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Projects with Smart Substation Solution

NR Electric Co., Ltd.

Mar. 10, 2010

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Reference Projects with NR Smart Substation Solutions

	Projects	Service Date	NCIT		GOOSE Message		SV			Process Bus Topology			
			ECT/ VT	OCT	GOOSE Interlocking	GOOSE Trip/Close	IEC 61850-9-1	IEC 61850-9-2 LE	IEC 60044-8	Dual LANs with SV & GOOSE	Dual LAN with GOOSE	Dual LAN with SV	Point-to-Point with SV
1	220kV Tongling Substation, Anhui, China	2006.4	Y						Y				Y
2	220kV Wushan Substation, Qingdao, China	2008.6	Y		Y				Y				Y
3	220kV Xuanjia Substation, Zhejiang, China	2008.2			Y	Y					Y		
4	220kV Dongjiayao Substation, Jiangxi, China	2008.12	Y		Y				Y				Y
5	220kV Shanxiang Substation, Shandong, China	2008.12	Y		Y	Y			Y		Y		Y
6	220kV Yanshou Substation, Helangjiang, China	2008.12	Y		Y	Y			Y		Y		Y
7	110kV Linghe Substation, Inner Mongolia, China	2008.12	Y		Y	Y			Y		Y		Y
8	110kV Wujiaying Substation, Yunnan, China	2008.12	Y		Y	Y			Y		Y		Y
9	220kV Anxin Substation, Hebei, China	2009.6	Y		Y	Y			Y		Y		Y
10	110kV Mengjia Substation, Jiling, China	2009.12	Y		Y	Y			Y		Y		Y
11	220kV Zhiwuyuan Substation, Anhui, China	2009.6	Y		Y	Y			Y		Y		Y
12	110kV Mengzi Substation, Shanghai, China	2009.10		Y	Y	Y	Y				Y		Y
13	500kV Lanxi Substation, Zhejiang, China	2009.7			Y	Y					Y		
1	110kV Dalv Substation, Zhejiang, China	2009.10	Y	Y	Y	Y		Y		Y			

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15	110kV Expo Center Substation, Fujian, China	2009.12	Y		Y	Y			Y		Y		Y
16	220kV Huama Substation, Helongjiang, China	2009.1		Y					Y				Y
17	110kV Wenchong Substation, Guangdong, China	2009.12	Y	Y	Y	Y		Y			Y	Y	
18	220kV Wenyan Substation, Zhejiang, China	2010.9				Y					Y		
19	110kV Lengquan Substation, Henan, China	2010.6	Y		Y	Y		Y			Y	Y	
20	110kV Changzhou Substation, Guangdong, China	2010.1	Y		Y	Y		Y		Y			
21	110kV Sailun Substation, Shandong, China	2010.5	Y		Y	Y			Y		Y		Y
22	110kV Futang Substation, Shandong, China	2010.6	Y		Y	Y		Y			Y	Y	
23	220kV Wangtie Substation, Liaoning, China	2010.10	Y		Y	Y		Y			Y	Y	
24	220kV Dashiqiao Substation, Liaoning, China	2010.10	Y		Y	Y		Y			Y	Y	
25	35kV Zhouzi Wind Power Station, Inner Mongolia, China	2010.9	Y	Y	Y	Y		Y			Y	Y	
26	110kV Jinguyuan Substation, Henan, China	2010.10	Y		Y	Y		Y			Y	Y	
27	110kV Yunling Substation, Zhejiang, China	2010.12			Y	Y		Y			Y	Y	
2	220kV Qixian Substation, Henan, China		Y		Y	Y		Y			Y	Y	

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29	110kV Qidaowan Substation, Xinjiang, China		Y		Y	Y		Y			Y	Y	
30	110kV Xiaozhuang Coal Mine Station, Shanxi, China		Y		Y	Y		Y			Y	Y	
31	110kV Changanbai Substation, Shanxi, China		Y		Y	Y		Y			Y	Y	
32	35kV Zhangbei Wind Power Station, Hebei, China		Y		Y	Y		Y			Y	Y	
33	110kV Shanshu Substation, Chongqiang, China				Y	Y		Y			Y	Y	
34	110kV CLP Eastern Road Substaion, Hongkong		Y		Y	Y		Y			Y		Y

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Typical Projects

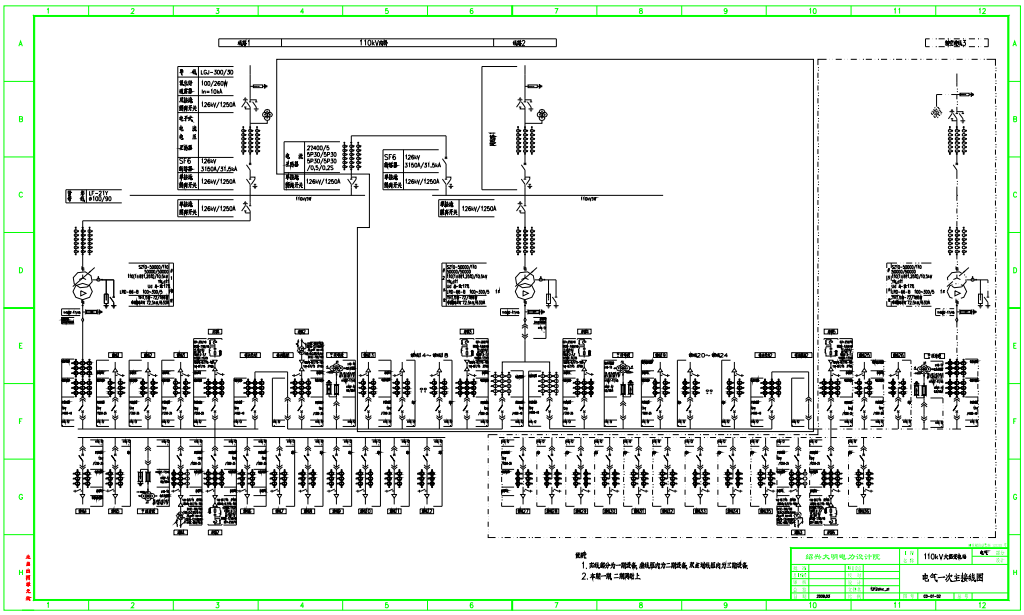
110kV Dalv Substation

- **Background**

  Service Date: Dec, 2009

  Substation Information: AIS, 2 *110/10kV transformers, 2 *110kV lines, 27*10kV bays

  Single Line Diagram:



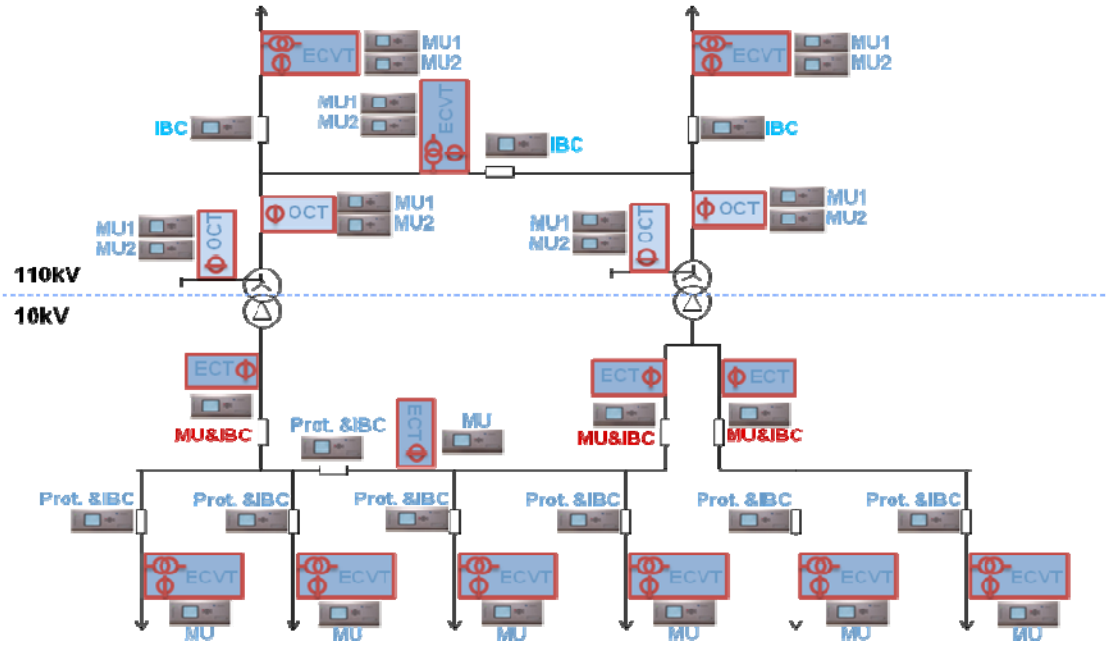
- **ECVT, OCT, MU & IBC Arrangement**

In 110kV Switchyard:

- ECVT (Composited ECT/VT) & OCT used
- Dual MUs for 1 ECVT / OCT
- Single IBC for each breaker
- MUs in 110kV using IEC 61850-9-2, sampling rate: 4k sample/s @ 50Hz

In 10kV Switchyard:

- ECT & ECVT used for 110kV transformer protections
- Single MU for each ECT or ECVT
- IBC integrated in MU for transformer outgoing bays
- IBC integrated in Relay for feeder bays



➢ System Architecture

Station Bus:

- Single-Star LAN
- MMS, GOOSE Interlocking & 10kV GOOSE Tripping (10kv Bus Protection to 10kV IBC), SNTP clock synchronization
- MMS & GOOSE using the same interface in 10kV IEDs

Process Bus:

- Dual-Star LANs (110kV),)
- Main I protection connected to LAN A, Main II protection connected to LAN B (transformer, 110kV busbar)
- Line Protection connected in LAN A
- MU 1 connected in LAN A, MU 2 connected in LAN B
- IBC connected in LAN A&B
- 10kV MUs to 10kV bus protection using P-to-P communications
- 110kV SVs & GOOSE Tripping using the same LANs
- (10kV GOOSE Tripping using station bus)
- ***SVs synchronized via IEEE 1588, first project in the world***
- Redundant GPS receiver providing clock signal (hot-standby mode)
- IEDs with different interfaces for station bus & process bus

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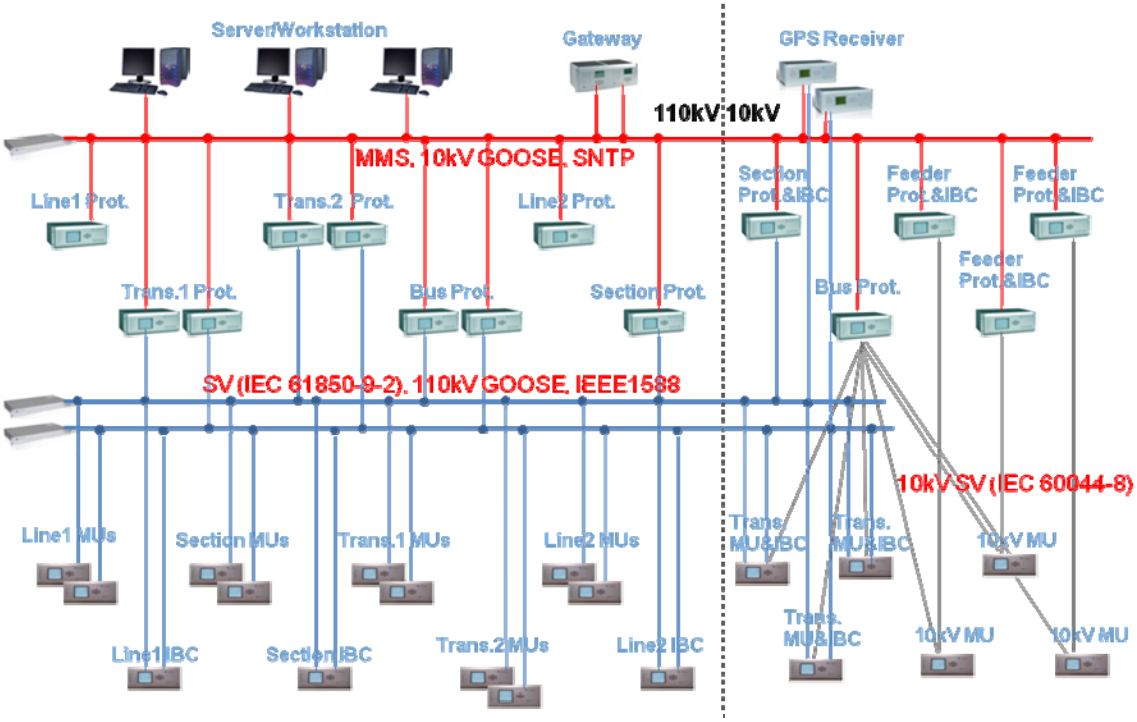

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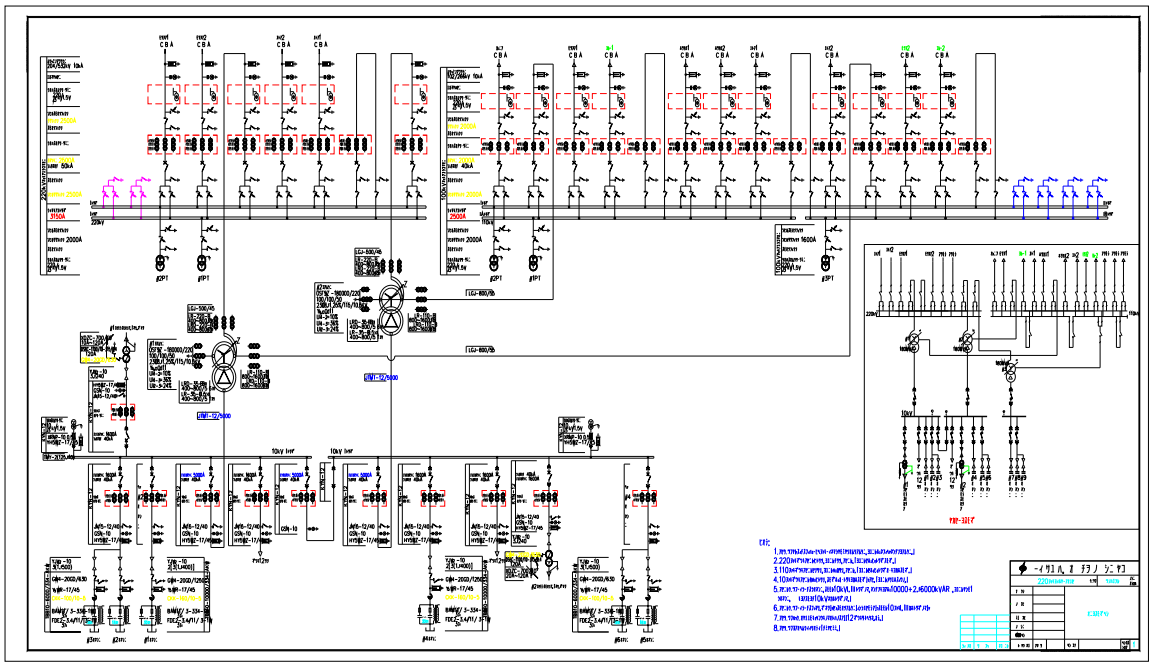
220kV Zhiwuyuan Substation

➢ Background

Service Date: Jun, 2009

Substation Information: GIS, 2 *220/110/10kV transformers, 4 *220kV lines, 9*110kV lines, 8*10kV bays, Double-busbar in 220kV & 110kV, Busbar with section in 10kV

Single Line Diagram:



➢ System Architecture

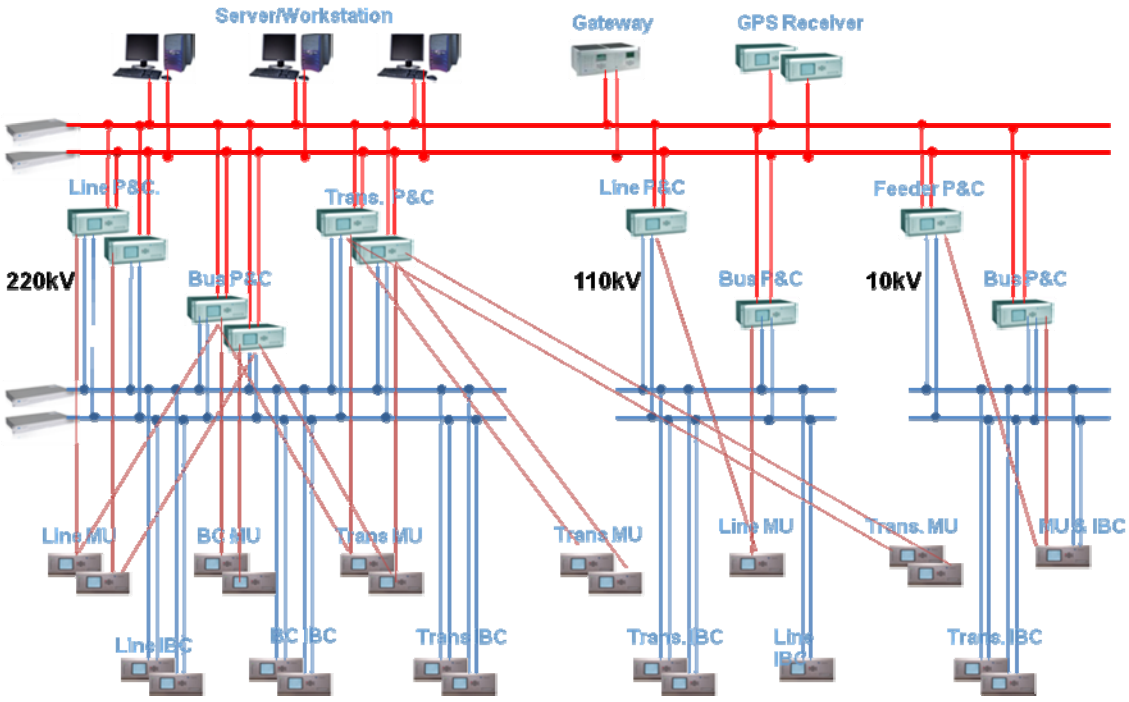
Station Bus

- Double-Star LAN
- MMS, GOOSE Interlocking, SNTP clock synchronization

Process Bus

- GOOSE network divided into 3 dual-star LANs (220kV GOOSE, 110kV GOOSE, 10kV GOOSE)
- Main I protection connected to LAN A &B, as well as Main II
- IBC1 connected to LAN A&B, as well as IBC 2

- SVs using P-to-P communication
- MU 1 connected to Main I protection, MU 2 connected to Main II protection
- Duplicated MUs & IBCs for transformer bays in 220kV, 110kV & 10 kV, to cooperate with duplicated protections
- ECT/VT used in 220kV, 110kV & 10kV



500kV Lanxi Substation

➢ Background

Service Date: Jul, 2009

Substation Information: AIS, 2*500/220/35kV transformers, 2*500kV transmission lines, 8*220kV transmission lines, 1*35kV capacitor bank, 2*35kV reactor, 3*35kV station transformer

One-and-a-breaker in 500kV, double busbar with section in 220kV

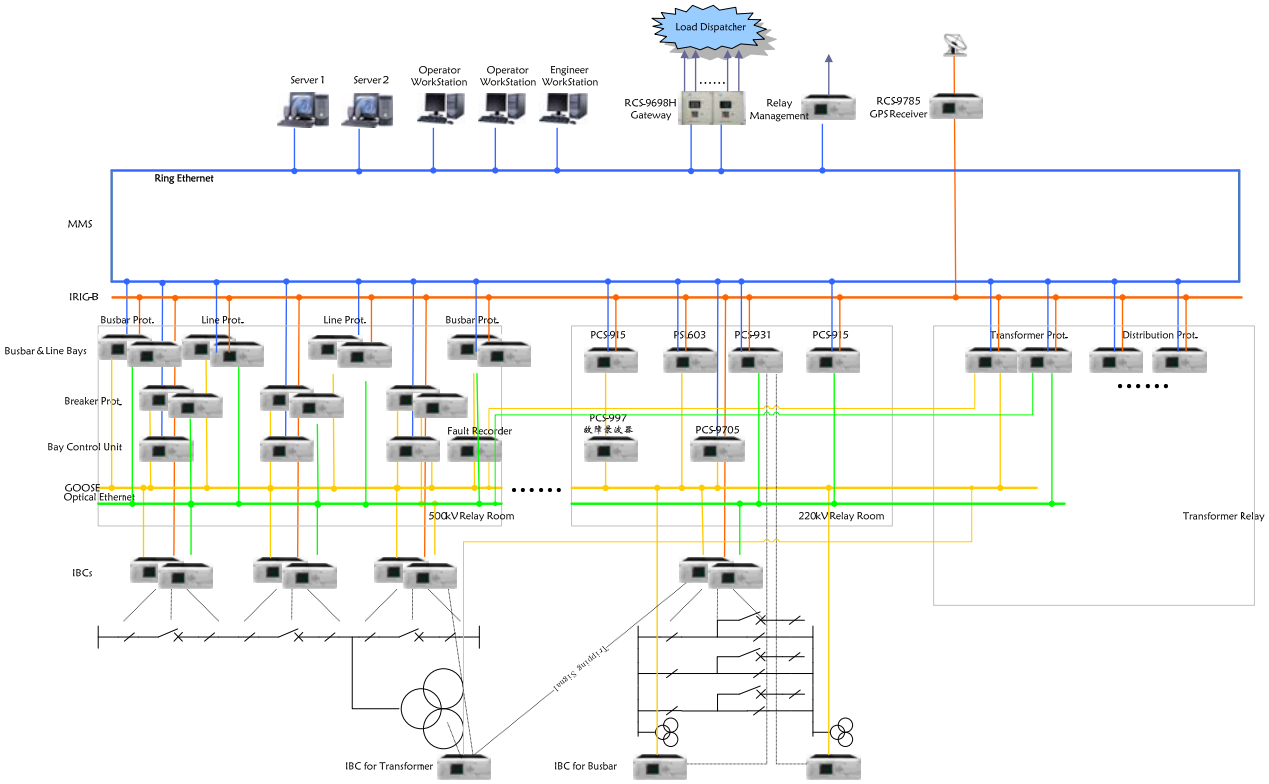
➢ System Architecture

Station Bus

- Single Loop LAN
- MMS, GOOSE Interlocking, SNTP clock synchronization

Process Bus

- GOOSE network divided into 2 dual-star LANs (500kV GOOSE, 220kV GOOSE)
- Redundant consideration in 500kV & 220kV relay configuration
- Main I protection connected to LAN A, Main II protection connected to LAN B
- Redundant consideration in IBC configuration
- IBC1 connected to LAN A, IBC2 connected to LAN B
- SVs using P-to-P communication as pilot test
- MU 1 connected to Main I protection, MU 2 connected to Main II protection


Load Dispatcher
Server 1
Server 2
Operator WorkStation
Operator WorkStation
Engineer WorkStation
RCS-9698H Gateway
Relay Management
RCS-9785 GPS Receiver
Ring Ethernet
MMS
IRIG-B
Busbar Prot.
Line Prot.
Line Prot.
Busbar Prot.
PCS-915
PCS-603
PCS-931
PCS-915
Transformer Prot.
Distribution Prot.
Busbar & Line Bays
Breaker Prot.
Bay Control Unit
Fault Recorder
PCS-997
故障录波器
PCS-9705
GOOSE Optical Ethernet
500kV Relay Room
220kV Relay Room
Transformer Relay
IBCs
Trip&Close Signal
IBC for Transformer
IBC for Busbar

220kV Wangtie Substation

➢ Background

Service Date: Oct, 2010

- All-in-one solutions: all protection & control functions of the whole station integrated in several station-wide IEDs
- Due to only several optical fibers in IEDs, without massive copper cables

➢ System Architecture

3 IEDs for the whole 11 bays on 220kV side

- IED1 for 1 busbar, 2 transformers, load shedding & auto-transfer scheme
- IED2 for 4 transmission lines & 1 bus coupler
- IED3 for 4 transmission lines

5 IEDs for the whole 24 bays on 66kV side

IEDs connected to MUs & IBCs in switchyard via optical LANs