RELIABILITY RISK PRIORITIES FOR THE WESTERN INTERCONNECTION

THIS REPORT PRESENTS THE RESULTS OF INPOWERD LLC'S EVALUATION AND ASSESSMENT OF THE ERO RELIABILITY RISK PRIORITIES REPORT AND ITS RELEVANCE TO THE WESTERN INTERCONNECTION

PREPARED FOR THE WESTERN INTERCONNECTION REGIONAL ADVISORY BODY

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EXECUTIVE SUMMARY

On an annual basis, the Reliability Issues Steering Committee (RISC) submits to the North American Electric Reliability Corporation (NERC) Board of Trustees (BoT) the ERO Reliability Risk Priorities Report. This report provides the results of an annual risk analysis which identifies key reliability risks and prioritized risk profiles that threaten the reliability of the Bulk Electric System (BES). The report also provides recommended actions for the ERO and the electric industry to manage and reduce the probability and impact of the identified risk profiles. The annual RISC report builds on, updates, and refines the risk conclusions and recommendations from the initial risk assessment and corresponding report submitted to the NERC BoT in February 2013. Although the annual RISC report provides a comprehensive continent-wide assessment of key electric industry risks, and prioritizes risk groups and risk profiles for the ERO to consider, it is not in the scope of the RISC to segment the risk profiles by probability and impact for each of the major electric interconnections. It is also not in the RISC's scope to map the identified risks back to the NERC reliability standard requirements.

This project assessment was completed to evaluate if any or all the RISC identified risk profiles and recommended actions submitted to the NERC BoT are applicable to the Western Interconnection and to determine what level of priority the ERO Enterprise's delegated regional entity, the Western Electric Coordinating Council (WECC), should place on the identified risk profiles. It was also a goal to 1) determine how WECC fundamentally manages the identified risk profiles and executes on the risk actions recommended by the RISC, and 2) to benchmark WECC's response with that of other NERC Regional Entities.

This report concludes and clarifies that all the RISC identified risk profiles are not only applicable continent wide, but are also directly applicable to the Western Interconnection. This report recommends the following risk profiles be considered by WIRAB as priority Western Interconnection risk focus areas based on: 1) continuous high-level priority rating by the RISC, 2) increased trajectory and probable impact to BES reliability, 3) NERC violation metrics, and 4)

discussion with key Western Interconnection regulators and leadership on their biggest concerns from the list of RISC identified risk profiles:

1. Cyber Security Vulnerabilities
2. Changing Resource Mix
3. Physical Security Vulnerabilities
4. Resource Adequacy

This report concludes that NERC and WECC have considered the identified risk profiles and are devising action plans and approaches to help manage or mitigate the risk elements. As with any process or series of processes and workflows, there are always opportunities for improvement. To ensure risk profiles are appropriately identified and addressed in the Western Interconnection, observations and recommendations including, but not limited to, the following are provided. The Western Interconnection should increase its participation and solicit more volunteers to participate on the RISC. To provide transparency, WECC should consider conducting webinars and providing presentations during workshops to articulate how WECC is addressing the each of the RISC identified Risk Profiles they have adopted and included in their programs. WECC should identify risk responses that have immediate impact for the Western Interconnection. Each of these risk responses should be transparently assigned and tracked. WECC should consider providing a public and non-public report on the findings and recommendations from the upcoming Western Interconnection specific Risk Assessment. This provides clarity and transparency for the industry and with this transparency, WECC can implement a strategic vision that ensures reliability for the Western Interconnection.

INTRODUCTION

> "The only alternative to risk management is crisis management—and crisis management is much more expensive, time consuming, and embarrassing."
>
> James Lam, Enterprise Risk Management, *From Incentives to Controls* 2003

Organizations with strong tactical risk management cultures have successfully demonstrated that effectively designed risk strategies are integral to anticipate, predict, and govern operational and compliance risk elements. As the complexity of the Bulk Electric System (BES) evolves and security around critical systems and assets escalates, the consequences of risk that has escaped the focus of the Electric Reliability Organization (ERO) and the electric industry can be catastrophic. An artifact of this loss of risk focus culminated in the 2011 Southwest Blackout event. The good news is organizations need not suffer from the negative impact of this risk. Effective deployment of risk management tools and strong internal control systems help identify latent organizational weaknesses, human drift from expected organizational standards, and other vulnerabilities that prevent organizations from achieving reliability and compliance objectives. These programs are the foundation to a secure business resiliency plan.

PURPOSE

The purpose of this assessment was to provide a strategic vehicle to effectively inform the Western Interconnection Regional Advisory Body (WIRAB) of evolving Western Interconnection BES risk profiles (high, medium, and low) and the recommended actions needed to support Western interconnection reliability. This allows the development of necessary risk strategies that can be submitted to WECC board of directors as WIRAB policy feedback on WECC strategic goals and objectives. This report can also serve as a vehicle to provide feedback to NERC and the RISC on opportunities for improvement to the RISC process.

SCOPE OF WORK

The scope of work for this project is to evaluate the November 2016 Reliability Issues Steering Committee (RISC) "ERO Reliability Risk Priorities Report" and determine if any identified BES risk profiles submitted to the NERC Board of Trustees (BoT) are applicable to the Western Interconnection. A secondary scope is to review other relative ERO documentation and determine if WECC is actively addressing the identified ERO BES risk profiles by way of:

- Incorporation of actions in the strategic planning process
- Conducting Inherent Risk Assessments of the Western Interconnection
- Increased or revised compliance monitoring scopes (audits, spot checks etc.) to address the risk profiles
- Production of regional guidance documents and industry awareness webinars
- Formulation of risk committees or steering groups to evaluate the ERO Risk Profiles
- Other risk response activities

OBJECTIVES

The following objectives guided the development of this report.

1) Determine if RISC identified BES risk profiles and the recommended actions submitted to the North American Electric Reliability Corporation (NERC) Board of Trustees (BoT) are relevant for the Western Interconnection;

2) Determine what priority and what level of response WECC and the Western Interconnection should place on the risk profiles and how recommend actions should be addressed to support Western Interconnect reliability;

3) Benchmark WECC's response to the ERO BES Risk Profiles with other delegated regions to see if their focus on risk is aligned and coordinated with the overall ERO goals and objectives for the Western and Eastern Interconnections.

RISC Background and Framework[1]

The RISC is an industry leadership driven advisory committee that provides front-end, high-level risk management policy input by identifying continent-wide risks, threats and other issues of strategic importance to BES reliability. The RISC framework for developing, formalizing, and prioritizing BES risk profiles and recommended risk response actions helps NERC and the electric industry focus resources on critical issues that could impact BES Reliability. The RISC produces a comprehensive deliverable in the form of an ERO RISC Priorities Report, this report is submitted to the NERC BoT on an annual basis for endorsement and approval. The input and analysis workflow for developing this report can be seen in Figure 1.

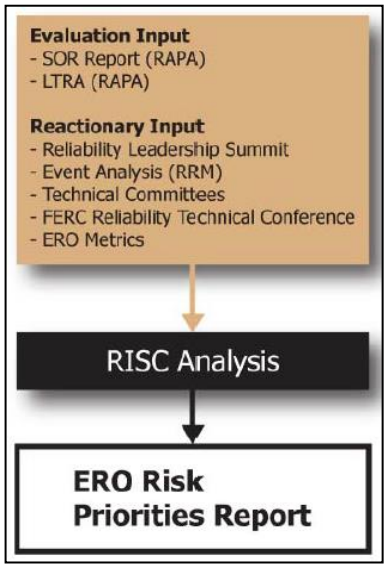

Figure 1 - RISC Analysis Workflow[3]

It is the expectation of the RISC that the NERC BoT and ERO Enterprise leadership consider this report as an input for the ERO's multiyear Strategic Plan, its Business Plan and Budget, and NERC standing committee workplans. It is also the expectation of NERC that the delegated regional entities use this report as input for an inherent risk assessment of its regional entity footprint; any resulting risk response and monitoring measures should be included in their annual Risk-based CMEP implementation plan. NERC states: "NERC uses these risk elements to identify and prioritize interconnection and continent-wide risks to the reliability of the BPS. These identified risks, as well as risks to the reliability of the BPS identified by each RE for its footprint, will be used by REs to focus monitoring activities, and will be used as inputs for developing oversight plans for individual registered entities[2]". NERC also states that it sets regional metrics and monitors the efforts - "subject to NERC monitoring, REs will consider the ERO Enterprise risk elements, along with RE risk elements, when conducting compliance

[1] RISC Charter and RISC Members Handbook
[2] The ERO CMEP Implementation Plan (page 7), 2017

monitoring activities and assessing compliance with identified NERC standards and requirements[2]". The following framework (Figure 2) shows the expected workflow for incorporating the reliability risk profiles and priorities, into the ERO Strategic Plan, Business Plan and Budget activities, and the establishing of metrics and regional performance goals.

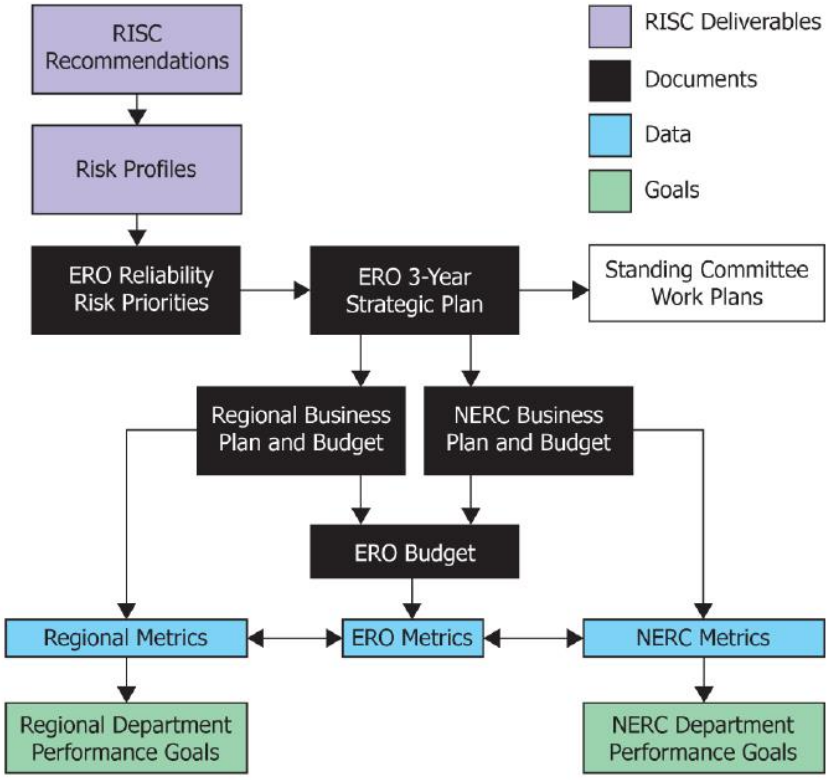

Figure 2: RISC Framework[3]

The next framework (figure 3) shows the expected inputs, results, and metrics used by NERC when assessing this process workflow.

[3] NERC RISC Member Handbook, 2015

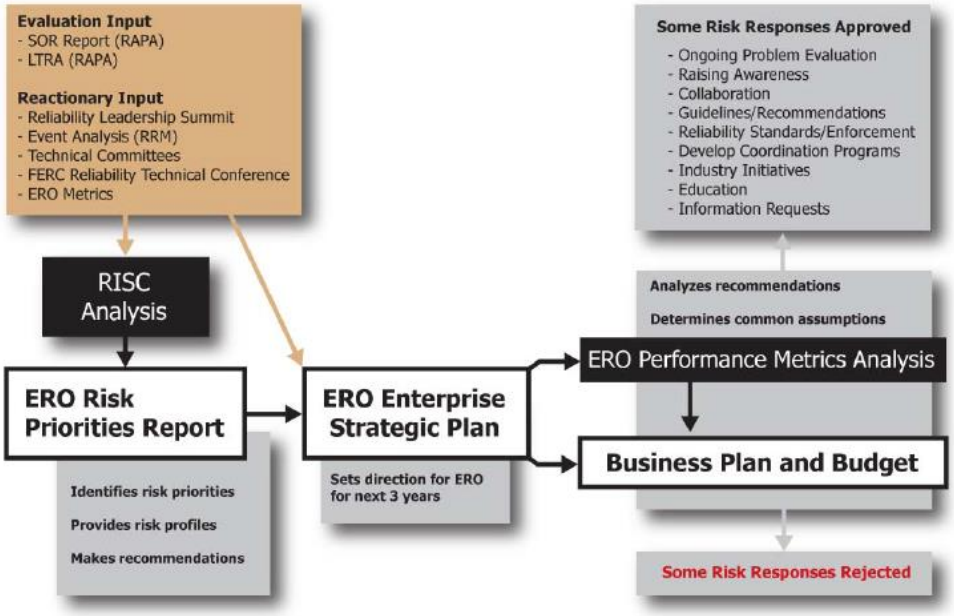

Figure 3: Reliability Risk Management Process[3]

RISC PROFILES AND GROUPINGS

When developing current state risk profiles and associated risk groupings, the RISC re-assesses the previous year's risk profiles and seeks to identify if there are any new emerging risks[4] that need to be considered, assessed and monitored. The profiles are then depicted by the likelihood of occurrence, the expected impact on reliability and the trajectory (increasing or de-creasing) of the risks. The identified risk profiles are categorized using a typical risk management 3-tiered approach of High, Moderate and Low. It's important to know that low risk profiles are not meant to indicate the risk is not a threat to BES reliability, all risks require risk proportional monitoring and action plans to mitigate or reduce the likelihood of the risk occurring. It's also important to understand the level of residual risk[5] remaining after the identified risk response is implemented. This residual level of risk needs to be monitored to make sure conditions do not

[4] The RISC did not identify any new emerging risks for 2017, the current profiles were carried over from 2016.
[5] Residual Risk – the remaining risk after risk response actions have been implemented

change and recharge the risks probability of occurring. The RISC identified the following 2017 risk profiles, groupings and their associated risk ranking[6]:

High Risk Profiles

- Cybersecurity Vulnerabilities
- Changing Resource Mix
- BPS Planning
- Resource Adequacy

Moderate Risk Profiles

- Loss of Situational Awareness
- Physical Security Vulnerabilities
- Extreme Natural Events

Low Risk Profiles

- Asset Management and Maintenance
- Human Performance and Skilled Workforce

The RISC report identifies the top risk priorities based on input from industry leadership represented on the committee. The current RISC roster consists of 20 members representing the electric industry and can be found in APPENDIX #1 – 2017 RISC ROSTER. The RISC member representation is segmented as follows:

- Eastern Interconnection (8)
- Western Interconnection (5)
- ERCOT (1)
- Canada (1)
- NERC (1)

[6] ERO Risk Priorities RISC Recommendations Report, November 2016

- Trades Organizations (2)
- Consulting Firms (2)

The risks are also prioritized based on feedback from the following sources:

- ERO Enterprise
- Industry Stakeholders
- Policy Makers
- Focused executive leadership interviews

The following Risk or Heat Map (Figure 4) shows the trajectory of the 2017 risk profiles. The four profiles in red are the high priority risks. The solid numbered circles in the heat map denote the current state for each risk area, and they are mapped against likelihood and impact scales. The risk trend represents where the RISC views the risk to be trending in the future.

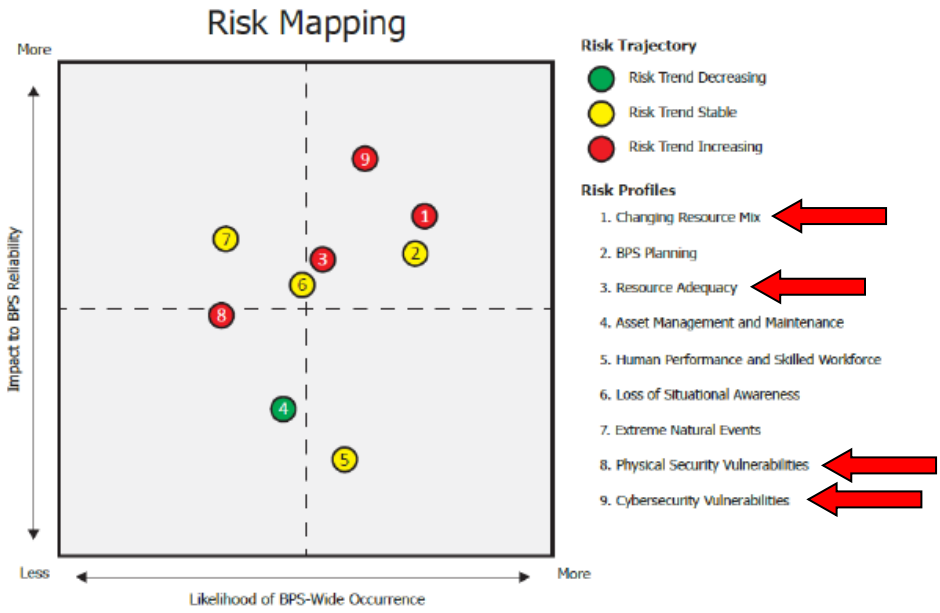

Figure 4: Risk Map of ERO Risk Profiles

RISC PRIORITIES AND APPLICABILITY

Applicability to Western Interconnection

As mentioned, the RISC report scope does not specifically map the risk profiles to individual electric interconnections or regional entities. Nor do they map the risk profiles to specific reliability standards. NERC states in its 2017 ERO Implementation plan, that the identified risk profiles address "interconnection and continent-wide risks to the reliability of the BES". This statement is generic and does not specifically identify each of the current electric interconnections. Discussion with NERC, WECC and RISC members to clarify this statement strongly supports the view that 1) the RISC used input and expertise from participants representing each of the major interconnections; the membership supported each of the risk profiles as applicable to the major interconnections, 2) NERC and the regional leadership (WECC included) consider each of the risk profiles applicable to each of the major electric interconnections, and 3) the ERO Enterprise expects the regional entities, standing committees and industry groups and forums to align risk management activities with effective review and response to each of the RISC identified risk profiles. After reviewing, inPOWERd LLC believes each of the risk profiles identified by the RISC are applicable to the complex nature of the Western Interconnection based on the above bullets and firsthand experience with these risk issues in the Western Interconnection. **This conclusion supports Objective #1 for this report.**

inPOWERd LLC recommends the following segmented risk profiles be considered by WIRAB as key Western Interconnection risk focus areas based on: 1) continuous high-level priority rating by the RISC, 2) increased trajectory and probable impact to BES reliability, 3) NERC violation metrics, and 4) discussion with key Western Interconnection regulators and leaders on their biggest concerns of RISC identified risk profiles. This is list is in order of priority.

1. **Cyber Security Vulnerabilities**
2. **Changing Resource Mix**
3. **Physical Security Vulnerabilities**
4. **Resource Adequacy**

Cyber Security Vulnerabilities

This risk profile has an increasing risk trajectory and is one of 4 high priority (Red) risk profiles on the risk mapping analysis (see figure 4 Heat Map).

As the complexity of the Bulk Electric System (BES) evolves, and new technology is adopted, the potential for malevolent access to critical energy sector assets via cyber intrusion exponentially increases. The number of cyber security attacks on industries and Industrial Control Systems (ICS) has seen a marked increase in terms of both frequency and intensity over the past five years, "with a six-fold increase in the number of cyber incidents over the previous year[7]". Intruder attack data[8] has revealed that 75% of oil, gas and power sectors have been subject to successful cyber intrusions in the past year. This threat is amplified by coordinated state-sponsored attacks intended to create larger scale disruptions in critical infrastructure. A Recent Blackhat USA Attendee Survey of top level cyber security professionals concluded that "most information security professionals believe that the US critical infrastructure will be breached by a cyber-attack within the next two years. Most also believe that their own enterprises will be breached in the next 12 months. And most believe that the defenders of those infrastructures are not ready to respond". This overarching issue impacts all levels of the industrial industry and business world with a potential cost of remediation of more than $1 Trillion annually with a projection of $2 Trillion by 2019[9]. This issue directly challenges resiliency of business operations and threatens the security of critical data and information.

Owners and operators of energy sector assets understand the impact of coordinated physical and cyber-attacks which threaten the reliability and resilience of the generation, transmission, and distribution systems. However, with a long-standing focus on grid reliability, energy utilities although concerned, often lack a full scope perspective of their cyber security posture.

This lack of perspective is supported by 2016 NERC compliance violation statistics. Part of the ERO risk-based framework is prioritization of continent-wide risks, which results in an annual compilation of risk elements applicable across the ERO Enterprise. As demonstrated in ERO Table 1.1 below, CIP Risk Elements is and continues to be a chief concern of regulators.

[7] Cyber Threats and Vulnerability Analysis of the U.S. Electric Sector, Idaho National Laboratory, Aug 2016
[8] Cyber Security in the Era of Industrial IoT White Paper, Frost and Sullivan

Table 1.1: Comparison of 2015 and 2016 Risk Elements	
2015 Risk Elements	**2016 Risk Elements**
Cyber Security	Critical Infrastructure Protection
Extreme Physical Events	Extreme Physical Events
Infrastructure Maintenance	Maintenance and Management of BPS Assets

Figure 5: ERO Top 3 Risk Elements

In addition to having the highest frequency of noncompliance in 2016, CIP-004, CIP-005, CIP-006, and CIP-007 are also among the most violated historically[10].

- CIP-005 - Electronic Security Perimeter(s) – access control and alarming Identification and protection of the electronic perimeters for the critical assets. Interactive Remote Access
- CIP-006 – Physical security of BES Cyber Systems, documenting & monitoring security and access to critical assets.
- CIP-007 – Systems Security Management - procedures for securing critical and non-critical assets.

NERC concluded[7] that the industry exhibits "a lack of commitment to compliance with the CIP standards". The following chart shows that CIP standards continue to dominate the top 10 most violated standards in 2016.

[9] Cyber Crime Statics infographic - https://www.checkmarx.com/2016/05/25/cyber-crime-statistics-infographic/
[10] ERO 2016 Annual CMEP Report, Feb 2017

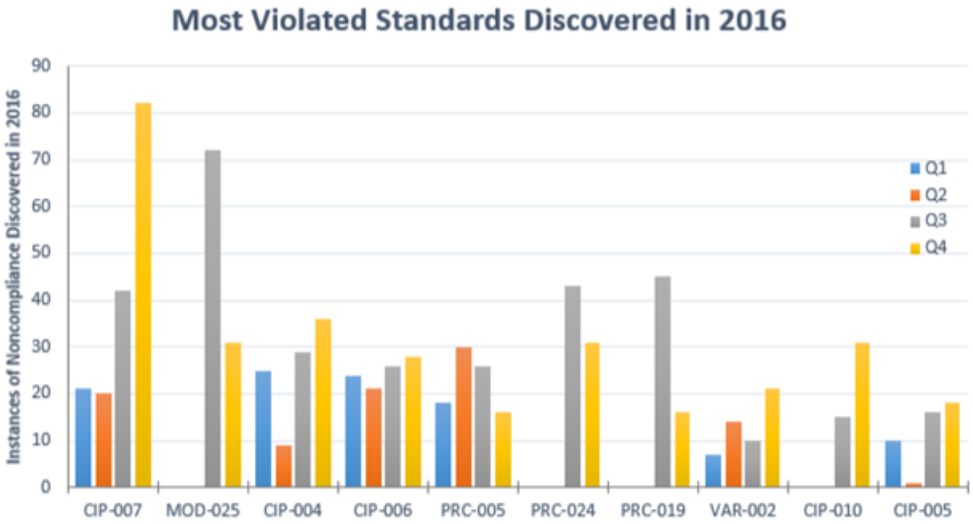

Figure 6: Most Violated Reliability Standards Discovered in 2016 by Quarter

The following chart provides clarity on regional violations and indicates that the top three regions with the most violations are ReliabiltyFirst (RF), Western Electricity Coordinating Council (WECC) and SERC Reliability Corporation (SERC). Although WECC has a larger footprint, RF and SERC consists of a more condensed load footprint. This chart lends credence to key geographical areas at risk for Cyber Security Vulnerabilities.

Table A.4: Noncompliance Discovered in 2016									
Discovery Month	FRCC	MRO	NPCC	RF	SERC	SPP RE	Texas RE	WECC	Total
January		1	3	16	7	4	9	8	**48**
February		5	4	19	29	2	7	10	**76**
March		3	7	11	5	4	4	12	**46**
April	1	1	8	14	21	8	4	9	**66**
May	1	1	5	15	2	9	40	9	**82**
June		4	3	10	7	6	11	15	**56**
July	3	8	4	30	17	18	7	20	**107**
August	4	4	2	28	38	9	8	20	**113**
September	4	6	4	12	34	94	12	29	**195**
October	2	3	12	74	25	5	9	43	**173**
November	3		6	19	23	2	29	30	**112**
December			1	22	34	1	5	51	**114**
Total	**18**	**36**	**59**	**270**	**242**	**162**	**145**	**256**	**1188**

Figure 7: Non-Compliance by Region

Another important factor is the historical trend of violations when new NERC standards become effective – regulated entities often find it hard to achieve compliance with newly implemented standards, especially when the new standard requires implementation of new technology. The following chart includes the implementation of new CIP standards and show this is a continuing trend.

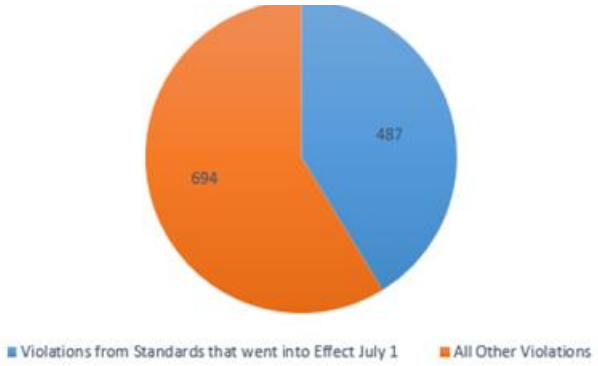

Figure 8: Percentage of Newly Discovered Non-Compliance with a July 1, 2016 Enforcement Date

Considering: 1) the complexity of cyber security, 2) the continuous flux of CIP standards, and 3) the regulated industry's struggle to adapt legacy systems and limited resources to address evolving cyber intrusion technology, inPOWERd LLC considers cyber security the risk profile with the highest probability for the Western Interconnection and a risk that warrants a coordinated focus of WECC and the Western Interconnection.

Changing Resource Mix

This risk profile has an increasing risk trajectory and is one of 4 high-priority (Red) risk profiles on the risk mapping analysis (see figure 4 Heat Map). This is supported by the RISC's conclusions that "these changes in the generation resource mix and the integration of new technologies are altering the operational characteristics of the grid and will challenge system planners and operators to maintain reliability". The change to the resource mix is accelerating due to fuel costs, subsidies, and federal, state, and provincial policies. Transmission planners, Balancing Authorities, and system operators of the BPS may not always have sufficient time to develop and deploy plans to mitigate reliability considerations with various resource additions

and retirements. The Western Interconnection is challenged by: 1) the integration of large amounts of new resource technologies, 2) distributed energy resources, 3) behind-the-meter resources, and 4) and the inability to observe and control distributed energy resources. This risk has been on the radar of regulators and Western Interconnection leadership for many years and given that there is a lack of performance metrics in the implementation of RISC recommended action, it is unclear if the risk responses have reduced the issue to a level of acceptance. Given that this risk profile has an increasing trajectory, it should be heavily considered by WECC during its 2017 Western Interconnection Risk Assessment.

Physical Security Vulnerabilities

This risk profile has an increasing risk trajectory and is one of 4 high-priority (Red) risk profiles on the risk mapping analysis (see figure 4 Heat Map). This is supported by increasing and evolving threats around physical attacks of critical interconnected transmission substations and generation plants. The high-profile April 2013 attack on Pacific Gas and Electric Co.'s Metcalf substation near San Jose, Calif and the exposed nature of the Western Interconnect grid, brings to light physical vulnerabilities that are difficult to protect, long lead times associated with manufacturing and accessing the existing spare equipment inventory, all of which leads to increased complexity of restoration after physical attacks that damage BES equipment. This risk has been on the radar of regulators and Western Interconnection leadership for many years and given that there is a lack of performance metrics in the implementation of RISC recommended action, it is unclear if the risk responses have reduced the issue to a level of acceptance. Given that this risk profile has an increasing trajectory, it should be heavily considered by WECC during its 2017 Western Interconnection Risk Assessment.

Resource Adequacy

This risk profile has an increasing risk trajectory and is one of 4 high-priority (Red) risk profiles on the risk mapping analysis (see figure 4 Heat Map). This is supported by the RISC conclusion that “traditional methods of assessing resource adequacy may not accurately or fully reflect the new resource mix ability to supply energy and reserves for all operating conditions”. This issue

coupled with historic methods of assessing and allocating ancillary services (e.g. regulation, ramping, frequency response, and voltage support) may not ensure the Western Interconnection has sufficient and available contingency reserves during real-time operations. This risk has been on the radar of regulators and Western Interconnection leadership for many years and given that there is a lack of performance metrics in the implementation of RISC recommended action, it is unclear if the risk responses have reduced the issue to a level of acceptance. Given that this risk profile has an increasing trajectory, it should be heavily considered by WECC during its 2017 Western Interconnection Risk Assessment.

Regional Risk Assessments[11]

The 2017 ERO CMEP Implementation plan states "when considering risk elements, REs will perform a Regional Risk Assessment to identify risks specific to their Region and footprint that could potentially impact the reliability of the BPS. After determining Region-specific risks, REs will also identify the related NERC Reliability Standards and Requirements associated with those risks to focus monitoring activities". APPENDIX #2 – MAPPING OF RELIABILITY STANDARDS describes how the ERO maps the risk profiles identified in the RISC report to the reliability standards. NERC expects each of the regions to use input from the RISC and regional risk assessments to help craft a regional specific CMEP implementation plan with the understanding that the output of each regional risk assessment may differ as result of the uniqueness and characteristics of each regional footprint.

WECC Response to RISC Priorities

After reviewing, it is apparent WECC considered and is actively addressing the RISC identified risk profiles from the ERO Reliability Risk Priorities Report with the following activities:

1. WECC formally adopted the ERO Strategic Plan and Metrics (2017-2020), which supports, with contributing activities, risk response measures for each of the risk profiles.

[11] 2017 ERO CMEP Implementation Plan "page 14"

2. WECC formally adopted[12] all relevant risk profiles (as mapped by NERC) in the WECC Regional CMEP Implementation plan, which will be used to revise compliance monitoring scopes (audits, spot checks etc.) to address the identified risk profiles.
3. WECC incorporates the risk profiles during Inherent Risk Assessments of registered entities to appropriately develop compliance monitoring scope of activities.
4. WECC has committed to consider the RISC identified risk profiles during a comprehensive Western Interconnection Risk Assessment[13]. This Risk Assessment will be completed by the end of 2017. WECC has not determined if this report will be made public.
5. WECC has outlined risk remediation actions as part of its 2017-2020 WECC Operating Plan. This Operating Plan is coordinated with Western Interconnection industry committees and work groups.

It is the opinion of inPOWERd LLC that WECC's strategy for response to the RISC Priorities that NERC mapped to the Reliability Standards is appropriate. This mapping can be found in APPENDIX #2 – MAPPING OF RELIABILITY STANDARDS. WECC's response to consider the risk profiles during a comprehensive Risk Assessment of the Western Interconnect is appropriate and well timed. **This conclusion supports Objective #2 for this report.**

As part of this Project, inPOWERd benchmarked NERC and each of the regional entities level of response to the RISC identified risk profiles. inPOWERd concluded that WECC's response to the risk profiles is more robust than other regional entities. This benchmarking is available in APPENDIX #3 – BENCHMARKING. **This benchmarking supports Objective #3 for this report.**

RESULTS OF THE ASSESSMENT

During this assessment, it was apparent that there are a lot of components and moving parts to

[12] Appendix A8 -Western Electricity Coordinating Council (WECC) 2017 CMEP Implementation Plan
[13] 2017-2020 WECC Operating Plan Initiative document.

establish and respond to risk profiles identified by the RISC. It takes tremendous coordination and communication between the ERO Enterprise and industry. The following observations, opportunities and recommendations to mature the ERO and Industry programs are provided for WIRAB to consider for future policy input.

Observations, Opportunities and Recommendations for WECC

Western Electric Coordinating Council (WECC)
Positive Observations
1. WECC exhibits a strong strategic response to the RISC Risk Priorities report. The Risk profiles are adopted and considered in WECC's CMEP Implementation plan and the WECC Operations Plan (2017-2020). 2. WECC will conduct a comprehensive Western Interconnection Risk Assessment in 2017, per the WECC Operating Plan (2017-2020).
Opportunities for Improvement
1. The Western Interconnection may be under represented on the RISC. Currently only 5 members of out 20 represent the west, two of those members are large companies who represent multiple interconnections. WECC should solicit Western Interconnection volunteers to be on the RISC. 2. WECC should consider conducting webinars and providing presentations during workshops to articulate how WECC is addressing the each of the RISC identified Risk Profiles they have adopted and included in their programs. This provides clarity and transparency for the industry. 3. WECC should Identify Risk Responses that have immediate impact (moves the bar) for the Western Interconnection. Each of these risk responses should be transparently assigned and tracked. 4. WECC should consider providing a public and non-public report on the findings and recommendations from the Western Interconnection Risk Assessment. This provides clarity and transparency for the industry.
Recommendations
1. WECC should consider the top 4 risk profiles in this report as key focus areas for the Western Interconnection with a heightened focus on Cyber Vulnerabilities. 2. WECC should form a Western Interconnection Risk Steering Committee to help

develop recommended risk response actions from the Western Interconnection Risk assessment. Provide the results of the risk assessment with recommendations to the RISC for inclusion in the annual RISC Risk Priorities report.

3. WECC should consider working with NERC and RISC to provide Guidance Documents relative to the Western Interconnection for each of the RISC identified Risk Profiles. This provides clarity and transparency for the industry.

Observations, Opportunities and Recommendations for the RISC

Reliability Issues Steering Committee (RISC)
Positive Observations
1. The RISC framework and level of industry participation exhibits a strong risk management accountability structure that provides for effective coordination with the ERO Enterprise. 2. The RISC Priorities report effectively identifies key BES risk elements. It also articulates the risk problems, the level of priority, and necessary actions for mitigation. 3. The RISC Priorities report effectively outlines a near and long-term roadmap as well as targeted audiences for the ERO to consider when implementing the recommendations.
Opportunities for Improvement
1. The RISC should consider maturing its continent-wide risk advisory approach by segmenting and prioritizing the continent-wide risk profiles by major electric interconnection. This will bring clarity to interconnection risk probability and impact for the development of geographical and regional action plans. This could include interconnection subgroups studying the risk profiles at the interconnection level. 2. The RISC should consider a mechanism to track each of the recommended actions and evaluate how well NERC, the Regional Entities, industry Trade Groups and Forums incorporate the recommended risk actions. Share the results in the annual RISC Priorities Report. This action should be coordinated with NERC.
Recommendations
1. The RISC should conduct individual risk assessments for each of the major electric interconnections and develop interconnect specific risk profiles. 2. The RISC should consider a mechanism to determine the level of residual risk remaining after the ERO enterprise and the industry implements the recommended actions provided by the RISC. This will help determine if the risks are being managed

to an acceptable level or if additional risk response is needed.

Observations, Opportunities and Recommendations for the ERO

Electric Reliability Organization (ERO)
Positive Observations
1. NERC exhibits a strong strategic response to the RISC priorities report, the RISC report is mention and adopted in the NERC Strategic planning process, the Business plan and Budget process and is used extensively in the ERO CMEP Implementation plan.
Opportunities for Improvement
1. NERC should consider strengthening transparency around the methods used to map identified risk profiles to the Reliability Standards. Currently only the mapping results can be seen in the 2017 ERO CMEP Implementation plan. Industry would benefit from a comprehensive report that defines the process used, which risk profiles are applicable to the Reliability Standards, and which are outside the scope of the current standards. 2. There is no clear or visible effort to track or measure the ERO progress of implementing the RISC recommendations. There are work flows that speak of regional metrics, however the use of the metrics and the level of regional performance is not apparent. This is also true for activities conducted by standing committees, industry forums, and industry trade groups. 3. NERC Should consider conducting webinars to articulate which of the risk profiles are mapped to Reliability Standards and which of the risk profiles are outside of the standards and are addressed by Standing Committees, industry Trade Groups and Forums. This provides clarity and transparency for the industry. 4. NERC should consider working with the regional entities, Standing Committees and the RISC to provide Guidance Documents on each of the RISC identified Risk Profiles. This provides clarity and transparency for the industry.
Recommendations
1. NERC should consider a mechanism to track each of the recommended actions and evaluate how well the ERO Enterprise, Standing Committees, industry Trade Groups and Forums incorporate the recommended risk actions. Share the results in the annual RISC Priorities Report. This action should be coordinated with the RISC. This provides clarity and transparency for the industry.

CONCLUSION

In conclusion, the RISC Priorities Reports provide the NERC BoT a strategic vehicle in the form of an annual risk assessment that identifies continent-wide risk profiles to assist the ERO Enterprise in prioritizing its risk based reliability and compliance strategies. From the 2016 RISC Priorities Report, all risks identified are applicable to the Western Interconnection. Due to: (1) continuous high-level priority rating by the RISC, (2) increased trajectory and probable impact to BES reliability, (3) NERC violation metrics, and (4) prioritization from Western Interconnection thought leaders, the following risk profiles should be considered priority focus areas for the West: (1) Cyber Security Vulnerabilities, (2) Changing Resource Mix, (3) Physical Security Vulnerabilities, and (4) Resource Adequacy.

This report concludes that NERC and WECC have strongly considered the risk profile policy feedback and are devising action plans and approaches to help manage or mitigate the risk elements. WECC has exhibited a strong strategic response to the RISC priorities by adopting the risk profiles its CMEP Implementation plan and the WECC Operations Plan (2017-2020), and WECC also plans to conduct a comprehensive Western Interconnection Risk Assessment in 2017.

During this review, it was apparent that the framework to develop, communicate and implement the recommendations from the report is complex and requires a considerable amount of coordination and communication across the ERO and industry to achieve the desired goals of risk management. As with any process or series of processes and workflows, there are always opportunities for improvement. To ensure risk profiles identified are addressed in the Western Interconnection, observations and recommendations including, but not limited to, the following are provided are provided. The Western Interconnection is under represented on the RISC and WECC should solicit Western Interconnection volunteers to participate on the RISC. To provide transparency, WECC should consider conducting webinars and providing presentations during workshops to articulate how WECC is addressing the each of the RISC identified Risk Profiles

they have adopted and included in their programs. WECC should identify risk responses that have immediate impact for the Western Interconnection. Each of these risk responses should be transparently assigned and tracked. WECC should consider providing a public and non-public report on the findings and recommendations from the Western Interconnection Risk Assessment. This provides clarity and transparency for the industry.

APPENDIX #1 – 2017 RISC ROSTER

Member Type/Term	Name/Title	Organization
Chair at Large Term expiring January 31, 2019	Peter Brandien Vice President of System Operations	ISO New England
At-large Member Term expiring January 31, 2019	Tim Eckel Vice President of Transmission Services	SaskPower
At-large Member Term expiring January 31, 2018	Daniel Froetscher Senior Vice President of Transmission, Distribution,	Arizona Public Service Company
At-large Member Term expiring January 31, 2018	Charles King Vice President and Chief Information	Kansas City Power & Light Company
At-large Member Term expiring January 31, 2019	Mark McCulla Vice President Transmission	Entergy
At-large Member Term expiring January 31,	Nelson Peeler Chief Transmission Officer	Duke Energy
At-large Member Term expiring January 31, 2019	Woody Rickerson Vice President of Grid Planning and Operations	ERCOT
At-large Member Term expiring January 31,	Chris Root Chief Operating Officer	Vermont Electric Power Company
At-large Member Term expiring January 31, 2018	Chris Shepherd Director of Critical Infrastructure Protection	NAES Corporation
At-large Member Term expiring January 31, 2018	Brian Allen Slocum Vice President of Operations and NERC Compliance Officer	ITC Holdings
MRC Member Term expiring January 31,	Carol Chinn Regulatory Compliance Officer	Florida Municipal Power Agency
MRC Member Term expiring January 31,	Dave Osburn Chief Executive Officer	Oklahoma Municipal Power Authority

MRC Member Term expiring January 31, 2019	John Pespisa Director, NERC Compliance Program	Southern California Edison
MRC Member Term expiring January 31, 2018	Herb Schrayshuen	Self
Compliance & Certification Committee Term expiring January 31,	Terry Bilke Consulting Advisor, Compliance Services	MISO
Critical Infrastructure Protection Committee Term expiring January 31,	Nathan Mitchell Senior Director, Electric Reliability Standards and	American Public Power Association
Standards Committee Term expiring January 31, 2018	Brian Murphy Senior Attorney	NextEra Energy Resources
Operating Committee Term expiring January 31, 2018	Lloyd Linke Vice President of Operations for Upper Great Plains Region	Western Area Power Administration
Planning Committee Term expiring January 31, 2018	Brian Evans-Mongeon President and CEO	Utility Services Inc.
Secretary	Mike Walker Senior Vice President, Chief Financial and Strategic	NERC

APPENDIX #2 – MAPPING OF RELIABILITY STANDARDS

Responsibility for mapping the risk profiles to reliability standards or identifying which risk profiles are outside of regulatory rule is left for the ERO Enterprise as they consider and implement the recommendations from the RISC report in their strategic and CMEP Implementation Plans. The RISC does recommend certain audiences to pursue certain activities to support the recommendations in the RISC Priorities Report. The following key audiences were identified across the RISC recommendations:

- NERC and Standing Committees
- ERO Enterprise (includes the regions)
- Industry Forums and Trade Groups

Although not depicted specifically in the ERO Implementation plan, Figure 5 below describes how the ERO maps the risk profiles identified in the RISC report to the reliability standards. This workflow represents each of the regional entities but is made specific to the WECC region.

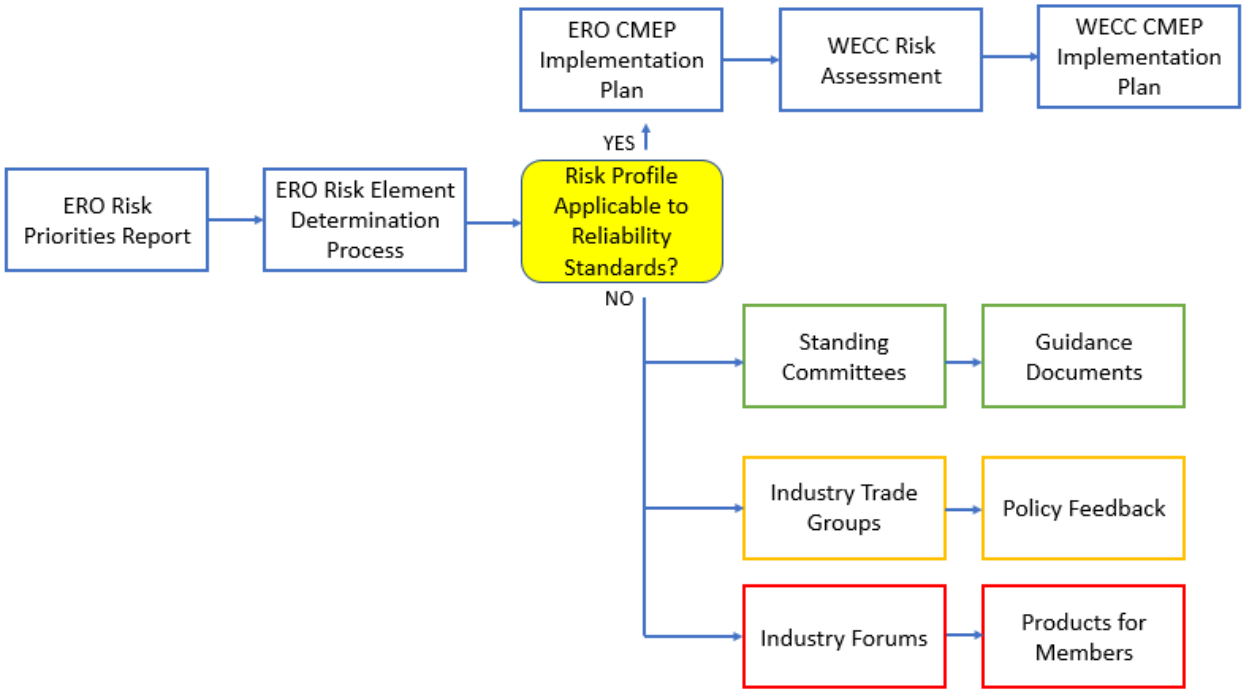

Figure 5 - ERO Risk Element Development Workflow

Risk elements determined to be applicable to the Reliability Standards are present in the 2017 ERO CMEP Implementation plan and are mapped to specific reliability standard requirements. NERC considers the mapped risk elements to be areas of focus to help the regional entities prioritize compliance monitoring efforts. NERC listed all the applicable mapped standards in a corresponding risk table which identifies the standard, the requirements, involved entities and affected asset types. As an example, High Risk Profile - Cybersecurity Vulnerabilities was mapped in the 2017 ERO CMEP Implementation Plan as follows:

Table 2: Critical Infrastructure Protection			
Standard	**Requirements**	**Entities for Attention**	**Asset Types**
CIP-002-5.1	R1, R2	Balancing Authority Distribution Provider Generator Operator Generator Owner Reliability Coordinator Transmission Operator Transmission Owner	Back up Control Centers Control Centers Data Centers Generation Facilities Substations
CIP-005-5	R1, R2	Balancing Authority Distribution Provider Generator Operator Generator Owner Reliability Coordinator Transmission Operator Transmission Owner	Backup Control Centers Control Centers Data Centers Generation Facilities Substations
CIP-006-6	R1, R2, R3	Balancing Authority Distribution Provider Generator Operator Generator Owner Reliability Coordinator Transmission Operator Transmission Owner	Backup Control Centers Control Centers Data Centers Generation Facilities Substations
CIP-007-6	R1, R2, R3, R5	Balancing Authority Distribution Provider Generator Operator Generator Owner Reliability Coordinator Transmission Operator Transmission Owner	Backup Control Centers Control Centers Data Centers Generation Facilities Substations

Figure 6: Areas of Focus for – Cyber Security Vulnerabilities Mapping[14]

[14] 2017 ERO CMEP Implementation Plan

It is difficult to track the remaining risk response activities that are not applicable to the reliability standards unless one was to review the agendas and work activities of industry Standing Committees, industry Trades Groups and industry Forums. It is presumed that the remaining risk elements are segmented by audience as outlined in the RISC report recommendations.

APPENDIX #3 – BENCHMARKING

As part of this Project, inPOWERd benchmarked NERC and each of the regional entities level of response to the RISC identified risk profiles. This demonstrates that WECC's response to the risk profiles is more robust than other regional entities.

Region	Strategic Plan	CMEP IP	Operating Plan	Inherent Risk Assessment	Interconnection Risk Assessment	Regional Risk Assessment	Webinars	Guidance
NERC	**X**	**X**	Unk	N/A		N/A	Yes	
FRCC	**X**	**X**	Unk	X			Yes	
MRO	**X**	**X**	Unk	X		**X**	Yes	
NPCC	**X**	**X**	Unk	X			Yes	
RF	**X**	**X**	Unk	X		**X**	Yes	
SERC	**X**	**X**	Unk	X		**X**	Yes	
SPP	**X**	**X**	Unk	X		**X**	Yes	
Texas RE	**X**	**X**	Unk	X		**X**	Yes	
WECC	**X**	**X**	**X**	**X**	**X**	**X**	Yes	

Legend:

- **Unk -** Unknown – could not readily find these documents on regional website.
- **N/A** – Not Applicable to this entity
- **Yes** – All regions have stated they will conduct webinars throughout the year. However, they do indicate these webinars will cover risk profiles.

APPENDIX #4 – REFERENCES

Documents Reviewed

The following documentation was used during this assessment. inPOWERd LLC also conferred and had conversations with individuals at NERC, WECC and on the RISC to better understand the RISC framework, the purpose of the RISC priorities report, and the expectations of the RISC and NERC after the report is delivered to the NERC BoT and executed by the ERO Enterprise.

Document	Description
ERO Reliability Risk Priorities - RISC Recommendations to the NERC Board of Trustees Nov 2016	This annual report documents the results of the RISC Steering Committee's continued work to identify key risks to reliable operation of the BES. This report was approved by the NERC Board in November of 2016
Electric Reliability Organization Enterprise Strategic Plan and Metrics (2017-2020)	The ERO Enterprise Strategic Plan and Metrics details the ERO Enterprise' mission, vision, values, goals, and metrics as well as the planning process, direction, and priorities.
Member Handbook – Reliability Issues Steering Committee February 2015	NERC provides this handbook to the members of the Reliability Issues Steering Committee (RISC) as an overview of the committee's history, functions, and processes as well as a description of general roles and responsibilities of each member.
Reliability Issues Steering Committee Charter – and current roster. Approved by NERC BoT May 7, 2015	RISC purpose, membership, overview and functions and reporting obligations.
ERO Enterprise Strategic Plan and Metrics (2017-2020)	The ERO Enterprise Strategic Plan and Metrics details the ERO Enterprise's1 mission, vision, values, goals, and metrics as well as the planning process, direction, and priorities.
2017 ERO CMEP Implementation Plan – includes WECC's 2017 CMEP Implementation Plan (appendix A8)	Annual operating plan used out by Compliance Enforcement Authorities (CEAs) while performing their responsibilities and duties. .
2017-2020 WECC Operating Plan Initiatives.	Describes the major initiatives that WECC proposes to undertake in support of the five Strategic Priorities.
WECC Risk Factor Criteria for Inherent Risk Assessments, April 2017	Risk Factors and criteria for conducting in inherent Risk assessments.

2017 Blackhat USA Attendee Survey – Portrait of an Imminent Cyberthreat	conclusions drawn by 580 respondents to the 2017 Black Hat Attendee Survey, a poll of top-level cybersecurity professionals who have attended the annual Black Hat USA conference in the last two years. Black Hat, a forum that features some of the most advanced security research in the world, is a destination for discussion among the industry's most experienced information security pros, including leading ethical hackers, IT security management, and technology developers.