Draft Illustrative Framework Example

Industrial Control Systems Profile for the Electricity Subsector

Overview: Industrial Control Systems, or ICSs, are specialized and complex systems used throughout the nation's critical infrastructure sectors. Comprised of various devices and communication systems, an ICS behaves differently than a traditional IT-based system and, as such, requires unique considerations for security. For example, many of these critical ICSs have legacy equipment that cannot be patched or upgraded for years or decades. Some sectors have existing programs or regulations surrounding the protection of these vital systems. The example below is intended to illustrate how an organization may leverage existing resources within the Framework Core or, alternatively, produce new internal programs to address a stronger cyber security posture.

The attached sample Profile is designed to be an illustrative example of the application of the Framework for an electric utility. Within the electricity subsector there are many stakeholders, including users, owners, and operators of the national power grid, as well as vendors, regulators and other interested parties. As such, there are many existing programs, guidelines, and standards, to leverage when creating a Framework Profile. Moreover, some organizations need to adhere to mandatory cyber security standards, such as the NERC CIPs. This Profile is written to be flexible and adaptable to different sizes and types of organizations within the electricity subsector, regardless of compliance obligations or existing programs.

Approach: The electricity subsector has created several guidelines, standards, and programs based on cybersecurity practices and controls. Any utility that opts to use the Framework should leverage these existing materials, rather than create new—and perhaps duplicative—efforts. To that end, this illustrative Framework example makes some assumptions regarding the electric utility, including that it:

- Complies with the North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) Version 3 standards and has identified Critical Cyber Assets (CCAs);
- Is aware of other security standards and relies on the informative references used in the Framework Core;
- Has performed a Department of Energy (DOE) Electricity Subsector Cybersecurity Capability Maturity Model (ES-C2M2) self-evaluation and is knowledgeable in the relevant domains and practices; and
- Is familiar with risk management processes, such as those contained in both the NERC CIP standards and DOE Risk Management Process.

The Profile recognizes that the electricity subsector maintains legacy equipment in operation that requires special consideration when implementing cybersecurity practices. This is demonstrated through the application of the ISA/IEC 62443 suite of standards (*Security for Industrial Automation and Control Systems*) and NIST SP 800-82 (*Guide to Industrial Control Systems Security*).

Components of this sample Framework Profile can be leveraged for organizations that are not required to meet the CIP Standards or for assets and systems that fall outside the scope of CIP compliance. Moreover, free resources, like the DOE ES-C2M2 can be applied across any organization, regardless of size or function.

The Profile should be evaluated using existing cybersecurity processes against the Categories and Subcategories to evaluate how those processes may be improved based on the guidance in the Informative References. The Profile highlights that existing cybersecurity programs for ICS owners and operators, including requirements for NERC CIP compliance, converge within the Framework Core. This Framework Profile does not alter compliance requirements in any way. Please consult your NERC CIP compliance authority for any questions on NERC CIP compliance. It should be noted that subcategories within this Profile may only be partially addressed by some the corresponding Informative References. It is recommended that implementers refer to the full list of Informative References listed to ensure that sufficient guidance has been considered.

Note that subcategories marked with * denote an addition to the Framework Core.

Function	Category	Subcategory	Informative Reference(s)
		ID.AM-1 : Inventory and track physical devices and systems within the organization	
IDENTIFY	Asset Management (AM): Identify and manage the personnel, devices, systems, and facilities that enable the organization to achieve business purposes, including their relative importance to business objectives, in support of effective risk decisions.	 ID.AM-2: Inventory software platforms and applications within the organization ID.AM-3: Identify organizational network components and connections ID.AM-4: Identify external information systems including processing, storage, and service location ID.AM-5: Identify classification / criticality / business value of hardware, devices, and software ID.AM-6: Identify business value of workforce 	 ISO/ISA 27001 A.7 CCS CSC #1 NISTIR 7628 SG.CM, SG.MP, SG.RA, SG.SI NIST SP 800-53 rev 4 CM, MP, RA, SI, SA NIST SP 800-40 NERC CIP-002-3, CIP-003-3, CIP-004-3, CIP-005-3a, CIP-007-3 DOE ES-C2M2 ASSET, RISK
(ID)		functions by role	
	Business Environment (BE): Identify and prioritize organizational mission, objectives, stakeholders, and activities to support cybersecurity roles, responsibilities, and risk decisions.	ID.BE-1: Identify third-party stakeholders (business partners, suppliers, customers) and interdependencies among those relationships	 NISTIR 7622, Supply Chain Risk Management DHS Cyber Security Procurement
		ID.BE-2: Identify organization's role within the industry, sector, and national critical infrastructure	 Language for Control Systems ISO/ISA 27001 A.12 DOE ES-C2M2 RISK,
		ID.BE-3: Identify and prioritize organizational mission, objectives, and activities	DEPENDENCIES, CYBER
	Governance (GV): Identify the policies, procedures, and processes to manage and monitor the organization's regulatory, legal, risk, environmental, and	ID.GV-1: Identify organizational information security policy	 ISA-62443-2 ISO/ISA 27001 A.5
		ID.GV-2: Identify information security roles & responsibility, coordination	 CIP-003-3 DOE ES-C2M2 CYBER, RISK

	operational requirements.	ID.GV-3:Identify legal/regulatory requirements	
	Risk Assessment (RA): Periodically assess risk to organizational operations	ID.RA-1: Identify vulnerabilities to organizational assets (both internal and external)	 ISO/ISA 27001 A.6 NIST SP 800-53 rev 4 RA
	(including mission, functions, image, or reputation),	ID.RA-2: Identify providers of threat information	 NIST SP 800-55 rev 4 KA DOE Electricity Subsector Cybersecurity Risk Management
	organizational assets, and individuals, resulting from the operation of organizational	ID.RA-3: Identify threats to organizational assets (both internal and external)	Process (RMP) • NERC Alerts • CIP-005-3, CIP-007-3
	information systems and the associated processing, storage, or transmission of organizational information.	ID.RA-4: Identify the potential impacts and likelihoods	 NIST IR 7628 SG.SI DOE ES-C2M2 RISK, THREAT, ASSET
	Risk Management Strategy	ID.RM-1: Identify and establish risk management processes at the organizational level	 ISO/ISA 27001 A.6 (Organization of information security) NIST IR 7628 SG.SI
	(RM): Identify the specific assumptions, constraints, risk tolerances, and priorities/trade-offs	ID.RM-2: Determine organizational risk tolerance level	 NIST SP 800-53 rev 4 Risk Assessment Family DOE Electricity Subsector Cybersecurity Risk Management
	used within the organization to support operational risk decisions.	ID.RM-3: Determine thresholds for incident alerts	 Cybersecurity Risk Management Process NERC CIP-002-3, CIP-008-3 NERC EOP-004 DOE ES-C2M2 RISK, SITUATION
	Access Control (AC): Limit facility and information access to authorized users, processes acting	PR.AC-1: Perform identity and credential management (including account management, separation of duties, etc.) for devices and users	 NIST IR 7628 SG.AC, SG.CA, SG.SC NIST SP 800-53 rev 4 AC, PE, CM, IA, CA, SP
PROTECT (PR)	on behalf of authorized users, or devices (including other information systems) and to the types of transactions and functions that authorized users are permitted	PR.AC-2: Enforce physical access control for buildings, stations, substations, data centers, and other locations that house logical and virtual information technology and operations technology	 ISO/IEC 27001 CIP-003-3, CIP-004-3, CIP-005-3, CIP-006-3c DOE ES-C2M2 ACCESS, ASSET NIST SP 800-82 rev 1 ISA-99.02.01-2009
	to exercise.	PR.AC-3: Protect remote access to organizational networks to include telework guidance, mobile	 ISA-99.02.01-2009 CCS CSC #11, #12, #15, #16, #19

	devices access restrictions, and cloud computing policies/procedures PR.AC-4: Enforce access restrictions including implementation of Attribute-/Role-based access control, permission revocation, and network access control technology (including multi-factor authentication*)	
	PR.AC-5: Protect network integrity by segregating networks/implementing enclaves (where appropriate)	
	PR.AT-1: Provide awareness and training that ensures that general users understand roles & responsibilities and act accordingly	
Awareness and Training (AT): Ensure that organizational	PR.AT-2: Provide awareness and training that ensures that privileged users (e.g., system, network, industrial control system, database administrators) understand roles & responsibilities and act accordingly	 NIST IR 7628 SG.AT, SG.CP, SG.IR NIST SP 800-53 rev 4 AT, CP NIST SP 800-82
personnel and partners are adequately trained to carry out their assigned information security- related duties and responsibilities through awareness and training	PR.AT-3: Provide awareness and training that ensures that third-party stakeholders (suppliers, customers, partners) understand roles & responsibilities and act accordingly	 ISO/IEC 27001 ISA-99.02.01-2009 CCS CSC #9 NERC CIP-004-3 DOE ES-C2M2 WORKFORCE,
 activities.	PR.AT-4: Provide awareness and training that ensures that senior executives understand roles & responsibilities and act accordingly	DEPENDENCIES
	PR.AT-5: Provide awareness and training that ensures that physical and information security personnel understand roles & responsibilities and act accordingly	

in f haz	Data Security (DS): Protect formation and records (data) from natural and man-made cards to achieve organizational onfidentiality, integrity, and availability requirements.	 PR.DS-1: Protect data (including physical records) during storage (aka "data at rest") to achieve confidentiality, integrity, and availability goals PR.DS-2: Protect data (including physical records) during transportation/ transmission (aka "data in motion") to achieve confidentiality, integrity, and availability goals PR.DS-3: Protect organizational property and information through the formal management of asset removal, transfers, and disposition PR.DS-4: Protect availability of organizational facilities and systems by ensuring adequate capacity availability (physical space, logical storage/memory capacity) PR.DS-5: Protect confidentiality and integrity of organizational information and records by preventing intentional or unintentional release of information to an unauthorized and/or untrusted environment (information/data leakage) PR.DS-6: Protect intellectual property in accordance with organizational requirements PR.DS-7: Reduce potential for abuse of authorized privileges by eliminating unnecessary assets, separation of duties procedures, and least privilege requirements PR.DS-8: Establish separate development, testing, and operational environments to protect systems from unplanned/unexpected events related to 	 NIST SP 800-53 rev 4 PE, MP, AU, SC, AC, CM, DM, SE NIST SP 800-82 ISA-99.02.01-2009 ISO/IEC 27001 NERC CIP-003-3, CIP-005-3a, CIP- 006-3c, CIP-007-3 NIST IR 7628 SG.MP, SG.AU, SG.SC, SG.AC, SG.CA, SG.CM CCS CSC #11, #12, #15, #16 DOE ES-C2M2 RISK, ASSET, CYBER, ACCESS, THREAT, RESPONSE, DEPENDENCIES
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	development and testing activities	
	PR.DS-9: Protect the privacy of individuals and personally identifiable information (PII) that is collected, used, maintained, shared, and disposed of by organizational programs and systems	
Information Protection Processes and Procedures (IP): Ensure adequate protection through security planning policy (that addresses purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities) and procedures to facilitate implementation.	 PR.IP-1: Develop, document, and maintain under configuration control a current baseline configuration of information technology/operations technology systems PR.IP-2: Develop, document, and maintain a System Development Life Cycle (including secure software development and system engineering and outsourced software development requirements) PR.IP-3: Determine, document, and implement configuration change controls for organizational systems PR.IP-4: Protect organizational information by conducting backups that ensure appropriate confidentiality, integrity, and availability of backup information, storing the backed-up information properly, and testing periodically to ensure recoverability of the information PR.IP-5: Ensure appropriate environmental 	 NIST SP 800-53 rev 4 CM, CP, PE, PS NIST IR 7628 SG.CM, SG.CP, SG.IR, SG.MP, SG.CA, SG.CM, SG.PS NIST SP 800-82 NERC CIP-003-3, CIP-004-3, CIP-007-3, CIP-008-3, CIP-009-3 ISA 99.02.01 4.3.4.3.2, 4.3.4.3.3 COBIT BAI 06.01, BAI 01.06 ISO/IEC 27001 A.10.1.2 NERC EOP-008-0 DOE ES-C2M2 ASSET, CYBER, SITUATION, THREAT, RESPONSE, ACCESS, WORKFORCE
	 requirements are met for personnel and technology PR.IP-6: Destroy/dispose of assets (to include data destruction) in a manner that prevents disclosure of information to unauthorized entities PR.IP-7: Achieve continued improvement 	

	(lessons learned, best practices, feedback, etc.)	
	PR.IP-8: Develop, document, and communicate response plans (Business Continuity Plan(s), Disaster Recovery Plan(s), Incident Handling Plan(s)) that address purpose, scope, roles, responsibilities, management commitment, coordination among organizational entities, and compliance	
	PR.IP-9: Plan for what it takes to deliver critical infrastructure services for which the organization is responsible, including the identification of dependencies that might prevent delivery of those services	
	PR.IP-10: Integrate cybersecurity practices/procedures with human resources management (personnel screenings, departures, transfers, etc.)	
Protective Technology (PT):	PR.PT-1: Determine, document, and implement physical and logical system audit and log records in accordance with organizational auditing policy	 ISA 99.02.01 4.3.3.3.9, 4.3.3.5.8, 4.3.4.4.7, 4.4.2.1, 4.4.2.2, 4.4.2.4 NERC CIP-003-3 - CIP-009-3 NIST IR 7628 SG.AC, SG.MP,
Implement technical security solutions that supplement processes and procedures to ensure ongoing cybersecurity and resilience commensurate with organizational	PR.PT-2: Restrict the use of removable media (including writable portable storage devices), personally/externally owned devices, and network accessible media locations	SG.CM, SG.SC NIST SP 800-53 rev 4 AC, IA, MP ISO/IEC 27001 NERC Alerts CCS CSC #11
risk decisions.	PR.PT-3: Implement and maintain technology that enforces policies to employ a deny-all, permit-by-exception policy to allow the execution of authorized software programs on organizational systems (aka whitelisting of applications and	• DOE ES-C2M2 RISK, ASSET, ACCESS, THREAT, SITUATION, SHARING, RESPONSE, DEPENDENCIES, WORKFORCE, CYBER

		network traffic) PR.PT-4: Protect wireless network security including monitoring for unauthorized devices/networks, processes for authorization and authentication for wireless networks, adequate encryption to protect information transmitted wirelessly PR.PT-5: Protect operational technology (to include ICS, SCADA, DCS)	
DETECT (DE)	Anomalies and Events (AE): Detect anomalous activity and determine the potential impact of events to achieve the organization's goals as determined in the Protect function.	 DE.AE-1: Identify and determine normal organizational behaviors and expected data flow of personnel, operations technology, and information systems DE.AE-2: Characterize detected events (including through the use of traffic analysis) to understand attack targets and how a detected event is taking place DE.AE-3: Perform data correlation to improve detection and awareness by bringing together information from different information sources or sensors DE.AE-4: Assess the impact of detected cybersecurity events to inform response & 	 CCS CSC #14, #16 NIST SP 800-53 rev 4 AC, PE, SI NERC CIP-005-3a, CIP-007-3, CIP-008-3, CIP-009-3 NIST IR 7628 SG.AU, SG.PE, SG.SI, SG.AC NIST 800-12 NIST SP 800-92 NIST SP 800-137 DOE ES-C2M2 RISK, SITUATION, RESPONSE, CYBER, THREAT
	Security Continuous Monitoring (CM): Track, control, and manage cybersecurity aspects of development and operation (e.g.,	recovery activity DE.CM-1: Perform network monitoring for cybersecurity events flagged by the detection system or process DE.CM-2: Perform physical monitoring for	 NIST 800-12 NIST SP 800-92 NIST SP 800-137 NIST SP 800-53 rev 4 AC, AU, CA, CM, SI, PE, RA

products, services, manufacturing, business processes, and information technology) to identify cybersecurity events.	 cybersecurity events flagged by the detection system or process DE.CM-3: Perform personnel monitoring for cybersecurity events flagged by the detection system or process DE.CM-4: Employ malicious code detection mechanisms on network devices and systems to detect and eradicate malicious code (including regular update of signatures*) DE.CM-5: Detect the use of mobile code and implement corrective actions (blocking, quarantine, or alerting administrators) when unacceptable mobile code is detected DE.CM-6: Perform personnel and system monitoring activities over external service providers DE.CM-7: Perform periodic checks for unauthorized personnel, network connections, devices, software DE.CM-8: Perform periodic assessment to identify vulnerabilities that could be exploited by adversaries (aka penetration testing) 	 NIST IR 7628 SG.AC, SG.AU, SG.SI, SG.PE, SG.CA, SG.RA NERC CIP-005-3a, CIP-007-3, CIP- 008-3, CIP-009-3 ISA-99.02.01-2009 NIST SP 800-82 rev 1 6.2.6.1 CCS CSC #1, #2, #4, #5, #16, #20 DOE ES-C2M2 RISK, ASSET, ACCESS, THREAT, SITUATION, SHARING, RESPONSE, DEPENDENCIES, WORKFORCE, CYBER
Detection Processes (DP): Ensure timely and adequate awareness of anomalous events through tested and implemented detection processes and procedures.	 DE.DP-1: Ensure accountability by establishing organizational roles, responsibilities for event detection and response DE.DP-2: Perform policy compliance and enforcement for detect activities (internal, external constraints) 	 NIST SP 800-53 rev 4 AC, SI, CP, IR, PM CCS CSC #13, #16, #19, #20 NERC CIP-005-3a, CIP-007-3, CIP-008-3, CIP-009-3 NIST SP 800-83 NIST SP 800-94 ISA-99.02.01 4.4.3.2

		 DE.DP-3: Conduct exercises (e.g., tabletop exercises) to ensure that staff understand roles/responsibilities and to help provide quality assurance of planned processes DE.DP-4: Communicate and coordinate cybersecurity event information among appropriate parties 	 NIST IR 7628 SG.CP, SG.IR, SG.AT DOE ES-C2M2 RISK, ACCESS, THREAT, SITUATION, SHARING, RESPONSE, DEPENDENCIES, WORKFORCE, CYBER
RESPOND (RS)	Planning (PL): Communications (CO): Coordinate response with internal and external stakeholders, as appropriate, to include external support from federal, state, and local law enforcement agencies.	RS.PL-1: Execute Response plan	 NIST SP 800-53 rev 4 IR NIST SP 800-82 rev 1-6.2.8 NIST SP 800-12 NIST SP 800-61rev 2 NIST SP 800-83 NIST SP 800-100 NIST IR 7628 SG.IR
		*RS.PL-2: Hold exercises to test implementations of plan	 CCS CSC #18 NERC CIP-001-2a, CIP-008-3 NIST SP 800-84 NIST SP 800-61 rev 2 ISA-99.02.01-2009 A.3.4.5 DOE ES-C2M2 THREAT, RESPONSE, CYBER
		RS.CO-1: Ensure coordinated understanding of dependencies (personnel and systems) to informed prioritized response and support the response plan(s)	 CCS CSC #18 NIST SP 800-53 rev 4 IR NIST SP 800-16 NIST SP 800-50 NERC CIP-001-2a, CIP -008-3
		RS.CO-2: Report physical and logical cybersecurity events in association with pre-established criteria including required timeframes and reporting processes	 NERC EOP-004 NIST IR 7628 SG.IR OE-417 NIST SP 800-82 rev 1 6.2.8 NIST SP 800-61 rev 2

	 RS.CO-3: Implement necessary communications for mandatory sharing of detection/response information such as breach reporting requirements RS.CO-4: Coordinate authority Coordinate roles Coordinate implications to stakeholders Coordinate agreement criteria Coordinate required reporting criteria RS.CO-5: Conduct voluntary coordination (with mission/business partners, information sharing and analysis centers (ISACs), customers, and developers) to aid in general cybersecurity awareness and assist with events that transcend a given organization 	 ISA-99.02.01-2009 A3.4.5 DOE ES-C2M2 RISK, THREAT, SITUATION, SHARING, RESPONSE, DEPENDENCIES, WORKFORCE, CYBER
Analysis (AN): Conduct ongoing analysis activities, relative to the Respond function, to ensure adequate response and support recovery activities.	RS.AN-1: Investigate anomalies, including cybersecurity events (from network, physical, or personnel monitoring) flagged by the detection system or process RS.AN-2: Conduct an impact assessment (damage/scope) RS.AN-3: Perform forensics RS.AN-4: Classify the incident	 CCS CSC #18 NIST SP 800-53 rev 4 IR NIST SP 800-16 NIST SP 800-50 NISTIR 7628 SG.IR ISA - 99.02.01-2009 A 3.4.5 NERCCIP-001-2a, CIP-005-3a, CIP-007-3, CIP-008-3 ISA - 99.02.01-2009 A 3.4.5 DOE ES-C2M2 RISK, THREAT, SITUATION, RESPONSE, CYBER
Mitigation (MI): Conduct activities to prevent expansion of an event, mitigate its effects, and eradicate the incident.	RS.MI-1: Contain the incident RS.MI-2: Eradicate the incident (includes strengthening controls to prevent incident recurrence)	 CCS CSC #18 NIST SP 800-53 rev 4 IR NIST IR 7628 SG. IR CIP-008-3 DOE ES-C2M2 RISK, THREAT, SITUATION, RESPONSE, CYBER
Improvements (IM): Improve organizational response by	RS.IM-1: Incorporate lessons learned into plans	 ISO/IEC 27001 A.13.02.02 CIP-008-3, CIP-009-3

	incorporating lessons learned (from current and previous detection/response activities).	RS.IM-2: Update response strategies	 NIST IR 7628 SG.CP NIST SP 800-53 rev 4 CP DOE ES-C2M2 RISK, THREAT, SITUATION, RESPONSE, CYBER
	Recovery Planning (RP): Execute Recovery Plan activities to achieve restoration of services or functions commensurate with business decisions.	RC.RP-1: Execute recovery plan	 NISTIR 7628 SG.CP NIST SP 800-53 rev 4 CP NIST SP 800-82
		*RC.RP-2: Hold exercises to practice/test implementation of recovery plan	 ISO/IEC 27001 NERC CIP-009-3 DOE ES-C2M2 RISK, THREAT, SITUATION, RESPONSE, CYBER
RECOVER	Improvements (IM): Improve recovery planning and processes by incorporating lessons learned into future activities.	RC.IM-1: Incorporate lessons learned into plans	 NISTIR 7628 SG.CP NIST SP 800-53 rev 4 CP ISO/IEC 27001
		RC.IM-2: Update recovery strategies	 NERC CIP-009-3 DOE ES-C2M2 RISK, THREAT, SITUATION, RESPONSE, CYBER
	Communications (CO): Interact with outside parties, such as coordinating centers, Internet Service Providers, owners of attacking systems, victims, other	RC.CO-1: Communicate with public affairs/media	 NERC EOP-004-1 DOE Form OE-417 NERC CIP-001-2a, CIP-008-3 R1
			 CCS CSC #18 NIST SP 800-53 Rev 4 IR NIST SP 800-82 rev 1 6.2.8
	CSIRTs, and vendors.	RC.CO-2: Communicate to perform reputation recovery	 NIST SP 800-61 Rev 2 NIST IR 7628 SG.IR ISA-99.02.01-2009 A. 3.4.5 DOE ES-C2M2 RESPONSE