



# CRRC Metro System Integration Solution

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ZHUZHOU CRRC TIMES ELECTRIC CO.,LTD.

**1**

**COMPANAY OVERVIEW**

**2**

**PRODUCTION LINE**

**3**

**OVERSEAS STRENGTH**

**4**

**SOLUTION FOR YOU**

**5**

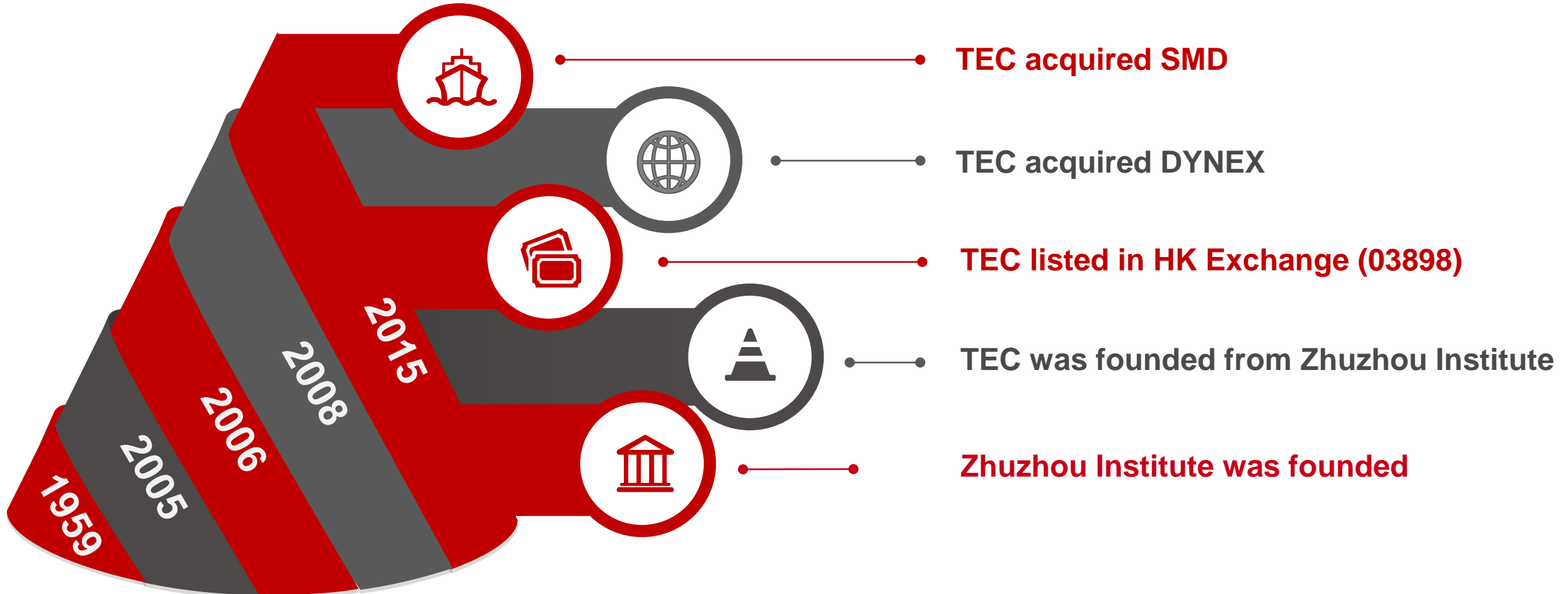
**TYPICAL PROJECTS**



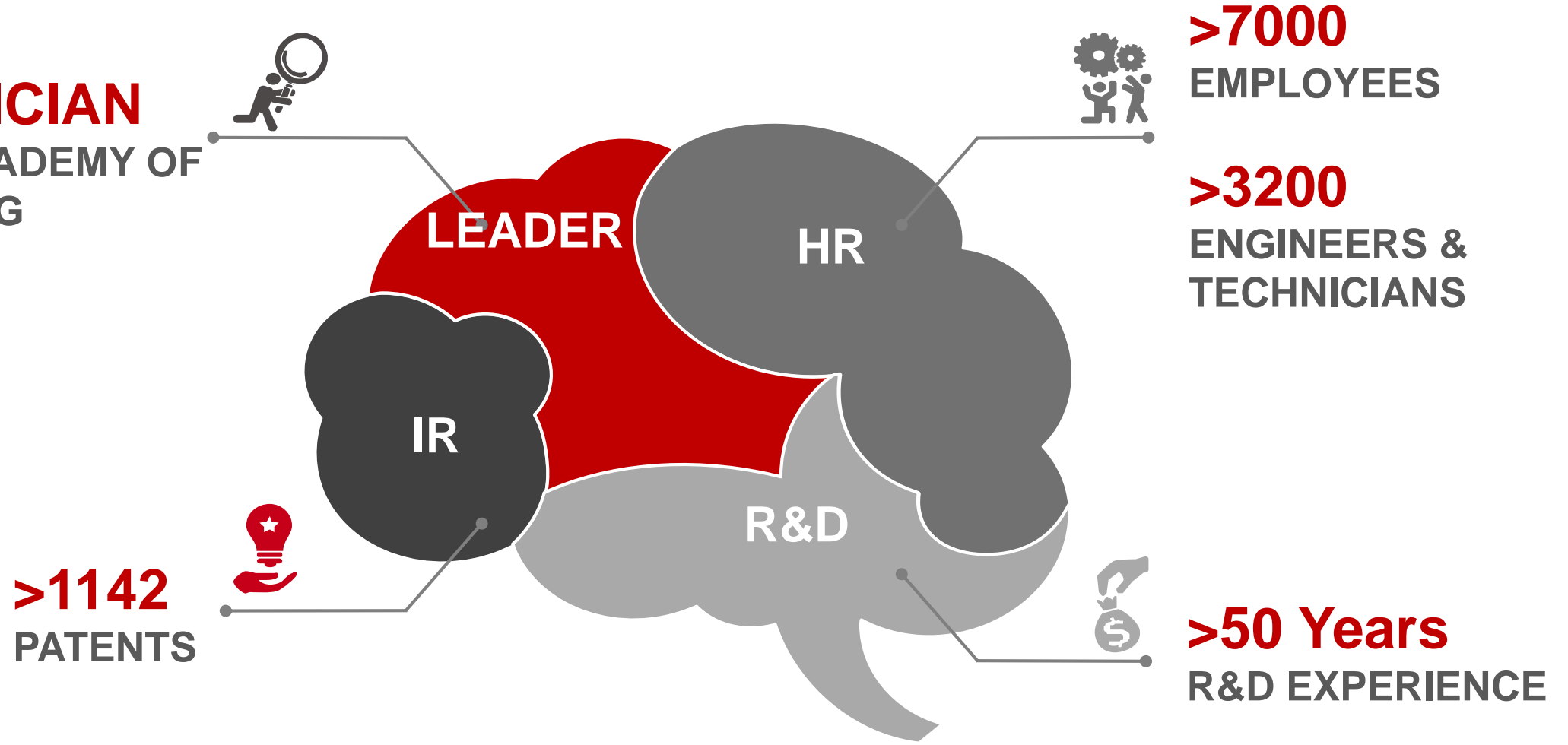
# 1. COMPANY OVERVIEW



## ZHUZHOU CRRC **T**IMES **E**LECTRIC **C**O., LTD



**ACADEMICIAN**  
CHINESE ACADEMY OF  
ENGINEERING





# MANUFACTURING CAPABILITIES



TEC production bases cover **>300,000 m<sup>2</sup>**  
located in over 20 cities internationally, all equipped with  
modern production lines to meet fast delivery requirements.



# QUALIFICATION & CERTIFICATION



**QUALIFICATION** : CNAS, CMA, ILAC ...

**CERTIFICATION** : ISO9000, ISO14000, OHSAS18000, IRIS, TUV, EN15085 ...

**LABS** : Traction System Labs , Electronic Equipment Labs ,  
EMC Labs , Environment Labs , Converting Tech Labs ...

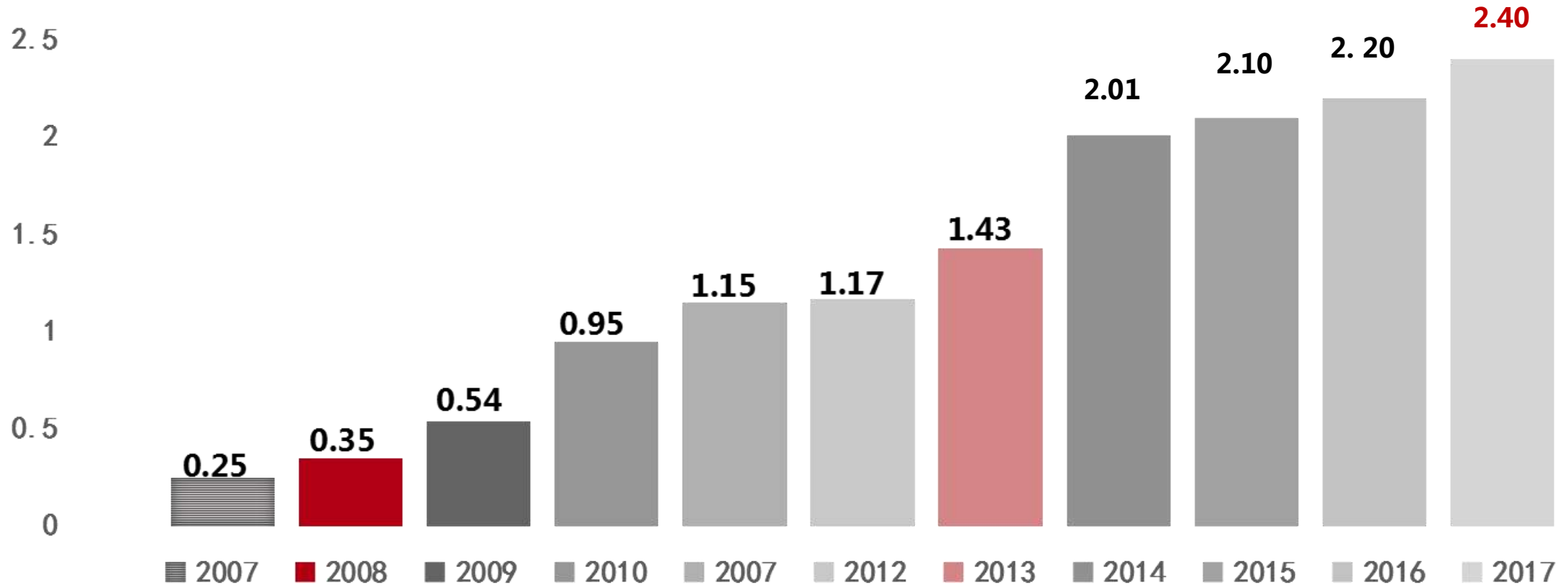


**TEC won the " National Quality Award " as the only winner ever in the rolling stock industry**

# Part1 TEC REVENUE GROWTH



(Billion USD)





## 2. PRODUCTS LINE



# 1. TRAIN SYSTEMS

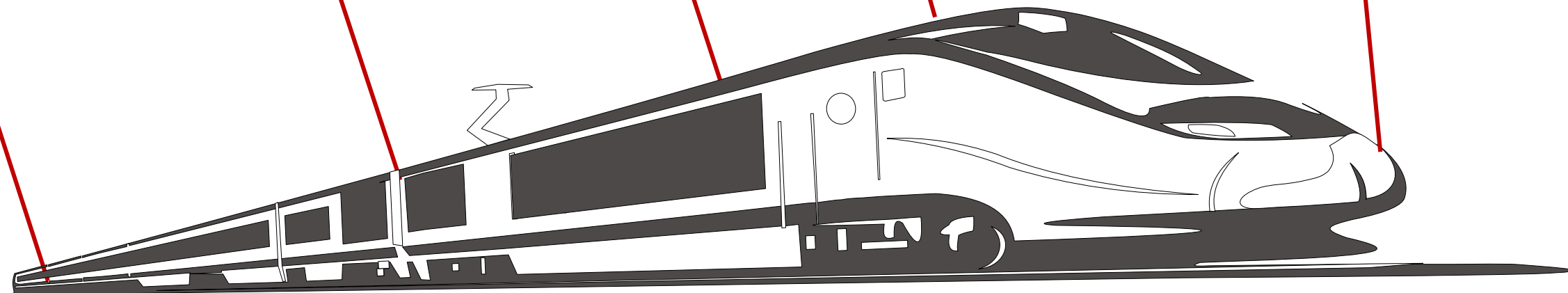
TRACTION  
CONVERTOR

AUXILIARY POWER  
SUPPLY

TCMS

ATP, ATO, ATS

CMD



**LOCO**

more than

**3400 locos 机车**

**EMU**

more than

**7000 vehicles**

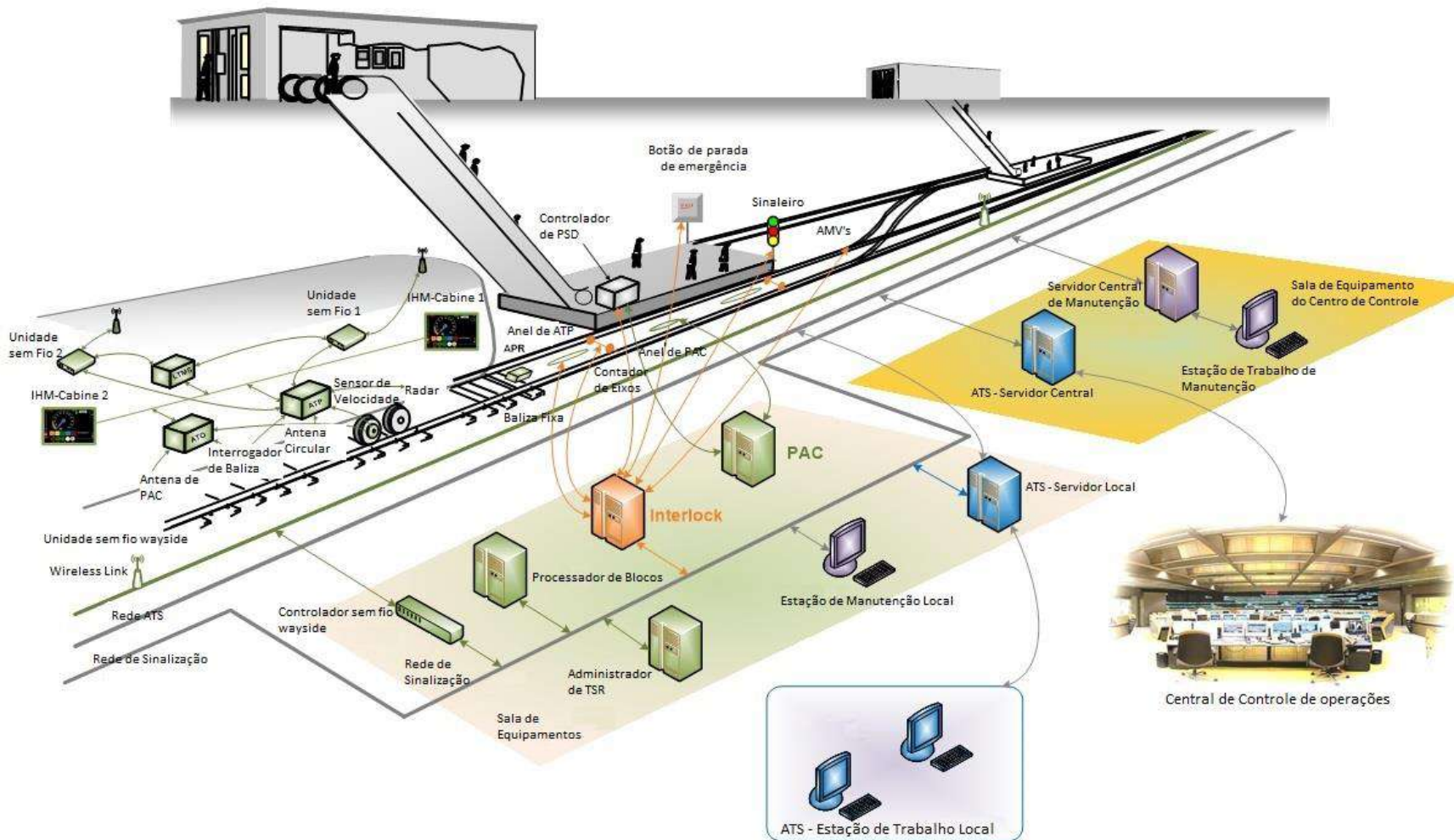
**METRO**

more than

**5000 vehicles**



## INTERGRATED SOLUTION



Signaling System

Platform Safety Door

Substation Power Supply

Maintenance Vehicles

Operation Facilities

Central Processing Unit

Lighting & Ventilation Systems

# 3. NEW INDUSTRY



**DEEP-SEA ROBOT**



**ELECTRIC CAR DRIVE SYSTEM**



**TRUCK CONVERTOR**



**INDUSTRIAL CONVERTOR**



**SOLAR POWER**



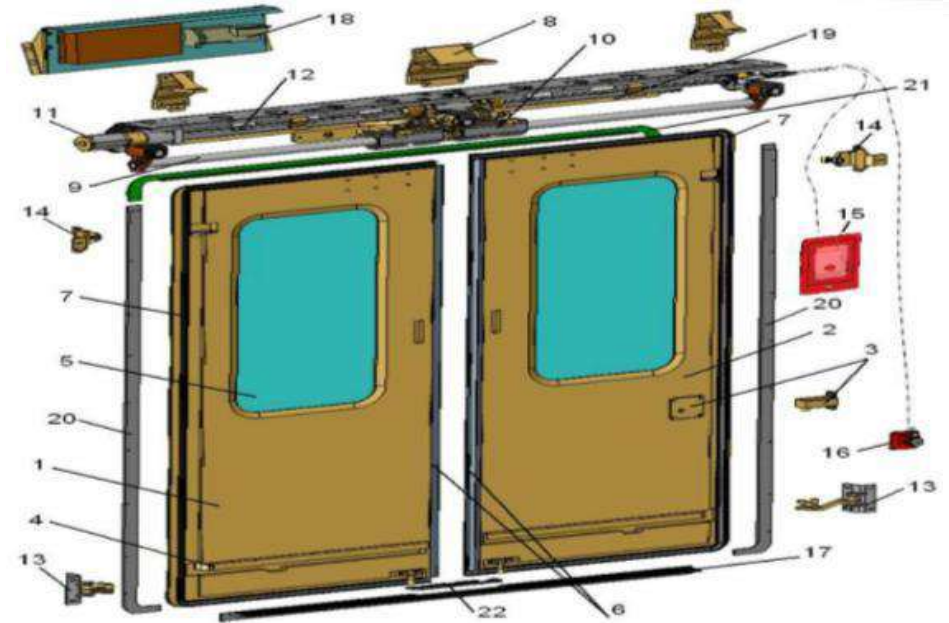
**POWER QUALITY CONTROL**





## Railway Toilet System

- PRUDOCTS: Integrated Toilet System for locomotive , vacuum Toilet holding for passenger train , Push-pull Toilet System for EMU, etc.



## Vehicle Door

- Doors for: high-speed rail, EMUs, bus, metro, urban rail, tram, road bus, etc.

# 4. KEY COMPONENTS



## Semi-Conductors

PRUDOCTS: Thyristor, Diode, GTO, IGCT, IGBT and Power Assemblies



## Sensors

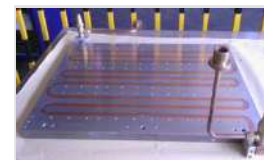
6 TYPES :  
Voltage, Current, Temperature, Speed, Pressure and Displacement sensors

12 SERIES      600 MODELS



## Power Resistors

Brake Resistor  
Over-voltage Absorption Resistors  
Chopper Resistor



## Heat Sink

Fin-Inserted Heat Sink  
Water Cooling Heat Sink  
Hot-pipe Heat Sink



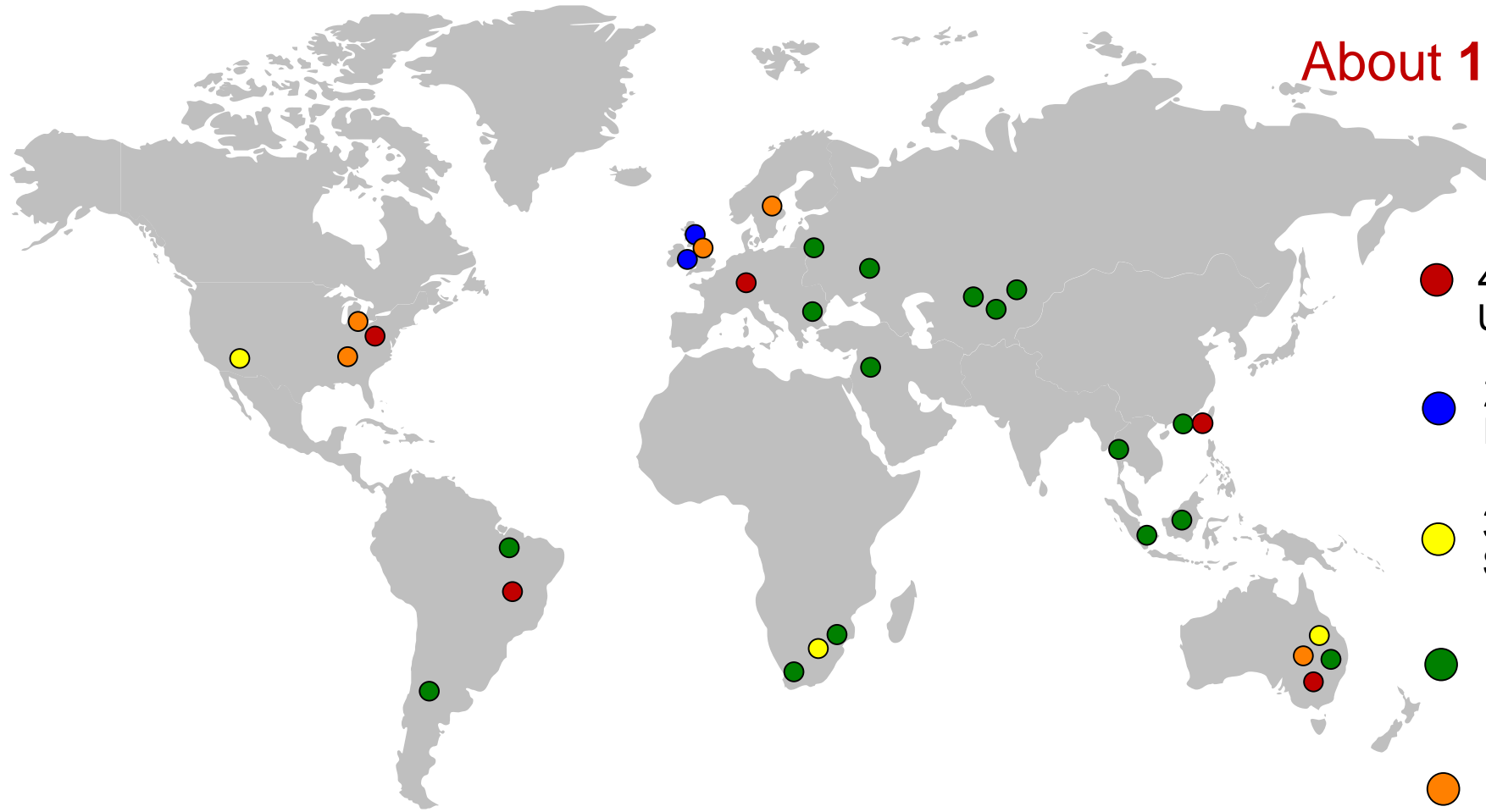
3.



## OVERSEAS STRENGTH



About **1000** overseas employees



● 4 overseas subsidiaries company  
USA, Australia, HK, Brazil

● 2 overseas M&A subsidiaries  
Dynex & SMD

● 3 overseas manufacturing base  
South Africa

● 16 overseas service sites

● 8 overseas R&D centers  
England, Michigan, Melbourne etc



4.



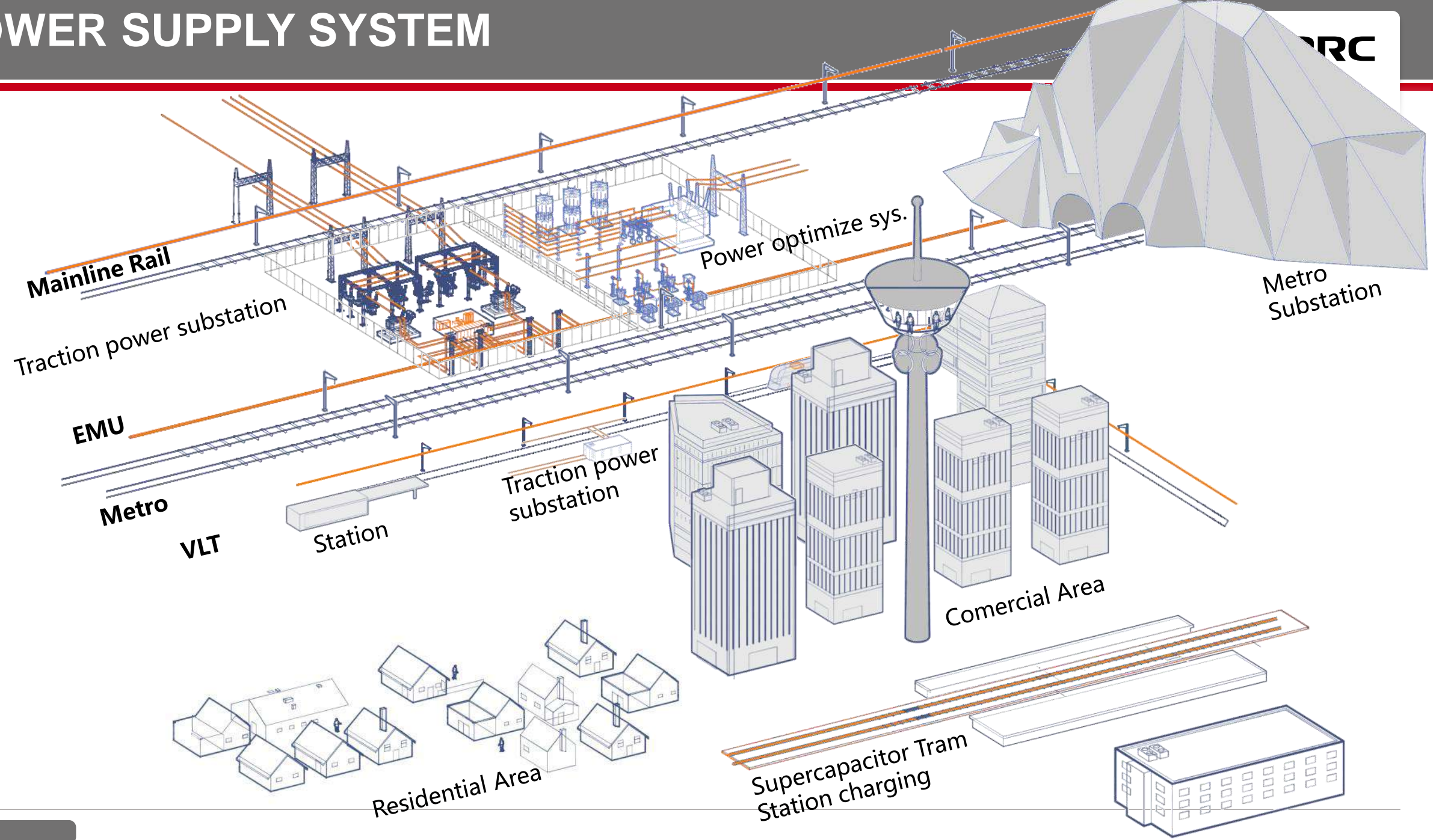
## SOLUTION FOR YOU





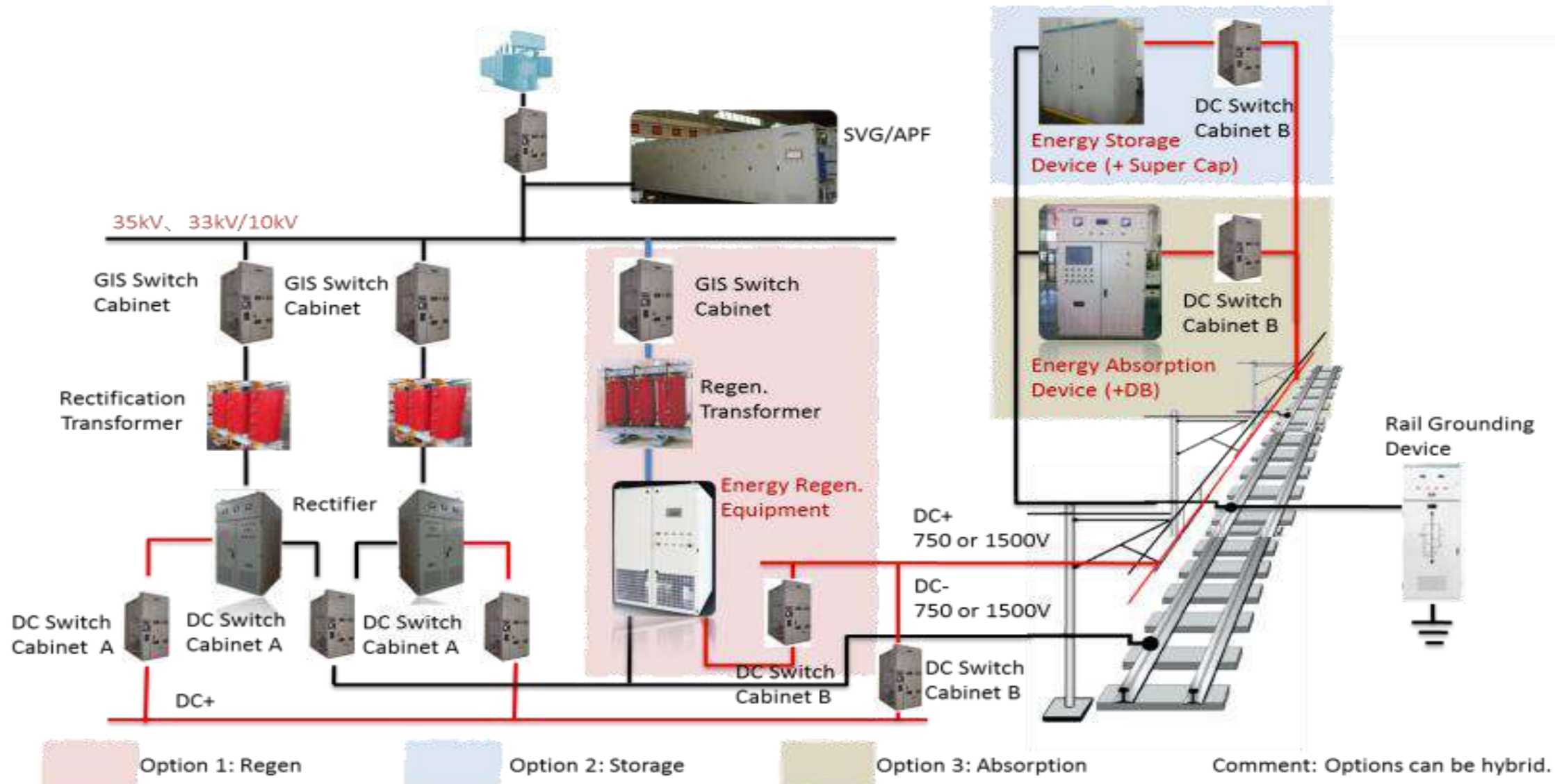
# POWER SUPPLY SYSTEM

ARC



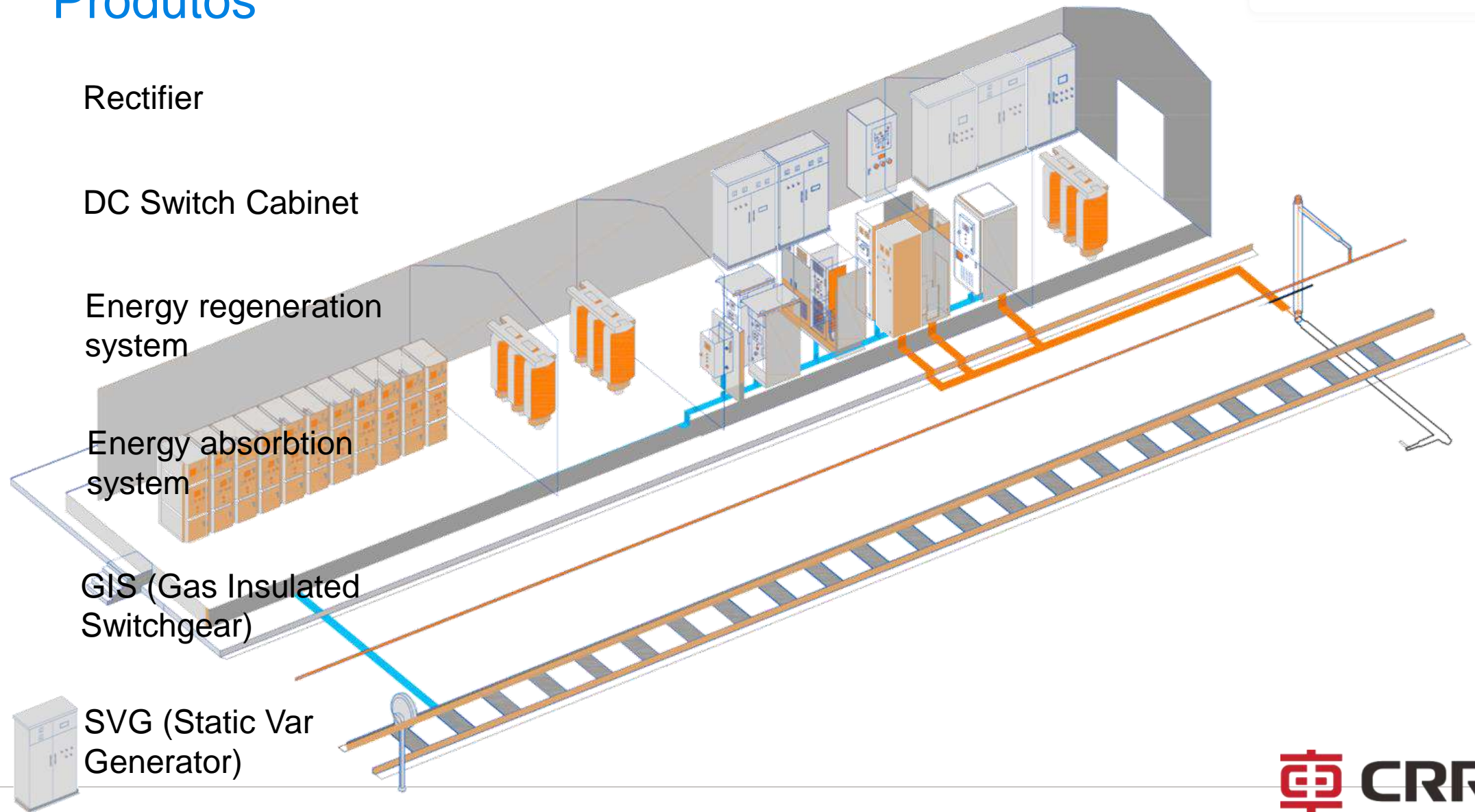


# POWER SUPPLY SYSTEM



# POWER SUPPLY SYSTEM

## Produtos







## RECTIFIRER



DC Switch Cabinet



Energy Regen.  
Equipment



Energy Absorption  
Equipment



GIS (Gas Insulated  
Switchgear)



SVG (Static Var  
Generator)



### Typical Parameters

Nominal Capacity	1000kW-5000kW
Input AC Voltage	2* 3 phase AC 590V/1180V
Output DC Voltage	DC750V/DC1500V
Non-load Loss	ab. 4.86kW
Power Factor	0.95
Efficiency	≥ 98%
Outline	1200mm x 1200mm x 2300mm

**HIGH RELIABILITY:**

**10 years of operation**

**SMALL SIZE & EASY MAINTENANCE:**

**GGD cabinet**



Rectifier



**DC SWITCH  
CABINET**



Energy Regeneration  
Equipment



Energy Absorption  
Equipment



GIS(Gas  
Insulated  
Switchgear)



SVG (Static Var  
Generator)

## Typical Parameters

		Type A	Type B
Nominal Voltage		DC750V/DC1500V	DC750V/DC1500V
Nominal Insulation Voltage		3000V	3000V
Nominal Current		4000A/6000A	4000A/6000A
Dimension	Width	500mm	500mm
	Depth	1500mm	1500mm
	Height	2350mm	2350mm
Comment		HSCB or Disconnection SW	HSCB

**EASY OPERATION: remotely configure**





Rectifier



DC Switch Cabinet



**ENERGY  
REGENERATION  
EQUIPMENT**



Energy Absorption  
Equipment



GIS(Gas  
Insulated  
Switchgear)



SVG (Static Var  
Generator)



## Typical Parameters

AC Voltage	AC 35kV/AC10kV/AC380V
DC Voltage	DC750V/DC1500V
Nominal Peak Power Pn	600kW-3600kW (Cycle: 30s/120s)
Regen. Power Factor	≥0.99
Efficiency	≥95%
Regen Threshold Voltage	1700V/850V DC (TBD)
Outline (mm)	Inverter Cabinet: 1200x 1200x 2300 DC Aux. Cabinet: 1200x 1200x 2300 Transformer: 3000x 1800x 3000

**ENERGY SAVING:** Generally about 7%-22%

**PROTECTION:** Redundant protection



Rectifier



DC Switch Cabinet



Energy Regeneration Equipment



**ENERGY ABSORPTION EQUIPMENT**



GIS(Gas Insulated Switchgear)



SVG (Static Var Generator)

**OPTIIMIZATION DESIGN :** reduce overvoltage risk

**HIGH SPONSE SPEED:** response time<2ms

**CONTROL MODE:** DSP + dual CPLD + IPC

**FAULT RECORD FUNCTION**







Rectifier



DC Switch Cabinet



Energy Regeneration Equipment



**ENERGY  
ABSORPTION  
EQUIPMENT**



GIS(Gas Insulated Switchgear)



SVG (Static Var Generator)

## Typical Parameters

Nominal Voltage	DC 750V	DC 1500V
3 <sup>rd</sup> Rail/ Catenary Voltage Range	DC 500V-900V	DC 1000V-2000V
3 <sup>rd</sup> Rail/ Catenary Voltage Range for Energy Absorption	830V-900V	1630V-1800V
Absorption Current (peak)	3200A-9600A	
Outline (mm)	Isolating switch cabinet: 1300 × 1300 × 2300 Resistor Cabinet: 1300 × 1300 × 2600 Chopper Cabinet: 1300 × 1300 × 2300	



Rectifier



DC Switch Cabinet

Energy Regeneration  
EquipmentEnergy Absorption  
Equipment**GIS (Gas  
Insulated  
Switchgear)**SVG (Static Var  
Generator)

### Typical parameters

Nominal Industrial Frequency Withstand Voltage	95kV
Nominal Surge Impulse Withstand Voltage	185kV
Nominal Frequency	50/60Hz
Nominal Main Busbar Current	1250-5000A
Nominal Peak Withstand Current	100kA
Insulating gas (SF <sub>6</sub> )	Nominal insulating inflation pressure 50-130kPa (absolute value) 20°C Minimum operation pressure 30-110kPa (absolute value) 20°C
IP Grade	IP65
Outline (mm)	600x1625x2350 (single busbar) 600x2665x2350 (double busbars)



Rectifier



DC Switch Cabinet



Energy Regeneration Equipment



Energy Absorption Equipment



GIS (Gas Insulated Switchgear)



**SVG (Static Var Generator)**



### Typical parameters

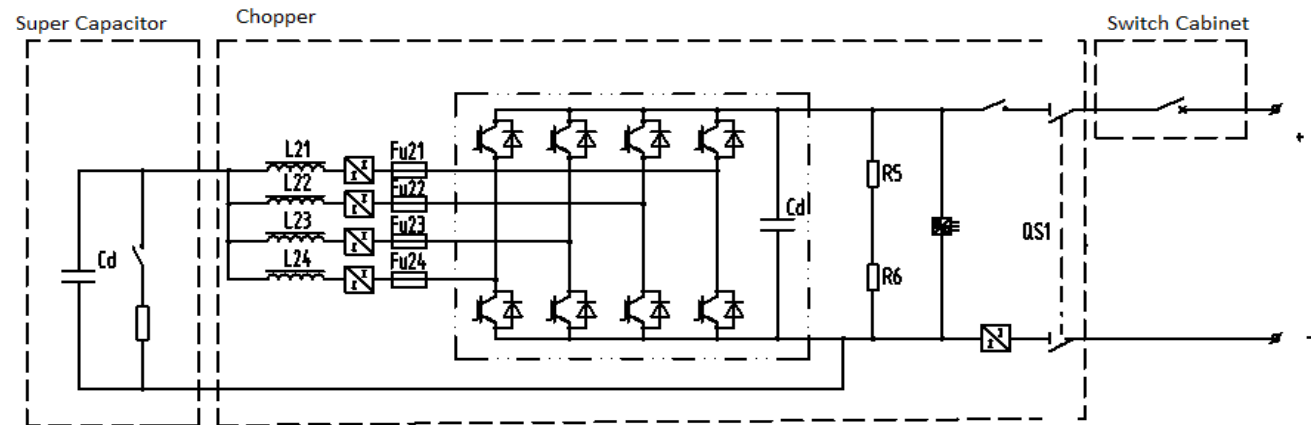
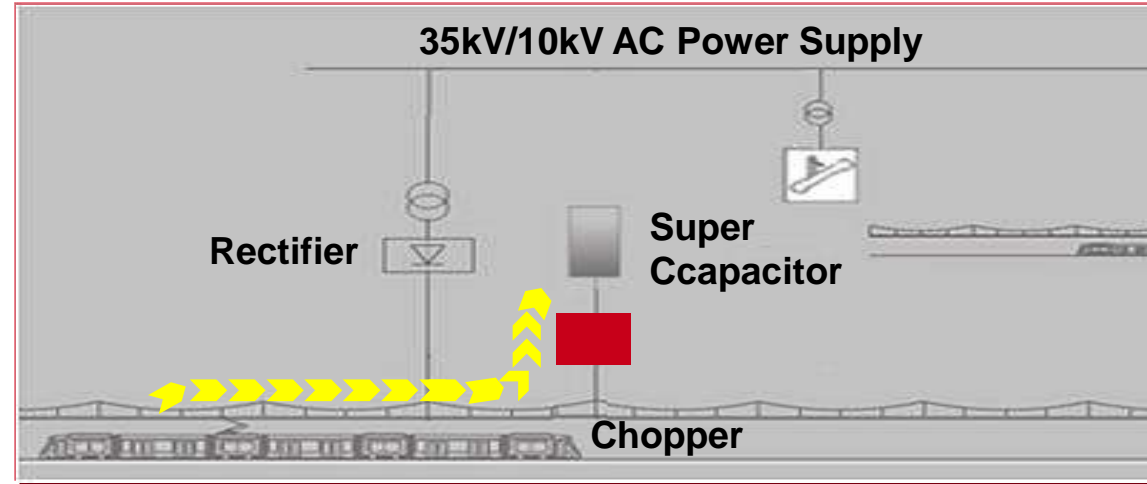
Nominal Voltage	AC 3-35kV, 50Hz $\pm$ 5%	
Output Capacity	0~20MVA	20~200MVA
Response Time	$\leq$ 5ms	
Active Power Loss	$\leq$ 0.8%	
Control/Auxiliary Power Supply	DC 220V/AC 220V/AC 380V	
Controller	DSP+CPLD+FPGA	
Communication	RS485/RS232/Ethernet etc.	

- LOW ENERGY LOSS:**  $\leq$ 0.8 ( average 1.5% )
- HIGH DYNAMIC RESPONSE SPEED:**  $\leq$ 5ms ( average 10ms-30ms )
- START-UP WITHOUT IMPACT:** self-excitation
- LARGE OPERATION RANGE:** continuous reactive output
- LOW HARMONICS:** suppress harmonic wave under 13th
- COMPACT OUTLINE:** 1/3-1/2 of SVC with same capacity





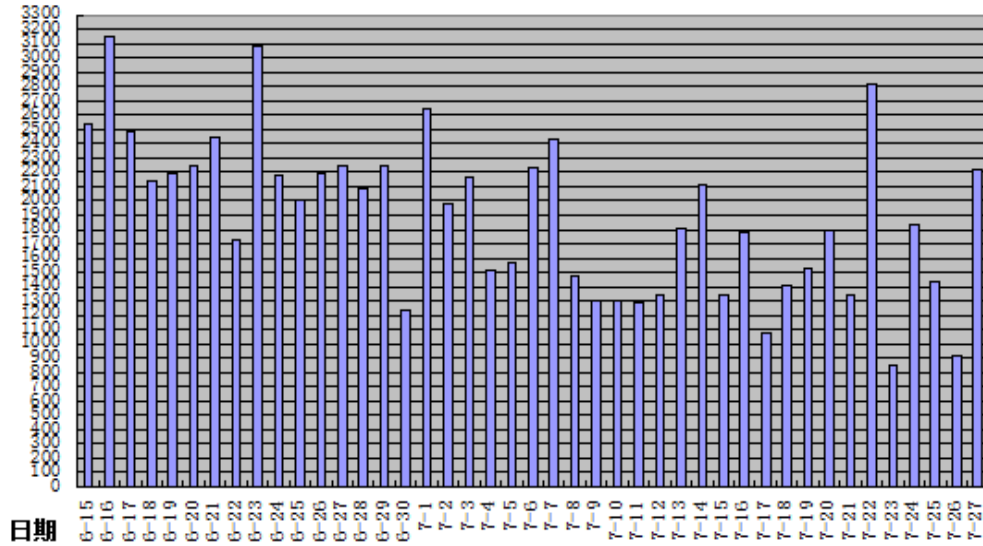
## ENERGY STORAGE SYSTEM



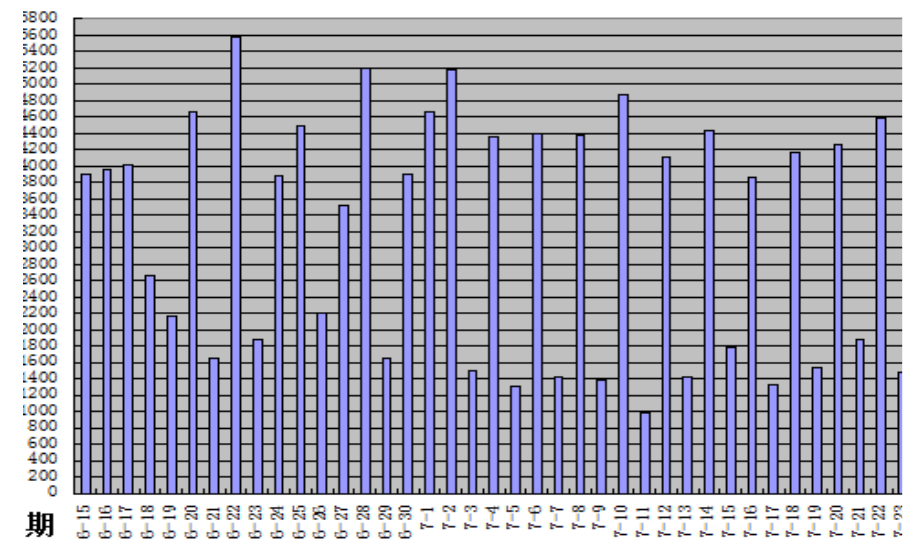
# Caso de Economia de Energia

## Linha 14 de Beijing - Yuanboyuan e Dajing ( Regeneração Mensal de Energia )

### Estação Yuanboyuan



### Estação Dajing



■ 系列1

Estação	Regeneração Diária de Energia ( kwh )	Energia Diária de Tração ( kwh )	Taxa de Regeneração	Regeneração Média Diária de Energia ( kwh )	Média de Energia Diária de Tração ( kwh )	Taxa média de Regeneração	Energia Regenerada Mensal por Estação ( kwh )
Yuanboyuan	2127	5231	40,66%	2737	7183	<b>38,1%</b>	<b>82110</b>
Dajing	3347	9135	36,64%				

# Reference Projects - Power Supply System

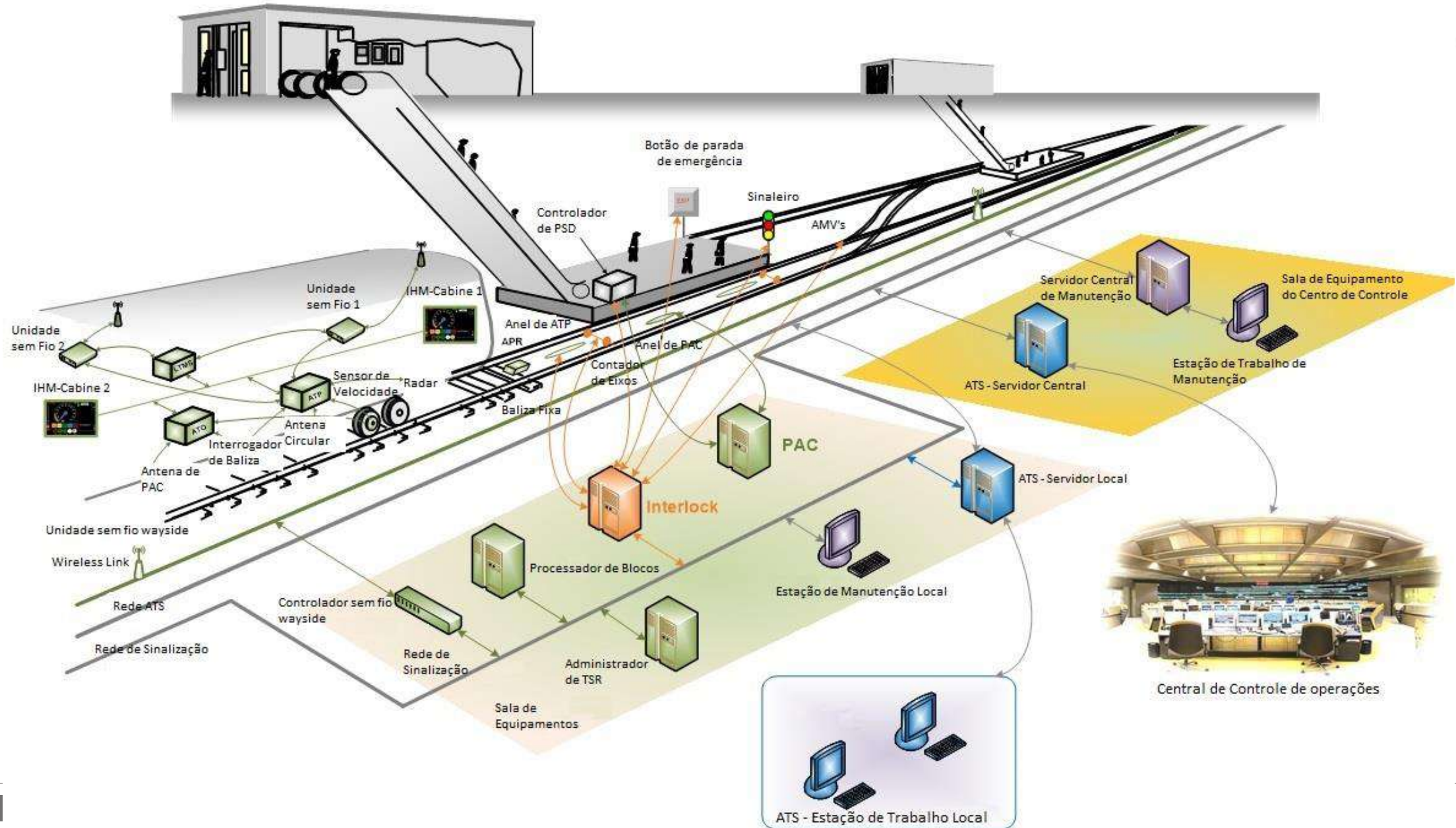


No.	Project	Period
1	Changsha Maglev substation	2016
2	Kunming Rail Transit Line 1	2015
3	Linha 6 do Trem Urbano de Wuhan	2014
4	Linha 2 do Metrô de Chengdu	2014
5	Linha 3 do Metrô de Kunming	2014
6	Linha 1 do Metrô de Chengdu	2013
7	Linha 6 do Metrô de Kunming	2012
8	Fase 1 do Metrô de Kunming	2011
9	Linha 4 do Metrô de Wuhan Fase I	2011
10	Linha 1 do Metrô de Wuhan	2011
11	Linha 2 do Metrô de Shenyang	2010
12	Linha 15 do Metrô de Beijing	2009

No.	Projeto	Period
11	Linha 1 do Metrô de Wuhan Fase II	2009
12	Linha 3 do Metrô de Guangzhou - Extensão	2009
13	Linha de Guang-Fo	2009
14	Linha 5 do Metrô de Guangzhou	2008
15	Linha 1 do Metrô de Shenzhen - Extensão	2008
16	Linha Tianjin Binhai - Extensão	2008/2011
17	Linha 1 do Metrô Shenyang	2007
18	Linha 3 do Metrô Guangzhou	2005
19	Linha de Tianjin Binhai	2004
20	Linha 1 de Wuhan Fase I	2003
21	Linha 1 do Metrô de Shenzhen	2003
22	Linha 2 do Metrô de Guangzhou	2002



# 2. CBTC Signaling System



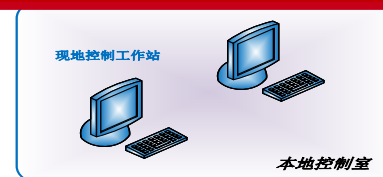
## The major functions of ATS:

- Description of the train operation
- Traffic information monitoring
- Train route control
- Regulation of the train operation
- Stop at stations
- Energy-efficiency operation dispatch
- Restrict train operation
- Preparation and Management of the train graph/timetable
- Train service plan and train management
- Inquiry of train operation
- Display of departure indication
- Operation record and statistical report
- System failure monitoring and alarm
- Exchange information with other systems
- Simulative demonstration and training

ATS subsystem

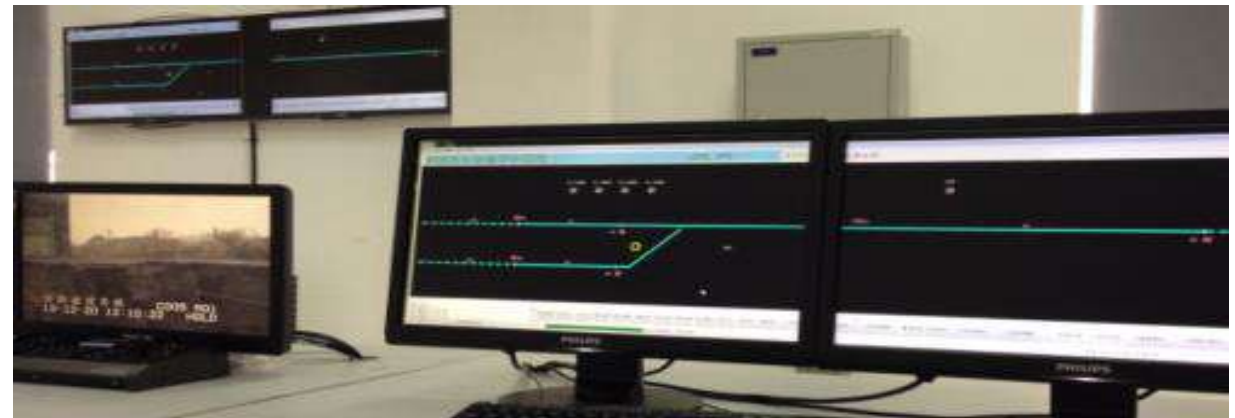


**Applied to Changsha Medium-Low Speed Maglev Line**



## Independent R&D of Computer Interlocking Subsystem

- ◆ Prototype development completed
- ◆ In 2013, field testing on CSR magnetic levitation demonstration line completed
- ◆ In 2014, SIL4 safety certification contract signed, continue field testing (in Baoji CSR Times)
- ◆ In August 2015, pass SIL4 safety certification.





## INTERLOCKING

- Diagnose HW/SW, diagnose internal memory protection, monitor operation cycle
- Redundant 2 out of 2 hardware system



## ATP/ATO

- ATP  
Redundant 2 out of 2 hardware system
- ATO  
Real-time backup architecture with high reliability



## Independent R&D of ATP/ATO Subsystem

In 2013, prototype verification

(CSR magnetic levitation demonstration line)

In 2014, prototype development

In 2015, prototype engineering and forming

In 2016, safety certification

## 1. COMMUNICATION & SIGNALING SYSTEMS

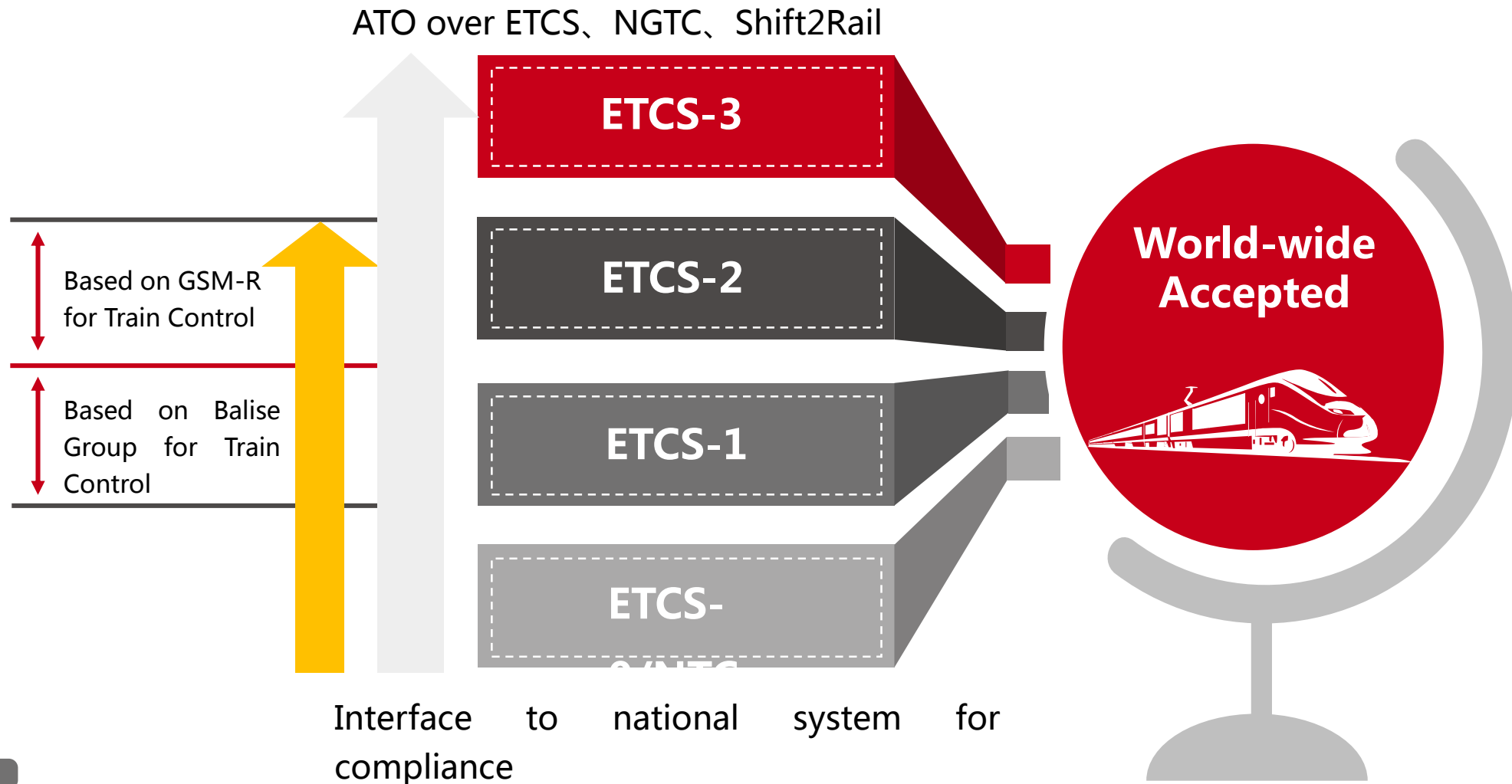
- ❑ Shanghai Maglev Testing Line
- ❑ Changsha Metro Line 2 and Maglev Line
- ❑ Changsha Metro Line 4 and Kumming Metro Line 9

Software and hardware have been applied in more than 2000 vehicles internationally, such as Spain, Singapore, and Ethiopia, etc.

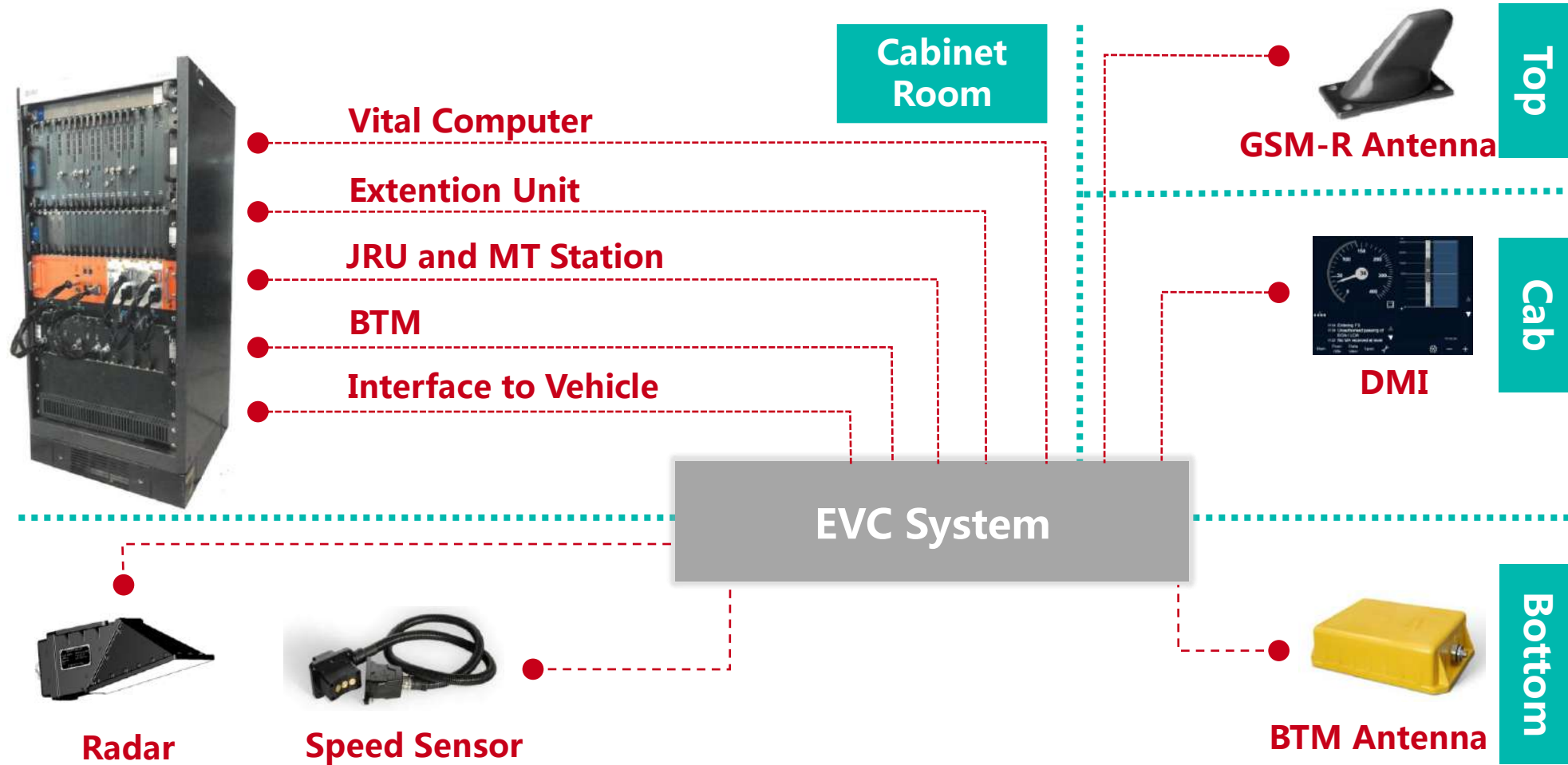




# SigThemis Signaling System :

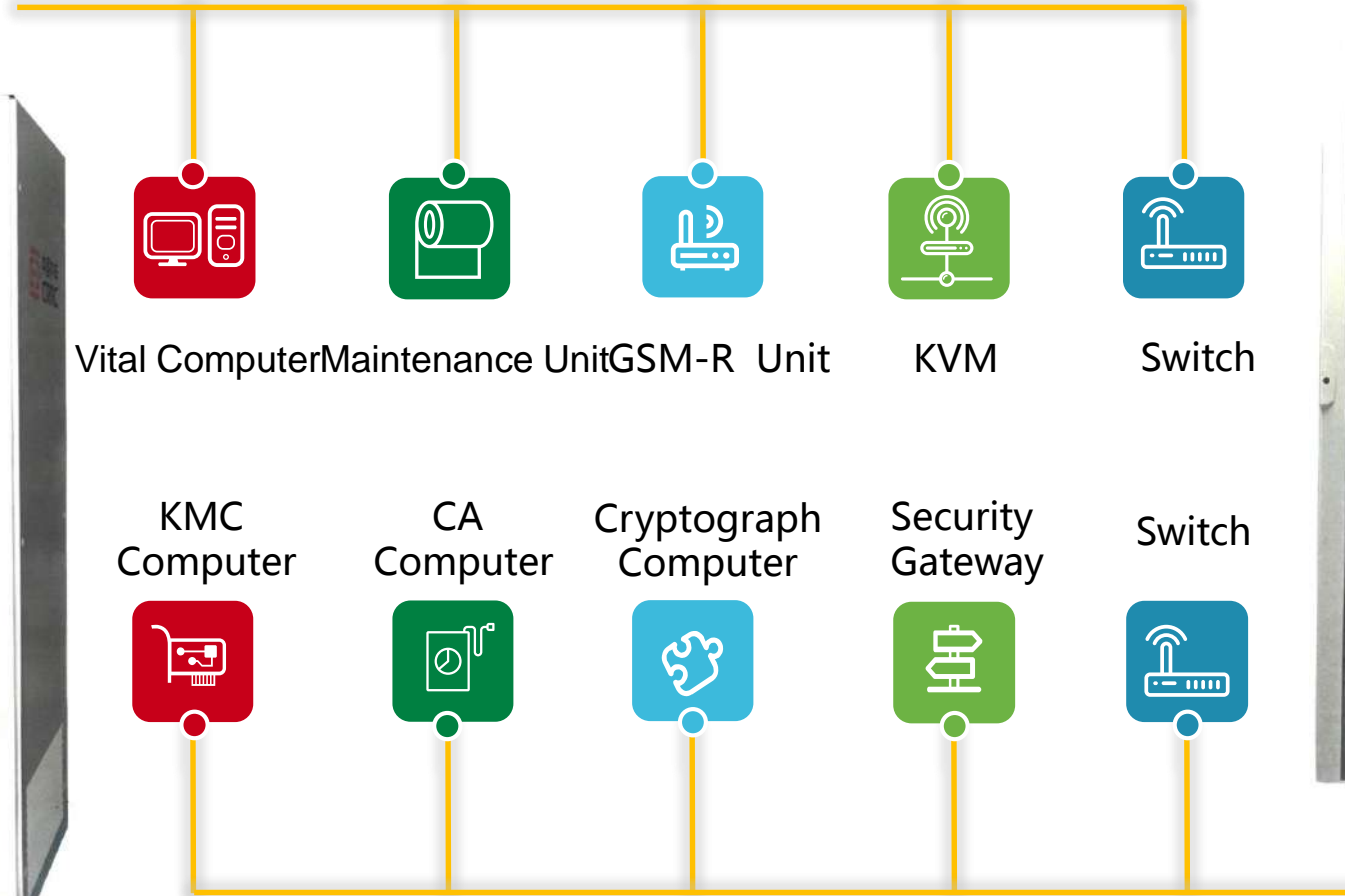


# SigThemis Signaling System-EVC



# SigThemis Signaling System-RBC&KMC

Remote  
Block  
Center



Key  
Management  
Center



# SigThemis Signaling System-Certification

## SIL4 : EVC, RBC, CBI

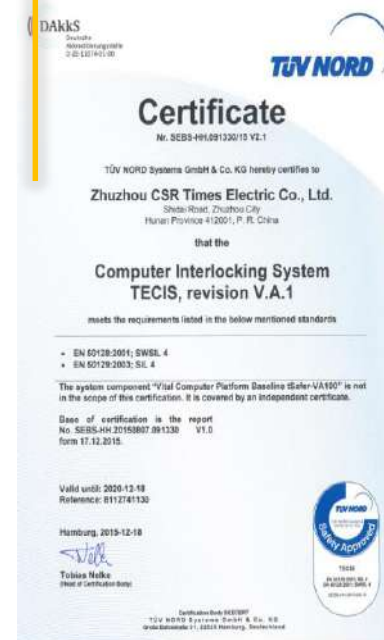
## SIL2 : CTC



EVC ISA SIL4 Certificate



RBC ISA SIL4 Certificate

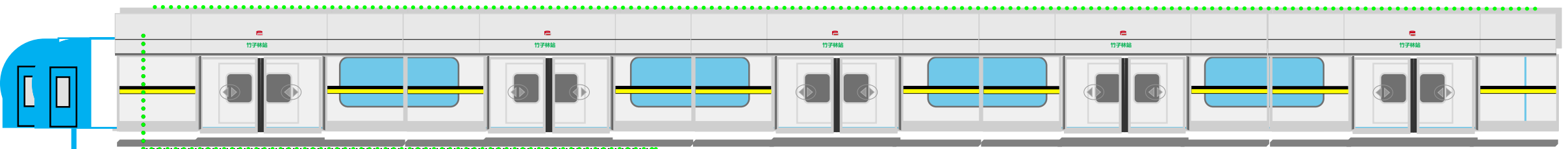


CBI ISA SIL4 Certificate



CTC ISA SIL2 Certificate

## Systematic control



Allowed and opening signal

SIG



Open  
Door opened  
close  
Door closed

PSC

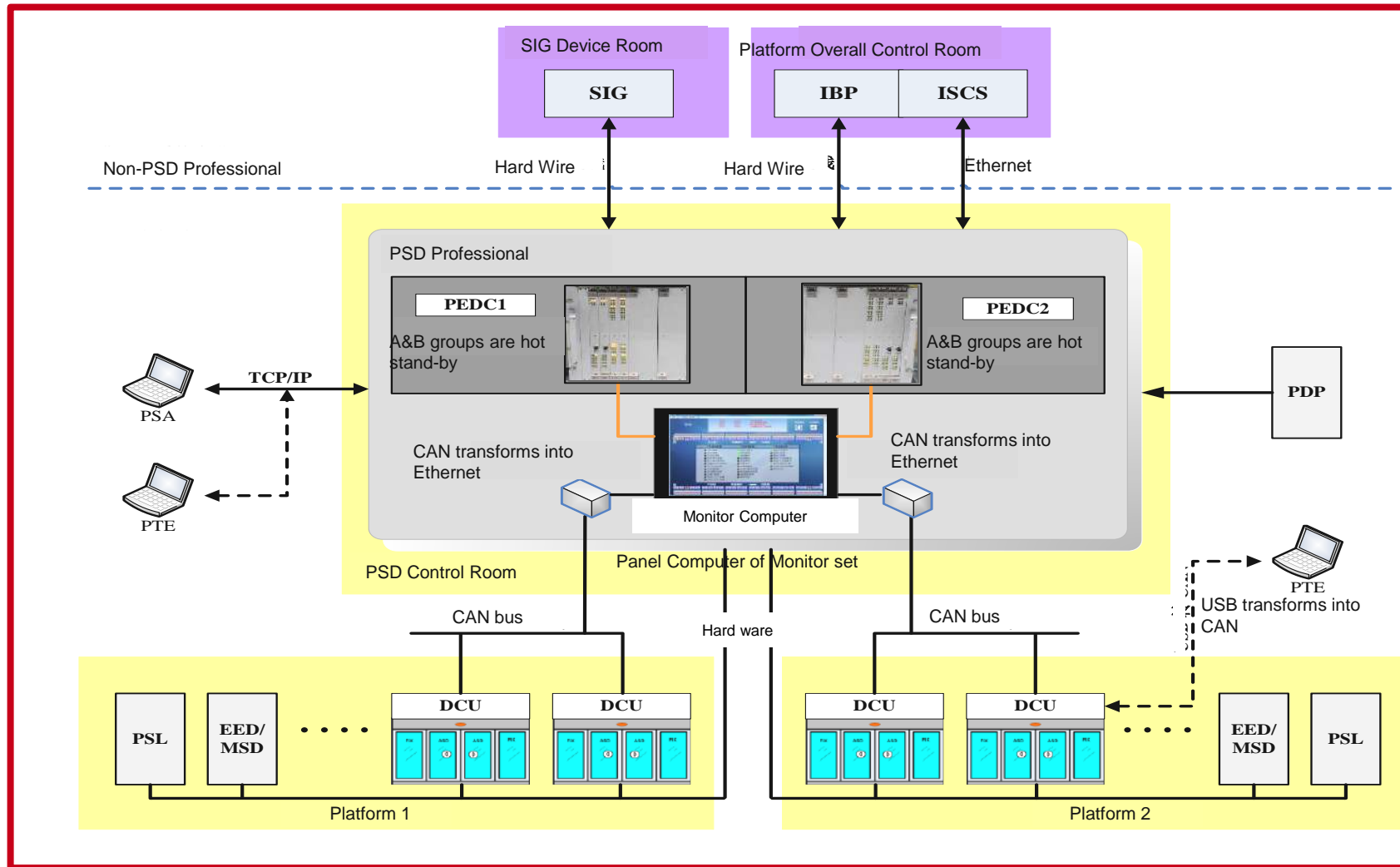


- Train arrive at station
- Door is open
- Passenger gets on/off
- Door is close
- Train leave station



.....

# CONTROL SOFTWARE LAYOUT FOR METRO PSD

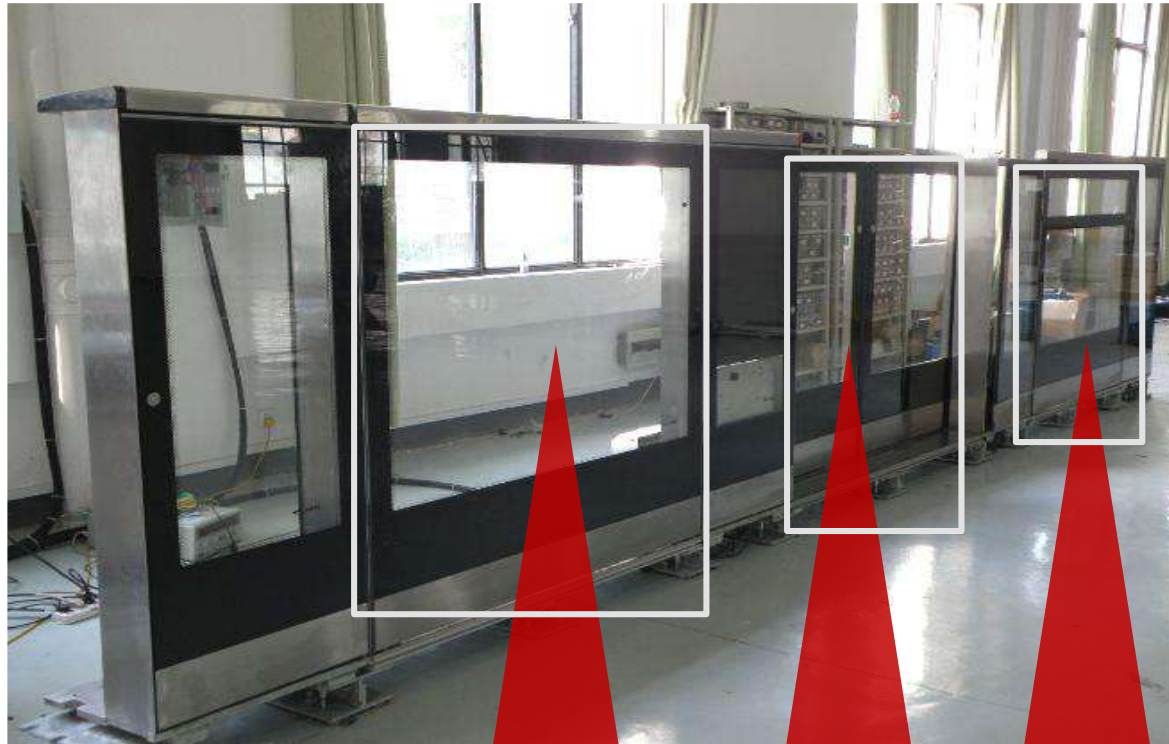


## PSD LAYOUT COMPONENTS

<b>ASD</b> (Automatic Sliding Door)
<b>EED</b> (Emergency Escape Door)
<b>FIX</b> (Fixed Panel)
<b>MSD</b> (Manual Secondary Door)
<b>PSL</b> (PSD Local Control Panel/PSD)
<b>PSC</b> (Platform Station Controller)
<b>DCU</b> (Door Control Unit)
<b>DOI</b> (Door Open Indicator (light alarm))
<b>LCB</b> (Local Control Box)
<b>PEDC</b> (Platform End Door Controller)
<b>PSD</b> (Platform Safety Door)
<b>SIG</b> (Signal System)
<b>PTE</b> (Portable Test Equipment)
<b>UPS</b> (Uninterrupted Power Supply)
<b>IBP</b> (Integration Backup Panel)



# CONTROL HARDWARE LAYOUT FOR METRO PSD



**FIX**

**ASD**

**EED**

**Full-height**



**Half-height**



**Our PSD products include FIX, ASD and EED.  
Our door panels comprise models from half-height to full-height , and fully closed system option.  
Half-height PSD is between 1.2m to 1.7m.**

## Appearance Design of Door Body





## Appearance Design of Door Body





# Experience Record

- CRRC main project performance

No.	Name of project
1	Ningbo Metro Line 1 phase I PSD&PSG
2	Ningbo Metro Line 2 phase I PSD&PSG
3	Guiyang-Kaiyang intercity railway PSG project
4	Changsha Metro line 2 west extension part PSD project
5	Changsha Maglev Project PSD Equipment Project
6	Guang-Sheng-Hongkong Passenger Line ZH-4 Bid Futian Station PSD project
7	Zhengzhou Airport line PSD project
8	<b>Calcutta Metro, India</b>
9	<b>Mumbai Metro Line 7, India</b>
10	<b>Metro Sao Paulo Line 17, Brazil</b>

SIEMENS

Auditreport - SCM-A6Z00038403230-001\_Time Ningbo

Auditor	Wang Yasen Li Zhu	Date of Audit	2016-11-10	Close of Audit	2015-11-11
Participants	Times Ningbo: Liu Lei (PM), He Bin (Production), Zhou Yuan (QM); Liu Dandong (EN)				
Audit-ID	SCM-A6Z00038403230-001_Time Ningbo	Supplier	CRRC Times Ningbo	Product /Process	PSD

Basic Requirement ISO 9001, ISO 14001, OHSAS 18001, IRIS Applicable Siemens Internal Rules and Regulations

### Scoring

**Total:** 88%

ITEM	Score
A	86%
B	95%
C	88%
D	82%
E	94%
F	83%

ITEM	Score
G	90%
H	83%
I	90%
J	90%
K	87%

Evaluation scheme  
80-100% fully acceptable  
50-79% acceptable with recommendations  
0-49% failed

#### Strong points

*CRRC Times Ningbo has a strong electrical and Electronic R&D capability. Different Test equipments for electrical components development are in their lab. Such as the shock and vibration, climate, water and dust tightness, EMC test machines. The lab was certified by CNAS. The mother company support the oversea business strongly. QM system was running well. Material storage was clear, clean and in order. Working instructions are clearly defined and implemented. The main products are railway industry sensors which were sold to international markets as well.*

#### Potential of improvement

*Material shelf-life could be more better, and expired date could be in the system and the packing to reduce the risk of implement expired material. The serials number could be implemented from the PCBA of DCU. The month production plan could be put in the Kanban in the workshop. Non-conformance material area could be more better, that the NCR report could be together with the parts, and only the non-conformance material could be put in the red area, not the R&D parts. The test and inspection plan could be defined based on project.*

#### Comment

*CRRC Times Ningbo is focus on project management and the electrical and electronic system, the PCBA of DCU can be manufactured by Times Ningbo, and the supplier. The operator of the full height PSD was manufactured by the Times Ningbo, the mechanical parts are from their suppliers, and Times Ningbo will do the expediting at supplier, do the final tests and issue the certificate. There is 4 oversea projects in biding phase. The 12 local projects were finished. 5 local projects are in execution phase.*

Unrestricted D:\020\_CVS\004\_CVS\_Supplier\20151111\_CRRC Times Ningbo\_AuditReport.xls Summary

Wang Yasen 2016.11.11

- CRRC main project performance

No.	Name of project	Door units	status
11	Guangzhou Metro Line 4 Qingsheng Station PSD Project	1 Station	Operation
12	Wenzhou Metro Line S1 Phase-1 PSD/PSG supply and Service Project	19 Stations	Under construction
13	Hangzhou Metro Line2 phase2 PSD system supply and Service Project	9 Stations	Under construction
14	Guangzhou Metro Line 8 North Extend Project PSD equipment Purchase Project	10 Stations	Under construction
15	Guangzhou Metro Line 6 Phase-2 PSD Purchase Project	9 Stations	Under construction
16	Zhujiang River Delta Intercity Rapid Transit of Guangzhou to Foshan section phase-2 PSD Bid 2 project	4 Stations	Under construction
17	Kunming line 1 PSD system localization project	4 Stations	Under construction
18	Chang-Zhu-Tan Intercity Project	9 Stations	Under construction
19	Changsha Line 4	25 Stations	Under construction

## SIX SERIES

HEAVY RAIL CAR SERIES

TEST TRAIN SERIES



CATENARY WORK CAR SERIES

LARGE-SCALE TRACK MAINTENANCE MACHINERY SERIES



CRANE RAIL CAR SERIES

METRO CAR SERIES





# HEAVY RAIL CAR SERIES



**GCD-600**  
(Diesel AC Traction)



**GC-220**



**GCY-300**  
(crew vehicle)



**GCY-350**  
(shunter)



**GCY-300II Railway Car for High-speed railway**

Vehicle Type	GC	GCY	GCD
Rated Power (hp)	290~375	400~1,350	460 x 2
Drive Mode	Mechanical	Hydrodynamic	AC Electric
Wheel Base (mm)	2,100		2,500
Bogie Center Distance (mm)	7,000~14,500		14,500
Axle Arrangement	1A-A1, B-2, B-B		Bo-Bo
Wheel Diameter (mm)	840, 1,050		915
Min. Negotiable Curve Radius (m)	100	100, 145	145
Brake Mode	Air Brake, Parking Brake		Resistor Brake
Max. Self-propelled Travel Speed (km/h)	110,120	100,120	160

# CATENARY WORK CAR SERIES



## OCS Installation & Maintenance Vehicle

- ❑ Installation, maintenance and daily inspection of overhead catenary system
- ❑ Used as traction vehicle

DA12

DAS 7

DAS

DX2

JW-4G



**JZW-4G OCS  
Aerial Maintenance Vehicle**

## Wire Unrolling Vehicle

- ❑ Unrolling & recycling of catenary

DF4







DFH



## DAS7 Multifunction Installation & Maintenance Vehicle (for high speed rail)



### FUNCTIONS

-  Catenary Dynamic Inspection
-  Installation, Adjustment
-  Replacement
-  Across adjacent line operations

Engine	German MAN
Rated Power	588kW×2
Maximum Speed	160km/h
Low Constant Speed range	1~10km/h



# CRANE RAIL CAR SERIES

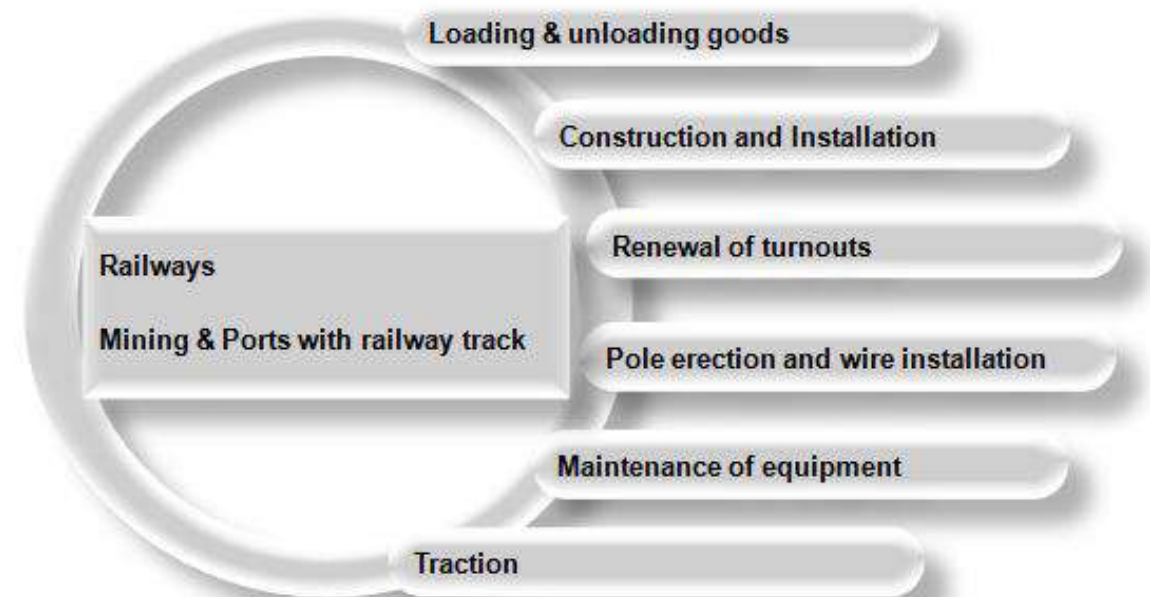


	QGC-16	QGC-25
Rated Power of Engine (hp)	290	336
Drive Mode	Mechanical (self-propelled), Hydrodynamic (lifting)	
Axle Arrangement	3-Axle	4-Axle ( 1A-A1 )
Brake Mode	Air Brake, Parking Brake	
Self-propelled Max. Speed (km/h)	95	100
Lifting Travel Speed (km/h)	0~8	0~10
Max. Lifting Weight (t)	16	25
Max. Lifting Height (m)	20.5	
Max. Working Range (m)	18	
Total Weight (t)	35	56

QGC-16 Railway Crane



QGC-25 Railway Crane



## Track Inspection Vehicle

- ❑ Track section detection
- ❑ Track patrol inspection
- ❑ Under track clearance detection
- ❑ OCS geometry parameters detection (by pantograph)
- ❑ Video detection of environment conditions
- ❑ Tracksides electrical facilities patrol inspection & precise positioning



**GCY-300III**

Rated Power (hp)	405hp,405hp×2, 480hp ×2
Drive Mode	Hydrodynamic Drive
Wheelbase (mm)	2,100, 2,500
Bogie Center Distance (mm)	14,500, 10,500
Axle Arrangement	B-B
Wheel Diameter(mm)	840, 915
Min. Negotiable Curve Radius (m)	140 ~ 145
Brake Mode	Air Brake, Parking Brake
Max. Self-propelled Speed(km/h)	100 ~ 120
Service Weight(t)	54, 95

# LARGE-SCALE TRACK MAINTENANCE SERIES



**GTC-80 Rail Flaw Detection Vehicle**

- ❑ Track internal flaws detection
- ❑ Track profile
- ❑ Contour detection
- ❑ Railway status patrol inspection

- ❑ 2 car /set (a traction car and an inspection car).
- ❑ Detection speed: 80km/h.



**SYS-1900  
Track Internal Flaws  
Detection System**

**Based on ultrasonic wave**

Rated Power (hp)	405×2
Drive Mode	Hydrodynamic Drive
Wheelbase (mm)	2,300 (traction car), 2,500 (inspection car)
Bogie Center Distance (mm)	10,500
Wheel Diameter (mm)	915
Min. Negotiable Curve Radius (m)	140
Brake Mode	Air brake and Parking brake
Max. Self-propelled speed(km/h)	120
Max. Detection speed(km/h)	80
Service Weight(t)	95



# LATEST NEW-TYPE JJC OCS Working Car

- 2 traction vehicles and 10 work vehicles
- 173.8m height of work platform
- Highest speed: 120km/h
- Platform, traction system, power system, generator, material storages , spare parts, kitchen rooms, meeting rooms and spot office rooms etc.



## MAINTENANCE VEHICLE SERIES

Region	Projects	Type	Gauge ( mm )	Qty
Iran	Rail Car	GC-120 , GC-160	1435	5
Vietnam	Rail Car	GC-160M	1000	10
Vietnam	Rail Car	GCY-300	1000	2
Nigeria	Rail Car	GC-160	1067	10
Hong Kong	Emergency Rescue Car	ERB	1435	1
Angola	Crew Car	WSY	1435	8
Angola	Dining Car	WCA	1435	3
Tanzania & Zambia	Rail Car	22HP	1007	10
Taiwan	Materials Transport Car	GY1	1000	1
Taiwan	Rail Car	QDY-240	1000	1
Mongolia	Comprehensive Maintenance Car	GC-170K	1520	1
Mongolia	Rail Car	GC-220K	1520	1
Tanzania & Zambia	Rail Car	GC-220Z	1067	5
Angola	Rail Car	GC-170Z	1435	5



5.



# TYPICAL PROJECTS





## 1. CHANGSHA METRO LINE 2 (26.6km, 19 station, 447k/day )

### ▣ KEY SYSTEMS INTERGRATION :

Traction System

Signaling System

Dynamic Braking System

▣ The **FIRST company** ever in the world provides both traction, signaling and braking system for a single mass transit line

▣ Maintenance vehicles



## 2. CHANGSHA MAGLEV LINE- the first MEDIUM LOW SPEED MAGLEV line (3 Elevated Stations, 18.55 km, 7k/day)

### ❑ ONBOARD SYSTEMS INTERGRATION :

Traction System

Dynamic Braking System

### ❑ Platform Screen Door Systems

### ❑ Signaling System

### ❑ Maintenance Vehicles



## 3. Kunming Metro Line 3 (19.1km, 16 station)

### □ KEY SYSTEMS INTERGRATION:

Traction System

Signaling System

Dynamic Braking System

### □ Platform Screen Door Systems

### □ Maintenance Vehicles

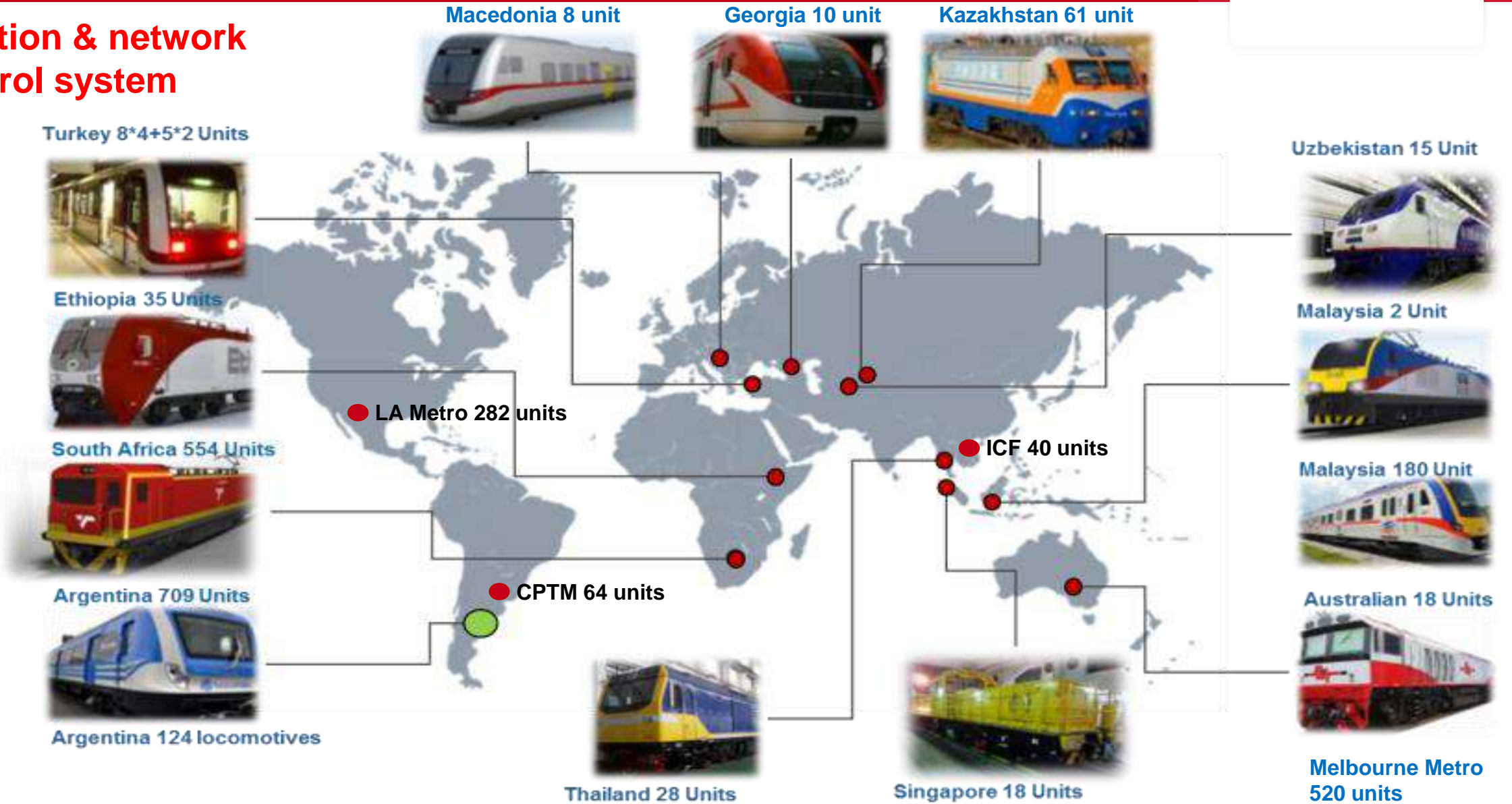




# Overseas Performance



## Traction & network control system





Technology  
Experience  
Capability

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