



Modernising SCADA

- *Ben Dobson*

Apex Summit 2017

What is SCADA

- Supervisory Control And Data Acquisition
- Monitors and controls an industrial process – The Power System!
- Displays all information graphically for operators
- Less operating costs compared to manned sites

Before SCADA and Communications



Before SCADA and Communications



The Beginnings of a Control Centre



Modern Day Control Centre



Two Main Interfaces

- Master Station (Front and Back End)
 - Rows and rows of endless data!
 - Operators GUI
- Site Interfaces
 - Computer (RTU)
 - Protection Relays
 - Primary Plant

T1 Tap Changing	T1 Tap Changed	L1		N	N	Y	Y	Y	40
T1 Buchholz Alarm	T1 Buchholz Normal	3 L1		N	N	Y	Y	N	40
T1 Buchholz Trip	T1 Buchholz Reset	3 L1		N	N	Y	Y	N	40
T1 Tapchanger Fail	T1 Tapchanger Normal	3 L1		N	N	Y	Y	N	40
CB1 Open	CB1 Racked	3 L1 S1		Y	N	Y	Y	Y	0
CB1 Invalid	CB1 Closed	3 L1 S1		@Y	N	Y	Y	Y	0
CB1 Lockout	CB1 Lockout Reset	3 L1		N	N	Y	Y	Y	0
CB1 Reclose Off	CB1 Reclose On	2 L1		N	N	Y	Y	N	@40
CB1 Remote Off	CB1 Remote On	2 L1		N	N	Y	Y	N	@40
CB1 BC Disabled	CB1 BC Enabled	2 L1		N	N	Y	Y	N	@40

Operators View

National Energy Overview

Grid Frequency		Generation Totals		NPPS SPPS		Load Totals	
49.93 Hz	49.96 Hz	3138 MW	2301 MW	3479 MW	1952 MW	3362 MW	1877 MW

NI Generation	MW	MVar	KV
KOE	21	-3	
SWN	0	0	223.4
OTA			223.4
HLY	374	-29	222.6
GLN	48	12	
TWH	42	6	
KIN	36	2	
MOCK	101	-7	
TGA	30	-1	111.7
ROT	12	1	
MAT	40	0	
MAT	11	0	
KAG	105	3	114.2
KAW	29	0	221.2
WHI	0	0	
WRK	24		
WRK	131	2	224.8
OKI	45	8	
PPH	47	0	
TII	167	3	223.3
MAP			224.5
TII	75	-4	112.5
TRU	142	-3	Configure
RPD	62	-8	226.5
SFD	212	-2	229.6
MIKE	94	5	114.5
TAA	0	6	111.0
RTM	85	13	
WAA	8		
PTA	3		

NI Generation	MW	MVar	KV
ARA	53	1	224.5
DIRK	97	1	224.8
ATI	77	0	Configure
WKM	74	1	
MTI	146	8	Configure
WPA	37	1	227.9
ARI	155	-3	
KPD	66	0	111.8

WTO Total 692

SI Generation	MW	MVar	KV
TRA	26	1	113.6
TRB	140	9	224.1
CDB	32	3	Configure
KUM	3		
COL	27		
BRK	18		
TRW	9		
ORA	185	-11	Configure
ORB	156	-10	223.6
ORC	155	-8	223.6
DEM	394	-152	223.6
AVI	155	3	
WTK	66	12	223.3
CYD	223	-13	Configure
ROX	152	-3	230.1
	40	-2	115.9
MAN	499	57	230.0

HVDC (BEN)		
P2	174	NORTH
P3	175	NORTH
TOTAL	352	

Loads	
Zone 1 Load	568
GLN Smelter	69
Pacific	2
KIN	83
Tennant pulp	30
WIN TNG	26
PAN PAC	61
TWI	575

NI WIND Total MW 379		
WWD		119
WLV	TAP	42
TWC	TWC	48
	TRH	26
LTN	TWF N	24
DPE	TWF S	24
TWH	TUK	15
MOCK		55
SI WIND Total MW 16		
TRW	MAH	5
WMA	WHL	11

Sys Act: HAY FREQ_CTRL FREQ KEEP CTRL HZ CNTRL HVDC ON || EXCDEF_CIRCLG, value = S002_TH



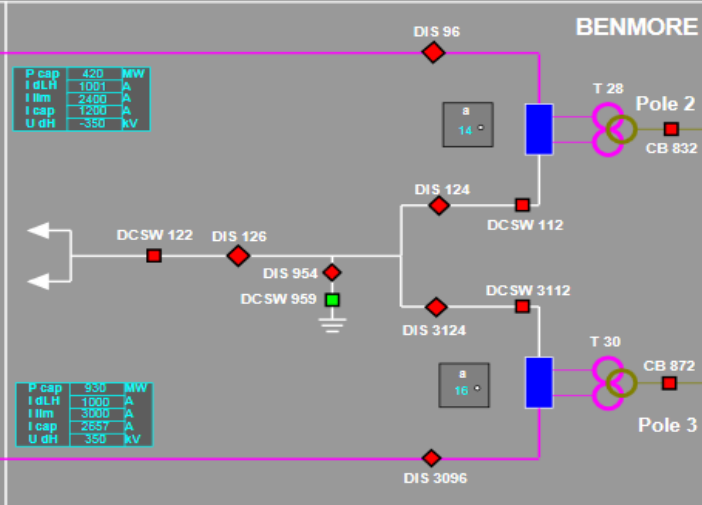
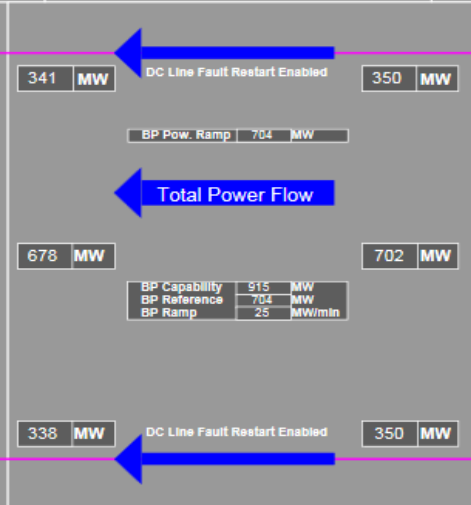
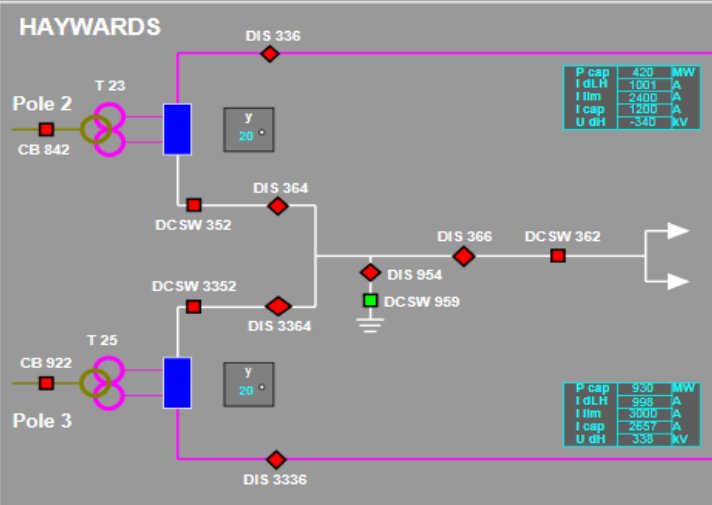
Operators View

Haywards Converter Station						Sys Ctrl	
	Ctrl Mode	Act Stat Op	Sel Stat Op	VC	TC		
Pole 2	Auto	UNDEFINED		On	On	Stn Ctrl	
Pole 3	Auto	DEBLOCKED		On	On	RPC Ctrl	
Communication OK	Interstation	On					
	P2	On				Aux Ctrl	
	P3	On					

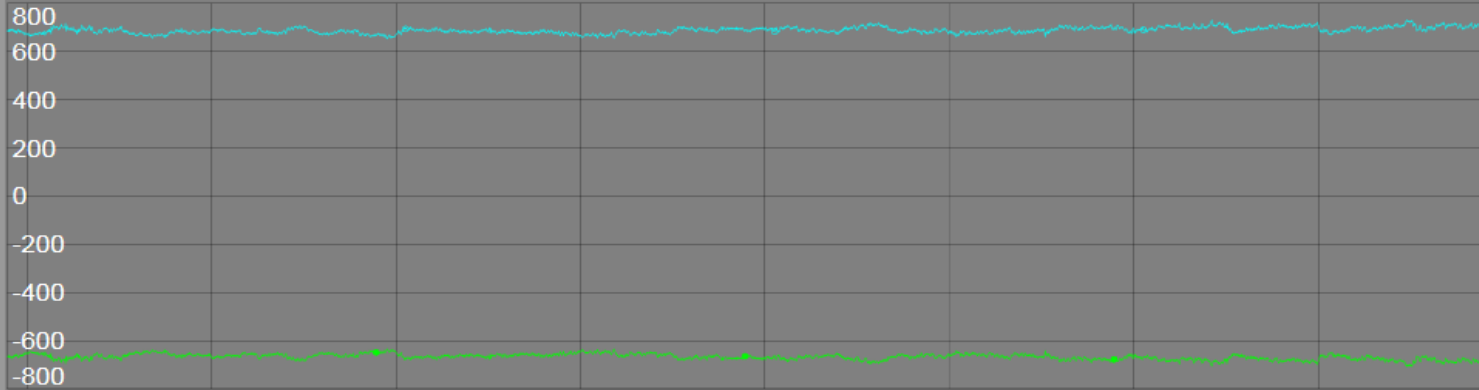
ENABLED	Stability Fcts	ENABLED
P2 On	Power	P2 On
P3 On	Trans Mode	P3 On
On	Round Power	On
P2 Off	Reduced	P2 Off
P3 Off	Voltage	P3 Off

SYSTEM OVERVIEW

Benmore Converter Station					
	Ctrl Mode	Act Stat Op	Sel Stat Op	VC	TC
Stn Ctrl	Auto	UNDEFINED		On	On
RPC Ctrl	Pole 3	DEBLOCKED		On	On
Aux Ctrl	Communication	Interstation	On		
	OK	P2	On		
		P3	On		



HVDC POWER TRANSFER



- HAY HVDC BIPOLE_MS.MWDC -679.12 MWDC
- BEN.HVDC.BIPOLE_MS.MWDC 702.64 MWDC

Operators View

Benmore 220 kV

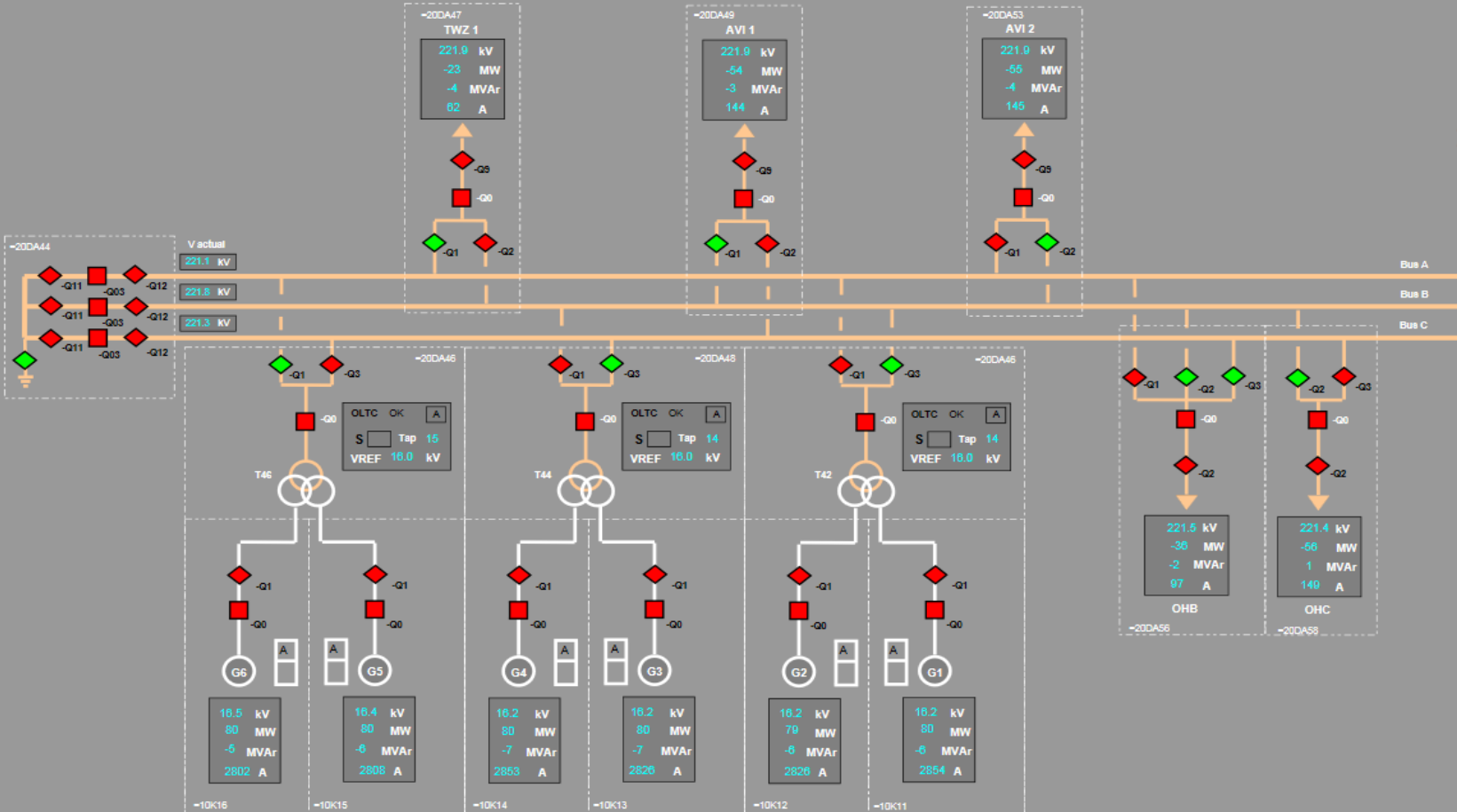
Version 1.0 (23/03/15)

Haywards Converter Station						Sys Ctrl	
	Ctrl Mode	Act Stat Op	Sel Stat Op	VC	TC		
Pole 2	Auto	UNDEFINED		On	On	Stn Ctrl	
Pole 3	Auto	DEBLOCKED		On	On	RPC Ctrl	
Communication OK	Interstation	On				Aux Ctrl	
	P2	On					
	P3	On					

ENABLED	Stability Fcts	ENABLED
P2 On	Power	P2 On
P3 On	Trans Mode	P3 On
	Round Power	
P2 Off	Reduced Voltage	P2 Off
P3 Off		P3 Off

Benmore Converter Station						Sys Ctrl	
	Ctrl Mode	Act Stat Op	Sel Stat Op	VC	TC		
Pole 2	Auto	DEBLOCKED		On	On	Stn Ctrl	
Pole 3	Auto	DEBLOCKED		On	On	RPC Ctrl	
Communication OK	Interstation	On				Aux Ctrl	
	P2	On					
	P3	On					

BENMORE 220 kV AC Yard



TODO
 Add missing data
 Add further indication to generators

Live Data

Power System Live Data

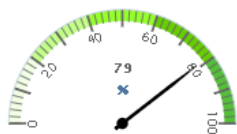
Live Data Summary

Updated: 17 Aug 2017 12:45

NZ Total:	5171 MW
NI Total:	3523 MW
SI Total:	1648 MW
Net HVDC:	130 MW N

% Renewables Generating

% Renewables (as at): 17 Aug 2017 12:34

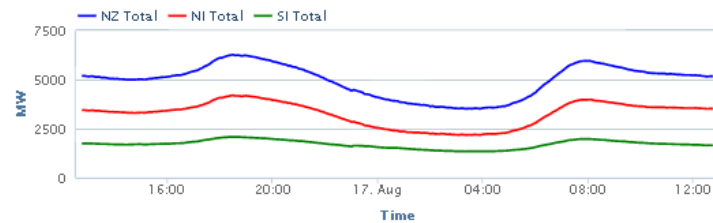


Current Generation (MW)

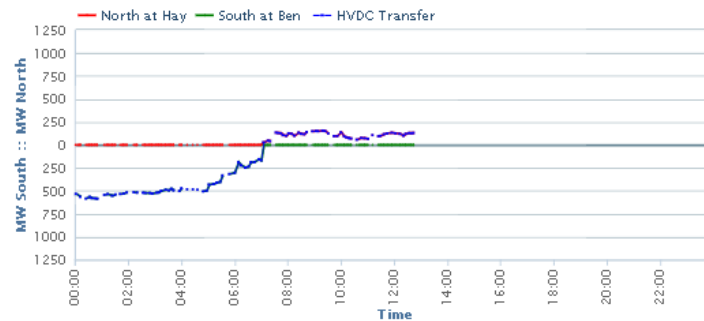
Power (as at) 17 Aug 2017
Generation 12:34

Load Data Totals

Updated: 17 Aug 2017 12:45



Today's HVDC Transfer Summary



Current Generation (MW)

SCADA Upgrade – Why?

- Ageing Equipment
- Fast moving technology
- Demand for more data / features
- Additions over time not documented
- 3rd party interfaces
- Remote Functionality

Benmore Substation & HVDC



Existing SCADA infrastructure

- Serial communications
- Centralised I/O schemes
- Interfaces with HVDC and 3rd Party (Generator)
- Multiple Control Rooms

Modern SCADA infrastructure



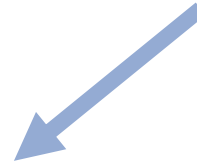
Switchgear



Hardwired Input/Output Module



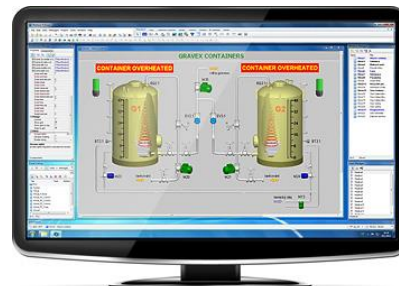
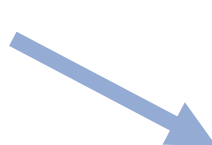
Protection Relay



IP Network Switch



Substation Computer (RTU)



Remote HMI PC

Tools and Outputs

- AutoCAD, Excel, SCADA / Computer Modelling software
- Drawings (Lots!)
- Mapping Schedules
- Documentation
- Setting files
- Nearly every service within the substation will be modified in some way when completing SCADA upgrades

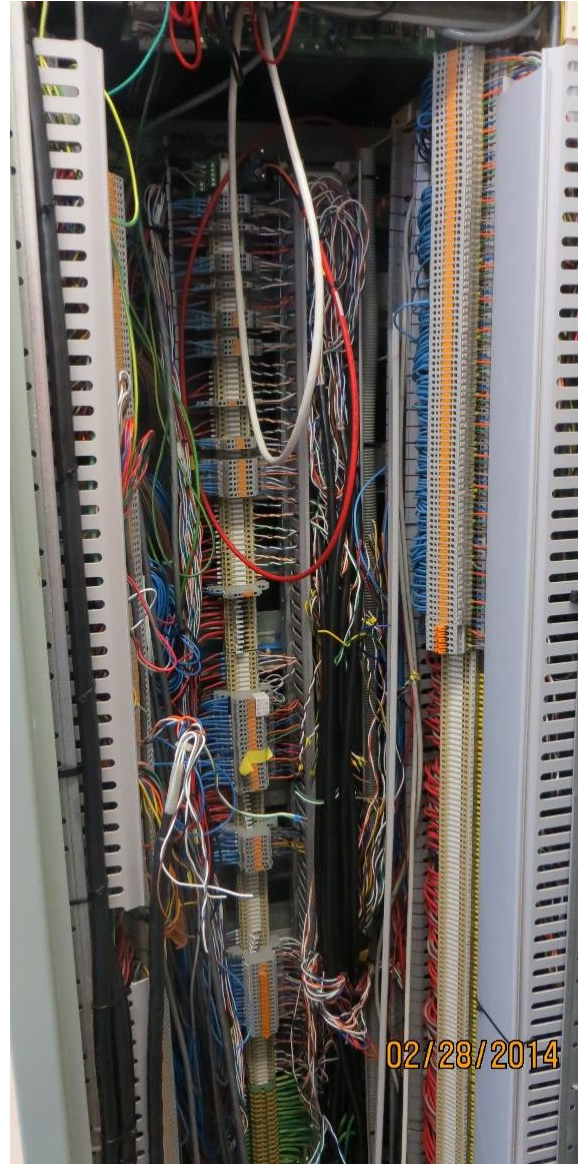
SCADA Upgrade - Before



SCADA Upgrade - After



SCADA Upgrade - Before



SCADA Upgrade - After



SCADA Upgrade - After

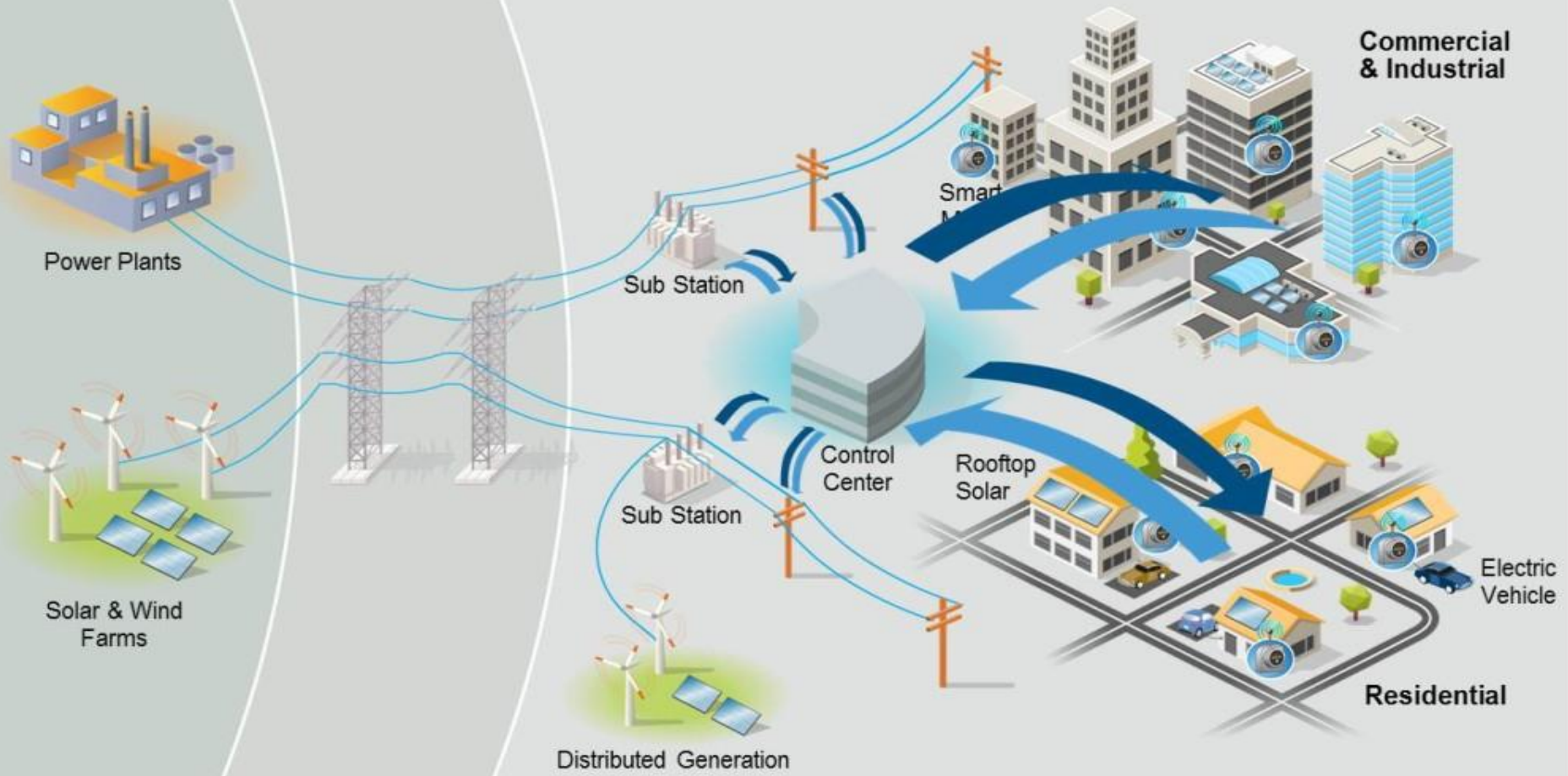


Key Points

GENERATION

TRANSMISSION

DISTRIBUTION & CONSUMPTION





Questions