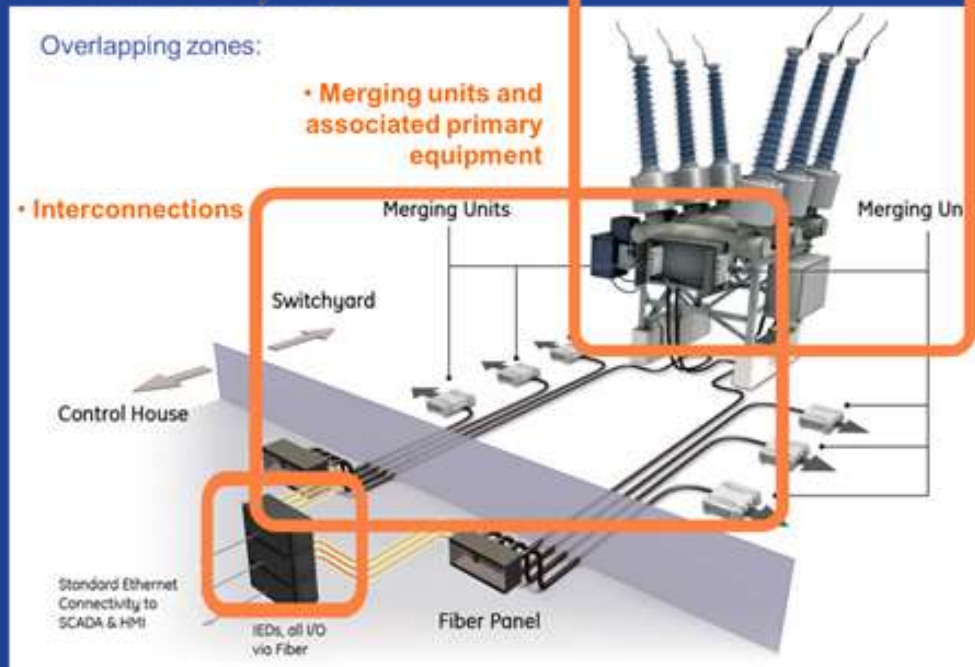


The Azerbaijani experiences in Digital Substation deployment. How Process Bus and IEC 61850 addresses utility requirements

Saeid Shoarinejad, Jorge Seco, Jorge Cardenas
ARAZ Energy, GE Digital Energy
Azerbaijan, Spain

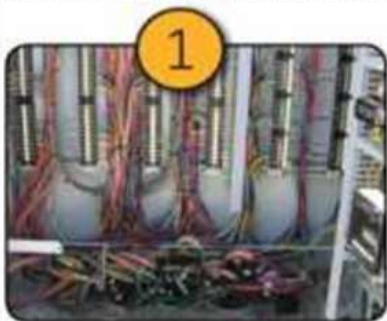
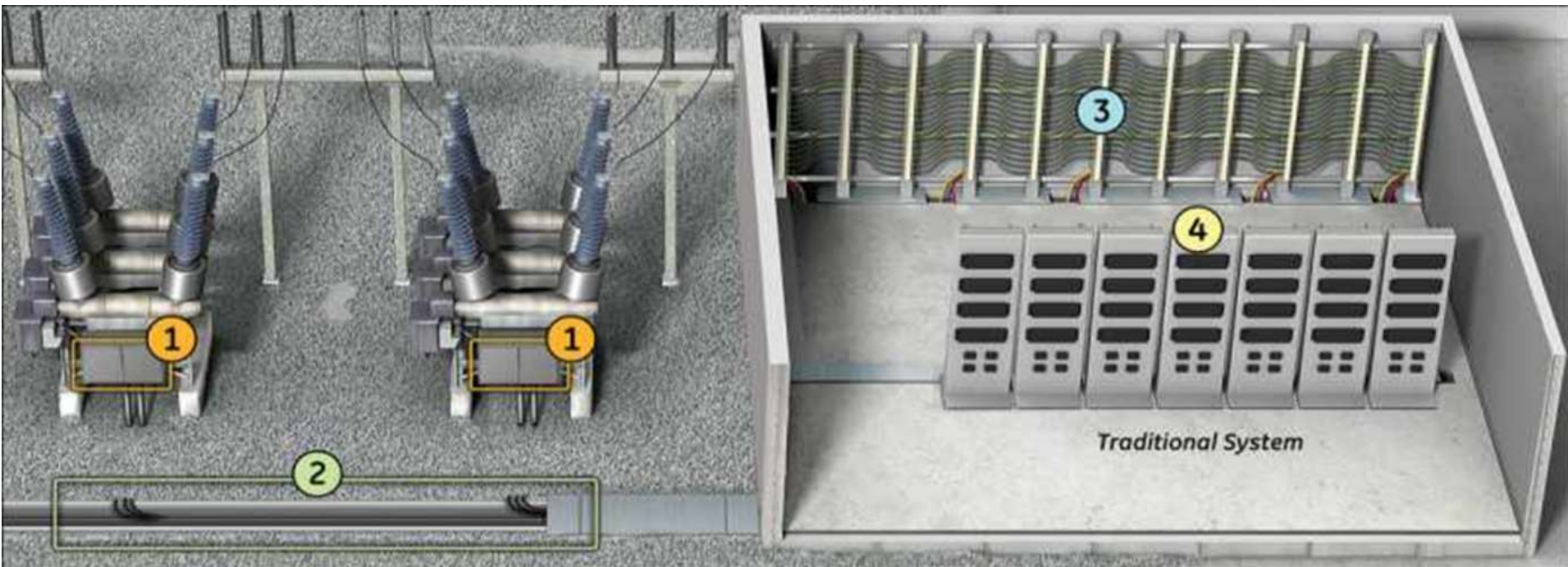
Process Bus System



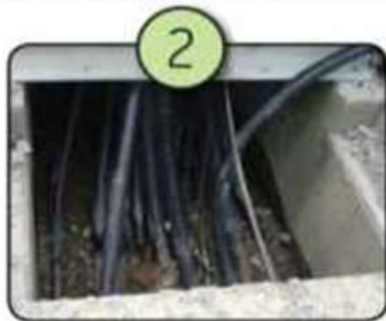
THE CHALLENGE

- Baki Elektrik Shabakasi/ BES required retrofit of Protection & Control System in four 110 kV Substations
- Time Span to do the Installation and Commissioning job of new system was 10 days per substation
- Due time constrains, there were no possible the use of traditional cooper wire solution

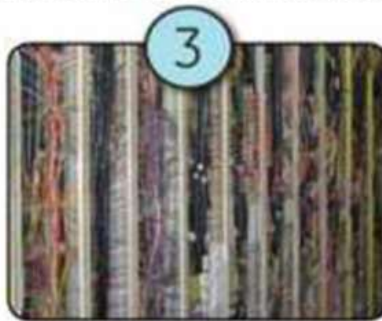
ACTUAL STATUS



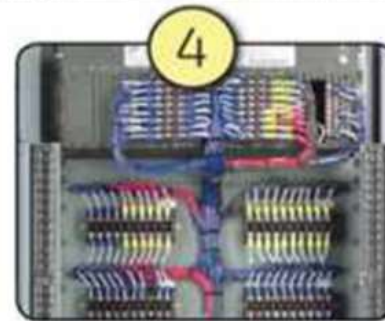
Traditional Breaker Wiring



Traditional Cable Trench

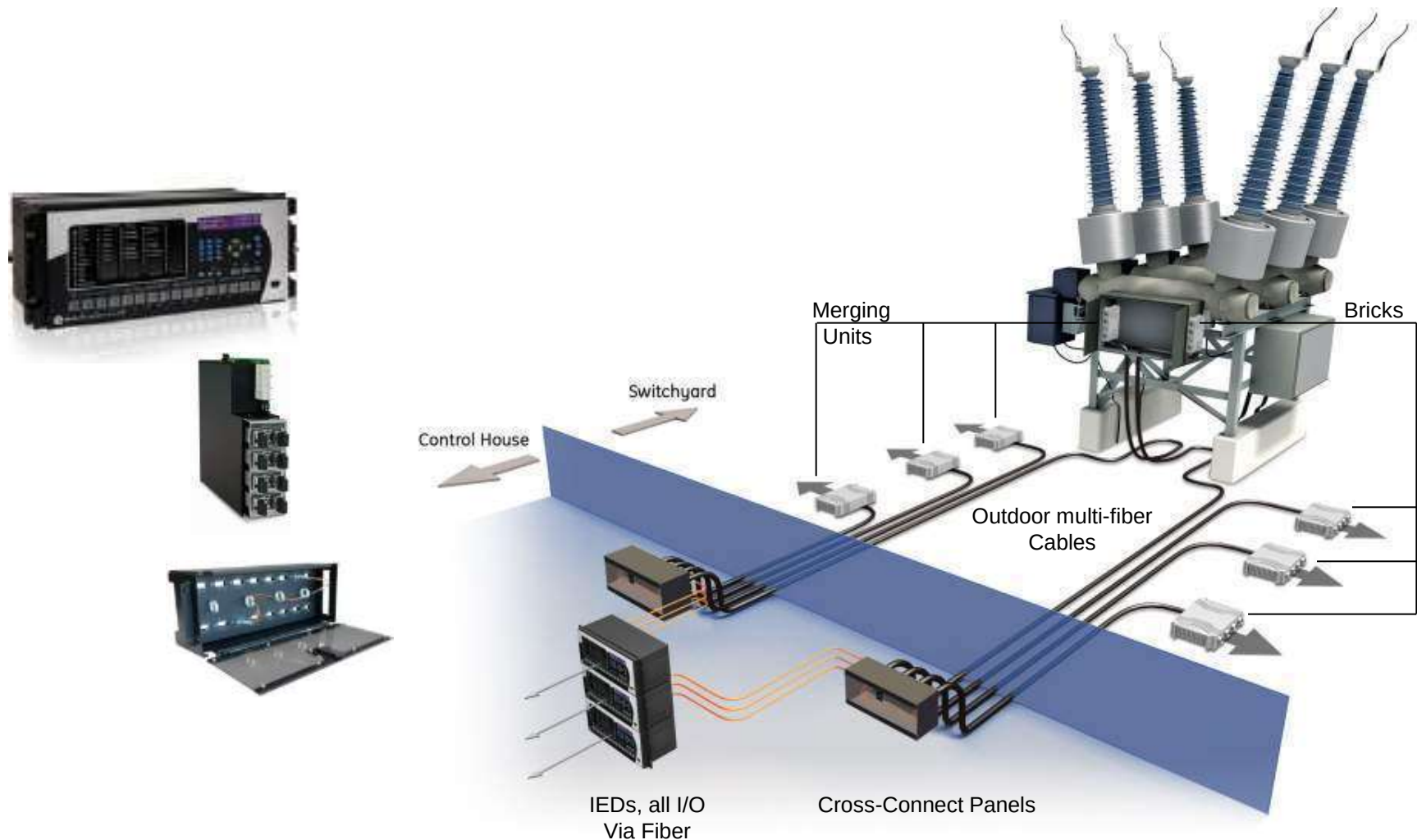


Thousands of Copper Wires
from Switchyard



Labor Intensive Copper
Wiring on Relay Panels

THE SOLUTION - NEW CONCEPT

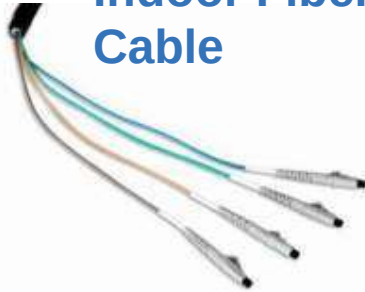


MERGING UNITS DEPLOYMENT IN SWITCHYARD

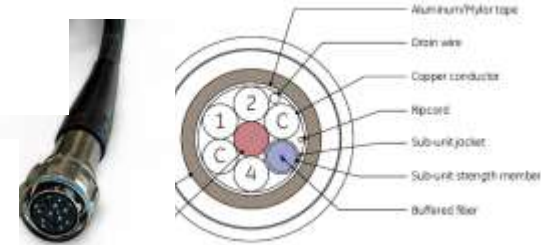


SYSTEM COMPONENTS

Indoor Fiber Cable



CrossConnect Panel



Outdoor Fiber Cable

Finite set for
all
applications

UR
Process
Card



Pre-terminated
copper cable



Outdoor Rugged
Merging Unit (IP66)



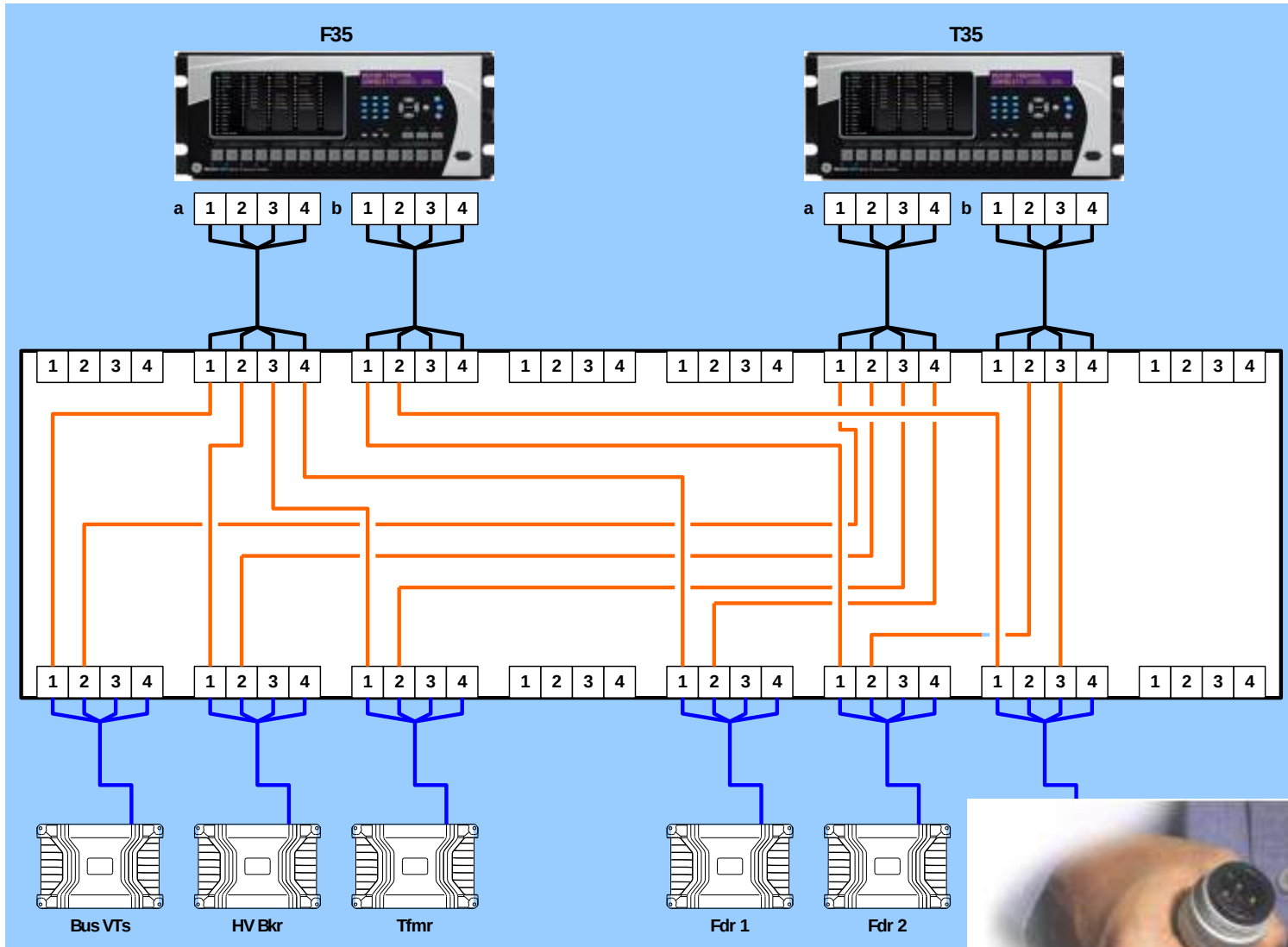
HardFiber: Field connections



**Into simple tool-free
connections**

- One simple twist to connect fiber cable

MAKING THE CONNECTION

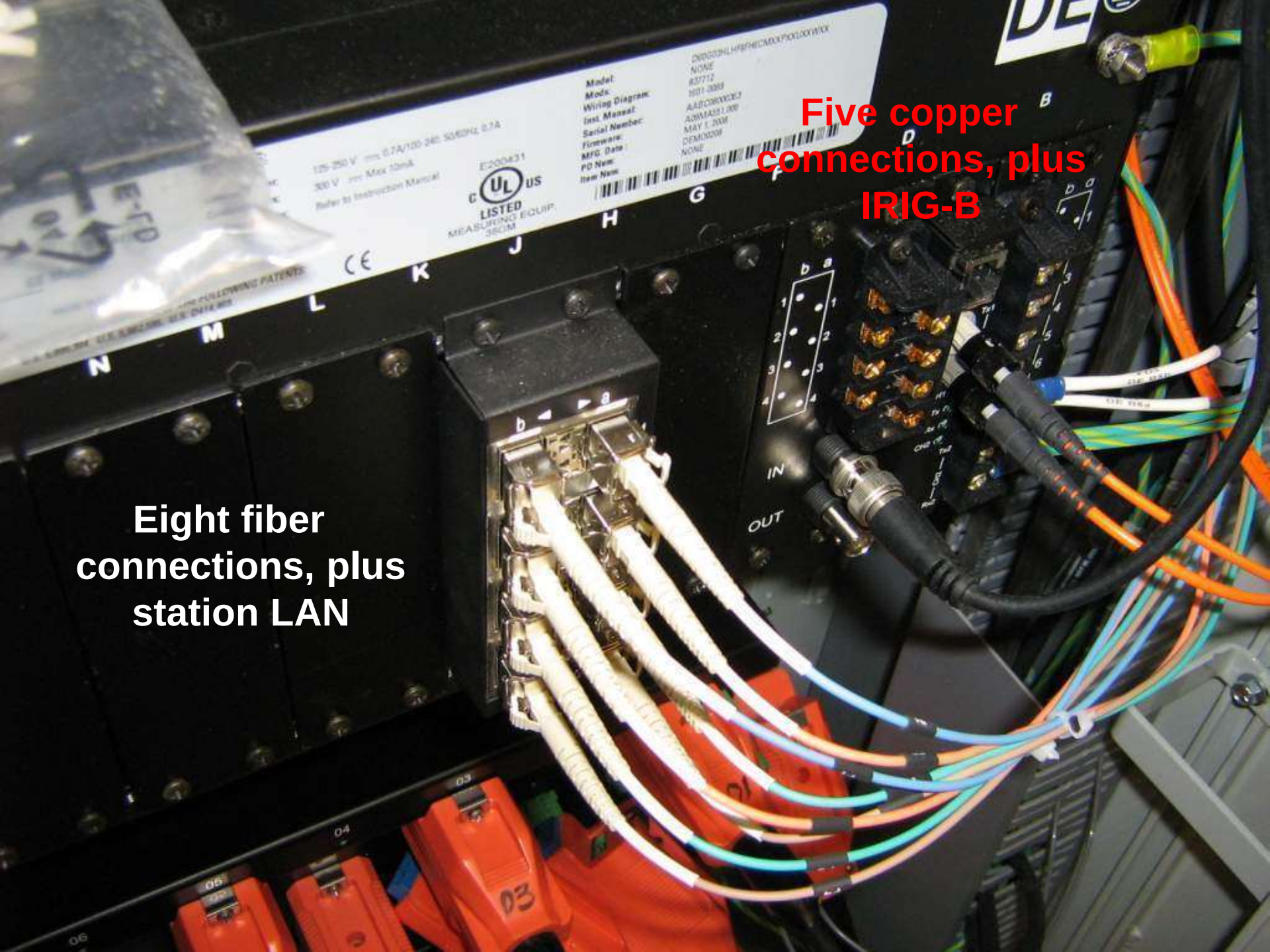


only tools you
will ever need



Five copper connections, plus IRIG-B

Eight fiber connections, plus station LAN



EASY INTUITIVE RELAY ENGINEER APPROACH CONFIGURATION

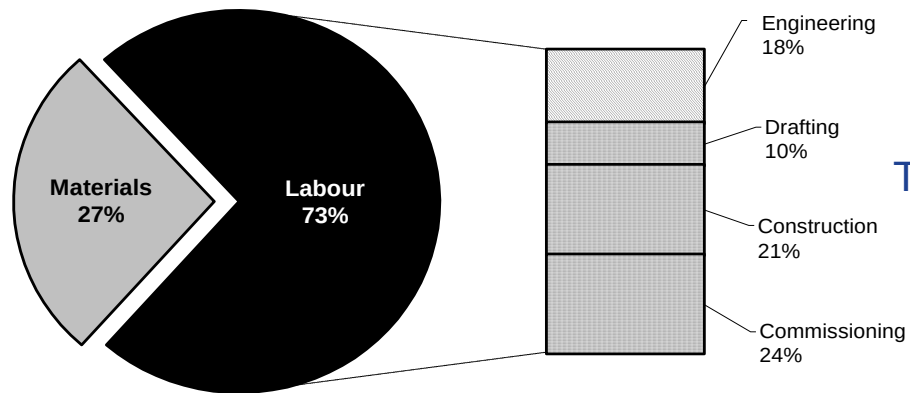
Field Unit #	ID	Function	Brick Order Code	Brick Serial Number	Brick Core	Process Card Port	Actual Value Status
U1	Bus VTs	Enabled	CV-05		1	H1a	⊗ Disabled
U2	HV Bkr	Enabled	CC-05		1	H2a	⊗ Disabled
U3	Tfmr	Enabled	CC-05		1	H3a	⊗ Disabled
U4	Fdr 1	Enabled	CC-05		1	H4a	⊗ Disabled
U5	Fdr 2	Enabled	CC-05		1	H1b	⊗ Disabled
U6	Fdr 3	Enabled	CC-05		1	H2b	⊗ Disabled
U7	U 7	Disabled	CC-05	000000000000	1	H3b	⊗ Disabled
U8	U 8	Disabled	CC-05	000000000000	1	H4b	⊗ Disabled
AC Bank #	B1	B2	B3	B4	B5		
Phase Origin 1	U1/AC5..7	U2/AC1..3	U3/AC5..7	U4/AC1..3	U5/AC1..3		
Phase Origin 2	None	None	None	None	None		
AUX Origin 1	None	None	U3/AC8	None	None		
AUX Origin 2	Voltage bank	Current bank	None	None	None		
Crosschecking	None	Dependability Biased		Dependability Biased	Dependability Biased		
Phase CT Primary	1	100	1000	600	600	600	
Phase CT Secondary	1 A	5 A	5 A	5 A	5 A	5 A	
AUX CT Primary	1	1	1	1	1	1	
AUX CT Secondary	1 A	1 A	1 A	1 A	1 A	1 A	
Phase VT Ratio	120.00	1.00	1.00	1.00	1.00	1.00	
Phase VT Secondary	66.4	66.4	66.4	66.4	66.4	66.4	
Phase VT Connection	Wye	Wye	Wye	Wye	Wye	Wye	
AUX VT Ratio	1.00	1.00	1.00	1.00	1.00	1.00	
AUX VT Secondary	66.4	66.4	66.4	66.4	66.4	66.4	
AUX VT Connection	Vag	Vag	Vag	Vag	Vag	Vag	
PARAMETER	SOURCE 1	SOURCE 2	SOURCE 3	SOURCE 4	SOURCE 5	SOURCE 6	
Name	Fdr 1	Fdr 2	Fdr 3	T HV	T LV	SRC 6	
Phase CT	B4	B5	B6	B2	B3	None	
Ground CT	None	None	None	None	B3	None	
Phase VT	B1	B1	B1	None	None	None	
Aux VT	None	None	None	None	None	None	

Determined during engineering

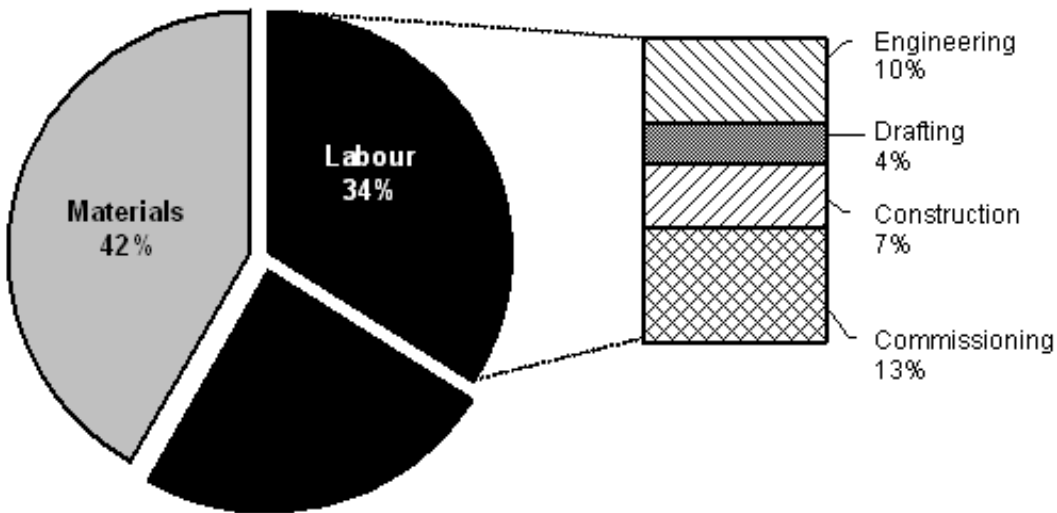
Determined during configuration

Determined during commissioning

PROJECT SAVINGS



**Equivalent Project Budget (Process Bus)
of \$407,000**



Task	Savings
Engineering	45 %
Drafting	56 %
Construction	67 %
Commissioning	47 %
Total	54%

CONCLUSIONS

- Standardization 44% time reduction in Substation Detailed Design and shop drawings
- Wiring : 67% less time needed for wiring works
- Cable trays and canals/trenches: 70% less cost and time needed for cable trays' installations and making canals/trenches for the cables
- Installation: 50% less man-hours during installation works (this will decrease a lot over time after more practices)
- Start-up: 67% less time needed for commissioning and testing (this will decrease a lot over time after more practices)
- Configuration : 50% more time needed for IED set ups (this will decrease a lot over time after more practices)
- Documentation (e.g. "As Built Drawings"): 65% less time needed for documentations because of the system's modularity and typicality
- Number of cores of CT and their burdens would be decreased including its costs
- Less P&C panels (much lower costs for making and wiring panels in Process Bus System versus conventional and regular SAS)
- Less civil/ construction costs of control room versus conventional and regular SAS substations