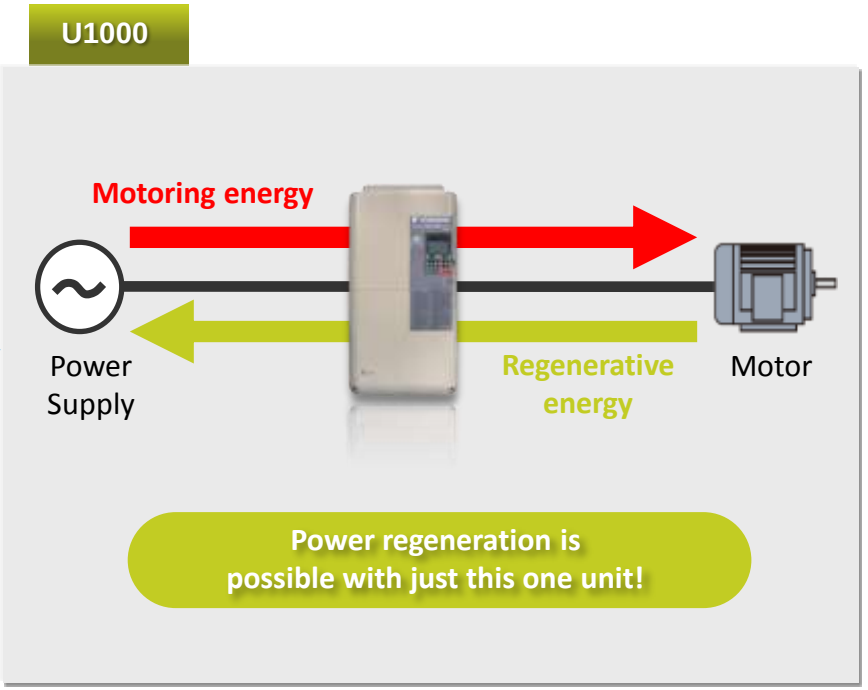
	Current Harmonics	Current Waveform	Current Distortion	True Power Factor
Variable Frequency Drive without reactor			88%	0.75
Variable Frequency Drive with DC reactor			33%	0.90
Variable Frequency Drive with multi-pulse			12%	0.98
U1000 Matrix Variable Frequency Drive			3 to 5%	0.99

U1000- Energy Savings through Regeneration

A braking resistor converts the energy as heat; however the regenerative energy can be returned to the power supply to save energy.

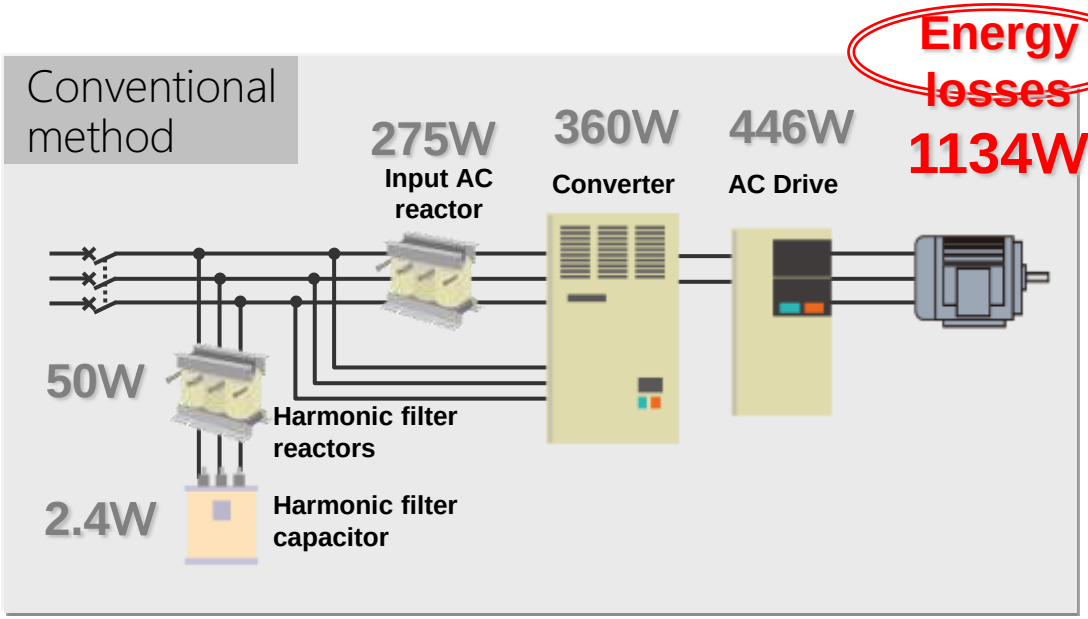
Efficient Energy Usage



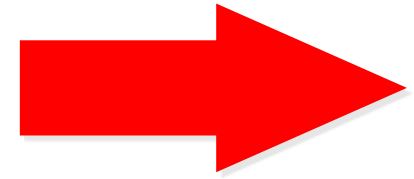


U1000 – Advantages against Active front end.

Compared to the conventional power supply regeneration system, energy losses can be reduced due to no peripheral devices.
→ Electricity charges can be saved.



Example of 400V 15kW



Energy losses 922W

Loss Reduced by Approx. 19 %

U1000 – Simple design

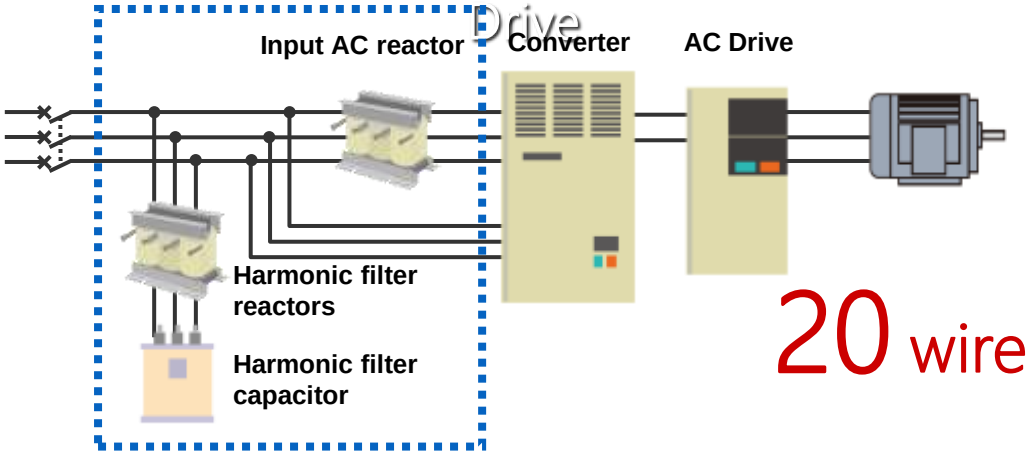
Wiring man-hours has been reduced drastically!

Harmonic countermeasures that were previously required to connect a converter are

not needed.

- Input AC reactor
- Harmonic filter reactors
- Harmonic filter capacitor

Sinusoidal wave converter + general-purpose AC Drive

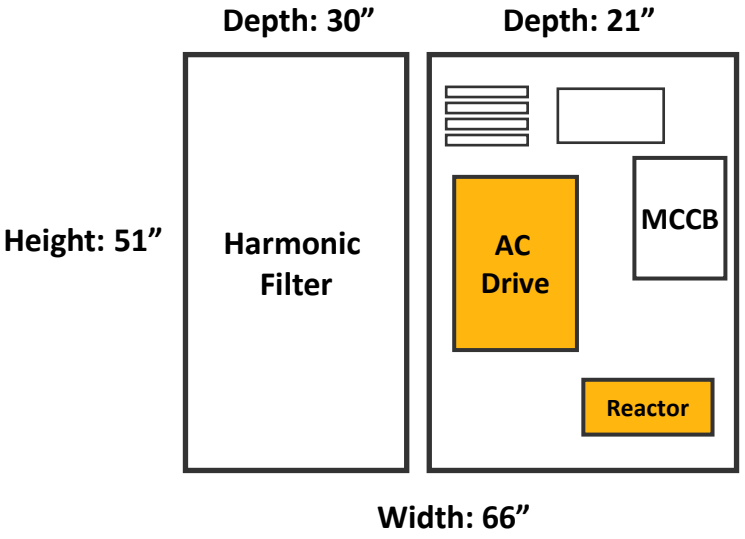


Matrix Converter U1000

Main circuit is connected only with 3 power supply wires and 3 motor wires.

Example of 200V 270 kW

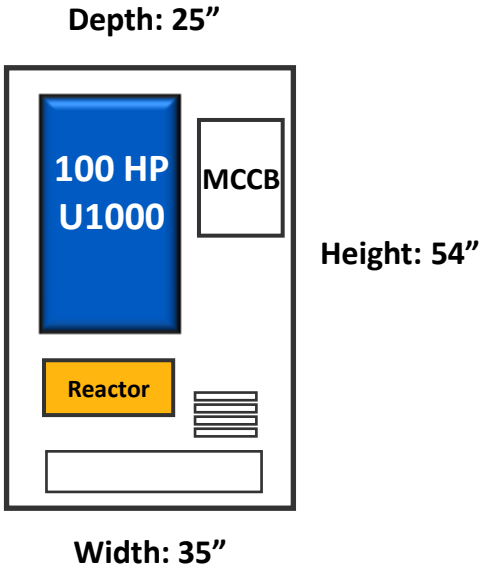
System space comparison



How’s This for Compact?

Floor Space: 56% less

Wall Space: 45% less



Global recognition so far

4 prize in JPN, US and Europe, and 1 certificate in Singapore

Minister of Economy, Trade and Industry award of Energy Conservation Grand Prize

Control Engineering 2016 Engineers' Choice Award

Consulting -Specifying Engineer 2016 Product of the Year

AUTOMATICA 2016 MM Award innovation prize

Singapore GREEN BUILDING PROUDCT LABELLING SCHEME CERTIFICATE

Case story : EOT Crane Application

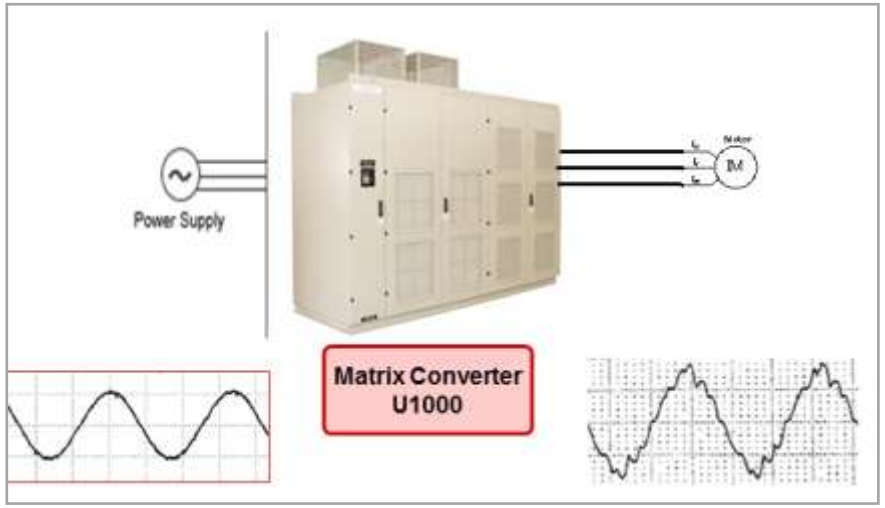
Application :- EOT crane application for scrap yard.
Load : 16Ton
Motor details: 55 kW /126 Amp/980 rpm
Drives supplied for MH-1: CIMR-UD4A0156AMA
Drives supplied for MH-2: CIMR-UD4A0156AMA

Crane operation data		
Number of days crane in usage	6 days in week	
Number of weeks crane in usage	50 weeks in a year	
Number of hours crane in usage	16 hours in a day	
Power consumption data	Hoisting	Lowering
Daily hours of operation	8	8
Total hours of operation per year	2,400	2,400
power consumed in kW	42	32
Total power consumed per year kWh	100,800	76,800

Energy cost calculations	
Unit rate of power	Rs. 7 per kWh
cost of power consumed in hoisting	Rs.705,600
cost of power consumed in lowering	Rs.537,600
Net cost of power consumed	Rs.168,000

Case story : Locomotive Compressor Test bench

Application:-Locomotive compressor test
Motor details:45 Kw, 3000RPM,120Hz, dual pole motor
Drives supplied: CIMR-UD4A0590AMA

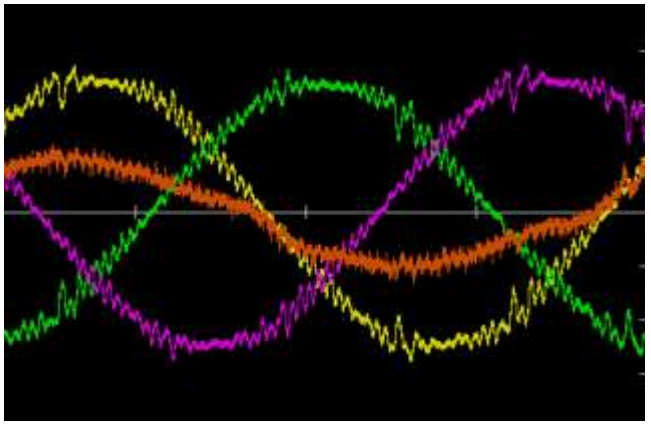


Input
waveforms

Output
Wave forms

Oscilloscope waveforms

Output
Wave forms



Solution for Locomotive compressor test bench instead of Alternator AC power supply.
To achieve balanced voltage output and current harmonics ITHD<5% and online Motor pole changes.

Case story : Sugar Centrifuge

Application:-Sugar centrifuge
Cycle time:1200Kg, cycle time 1 minutes, 30 seconds
Motor details:200 Kw, 750RPM, 385 Amps
Drives supplied: CIMR-UD4A0414AMA

Energy saving and ROI in comparison with existing DC system:

Description	DC kWh	AC kWh
Energy consumed for one cycle	1.25	0.57
Energy consumed for 20 Cycles/ hour	25	11.4
Energy consumed/ day	600	273.6
Energy consumed/ year considering 160 days of crushing	96000	43776
Cost @ 6 rs/kWh	5,76,000/- Rs	2,62,656/-Rs
Net energy saving of AC system in comparison to DC system	52,224 kWh	
Net cost saving of AC system in comparison to DC system	3,13,344 Rs	
Cost of DC system (DC drive + DC motor)- Approximate	13,00,000/- Rs	
Cost of AC system (AC Yaskawa drive + AC motor)- Approximate	21,00,000/- Rs	
Difference in cost	8,00,000/- Rs	
By considering the saving of 3,13,334/- Rs the ROI will be	3 Seasons	

Case story : Engine testing Bench

Application:-Engine test bench
Motor details:22 Kw, 7000RPM,52Amps
Drives supplied: CIMR-UD4A0052AMA

In Engine testing machine, Dynamometer operates in two mode:

1. 1.Speed mode >> friction test>>part throttle test>>performance test.
2. 2.Torque Mode>>Motoring torque test>>regenerative torque mode.

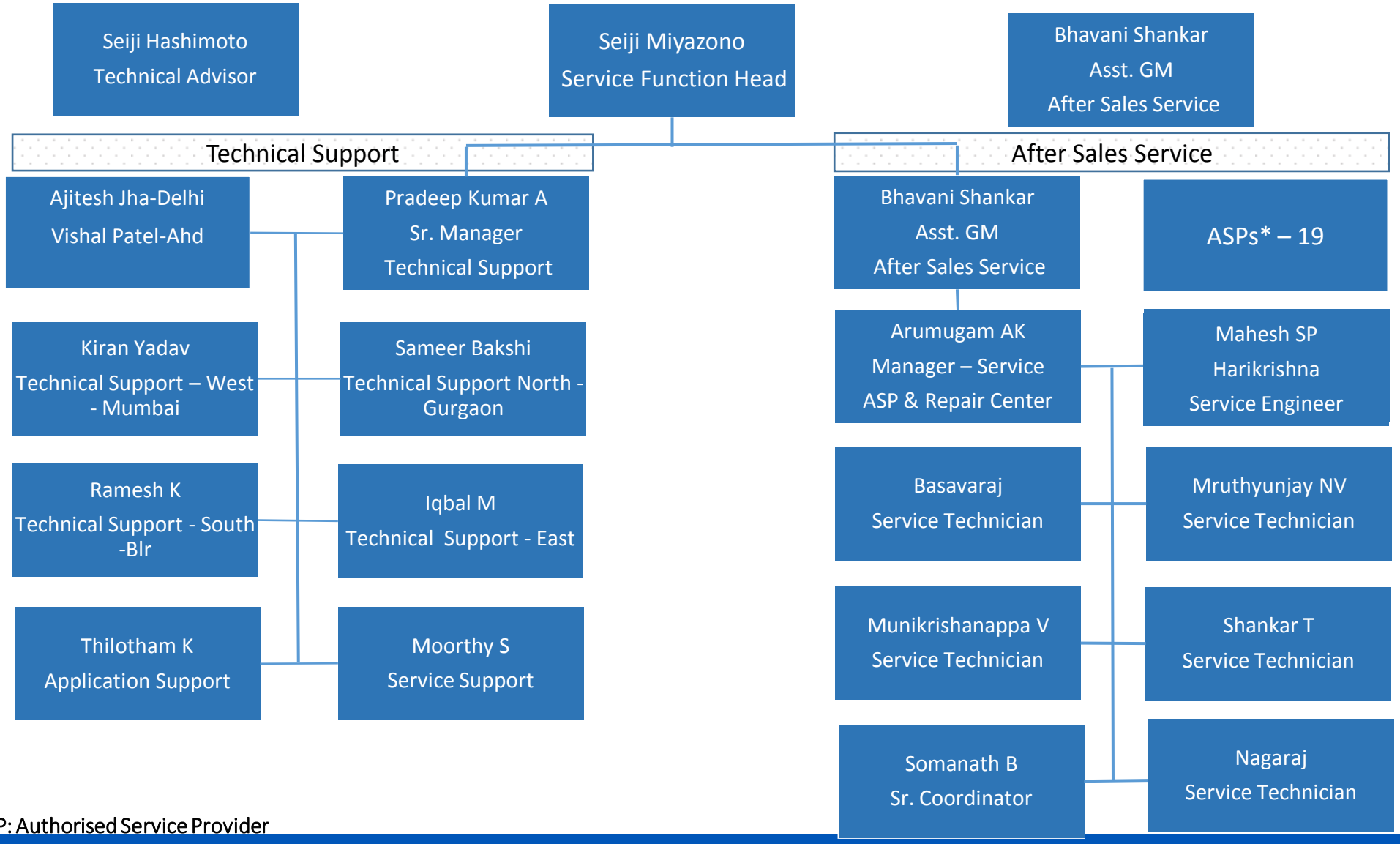
Benefits:

1. Fast Torque response
2. Energy Regeneration during regeneration
3. Low inertia with AC dynamometer
4. Easy installation process
5. Less Harmonics (compliance IEEE519)
6. Improved Power factor (>0.98)

YASKAWA

SERVICE MANAGEMENT

Organization chart – Service support



*ASP: Authorised Service Provider

Service Management Portal

Service Management Portal is an online portal available on internet for the customers to register their service product requirements, viz, Repairs, Field Services, Spare Parts and Technical Support.

How to Access the Portal?

The Hyperlink to the Portal is available in Yaskawa India's Web Page http://www.yaskawaindia.in/,
and Click on "SERVICE QUICK"

Who Can Access the Portal?

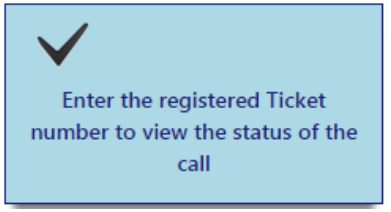
This is an Open Portal and can be accessed by All Customers and Partners who use YASKAWA Products.

What Can you Do when you open the Web Page?

Customer can register their Service Requirements through the Call Registration Button, a Form will open and they can enter all the required details and select one of the Four Service Options.

Also they can view the

Status of the Complaint
Any Time by Status Button



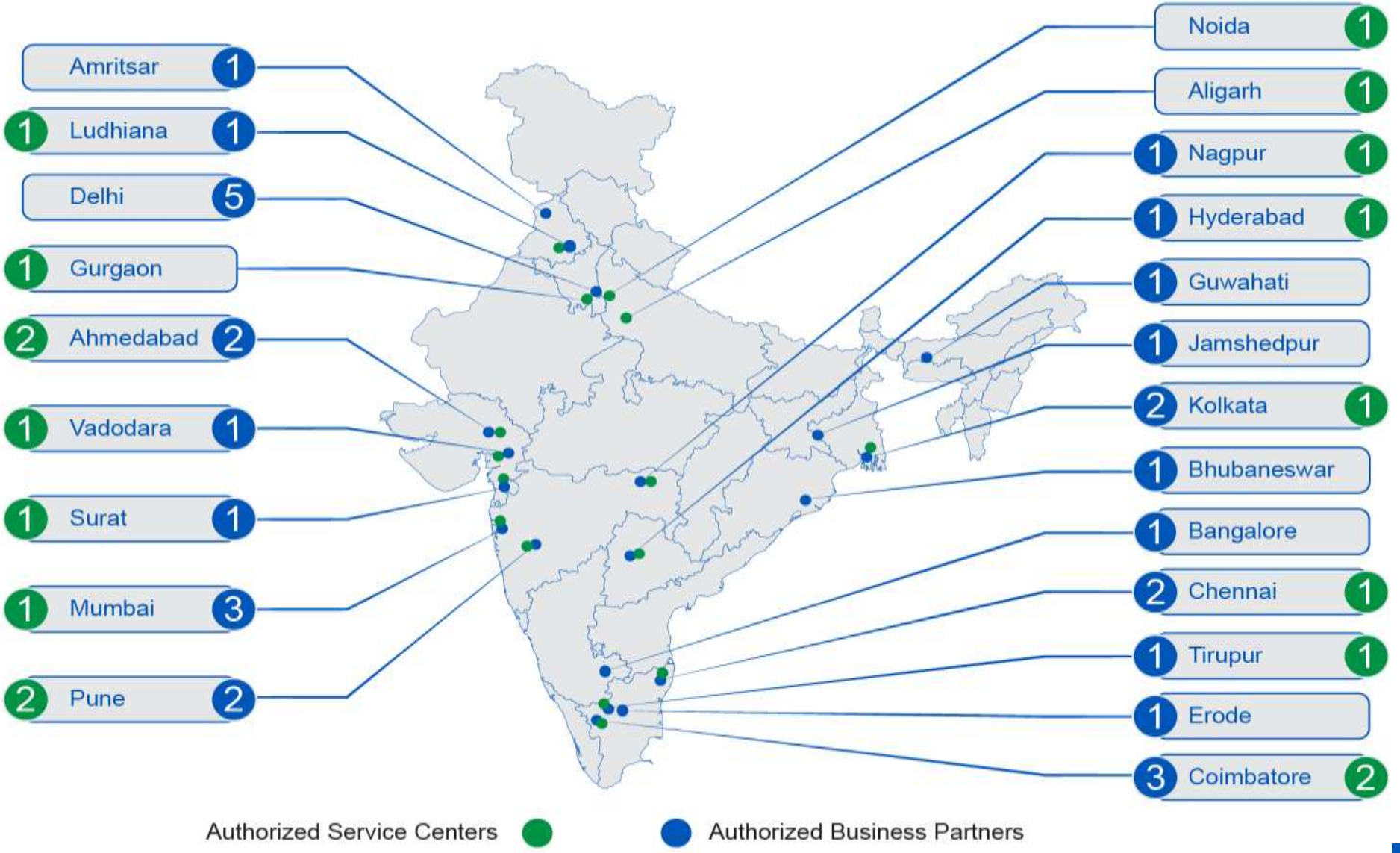
Service Management Portal

How the Portal Works?

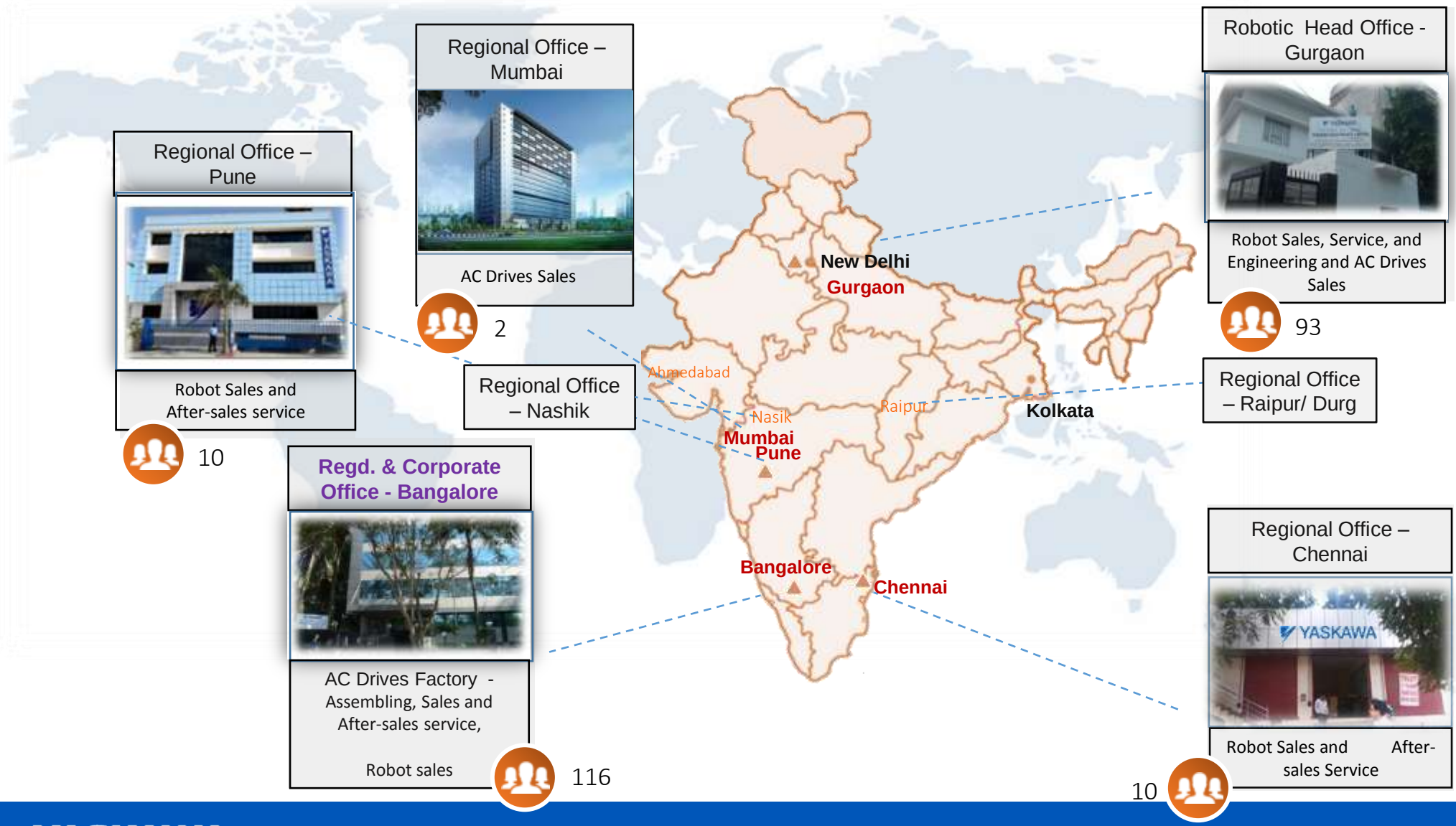
1. Enroll the Customer Service Requests
2. Customer will receive the Ticket number for every Service Request.
3. Service Engineer is allocated, dedicated to each Service Request.
4. Update the Customer on the Service Request process by SMS and email.
5. Service engineer will provide the solution to Respective Request
6. Customer Support Representative verify the feedback from the customer on each Service request and close the call.

YASKAWA TOLL FREE HOTLINE NUMBER: 1800 200 3699

Partners' Network

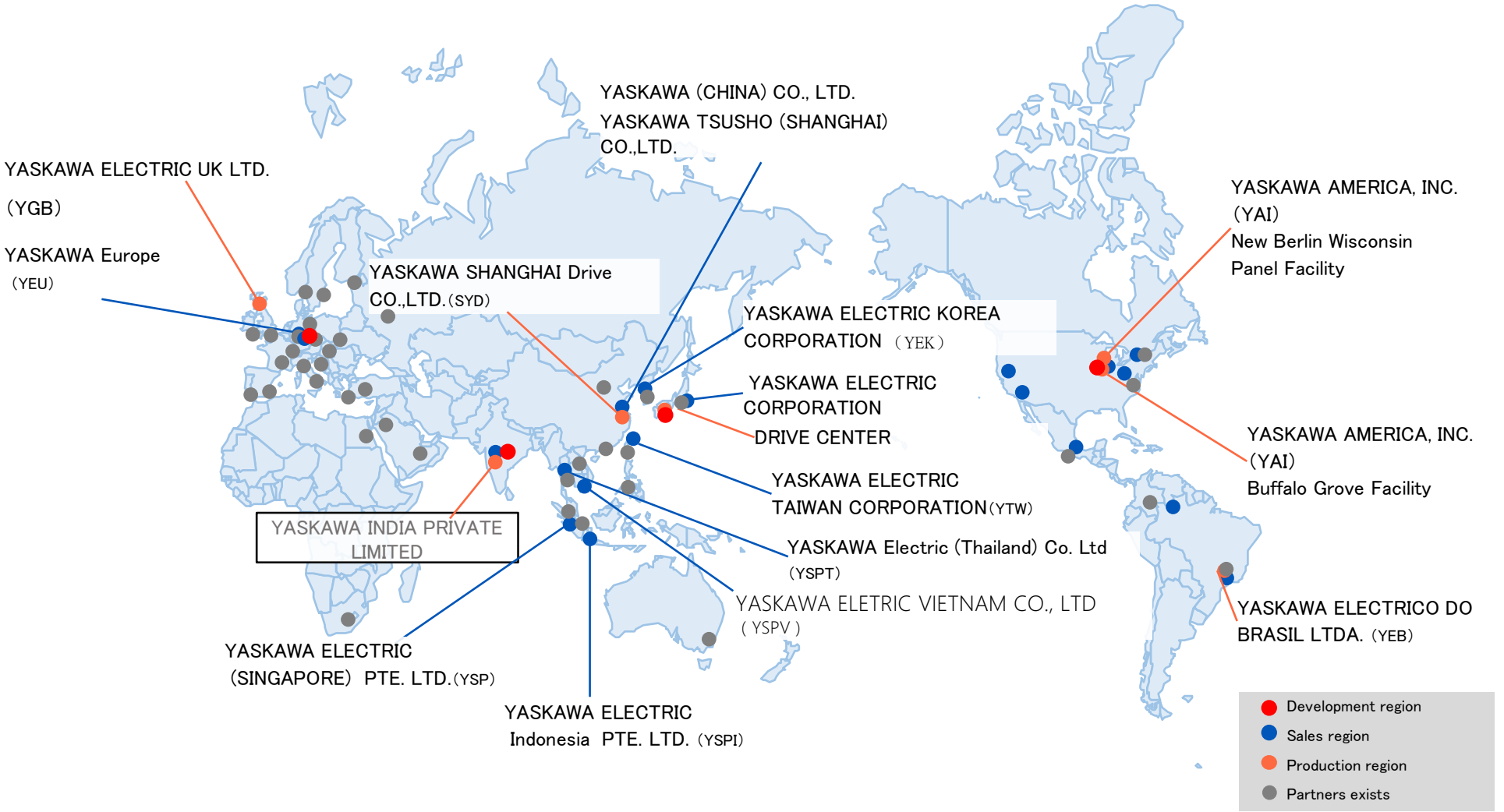


Sales & Service Network



Global Network

4 development bases, 5 production regions,150 After Service bases



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