

The World Market for Substation Automation and Integration Programs in Electric Utilities: 2011-2013

Volume 1: North American Market

NEWTON-EVANS
RESEARCH
COMPANY 

©December 2010

SAMPLE

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Please indicate the communications switch requirements (# of switches per substation) for the following types of substations as they are now in 2010 and as they are expected to be in 2013

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Table 21. What specific equipment types are/will be part of your substation-wide automation and integration program? Please check all that apply. Also, please indicate your utility's preferred vendors for each equipment type.

Table 22. Do you have (or are you planning to have) a Vendor Security Certification Program (to certify your Substation Automation Vendor's processes and practices for integrating security into their processes?) Check all that apply.

Introduction

The summaries in this first section provide top-level views and synopsis. In Section Three of this report, the authors have cross-tabulated survey results by size and type of responding utility.

According to the U.S. Department of Energy and American Public Power Association records, at year-end 2008 there were 202 investor-owned electric utilities, 2,008 publicly-owned electric utilities, 877 consumer-owned rural electric cooperatives, and 9 Federal electric utilities. Since Federal electric utilities only make up a fraction of a percent of the total population of U.S. electric utilities, in the survey sample Newton-Evans includes them with publicly owned electric utilities. Both TVA and BPA indirectly serve more than 25 million end-use customers.

Canada's electric utility count remained at 239 in mid-2010. This number includes 21 investor-owned utilities, 5 TSOs, 23 provincial level utilities, 125 municipals, 64 cooperatives and one public power district. The province of Ontario alone accounts for 43% of the number of Canadian utilities.

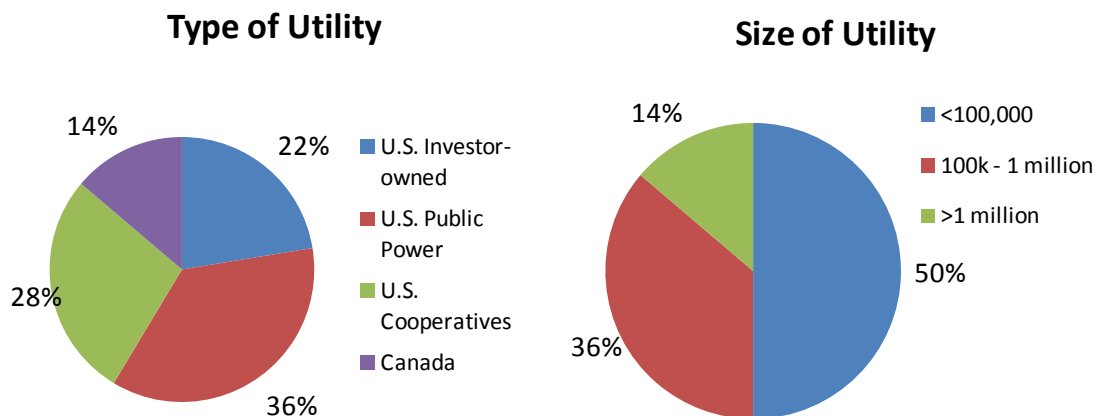
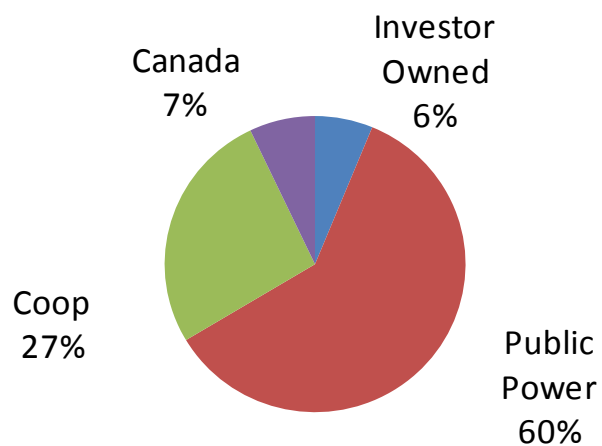


Fig. ii. Proportion of Types of U.S. & Canada Electric Utilities According to the U.S. DOE & PLATTS Directory 2008



The Newton-Evans 2010 sample for this study represents a total of 27,459,646 end-use customers, 1,633 transmission substations and 5,448 distribution substations in the United States and Canada.

List of **Participating Utilities**

Investor Owned

American Transmission Company
Bangor Hydro
Black Hills Power/Cheyenne L, F & P
Central Hudson G&E
Empire District Electric Company
MidAmerican Energy Co.
Orange & Rockland
PacifiCorp
Progress Energy Carolinas
Progress Energy FL
PSE&G
Southern California Edison
Tucson Electric Power

Cooperatives

Carroll EMC
Cass County Electric Co-op
Citizens Electric Cooperative
Connexus Energy
Dakota Electric Association
Delaware Electric Co-op
Marshall County RMC
Mid-Carolina ECI
Moon Lake Electric
New Hampshire Electric Co-op
Northern Virginia Electric Co-op
Palmetto Electric Co-op
Rappahannock Electric Cooperative
South Mississippi EPA
Southwest Transmission Co-op
United Power, Inc.

Canada

Enersource Hydro Mississauga
Hydro Ottawa Ltd.
Hydro-Québec
Hydro-Sherbrooke
Maritime Electric
Medicine Hat
Oakville Hydro
PowerStream

Public Power

Alcoa Electric Dept.
Anaheim Public Utilities
Bryan Texas Utilities
Clark Public Utilities
Cleveland Utilities (TN)
Clinton Utilities Board
Cowlitz PUD
Eugene Water and Electric Board
Grand Haven BLP
Grant PUD
High Point NC
Huntsville Utilities
Lakeland Electric
Loup Power District
Nashville Electric Service
Rochester Public Utilities
Sacramento Municipal Utility District
Salem Electric Department
Santa Clara/Silicon Valley Power
Snohomish County PUD
St. Charles Municipal Electric Utility

Questionnaire

1. Please rank the significance from 1 to 5 for all of the following listed "potential obstacles" to implementing substation automation and integration for both new and retrofit substations through year-end 2013. Use: "1 = doesn't stand in our way" to "5 = formidable obstacle." (You may use the same number more than once here.)

Potential obstacles	Ranking for New Substations	Ranking for Retrofit Substations
Lack of appropriate communications technology <i>inside the fence</i>	[]	[]
Lack of appropriate communications technology <i>substation to substation</i>	[]	[]
Lack of appropriate communications technology <i>substation to master</i>	[]	[]
Not enough skilled internal staff	[]	[]
Benefits do not outweigh the costs	[]	[]
Our key substations are already automated sufficiently	---	[]
Uncertain management philosophy concerning substation automation at this time	[]	[]
Substation equipment vendor community will not have required "open" products and equipment by year end 2013	[]	[]
Economic and business justification case has not been made on behalf of substation automation programs here	[]	[]
Lack of funding	[]	[]
Lack of standard products	[]	[]
Security concerns	[]	[]
Other: (please describe) []	[]	[]

2. What is your estimate of probable spending for new and retrofit substation automation and integration programs at your utility between 2011 and 2013?

Probable spending estimate	New Substations	Retrofit Substations	No funds budgeted over this period (check box)
2011 (in US Dollars)	\$	\$	<input type="checkbox"/>
2012 (in US Dollars)	\$	\$	<input type="checkbox"/>
2013 (in US Dollars)	\$	\$	<input type="checkbox"/>

3. Approximately how many of the utility's transmission and distribution substations fit in each stage of automation**?

SUBSTATIONS	TRANSMISSION			DISTRIBUTION		
	# Substations now in operation	# Substations to be retrofit by YE 2013	# of new substations to be built by YE 2013	# Substations now in operation	# Substations to be retrofit by YE 2013	# of new substations to be built by YE 2013
TOTAL # OF SUBSTATIONS (ALL STAGES OF AUTO) →	[]	[]	[]	[]	[]	[]
SUBTOTALS - Please make sure that the # of substations in the three categories below add up to the TOTAL # directly above it.						
# with no IEDs and with No Automation	[]	[]	[]	[]	[]	[]
# at Stage 1	[]	[]	[]	[]	[]	[]
# at Stage 2	[]	[]	[]	[]	[]	[]

**STAGES OF AUTOMATION

Stage 1 - Some Automation: Some combination of RTU's, IED's & 2 way communications

Stage 2 - Full Automation: Substation based applications/platform to automate substation functions

Questionnaire

4a. Please check your choice of protocol within the substation, between substations, and from the substation to the external host or network.

Protocols	Within Substation		Substation to Substation		Substation to External Host/Network	
	Current	By YE 2013	Current	By YE 2013	Current	By YE 2013
C37.118	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Data Highway Plus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DNP 3 LAN (TCP or UDP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DNP 3 (Serial)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ICCP/MMS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IEC 60870-5-101	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IEC 60870-5-103	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IEC 60870-5-104	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IEC 61850	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IEC 61850 Edition 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modbus LAN (TCP or UDP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modbus Plus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modbus (Serial)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other TCP/IP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UCA 2/MMS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SEL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Common Industry Protocol (Ethernet, IP, Devicenet, ControlNet)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: (name) []	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4b. Are protocols encrypted? ☐ No ☐ Yes → Method used: []

5. What are your alternate methods of communication with the remote site in the event of loss of the routine communications pathways?

6a. Please indicate the approximate number of Ethernet ports *per substation* for the following types of substations as they are now in 2010 and as they are expected to be in 2013:

	2010	2013	Does not apply to us
>345kV Transmission Substations	_____ ports/sub	_____ ports/sub	<input type="checkbox"/>
110kV-345kV Transmission Substations	_____ ports/sub	_____ ports/sub	<input type="checkbox"/>
Medium Voltage Distribution Substations	_____ ports/sub	_____ ports/sub	<input type="checkbox"/>

6b. Are these ports secured? ☐ No ☐ Yes, via → ☐ port security ☐ other means (describe below)

7a. Do you use *redundancy* in your Ethernet networks?

☐ No Redundancy ☐ STAR ☐ RING

7b. What protocols do you use for redundancy?

☐ Rapid Spanning Tree (RSTP) ☐ IEC 62439 (Parallel Redundancy) ☐ IEC 62439 (Hot Standby Router)

☐ Other: specify []

7c. Do you require ethernet switches/routers to meet the requirements of IEEE 1613 (Environmental and Testing requirements for substation based communications networking device) ☐ No ☐ Yes

Questionnaire

8a. Indicate the various substation Ethernet LAN architectures that you use or plan to use by year end 2013

	Current	By YE 2013
Single network without failover	<input type="checkbox"/>	<input type="checkbox"/>
Single network with multiple paths/failover	<input type="checkbox"/>	<input type="checkbox"/>
Independent primary devices/primary network and backup devices/backup network	<input type="checkbox"/>	<input type="checkbox"/>
Every device connected to two independent networks	<input type="checkbox"/>	<input type="checkbox"/>
Other: Describe []	<input type="checkbox"/>	<input type="checkbox"/>

8b. What is the maximum allowed failover/recovery time (in seconds) for network reconfiguration? _____ seconds

9. What is the number of simultaneous wireless connections allowed in Transmission substations? _____ or ☐ none allowed

10. What is the number of simultaneous wireless connections allowed in Distribution substations? _____ or ☐ none allowed

11. What is your application of communication links?

Communication type	Substa. to Control Center (SCADA/EMS)		Substa. to End Device		Substa. to Substa. (Prot. Relay)	
	Current	By Year End 2013	Current	By Year End 2013	Current	By Year End 2013
Leased Line	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dialup	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Frame relay	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Power Line Carrier or BPL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fiber/Synchro Optical Network	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T-1 or Other Multiplexer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet (IP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microwave	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spread Spectrum Multiple Address Radio	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Licensed Radio	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Satellite	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cellular (CDMA)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cellular (GSM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cellular (UMTS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wireless 802.11 (a, b, g)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Does your utility use routable paths to the end devices?

☐ No ☐ Yes → Are they monitored? → ☐ No ☐ Yes

13. Please check your choice of communications architecture within the substation and to the substation.

Communications Architecture	Within substation		To substation	
	Current	By YE 2013	Current	By YE 2013
LAN (local area network)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Serial Links	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VSAT (satellite)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
WAN (wide area network)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: Describe[]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Questionnaire

14. How are/will primary substation information processing tasks "inside the fence" be handled?

	Current	By YE 2013		Current	By YE 2013
"Smart" RTU	<input type="checkbox"/>	<input type="checkbox"/>	"Dumb" RTU	<input type="checkbox"/>	<input type="checkbox"/>
Separate microcomputer	<input type="checkbox"/>	<input type="checkbox"/>	Programmable Logic Controller	<input type="checkbox"/>	<input type="checkbox"/>
Communications Processor	<input type="checkbox"/>	<input type="checkbox"/>	Data Concentrator	<input type="checkbox"/>	<input type="checkbox"/>
Distributed over multiple platforms	<input type="checkbox"/>	<input type="checkbox"/>	Other substation controller Device: Describe []	<input type="checkbox"/>	<input type="checkbox"/>
PC in substation	<input type="checkbox"/>	<input type="checkbox"/>			

15. Please check any external assistance that will be needed by your utility for the following substation automation and integration-related activities.

Substation Automation and Integration-Related Activity	Require Now	Not Yet, but by 2013	Not at all
Pre-packaged substations (SS control house arrives "on a truck")	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Control and protection design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Commissioning and testing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Security	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Engineering drawing support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Specifications development to help define needs before RFQ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IED configuration support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Long term maintenance agreements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. Bandwidth Requirements

Please indicate the bandwidth requirements (in *kbps*) for the following types of substations as they are now in 2010 and as they are expected to be in 2013:

	2010	2013	Does not apply to us
>345kV Transmission Substations	_____ kbps	_____ kbps	<input type="checkbox"/>
110kV-345kV Transmission Substations	_____ kbps	_____ kbps	<input type="checkbox"/>
Medium Voltage Distribution Substations	_____ kbps	_____ kbps	<input type="checkbox"/>

17. Latency Requirements

Please indicate the latency requirements (in *milliseconds*) for the following types of substations as they are now in 2010 and as they are expected to be in 2013:

	2010	2013	Does not apply to us
>345kV Transmission Substations	_____ ms	_____ ms	<input type="checkbox"/>
110kV-345kV Transmission Substations	_____ ms	_____ ms	<input type="checkbox"/>
Medium Voltage Distribution Substations	_____ ms	_____ ms	<input type="checkbox"/>

18. Router Requirements

Please indicate the router requirements (# of routers *per substation*) for the following types of substations as they are now in 2010 and as they are expected to be in 2013:

	2010	2013	Does not apply to us
>345kV Transmission Substations	_____ routers/sub	_____ routers/sub	<input type="checkbox"/>
110kV-345kV Transmission Substations	_____ routers/sub	_____ routers/sub	<input type="checkbox"/>
Medium Voltage Distribution Substations	_____ routers/sub	_____ routers/sub	<input type="checkbox"/>

19. Communications Switch Requirements

Please indicate the communications switch requirements (# of switches *per substation*) for the following types of substations as they are now in 2010 and as they are expected to be in 2013:

	2010	2013	Does not apply to us
>345kV Transmission Substations	_____ switches/sub	_____ switches/sub	<input type="checkbox"/>
110kV-345kV Transmission Substations	_____ switches/sub	_____ switches/sub	<input type="checkbox"/>
Medium Voltage Distribution Substations	_____ switches/sub	_____ switches/sub	<input type="checkbox"/>

Questionnaire

20. For what applications are you using or planning to use substation-based computing platforms?

	Current	YE 2013
Local HMI	<input type="checkbox"/>	<input type="checkbox"/>
Protocol conversion/data concentration	<input type="checkbox"/>	<input type="checkbox"/>
Synchrophasor archiving	<input type="checkbox"/>	<input type="checkbox"/>
Historian	<input type="checkbox"/>	<input type="checkbox"/>
Engineering access	<input type="checkbox"/>	<input type="checkbox"/>
Distribution automation	<input type="checkbox"/>	<input type="checkbox"/>
RTU	<input type="checkbox"/>	<input type="checkbox"/>
Other: Describe []	<input type="checkbox"/>	<input type="checkbox"/>

21. What specific equipment types are/will be part of your substation-wide automation and integration program? Please check all that apply. Also, please indicate your utility's preferred vendors for each equipment type.

	TRANSMISSION SUBSTATIONS		DISTRIBUTION SUBSTATIONS		PREFERRED VENDORS
	Current	Year-End 2013	Current	Year-End 2013	
Remote terminal units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Digital fault recorders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Electro-mechanical relays	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Digital/numerical relays	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Redundant protection schemes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Sequence of events recorders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Power transformer monitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Power transformer regulators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Programmable logic controllers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
LTC transformers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Smart meters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Smart transducers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Substation computer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Substation security equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Phasor Measurement Units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Phasor Data Concentrator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Switches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Routers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Fault Current Interrupter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]
Annunciators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	[]

22. Do you have (or are you planning to have) a Vendor Security Certification Program (to certify your Substation Automation Vendor's processes and practices for integrating security into their processes?) Check all that apply.

- ☐ Yes, we have one currently in place, involving→
- ☐ A) Organizational processes and disciplines
 - ☐ B) Product and service design, development and testing processes
 - ☐ C) Commissioning and maintenance processes
 - ☐ D) Other: Describe[]
- ☐ No, but we will require vendor security certification by year end 2013
- ☐ No, and we have no plans for vendor security certification
- ☐ Other situation: Describe[]

THANK YOU FOR YOUR HELP IN THIS RESEARCH EFFORT