



NORTH AMERICAN ENERGY STANDARDS BOARD

801 Travis, Suite 1675 • Houston, Texas 77002 • Phone: (713) 356-0060 • Fax: (713) 356-0067
email: naesb@naesb.org • Web Site Address: www.naesb.org

September 29, 2020

RE: Release of the NAESB Digital Committee Inaugural Report

It is with great pleasure that we forward the Digital Committee report, approved unanimously by our Board of Directors on September 3, 2020. We view this document as a foundation upon which we can build other standards development, services and tools development efforts to support digital technologies. On a periodic basis, the Digital committee will reconvene to consider updates, relying upon industry research and continuing dialogs with subject matter experts.

The analysis presented in the report identifies, among other items, both cybersecurity efforts and distributed ledger technology (DLT) support as areas that should continue to receive our focus, and indeed it continues to do so. We have already developed both cybersecurity standards and DLT standards in our body of work products. NAESB is pioneering the first of its kind DLT test for the Electric and Natural Gas industry. Further, we are examining how best to expedite our processes for responding to requests to modify our cybersecurity standards. With the assistance of the U.S. Department of Energy, we have undergone a surety assessment, and are in the process of implementing several of the proposed recommendations.

As noted in the report, the committee recommends continued monitoring of areas that were identified as strongly relevant to the processes/transactions that our standards currently address or may address in the future. This recommendation serves as the basis for future work by the committee, and we look forward to building upon this report, by identifying related possible standards development. Accordingly, items recommended for continued NAESB attention were discussed by the Board's Strategy Committee and included in the 2020 NAESB Standards Development Survey, the results of which overwhelmingly confirmed continued attention.

During the drafting of the report and its assembly, the Coronavirus Disease 2019 (COVID-19) emerged, redefining "business as usual." The advent of the virus has impacted the energy industry and we are only beginning to understand its significance. A conclusion could be drawn that the urgency with which we review the need for standards, services and tools that enable the digital transformation has increased, as our market shifts to operate efficiently within the restrictions imposed by the virus.

The valuable input of NAESB staff, our members, our Advisory Council, several government agencies and other energy groups, without which this report could not have been prepared, is much appreciated. The wealth of information available on digitization can be daunting, but with the assistance of staff and committee members, we were able to include analyses prepared by other entities, thus improving and broadening the overall report. Many thanks go to all who provided their time and expertise. We know that we will count on them in the future as additional work is undertaken.

As you and/or your staff review the report, have any comments on the report or wish to contribute to future efforts, please do not hesitate to contact the NAESB Office. Input is always welcome.

With Best Regards,

Michael Desselle
Chairman, NAESB Board of Directors

Bruce Ellsworth
Chairman, NAESB Advisory Council



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

North American Energy Standards Board Digital Committee Inaugural Report

Adopted by the NAESB Board of Directors on September 3, 2020



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

NORTH AMERICAN ENERGY STANDARDS BOARD DIGITAL COMMITTEE REPORT TABLE OF CONTENTS			Page
I.	Executive Summary		3
II.	Background and Creation of the Committee		4
III.	Process Followed by the Committee		5
IV.	Goals of the Digital Committee		7
V.	Areas of Investigation		7
VI.	Additional Considerations		31
VII.	Possible Action for Board Consideration		32
VIII.	Conclusion		32
Appendices	A.	External Activities Reference Points	35
	B.	List of Committee Members and Participants	49
	C.	List of Meetings	51
	D.	Board Digital Committee Mission Statement	52
	E.	July Survey and Responses	53
	F.	October Survey and Responses	80
	G.	Board and Advisory Council Survey and Responses	96
	H.	Sandia Surety Assessment Work Papers	114



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

I. EXECUTIVE SUMMARY

The purpose of this report is to provide guidance to the NAESB Board of Directors concerning the “digital transformation” that is taking place within the energy industry. It describes the cursory findings and recommendations developed through a series of conference calls and surveys of the NAESB Board Digital Committee and Board of Directors and is intended to aid NAESB as it considers new standards activities to support digital technologies. With the support of the Board of Directors, the information contained herein will serve as a basis for further exploration by the committee of the identified seminal areas.

As described in recent years, a “digital transformation” is taking place within the energy, financial, manufacturing, and healthcare sectors across the world. These industries, and others, are taking advantage of the ever-increasing quantity and quality of data now accessible through new digital technologies that have lowered the cost of data collection, storage and processing and are enabling advanced analytics to drive better performance, increase productivity and support better strategic decision making. In response to these transformative technology advancements, governmental entities, research organizations and standards developers are evaluating impact of new digital technologies and how those technologies are being implemented within specific industries, including the energy sector.

At the request of the NAESB Board of Directors and through the process described in this report, the Board Digital Committee conducted an investigation and evaluation of a number of areas and technologies that are enabling digitalization, are enabled by digitalization or are impacting the digitalization of the energy industry. Based on this effort, the Digital Committee is making the following recommendations for consideration by the NAESB Board of Directors at this time:

- Continue standards development efforts in support of cybersecurity and distributed ledger technology.
- Monitor areas identified in the report that have been identified as strongly relevant to the processes/transactions that NAESB standards currently address or may address in the future.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

II. BACKGROUND AND CREATION OF THE COMMITTEE

During the December 2018 Board of Directors meeting, a recommendation was made that NAESB consider action to support the digital transformation taking place in the energy industry by focusing its standards development efforts in areas that will enable and hasten the implementation of new advances in digital technology. These advances are already increasing efficiencies in the markets, and through the development of supportive standards, there is potential to both accelerate the speed at which these beneficial technologies are adopted and to reduce the likelihood of developing solutions that must be retrofitted to support interoperability with other technologies. The Board of Directors also discussed the impact that new technologies may have on existing NAESB standards and recognized that shifts in technology, such as the utilization of distributed ledgers or the implementation of 5G networks, will likely alter the manner in which the transactions governed by NAESB standards take place.

In response to the request, the Chairman of the Board of Directors, Michael Desselle, informally contacted a number of subject matter experts to solicit their feedback on technology advances and the digitalization of the energy industry and requested that NAESB staff conduct research regarding other similarly situated organizations' activities in the area of digital technology. Through these discussions and research, it was discovered that global investment in digital technologies by energy companies has risen over 20% annually since 2014, and that in 2016, it was estimated that \$47 billion USD was invested in digital electricity infrastructure alone. This digital investment in 2016 was almost 40% higher than investment in gas-fired power generation worldwide (\$34 billion USD).¹ It was also discovered that other standards development organizations, such as the International Organization for Standardization, IEEE, SAE International and ANSI, have followed the recommendations contained in the 2017 G20 Report concerning the role of standards in the "digital transformation" as well as created groups within their organizations and/or held targeted meetings that focus specifically on exploring how new digital technology is transforming their industry sectors.² In recognition of this information, Mr. Desselle established the NAESB Board Digital Committee and announced its formation during the April 2019 Board of Directors meeting.³

As described in the Board Digital Committee's Mission Statement (Appendix D), the committee is tasked with providing assistance to the Board of Directors by (a) annually surveying the energy markets to identify new digital technologies being deployed by market participants, (b) appraising whether standardization in support of the new digital technologies would be beneficial to the industry, and (c) submitting any recommendations concerning potential standards to the organization for consideration. The committee is comprised of sixteen named members from the

¹ International Energy Agency - Digitalization and Energy 2017:

<https://www.iea.org/publications/freepublications/publication/DigitalizationandEnergy3.pdf>

² G20 Report - Key Issues for Digital Transformation in the G20: <https://www.oecd.org/g20/key-issues-for-digital-transformation-in-the-g20.pdf>

³ Letter from M. Desselle Concerning a NAESB Board Digital Committee:
<https://www.naesb.org/pdf4/bd041119w1.docx>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

NAESB Board of Directors and NAESB Advisory Council that represent a balance of interests across the energy markets, and possess specific knowledge about digital technologies, technology standards and industry investment.

Board Digital Committee – Named Board Members

Name	Organization
Dick Brooks	Reliable Energy Analytics
Jim Buccigross	8760, Inc.
J. Cade Burks	Big Data Energy Services
Valerie Crockett	Tennessee Valley Authority
Michael Desselle	Southwest Power Pool
Howard Gugel	North American Electric Reliability Corporation
Steven McCord	TransCanada Pipelines Limited
Annie McIntyre	Ardua Strategies Inc.
Joelle Ogg	DC Energy
Randy Parker	Exxon Mobil Corporation
Emil Pena	EPII
Timothy Simon	TAS Strategies
Leigh Spangler	Latitude Technologies LLC
Terence (Terry) Thorn	JKM Energy & Environmental Consulting
Sue Tierney	Analysis Group, Inc.
Pat Wood III	Wood3 Resources

As with other NAESB board committees, the Board Digital Committee serves at the pleasure of the NAESB Board of Directors and makes decisions and offers recommendations determined to be in the best interest of the organization as a whole. In addition to the charge provided by the Board and described in the committee's Mission Statement, the committee agreed that it should not recommend actions that would be duplicative of other efforts already underway in the industry and that recommendations for board consideration, possibly leading to action by NAESB, should only be offered if they are perceived as having a high degree of success and could provide long term benefits. It was also agreed that recommendations for standards development to support a technology include a specific business purpose.

III. PROCESS FOLLOWED BY THE COMMITTEE

Since its formation in April, the Board Digital Committee held six conference calls taking place in May, June, July, August and October 2019 and February 2020 (Appendix C). As with all NAESB meetings, the conference calls were open for participation by all interested parties, and the agendas, work papers and meeting notes have been made available on the NAESB website (https://naesb.org/board_digital.asp). Through discussion, the committee agreed to develop a report to respond to the charge of the Board of Directors, in a similar format to other board committee reports, that identifies and provides information on specific areas of technology being widely deployed in the gas and



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

electric markets. To initiate the development of the report, committee members were asked to identify digital technologies or areas related to digital technology that should be explored by the committee and could ultimately lead to recommendations for consideration by the Board of Directors. Specifically, the following areas or technologies were identified:

Areas/Technologies Identified for Investigation

- | | |
|--------------------------------------|--|
| 1 Distributed ledger technology | 7 Data governance requirements |
| 2 Cybersecurity | 8 Distributed energy resources |
| 3 Cloud computing | 9 Renewable energy certificate/credit tracking |
| 4 Deployable shareware | 10 Internet of Things |
| 5 5G technologies and implementation | 11 Data analytics |
| 6 Energy usage data | |

Over the course of four subsequent conference calls, the committee discussed each of the eleven areas/technologies identified, how they could be categorized for evaluation, and which areas/technologies would benefit the most from standardization. Discussions also focused on the efforts of other standards development organizations, consortiums and governmental bodies engaged in support of the areas/technologies identified, including the National Institute of Standards and Technology, the Department of Energy, IEEE, the International Organization of Standards and the North American Electric Reliability Corporation (NERC). It was agreed that future coordination with these groups may be necessary, depending on the actions taken by the Board of Directors.

In addition to holding conference calls, the committee also developed and issued three surveys to garner more targeted input from the committee members, the NAESB Board of Directors and the NAESB Advisory Council. The first survey solicited information from the members concerning how their individual companies view the areas/technologies identified by the committee, the costs and benefits of their adoption and implementation, any specific use cases related to the areas/technologies that could benefit from standards development, and the identification of any relevant activities or standards development by other organizations. The second survey asked respondents to provide information concerning the relevancy of the areas/technologies to the processes and transactions that the NAESB standards address now or may in the future and the urgency of developing NAESB standards to support the area/technology. The third survey posed the same questions as the second survey and was distributed to all NAESB Board and Advisory Council members to receive input from a wider audience.

The information captured through the surveys and meetings form the basis for this report and the recommendations to the Board of Directors made herein. With the exception of deployable shareware, each area/technology contained in the table above has been included in this report and is accompanied by a recommendation of the committee included in Section V. The recommendations vary from simply continuing to monitor a certain area/technology to initiating or continuing standards development to support an area/technology. A number of recommendations will require follow-



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

up by the committee, and it is the desire of the committee to continue its efforts to further explore the areas/technologies identified in this report consistent with the recommendations included below.

IV. GOALS OF THE DIGITAL COMMITTEE

The NAESB Board Digital Committee has identified the following goals it intends to meet through the authority and powers granted by the Board of Directors as described in the committee's Mission Statement:

1. Inform the Board of Directors of industry activities pertaining to the application of digitalization methods, tools and techniques that would support the development of business practices
2. Provide analysis and recommendations for consideration by the Board of Directors on a periodic basis consistent with the strategic goals of the organization related to standards, certification, tool management and coordination⁴
3. Respond to requests of the Board of Directors regarding digitalization of the energy industry

V. AREAS OF INVESTIGATION

As noted above, the committee undertook efforts to categorize the identified areas/technologies to provide some context for their review and evaluation. This categorization took two forms. First, the committee determined if (1) it is an area/technology that is *enabled by* digitalization, (2) it is an area/technology that *enables* digitalization, or (3) it is an area/technology that *impacts or will be impacted by* digitalization. As we noted above, this exercise was not just a review of new and advancing technologies but rather a holistic evaluation of how digitalization may impact the energy sector in the context of NAESB standards development. The committee also categorized the areas/technology as emerging, established, data specific, and/or high interest/high value. The identified areas/technologies captured by this report are not intended to be an exhaustive listing of the areas/technologies related to digitalization that are being considered by the energy sector, but it is intended serve as a "snapshot" of current activities and a foundation for future evaluation. Moving forward, with Board support, the committee will continue to review additional areas/technologies as well as monitor and explore the identified areas/technologies to ensure that NAESB remains informed and relevant in digitalization discussions.

1. Areas/Technologies Enabled by Digitalization

Distributed Ledger Technology

Background: Distributed ledger technology allows trading parties to execute automated processes using a secured shared ledger. The shared or distributed ledger created through the technology serves as a digital record of transactions

⁴ NAESB Strategic Plan 2019-2021: http://www.naesb.org/pdf4/naesb_strategic_plan_2019_2021.pdf



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

that can be used for tracking commodities. Transactions are often recorded onto a distributed ledger through the use of a “smart contract,” which is a trackable software technology designed to represent and execute the terms of a contract, automatically executing transactions under a set of specific circumstances without the use of manual intervention, reconciliations, or a third-party agent. The data included in a “smart contract” is encrypted into a block, which generates a unique identifier that is used to verify the next block, creating a chain of blocks – one block verifying the next to ensure integrity, security, and provenance of the distributed ledger. The distributed ledgers created using this technology can be open and public or private and permissioned, the latter of which limits access and participation to specific authorized parties. This technology is currently being adopted in many industries throughout the world for the efficiency and security it provides when conducting transactions.

Since February 2018, when the NAESB Advisory Council recommended that NAESB consider standards development to support blockchain, or more specifically, distributed ledger technology, the membership has been engaged in evaluating the technology and its applicability and use for transactions in the energy industry. As a result of a subsequent standards request and additions to the annual plans, NAESB is currently undertaking standards development efforts to support this technology in the wholesale and retail electric and gas markets. At the time of this report, the NAESB Wholesale Gas Quadrant (WQG) is working to conclude its efforts to develop a standard to support conversion of the NAESB Base Contract for Sale and Purchase of Natural Gas into a digital “smart” contract that can be used with distributed ledger technology, and the NAESB Wholesale Electric Quadrant (WEQ) and Retail Market Quadrants (RMQ) are jointly addressing an annual plan item to develop a standard contract to improve and automate the current voluntary Renewable Energy Certificate (REC) processes. These model contracts may also be converted for use with distributed ledgers. Additionally, the NAESB WEQ has a second annual plan item slated for 2020 to consider standards development related to distributed ledger technology that will support the accounting close cycle for power trading. With these activities already underway within NAESB, the Digital Committee focused on exploring additional use cases or business cases for the technology that could be supported through standards development in other areas. The committee also discussed recommendations for how NAESB resources should be dedicated to the development of standards to support the technology and the priority that should be given to current and new efforts.

Evaluation: The committee identified distributed ledger technology as an emerging high interest and high value area for standards development within NAESB. Overall, the committee members agreed that, while caution should be used with immature and developing technologies, it is important that NAESB remain active in the development of supportive standards and continue involvement as the energy industry continues to adopt applications for the technology. Many potential benefits of the technology were identified by the committee, including improved cybersecurity, increased transparency and efficiency and a reduction in the operational and administrative costs of supporting transactional processes. As noted, caution was also expressed about developing standards for a technology that is still evolving in an area where there may be unsettled legal and regulatory ground. Parallels were drawn by the committee between the adoption and implementation of electronic data interchange transactions in the energy industry

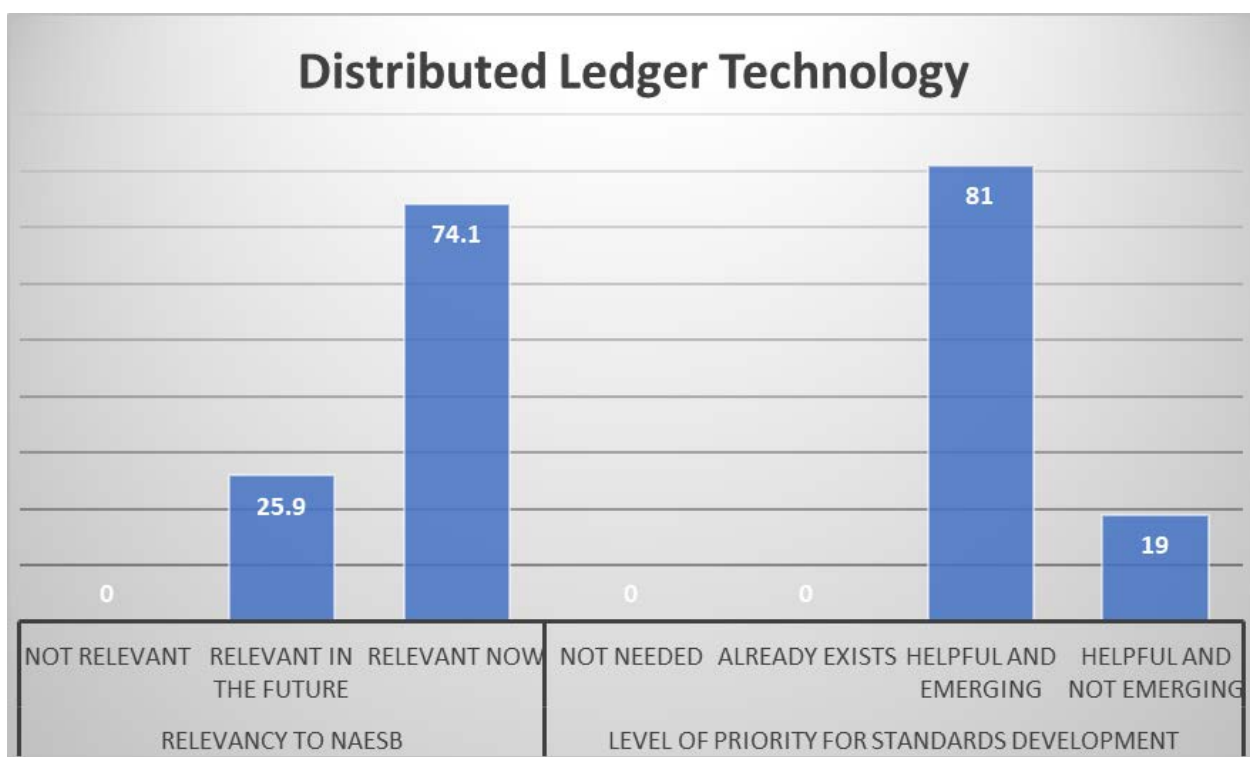


North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

with the emergence of Gas Industry Standards Board standards in 1996, and the essential nature of technical standards to support that transition was recognized. There was also recognition that standards are emerging in other markets, including the financial sector, and that the energy industry would benefit from defining how the technology is standardized for its unique transactions. A number of generalized potential use cases for the technology were provided beyond those being addressed through the current standards development; however, focus was given to decentralized generation and grid management applications and/or distributed energy resources.

Relevancy and Urgency: Distributed ledger technology received strong support as an area being relevant to the processes and transactions that the NAESB standards currently address and as an area where NAESB standards would be helpful and are emerging for the industry.



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following actions related to distributed ledger technology.

- NAESB should continue to focus its resources on developing standards that support distributed ledger technology.
- NAESB should explore the potential for the development of standards that support the use of distributed ledger technology for transactions related to distributed energy resources. This should be an area included on the 2020 NAESB Standards Development Survey.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

- NAESB should continue to monitor emerging standards development efforts within the energy industry to ensure that NAESB does not undertake duplicative efforts of other organizations and coordinates its standards development where appropriate.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DISTRIBUTED LEDGER TECHNOLOGY⁵

Organization	Identified Standard, Activity or Documentation
The Enterprise Ethereum Alliance (EEA)	Client Specification (Version 4), Off-Chain Trusted Compute Specification (Version 1.1), Architecture Stack
The Linux Foundation	Hyperledger Greenhouse (list of frameworks and tools hosted by Hyperledger)
National Institute of Standards and Technology (NIST)	NISTIR 8202 Blockchain Technology Overview Report, Blockchain for Industrial Applications Community of Interest, Enhanced Distributed Ledger Technology
American National Standards Institute (ANSI)	Blockchain & Standards Presentation (2017), Blockchain in Smart Mobility Presentation (2018), The Role of Smart Contracts in Smart Production Presentation (2018)
International Organization for Standards (ISO)	ISO/TC 307 Committee – Blockchain and Distributed Ledger Technologies:
World Wide Web Consortium	
Internet Research Task Force	
International Telecommunications Union	Focus Group on Application of Distributed Ledger Technology
Energy Blockchain Consortium	Developing Open Energy Blockchain Framework to include data and interoperability standards, reference architecture, and implementation blueprint
Energy Web Foundation (EWF)	Developed enterprise-grade blockchain platform (Energy Web Chain) tailored to regulatory, operational, and market needs
Electric Power Research Institute (EPRI)	Blockchain: Technology Risk and Rewards for Utilities Report
New York Utilities Group	Avangrid, Consolidated Edison, New York Power Authority, and National Grid collaborating to study the potential for blockchain in NY power system
OASIS Key Management Interoperability Protocol (KMIP)	Unbound and OASIS KMIP Interoperability Presentation
IEEE	IEEE P2418.5 Blockchain in Energy Working Group
Commodity Futures Trading Commission	LabCFTC Primer on Smart Contracts
Value Technology Foundation	

Internet of Things

⁵ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

Background: The Internet of Things (IoT) is a concept of connected electronic devices or their components to each other and the Internet, which, in the energy industry, can provide efficiency, lead to easier data sharing, and revamp how operations occur. Gartner has reported that by 2020 there will be over 26 billion connected devices and that 30% of energy management systems will leverage IoT platforms, also by next year. This is consistent with a 2018 Gartner study that found that data analytics, artificial intelligence, and the IoT rank at the top of game-changing technology areas for utility businesses and that a significant proportion of digital initiatives in utilities have shifted from the initiation phase to the scaling phases. With worldwide energy consumption expected to grow by over 40% in the next 25 years, the demand for smart and efficient energy systems, including IoT applications for grid modernization programs and other energy services, will also grow. Examples include the use of IoT technology to support the management of wind farms through operational control of individual turbines, monitoring systems for gas pipeline maintenance, and ensuring compliance with emissions and waste regulations.

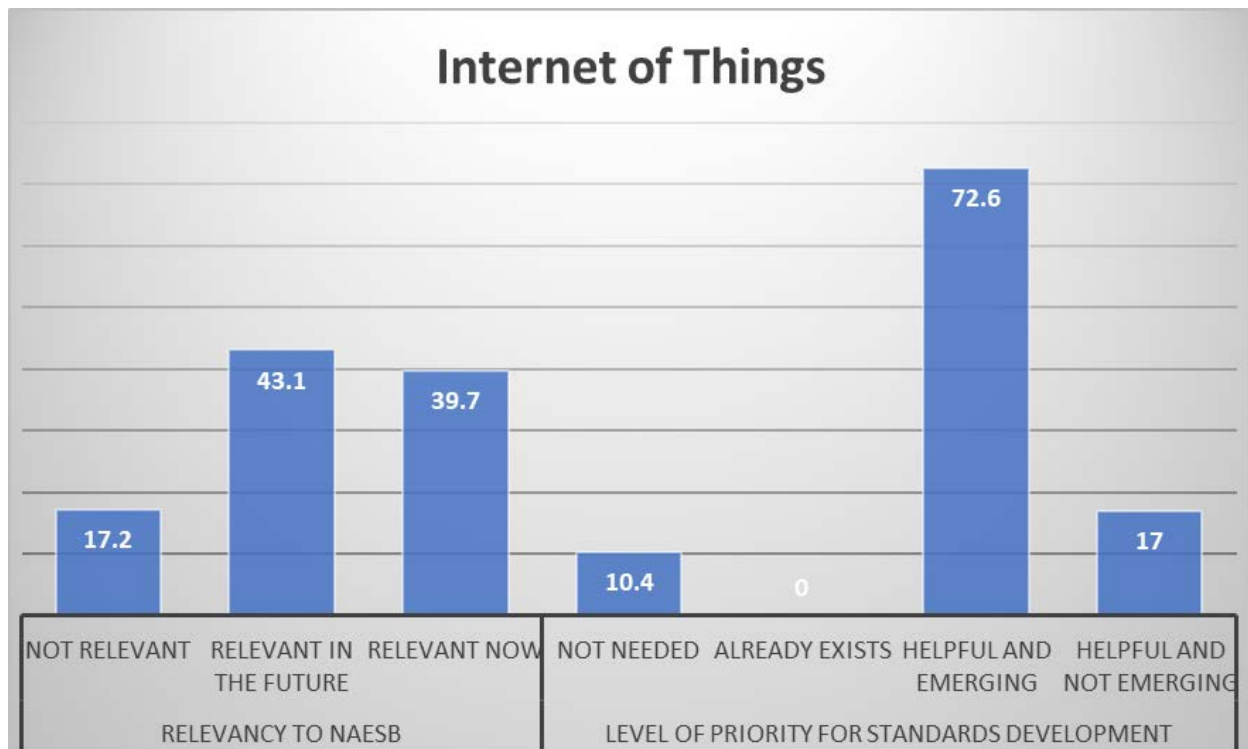
Evaluation: The committee identified IoT as an emerging high interest and high value area for standards development that could be appropriate for NAESB in specific circumstances. The committee recognized that the inherent data sharing and connectivity that accompanies the adoption of IoT technologies will drive the need for new standards that support both privacy and cybersecurity, especially when used within operational or control environments (including SCADA systems). The benefits of industry adoption of IoT technology identified by the committee included asset optimization, better decision-making capabilities resulting from enhanced situational awareness, cost savings and efficiency; however, it was recognized that increased connectivity presents broader exposure to cybersecurity threats and that the integration of IoT technology will require significant investment in security and asset management hygiene. The committee also noted that IoT elements need to be considered as part of a larger system that includes business processes, software and information flows and should be implemented with a system-level aggregate view that is interoperable with other systems in the operating environment. The committee identified several use cases for the technology focused mostly on maintenance and operations/situational awareness. One specific use case provided was utilization of the technology for monitoring and sensing distributed energy resources on the grid. The committee recognized that many of the existing NAESB standards, while not directly identified as IoT standards, support or enable the application of the technology. Specifically, the NAESB Open Field Message Bus Model Business Practices, the NAESB Energy Services Provider Interface Model Business Practices, the NAESB Third Party Access to Smart Meter-based Information Model Business Practices, and the Model Business Practices and Business Practice Standards adopted to support the Energy Independence and Security Act of 2007. The committee discussed that there are many existing standards in the area that have already been developed, or are in development, to support the energy industry and that many of the use cases identified by the committee have been adequately addressed with requisite standards. It was also noted that NAESB standards are focused on commercial transactions and that any standards development to support IoT technology undertaken by the organization should thus focus on commercial applications in the energy supply chain.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

Relevancy and Urgency: IoT technology received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to IoT.

- NAESB should explore the potential for the development standards that support commercial applications related to IoT technology. This should be an area included on the 2020 NAESB Standards Development Survey.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO INTERNET OF THINGS (IoT)⁶

Organization	Identified Standard, Activity or Documentation
North American Energy Standards Board (NAESB)	RMQ Applicable Standards – Specifications for Common Electricity Product and Pricing Definition, Specifications for Common Schedule Communication Mechanism for Energy Transactions, Specifications for Retail Standard Demand Response Signals, Retail Customer Energy Usage Information Communication, Smart Grid Standards Data Elements, Energy Services Provider Interface, Third Party Access to Smart Meter-based Information, Open Field Message Bus

⁶The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO INTERNET OF THINGS (IoT)⁶

Organization	Identified Standard, Activity or Documentation
	WEQ Applicable Standards – Specifications for Common Electricity Product and Pricing Definition, Specifications for Common Schedule Communication Mechanism for Energy Transactions, Specifications for Wholesale Standard Demand Response Signals, Customer Energy Usage Information, Smart Grid Standards Data Elements Table
National Institute of Standards and Technology (NIST)	Considerations for Managing Internet of Things Cybersecurity and Privacy Risks (NISTIR 8228), Core Cybersecurity Feature Baseline for Securable IoT Devices (Draft NISTIR 8259)
National Renewable Energy Laboratory (NREL)	
Department of Homeland Security (DHS)	Continuous Diagnostics and Mitigation (CDM) (requirements for full lifecycle asset management), 5G, Internet of Things (IoT) and Smart Cities, Internet of Things Fact Sheet, Strategic Principles for Securing the Internet of Things
Federal Energy Regulatory Commission (FERC)	2018 Reliability Technical Conference, Transcript, 2019 Reliability Technical Conference Regarding the Bulk-Power System
North American Electric Reliability Corporation (NERC)	Statement from James R. Robb on FERC/DOE Security Investments for Energy Infrastructure Technical Conference
Internet Engineering Task Force (IETF)	IoT Directorate, Thing-to-Thing Research Group, Trusted Execution Environment Provisioning (TEEP) Working Group, Internet Research Task Force, IoT: Standards and Guidance from the IETF
Institute of Electrical and Electronics Engineers (IEEE)	IEEE IoT Journal, IEEE IoT Related Standards, IEEE IoT Related Standards in Development, Building Code for the Internet of Things, IEEE 2030.5-2018 IEEE Standard for Smart Energy Profile Application Protocol
International Organization of Standards (ISO)	ISO/IEC JTC 1/SC 41 (IoT and Related Technologies Committee) Standards Under Development: Trustworthiness Framework, Requirements of IoT Data Exchange Platforms, Compatibility Requirements and Model for Devices within Industrial IoT Systems, Real-time IoT Framework
Internet of Things Consortium (IoTC)	
Industrial Internet Consortium (IIC)	Industrial Internet Reference Architecture, Industrial Internet Vocabulary Technical Report, Industrial IoT Analytics Framework, Industrial Internet Security Framework Technical Document, IoT Security Maturity Model: Practitioners Guide
Open Connectivity Foundation (OCF)	International Standards Developed/Under Development, Core Specification, Core Optional Framework, Security Specification, Bridging Specification, Resource Type Specification, Device Specification, Wi-Fi Easy Set Up Specification
3 rd Generation Partnership Project (3GPP)	Partnership of telecommunication standards development organizations to support 3GPP technologies
SRI International	Internet of Things (IoT) Security and Privacy Center



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

[Improved] Data Analytics

Background: Improved data analytics and the increased integration of big data applications are anticipated as the availability and volume of data continues to expand due the inevitable implementation of 5G networks. These networks will provide connectivity designed to operate within the IoT framework and will facilitate faster decisions, transactions, and visibility (particularly by the executive suite) into operational details. It will also provide descriptive and predictive reporting aids in many business functions ranging from risk management to market performance. Additionally, the back-office applications are expected to support machine learning technologies and artificial intelligences technologies that will provide faster and more accurate analysis of the information available.

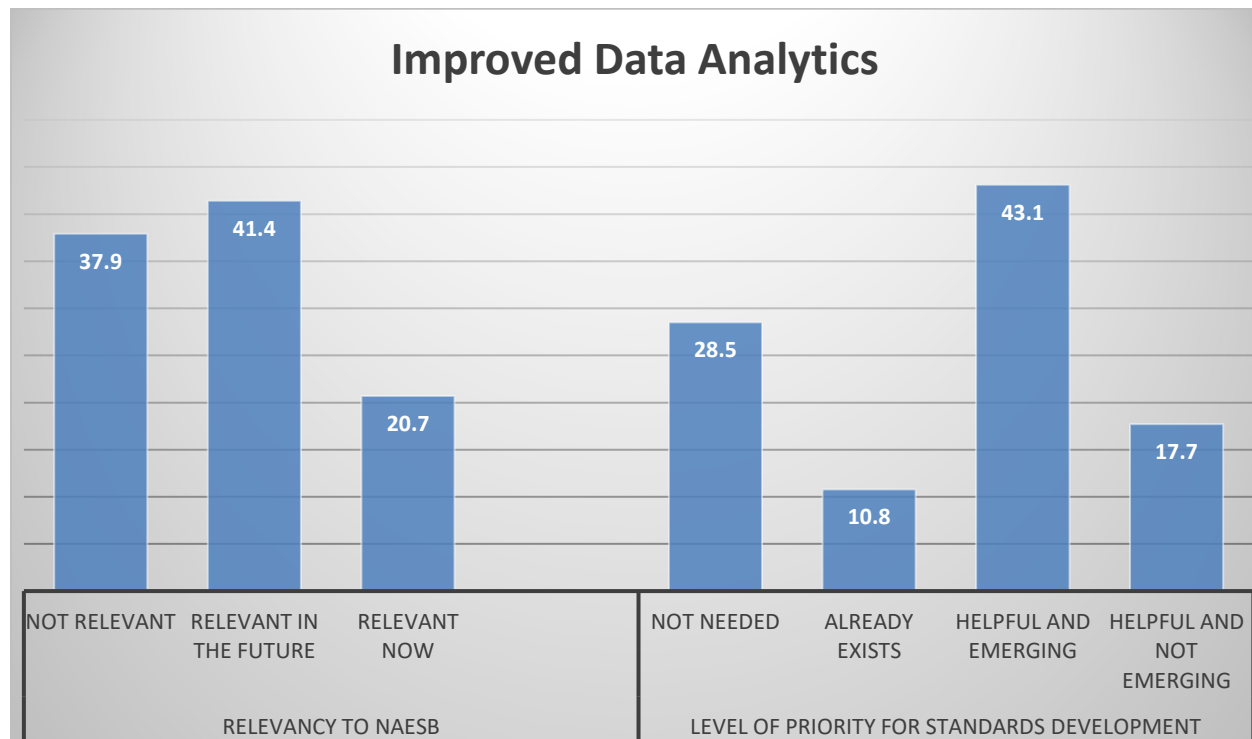
Evaluation: The committee categorized improved data analytics as an area that is being enabled by the digitalization of the energy industry. Data is becoming the highest value asset in operations and, of the areas identified by the committee, standards development in this area may be the most impactful. The services market for data analytics is the fastest growing in the industry and represents the largest portion of digitalization investments. Some of the benefits identified by the committee included, improved grid reliability/predictability, asset optimization, improved trade performance, increased efficiency, and better modeling. While the benefits of improving data analysis were easily identifiable, concerns related to the cost of enhanced computing infrastructures, storage and subject matter expertise were expressed by the committee; however, the number of data analytics use cases described by the committee members were far greater than other areas investigated and were extremely wide ranging, from pipeline flow dynamics and natural gas storage optimization to financial risk management and trading strategies. The committee did not identify a specific use case or business case that should be forwarded to the board for standards development consideration in this area, but the committee supports continuing discussions on how NAESB can support maintaining data integrity, privacy and meeting governance goals.

Relevancy and Urgency: [Improved] data analytics received support as an area that is relevant to the processes and transactions that the NAESB standards will address in the future. It also received support as an area where NAESB standards would be helpful and are emerging for the industry; however, roughly, a third of respondents indicated that the area is not relevant to NAESB and that NAESB standards in the area are not needed.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to [Improved] Data Analytics.

- The NAESB Board Digital Committee should continue discussions on how to support data analytics and review any use cases brought forward by committee participants for evaluation.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DATA ANALYTICS⁷

Organization	Identified Standard, Activity or Documentation
U.S. Department of Energy	Smart Energy Analytics Campaign
Energy Sector Management Assistance Program	Energy Analytics for Development – Big Data for Energy Access, Energy Efficiency, and Renewable Energy

Renewable Energy Certificate Tracking/Accounting Technology

Background: A renewable energy certificate (REC) is a market-based instrument that represents the property rights to the environmental, social, and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour of electricity is generated and delivered to the electricity grid from a renewable energy resource and may include many data attributes. Because the physical electricity we receive through the utility grid says nothing of its origin or how it was generated, RECs play an important role in accounting, tracking, and assigning ownership

⁷ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

to renewable electricity generation and use. On a shared grid, whether from on-site or off-site resources, RECs are the instrument that electricity consumers must use to substantiate renewable electricity use claims. There are three common types of REC tracking systems in use in the energy industry today, (1) certificate-based tracking, (2) third-party verification and (3) contract-path tracking. Certificate-based systems are common in the wholesale market and vary by region. They are also often used by regulators for state renewable portfolio standards compliance while third-party verification systems are used in the retail markets by green power customers that generally do not hold accounts on certificate-based systems. With appropriate technology standards, there may be an opportunity to bridge the wholesale and retail markets, helping to ensure REC authenticity and eliminate current duplicity concerns.

As noted in the distributed ledger technology section, the NAESB WEQ and RMQ are currently working jointly on first steps that may lead to a technology standard that could improve and automate the current voluntary REC processes. The WEQ and RMQ have agreed to first consider the development of a standardized NAESB REC contract, beginning with the voluntary REC market, and then investigate how technologies, such as distributed ledger technology, could support the efficiency and accuracy in the existing REC markets. As annual plan items were included on the 2019 quadrant annual plans to consider how technology could support the REC market, the Digital Committee focused discussions on these activities, noting the opportunities they may present.

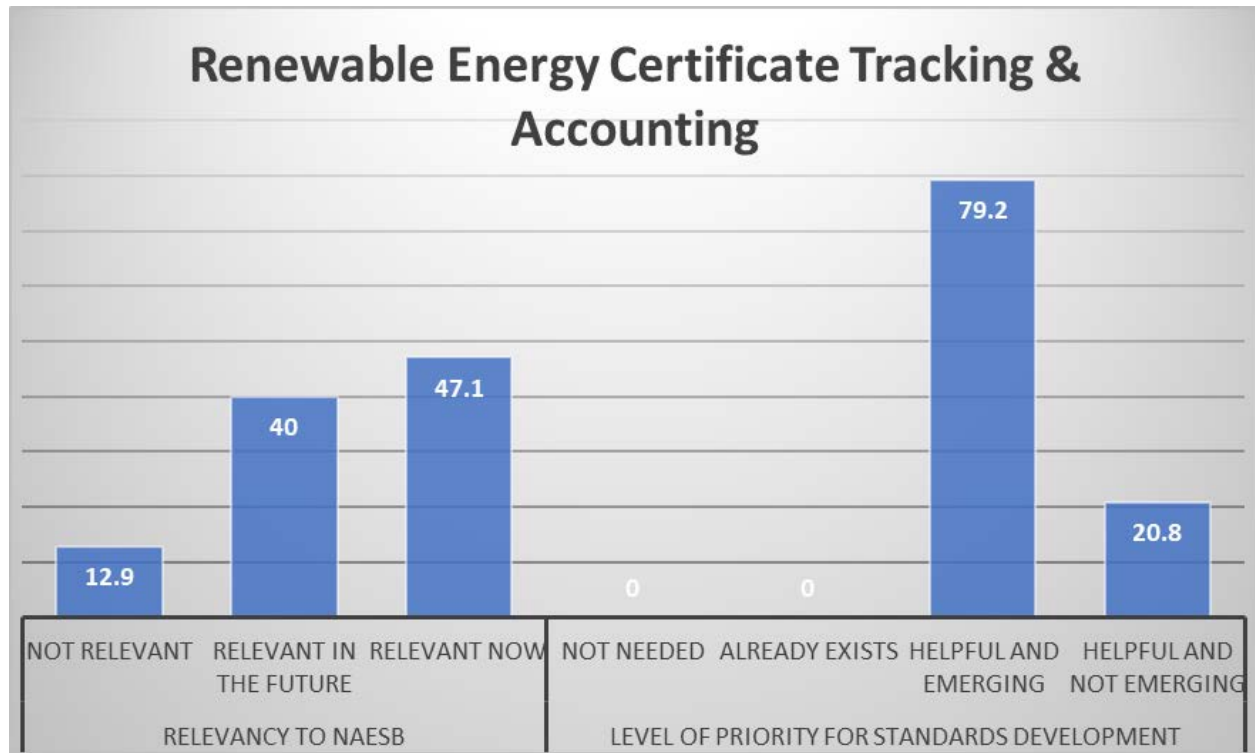
Evaluation: The committee categorized improved REC tracking and accounting technology as an area where standards and research currently exist but may benefit from new use case specific standards development in areas where standards are not in place. In addition to the WEQ and RMQ annual plan items to consider distributed ledger technology standards to support REC processes, the committee noted that alternative standards to support data integrity, the reliability of the existing tracking mechanisms, and auditing may be beneficial. Specific use cases were not identified but the committee supports continued investigation into the area and monitoring of the efforts to develop a standardized NAESB REC contract for potential use with distributed ledger technology.

Relevancy and Urgency: REC tracking and accounting technology received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to.

- The NAESB Board Digital Committee should continue monitoring the development of the NAESB REC contract and continue discussions concerning potential standards that support data integrity, the reliability of the existing tracking mechanisms and the auditing of RECs.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO REC TRACKING AND ACCOUNTING TECHNOLOGY⁸

Organization	Identified Standard, Activity or Documentation
National Renewable Energy Laboratory (NREL)	REC Tracking Systems: Costs & Verification Issues Presentation, Voluntary Green Power Procurement, Status and Trends in the U.S. Voluntary Green Power Market
Green-e	Green-e Energy Program

⁸ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

Distributed Energy Resource Communication Protocols

Background: A Distributed Energy Resource (DER) is any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System. DER includes any non-BES resource (e.g. generating unit, multiple generating units at a single location, energy storage facility, micro-grid, etc.) located solely within the boundary of any distribution utility or distribution provider. As states, for example California, create action plans for DER integration and are adopting technical standards (IEEE 2030.5 & IEEE 1547-2018) to support that integration, the need for business practices standards or communication protocols may arise to ease interoperability between DERs and the grid.

Evaluation: The committee categorized DER communication protocols as an area where research and some technical standards exist but transactional standards are lacking. The NAESB Board of Directors has contemplated standards development in the area for many years but has not moved forward with any specific efforts. In the 2018 NAESB Standards Development Survey, distributed generation garnered the third highest strongly agree and agree responses as an area where NAESB should consider standards development within the next 18 to 24 months.⁹ Committee feedback concerning the need for consensus on a valid protocol was consistent with these results. The informational needs of grid operators concerning aggregation of loads and available distributed resources to support grid reliability will likely be met through NERC standards, but there are also market benefits that may be achieved by standardizing protocols for commercial purposes. While the use cases identified by the committee relate to operations control and reliability, it was noted that there may be an opportunity to develop standards that support performance tracking or reporting.

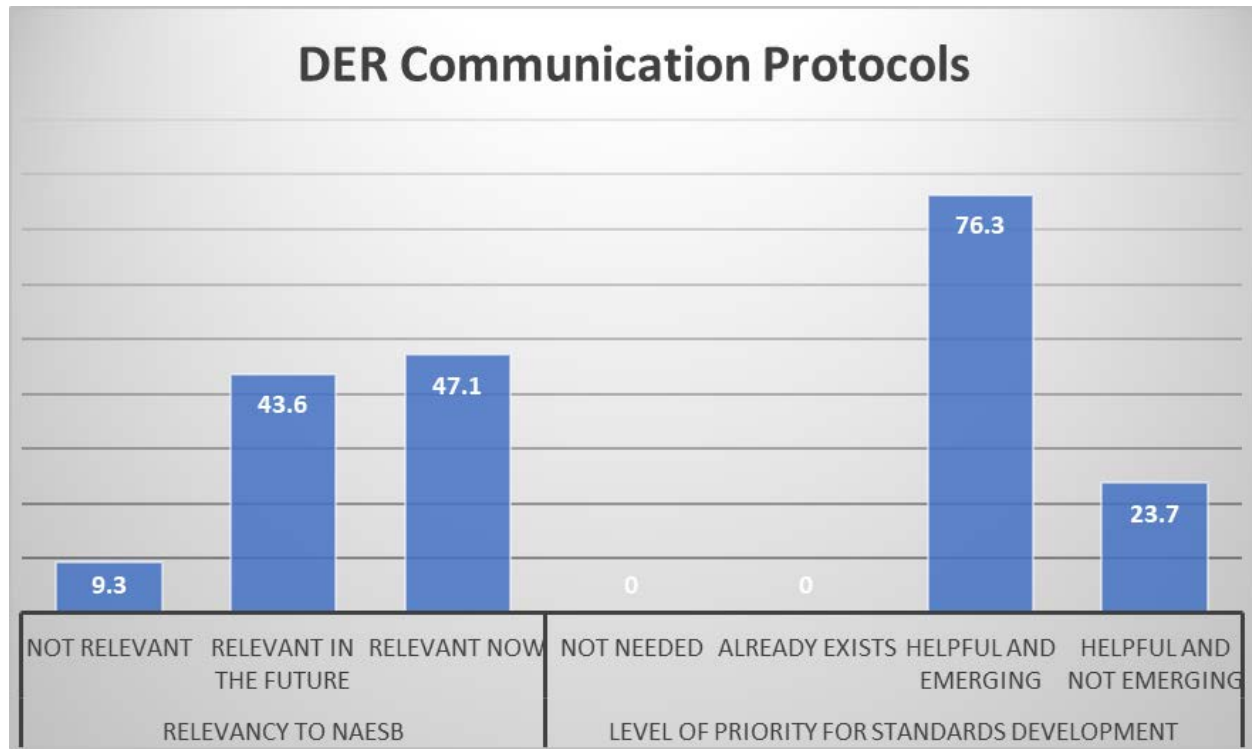
Relevancy and Urgency: DER communication protocols received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as a technology area where NAESB standards would be helpful and are currently emerging for the industry.

⁹ 2018 NAESB Standards Development Survey Results: https://naesb.org/pdf4/bd_strategic_081718a1.docx



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to DER Communication Protocols.

- NAESB should explore the potential for the development of standards that support the commercial functions related to DER. This should be an area included on the 2020 NAESB Standards Development Survey and a request for relevant use cases should be made.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DER RESOURCE COMMUNICATION PROTOCOLS¹⁰

Organization	Identified Standard, Activity or Documentation
California PUC	California PUC CA Rule 21 Resolution E-5000, Smart Inverter Working Group, DER Action Plan
Institute of Electrical and Electronics Engineers (IEEE)	IEEE 2030.5-2018 – IEEE Standard for Smart Energy Profile Application Protocol, IEEE 1547-2018 – IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

¹⁰ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

Energy Usage Data

Background: Accessible energy usage data provides efficiency and cost savings to utilities, end users and consumers by enabling better management of energy usage in homes, buildings and communities. For utilities, the aggregated data can be used for resource planning and forecasting at a distribution level, while end users, including commercial and industrial facilities, can make better-informed decisions about their energy consumption. NAESB's involvement in developing standards to support energy usage data technology began in 2010 when NAESB was asked to develop an information model to standardize energy usage information as part of the National Institute of Standards and Technology effort to respond to the Energy Independence and Security Act of 2007. This was followed by a standards development request supported by the Department of Energy and the White House Office of Science and Technology Policy to standardize the mechanism by which detailed customer energy usage information could be made available for download in a simple, common format. NAESB responded by developing the Energy Services Provider Interface model business practices which now serve as a basis for the White House's Green Button Initiative. The Green Button Initiative has led to over 150 utilities and service providers committing to provide more than 60 million U.S. households, altogether 100 million people, with access to their Green Button energy data.

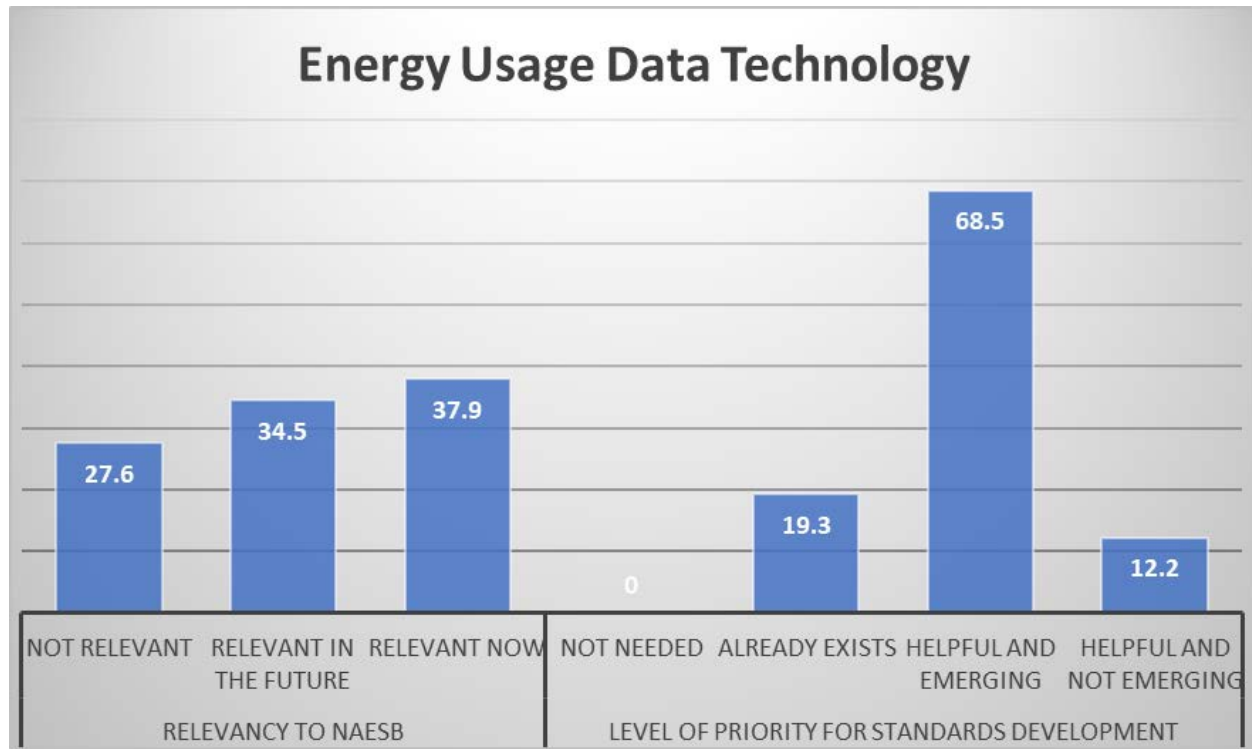
Evaluation: The committee categorized technology standards to support energy usage data as a high interest and high value area for standards development area within NAESB. Beyond the work already undertaken by NAESB in the area, the committee identified potential standards development related to data privacy, data management and data transit as very impactful to the industry. The committee discussed the existing Third-Party Access to Smart Meter-based Information model business practices and potential use cases that extend beyond the data privacy standards for meter data contained therein. Specifically, the development of standards to support operational models used in forecasting DER, demand side management and demand response.

Relevancy and Urgency: Technology to support energy usage data received support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future; however, a third of the respondents stated that the area is not relevant to NAESB. The item was also identified as an area where NAESB standards would be helpful and are emerging for the industry.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to energy usage data standards development.

- NAESB should explore the potential for the development of additional standards that support the technologies related to energy usage data.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DIGITAL APPLICATIONS OF ENERGY USAGE DATA¹¹

Organization	Identified Standard, Activity or Documentation
North American Energy Standards Board (NAESB)	RMQ Applicable Standards <ol style="list-style-type: none"> 1. Energy Service Provider Interface 2. Retail Customer Energy Usage Information Communication 3. Third Party Access to Smart Meter-based Information WEQ Applicable Standards <ol style="list-style-type: none"> 1. Customer Energy Usage Information Communication
Green Button Alliance	Green Button Initiative
American Council for an Energy Efficient Economy (ACEEE)	Improving Access to Energy Usage Data Toolkit Best Practices for Working with Utilities to Improve Access to Energy Usage Data

¹¹ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DIGITAL APPLICATIONS OF ENERGY USAGE DATA¹¹

Organization	Identified Standard, Activity or Documentation
Environmental Protection Agency (EPA)	Utility Best Practices Guidance for Providing Business Customers with Energy Use and Cost Data

2. Areas/Technologies that Enable Digitalization

5G

Background: 5G networks are the next generation of mobile internet connectivity, offering faster speeds, more reliable connections, and providing the infrastructure needed to carry huge amounts of data. Technologies for 5G and future generations of connectivity will provide higher bandwidth and lower latency than 4G networks as well as provide connectivity to billions of devices. 5G networks are needed to realize the benefits of IoT and support improved data analytics but come with physical implementation challenges and required operational changes. While issues facing the industry concerning spectrum/bandwidth limits and increased energy consumption need to be resolved, the Utilities Technology Council has stated that utilities are the prime targets for 5G applications. This is due to the increasing number of requirements for monitoring and control driven by regulatory and commercial pressures. For utilities alone, 5G can support the digitization of many aspects of utility field work, which would lower costs, improve efficiency of operations and support improved worker safety. In time, 5G networks could support real-time operations for the integration of DER.

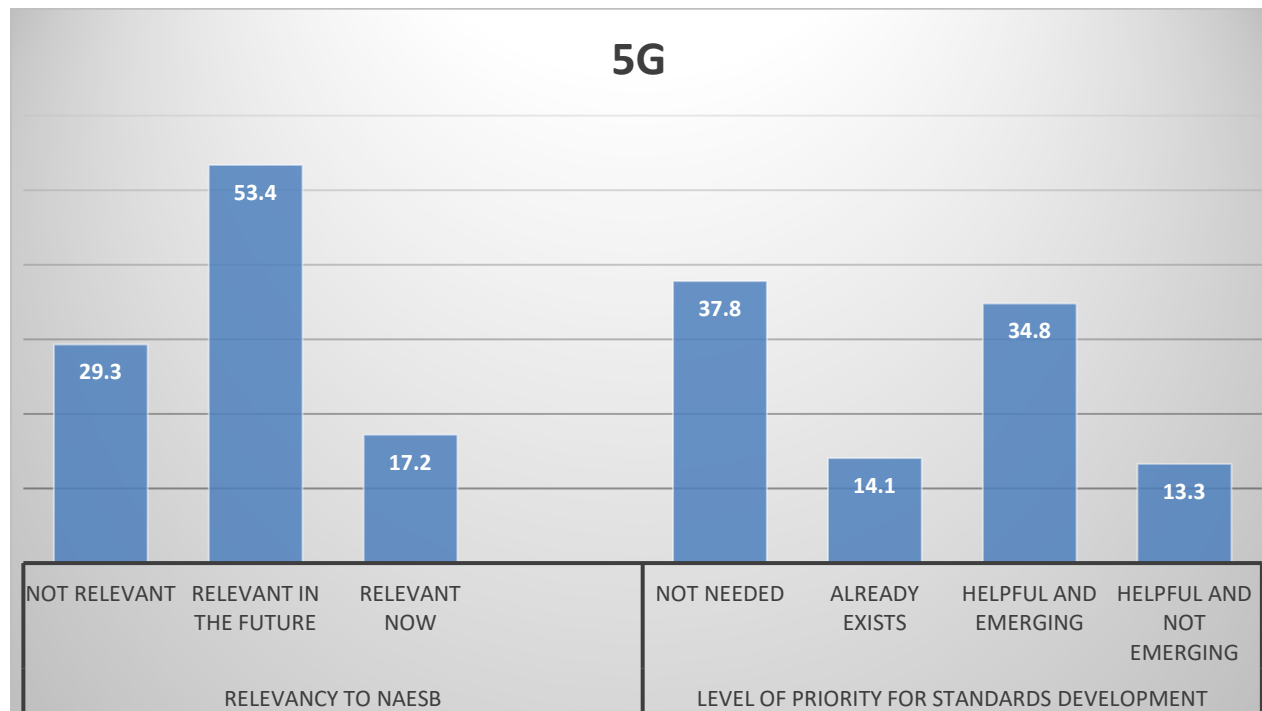
Evaluation: The committee identified 5G service delivery, not necessarily a technology itself, as a still emerging area that's impact on the energy industry, while anticipated to be significant, is yet to be defined. Although implementation strategies are still in development by utilities and other market participants, it is expected that moving more data at faster rates could enable the next wave of smart grid and energy efficiency benefits and support more accurate transactions. While the committee recognized the transformative nature of the inevitable 5G network service delivery, several concerns about the area were also noted. Specifically, the reliability and resiliency of the network and the limited range of its band frequency. There is nothing inherent in 5G to make it more reliable and resilient than previous generations of technology, and the potential infrastructure expansions that may be needed to provide the service in less dense areas may actually increase the cost of enhancing reliability. The committee did not pinpoint any use cases for NAESB to consider through standards development specific to the area, but it was noted that focusing on the broader topic of mobile applications and interactions with pipeline electronic bulletin boards could be explored.

Relevancy and Urgency: 5G received strong support as being relevant to the processes and transactions that the NAESB standards will address in the future, and responses concerning whether NAESB standards would be helpful in the area were mixed. Fifty percent of respondents believe that NAESB standards are not needed in the areas or that adequate standards are in place to support the area for the energy industry.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to 5G networks.

- NAESB should monitor the industry transition to 5G networks and continue to explore and discuss any areas related to the transition that may be benefited by standards development.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO 5G¹²

Organization	Identified Standard, Activity or Documentation
International Telecommunications Union	Setting the Scene for 5G: Opportunities & Challenges
Utilities Technology Council	Cutting Through the Hype: 5G and its Potential Impact on Electric Utilities White Paper
Department of Homeland Security (DHS)	Overview of Risks Introduced by 5G Adoption in the United States, 5G Infographic

3. Areas/Technologies that Impact or are Impacted by Digitalization

Cybersecurity

Background: According to Gartner, cybersecurity is the combination of people, policies, processes and technologies employed to protect cyber assets. Networks, electronic devices, electronic transactions, systems, applications and

¹² The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

data, including those that are Internet-facing, are defended from malicious attacks and unauthorized access through a body of technologies, processes, and practices that ensure the integrity, confidentiality, and availability of information. Cybersecurity is an inseparable part of any discussion concerning the digital transformation.

Evaluation: Through the sponsorship of the Department of Energy, Sandia National Laboratories (Sandia) completed its third surety assessment of the existing NAESB Business Practice Standards and delivered a series of reports to the NAESB Board of Directors in July of this year. In addition to making recommendations for standards modifications intended to mitigate specific potential security issues identified in the NAESB standards, Sandia offered a number of findings and considerations that NAESB has committed to reviewing. Of those findings and evaluations, two items were specifically assigned to the Board Digital Committee for its review. Given the assignments and the wide scope that cybersecurity presents as an area of investigation for the committee, an entire meeting was dedicated to reviewing the recommendations contained in the July 2019 Sandia Surety Assessment Reports and discussing how cybersecurity, as an area impacting all aspects of digital technology, should be evaluated by the committee moving forward.¹³ During this meeting, it was agreed that cybersecurity is an overarching umbrella area that is pervasive throughout all other areas but can be refined and evaluated in the context of specific digital technologies. As the committee moves forward with any recommendations for standards development to support specific digital technologies, information concerning related cybersecurity requirements will accompany the recommendations.

Additionally, it was recognized that cybersecurity requirements and impacts have been a consideration in the development of every existing NAESB standard and will continue to be a growing focus of the organization in the future. How that focus is defined for the organization and the role that NAESB should play related to cybersecurity should be an ongoing discussion by the Board of Directors, the Board Digital Committee, the Board Critical Infrastructure Committee and the Board Strategy Committee. Beyond standards development, NAESB Board of Directors and committees must continually monitor the evolving cybersecurity landscape of the energy sector to determine if the organization is best serving its members and the industry at large. This not only includes reviewing and revising existing NAESB business practice standards as needed to ensure a minimum level of security for the transactions addressed by the standards but also considering how NAESB's activities are ensuring that the organization is market responsive. While no specific use cases for cybersecurity and information security measures were identified, the need to avoid "one size fits all" solutions in the development of standards and to incorporate cost considerations, when appropriate, were noted. Finally, it was also noted that NAESB's unique role in the energy industry may present an opportunity for the organization to consider acting as a repository for sharing information related to cybersecurity or cyber threats and their mitigation.

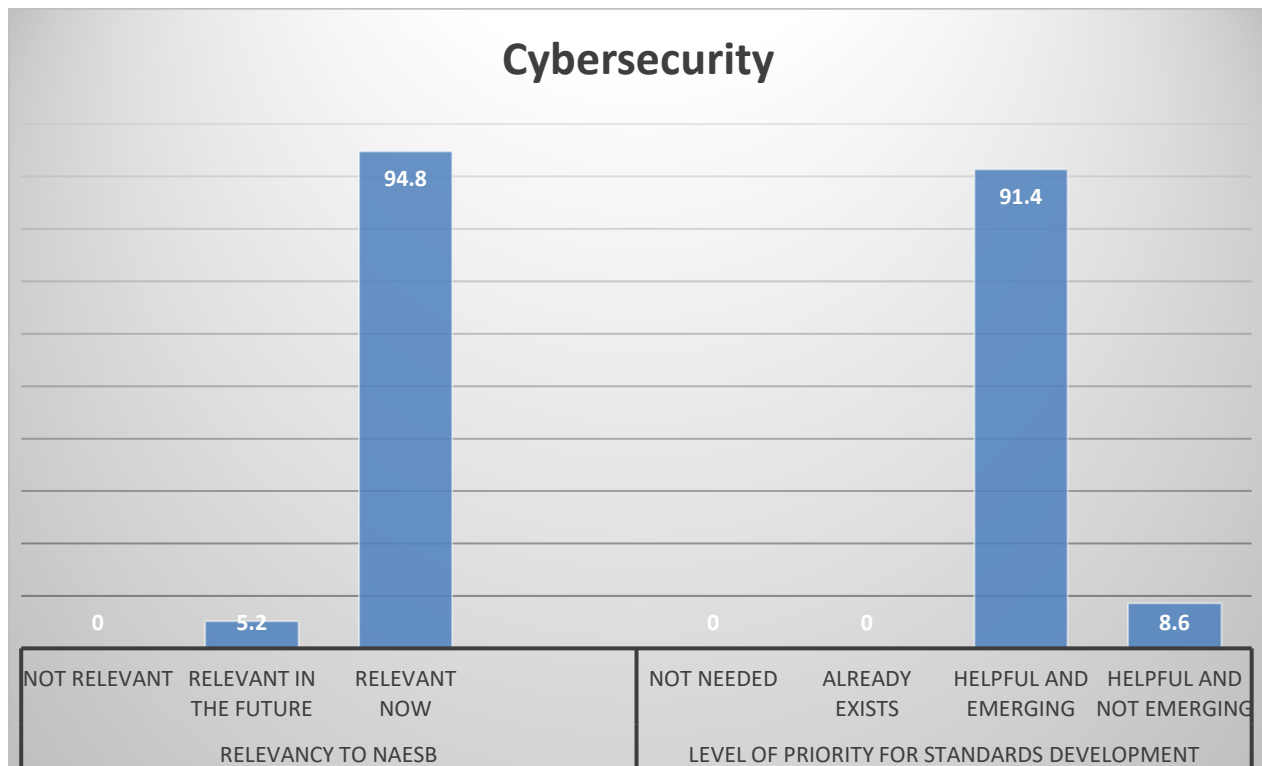
¹³ Link to the reports and note that the committee determined that the recommendations assigned to the digital committee should be included as an appendix to the report.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

Relevancy and Urgency: As expected, cybersecurity received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to Cybersecurity.

- NAESB should continue to focus its attention and resources on developing standards that support cybersecurity for the transactions the standards address.
- In the development of recommendations to the Board of Directors for standards development to support specific digital technologies, information concerning related cybersecurity requirements should accompany the recommendations.
- The NAESB Strategy Committee should review the considerations and findings contained in the surety assessment reports provided by Sandia and recommend process and procedures modifications for consideration by the Board that may be necessary to support a new model for the implementation of NAESB cybersecurity standards.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO CYBERSECURITY¹⁴

Organization	Identified Standard, Activity or Documentation
National Institute of Standards and Technology (NIST)	Cybersecurity Framework Version 1.1
Center for Internet Security (CIS)	CIS Controls Version 7.1, Links to CIS Benchmarks
Institute of Electrical and Electronics Engineers (IEEE)	Building Code for Power System Software Security, Cybersecurity Subcommittee
North American Electric Reliability Corporation (NERC)	NERC Critical Infrastructure Protection Reliability Standards: <ol style="list-style-type: none">1. CIP-002-5.1a BES Cyber System Categorization2. CIP-003-6 Security Management Controls3. CIP-004-6 Personnel & Training4. CIP-005-5 Electronic Security Perimeter(s)5. CIP-006-6 Physical Security of BES Cyber Systems6. CIP-007-6 System Security Management7. CIP-008-5 Incident Reporting and Response Planning8. CIP-009-6 Recovery Plans for BES Cyber Systems9. CIP-010-2 Configuration Change Management and Vulnerability Assessments10. CIP-011-2 Information Protection11. CIP-014-2 Physical Security
Federal Energy Regulatory Commission (FERC)	FERC Order No. 850 Supply Chain Risk Management Reliability Standards
Department of Homeland Security	Transportation Security Administration (TSA) – Pipeline Security Program – H.R. 3699, Pipeline Security Act Cybersecurity and Infrastructure Security Agency (CISA) - Pipeline Cybersecurity Initiative
Department of Energy	Office of Cybersecurity, Energy Security and Emergency Response (CESER) – Cybersecurity Program
Congressional Budget Office	H.R. 370, Pipeline and LNG Facility Cybersecurity Preparedness Act
Interstate Natural Gas Association of America (INGAA)	Various Cybersecurity Initiatives
American Gas Association (AGA)	Various Cybersecurity Initiatives
Pipeline and Hazardous Materials Safety Administration (PHMSA)	Integrated Audits

¹⁴ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO CYBERSECURITY¹⁴

Organization	Identified Standard, Activity or Documentation
US Senate	Senate Bill 300 – Pipeline and LNG Facility Cybersecurity Preparedness Act

Data Governance

Background: Data governance is the management of the availability, usability, integrity, and security of data through policies and procedures. Data governance can include standards and certifications, policies, and processes. As data crosses industries and markets, better data governance provides a level of consistency and integrity to support decision making. Governance can include compliance and audit procedures and can provide rules for data storage, archiving, and protection. As more data is stored across multiple platforms for use in multiple applications, formal data governance becomes more critical.

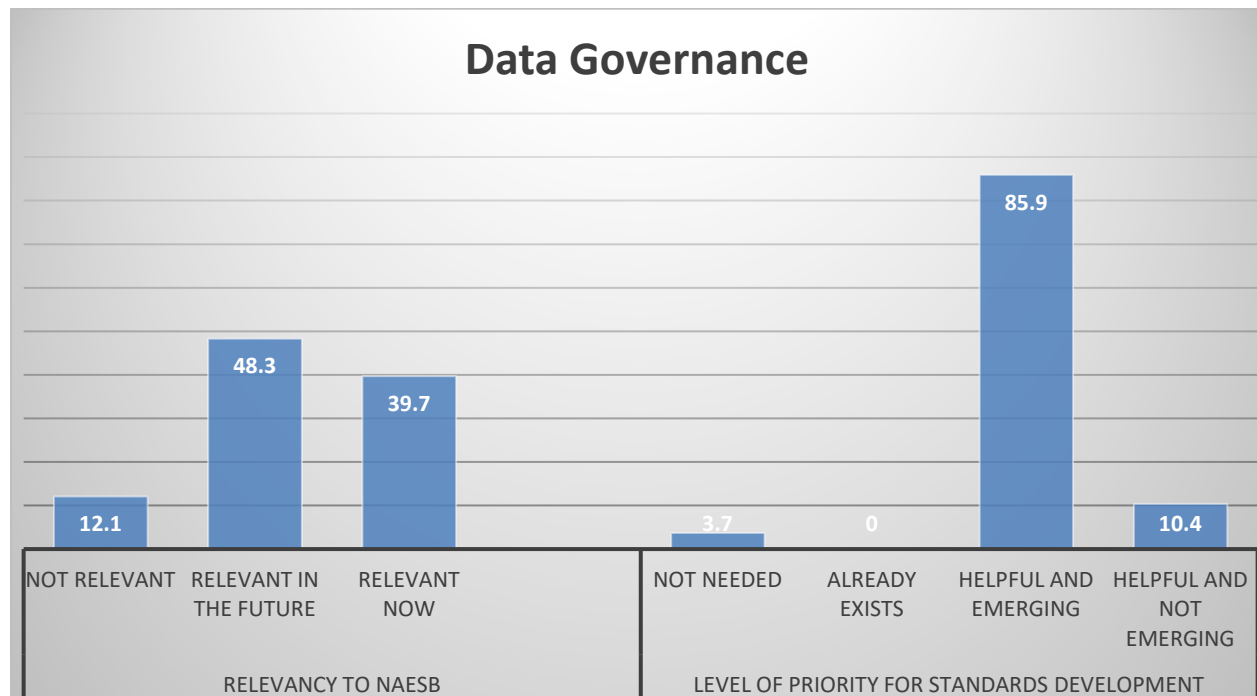
Evaluation: Similar to cybersecurity, the committee categorized technology standards to support data governance as inseparable from the digital transformation discussion and an area that serves as an overarching umbrella throughout all other identified areas. In many ways, all NAESB standards already function as data governance standards, and the non-policy related areas of data governance fall squarely in NAESB's domain. Adopting and implementing robust data governance standards that support retention, destruction, distribution, privacy and access controls will resolve many issues the industry will be faced with throughout the digital transformation. Appropriate standards can eliminate issues concerning security, validation, data integrity and other areas that may impact operational decision making. The committee identified several use cases that could be further explored by the committee including governance standards related to storage, transmission and the handling of proprietary information. While some of the use cases involve back-office functions managed at a corporate level, standardization could provide a level of protection that may validate and bolster these practices.

Relevancy and Urgency: Data governance received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to data governance standards development.

- NAESB should continue to explore existing use cases that would be benefited by the development of standards that support data governance practices.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DATA GOVERNANCE¹⁵

Organization	Identified Standard, Activity or Documentation
ISO New England	Dynamics Data Management System Project
Google	Principles and Best Practices for Data Governance in the Cloud White Paper
Amazon	Addressing the Perils of PII with the De-Identified Data Lake
National Institute of Standards and Technology (NIST)	NIST SP800-171 Protecting Controlled Unclassified Information in Nonfederal Information Systems and Organizations
Federal Information Processing Standards (FIPS)	FIPS PUB 199 Standards for Security Categorization of Federal Information and Information Systems

¹⁵ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

Cloud Computing

Background: Cloud computing is a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service by third parties using internet technologies. These third parties provide an infrastructure, platform, resources and software service(s) through multiple interconnected servers that can host data and perform services and/or analysis. While using a dedicated server can provide a certain level of security, control and customization, cloud hosting can be configured to offer similar characteristics that are scalable and may be more easily adaptable to meet changing business needs.

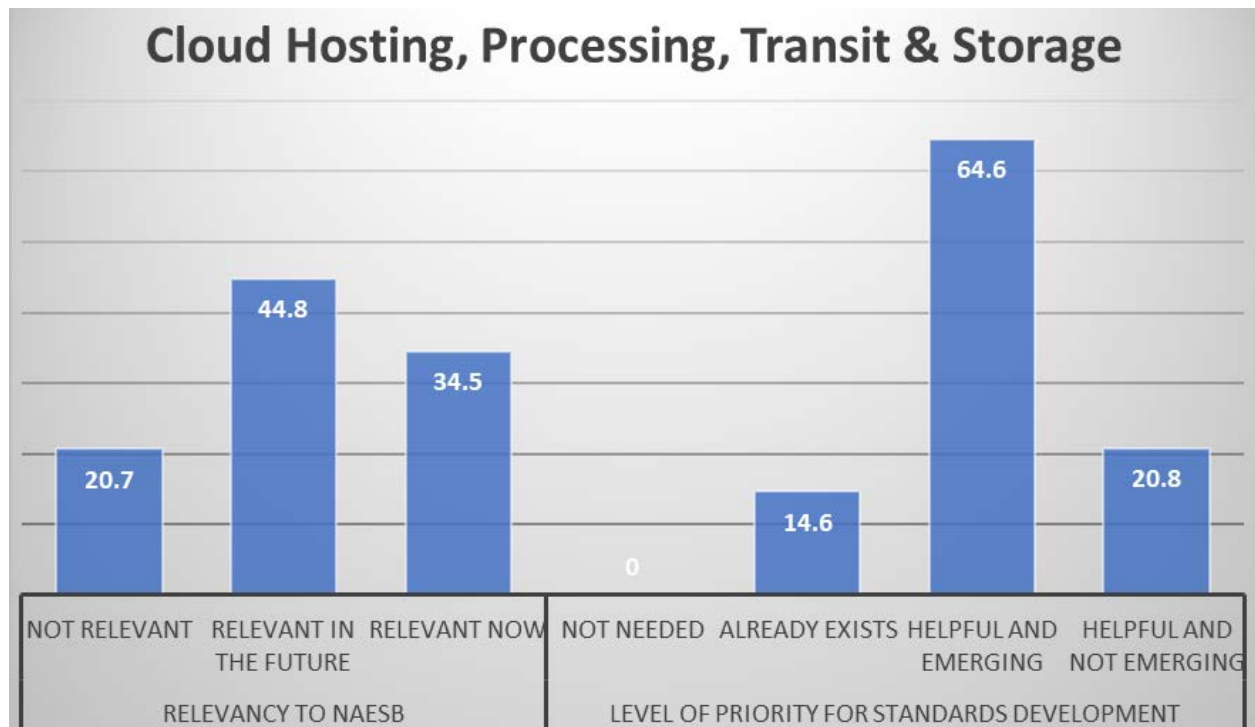
Evaluation: The committee categorized cloud computing as another area where standards and research exist but may benefit from additional security requirement standards specific to the energy supply chain. The committee also discussed the interrelation of cloud computing with several of the other identified areas including distributed ledger and IoT technologies and the impact of cloud computing on data analytics. Specific use cases for potential standards development were not identified, other than defining general security baselines, and it was noted that a focus on standardizing how data is stored would be a departure from NAESB's traditional focus on data formatting, content and transport standards.

Relevancy and Urgency: Cloud computing received strong support as being relevant to the processes and transactions that the NAESB standards address now or will in the future and also, as an area where NAESB standards would be helpful and are emerging.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org



Recommendations: Based upon the information provided and reviewed, the committee is recommending NAESB consider the following action related to cloud computing standards development.

- NAESB should continue to monitor cloud computing applications to determine if defining baseline security requirements would be beneficial.

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO CLOUD TECHNOLOGY¹⁶

Organization	Identified Standard, Activity or Documentation
Open Connectivity Foundation (OCF)	Device to Cloud Services Specification, Cloud Security Specification:
Google	Principles and Best Practices for Data Governance in the Cloud White Paper
North American Electric Reliability Corporation	NERC Project 2019-02 BES Cyber System Information Access Management

¹⁶ The full table with hyperlinks to accessible documentation is included in Appendix A



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

VI. ADDITIONAL CONSIDERATIONS

On July 22, 2019, Sandia provided NAESB with a Department of Energy sponsored surety assessment report that identified twelve recommendations to mitigate security issues found with the NAESB standards and identified twenty-two additional findings and/or considerations that the organization should take under advisement. While the security issues as well as a majority of the findings and/or considerations related to specific standards have been addressed by the NAESB Executive Committees, NAESB was asked through an informal recommendation to work with Federal Energy Regulatory Commission and the Department of Energy, to consider a new model for the implementation of its cybersecurity standards. Specifically, it was noted that the process of developing and/or modifying cybersecurity standards through NAESB and submitting those standards to FERC for consideration as part of a possible rulemaking prior to implementation by the industry requires a minimum amount of time that may be untenable to ensure that base level protections are being employed by all parties to transactions within the industry. Additionally, the surety assessment report included an addendum that provided a threat-based examination of the NAESB standards and business operations. A number of the findings and conclusions included in the addendum were focused on new digital technologies and their adoption by the industry. During its October meeting, the Board Digital Committee dedicated a meeting to a review of the surety assessment reports and the informal recommendation made to consider a new model for setting industry cybersecurity standards. The information provided through the addendum concerning the digital technologies has been included in Appendix G of this report and will serve as basis for future recommendations related to the specific technologies identified going forward. Related to the recommendation concerning a new model for setting cybersecurity standards, the issue was discussed and a recommendation for further action was submitted to the Board Strategy Committee. The Board Digital Committee has committed to coordinating with the Board Strategy Committee on the topic where appropriate.

Additionally, through discussions of the committee, it was recognized that NAESB may be able to support the digitalization of the industry by developing new industry tool, services, and/or certification in support of any standards that are developed by NAESB to support digital areas/technologies. Specifically, the potential for NAESB to support NERC responsibilities related to supply chain management systems and vendor certifications was identified as an area that NAESB may want to consider in the future. The committee, working through committee member Howard Gugel (NERC), agreed to monitor the efforts of NERC and discuss any roles that NAESB may play in the future as a coordinator or through certification programs.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

VII. POSSIBLE ACTION FOR BOARD CONSIDERATION

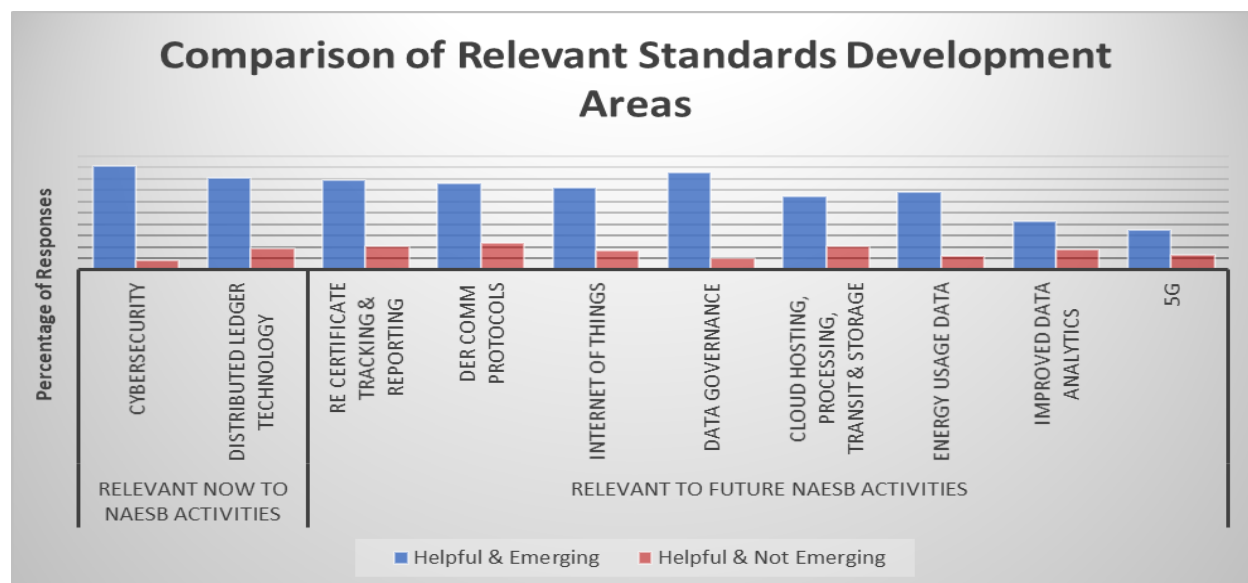
As detailed in the Evaluation sections of this report, a number of recommendations have been made for consideration by the Board of Directors, but no new standards development efforts to support digitalization have been made at this time. The recommendations of the committee can be found below:

- Continue standards development efforts in support of cybersecurity and distributed ledger technology.
- Monitor areas identified in the report that have been identified as strongly relevant to the processes/transactions that NAESB standards currently address or may address in the future.

VIII. CONCLUSION & NEXT STEPS

From the committee and board member responses, it is clear that NAESB should continue its work on both cybersecurity and distributed ledger technology. Other areas of activity may need a broader constituency to contribute to the results using this report as a framework.

The chart below shows the areas of standards development. Areas that were deemed currently relevant to NAESB activities by at least 50% of respondents included cybersecurity and distributed ledger technology. Standards development efforts that were considered relevant for future NAESB activities included energy usage data, improved data analytics, renewable energy certificate tracking and reporting, distributed energy resources communication protocols, data governance, Internet of Things, cloud hosting, processing, transit, and storage, and 5G.



The “helpful and emerging” category compared to the “helpful and not emerging” category depict the market preparedness for the area noted and for the application of standards as beneficial to the market. All areas noted have



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002

Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org

Home Page: www.naesb.org

a strong indication that the markets are ready and could benefit from standards, with the majority already having some market acceptance.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDICES

A. EXTERNAL ACTIVITIES REFERENCE POINTS

Listing of sources used and hyperlinks to documents

B. LIST OF COMMITTEE MEMBERS AND PARTICIPANTS

Listing of committee members and participants with their organizations.

C. LIST OF MEETINGS

Listing of meetings and conference calls, with brief synopsis of meeting, and links to agendas, work papers and minutes.

D. BOARD DIGITAL COMMITTEE MISSION STATEMENT

Comments of and work papers created by committee members and submitted for inclusion in the report.

E. JULY SURVEY AND RESPONSES

Comments of and work papers created by committee members and submitted for inclusion in the report.

F. OCTOBER SURVEY AND RESPONSES

Brief descriptions of efforts that could be applicable to NAESB, and from which we may benefit from their “lessons learned.”

G. SANDIA SURETY ASSESSMENT WORK PAPER



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DISTRIBUTED LEDGER TECHNOLOGY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
The Enterprise Ethereum Alliance (EEA)	<p>Client Specification (Version 4): https://entethalliance.org/wp-content/uploads/2019/11/EEA_Enterprise_Ethereum_Client_Specification_V4.pdf</p> <p>Off-Chain Trusted Compute Specification (Version 1.1): https://entethalliance.org/wp-content/uploads/2019/11/EEA_Off-Chain_Trusted_Compute_Specification_v1.1.pdf</p> <p>Architecture Stack: https://entethalliance.org/wp-content/uploads/2019/10/arc-stack-pdf.pdf</p>
The Linux Foundation	<p>Hyperledger Greenhouse (list of frameworks and tools hosted by Hyperledger) - https://www.hyperledger.org/</p> <p>Hyperledgers:</p> <ol style="list-style-type: none">1. BESU (java-based Ethereum): https://github.com/hyperledger/besu2. BURROW (permissionable smart contract machine): https://github.com/hyperledger/burrow3. FABRIC (enterprise-grade DLT with privacy support): https://www.hyperledger.org/projects/fabric4. INDY (decentralized identity): https://www.hyperledger.org/projects/hyperledger-indy5. IROHA (mobile application focused): https://www.hyperledger.org/projects/iroha6. SAWTOOTH (permissioned and permissionless support; EVM transaction family): https://www.hyperledger.org/projects/sawtooth <p>Tools:</p> <ol style="list-style-type: none">1. Hyperledger Aries (interoperable tool kit): https://www.hyperledger.org/projects/aries2. Hyperledger Caliper (blockchain benchmark tool): https://www.hyperledger.org/projects/caliper3. Hyperledger Cello (module toolkit): https://www.hyperledger.org/projects/cello4. Hyperledger Composer (collaboration tools for building blockchain business networks): https://www.hyperledger.org/projects/composer5. Hyperledger Explorer (blockchain module): https://www.hyperledger.org/projects/explorer6. Hyperledger Grid (reference implementations for supply chain data): https://www.hyperledger.org/projects/grid7. Hyperledger Quilt (interoperability tool): https://www.hyperledger.org/projects/quilt8. Hyperledger Ursa (shared cryptographic library) https://www.hyperledger.org/projects/ursa <p>White Papers:</p> <ol style="list-style-type: none">1. Hyperledger Blockchain Performance Metrics: https://www.hyperledger.org/resources/publications/blockchain-performance-metrics#



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DISTRIBUTED LEDGER TECHNOLOGY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
	<ol style="list-style-type: none">2. An Introduction to Hyperledger: https://www.hyperledger.org/wp-content/uploads/2018/08/HL_Whitepaper_IntroductiontoHyperledger.pdf3. Hyperledger Architecture, Volume 2: Smart Contracts: https://www.hyperledger.org/wp-content/uploads/2018/04/Hyperledger_Arch_WG_Paper_2_SmartContracts.pdf4. Hyperledger Architecture, Volume 1: Introduction to Hyperledger Business Blockchain Design Philosophy and Consensus: https://www.hyperledger.org/wp-content/uploads/2017/08/Hyperledger_Arch_WG_Paper_1_Consensus.pdf5. Sawtooth: An Introduction: https://www.hyperledger.org/wp-content/uploads/2018/01/Hyperledger_Sawtooth_WhitePaper.pdf6. Distributed Ledger Technology and Opportunities in Correspondent Banking: https://bluenotes.anz.com/media/1002/ANZ_WellsFargo_DLT_Paper_HIRES.pdf7. SWIFT and Accenture Outline Path to Distributed Ledger Technology Adoption within Financial Services: https://www.swift.com/insights/press-releases/swift-and-accenture-outline-path-to-distributed-ledger-technology-adoption-within-financial-services8. Embracing Disruption, Tapping the Potential of Distributed Ledgers to Improve the Post-Trade Landscape: http://www.dtcc.com/news/2016/january/25/new-dtcc-white-paper-calls-for-leveraging-distributed-ledger-technology9. Distributed Ledger with Secure Data Deletion: https://lists.hyperledger.org/pipermail/hyperledger-technical-discuss/attachments/20161104/ea63a52e/attachment-0001.pdf
National Institute of Standards and Technology (NIST)	<p>NISTIR 8202 Blockchain Technology Overview Report: https://doi.org/10.6028/NIST.IR.8202</p> <p>Blockchain for Industrial Applications Community of Interest: https://www.nist.gov/el/systems-integration-division-73400/blockchain-industrial-applications-community-interest (developing guidelines to create better synergy between end users, research community, and solution providers)</p> <p>Enhanced Distributed Ledger Technology: https://csrc.nist.gov/Projects/enhanced-distributed-ledger-technology (seeking to create new blockchain data structure to provide higher reliability/security and enable deletion/updating capabilities)</p>
American National Standards Institute (ANSI)	<p>Blockchain & Standards Presentation (2017): https://share.ansi.org/Shared%20Documents/Meetings%20and%20Events/WSW-2017/Services/Kreger_Services-2017.pdf</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DISTRIBUTED LEDGER TECHNOLOGY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
	Blockchain in Smart Mobility Presentation (2018): https://share.ansi.org/Shared%20Documents/Standards%20Activities/International%20Standardization/Regional/Europe-Middle%20East-Africa/Europe/U.S.-German%20Standards%20Panel%202018/Presentations/SMob_Kuom_Presentation.pdf
	The Role of Smart Contracts in Smart Production Presentation (2018): https://share.ansi.org/Shared%20Documents/Standards%20Activities/International%20Standardization/Regional/Europe-Middle%20East-Africa/Europe/U.S.-German%20Standards%20Panel%202018/Presentations/SMfg_Skwarek_Presentation.pdf
International Organization for Standards (ISO)	ISO/TC 307 Committee – Blockchain and Distributed Ledger Technologies: https://www.iso.org/committee/6266604.html Standards Under Development (no draft documentation available): https://www.iso.org/committee/6266604/x/catalogue/p/1/u/1/w/0/d/0 <ol style="list-style-type: none">1. ISO/CD TR 3242 Use Cases2. ISO/DIS 22739 Terminology3. ISO/DTR 23244 Privacy and Personally Identifiable Information Protection Considerations4. ISO/CD TR 23245 Security Risks, Threats, and Vulnerabilities5. 5 ISO/NP TR 23246 Overview of Identity Management6. ISO/CD 23257.2 Reference Architecture7. ISO/WD TS 23258 Taxonomy and Ontology8. ISO/AWI TS 23259 Legally Binding Smart Contracts9. ISO/CD TR 23576 Security Management of Digital Asset Custodians10. ISO/NP TS 23635 Guidelines for Governance
World Wide Web Consortium	Link to Blockchain Archives: https://www.w3.org/blog/category/technology/blockchain/
Internet Research Task Force	Decentralized Internet Infrastructure Research Group (DINRG) to investigate open research issues by focusing on infrastructure services that can benefit from decentralization: https://irtf.org/dinrg
International Telecommunications Union	Collection of Blockchain Resources: https://www.itu.int/en/ITU-T/ssc/resources/Pages/topic-004.aspx Focus Group on Application of Distributed Ledger Technology: https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DISTRIBUTED LEDGER TECHNOLOGY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
	Focus Group Deliverables: <ol style="list-style-type: none">1. DLT Terms and Definitions: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d11.pdf2. DLT Overview, Concepts, Ecosystems: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d12.pdf3. DLT Standardization Landscape: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d13.pdf4. DLT Use Cases: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d21.pdf5. DLT Reference Architecture: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d31.pdf6. Assessment Criteria for DLT Platforms: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d33.pdf7. DLT Regulatory Framework: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d41.pdf8. Outlook on DLTs: https://www.itu.int/en/ITU-T/focusgroups/dlt/Documents/d51.pdf
Energy Blockchain Consortium	<p>Blockchain Technology Needs Standardization (Part 1 of 5): https://medium.com/blockchain-standards/blockchain-technology-needs-standardization-596fba2d0cf</p> <p>Blockchain Technology Needs Standardization (Part 2 of 5): https://medium.com/blockchain-standards/blockchain-standards-part-2-of-5-the-international-standards-organizations-340c2fc73e1e</p> <p>Blockchain Technology Needs Standardization (Parts 3 – 5): unavailable</p> <p>The Future of Blockchain Usage Depends on Applications, Not Protocols: https://medium.com/blockchain-standards/the-future-of-blockchain-usage-depends-on-applications-not-protocols-1d2eae03a50</p> <p>Interoperability Will Change What a Blockchain Means and Upend the Order of the Blockchain Industry: https://medium.com/blockchain-standards/interoperability-will-change-what-a-blockchain-means-and-upend-the-order-of-the-blockchain-industry-975ded47b313</p>
Energy Web Foundation (EWF)	<p>Developing Open Energy Blockchain Framework to include data and interoperability standards, reference architecture, and implementation blueprint (no links)</p> <p>White Paper (must request copy): http://energy-blockchain.org/docs/</p>
Electric Power Research Institute (EPRI)	<p>Developed enterprise-grade blockchain platform (Energy Web Chain) tailored to regulatory, operational, and market needs: https://www.energyweb.org/technology/energy-web-chain/</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DISTRIBUTED LEDGER TECHNOLOGY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
New York Utilities Group	Blockchain: Technology Risk and Rewards for Utilities Report: https://www.epri.com/#/pages/product/000000003002010242/?lang=en-US Quick Insights – Blockchain: Early Activity for Utilities Report: https://www.epri.com/#/pages/product/3002009889/?lang=en-US
OASIS Key Management Interoperability Protocol (KMIP)	Avangrid, Consolidated Edison, New York Power Authority, and National Grid collaborating to study the potential for blockchain in NY power system: https://www.greentechmedia.com/articles/read/utilities-and-blockchain#gs.BAc91FE Areas of Study: <ol style="list-style-type: none">1. Customer Management2. Clearing and Settlement (including RECs)3. Decentralized Energy Markets4. Cybersecurity5. DER Management6. Electric Vehicles
IEEE	IEEE P2418.5 Blockchain in Energy Working Group: https://standards.ieee.org/project/2418_5.html
Commodity Futures Trading Commission LabCFTC	LabCFTC Primer on Smart Contracts: https://www.cftc.gov/sites/default/files/2018-11/LabCFTC_PrimerSmartContracts112718_0.pdf
Value Technology Foundation	Homepage: https://www.valuetechology.org/

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO INTERNET OF THINGS (IoT) – FULL TABLE

Organization	Identified Standard, Activity or Documentation
North American Energy Standards Board (NAESB)	RMQ Applicable Standards:



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO INTERNET OF THINGS (IoT) – FULL TABLE

Organization	Identified Standard, Activity or Documentation
	<ol style="list-style-type: none">Specifications for Common Electricity Product and Pricing Definition: https://naesb.org/member_login_check.asp?doc=retail_bk15_071417.pdfSpecifications for Common Schedule Communication Mechanism for Energy Transactions: https://naesb.org/member_login_check.asp?doc=retail_bk16_071417.pdfSpecifications for Retail Standard Demand Response Signals: https://naesb.org/member_login_check.asp?doc=retail_bk17_071417.pdfRetail Customer Energy Usage Information Communication: https://naesb.org/member_login_check.asp?doc=retail_bk18_071417.pdfSmart Grid Standards Data Elements: https://naesb.org/member_login_check.asp?doc=retail_bk20_071417.pdfEnergy Service Provider Interface: https://naesb.org/member_login_check.asp?doc=retail_bk21_071417.pdfThird Party Access to Smart Meter-based Information: https://naesb.org/member_login_check.asp?doc=retail_bk22_071417.pdfOpen Field Message Bus: https://naesb.org/member_login_check.asp?doc=retail_bk26_071417.pdf
	WEQ Applicable Standards
	<ol style="list-style-type: none">Specifications for Common Electricity Product and Pricing Definition: https://naesb.org/member_login_check.asp?doc=weq016_bklet_120817.pdfSpecifications for Common Schedule Communication Mechanism for Energy Transactions: https://naesb.org/member_login_check.asp?doc=weq017_bklet_120817.pdfSpecifications for Wholesale Standard Demand Response Signals: https://naesb.org/member_login_check.asp?doc=weq018_bklet_120817.pdfCustomer Energy Usage Information Communication: https://naesb.org/member_login_check.asp?doc=weq019_bklet_120817.pdfSmart Grid Standards Data Elements Table: https://naesb.org/member_login_check.asp?doc=weq020_bklet_120817.pdf
National Institute of Standards and Technology (NIST)	Considerations for Managing Internet of Things Cybersecurity and Privacy Risks (NISTIR 8228): https://www.nist.gov/news-events/news/2019/06/connecting-iot-device-check-out-new-nist-report-cybersecurity-advice Core Cybersecurity Feature Baseline for Securable IoT Devices (Draft NISTIR 8259): https://www.nist.gov/news-events/news/2019/06/connecting-iot-device-check-out-new-nist-report-cybersecurity-advice



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO INTERNET OF THINGS (IoT) – FULL TABLE

Organization	Identified Standard, Activity or Documentation
National Renewable Energy Laboratory (NREL)	N/A
Department of Homeland Security (DHS)	Continuous Diagnostics and Mitigation (CDM) (requirements for full lifecycle asset management): https://www.dhs.gov/cisa/cdm 5G, Internet of Things (IoT) and Smart Cities: https://www.dhs.gov/publication/5g-internet-things-iot-and-smart-cities Internet of Things Fact Sheet: https://www.dhs.gov/sites/default/files/publications/IOT%20fact%20sheet_11162016.pdf Strategic Principles for Securing the Internet of Things: https://www.dhs.gov/sites/default/files/publications/Strategic_Principles_for_Securing_the_Internet_of_Things-2016-1115-FINAL_v2-dg11.pdf
Federal Energy Regulatory Commission (FERC)	2018 Reliability Technical Conference: https://www.ferc.gov/CalendarFiles/20180601165412-AD18-11-000.pdf Transcript, 2019 Reliability Technical Conference Regarding the Bulk-Power System: https://www.ferc.gov/CalendarFiles/20190809142302-Transcript%20-%20062719ReliabilityTechnicalConference.pdf
North American Electric Reliability Corporation (NERC)	Statement from James R. Robb on FERC/DOE Security Investments for Energy Infrastructure Technical Conference: https://www.ferc.gov/CalendarFiles/20190402103114-Robb.%20NERC.pdf
Internet Engineering Task Force (IETF)	IoT Directorate (several working groups developing protocols relevant to IoT, Directorate an advisory group to coordinate these efforts): https://datatracker.ietf.org/group/iotdir/about/ Thing-to-Thing Research Group (investigate open research issues IoT that touch on opportunities for standardization in IETF): https://irtf.org/t2trg Trusted Execution Environment Provisioning (TEEP) Working Group (working to standardize protocols for provisioning applications into secure areas of computer processors): https://datatracker.ietf.org/wg/teep/about/ Internet Research Task Force: https://irtf.org/ IoT: Standards and Guidance from the IETF: https://www.ietfjournal.org/internet-of-things-standards-and-guidance-from-the-ietf/



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO INTERNET OF THINGS (IoT) – FULL TABLE

Organization	Identified Standard, Activity or Documentation
Institute of Electrical and Electronics Engineers (IEEE)	IEEE IoT Journal: https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6488907 IEEE IoT Related Standards: https://standards.ieee.org/initiatives/iot/stds.html IEEE IoT Related Standards in Development: https://standards.ieee.org/initiatives/iot/projects.html Building Code for the Internet of Things: https://ieeecs-media.computer.org/media/technical-activities/CYBSI/docs/Building_Code_IoT_online.pdf IEEE 2030.5-2018 IEEE Standard for Smart Energy Profile Application Protocol: https://standards.ieee.org/standard/2030_5-2018.html
International Organization of Standards (ISO)	ISO/IEC JTC 1/SC 41 (IoT and Related Technologies Committee): https://www.iso.org/committee/6483279.html Standards Under Development (no draft documentation): https://www.iso.org/committee/6483279/x/catalogue/p/0/u/1/w/0/d/0 <ol style="list-style-type: none">1. Trustworthiness Framework2. Requirements of IoT Data Exchange Platforms3. Compatibility Requirements and Model for Devices within Industrial IoT Systems4. Real-time IoT Framework
Internet of Things Consortium (IoTC)	Business Development Association (no documents available): https://iofthings.org/about/
Industrial Internet Consortium (IIC)	Industrial Internet Reference Architecture: https://www.iiconsortium.org/IIRA.htm Industrial Internet Vocabulary Technical Report: https://www.iiconsortium.org/vocab/index.htm Industrial IoT Analytics Framework: https://www.iiconsortium.org/industrial-analytics.htm Industrial Internet Security Framework Technical Document: https://www.iiconsortium.org/IISF.htm IoT Security Maturity Model: Practitioners Guide: https://www.iiconsortium.org/pdf/IoT_SMM_Practitioner_Guide_2019-02-25.pdf
Open Connectivity Foundation (OCF)	International Standards Developed/Under Development: https://openconnectivity.org/developer/specifications/international-standards/



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO INTERNET OF THINGS (IoT) – FULL TABLE

Organization	Identified Standard, Activity or Documentation
	Core Specification: https://openconnectivity.org/specs/OCF_Core_Specification_v2.0.5.pdf
	Core Optional Framework: https://openconnectivity.org/specs/OCF_Core_Optional_Specification_v2.0.5.pdf
	Security Specification: https://openconnectivity.org/specs/OCF_Security_Specification_v2.0.5.pdf
	Bridging Specification: https://openconnectivity.org/specs/OCF_Bridging_Specification_v2.0.5.pdf
	Resource Type Specification: https://openconnectivity.org/specs/OCF_Resource_Type_Specification_v2.0.5.pdf
	Device Specification: https://openconnectivity.org/specs/OCF_Device_Specification_v2.0.5.pdf
	Wi-Fi Easy Set Up Specification: https://openconnectivity.org/specs/OCF_Wi-Fi_Easy_Setup_Specification_v2.0.5.pdf
3 rd Generation Partnership Project (3GPP)	Partnership of seven telecommunication standards development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC) to support 3GPP technologies: https://www.3gpp.org/technologies/technologies
SRI International	Internet of Things (IoT) Security and Privacy Center: https://www.sri.com/work/projects/internet-things-iot-security-and-privacy-center

IDENTIFIED ACTIVITIES TO MONITOR RELATED 5G – FULL TABLE

Organization	Identified Standard, Activity or Documentation
International Telecommunications Union	Setting the Scene for 5G: Opportunities & Challenges: https://www.itu.int/en/ITU-D/Documents/ITU_5G_REPORT-2018.pdf
Utilities Technology Council	Cutting Through the Hype: 5G and its Potential Impact on Electric Utilities White Paper: https://utc.org/wp-content/uploads/2019/03/Cutting_through_the_Hype_Uilities_5G-2.pdf
Department of Homeland Security (DHS)	Overview of Risks Introduced by 5G Adoption in the United States: https://www.dhs.gov/sites/default/files/publications/19_0731_cisa_5th-generation-mobile-networks-overview_0.pdf



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED 5G – FULL TABLE

Organization	Identified Standard, Activity or Documentation
	5G Infographic: https://www.dhs.gov/sites/default/files/publications/pdm19028_5g_risk_characterizationc_v14_05july2019.pdf

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DATA ANALYTICS – FULL TABLE

Organization	Identified Standard, Activity or Documentation
U.S. Department of Energy	Smart Energy Analytics Campaign: https://smart-energy-analytics.org/
Energy Sector Management Assistance Program	Energy Analytics for Development – Big Data for Energy Access, Energy Efficiency, and Renewable Energy: https://www.esmap.org/sites/default/files/esmap-files/FINAL_ESMAP_Energy_Analytics_KS027-17_Web_opt%20.pdf

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO RENEWABLE ENERGY CERTIFICATE (REC) TRACKING AND ACCOUNTING – FULL TABLE

Organization	Identified Standard, Activity or Documentation
National Renewable Energy Laboratory (NREL)	REC Tracking Systems: Costs & Verification Issues Presentation: https://www.nrel.gov/docs/fy14osti/60640.pdf Voluntary Green Power Procurement: https://www.nrel.gov/analysis/green-power.html Status and Trends in the U.S. Voluntary Green Power Market: https://www.nrel.gov/docs/fy19osti/72204.pdf
Green-e	Green-e Energy Program: https://www.green-e.org/programs/energy



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DER RESOURCE COMMUNICATION PROTOCOLS – FULL TABLE

Organization	Identified Standard, Activity or Documentation
California PUC	California PUC CA Rule 21 Resolution E-5000: http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M309/K713/309713654.PDF Smart Inverter Working Group: https://www.cpuc.ca.gov/General.aspx?id=4154 DER Action Plan: https://www.cpuc.ca.gov/General.aspx?id=6442458159
Institute of Electrical and Electronics Engineers (IEEE)	IEEE 2030.5-2018 – IEEE Standard for Smart Energy Profile Application Protocol: https://standards.ieee.org/standard/2030_5-2018.html IEEE 1547-2018 – IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces: https://standards.ieee.org/standard/1547-2018.html

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO CYBERSECURITY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
National Institute of Standards and Technology (NIST)	Cybersecurity Framework Version 1.1: https://doi.org/10.6028/NIST.CSWP.04162018
Center for Internet Security (CIS)	CIS Controls Version 7.1 (must email request): https://learn.cisecurity.org/cis-controls-download Links to CIS Benchmarks: https://www.cisecurity.org/cis-benchmarks/
Institute of Electrical and Electronics Engineers (IEEE)	Building Code for Power System Software Security: https://ieeecs-media.computer.org/media/technical-activities/CYBSI/docs/BCPSSS.pdf Cybersecurity Subcommittee: https://site.ieee.org/pes-pscc/cybersecurity-subcommittee-s0/
North American Electric Reliability Corporation (NERC)	NERC Critical Infrastructure Protection Reliability Standards:



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO CYBERSECURITY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
	<ol style="list-style-type: none">1. CIP-002-5.1a BES Cyber System Categorization: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-002-5.1a&title=Cyber%20Security%20-%20E2%80%94%20BES%20Cyber%20System%20Categorization2. CIP-003-6 Security Management Controls: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-003-6&title=Cyber%20Security%20-%20Security%20Management%20Controls3. CIP-004-6 Personnel & Training: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-004-6&title=Cyber%20Security%20-%20Personnel%20&%20Training4. CIP-005-5 Electronic Security Perimeter(s): https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-005-5&title=Cyber%20Security%20-%20Electronic%20Security%20Perimeter(s)5. CIP-006-6 Physical Security of BES Cyber Systems: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-006-6&title=Cyber%20Security%20-%20Physical%20Security%20of%20BES%20Cyber%20Systems6. CIP-007-6 System Security Management: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-007-6&title=Cyber%20Security%20-%20System%20Security%20Management7. CIP-008-5 Incident Reporting and Response Planning: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-008-5&title=Cyber%20Security%20-%20Incident%20Reporting%20and%20Response%20Planning8. CIP-009-6 Recovery Plans for BES Cyber Systems: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-009-6&title=Cyber%20Security%20-%20Recovery%20Plans%20for%20BES%20Cyber%20Systems9. CIP-010-2 Configuration Change Management and Vulnerability Assessments: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-010-2&title=Cyber%20Security%20-%20Configuration%20Change%20Management%20and%20Vulnerability%20Assessments10. CIP-011-2 Information Protection: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-011-2&title=Cyber%20Security%20-%20Information%20Protection11. CIP-014-2 Physical Security: https://www.nerc.com/ layouts/PrintStandard.aspx?standardnumber=CIP-014-2&title=Physical%20Security
Federal Energy Regulatory Commission (FERC)	FERC Order No. 850 Supply Chain Risk Management Reliability Standards: https://www.ferc.gov/whats-new/comm-meet/2018/101818/E-1.pdf



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DIGITAL APPLICATIONS OF ENERGY USAGE DATA – FULL TABLE

Organization	Identified Standard, Activity or Documentation
North American Energy Standards Board (NAESB)	<p>RMQ Applicable Standards</p> <ol style="list-style-type: none">4. Energy Service Provider Interface: https://naesb.org/member_login_check.asp?doc=retail_bk21_071417.pdf5. Retail Customer Energy Usage Information Communication: https://naesb.org/member_login_check.asp?doc=retail_bk18_071417.pdf6. Third Party Access to Smart Meter-based Information: https://naesb.org/member_login_check.asp?doc=retail_bk22_071417.pdf <p>WEQ Applicable Standards</p> <ol style="list-style-type: none">2. Customer Energy Usage Information Communication: https://naesb.org/member_login_check.asp?doc=weq019_bklet_120817.pdf
Green Button Alliance	Green Button Initiative: https://www.greenbuttonalliance.org/about
American Council for an Energy Efficient Economy (ACEEE)	<p>Improving Access to Energy Usage Data Toolkit: https://aceee.org/sector/local-policy/toolkit/utility-data-access</p> <p>Best Practices for Working with Utilities to Improve Access to Energy Usage Data: https://aceee.org/files/pdf/toolkit/utility-data-access.pdf</p>
Environmental Protection Agency (EPA)	Utility Best Practices Guidance for Providing Business Customers with Energy Use and Cost Data: https://www.epa.gov/sites/production/files/2015-08/documents/utility_data_guidance.pdf

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DATA GOVERNANCE – FULL TABLE

Organization	Identified Standard, Activity or Documentation
ISO New England	Dynamics Data Management System Project: https://www.iso-ne.com/participate/support/customer-readiness-outlook/dynamics-data-management-system-project



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX A: EXTERNAL ACTIVITIES REFERENCE POINTS

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO DATA GOVERNANCE – FULL TABLE

Organization	Identified Standard, Activity or Documentation
Google	Principles and Best Practices for Data Governance in the Cloud White Paper: http://services.google.com/fh/files/misc/principles_best_practices_for_data-governance.pdf
Amazon	Addressing the Perils of PII with the De-Identified Data Lake: https://d1.awsstatic.com/partner-network/partner-solutions/data-governance-eBook.pdf
National Institute of Standards and Technology (NIST)	NIST SP800-171 Protecting Controlled Unclassified Information in Nonfederal Information Systems and Organizations: https://doi.org/10.6028/NIST.SP.800-171r1
Federal Information Processing Standards (FIPS)	FIPS PUB 199 Standards for Security Categorization of Federal Information and Information Systems: https://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.199.pdf

IDENTIFIED ACTIVITIES TO MONITOR RELATED TO CLOUD TECHNOLOGY – FULL TABLE

Organization	Identified Standard, Activity or Documentation
Open Connectivity Foundation (OCF)	Device to Cloud Services Specification: https://openconnectivity.org/specs/OCF_Device_To_Cloud_Services_Specification_v2.0.5.pdf Cloud Security Specification: https://openconnectivity.org/specs/OCF_Cloud_Security_Specification_v2.0.5.pdf
Google	Principles and Best Practices for Data Governance in the Cloud White Paper: http://services.google.com/fh/files/misc/principles_best_practices_for_data-governance.pdf
North American Electric Reliability Corporation	NERC Project 2019-02 BES Cyber System Information Access Management: https://www.nerc.com/pa/Stand/Pages/Project2019-02BCSIAccessManagement.aspx



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX B: LIST OF COMMITTEE MEMBERS AND PARTICIPANTS

NAESB Board Digital Committee – Members and Participants

Name	Organization
Rakesh Agrawal	Blackstone Technology Group
Jonathan Booe	NAESB
Dick Brooks (<i>Member</i>)	Reliable Energy Analytics
Jim Buccigross (<i>Member</i>)	8760, Inc.
Christopher Burden	Enbridge
J. Cade Burks (<i>Member</i>)	Big Data Energy Services
Pete Connor	Representing American Gas Association
Valerie Crockett (<i>Member</i>)	Tennessee Valley Authority
Debbie Curry	Southwest Power Pool
Jerry Dempsey	OATI
Michael Desselle (<i>Member</i>)	Southwest Power Pool
Rob Engelhardt	Alliance Pipeline
Somal Goyal	Adjoint, Inc.
Lisa Goth	Boardwalk Pipeline Partners
Howard Gugel (<i>Member</i>)	North American Electric Reliability Corporation
Ronnie Hensley	Southern Star Central Gas Pipeline
Marcy McCain	Enbridge
Steven McCord (<i>Member</i>)	TransCanada Pipelines Limited
Annie McIntyre (<i>Member</i>)	Ardua Strategies Inc.
Rae McQuade	NAESB
Sylvia Munson	44 Farris
David Nilsson	Adapt2 Solutions
Gene Nowak	Kinder Morgan
Joelle Ogg (<i>Member</i>)	DC Energy
Randy Parker (<i>Member</i>)	Exxon Mobil Corporation
Emil Pena (<i>Member</i>)	EPII
Joshua Phillips	Southwest Power Pool
Denise Rager	NAESB
Mark Ruane	ERCOT
Keith Sappenfield	Cheniere Creole Trail Pipeline
Timothy Simon (<i>Member</i>)	TAS Strategies



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX B: LIST OF COMMITTEE MEMBERS AND PARTICIPANTS

Name	Organization
Leigh Spangler (<i>Member</i>)	Latitude Technologies LLC
Mark Stultz	EVC Insights, LLC / Faraday Grid
Terence (Terry) Thorn (<i>Member</i>)	JKM Energy & Environmental Consulting
Sue Tierney (<i>Member</i>)	Analysis Group, Inc.
Caroline Trum	NAESB
Kim Van Pelt	Boardwalk Pipeline Partners
Pat Wood III (<i>Member</i>)	Wood3 Resources



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX C: LIST OF MEETINGS

Meetings of the NAESB Board Digital Committee

Date	Brief Synopsis of Meeting	Agenda, Work Papers and Meeting Notes
May 14, 2019		Agenda: https://www.naesb.org/pdf4/bd_digital051419a.docx Meeting Notes: https://www.naesb.org/pdf4/bd_digital051419notes.docx
June 26, 2019		Agenda: https://www.naesb.org/pdf4/bd_digital062619a.docx Work Papers: Digital Committee Report Outline: https://www.naesb.org/pdf4/bd_digital062619w1.docx Meeting Notes: https://www.naesb.org/pdf4/bd_digital062619notes.docx
July 23, 2019		Agenda: https://www.naesb.org/pdf4/bd_digital072319a.docx Work Papers: Work Paper - Digital Committee Outline Section V: https://www.naesb.org/pdf4/bd_digital072319w1.docx Meeting Notes: https://www.naesb.org/pdf4/bd_digital072319notes.docx
August 8, 2019		Agenda: https://www.naesb.org/pdf4/bd_digital080819a.docx Work Papers: Digital Committee Survey Results: https://www.naesb.org/pdf4/bd_digital080819w1.docx Meeting Notes: https://www.naesb.org/pdf4/bd_digital080819notes.docx
October 2, 2019		Agenda: https://www.naesb.org/pdf4/bd_digital100219a.docx Work Papers: Surety Assessment Board Discussion-Determination Items: https://www.naesb.org/pdf4/bd_digital100219w1.docx Surety Assessment Assignments to Board Digital Committee: https://www.naesb.org/pdf4/bd_digital100219w2.docx Digital Committee Report Outline: https://www.naesb.org/pdf4/bd_digital100219w3.docx Meeting Notes:



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX D: BOARD DIGITAL COMMITTEE MISSION STATEMENT

Mission Statement of the Board Digital Committee

- Statement of Purpose – To provide assistance to the Board of Directors by (a) annually surveying the energy markets to identify new digital technologies being deployed by market participants, (b) appraising whether standardization in support of the new digital technologies would be beneficial to the industry, and (c) submitting any recommendations concerning potential standards to the organization for consideration.
- Relationship to the Board of Directors – All non-administrative decisions, including any recommendations of items for inclusion on the NAESB Annual Plan(s), are subject to the approval of the Board of Directors.
- Relationship to other committees – The committee will work with other board committees as needed, such as the Parliamentary Committee for governance issues, the Board Strategy Committee for NAESB survey items or strategic recommendations, and the Revenue Committee for communications outreach. The work of the committee, as it pertains to standards development, will be provided to the Annual Plan Subcommittee for discussion and consideration for inclusion in the Annual Plan(s) under development. The Board of Directors, if it so chooses, may add standards development items to the existing Annual Plan(s) that the committee has recommended. Additionally, the committee members may submit standards request to NAESB through the industry standards request process.
- Membership and Qualifications – NAESB Board of Director members and NAESB Advisory Council members as named by the chairman may serve on the committee. The membership will be reviewed by the chairman periodically to determine if roster changes are needed to support the activities of the committee and ensure a balance of interests is maintained. As with the responsibilities of membership on the Board of Directors, members of the committee will serve and make decisions in the best interests of the NAESB organization as a whole.
- Meetings – The committee will meet as needed to complete tasks, and the meetings will be administered by an officer of the Board of Directors. The meetings will be open to all interested parties, however only named members may make motions and vote.
- External Communications - Any communications with external organizations representing the North American Energy Standards Board (NAESB), or citing leadership roles within NAESB or its committees and subcommittees, must be approved by the NAESB Managing Committee prior to release or disclosure of the communication.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

via posting

DATE: July 26, 2019
TO: **Board Digital Committee:** Dick Brooks, Jim Buccigross, Cade Burks, Valerie Crockett, Michael Desselle, Howard Gugel, Steven McCord, Annie McIntyre, Joelle Ogg, Randy Parker, Emil Pena, Timothy Simon, Leigh Spangler, Terry Thorn, Sue Tierney, Pat Wood
FROM: Jonathan Booe, Executive Vice President & CAO, NAESB
RE: Draft NAESB Board Digital Committee Survey Questions

Dear Digital Committee Members,

Thank you for your participation in the Board Digital Committee's efforts to develop a report concerning the digitalization of the energy industry and how it may impact NAESB. Through the three conference calls held on May 14th, June 26th and July 23rd, the committee has identified 11 areas for consideration and further exploration through the development of the report. The purpose of this survey is to solicit information and comments related to the 11 identified areas and to determine if there are additional areas that should be evaluated by the committee as part of the report.

To provide context, the committee has grouped the 11 identified areas by their relationship to digitalization or digital technology as being (1) an area enabled by digitalization or digital technology, (2) an area impacted by digitalization or digital technology or (3) an area that impacts digitalization or digital technology.

Please respond to each of the following questions and provide any supportive information concerning your response that you deem appropriate. You do not need to respond to all questions for your input to be provided to the committee. Should you need access to the minutes and work papers of the committee, please contact the office. We urge you to reach out to your colleagues if you believe that additional information would be helpful to your responses.

You can access the survey through the following link: [NAESB Board Digital Committee Survey](#). Your response is requested by end of business Monday, August 5. If you would prefer the survey to be conducted by phone, let our office know and it will be scheduled. As another alternative, you can simply respond to the questions attached and email your responses to the office by August 5.

We very much appreciate the efforts that you have provided to date, and will continue to do so in the future to shape our work products --

With Best Regards,

Jonathan Booe
Executive Vice President & Chief Administrative Officer
North American Energy Standards Board



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

Questions for the Survey

1. Please select all areas associated with the digitalization and/or digital technology that you are: (1) in the process of implementing, (2) are considering implementing or (3) consider important to be included in the report:

Areas Enabled by Digitalization or Digital Technology

- a. Distributed Ledger Technology
 - i. How should the energy industry, or how does your company, define Distributed Ledger Technology?
 - ii. Are there any (additional) use cases / business cases for the technology that should be considered?
 - iii. What are the benefits of adopting the technology?
 - iv. What are the costs/issues/concerns associated with the adoption of the technology?
 - v. Are there other standards development efforts that the committee should monitor?
 - vi. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.
- b. Internet of Things
 - i. How should the energy industry, or how does your company, define the Internet of Things?
 - ii. Are there any use cases / business cases for technology associated with the Internet of Things that should be considered?
 - iii. What are the benefits of adopting technology that supports the Internet of Things?
 - iv. What are the costs/issues/concerns associated with the adoption of the technology?
 - v. Are there other standards development efforts that the committee should monitor?
 - vi. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.
- c. 5G Implementation
 - i. Are there any use cases / business cases associated with the implementation of 5G that should be considered?
 - ii. What are the benefits of adopting technology that supports 5G implementation?
 - iii. What are the costs/issues/concerns associated with the adoption of the technology?
 - iv. Are there other standards development efforts that the committee should monitor?
 - v. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

- d. [Improved] Data Analytics
 - i. How should the energy industry, or how does your company, define [improved] data analytics resulting from the digitalization of the energy industry?
 - ii. Are there any use cases / business cases associated with [improved] digital data analytics that should be considered?
 - iii. What are the benefits of [improved] digital data analytics?
 - iv. What are the costs/issues/concerns associated with [improved] digital data analytics?
 - v. Are there other standards development efforts that the committee should monitor?
 - vi. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

Areas Impacted by Digitalization or Digital Technology

- e. Renewable Energy Certificate Tracking/Accounting
 - i. How should the energy industry, or how does your company, define the tracking/accounting of Renewable Energy Certificates
 - ii. Are there any (additional) use cases / business cases associated with digital Renewable Energy Certificate tracking/accounting that should be considered?
 - iii. What are the benefits of digital Renewable Energy Certificate tracking/accounting?
 - iv. What are the costs/issues/concerns associated with digital Renewable Energy Certificate tracking/accounting?
 - v. Are there other standards development efforts that the committee should monitor?
 - vi. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.
- f. Distributed Energy Resource Communication Protocols
 - i. How should the energy industry, or how does your company, define digital Distributed Energy Resource communication protocols?
 - ii. Are there any use cases / business cases associated with digital Distributed Energy Resource communication protocols that should be considered?
 - iii. What are the benefits of digital Distributed Energy Resource communication protocols?
 - iv. What are the costs/issues/concerns associated with digital Distributed Energy Resource communication protocols?
 - v. Are there other standards development efforts that the committee should monitor?
 - vi. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

g. Deployable Shareware

- i. How should the energy industry, or how does your company, define its use of deployable shareware?
- ii. Are there any use cases / business cases associated with deployable shareware that should be considered?
- iii. What are the benefits of deployable shareware?
- iv. What are the costs/issues/concerns associated with digital deployable shareware?
- v. Are there other standards development efforts that the committee should monitor?
- vi. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

Areas that impact Digitalization or Digital Technology

h. Cybersecurity

- i. How should the energy industry, or how does your company, ensure the cybersecurity of its digital technologies?
- ii. Are there any use cases / business cases for the cybersecurity of digital technologies that should be considered?
- iii. What are the costs/issues/concerns associated with the cybersecurity of digital technologies?
- iv. Are there other standards development efforts that the committee should monitor?
- v. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

i. Energy Usage Data

- i. Are there any use cases / business cases associated with digital applications of energy usage data that should be considered?
- ii. What are the benefits of digital applications of energy usage data?
- iii. What are the costs/issues/concerns associated with digital applications of energy usage data?
- iv. Are there other standards development efforts that the committee should monitor?
- v. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

- j. Data Governance
 - i. How should the energy industry, or how does your company, define data governance related to digital technologies?
 - ii. Are there any use cases / business cases associated with data governance related to digital technologies that should be considered?
 - iii. What are the costs/issues/concerns associated with data governance related to digital technologies?
 - iv. Are there other standards development efforts that the committee should monitor?
 - v. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.
 - k. Cloud Hosting, Processing, Transit and Storage
 - i. How should the energy industry, or how does your company, define/manage its interaction with the “cloud?”
 - ii. Are there any use cases / business cases associated with the “cloud” that should be considered?
 - iii. What are the costs/issues/concerns associated with the “cloud?”
 - iv. Are there other standards development efforts that the committee should monitor?
 - v. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.
2. Other areas of analysis not identified in the 11 areas specified:
- a. Please identify other areas related to digitalization or digital technology that we should include in our analysis, that could impact NAESB standards development activities.
 - b. For each of the areas identified in question 2(a), please answer the following questions:
 - i. Are there specific definitions or descriptions that you would want applied to this area?
 - ii. Are there any use cases / business cases associated with this area that should be considered?
 - iii. What are the costs/issues/concerns associated with implementation of this area?
 - iv. Are there other standards development efforts that the committee should monitor related to this area?
 - v. Please provide comments specific to this area that you would like the committee to consider as the report is drafted.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

- c. For each of the areas identified in question 2(a), please note which one of the three sections is most appropriate:
 - i. Areas enabled by digitalization or digital technology and related services
 - ii. Areas that are impacted by digitalization or digital technology and related services
 - iii. Areas that impact digitalization or digital technology and related services

- 3. General Comments:



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

via posting

DATE: August 6, 2019
TO: **Board Digital Committee:** Dick Brooks, Jim Buccigross, Cade Burks, Valerie Crockett, Michael Desselle, Howard Gugel, Steven McCord, Annie McIntyre, Joelle Ogg, Randy Parker, Emil Pena, Timothy Simon, Leigh Spangler, Terry Thorn, Sue Tierney, Pat Wood
FROM: NAESB Office
RE: Draft NAESB Board Digital Committee Survey Results

Dear Digital Committee Members,

Thank you for your participation in the Board Digital Committee's efforts to develop a report concerning the digitalization of the energy industry and how it may impact NAESB. The survey sent to you on July 26th and the results of the survey are included below. As previously discussed, the information provided will be reviewed during our call on August 8th, and we will determine if there is any additional information that should be collected and included in the next iteration of the report.

With Best Regards,

Jonathan Booe
Executive Vice President & Chief Administrative Officer
North American Energy Standards Board



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

Q1: For Distributed Ledger Technology, please provide your thoughts on the following:

How should the energy industry, or how does your company, define Distributed Ledger Technology?

This is an immature field with terminology still evolving and with numerous “working definitions” – none universally recognized. Definitions from frequently referenced sources do not agree (e.g., Gartner, NIST, Wikipedia, etc.). Numerous Blockchain/DLT related articles and reports have definitions within the context of the document, but do not necessarily “fit” beyond that context. A set of NAESB “agreed upon” definitions for the Energy Industry is a definite need and would be most useful. Candidate terms to define: Distributed Ledger, Blockchain (as a variant of DL), and Smart Contract. Current TVA internal definitions:

1. Blockchain/Distributed Ledger Technology (February 2019): A distributed data management protocol utilizing ledger technology for ordering, validating, and maintaining records of digital asset transactions in a consensus-based immutable manner.
2. Smart Contract (February 2019): A collection of if/then statements codified in a digital protocol that self-execute on predefined criteria and thus represents traditional contract processes, including contract formation, creation of enforceable and immutable rights and obligations, and execution of performance.

Not currently applicable

Transaction processing across a secure distributed network

The use of data blocks to validate a transaction and mine transactional data.

A distributed ledger is a database that is consensually shared and synchronized across multiple sites, institutions or geographies. It allows transactions to have public “witnesses,” thereby making a cyberattack more difficult. The participant at each node of the network can access the recordings shared across that network and can own an identical copy of it.

Using shared ledger files maintained across multiple computers on multiple networks to maintain data integrity/security. To the best of my knowledge, TransCanada Pipelines Limited is not currently using the technology.

Are there any (additional) use cases / business cases for the technology that should be considered?

Beyond the current NAESB efforts on Natural Gas post-trade settlement processing, any Energy Industry use case that aligns to these criteria from Gartner would be good candidates for a DLT-based solution – read as a set of conditions that must exist for a good use case:

1. Consistent data store across multiple entities,
2. Tamper-proof log of all witnesses to the data store,
3. Data records once written are never modified or deleted,
4. More than one entity contributes to the data,
5. Entities with write-access have a hard time deciding who should be in control of the data store, and
6. Shared visibility and history, and high availability for shared data.

Numerous use cases align with the utility value chain: Generation (including Traditional & Renewables), Market Operations and Trading, Transmission, Distribution, Consumer & Prosumer (selling excess energy back to the grid). Typical use case categories include:



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

1. Wholesale Markets (energy trading/settlement; Carbon Credits and Renewable Energy Credits),
2. Decentralized Generation & Grid Management (Grid, DER, and Smart Home),
3. eV Charging & Mobility (energy source provenance; access and settlement management),
4. Peer-to-Peer (P2P) (prosumer to consumer),
5. Retail Switching & Retail Market Settlements,
6. Payment Enablement (currencies & tokens),
7. Operations & Efficiencies (streamlined operations & back office processes),
8. Security Management (for participants and devices).

Energy trading, invoice payments

Focus on blockchain in permissioned networks (other implementations offer anonymity and other attributes less useful in the transaction space).

NAESB's EIR would be a good use case for distributed ledger technology

This overview from NIST lists active standards efforts ...

<https://csrc.nist.gov/CSRC/media/Presentations/NIST-Block-Chain-Research-Project/images-media/ready-blockchain-combined.pdf>

What are the benefits of adopting the technology?

Paramount is improving our enterprise capabilities with DLT/Blockchain as a key enabling technology that:

1. Is “broadly applicable” to our Core (Energy, Environment, and Economic Development) and Corporate (Supply Chain, Finance, HR, etc.) functions,
2. Provides “connected trust” enabling individuals, organizations, devices, machines, algorithms (and combinations) to conduct business in more direct and efficient ways,
3. Is “potentially transformative” through opportunities to re-think how energy is supplied and consumed, how assets are validated, and how business is conducted.

Key benefits we expect:

1. Increased data & process transparency,
2. Reduced operational & administrative costs,
3. Accelerated operational & administrative processes,
4. Enhanced security & trust, and
5. Improved standardization.

Reduced errors, faster processing

Offers a fairly easily implemented, secure method of transacting and traceability.

Eliminate single points of failure and make information shareable in a distributed fashion

Provides a level of trust and security in shared files.

What are the costs/issues/concerns associated with the adoption of the technology?



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

1. Much “hype” as an emerging tech - Still immature as far as mainstream adoption; utilities “lag” with respect to Financial and Supply Chain sectors,
2. Standards & Regulations - Evolving and don’t yet adequately address needs; inconsistent,
3. Legal perspective - Smart contracts recognition and enforcement; Federal and State laws evolving; inconsistent,
4. Culture Resistance - Companies accustomed to “central authority”,
5. Production Scale? - Many Proof-of-Concept and Pilots...where is the mainstream Production Scale evidence,
6. Industry “Tension” - Competition; comfort with data sharing; buy-in for Industry-wide Use Cases – how many in an industry need to “agree” to develop a DLT-based solution and be considered representative/inclusive; who will fund and who will get benefits; collection of fees/transaction, coverage for admin overhead,
7. Knowledge & Talent - Lack of applied/practical knowledge in both technical and managerial ranks; small, but growing talent pool, and
8. Technology “Switch-Over” - Time and costs to move from existing “legacy” systems; questions about “proof-of-value” over existing systems.

Mostly confidentiality, and of course security

Ensuring that \$ are focused on an implementation that will be standardized and accepted in the industry.

Unauthorized access to sensitive information that could be placed on a DLT

Are there other standards development efforts that the committee should monitor?

General Industry: These groups have efforts in progress to address standards for general industry:

1. The Enterprise Ethereum Alliance (EEA),
2. The Linux Foundation Hyperledger open source collaborative effort,
3. National Institute of Standards and Technology (NIST),
4. Institute of Electrical and Electronics Engineers (IEEE),
5. American National Standards Institute (ANSI),
6. International Organization for Standardization (ISO),
7. World Wide Web Consortium (W3C),
8. Internet Research Task Force (IRTF),
9. International Telecommunications Union (ITU), and
10. Medium.com writer James Barry about Blockchain Standards - series of “insightful” articles.

Energy Industry: These blockchain “groups” have significant Energy Industry membership and should be considered for standards engagement:

1. Energy Blockchain Consortium,
2. Energy Web Foundation (EWF),
3. Electric Power Research Institute (EPRI),
4. New York Utilities Group.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

<https://www.oasis-open.org/committees/download.php/62905/Unbound%2520KMIP%2520Presentation%2520RSA%25202018.pdf>

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

DLT/Blockchain is but one item in a broad perspective to consider around Technology Disruptors in the Energy sector. Look to "Future of Energy" type publications/presenting to identify other disruptors that align and mutually enable/benefit each other (e.g., DLT and IoT).

Despite several reviews/meetings on DLT, we still lack a clear use case in the energy trading space

Data standardization is a critical first step in the decision to use DLT. The data that's placed on a DLT should be agreed by all parties that plan to implement a DLT.

Q2. For the Internet of Things, please provide your thoughts on the following:

How should the energy industry, or how does your company, define the Internet of Things?

TVA's broadest definition, which encompasses consumer as well as industrial technology: The Internet of Things (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment. TVA has adopted the Industrial Internet Consortium (IIC) definition for industrial IoT technology: An Industrial Internet of Things (IIoT) system connects and integrates industrial control systems with enterprise systems, business processes and analytics. TVA acknowledges that both consumer and industrial IoT technologies are at play in our lower risk environments.

Not currently applicable

The enabling or enhancement of otherwise "unconnected" processes or objects via the Internet

Connectivity of distributed digital assets that offers central command and control.

Tools and Techniques that provide operational entities with useful information to support real-time situational awareness and decision making.

Technology that allows connected physical devices to communicate with and/or control each other over the internet. Most common example is that of connected smart devices in homes.

Are there any (additional) use cases / business cases associated with the Internet of Things that should be considered?

Near term:

1. Condition Based Maintenance,
2. Reliability and Outage Optimization,
3. Enhanced Situational Awareness and Decision Support,
4. Advanced Metering Infrastructure (AMI),
5. Smart Facilities, Equipment, and Instrumentation,
6. Fleet and Asset Management Optimization,



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

7. Enhanced Physical Security.

Longer term:

1. Predictive Maintenance,
2. Generation Optimization,
3. Smart Grid, Microgrids, Energy Storage Infrastructure,
4. Continuous Environmental, Health, and Safety Monitoring,
5. Autonomous Operations, especially DER Infrastructure,
6. Electric Vehicle Infrastructure.

IOT would seem to have most usefulness in the SCADA/control environment

IoT is gaining traction in the operational space, even in high consequence areas (i.e. process safety)

Monitoring and sensing for Distributed Energy Resources

I am not aware of any as they may relate to NAESB Standards. There could be some back-office applications.

What are the benefits of adopting technology that supports the Internet of Things?

1. Lower Costs,
2. Optimized Assets,
3. Conserved Resources,
4. Responsive and Efficient Operations,
5. Improved Reliability,
6. Improved Awareness and Ability to Act- When coupled with real-time AI and Data Analytics,
7. Improved Safety and Security,
8. Improved Compliance,
9. Lower Risk.

#7,8 & 9 if implemented and operated securely, which is a current challenge.

Increased visibility and response times

Increased situational awareness in a networked environment, rapid response, remote control.

Situational awareness from grid edge devices to improve real-time decision making by controlling entities

Potentially lower cost than traditional communication methods.

What are the costs/issues/concerns associated with the adoption of the technology?

1. Immature IoT/IIoT Standards, Laws, and Regulations,
2. Immature supporting elements such as software, interoperability protocols, AI, data governance, and analytics,
3. Lack of adoption and requirement for adoption of existing standards by manufacturers,
4. Lack of integrated system, information, and business process perspective,
5. Lack of cyber and asset management basic hygiene for existing deployed IoT elements, and



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

6. Relative lack of Cyber Physical Security expertise overall.

Security, security, security

IoT greatly increases an attack surface and can introduce significant cyber security risks.

Cybersecurity is #1. IoT data must be trustworthy in order to be useful.

Management, secure communications, and security of the devices

Are there other standards development efforts that the committee should monitor?

1. National Institute of Standards and Technology (NIST),
2. National Renewable Energy Laboratory (NREL),
3. Department of Homeland Security (DHS),
4. Federal Energy Regulatory Commission (FERC),
5. North American Electric Reliability Corporation (NERC),
6. Internet Engineering Task Force (IETF),
7. Institute of Electrical and Electronics Engineers (IEEE),
8. International Standards Organization (ISO) / IEC JTC 1/SC 41,
9. Internet of Things Consortium (IoTC),
10. Industrial Internet Consortium (IIC),
11. Open Connectivity Foundation (OCF),
12. 3rd Generation Partnership Project (3GPP), Mobile Telephony, 5G, etc.

A lot of research in this area, this is one example that has gained traction in the o&g sector
<https://www.sri.com/work/projects/internet-things-iot-security-and-privacy-center>

IEEE 2030.5

<https://www.nist.gov/topics/internet-things-iot>

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

1. Numerous preexisting IoT devices have accumulated on energy industry networks over the years. Basic security and asset management hygiene must be invested in as well as foundational processes and expertise. Reference the DHS CDM program, for example, about requirements for full lifecycle asset management. <https://www.dhs.gov/cisa/cdm>,
2. IoT elements exist as part of a larger system that includes business processes, software, information flows, etc. This system-level aggregate view must be understood as well as the interrelationships with other systems in the operating environment.,
3. Establishing such a connected view is essential for managing complexity, limiting risk, and making progress.
4. We recommend consideration of the IoT Security Maturity Model from the Industrial Internet Consortium (IIC): <https://azure.microsoft.com/en-us/blog/presenting-the-new-iic-security-maturity-model-for-iot/>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

5. Cybersecurity threats for IoT infrastructure are real and must be addressed, and the modernization benefits of applying secure and standardized IoT needs further exploration and investment. Distributed Energy, Renewables, and Energy Storage is an ideal environment to vet this next generation of cyber-enabled energy technologies.

NAESB has dealt historically with the "administrative" aspects of the energy chain. Extending to SCADA would be a reach.

Q3. For the 5G implementation, please provide your thoughts on the following:

Are there any use cases / business cases associated with the implementation of 5G that should be considered?

5G mm band frequencies will enable higher throughput connections in dense environments, but it likely doesn't change much as compared to 4G since most use cases for us are in rural areas, or are low bandwidth.

Not currently applicable

hard to see

Defining the role of 5G in the transaction infrastructure - should there be a required backup? what data privacy protections should be in place? What carrier requirements are necessary regarding uptime, stability and protection?

5G mm band frequencies will enable higher throughput connections in dense environments, but it likely doesn't change much as compared to 4G since most use cases for us are in rural areas, or are low bandwidth.

Not from a strict 5G perspective.

What are the benefits of adopting technology that supports 5G implementation?

It will be more future proof.

increased speed, visibility

Facilitates faster decisions, more accurate transactions with the ability to move real-time field data rapidly

It will be more future proof.

Faster network speeds on mobile devices to allow for more data on mobile networks.

What are the costs/issues/concerns associated with the adoption of the technology?

Most 5G promises being made are centered around the mm band frequencies, but these frequencies are only good for very short range. They also don't deal with obstructions very well.

reliability (limited range, weather effects)

Availability and stability of 5G networks

Most 5G promises being made are centered around the mm band frequencies, but these frequencies are only good for very short range. They also don't deal with obstructions very well.

Are there other standards development efforts that the committee should monitor?



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

No

We are focused on the national security and data privacy aspects, under recent review by the Senate Judiciary Committee

No

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

I think 5G will be an incomplete, localized communication technology for the next several years, and as such will be of limited usefulness to NAESB or the broad energy industry

It might be better to have a section on mobility rather than just 5G technologies in order to cover all aspects of mobile applications. There could be a need at some point for standards modifications to specifically allow for better mobile device interaction with pipeline EBBs.

Q4. For the improved data analytics, please provide your thoughts on the following:

How should the energy industry, or how does your company, define [improved] data analytics resulting from the digitalization of the energy industry?

Data is treated as an agency asset and is managed and valued as a resource. Data acquisition, exploration and analysis is guided by TVA's business unit goals and outcomes. Analytics helps to develop valuable insights from the data and enables data-driven decision making. TVA is currently advancing standard methods to identify and prioritize business problems to be solved with analytics. Improving our analytical strategy would be speaking towards maximizing our production, optimizing our costs, and managing our risk. All analytics initiatives are fueled by those areas.

The definition of digital technology that we use is as it applies to tools for data analytics

Ability to manage, selectively process, and visualize actionable data; ability to determine correlations between data sets

Data analytics is facilitating faster decisions, transactions, and visibility (particularly by the executive suite) into operational details.

Data analysis is implemented for two purposes, descriptive and predictive reporting to aid in several business functions ranging from risk management to market performance and operational insights

Using new tools and technology to assist in the analysis of ever increasing quantities of information. From our perspective this is really a back-office application where one might use AI and Machine Learning technologies to provide faster, more accurate analysis of the information available

Are there any use cases / business cases associated with [improved] digital data analytics that should be considered?

The Data & Analytics team has worked with BU's to identify 70+ data use-cases and 180+ analytics use-cases. Uses-cases have been prioritized and the following analytics have been identified for TVA to begin to address in our Analytics Strategic Roadmap: Transmission Asset Analytics, Generation Asset Analytics, Supply Chain Analytics, Power Billing Analytics, and Business Intelligence analytics (Automation and Reporting). Other quick win use-cases are being developed in other areas as they arise.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

Pipeline flow dynamics; time/price trading strategies; nat gas storage optimization

Data in transit and storage is a critical part of data analytics. Security of these functions is paramount, and not always easy given the existing network architectures.

Financial risk management and operational risk management

Enabled by lower costs of cloud data storage and processing functionality.

What are the benefits of [improved] digital data analytics?

Improved productivity, increased accuracy, efficient operations, economic benefits, customer insights, competitive advantage, innovation.

Better analytics could be used to better predict grid reliability/predictability, generally speaking. Improved insight into the energy industry generally is another potential benefit.

Asset optimization, improved trade performance

Huge increase in visibility, awareness, better and faster decision making.

Improved operational efficiencies and better insights into financial risks.

More useful information on a timely basis. Better predictive models.

What are the costs/issues/concerns associated with [improved] digital data analytics?

Costs for storage/usage of data can be costly for high volume, high frequency data; lack of resources to develop advanced analytical models, lack of skillsets and knowledge of advanced modeling techniques.

There are inherent costs associated with improved digital data analytics, such as costs related to hardware, storage/CPU/computing infrastructure, compliance, data retention, reliability, personnel, and implementation.

Shortages of: 1) platforms able to handle large data 2) personnel with applicable experience

Various technologies adopted before testing and validation. Often companies end up with a solution not-so-fit-for-purpose after considerable expense.

Failure to implement useful data analytics can lead to blind spots that can have severe business consequences (i.e. GreenHat default) or a failed opportunity to improve business performance

Are there other standards development efforts that the committee should monitor?

Standards and usage guardrails for analytics tools don't exist yet at TVA. Users have to find their own way to a tool, and are at risk of picking the tool that does not adequately meet their usage needs. Our Technology Stack Team is in the process of developing standards and rationalization around analytics tools which will help users with their technology decisions.

Should be considered with IOT data

DHS did several large studies into best practices but no standards resulted.

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

The dream of every data driven organization is to be the disrupter in the industry, and to not be disrupted by the industry. Applying the correct analytics to the right initiatives at the right time with the right people helps us get closer to being able to achieve this.

There should be general standards or expectations with regards to machine readability and transparency as the industry relies on improved digital data analytics. Also note that many analytical techniques leverage open-source software and big data.

Many data analytic solutions will be proprietary - how can NAESB's standardization efforts best benefit/enhance data analytics?

The various methods used in descriptive and predictive analytics, i.e. Machine learning algorithms, deep learning methods and other statistical methods, i.e. Random Forests that may be worth developing a standard model for the industry

Q5. For renewable energy certificate tracking/accounting, please provide your thoughts on the following:

How should the energy industry, or how does your company, define the tracking/accounting of digital renewable energy certificates?

Internally we use a combination of spreadsheets and third-party software to manage our portfolio of RECs. Additionally, a portion of the portfolio of RECs is subject to the certification requirements for Green-e and NAR tracking

Not currently applicable

Not my area

Reliance on purely digital systems to produce, store, track, and transmit RECs in a secure fashion

Not involved with Renewable Energy Certificates.

Are there any use cases / business cases associated with [improved] digital renewable energy certificate tracking/accounting that should be considered?

All of our REC portfolio management functions are currently executed via digital tracking accounting.

Data integrity, storage and handling standardization would be very beneficial

What are the benefits of digital renewable energy certificate tracking/accounting?

Digital REC tracking accounting is the most efficient way to track and report on the REC position, as well as providing a clear look into the portfolio activity for audit purposes.

An area ripe for standardization.

What are the costs/issues/concerns associated with digital renewable energy certificate tracking/accounting?

There are costs associated with the software used to manage the portfolio, which must be managed. Depending on the vendor / software – there may be concerns about the quality of data and the reliability of the application.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

In my world, what an adversary could do with the info, or do to change the info is important, and not well-studied.

Are there other standards development efforts that the committee should monitor?

REC contract standardization will better enable renewable DER as it evolves.

None at this time

NREL did a significant study in this space several years ago, but no standards resulted

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

None at this time

I am not very familiar with Energy Certificates. Could this be a good application for using digital ledger technology to trade Energy Certificates like they do with bitcoin?

Q6. For distributed energy resource communication protocols, please provide your thoughts on the following:

How should the energy industry, or how does your company, define distributed energy resource communication protocols?

We define them as applications used to manager DER systems on the distribution grid (i.e. Local Power Company managed).

Not currently applicable

Not my area

We consider this part of all comm protocols, but in the operational environment, the value of the data in transit is higher, in a higher consequence space.

IEEE 1547-2018 and IEEE 2030.5 are key building blocks

Are there any use cases / business cases associated with distributed energy resource communication protocols that should be considered?

One of the main business cases is to control DER systems as needed to support grid reliability and safety. Another is to track, manage, and report performance.

In the operational environment, more obscure protocols have remained valid due to their inherent 'security through obscurity'. Understanding the risks with standard vs non-standard protocols would be useful.

California PUC RESOLUTION E-5000 July 11, 2019

Not involved with Distributed Energy Resources.

What are the benefits of digital distributed energy resource communication protocols?

You can have an awareness of DER systems and accessibility to control them as needed to support your grid reliability.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

A consensus on a valid protocol (benefits, risks, ROI, etc.) would be very helpful.

More precise command and control and situational awareness for grid operators

What are the costs/issues/concerns associated with digital distributed energy resource communication protocols?

TVA does not manage the distribution grid, and as such the communication protocols will have to be implemented by individual LPCs across the TN Valley. There is a risk of not adoption a standardized and consistent communication protocol across the TN valley.

Varying protocols means there is no standard target, but also slows down the ability to transact across varying systems, legacy systems, etc.

Are there other standards development efforts that the committee should monitor?

None at this time

IEEE 2030.5

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

None at this time

Implementations of IEEE 1547-2018 in Hawaii and California, along with CA Resolution E-5000

Q7. For use of deployable shareware, please provide your thoughts on the following:

How should the energy industry, or how does your company, define its use of deployable shareware?

Not currently applicable, unless open source software is considered deployable shareware.

Unclear what this is...

Shareware can have a lot of pros & cons. The benefit to using it for transactions would need to be clearly identified.

Should we consider using something like “Open Source Business Applications” here rather than “Deployable Shareware?” Traditionally, anything associated with “Shareware” has been avoided in most organizations. However, we are beginning to talk more about back-office usage of some of the open source databases and business applications in the cloud.

Are there any use cases / business cases associated with deployable shareware that should be considered?

No responses provided

What are the benefits of deployable shareware?

No responses provided

What are the costs/issues/concerns associated with use of digital deployable shareware?

The open-source nature of the software could leave it more vulnerable to cyber attacks?

Are there other standards development efforts that the committee should monitor?



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

No responses provided

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

I still don't have my mind totally wrapped around this concept for our use cases. I'm working on it.

Q8. Regarding cybersecurity, please provide your thoughts on the following:

How should the energy industry, or how does your company, ensure the cybersecurity of its digital technologies?

TVA reviews technology before connecting with systems or data. We perform reviews of security controls, contract language, industry threat/privacy assessments, and third party certifications to ensure the protection of TVA systems and data. The industry could serve each other in the sharing of assessments and provide vendor pressure for applying cybersecurity principals and guidance for industry technologies.

General cybersecurity and information security measures can include policies and procedures, training, monitoring, and following general best practices regarding protecting password security, encryption, keeping software updated, and general business continuity and disaster recovery practices.

We should (and do) maintain minimum industry security standards and continually revise and enhance them.

Ensure integrity, stability, confidentiality, and availability of all data and processing capability in energy transactions.

NERC CIP Standards and FERC Order 850 are key to protecting the Bulk Electric System from cyber attacks

Adherence to governmental guidelines. The pipeline industry is working with DOE to enhance cybersecurity measures. Our CyberSecurity and SCADA Network teams work closely with DHS (dept of homeland security) and are also evaluating common practices at the ICS (industrial control systems) CyberSecurity level.

Are there any use cases / business cases for the cybersecurity of digital technologies that should be considered?

Use cases should always be considered based on the risk associated with the device and data. For example, a "sensor only" device should be followed by human validation before proceeding with an operational change. A "sensor only" device can also be considered a consumable based on cost and function.

Protections with regards to proprietary data should be part of what is considered.

This is endless, but key elements for NAESB should be any data communication-related scenarios.

Permeates across all our topics. It needs to be addressed as an integral part of the transaction - just like safety of an operational environment.

Verification of Software objects prior to installation within any grid operators (transmission, distribution and generation levels) command and control systems

What are the costs/issues/concerns associated with the cybersecurity of digital technologies?



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

TVA has cost associated implementing and testing proper controls of digital technologies. This includes monitoring of controls to insure the confidentiality, integrity, and availability of the data. Additionally, some controls can yield process change and/or training personnel. We have also seen cost reduction and elimination of errors with automation.

There are inherent costs associated with general cybersecurity and information security include training, software costs, costs associated with breaches and reporting, and costs of updates, compliance, personnel, etc.

Again endless, but the key costs are the cost of constant enhancement/revision and the real costs of a breach.

Again, a lot of technology fielded without appropriate testing or applicability. This introduces considerable risk.

Becoming more challenging as more DER's come online with their embedded software code

Are there other standards development efforts that the committee should monitor?

The Cybersecurity industry provides multiple development efforts from government (e.g. NIST), professional trade (e.g. Center for Internet Security), and standards (e.g. IEEE). These should be regularly reviewed for reasonable expectations with vendors and industry members.

The NIST standards are a helpful guideline/best practice to follow, as they apply to the energy industry.

A ton of best practices, guidelines, and federal recommendations out there, aligned mostly per sub-sector.

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

There should not be a proscriptive requirement in most cases as it is not a one size fits all industry, but industry best practices or standards would be helpful and would help justify the cybersecurity and information security protections and costs associated with establishing such protections. It also would help to have a more centralized location for industry specific best practices. Piecemeal requirements make compliance more difficult.

While difficult, NAESB could be a position to act as a repository or clearing house for sharing cybersecurity tips, notices or info across the energy industry.

Even with best practices, we still see significant events like the EDI event last year. Incentivizing security is key, certainly standards from an industry group such as NAESB provide a huge value.

Q9. Regarding digital applications of energy usage data, please provide your thoughts on the following:

Are there any use cases / business cases associated with the digital applications of energy usage data that should be considered?

Not currently applicable

Energy resource planning, retail energy usage/offerings, energy conservation

Again, back to integrity of the data in storage and transit, as well as assigning a value/criticality to the data. Without this value, it is tough to ensure the right protections and handling exists within the technology.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

Not that I am aware of from the WGQ perspective. This item appears to be geared towards retail markets where monitoring real-time energy usage information would help with demand management and prediction.

What are the benefits of digital applications of energy usage data?

Reduced energy costs, energy conservation, more profitable energy purchasing/trading

Facilitates faster, more accurate decisions. Also feeds into operational models which add to stability, uptime, and trending analysis.

What are the costs/issues/concerns associated with the digital applications of energy usage data?

Privacy, varied localized regulatory schemes

Many new to the industry do not understand data ownership and chain of custody.

Are there other standards development efforts that the committee should monitor?

Greenbutton

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

NAESB can provide standardized data formats that can serve as the basis for energy data storage/transfer/analysis

Q10. Regarding data governance, please provide your thoughts on the following:

How should the energy industry, or how does your company, define data governance related to digital technologies?

Data Governance helps us to define a uniformed approach in becoming a data driven organization. It breaks down silos while encouraging collaboration which ultimately allows us to focus on the customer and to be able to extract the most amount of value we can from our data.

General data governance protections include performing backups, retention, destruction, distribution, privacy, and access controls.

Application of regulatory and ethical rules regarding the collection, transmission, storage and use of data, especially customer data

This is a huge issue that crosses all the data topics, if not all of the topics. As the representative body for energy transactions, NAESB membership should definitely have a voice in future data governance.

A well defined and adhered to data governance program can avoid many misunderstands in data usage that could have severe consequences

Overall management, validation and security of data within an organization. Again, this is a back-office function for our company managed at the corporate level.

Are there any use cases / business cases associated with data governance related to digital technologies that should be considered?



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

There are many. Use cases range from data lake management, enabling the agency to search and shop for data, reducing the report stack by vetting / certifying those that are published, data quality mechanisms, master data management practice, and many more.

Protections with regards to proprietary data and such data needs to be available when needed and easily retrievable.

For NAESB, any data standardization or communication activity can be considered

Again, data handling including governance for data ownership, storage, protections, and transmission would be very useful.

ISO New England has had a data governance program in place since 2012

Perhaps with some of the Cloud hosting companies like Amazon and Google.

What are the costs/issues/concerns associated with data governance related to digital technologies?

The cost of good data governance is multi-faceted. There are the technology costs of Metadata Management, Data Quality, and Master Data Management tools. Then there is also the more cultural / labor intensive costs that come from having the business units understand the value governance brings and what our analytics vision is. It takes deliberate allocation of time and resources from the business working with the data governance core team to extract the most value we can from our governance initiatives.

Data governance shares some of the same computing infrastructure required to perform data analytics. There are some additional software costs associated with data governance of digital technologies, such as backup software or software to replicate.

Walking the thin line between practice and policy

Without clear governance, significant risk can occur, divulging data or risking integrity of the data used to make operational decisions. Without standards, mishandling and negligence can be a murky subject.

Are there other standards development efforts that the committee should monitor?

Engagement, Data Quality, Data Landscape Assessments, Proliferation of Reporting, just to name a few.

FIPS and NIST have general guidelines under development with regards to information systems and security controls, etc.

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

Being a data driven organization means being purposeful and deliberate with what we do with our data. Data Governance helps us get there.

The energy industry would benefit from some best practices or general guidances for data governance of digital technologies.

The non-policy parts of this are NAESB's domain. The trick is to make useful, timely standards.

Look for best practices throughout industries



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

Q11. Regarding cloud hosting, processing, transit and storage, please provide your thoughts on the following:

How should the energy industry, or how does your company, define/manage its interaction with the “cloud?”

TVA defines the cloud as any software, platform or infrastructure that is provided by an outside entity.

Cloud procurement is a private contracting matter.

Cloud is now an integral part of processing and storing 'big data'. In many cases, processing and handling data would not be technically feasible without the cloud.

As an organization, we have embraced cloud technology in terms of data storage and governance, and are exploring many of the other cloud services being offered such as analytics with Machine Learning and Artificial Intelligence.

Are there any use cases / business cases associated with the “cloud” that should be considered?

With the rising costs of on premise storage, companies could deliver a quick win by implementing storage spaces with larger providers. This is especially true with archival data that needs to be kept for compliance but is not accessed on a regular basis. Companies that host their own solutions or offer an “on-prem” version can be leveraged for quick turnarounds. These type of solutions need to be thoroughly vetted though.

1. Businesses can be run entirely on the cloud including data analytics and cybersecurity on the cloud. 2. Businesses can share files, distribution, and expedite computing activity in the cloud.

Cloud security is not transparent in many cases. Heavy reliance on the supply-chain. If baseline security standards existed, companies could use this guidance to ensure the cloud meets a minimum level of security. Many times industry owners are not sure what questions to ask or where to begin, and they have to trust the provider.

Cloud Providers can deliver the enabling technologies for Digital Ledger and IoT implementations.

What are the costs/issues/concerns associated with the “cloud?”

From a cost perspective, it is important to understand that as you transition, both your on-premise and cloud solution need to run at the same time. This is the larger up front cost that is usually not factored in. Once that transition is complete, the cost will begin to level out and general goes down. All cloud products are subscription-based. This means that there are ongoing costs that need to be accounted for. Data stored in the cloud needs to be properly secured, preferably with MFA, to prevent data breaches, ransomware and lost revenue and/or reputation. Monitoring of systems for availability and security is much different than on-premise solutions. Figuring these systems out on the front side of an effort will save time and money in the long run.

1. There are capital costs and service costs and due diligence costs associated with cloud technology

The usual - security, reliability

Availability is perhaps the biggest concern currently. High availability and fault tolerance comes with a premium cost.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

Are there other standards development efforts that the committee should monitor?

AI and ML are becoming increasingly popular and should be monitored. There is the possibility of data manipulation which would affect the desired outcome of AI/ML application.

Please provide comments specific to this area that you would like the committee to consider as the report is drafted.

NAESB should focus on data-centric standards (format, content, communication). How the data is stored is almost immaterial.

The cloud is providing companies with low cost storage and backup while offering computing power that most companies did not have available on in-house servers. This is opening a new realm of data analytics that should enhance prediction models and overall information availability.

Q12: For other areas that should be examined and included in the report, but are not included in the 11 areas already identified:

Please identify others areas related to digitalization or digital technology that we should include, that could impact NAESB standards development activities.

One area to consider is general standards or expectations with regards to machine readability and transparency as the industry relies on improved digital data analytics.

Perhaps some other mobile technologies.

For each of the areas identified above, please provide information regarding (i) any descriptions or definitions you would want discussed for possible inclusion in the report, (ii) any related business cases or use cases you are aware of, (iii) any costs/issues/concerns associations with implementation, (iv) other areas of standards development to be monitored, and (v) any specific comments.

(iii) Issues and Concerns around either mobile applications or web browsers deal with accessibility on both IOS and Android platforms, and with scalability for varying screen sizes of mobile devices.

For each of the areas identified above, please note whether the area fits best as (i) enabling digitalization or digital technology and related services; (ii) impacted by digitalization or digital technology and related services; or (iii) impacting digitalization or digital technology and related services.

The mapping that you have created to these areas is solid. I could see some potential areas of overlap in the broader topics.

(i) This category would be most appropriate.

Q13. Please provide any additional comments:

Open-Ended Response

It would be helpful to have definitions of the terms within the survey to address ambiguity about the use of such terms in the questions posed in this survey and provide a baseline understanding of such terms.

I can see how some of these topics could be combined, or we could have "umbrella" topics such as data governance and cyber security. The challenge in doing this is make certain the individual standards



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX E: JULY SURVEY AND RESPONSES

NAESB Digital Committee Survey Results

activities remain focused enough to provide valuable technical metrics and also get sizable participation from the NAESB members. In that same sense, I could also see how a standards activity may fall into more than one category. I'm curious to see if definitions in these areas are consistent among the members and if some detailed sub-topics develop into a natural prioritization.

Most relevant areas for NAESB to involve itself are: Distributed Energy Resource Communication Protocols, Energy Usage Data, and Data Governance: We are early in the de-centralization of the network and when you graft Blockchain into all this, these three areas are going to be the Wild West. Getting inside before proprietary systems are built could be tricky but important in saving everyone a lot of time and \$\$ later on.

Deployable Shareware, Cybersecurity, and Cloud Hosting, Processing, Transit and Storage aren't exactly related but I think of them together in this regard. They cross many other industries, and we have to be smart on what's being done with them, but I don't see an evident role of NAESB in standards setting.

Rec Certificates are kind of old news, and I think someone else is doing that, but its importance will only grow. I'd like to hear if the others think we have anything to add here.

IoT and 5G are huge issues across many industries. We'll want to stay smart on these two but in the "crawl before you run" paradigm, I would suggest our role on an sort of standards there might not be imminent at all.

Q14. Respondents:

Dick Brooks
Valerie Crockett
Steven McCord
Annie McIntyre
Joelle Ogg
Leigh Spangler
Pat Wood



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

via email

DATE: October 7, 2019

TO: **Board Digital Committee:** Dick Brooks, Jim Buccigross, Cade Burks, Valerie Crockett, Michael Desselle, Howard Gugel, Steven McCord, Annie McIntyre, Joelle Ogg, Randy Parker, Emil Pena, Timothy Simon, Leigh Spangler, Terry Thorn, Sue Tierney, Pat Wood

FROM: Rae McQuade & Jonathan Booe, NAESB

RE: NAESB Board Digital Committee Survey Questions – Priorities, Relevancy and Urgency

Dear Digital Committee Members,

In furtherance of our mission to develop a report for presentation to the NAESB Board of Directors during its December 11, 2019 meeting, we are distributing a follow-up to the survey previously sent to committee members on July 26th. The purpose of this survey is to solicit additional information and comments related to the 10 identified areas and to determine the relevancy and urgency of potential standards development to support the areas.

Please respond to each of the following questions and provide any supportive information concerning your response that you deem appropriate. You do not need to respond to all questions for your input to be provided to the committee. For reference the results of the July 26th survey and the updated Report Outline, which includes a summary of the results, can be found through the following hyperlinks.

Digital Committee Survey Results: https://www.naesb.org/pdf4/bd_digital080819w1.docx

Updated Report Outline: <https://www.naesb.org/pdf4/bd090519w4.docx>

You can access the survey through the following hyperlink: [NAESB Digital Committee Survey on Relevance and Urgency](#). Your response is requested by end of business on **October 14, 2019**. If you would prefer the survey to be conducted by phone, let our office know and it will be scheduled. As another alternative, you can simply respond to the questions attached and email your responses to the office.

We are grateful the efforts that you have provided to date, and appreciate your help in shaping our future work products

--

With Best Regards,

NAESB Office



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

SURVEY

- 1 **Areas Enabled by Digitalization or Digital Technology:** *For each of the four areas enabled by digitalization or digital technology, please answer the questions highlighted in blue.*

- a. **Distributed Ledger Technology:** Distributed ledger technology allows trading parties to execute automated processes using a secured shared ledger. The shared, or distributed, ledger created through the technology serves as a digital record of transactions that can be used for tracking commodities. Transactions are often recorded onto a distributed ledger through the use of a “smart contract,” which is a trackable software technology designed to represent and execute the terms of a contract, automatically executing transactions under a set of specific circumstances without the use of manual intervention, reconciliations, or a third party agent. The data included in a “smart contract” is encrypted into a block, which generates a unique identifier that is used to verify the next block, creating a chain of blocks – one block verifying the next to ensure integrity, security, and provenance of the distributed ledger. The distributed ledgers created using this technology can be open and public or private and permissioned, limiting access and participation to specific authorized parties. This technology is currently being adopted in many industries throughout the world for the efficiency and security it provides when conducting transactions. As the energy industry adopts applications of the technology, it is important that NAESB remain active in the development of supportive standards.

Please select the appropriate level of relevancy for the technology:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8.

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the technology that you would like considered in the development of the report.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

- b. **Internet of Things:** The Internet of Things is a concept of connected electronic devices or their components to each other and the Internet. The connectivity can provide efficiency, lead to easier data sharing, and revamp how operations occur. The analyst firm Gartner says that by 2020 there will be over 26 billion connected devices. Data sharing, privacy and cybersecurity will require more attention as the connectivity is broadened. Specific to the energy industry, as an example, IoT can make energy use more efficient.

Please select the appropriate level of relevancy for the technology:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8.

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the technology that you would like considered in the development of the report.

- c. **5G Implementation** – 5G networks are the next generation of mobile internet connectivity, offering faster speeds, more reliable connections, and providing the infrastructure needed to carry huge amounts of data. 5G networks are needed to realize the benefits of IoT, and support improved data analytics, but come with physical implementation challenges and required operational changes.

Please select the appropriate level of relevancy for the technology:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the technology that you would like considered in the development of the report.

- d. **[Improved] Data Analytics** – Data volumes are expanding, and with the needed technology implementation of 5G networks and the connectivity provided as devices are designed to operate within the IoT framework, improved data analytics are a given along with the necessary integration of big data.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the area that you would like considered in the development of the report.

4. **Areas Impacted by Digitalization or Digital Technology:** *For each of the two areas impacted by digitalization or digital technology, please answer the questions highlighted in blue.*

- a. **Renewable Energy Certificate Tracking/Accounting** - A renewable energy certificate, or REC (pronounced: rĕk), is a market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource and may include many data attributes. Because the physical electricity we receive through the utility grid says nothing of its origin or how it was generated, RECs play an important role in accounting, tracking, and assigning ownership to renewable electricity generation and use. On a shared grid, whether from on-site or off-site resources, RECs



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

are the instrument that electricity consumers must use to substantiate renewable electricity use claims

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. NAESB standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the area that you would like considered in the development of the report.

- b. **Distributed Energy Resource Communication Protocols** - A Distributed Energy Resource (DER) is any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System (BES). DER include any non-BES resource (e.g. generating unit, multiple generating units at a single location, energy storage facility, micro-grid, etc.) located solely within the boundary of any distribution utility or Distribution Provider.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. NAESB standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the area that you would like considered in the development of the report.

5. **Areas that impact Digitalization or Digital Technology:** *For each of the four areas impacted by digitalization or digital technology, please answer the questions highlighted in blue.*

- a. **Cybersecurity** – According to Gartner, cybersecurity is the combination of people, policies, processes and technologies employed to protect cyber assets. Networks, electronic devices, electronic transactions, systems, applications and data, including those that are Internet-facing, are defended from malicious attacks and unauthorized access through a body of technologies, processes and practices, thus ensuring the integrity, confidentiality and availability of information. According to Forbes, some of the recent cybersecurity trends now and on the horizon include targeted phishing attacks, the European Union’s General Data Protection Regulation (GDPR) for data privacy and data protection, third party platform technologies and devices (mobile, cloud, social media), exploiting user awareness, and shadow technologies.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the area that you would like considered in the development of the report.

- b. **Energy Usage Data** – Accessible energy usage data provides efficiency and cost savings – to utilities, end users and consumers – through better managing energy usage in homes, buildings and communities. The aggregated data can be used for resource planning and forecasting. Green Button applications are an example of the how energy usage data can be provided and used by consumers.

Please select the appropriate level of relevancy for the area:



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the area that you would like considered in the development of the report.

- c. **Data Governance** – Data governance is the management of the availability, usability, integrity and security of data, and can include a governing body(ies), through policies and procedures. Data governance can include standards and certifications, policies, processes and the like. As data crosses industries and markets, better data governance provides a level of consistency and integrity to support decision making. Governance can include compliance and audit procedures; and can provide rules for data storage, archival, and protection. As more data is stored across multiple platforms for use in multiple applications, formal data governance becomes more critical.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

8. Please provide any comments related to the area that you would like considered in the development of the report.

- d. **Cloud Hosting, Processing, Transit and Storage** – Cloud hosting, through multiple interconnected servers, is an infrastructure, platform and software service(s) that hosts data, services and analysis. Cloud hosting, as opposed to dedicated hosting, provides scalability to more easily meet changing business requirements. Cloud hosting, processing, and storage, uses shared resources in an environment not controlled by the end user. Dedicated hosting provides more ability to customize as the user has more control over the infrastructure, software and applications. Cloud hosting and computing relies on a third party to provide the infrastructure and resources to operate the service.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

4. NAESB standards to support the area are not needed for the energy industry
5. Standards currently exist that adequately address the area for the energy industry
6. NAESB standards in the area would be helpful and are currently emerging for the energy industry
7. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
8. Please provide any comments related to the area that you would like considered in the development of the report.

6. **General Comments:** *Please provide any additional comments that have not been included in your comments provided for each area.*



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

DIGITAL COMMITTEE SURVEY ON RELEVANCE AND URGENCY RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
DISTRIBUTED LEDGER TECHNOLOGY	0	3	9	0	0	9	3	<p>There is a very limited potential for DLT at this time.</p> <p>The technology is emerging rapidly. NAESB should finish up the gas contract aspects and move forward from there to other aspects of DLT, e.g. wholesale and retail electric contracts.</p> <p>I would actually choose two answers for the first question: Relevant to processes/transactions that NAESB standards currently, and may, address....</p> <p>Current efforts to develop electronic datasets for the natural gas purchase and sales agreements and transactional information can result in efficiencies in the natural gas trading environment. Digital Ledger Technology might be used to effectuate the trading of these datasets in the future.</p> <p>High Urgency</p> <p>This is addressed in the DL proposal to DOE.</p> <p>This seems to be beyond the scope of NAESB, as they are deployed outside of industry control.</p>
INTERNET OF THINGS	2	5	5	1	0	7	2	<p>Possibly ESPI and Energy Efficiency standards could benefit from IoT standards.</p> <p>The urgency is greater for the electric and combination companies, somewhat for a gas distributor, and a lower priority for pipelines. gas</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
5G IMPLEMENTATION	3	7	2	4	1	3	2	<p>NAESB Standards for Wholesale Gas support the business needs of the industry with business practices and communications standards for our Electronic Bulletin Boards and Informational Postings websites. IoT devices are operational in nature for WGQ and are not likely to be addressed by NAESB Standards in the near future.</p> <p>Medium Urgency - The OpenFMB and Green Button may be areas where the internet of things could be addressed. Data formats, security, and communication methods seem like areas that are ripe for standards.</p> <p>Security standards in IoT as related to data integrity used in transactions, as well as efficiencies gained by using a standard implementation tuned to our industry.</p> <p>5G offers tremendous opportunities for speed and bandwidth in communications. However, at this time I'm not convinced if offers much more than a faster speed for existing transactions to members. This may change in the future.</p> <p>5G technology is promised to be transformational for network speeds and mobile computing and will be extremely important to the industry as a back-office technology. However, NAESB Standards might not be needed for this technology in the near future unless there becomes a need for modified protocols or security elements associated with its use.</p> <p>This could probably be covered in an IoT standard, or data analytics.</p>
IMPROVED DATA ANALYTICS	4	6	2	3	1	4	2	<p>The forthcoming REC standard could benefit from data analytic capabilities.</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
RENEWABLE ENERGY CERTIFICATES TRACKING/ACCOUNTING	1	5	5	0	0	7	3	<p>The most exciting thing about data analytics is the opportunity for real time monitoring of the performance of assets. It should be a top priority.</p> <p>For Wholesale Gas, Data Analytics is a back-office activity that is not shared outside of the organization. For WGQ, NAESB Standards do not play a part in back-office activities like Data Analytics.</p> <p>Like cybersecurity, this is a large area with ongoing and evolving challenges. NAESB is well-poised to include this topic in new standards, or added to existing standards.</p> <p>Capacity exchanges such as REBA, Level Ten and Rocky Mountain's Marketplace provide Green Buyers an efficient route to secure PPA's with voluntary REC's. This area is growing rapidly and will have profound impact on qualifying reporting entities for REC's.</p> <p>This will be more of a priority in those states who are setting deadlines for an "all renewables" by certain date.</p> <p>High Urgency - Several regional/state have different initiatives. A NAESB standard to assist the voluntary REC market would be a good place to start.</p> <p>I'm not aware of any emerging standards in this area.</p> <p>Measurement and verification and cybersecurity are two prime areas.</p>
DISTRIBUTED ENERGY RESOURCES COMMUNICATIONS PROTOCOLS	1	5	5	0	0	7	3	<p>This is a priority for the electric industry and will be critical for the integration of DER.</p> <p>High Urgency - Many small DER can amount to a impactful load on the BES. Rooftop solar is having a big impact in Hawaii and</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
CYBERSECURITY	0	1	11	0	0	11	1	<p>California. In ERCOT, gas fired generation acting as backup power to commercial buildings is being deployed for economic reasons. The ISO/utility is impacted by a growing number of small DER generation. Communication, Security, and data formats would be areas that would benefit from standards. This may fit in the OpenFMB group or a similar group.</p> <p>Not relevant to the processes/transactions that NAESB standards currently address or may address in the future [Numerous guidelines, particularly those resulting from research at DOE labs, already exist for DER]</p> <p>Ensure no overlap with NERC Cyber standards.</p> <p>NERC's introduction of Supply Chain standards for software cover Bulk Electric System assets, but Market system assets have no such guidance - NAESB could provide Supply Chain standards for non-BES assets/market applications.</p> <p>This is a big concern to everyone in the industry, NAESB should continue to stay on top of cybersecurity issues, as I believe they are currently doing.</p> <p>A high priority that is being unevenly focused upon among the various industry segments.</p> <p>For Wholesale Gas, cyber security is integral to all we do, and is very relevant to the NAESB Standards for secure communications and data transmittal. On a larger scale, cyber security is being addressed corporately and on a national level with other industry organizations and governmental entities.</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
ENERGY USAGE DATA	4	4	4	0	2	7	2	<p>High Urgency - This is a rapidly changing area and it demands NAESB and the industry to step up in all areas. I think the board needs to consider the speed and depth of our scope. The Sandia Surety Assessment pointed out several areas that NAESB has not covered historically, but may need to be addressed now.</p> <p>The OASIS Data Sensitivity issue is interesting to consider for NAESB's cyber role at the board level. The FERC has rules around market transparency that NAESB's WEQ OASIS subcommittee have done a great job in supporting. However, the Surety Assessment has pointed out that publishing transmission constraints and other market data may be useful to nation state hackers in disrupting the electricity grid. Is this something NAESB should address?</p> <p>The EDM Standard Compliance issue is an area that the board needs to evaluate NAESB's role. The Surety Assessment report suggests that new EDM standards should be implemented within 90 days and the previous standards be deprecated (removed from use). The report suggests that NAESB should be monitoring this for the industry. The current EDM standards cannot be monitored by NAESB, but could possibly be something to do in the future. There are companies still using GISB V1.4 standards that were deprecated in the late 1990s.</p> <p>NAESB has an excellent foundation in their standards that can be expanded upon and can continue to address evolving cybersecurity and emerging threats.</p> <p>I believe ESPI and EE measurement verification may fall into this category.</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
DATA GOVERNANCE	1	6	5	0	0	9	1	<p>For Wholesale Gas, similar to IoT devices, the collection and use of Energy Usage Information is more operational and confidential in nature and should not require NAESB Standards in the near future.</p> <p>Low Urgency</p> <p>Not relevant to the processes/transactions that NAESB standards currently address or may address in the future [This could be included in the Data Analytics topic]</p> <p>For Wholesale Gas, Data Governance is a back-office process that is managed confidentially by the individual organizations. For WGQ, NAESB Standards do not play a part in back-office activities like Data Governance.</p> <p>Medium Urgency - Digital data is an asset and needs to be managed as such. Companies treated digital data like paper documents where different departments needed a copy of the same contract, purchase order, and invoice. Today companies have focused managing their data as an asset. Taxing authorities allow data to be treated as an asset on the company balance sheet.</p> <p>NAESB should explore as an industry what standards should exist around industry-wide data governance. The Distributed Ledger standards and subsequent implementations are a good place to start. How a smart contract replaces the physical contract and the associated data has many data governance issues.</p> <p>This could possibly be combined with cybersecurity (i.e. a next generation PKI standard), but NAESB membership could benefit from standard operating guidelines.</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
CLOUD HOSTING, PROCESSING, TRANSIT AND STORAGE	2	6	4	0	1	6	3	<p>NAESB standards to support the implementation of data governance.</p> <p>OATI's OASIS cloud implementation is one such example.</p> <p>As with 5G, another nice to have aspect which would speed up transaction times, but not a priority today as existing bandwidth is more than capable of handling NAESB transactions.</p> <p>Cloud hosting is the purvue of such industry giants as IBM.</p> <p>Again, for Wholesale Gas, this is a back-office function of business that is managed for all aspects of the corporation. NAESB Standards related to this item are not likely to be needed in the near future.</p> <p>Medium Urgency - The FEDRAMP (https://www.fedramp.gov) program is an area that NAESB should review and determine how our organization and members would benefit from adoption of cloud service standards.</p> <p>There is a lack of emerging standards for use of the cloud that pertain to the transactional space, this could be a good fit for NAESB.</p>
GENERAL COMMENTS								

LEGEND:

NR Not relevant to the processes/transactions that NAESB standards currently address or may address in the future

RF Relevant to processes/transactions that NAESB standards may address in the future



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX F: OCTOBER SURVEY AND RESPONSES

- RN** Relevant to processes/transactions that NAESB standards currently address
- SX** NAESB standards to support the area are not needed for the energy industry
- S** Standards currently exist that adequately address the area for the energy industry
- SHE** NAESB standards in the area would be helpful and are currently emerging for the energy industry
- SHNE** NAESB standards in the area would be helpful and are not currently emerging for the energy industry



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

via email

DATE: January 16, 2020
TO: NAESB Board of Directors, NAESB Advisory Council
cc: **Board Digital Committee:** Dick Brooks, Jim Buccigross, Cade Burks, Valerie Crockett, Michael Desselle, Howard Gugel, Steven McCord, Annie McIntyre, Joelle Ogg, Randy Parker, Emil Pena, Timothy Simon, Leigh Spangler, Terry Thorn, Sue Tierney, Pat Wood
FROM: Rae McQuade & Jonathan Booe, NAESB
RE: NAESB Board Digital Committee Survey – Priorities, Relevancy and Urgency, **DUE January 31, 2020**

Dear Board and Advisory Council Members,

In furtherance of our mission to develop a report concerning the digitalization of the energy industry and to broaden the audience to include all Board and Advisory Council members, we are distributing a survey regarding the priority, relevance and urgency of 10 areas for possible standards development. We would ask that you respond to this survey by January 31, 2020. You may respond through our automated software – which can be accessed through the following hyperlink [Digitalization Report Survey](#) or you can simply fill out the attached pages and email them to our office (naesb@naesb.org). If you would prefer the survey to be conducted by phone, let our office know, and it will be scheduled.

As noted during the December 11, 2019 board meeting, the Board Digital Committee has recommended that the survey developed and used by the committee to solicit information concerning 10 areas for possible standards development be distributed to our Board and Advisory Council members for additional input. The responses to this survey provided by the Digital Committee served as the basis for the initial report concerning digitalization that was presented to the Board of Directors on December 11, 2019. The report can be accessed through the following hyperlink: <https://www.naesb.org/pdf4/bd121119w1.docx> and provides background information on the development of the survey and the thoughts of the Digital Committee concerning the 10 identified for potential standards development. We encourage you to review the report prior to taking the survey.

If you agree with the majority opinions of the Digital Committee captured in the report and do not wish to provide any additional information, you can simply provide your survey respondent contact information and answer the survey direction question on page 1, along with any comments you feel appropriate. A description of the majority opinions of the Digital Committee for each of the 10 areas for possible standards development has been included on the following page. If you prefer to provide a detailed response that may vary from the majority opinions of the Digital Committee, please feel free to respond to the questions on pages 2 through 8 of the survey. You do not need to respond to all questions for your input to be considered. If you have already participated in this survey as a member of the Board Digital Committee, your prior responses will be included unless we are informed that you wish to provide new responses.

We are very grateful for the guidance that you provide through your participation on the Board of Directors or the Advisory Council, and we appreciate your help in shaping our work products --

With Best Regards,
NAESB Office



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002

Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org

Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

MAJORITY OPINIONS OF THE BOARD DIGITAL COMMITTEE

- 1.) DISTRIBUTED LEDGER TECHNOLOGY** - Distributed ledger technology received strong support as an area being relevant to the processes and transactions that the NAESB standards currently address and as an area where NAESB standards would be helpful and are emerging for the industry.
- 2.) INTERNET OF THINGS** – Internet of Things technology received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.
- 3.) [IMPROVED] DATA ANALYTICS** - [Improved] data analytics received support as an area that is relevant to the processes and transactions that the NAESB standards will address in the future. It also received support as an area where NAESB standards would be helpful and are emerging for the industry; however, roughly, a third of respondents indicated that the area is not relevant to NAESB and that NAESB standards in the area are not needed.
- 4.) RENEWABLE ENERGY CERTIFICATE TRACKING/ACCOUNTING TECHNOLOGY** – Renewable Energy Certificate tracking and accounting technology received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.
- 5.) DISTRIBUTED ENERGY RESOURCE COMMUNICATION PROTOCOLS** – Distributed Energy Resource communication protocols received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as a technology area where NAESB standards would be helpful and are currently emerging for the industry.
- 6.) ENERGY USAGE DATA** - Technology to support energy usage data received support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future; however, a third of the respondents stated that the area is not relevant to NAESB. The item was also identified as an area where NAESB standards would be helpful and are emerging for the industry.
- 7.) 5G** - 5G Implementation received strong support as being relevant to the processes and transactions that the NAESB standards will address in the future, and responses concerning whether NAESB standards would be helpful in the area were mixed. Fifty percent of respondents believe that NAESB standards are not needed in the areas or that adequate standards are in place to support the area for the energy industry.
- 8.) CYBERSECURITY** - Cybersecurity received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.
- 9.) DATA GOVERNANCE** - Data governance received strong support as being relevant to the processes and transactions that the NAESB standards currently address or will in the future and also, as an area where NAESB standards would be helpful and are emerging for the industry.
- 10.) CLOUD COMPUTING** - Cloud computing received strong support as being relevant to the processes and transactions that the NAESB standards address now or will in the future and also, as an area where NAESB standards would be helpful and are emerging.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002

Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org

Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

SURVEY – RESPONDENT INFORMATION AND SURVEY RESPONSE OPTIONS

Survey Respondent Information:

Name: _____

Company: _____

Survey Responses Direction:

Please select the direction for your survey (a or b):

- a. I support the majority opinion of the Digital Committee regarding relevance and level of urgency for the ten areas identified: (1) Distributed Ledger Technology, (2) Internet of Things, (3) 5G Implementation, (4) Improved Data Analytics, (5) Renewable Energy Certificate Tracking/Accounting, (6) Distributed Energy Resource Communication Protocols, (7) Cybersecurity, (8) Energy Usage Data, (9) Data Governance, and (10) Cloud Hosting, Processing, Transit and Storage.
- b. I will respond separately regarding relevance and level of urgency for the ten areas identified: (1) Distributed Ledger Technology, (2) Internet of Things, (3) 5G Implementation, (4) Improved Data Analytics, (5) Renewable Energy Certificate Tracking/Accounting, (6) Distributed Energy Resource Communication Protocols, (7) Cybersecurity, (8) Energy Usage Data, (9) Data Governance, and (10) Cloud Hosting, Processing, Transit and Storage.

If you chose option (b), please proceed to page 2.

Please provide any comments you want taken into consideration:

If you chose option (a), your survey response is complete. Thank you for taking time to provide us with this input as part of the NAESB Report on Digitalization.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

SURVEY – DETAILED RESPONSES

- 1 **Areas Enabled by Digitalization or Digital Technology:** *For each of the six areas enabled by digitalization or digital technology, please answer the questions highlighted in blue.*

- a. **Distributed Ledger Technology:** Distributed ledger technology allows trading parties to execute automated processes using a secured shared ledger. The shared, or distributed, ledger created through the technology serves as a digital record of transactions that can be used for tracking commodities. Transactions are often recorded onto a distributed ledger through the use of a “smart contract,” which is a trackable software technology designed to represent and execute the terms of a contract, automatically executing transactions under a set of specific circumstances without the use of manual intervention, reconciliations, or a third party agent. The data included in a “smart contract” is encrypted into a block, which generates a unique identifier that is used to verify the next block, creating a chain of blocks – one block verifying the next to ensure integrity, security, and provenance of the distributed ledger. The distributed ledgers created using this technology can be open and public or private and permissioned, limiting access and participation to specific authorized parties. This technology is currently being adopted in many industries throughout the world for the efficiency and security it provides when conducting transactions. As the energy industry adopts applications of the technology, it is important that NAESB remain active in the development of supportive standards.

Please select the appropriate level of relevancy for the technology:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8.

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the technology that you would like considered in the development of the report.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002

Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org

Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

- b. **Internet of Things:** The Internet of Things is a concept of connected electronic devices or their components to each other and the Internet. The connectivity can provide efficiency, lead to easier data sharing, and revamp how operations occur. The analyst firm Gartner says that by 2020 there will be over 26 billion connected devices. Data sharing, privacy and cybersecurity will require more attention as the connectivity is broadened. Specific to the energy industry, as an example, IoT can make energy use more efficient.

Please select the appropriate level of relevancy for the technology:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8.

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the technology that you would like considered in the development of the report.

- c. **[Improved] Data Analytics** – Data volumes are expanding, and with the needed technology implementation of 5G networks and the connectivity provided as devices are designed to operate within the IoT framework, improved data analytics are a given along with the necessary integration of big data.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the area that you would like considered in the development of the report.

- d. **Renewable Energy Certificate Tracking/Accounting** - A renewable energy certificate, or REC (pronounced: rĕk), is a market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource and may include many data attributes. Because the physical electricity we receive through the utility grid says nothing of its origin or how it was generated, RECs play an important role in accounting, tracking, and assigning ownership to renewable electricity generation and use. On a shared grid, whether from on-site or off-site resources, RECs are the instrument that electricity consumers must use to substantiate renewable electricity use claims

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. NAESB standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the area that you would like considered in the development of the report.

- e. **Distributed Energy Resource Communication Protocols** - A Distributed Energy Resource (DER) is any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System (BES). DER include any non-BES resource (e.g. generating unit, multiple generating units at a single location, energy storage facility, micro-grid, etc.) located solely within the boundary of any distribution utility or Distribution Provider.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. NAESB standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the area that you would like considered in the development of the report.

- f. **Energy Usage Data** – Accessible energy usage data provides efficiency and cost savings – to utilities, end users and consumers – through better managing energy usage in homes, buildings and communities. The aggregated data can be used for resource planning and forecasting. Green Button applications are an example of the how energy usage data can be provided and used by consumers.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the area that you would like considered in the development of the report.

7. **Areas that Enable Digitalization or Digital Technology:** *For the area that enables digitalization or digital technology, please answer the questions highlighted in blue.*

- a. **5G Implementation** – 5G networks are the next generation of mobile internet connectivity, offering faster speeds, more reliable connections, and providing the infrastructure needed to carry huge amounts of data.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

5G networks are needed to realize the benefits of IoT, and support improved data analytics, but come with physical implementation challenges and required operational changes.

Please select the appropriate level of relevancy for the technology:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the technology that you would like considered in the development of the report.

8. **Areas that Impact or are Impacted by Digitalization or Digital Technology:** *For each of the three areas impact or are impacted by digitalization or digital technology, please answer the questions highlighted in blue.*

- a. **Cybersecurity** – According to Gartner, cybersecurity is the combination of people, policies, processes and technologies employed to protect cyber assets. Networks, electronic devices, electronic transactions, systems, applications and data, including those that are Internet-facing, are defended from malicious attacks and unauthorized access through a body of technologies, processes and practices, thus ensuring the integrity, confidentiality and availability of information. According to Forbes, some of the recent cybersecurity trends now and on the horizon include targeted phishing attacks, the European Union's General Data Protection Regulation (GDPR) for data privacy and data protection, third party platform technologies and devices (mobile, cloud, social media), exploiting user awareness, and shadow technologies.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002

Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org

Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the area that you would like considered in the development of the report.

- b. **Data Governance** – Data governance is the management of the availability, usability, integrity and security of data, and can include a governing body(ies), through policies and procedures. Data governance can include standards and certifications, policies, processes and the like. As data crosses industries and markets, better data governance provides a level of consistency and integrity to support decision making. Governance can include compliance and audit procedures; and can provide rules for data storage, archival, and protection. As more data is stored across multiple platforms for use in multiple applications, formal data governance becomes more critical.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the area that you would like considered in the development of the report.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002

Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org

Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

- c. **Cloud Hosting, Processing, Transit and Storage** – Cloud hosting, through multiple interconnected servers, is an infrastructure, platform and software service(s) that hosts data, services and analysis. Cloud hosting, as opposed to dedicated hosting, provides scalability to more easily meet changing business requirements. Cloud hosting, processing, and storage, uses shared resources in an environment not controlled by the end user. Dedicated hosting provides more ability to customize as the user has more control over the infrastructure, software and applications. Cloud hosting and computing relies on a third party to provide the infrastructure and resources to operate the service.

Please select the appropriate level of relevancy for the area:

1. Not relevant to the processes/transactions that NAESB standards currently address **or may address in the future**
2. Relevant to processes/transactions that NAESB standards **may address in the future**
3. Relevant to processes/transactions that NAESB standards **currently address**

If you answered affirmatively for question 2 or 3, please select the appropriate level of urgency for standards development in questions 4 through 7, then provide comments in question 8.

If you answered affirmatively for question 1, then please skip questions 4 through 7, and provide comments in question 8:

9. NAESB standards to support the area are not needed for the energy industry
10. Standards currently exist that adequately address the area for the energy industry
11. NAESB standards in the area would be helpful and are currently emerging for the energy industry
12. NAESB standards in the area would be helpful and are not currently emerging for the energy industry
13. Please provide any comments related to the area that you would like considered in the development of the report.

9. **General Comments:** *Please provide any additional comments that have not been included in your comments provided for each area.*



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002

Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org

Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

Your survey response is complete. Thank you for taking time to provide us with this input as part of the NAESB Report on Digitalization.



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

BOARD AND ADVISORY COUNCIL SURVEY ON RELEVANCE AND URGENCY RESPONSES

In total, twenty-nine responses were provided by members of the Board of Directors and the Advisory Council. Respondents were given an opportunity to respond to the survey by noting their agreement with the initial results of the Board Digital Committee survey conducted in October 2019 or by providing specific answers to each of the questions. Eighteen of the respondents noted their concurrence with the survey results of the Board Digital Committee, and eleven respondents provided individual response to some or all of the questions presented in the full survey. The table below captures the responses and comments from all twenty-nine participants. Please note that the eighteen responses noting their concurrence with the committee's previous survey have been apportioned consistent with the percentage of overall support for each of the individual answers provided in the previous survey.

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
DISTRIBUTED LEDGER TECHNOLOGY	0	7.5	21.5	0	0	23.5	5.5	<p>Current efforts to develop electronic datasets for the natural gas purchase and sales agreements and transactional information can result in efficiencies in the natural gas trading environment. Digital Ledger Technology might be used to effectuate the trading of these datasets in the future.</p> <p>DLT is relevant to both processes/transactions that NAESB standards currently address and may address in the future.</p> <p>The technology is emerging rapidly. NAESB should finish up the gas contract aspects and move forward from there to other aspects of DLT, e.g. wholesale and retail electric contracts.</p> <p>There is a very limited potential for DLT at this time.</p> <p>Under Wholesale Gas - only applicable to Gas Purchase and Sale</p>
INTERNET OF THINGS	5	12.5	11.5	2.8	0	19.6	4.6	<p>NAESB Standards for Wholesale Gas support the business needs of the industry with business practices and communications standards for our Electronic Bulletin Boards and Informational Postings</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
IMPROVED DATA ANALYTICS	11	12	6	7.4	2.8	11.2	4.6	<p>websites. IoT devices are operational in nature for WGQ and are not likely to be addressed by NAESB Standards in the near future.</p> <p>The OpenFMB and Green Button may be areas where the internet of things could be addressed. Data formats, security, and communication methods seem like areas that are ripe for standards.</p> <p>The urgency is greater for the electric and combination companies, somewhat for a gas distributor, and a lower priority for pipelines.</p> <p>Possibly ESPI and Energy Efficiency standards could benefit from IoT standards.</p> <p>Not applicable to Wholesale Gas.</p> <p>For Wholesale Gas, Data Analytics is a back-office activity that is not shared outside of the organization. For WGQ, NAESB Standards do not play a part in back-office activities like Data Analytics.</p> <p>The most exciting thing about data analytics is the opportunity for real time monitoring of the performance of assets. It should be a top priority.</p> <p>The forthcoming REC standard could benefit from data analytic capabilities.</p> <p>Not applicable to Wholesale Gas.</p>
RENEWABLE ENERGY CERTIFICATES TRACKING/ACCOUNTING	3.6	11.2	13.2	0	0	20.6	5.4	<p>Several regional/state have different initiatives. A NAESB standard to assist the voluntary REC market would be a good place to start.</p> <p>This will be more of a priority in those states who are setting deadlines for an "all renewables" by certain date.</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
DISTRIBUTED ENERGY RESOURCES COMMUNICATIONS PROTOCOLS	2.6	12.2	13.2	0	0	20.6	6.4	<p>Capacity exchanges such as REBA, Level Ten and Rocky Mountain's Marketplace provide Green Buyers an efficient route to secure PPA's with voluntary REC's. This area is growing rapidly and will have profound impact on qualifying reporting entities for REC's.</p> <p>Not applicable to Wholesale Gas.</p> <p>Many small DER can amount to an impactful load on the BES. Rooftop solar is having a big impact in Hawaii and California. In ERCOT, gas fired generation acting as backup power to commercial buildings is being deployed for economic reasons. The ISO/utility is impacted by a growing number of small DER generation. Communication, Security, and data formats would be areas that would benefit from standards. This may fit in the OpenFMB group or a similar group.</p> <p>This is a priority for the electric industry and will be critical for the integration of DER.</p> <p>Measurement and verification and cybersecurity are two prime areas.</p> <p>Not applicable to Wholesale Gas.</p>
ENERGY USAGE DATA	8	10	11	0	5.2	18.5	3.3	<p>For Wholesale Gas, similar to IoT devices, the collection and use of Energy Usage Information is more operational and confidential in nature and should not require NAESB Standards in the near future.</p> <p>I believe ESPI and EE measurement verification may fall into this category.</p> <p>Not applicable to Wholesale Gas.</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
5G IMPLEMENTATION	8.5	15.5	5	10.2	3.8	9.4	3.6	<p>5G technology is promised to be transformational for network speeds and mobile computing and will be extremely important to the industry as a back-office technology. However, NAESB Standards might not be needed for this technology in the near future unless there becomes a need for modified protocols or security elements associated with its use.</p> <p>5G offers tremendous opportunities for speed and bandwidth in communications. However at this time I'm not convinced if offers much more than a faster speed for existing transactions to members. This may change in the future.</p> <p>Not applicable to Wholesale Gas.</p> <p>For Wholesale Gas, cyber security is integral to all we do, and is very relevant to the NAESB Standards for secure communications and data transmittal. On a larger scale, cyber security is being addressed corporately and on a national level with other industry organizations and governmental entities.</p>
CYBERSECURITY	0	1.5	27.5	0	0	26.5	2.5	<p>This is a rapidly changing area and it demands NAESB and the industry to step up in all areas. I think the board needs to consider the speed and depth of our scope. The Sandia Surety Assessment pointed out several areas that NAESB has not covered historically, but may need to be addressed now. The OASIS Data Sensitivity issue is interesting to consider for NAESB's cyber role at the board level. The FERC has rules around market transparency that NAESB's WEQ OASIS subcommittee have done a great job in supporting. However, the Surety Assessment has pointed out that publishing transmission constraints and other market data may be useful to</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
 Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
 Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
DATA GOVERNANCE	3.5	14	11.5	1	0	23.2	2.8	<p>nation state hackers in disrupting the electricity grid. Is this something NAESB should address? The EDM Standard Compliance issue is an area that the board needs to evaluate NAESB's role. The Surety Assessment report suggests that new EDM standards should be implemented within 90 days and the previous standards be deprecated (removed from use). The report suggests that NAESB should be monitoring this for the industry. The current EDM standards cannot be monitored by NAESB, but could possibly be something to do in the future. There are companies still using GISB V1.4 standards that were deprecated in the late 1990s.</p> <p>A high priority that is being unevenly focused upon among the various industry segments.</p> <p>This is a big concern to everyone in the industry, NAESB should continue to stay on top of cybersecurity issues, as I believe they are currently doing.</p> <p>NERC's introduction of Supply Chain standards for software cover Bulk Electric System assets, but Market system assets have no such guidance - NAESB could provide Supply Chain standards for non-BES assets/market applications.</p> <p>2-factor authentication should be considered for Wholesale Gas</p> <p>For Wholesale Gas, Data Governance is a back-office process that is managed confidentially by the individual organizations. For WGQ, NAESB Standards do not play a part in back-office activities like Data Governance.</p> <p>Digital data is an asset and needs to be managed as such. Companies treated digital data like paper documents where different</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
CLOUD HOSTING, PROCESSING, TRANSIT AND STORAGE	6	13	10	0	3.8	16.8	5.4	<p>departments needed a copy of the same contract, purchase order, and invoice. Today companies have focused managing their data as an asset. Taxing authorities allow data to be treated as an asset on the company balance sheet. NAESB should explore as an industry what standards should exist around industry-wide data governance. The Distributed Ledger standards and subsequent implementations are a good place to start. How a smart contract replaces the physical contract and the associated data has many data governance issues.</p> <p>Not applicable to Wholesale Gas.</p> <p>Again, for Wholesale Gas, this is a back-office function of business that is managed for all aspects of the corporation. NAESB Standards related to this item are not likely to be needed in the near future.</p> <p>The FEDRAMP (https://www.fedramp.gov) program is an area that NAESB should review and determine how our organization and members would benefit from adoption of cloud service standards.</p> <p>Cloud hosting is the purview of such industry giants as IBM.</p> <p>As with 5G, another nice to have aspect which would speed up transaction times, but not a priority today as existing bandwidth is more than capable of handling NAESB transactions.</p> <p>OATI's OASIS cloud implementation is one such example.</p> <p>Not applicable to Wholesale Gas.</p>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX G: BOARD AND ADVISORY COUNCIL SURVEY AND RESPONSES

AREA	LEVEL OF RELEVANCY			LEVEL OF URGENCY				COMMENTS
	NR	RF	RN	SX	S	SHE	SHNE	
GENERAL COMMENTS								<p>I applaud the efforts of the Committee in putting together a thorough and thoughtful list of topics and priorities. My only comment would be that NAESB might treat Cybersecurity as a topic area that is a consideration present in all of the other topics on the list. In other words, e.g., when considering standards for Digital Ledger Technology, NAESB may want to take into account any unique Cybersecurity measures that may be relevant to this technology.</p> <p>Cybersecurity impacts any and all projects/areas involved in the digitalization of the energy industry. Distributed Ledger Technology is of special interest to me since it is based on encryption and digital signature technologies which are important cybersecurity technologies that I have studied and taught seminars/courses on in the past.</p> <p>Distributed Ledger has the highest transformational potential of all items on the list</p> <p>The Digital Committee has appropriately identified a focus, especially cyber security. Many companies are doing more with less and NAESB standards are a mechanism to achieve these goals while maintaining and elevating existing cyber security.</p>

LEGEND:

- NR** Not relevant to the processes/transactions that NAESB standards currently address or may address in the future
- RF** Relevant to processes/transactions that NAESB standards may address in the future
- RN** Relevant to processes/transactions that NAESB standards currently address
- SX** NAESB standards to support the area are not needed for the energy industry
- S** Standards currently exist that adequately address the area for the energy industry
- SHE** NAESB standards in the area would be helpful and are currently emerging for the energy industry
- SHNE** NAESB standards in the area would be helpful and are not currently emerging for the energy industry



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX H: SANDIA SURETY ASSESSMENT WORK PAPERS

TO: All Interested Parties
FROM: Board Critical Infrastructure Committee
RE: Surety Assessment Standard Development Activities and Assignments

Surety Assessment Assignments to Board Digital Committee

On July 22, 2019, Sandia National Laboratories provided NAESB with the final reports on the surety assessment: (1) Assessment Report of the NAESB Public Key Infrastructure Program; (2) Assessment Report of the NAESB OASIS Standards; (3) Assessment Report of the NAESB Business Operations Practices and Standards; and (4) Addendum Report: Threat-based Examination of NAESB Standards and Business Operations. In anticipation of these reports being delivered, NAESB included on its 2019 Annual Plans a review of the final reports and the development and/or modifications of NAESB Business Practice Standards as needed to address recommendations from Sandia National Laboratories. The Department of Energy has requested that, where possible, NAESB expediate any resulting standard development. To assist in these efforts, the Critical Infrastructure Committee committed to reviewing the final reports to provide context to any recommendations containing actionable items for standards development.

Addendum Report: Threat-based Examination of NAESB Standards and Business Operations

Additional Findings and Considerations

As part of the Addendum Report: Threat-based Examination of NAESB Standards and Business Operations, the Critical Infrastructure Committee identified two areas as part of the additional findings or considerations made by Sandia National Laboratories for consideration by the Digital Committee. These two findings or considerations were made by Sandia National Laboratories as part of Section 3.2 and 3.3 of the report. These sections address future trends in operations and technical areas that are expected to be adopted in the future.

Issue	Report Section (Page Number)	Sandia Finding or Consideration	Standards Consideration (if applicable)	Assignment (if applicable)
7.	Addendum Report Section 3.2 – Government and Industry Standards (Page 27)	To address the security of the various emerging technologies such as those listed above, the assessment team recommends that organizations utilize the government and industry standards that are relevant to the technologies deployed. For example, NIST provides a number of whitepapers and standards related to cloud computing. These standards can be found at the NIST Cloud Computing Related Publications page and include special publications from the 500 and 800 series, and a variety	N/A Review of this recommendation will be considered if/when NAESB develops standards in this area.	Board Digital Committee



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX H: SANDIA SURETY ASSESSMENT WORK PAPERS

Issue	Report Section (Page Number)	Sandia Finding or Consideration	Standards Consideration (if applicable)	Assignment (if applicable)
		<p>of NIST cloud computing research papers.¹⁷ Some of the documents referenced on this page are:</p> <ul style="list-style-type: none">• NIST SP 500-299: NIST Cloud Computing Security Reference Architecture (Draft)• NIST SP 800-144: Guidelines on Security and Privacy in Public Cloud Computing, December 2011• NIST SP 800-145: NIST Definition of Cloud Computing, September 2011• NIST SP 800-146: Cloud Computing Synopsis and Recommendations, May 2012 <p>NIST also maintains a page related to the Internet of Things (IoT) that includes reports related to trust, fog computing (cloud computing for IoT), and other areas related to the IoT.¹⁸</p> <p>Other resources provided by NIST that address the above technologies include:</p> <ul style="list-style-type: none">• NIST 800-124rev1: Guidelines for Managing the Security of Mobile Devices in the Enterprise¹⁹• NISTIR 8144 (DRAFT): Assessing Threats to Mobile Devices and Infrastructure - The Mobile Threat Catalog²⁰• NCCoE Project: Mobile Device Security: Cloud and Hybrid Builds²¹		

¹⁷ <https://www.nist.gov/itl/nist-cloud-computing-related-publications>

¹⁸ <https://www.nist.gov/topics/internet-things-iot>

¹⁹ <https://csrc.nist.gov/publications/detail/sp/800-124/rev-1/final>

²⁰ <https://www.nccoe.nist.gov/sites/default/files/library/mtc-nistir-8144-draft.pdf>

²¹ <https://www.nccoe.nist.gov/projects/building-blocks/mobile-device-security/cloud-hybrid>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX H: SANDIA SURETY ASSESSMENT WORK PAPERS

Issue	Report Section (Page Number)	Sandia Finding or Consideration	Standards Consideration (if applicable)	Assignment (if applicable)
8.	Addendum Report Section 3.3 – Emerging Technologies (Pages 27 – 29)	<p>Data Analytics – this is an area of massive lab capability and investment. With respect to traditional internet communications analysis and detection the lab helps develop and implement novel defenses for both government and military networks. This effort includes advanced analysis for emerging threats and attack techniques. Sandia leads the national laboratory modeling and simulation in the development of a suite of network emulation and analysis capabilities collectively referred to as Emulytics™ (a holistic approach to system emulation and analytics)²². Over the last decade, we have developed and deployed a suite of cyber emulation, modeling, and analysis tools that support uses including predictive simulation, training, test & evaluation, and resilient system design.</p> <p>Emulytics™ experiments provide safe and isolated environments to study and test computing and communications systems and to exercise and train cyber staff. Enterprise computing and control systems environments are well supported today and we are developing support for emerging mobile computing and Internet of Things environments. Emulytics environments scale well and can be deployed on systems as small as a laptop and on clusters with hundreds of high performance servers. Our methodologies support the application of the scientific method to the study of cyber systems, and our tools make it easier to design, deploy, and collect data from virtualized experiments rapidly, reliably, and repeatedly.</p> <p>Machine Learning – a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention. Machine learning was the focus of a recently completed grand challenge laboratory directed research and development effort.²³</p> <p>Behavior Analytics – a tool that reveals the actions users take within a digital product. It organizes raw event data such as clicks into a timeline of each user's</p>	<p>N/A</p> <p>Review of this recommendation will be considered if/when NAESB develops standards in this area.</p>	Board Digital Committee

²² <https://www.sandia.gov/emulytics/>

²³ https://www.sandia.gov/news/publications/lab_accomplishments/articles/2018/adv_science_and_tech.html



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX H: SANDIA SURETY ASSESSMENT WORK PAPERS

Issue	Report Section (Page Number)	Sandia Finding or Consideration	Standards Consideration (if applicable)	Assignment (if applicable)
		<p>behavior, also known as a user journey. At Sandia, researchers model both malware and attacker behaviors to identify malicious activity. For example, Sandia scientists used virtual machine (VM) technology and a supercomputing cluster to watch how botnets work and explore ways to stop them.²⁴</p> <p>Software Defined Networking (SDN) – approach to network management that enables dynamic, programmatically efficient network configuration in order to improve network performance and monitoring making it more like cloud computing than traditional network management. SDN was recently adapted into a Sandia patented alternative reality which can be deployed as a network defense. The capability is known as HADES (High-fidelity Adaptive Deception & Emulation System) and it feeds a hacker not what he needs to know but what he wants to believe. HADES won a 2017 R&D 100 Award presented annually by R&D Magazine.</p> <p>Zero Trust Networks²⁵ – Zero trust security is an IT security model that requires strict identity verification for every person and device trying to access resources on a private network, regardless of whether they are sitting within or outside of the network perimeter. No single specific technology is associated with zero trust; it is a holistic approach to network security that incorporates several different principles and technologies.</p> <p>Fileless Malware²⁶ - Fileless malware refers to a cyberattack technique that uses existing software, allowed applications, and authorized protocols to carry out malicious activities. Fileless malware sneaks in without using traditional executable files as a first level of attack like traditional malware. Rather than using malicious software or downloads of executable files as its primary entry point onto corporate networks, fileless malware often hides in memory or other difficult-to-</p>		

²⁴ https://www.sandia.gov/news/publications/lab_accomplishments/assets/documents/lab_accomplish-2010.pdf

²⁵ <https://www.cloudflare.com/learning/security/glossary/what-is-zero-trust/>

²⁶ <https://www.carbonblack.com/resources/definitions/what-is-fileless-malware/>



North American Energy Standards Board

801 Travis, Suite 1675, Houston, Texas 77002
Phone: (713) 356-0060, Fax: (713) 356-0067, E-mail: naesb@naesb.org
Home Page: www.naesb.org

APPENDIX H: SANDIA SURETY ASSESSMENT WORK PAPERS

Issue	Report Section (Page Number)	Sandia Finding or Consideration	Standards Consideration (if applicable)	Assignment (if applicable)
		detect locations. From there, it is written directly to RAM rather than to disk to execute a series of events or is coupled with other attack vectors such as ransomware to accomplish its malicious intent. And because fileless malware doesn't write anything to disk like traditional malware does, it is much harder to detect and may defeat traditional security systems.		