

Table 4-2. Additional Standards, Specifications, Profiles, Requirements, Guidelines, and Reports for Further Review

	Standards, Specifications, Requirements, Guidelines, Reports	Application	Comments	WG
1	<p>ANSI C12.22-2008/IEEE P1703/MC1222</p> <p>http://webstore.ansi.org/FindStandards.aspx?SearchString=c12.22&SearchOption=0&PageNumber=0&SearchTermsArray=null c12.22 null</p> <p>ANSI C12.23</p> <p>ANSI C12.24</p>	<p>End Device Tables communications over any network.</p> <p>Compliance Testing for Standard Protocols (C12.18, C12.19, C12.21 and C12.22).</p> <p>A catalog of calculation algorithms for VAR/VA that is in draft form. It may ultimately become a report instead of a standard.</p>	<p>Open, mostly mature standards, developed and maintained by an SDO.</p> <p>It is recognized that C12.22 is an important standard relevant to the transport of C12.19 tables, and many comments on the draft framework document recommending it were received. However, it is identified for further review, because it is not clear that sufficient consensus exists for it. Several issues were raised in other comments received, including concerns about layering, security, and the need for better alignment with Internet Protocol and harmonization with the IEC 62056(Device Language Message Specification (DLMS)/Companion Specification for Energy Metering (COSEM)) standard (see #21 in this list). This further review may require a PAP to be established by the SGIP.</p> <p>Draft standard for compliance testing of ANSI C12 communication standards.</p> <p>VAR and VA have multiple formulas that can be used and depending on the waveform, do not give the same result. This document is a catalog</p>	PAP5, 6

			of the present algorithms used to implement the formulas in order for all parties to know what algorithm the meter has implemented. This document should be considered once it is completed.	
2	<p>CableLabs PacketCable Security Monitoring and Automation Architecture Technical Report</p> <p>http://www.cablelabs.com/specifications/PKT-TR-SMA-ARCH-V01-081121.pdf</p>	A technical report describing a broad range of services that could be provided over television cable, including remote energy management.	This report contains a security, monitoring, and automation architecture for home networks and should be re-evaluated by the SGIP.	H2G, HAN TF
3	<p>Global Positioning System (GPS) Standard Positioning Service (SPS) Signal Specification</p> <p>http://pnt.gov/public/docs/1995/signalspec1995.pdf</p>	Standard for using GPS to establish accurate geospatial location and time.	This specification defines the publicly available service provided by GPS and specifies GPS SPS ranging signal characteristics and SPS performance. See also Open Geospatial Consortium listing in this chapter.	T&D
4	HomePlug AV	Entertainment networking content distribution for consumer electronic equipment.	This specification uses Power Line Communications; harmonization and coexistence with other PLC standards is being addressed by PAP15 (PAP15: Harmonize Power Line Carrier Standards for Appliance Communications in the Home).	H2G, HAN TF, PAP15

5	HomePlug C&C	Control and management of residential equipment for whole-house control products: energy management, lighting, appliances, climate control, security, and other devices.	This specification uses Power Line Communications; harmonization and coexistence with other PLC standards is being addressed by PAP15 for PLC (PAP15: Harmonize Power Line Carrier Standards for Appliance Communications in the Home) .	H2G, HAN TF, PAP15
6	IEC 61400-25* http://www.iec.ch/cgi-bin/procgi.pl/www/iec/www.p?wwwlang=E&wwwprog=sea22.p&search=iecnumber&header=IEC&pubno=61400&part=&se= *This standard had been identified incorrectly in the original version. The correction was made Jan. 29, 2010.	Communication and control of wind power plants.	An open standard, developed and maintained by an SDO. This set of standards is being considered for addition to the “61850 Suite” because it uses 61850 modeling principles to address wind power applications. However, it goes further to recommend multiple protocol mappings, some of which cannot transport all of the basic services of 61850.	PAP16, R&S
7	ITU Recommendation G.9960 (G.hn) http://www.itu.int/ITU-T/aap/AAPRecDetails.aspx?AAPSeqNo=1853	In-home networking over power lines, phone lines, and coaxial cables.	An open standard, developed and maintained by an SDO. The harmonization and coexistence of this standard with other PLCs is being addressed by PAP15 for PLC. Harmonization of coexistence between IEEE and ITU-T completed successfully. Now the ISP-based broadband PLC coexistence mechanism has been ratified by ITU-T as Recommendation	PAP15, H2G, HAN TF

			G.9972 and by IEEE in the 1901 standard. (PAP15: Harmonize Power Line Carrier Standards for Appliance Communications in the Home).	
8	IEEE P1901	Broadband communications over Powerline medium access control (MAC) and physical layer (PHY) protocols.	The harmonization and coexistence of this standard with other PLCs is being addressed by PAP15 for PLC. Harmonization of coexistence between IEEE and ITU-T completed successfully. Now the ISP-based broadband PLC coexistence mechanism has been ratified by ITU-T as Recommendation G.9972 and by IEEE in the 1901 standard. (PAP15: Harmonize Power Line Carrier Standards for Appliance Communications in the Home).	PAP15, H2G, HAN TF
9	ISO/IEC 8824 ASN.1 (Abstract Syntax Notation)	Used for formal syntax specification of data; used in (e.g.) X.400.	Any SDO may decide to use ASN.1 notation when defining the syntax of data structures.	T&D
10	ISO/IEC 12139-1	High-speed power line communications medium access control (MAC) and physical layer (PHY) protocols.	The harmonization and coexistence of this standard with other PLC standards is being addressed by PAP15 for PLC Harmonization of coexistence between IEEE and ITU-T completed successfully. Now the ISP-based broadband PLC coexistence mechanism has been ratified by ITU-T as Recommendation G.9972 and by IEEE in the 1901 standard. (PAP15: Harmonize Power Line Carrier Standards for Appliance Communications in the	PAP15, H2G, HAN TF

			Home).	
11	IEEE 802 Family	This includes standards developed by the IEEE 802 Local Area and Metropolitan Area Network Standards Committee.	<p>A set of open, mature standards for wired and wireless LLC/MAC/PHY protocols, developed and maintained by an SDO.</p> <p>Other related specifications include those developed by Industry fora such as WiFi Alliance, WiMAX Forum, and Zigbee Alliance to promote the use of these standards and to provide implementation testing and certification. Version 1.0 of the Guidelines for Assessing Wireless Standards for Smart Grid Applications is now under consideration for approval by PAP02 (PAP02: Wireless Communications for the Smart Grid). The guideline is a draft of key tools and methods to assist Smart Grid system designers in making informed decisions about existing and emerging wireless technologies. An initial set of quantified requirements has been brought together for advanced metering infrastructure (AMI) and initial Distribution Automation (DA) communications.</p>	PAP02
12	TIA TR-45/3GPP2 Family of Standards	Standards for cdma2000® Spread Spectrum and High Rate Packet Data Systems.	<p>A set of open standards for cellular phone networks. Version 1.0 of the Guidelines for Assessing Wireless Standards for Smart Grid Applications is now under consideration for approval by PAP02 (PAP02: Wireless Communications for the Smart Grid). The guideline is a draft of key tools and methods to assist Smart Grid system designers in making informed decisions about existing and emerging wireless technologies. An initial set of quantified</p>	PAP02

			requirements has been brought together for advanced metering infrastructure (AMI) and initial Distribution Automation (DA) communications.	
13	3GPP Family of Standards - Including 2G (CSD, HSCSD, GPRS, EDGE, EDGE Evolution), 3G (UMTS/FOMA, W-CDMA EUTRAN, HSPA, HSPA+, 4G (LTE Advanced)	2G, 3G, and 4G cellular network protocols for packet delivery.	A set of open international standards for cellular phone networks. Draft of the Guidelines for Assessing Wireless Standards for Smart Grid Applications is now under consideration for approval by PAP02. PAP02 (PAP02: Wireless Communications for the Smart Grid). The guideline is a draft of key tools and methods to assist Smart Grid system designers in making informed decisions about existing and emerging wireless technologies. An initial set of quantified requirements has been brought together for advanced metering infrastructure (AMI) and initial Distribution Automation (DA) communications.	PAP02
14	ETSI GMR-1 3G Family of standards	GMR-1 3G is a satellite-based packet service equivalent to 3GPP standards.	ETSI and TIA Geo-Mobile Radio Air Interface standards for mobile satellite radio interface, evolved from the GSM terrestrial cellular standard.	PAP02
15	ISA SP100	Wireless communication standards intended to provide reliable and secure operation for non-critical monitoring, alerting, and control applications specifically focused to meet the needs of industrial users.	Standards developed by ISA-SP100 Standards Committee, Wireless Systems for Automation.	PAP02
16	ITU-T G.enhm/P1901.2 Narrowband Powerline			PAP15, H2G

	Communications			
17	Network Management Standards - including Internet based standards such as DMTF, CIM, WBEM, ANSI INCITS 438-2008, SNMP v3, netconf, STD 62, and OSI-based standards including CMIP/CMIS	Protocols used for management of network components and devices attached to the network.	A future PAP may be needed to produce guidelines on which protocol to use under specific network technology.	PAP1
18	ASHRAE 201P Facility SG Information Model			PAP17, B2G
19	NIST SP 500-267	A profile for IPv6 in the U.S. Government.	A version of IPv6 profile for Smart Grid will be produced.	PAP1
20	Z-wave http://www.z-wave.com/modules/ZwaveStart/	A wireless mesh networking protocol for home area networks.	Technology developed by the Z-Wave Alliance.	H2G, PAP2
21	IEEE 2030 Standards: IEEE P2030 IEEE P2030.1 IEEE P2030.2	IEEE Smart Grid series of standards: (1) IEEE P2030, "Draft Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with Electric Power System (EPS) and End-Use Applications and Loads;" (2) IEEE P2030.1 "Draft Guide for Electric-Sourced Transportation	The IEEE 2030 Smart Grid series standards are developed to provide guidelines for smart grid interoperability. IEEE P2030 provides a knowledge base addressing terminology; characteristics; functional performance and evaluation criteria; and the application of engineering principles for Smart Gstem with end-use applications and	2030.0: T&D, 2030.1: V2G, PAP11 2030.2: PAP7, R&S

		Infrastructure;” and (3) IEEE P2030.2 “Draft Guide for the Interoperability of Energy Storage Systems Integrated with the Electric Power Infrastructure.”	<p>loads. The guide discusses alternate approaches to good practices for the Smart Grid. (http://grouper.ieee.org/groups/scc21/2030/2030_index.html).</p> <p>IEEE P2030.1 provides guidelines that can be used by utilities, manufacturers, transportation providers, infrastructure developers, and end users of electric-sourced vehicles and related support infrastructure in addressing applications for road-based personal and mass transportation. (http://grouper.ieee.org/groups/scc21/2030.1/2030.1_index.html);</p> <p>IEEE P2030.2 provides guidelines for discrete and hybrid energy storage systems that are integrated with the electric power infrastructure, including end-use applications and loads. (http://grouper.ieee.org/groups/scc21/2030.2/2030.2_index.html).</p>	
22	IEC 60929 AC-supplied electronic ballasts for tubular fluorescent lamps – performance requirements	Standard specifies communications of information to and from lighting ballasts for Energy Management Systems.	<p>An open standard, developed and maintained by an SDO.</p> <p>Appendix E of this standard defines the Digital Addressable Lighting Interface (DALI), which is a protocol for the control of lighting in buildings.</p>	B2G, I2G, H2G

23	IEC 62056 Device Language Message Specification (DLMS)/Companion Specification for Energy Metering (COSEM) Electricity metering - Data exchange for meter reading, tariff and load control	Energy metering communications.	An open standard, developed and maintained by an SDO. This suite of standards contains specifications for the application layers of the DLMS for energy metering. It is supported by a user group, the DLMS User Association.	PAP05, 06, T&D
24	IEC PAS 62559 http://webstore.iec.ch/preview/info_iecpas62559%7Bed1.0%7Den.pdf	Requirements development method covers all applications.	This specification describes the EPRI Intelligrid SM methodology for requirements development. It is a pre-standard that is gaining acceptance by early Smart Grid and AMI implementing organizations and has been used at the NIST May workshop and is used in several PAP tasks.	
25	IEEE C37.2-2008 IEEE Standard Electric Power System Device Function Numbers	Protective circuit device modeling numbering scheme for various switchgear.	An open standard, developed and maintained by an SDO. The latest revision contains cross-references between C37.2 numbers and IEC 61850-7-4 logical nodes.	T&D
26	IEEE C37.111-1999 IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems (COMTRADE)	Applications using transient data from power system monitoring, including power system relays, power quality monitoring field and workstation equipment.	An open standard, developed and maintained by an SDO. It facilitates the exchange of captured power system transient data using standardized format.	T&D

27	IEEE C37.232 Recommended Practice for Naming Time Sequence Data Files	Naming time sequence data files for substation equipment requiring time sequence data.	Recommended practice that resolves issues with reporting, saving, exchanging, archiving, and retrieving large numbers of substation data files. The recommended practice has been adopted by utilities and manufacturers and is recommended by the North American Energy Reliability Corporation (NERC) and the Northeast Power Coordinating Council.	T&D, PAP13
28	IEEE 1159.3 Recommended Practice for the Transfer of Power Quality Data	Applications using of power quality data.	An open standard, developed and maintained by an SDO. It is a recommended practice for a file format suitable for exchanging power quality-related measurement and simulation data in a vendor- independent manner.	T&D, PAP12
29	IEEE 1379-2000	Substation Automation - Intelligent Electronic Devices (IEDs) and remote terminal units (RTUs) in electric utility substations.	An open standard, developed and maintained by an SDO. Recommends the use of DNP3 or IEC 60870-5 for substation IED communications.	PAP12, T&D
30	ISO/IEC 15045, "A Residential gateway model for Home Electronic System." http://www.iso.org/iso/ catalogue_detail.htm?c number=26313	Specification for a residential gateway (RG) that connects home network domains to network domains outside the house. This standard will be evaluated in the discussions of Home Area Networks.	An open standard, developed and maintained by an SDO. This should be considered as standards for residential networks are established under present and future PAPs.	H2G
31	ISO/IEC 15067-3 "Model of an energy management system for the Home	A model for energy management that accommodates a range of load control strategies.	An open standard, developed and maintained by an SDO. This should be reconsidered as standards for the residential networks are established under	H2G

	Electronic System.” http://webstore.iec.ch/preview/info_isoiec15067-3%7Bed1.0%7Den.pdf		present and future PAPs.	
32	ISO/IEC 18012, "Guidelines for Product Interoperability." http://www.iso.org/iso/catalogue_detail.htm?cnumber=30797 http://www.iso.org/iso/catalogue_detail.htm?cnumber=46317	Specifies requirements for product interoperability in the home and building automation systems.	An open standard, developed and maintained by an SDO. This should be reconsidered as standards for the residential networks are established under present and future PAPs.	H2G
33	North American Energy Standards Board (NAESB) Open Access Same-Time Information Systems (OASIS)	Utility business practices for transmission service.	Practices are mandated by FERC. It specifies the methods and information that must be exchanged between market participants and market Operators for transactions in wholesale electric power industry.	T&D
34	NEMA Smart Grid Standards Publication SG-AMI 1-2009 – Requirements for Smart Meter Upgradeability http://www.nema.org	This standard will be used by smart meter suppliers, utility customers, and key constituents, such as regulators, to guide both development and decision making as related to smart meter upgradeability.	This standard serves as a key set of requirements for smart meter upgradeability. These requirements should be used by smart meter suppliers, utility customers, and key constituents, such as regulators, to guide both development and decision making as related to smart meter upgradeability. The purpose of this document is to define requirements for smart meter firmware upgradeability in the context of an AMI system for industry stakeholders such as regulators,	PAP0

			utilities, and vendors.	
35	OASIS EMIX (Energy Market Information eXchange)	Exchange of price, characteristics, time, and related information for markets, including market makers, market participants, quote streams, premises automation, and devices.	This common price and product definition communication standard is under public review as part of the PAP03 current activities (PAP03: Develop Common Specification for Price and Product Definition).	PAP03
36	Fix Protocol, Ltd. FIXML Financial Information eXchange Markup Language http://www.fixprotocol.org/specifications/fix4.4fixml	FIXML is a Web services implementation of FIX (Financial Information Exchange). FIX is the most widely used protocol for financial trading today.	This standard serves as a reference point for OASIS EMIX (see above) in the PAP03 effort (PAP03: Develop Common Specification for Price and Product Definition).	PAP03
37	OASIS oBIX	General Web service specification for communicating with control systems.	This open specification is an integration interface to and between control systems and, to a growing extent, between enterprises and building systems.	B2G
38	OASIS WS-Calendar	XML serialization of IETF iCalendar for use in calendars, buildings, pricing, markets, and other environments. A communication specification used to specify schedule and interval between domains.	WS-Calendar describes a limited set of message components and interactions providing a common basis for specifying schedules and intervals to coordinate activities between services. The specification includes service definitions consistent with the OASIS SOA Reference Model and XML vocabularies for the interoperable and standard exchange of: <ul style="list-style-type: none"> • Schedules, including sequences of schedules • Intervals, including sequences of intervals 	PAP04, 03

			<p>This standard is the primary deliverable of the common schedules PAP04. (see Section 5.6 http://collaborate.nist.gov/twiki-sgrid/bin/view/SmartGrid/PAP04Schedules)</p> <p>This specification is used by EMIX (see PAP03: Develop Common Specification for Price and Product Definition) and Energy Interoperation (see PAP09: Standard DR and DER Signals)</p>	
39	<p>SAE J2847/1-3 Communications for PEV Interactions</p> <p>J2847/1: http://standards.sae.org/j2847/1_201006</p>	<p>J2847/1 “Communication between Plug-in Vehicles and the Utility Grid”. J2847/2 “Communication between Plug-in Vehicles and the Supply Equipment (EVSE)”. J2847/3 “Communication between Plug-in Vehicles and the Utility Grid for Reverse Power Flow”.</p>	<p>This series of standards will be considered when they are finalized. Only J2847/1 is published. J2847/2 and J2847/3 have not been published yet.</p>	PAP11, V2G
40	<p>W3C Simple Object Access Protocol (SOAP)</p>	<p>XML protocol for information exchange.</p>	<p>SOAP is a published standard for structured Web services communication. As such it should be considered for use in the Smart Grid domain when such functionality is required.</p>	
41	<p>W3C WSDL Web Service Definition Language</p>	<p>Definition for Web services interactions.</p>	<p>WSDL is a standard for defining Web services interactions. As such it should be considered for use in the Smart Grid domain when such functionality is required.</p>	

42	W3C XML eXtensible Markup Language	Self-describing language for expressing and exchanging information.	XML is a core standard for structuring data. As such it should be considered for use in the Smart Grid domain when such functionality is required.	
43	W3C XSD (XML Definition)	Description of XML artifacts, which are used in WSDL (q.v.) and Web Services as well as other XML applications.	XSD is a standard for defining XML data instances. As such it should be considered for use in the Smart Grid domain when such functionality is required.	
44	W3C EXI	Efficient XML interchange.	EXI is an alternate binary encoding for XML. As such it should be considered for use in the Smart Grid domain when such functionality is required.	
45	US Department of Transportation's Federal Highway Administration's Intelligent Transportation System (ITS) Standard NTCIP 1213, "Electrical Lighting and Management Systems (ELMS) http://www.ntcip.org/library/documents/pdf/1213v0219d.pdf	Addresses open protocol remote monitoring and control of street-, roadway-, and highway-based electrical assets including lighting, revenue grade metering, power quality, and safety equipment including remote communicating ground fault and arc fault interrupters.	Development began in 1992 by the NEMA 3-TS Transportation Management Systems and Associated Control Devices; transferred initial work from an ad hoc committee of the Illuminating Engineering Society of North America (IESNA) in 2002 and formed the ELMS Working Group to further develop the control objects based on NTCIP.	T&D
46	OpenADE Energy Service Provider Interface	Open Automatic Data Exchange (OpenADE) provides business requirements, use cases, and system requirements specifications	The OpenADE is developed by a group of Smart Energy management vendors, utilities, and consumer interests as a task force under OpenSG User Group. The task force is developing	PAP10

		that allow a consumer to grant a third party access to their electric data and in accordance with that authorization, the utility delivers the consumer data to the third party using a standard interoperable machine-to-machine (M2M) interface. These recommendations will be developed according to guidelines provided by SDOs such as IEC, referenced in OpenADE documents, with the goal of gaining consensus and adoption as international standards.	recommendations toward building interoperable data exchanges that will allow customer authorization and sharing of utility consumption information with third party service providers. The “OpenADE 1.0 Business and User Requirements” and “OpenADE 1.0 System Requirements” have been developed and approved by OpenSG.	
47	UL-1741 Implementation Guidelines and Testing for DER Generators and Storage	The standard specifies requirements for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources.		PAP7, R&S
Cybersecurity				
48	ISA SP99 http://www.isa.org/MS_Template.cfm?MicrositeID=988&CommitteeID=6821	Cybersecurity mitigation for industrial and bulk power generation stations. International Society of Automation (ISA) Special Publication (SP) 99 is a standard that explains the process for establishing an industrial automation and control systems	This has been used in the development of the NIST Interagency Report NISTIR 7628, <i>Smart Grid Cyber Security Strategy</i> : http://csrc.nist.gov/publications/nistir/ir7628/introduction-to-nistir-7628.pdf http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_voll.pdf	CSWG, I2G

		security program through risk analysis, establishing awareness and countermeasures, and monitoring and improving an organization's cybersecurity management system. Smart Grid contains many control systems that require cybersecurity management.	http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol3.pdf .	
49	ISO27000 http://www.27000.org/	The ISO 27000 series of standards have been specifically reserved by ISO for information security matters.	This has been used in the development of the NIST Interagency Report NISTIR 7628, <i>Smart Grid Cyber Security Strategy</i> ; (http://csrc.nist.gov/publications/nistir/ir7628/introduction-to-nistir-7628.pdf http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol1.pdf http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol3.pdf).	CSWG
50	NIST FIPS 140-2 http://csrc.nist.gov/publications/fips/fips140-2/fips1402.pdf	U.S. government computer security standard used to accredit cryptographic modules.	Required for the federal government. As such it should be considered for use in the Smart Grid domain when such functionality is required.	CSWG
51	OASIS WS-Security and OASIS suite of security standards	Toolkit for building secure, distributed applications, applying a wide range of security technologies. The toolkit includes profiles for use of tokens applying SAML, Kerberos, X.509, Rights	Broadly used in eCommerce and eBusiness applications. Fine-grained security. WS-Security is part of an extended suite using SAML, XACML, and other fine-grained security standards. As such it should be considered for use in the Smart Grid domain when such	CSWG

		Expression Language, User Name, SOAP profiles for security, and others.	functionality is required.	
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Draft for Discussion

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