AMERICAN PUBLIC POWER ASSOCIATION
Powering Strong Communities

axio

Cyber Readiness: What's the Score?

Utilizing small batch, artisanal data to bring powerful insights

JASON D. CHRISTOPHER

CTO, Axio // ICS Security Lead

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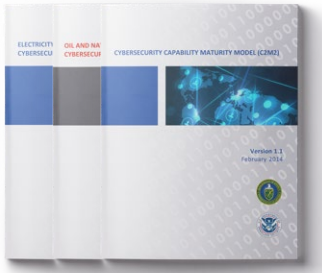
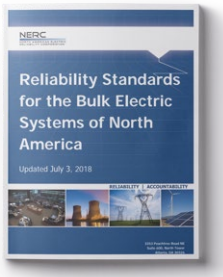
- Leads critical infrastructure strategy at Axio; actively involved in platform development
- SANS Instructor for ICS456
- Frequent speaker at conference and client events
- Federal energy lead for several industry standards and guidelines, including NERC CIPv5, NIST CSF, and the C2M2
- Incident response and risk management lead for DOE
- Security metrics development across EPRI and other research organizations
- Began career building control systems at a utility
- MS, Electrical Engineering, Cornell
- Based in Atlanta, GA





SANS

EPRI ELECTRIC POWER RESEARCH INSTITUTE

unlike most speakers

DON'T LISTEN TO ME

Be distracted, look things up!

- **Listen to your peers**
  - Over 250 public power utilities online
  - 400+ active users
  - Use cases from actual practitioners
  - I'm just another pretty beard.

Visit: http://scorecard.axio.com while I'm here

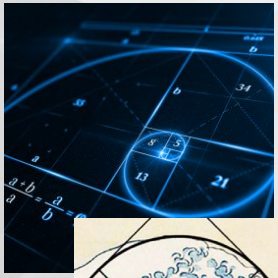
myth #1
GETTING DATA IS HARD ☹

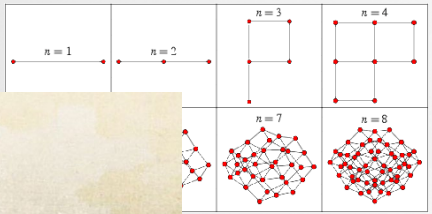
Then you're doing this wrong

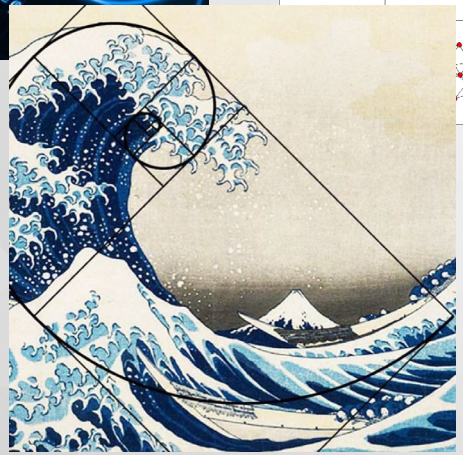
- **You really mean "I need the right starting point"**
  - What *can* you measure? Start somewhere
  - Understand that metrics improve with time (only barbarians measure in "stones" and "feet")
  - Resources may be constrained at first
    - But if you don't try, it won't get better

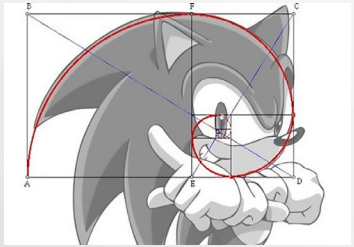
Literally, just do *something*.

myth #2
SECURITY IS AN ART









Really bad argument here…

- **There's measurement in almost everything**
  - Can you document something?
  - Can you count something?
  - Observe the trends where you can

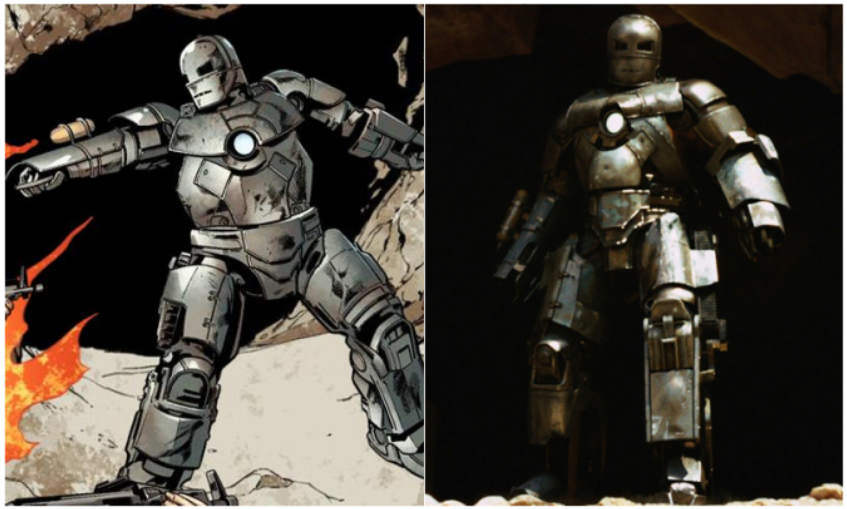
Literally, just do *anything*.

myth #3
THIS TAKES TOO MUCH TIME

Engineering 101: “Optimize within your constraints.”

- **Size your efforts to your team**
  - Team of 1? That still works (more on this later)
  - Don’t boil the ocean and don’t build a team to “admire the problem.”
  - Anything worth doing takes time and effort!

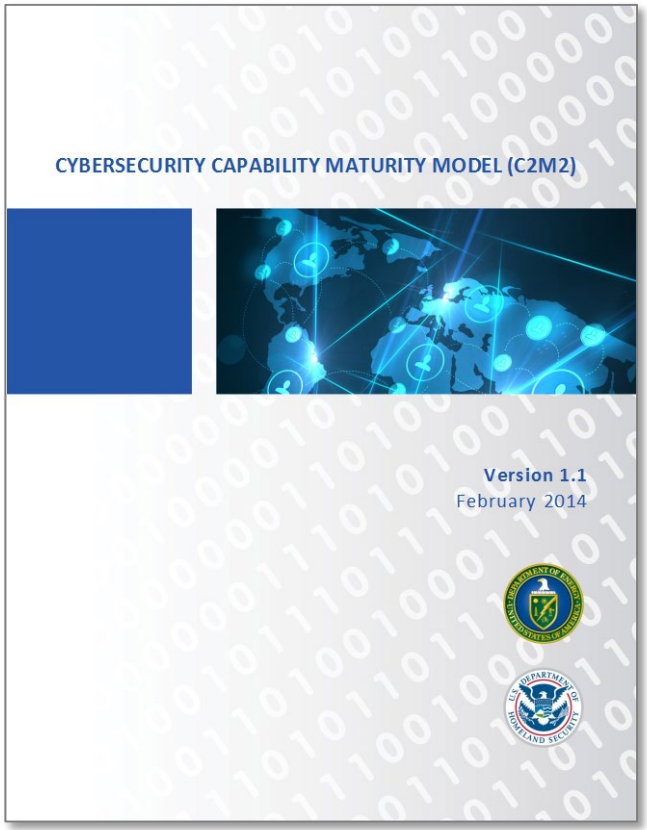
“If you’re not keeping score, you’re just practicing” – Vince Lombardi



ARE YOU #CyberReady?

The American Public Power Association is proud to present the all new Cybersecurity Scorecard. This robust platform is the result of a federally-funded cybersecurity improvement initiative that will be openly accessible to all Association members.

Cybersecurity Capability Maturity Model (C2M2) v1.1



A model and evaluation method to support ongoing evaluation and improvement of cybersecurity capabilities in IT and OT environments

Objectives

- Strengthen organizations' cybersecurity capabilities
- Enable organizations to effectively and consistently evaluate and benchmark cybersecurity capabilities
- Share knowledge, best practices, and relevant references as a means to improve cybersecurity capabilities.
- Enable organizations to prioritize actions and investments to improve cybersecurity

4 Maturity Indicator Levels

MIL3 (advanced)

MIL2 (intermediate)

MIL1 (beginning)

MIL0

Dual progression of practices from MIL1 to MIL3

MIL 3 practices

MIL 2 practices

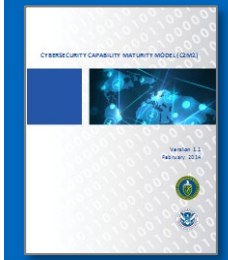
MIL 1 practices

No practices

261 MIL2 & MIL3 practices are progressively more complete, advanced, and ingrained; target levels should be set for each domain based on risk tolerance and threat environment

51 MIL1 practices are *basic activities that any organization should perform*; these are the starting blocks

C2M2 Model Architecture



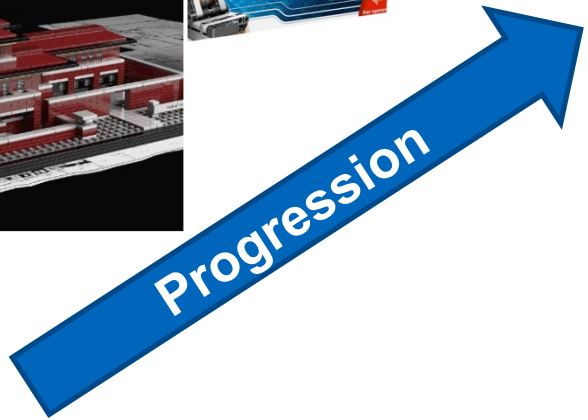
- **RM** Risk Management
- **ACM** Asset, Change, and Configuration Management
- **IAM** Identity and Access Management
- **TVM** Threat and Vulnerability Management
- **SA** Situational Awareness
- **ISC** Information Sharing and Communications
- **IR** Event & Incident Response, Continuity of Operations
- **EDM** Supply Chain & External Dependencies Management
- **WM** Workforce Management
- **CPM** Cybersecurity Program Management

10 Model Domains: logical groupings of cyber security practices — activities that protect operations from cyber-related disruptions

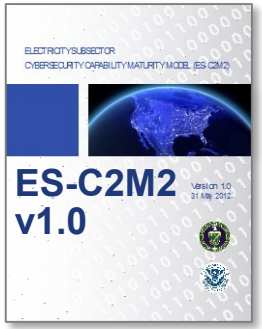
The Approach: Maturity Model

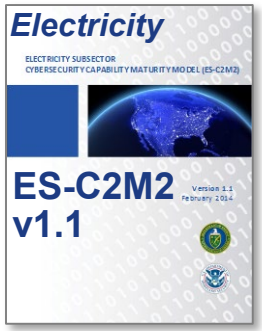
Maturity Model Definition:

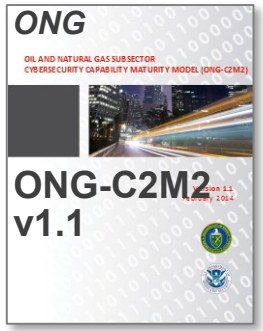
- An organized way to convey a path (a progression) of experience, wisdom, perfection, or acculturation.
- The subject of a maturity model can be an object or things, ways of doing something, characteristics of something, practices, or processes.

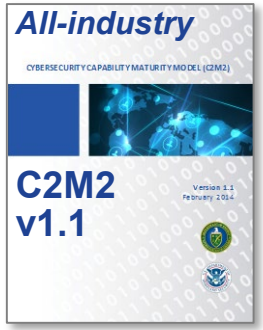


C2M2 Timeline









2012 | 2013 | 2014 | 2015 | 2016 | 2017

- ES-C2M2 kick-off
- ES-C2M2 v1.0 released
- 17 pilots
- ES-C2M2 used at NG utility
- Pilots with NG Utilities
- AGA Project: Self-evaluation workshops at 4 Small NG Utilities
- C2M2 v1.1 released
- AGA Workshops — American Gas Association
- AMERICAN PUBLIC POWER ASSOCIATION Workshops & Pilots

CYBERSECURITY SCORECARD

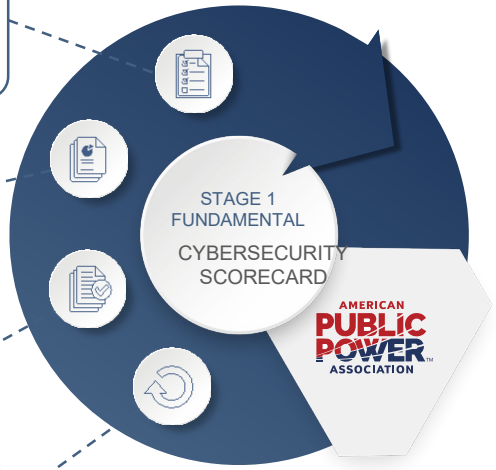
APPA CYBERSECURITY SCORECARD

ASSESSMENT
Complete an easy self-assessment of your cybersecurity capabilities in one hour or less.

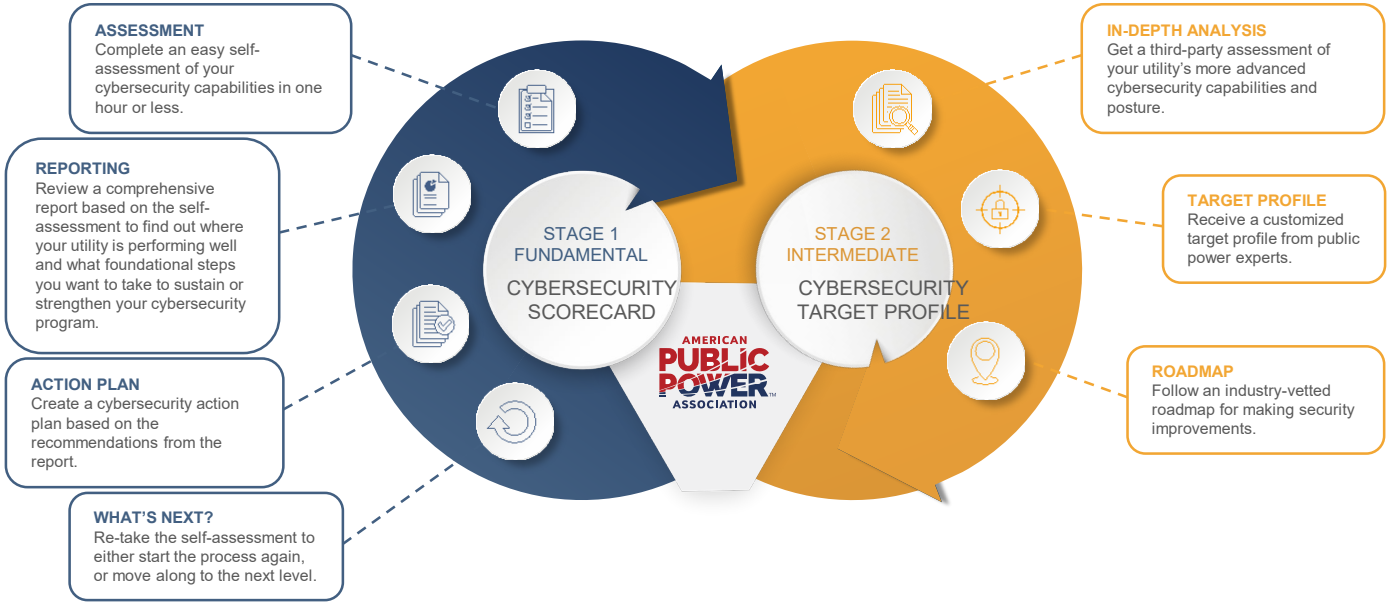
REPORTING
Review a comprehensive report based on the self-assessment to find out where your utility is performing well and what foundational steps you want to take to sustain or strengthen your cybersecurity program.

ACTION PLAN
Create a cybersecurity action plan based on the recommendations from the report.

WHAT'S NEXT?
Re-take the self-assessment to either start the process again, or move along to the next level.



APPA CYBERSECURITY SCORECARD



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IN-DEPTH ANALYSIS
Get a third-party assessment of your utility's more advanced cybersecurity capabilities and posture.

TARGET PROFILE
Receive a customized target profile from public power experts.

ROADMAP
Follow an industry-vetted roadmap for making security improvements.

IN-DEPTH ANALYSIS
Take the most advanced self-assessment, the Cybersecurity Capability Maturity Model.

TARGET PROFILE
Create an individualized target profile and make cybersecurity decisions on your own.

EVALUATION
Regularly re-assess your cybersecurity program to stay up-to-date on best practices.

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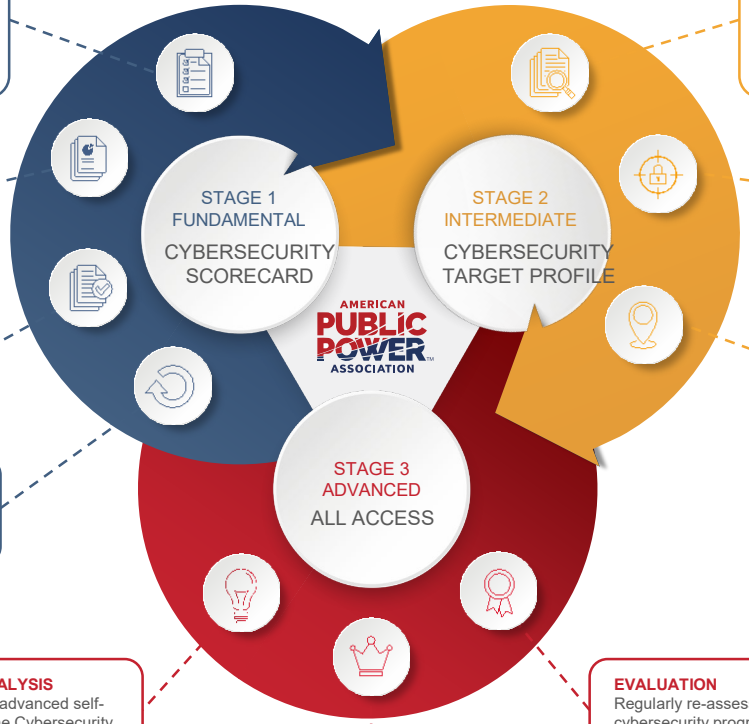

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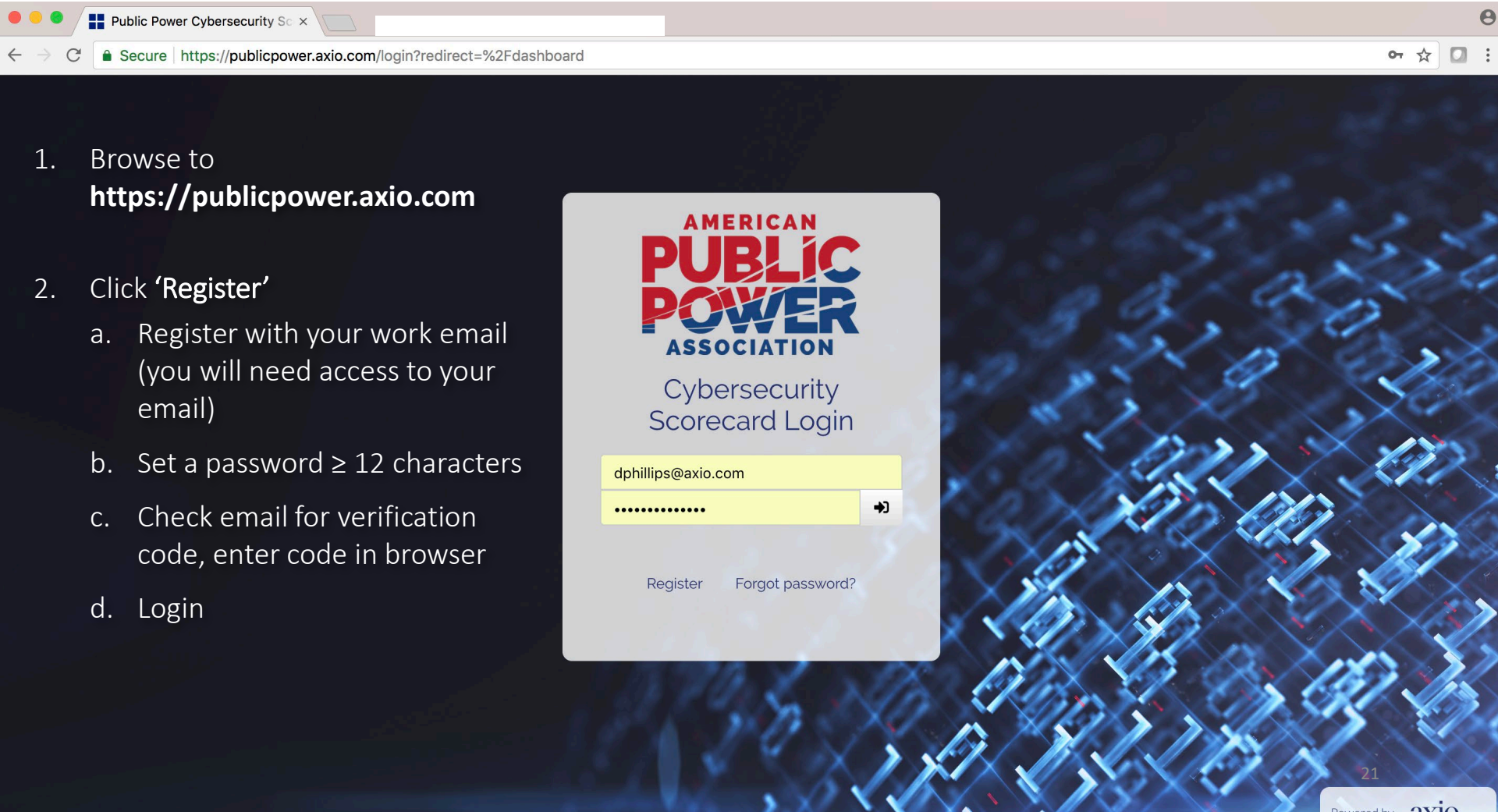
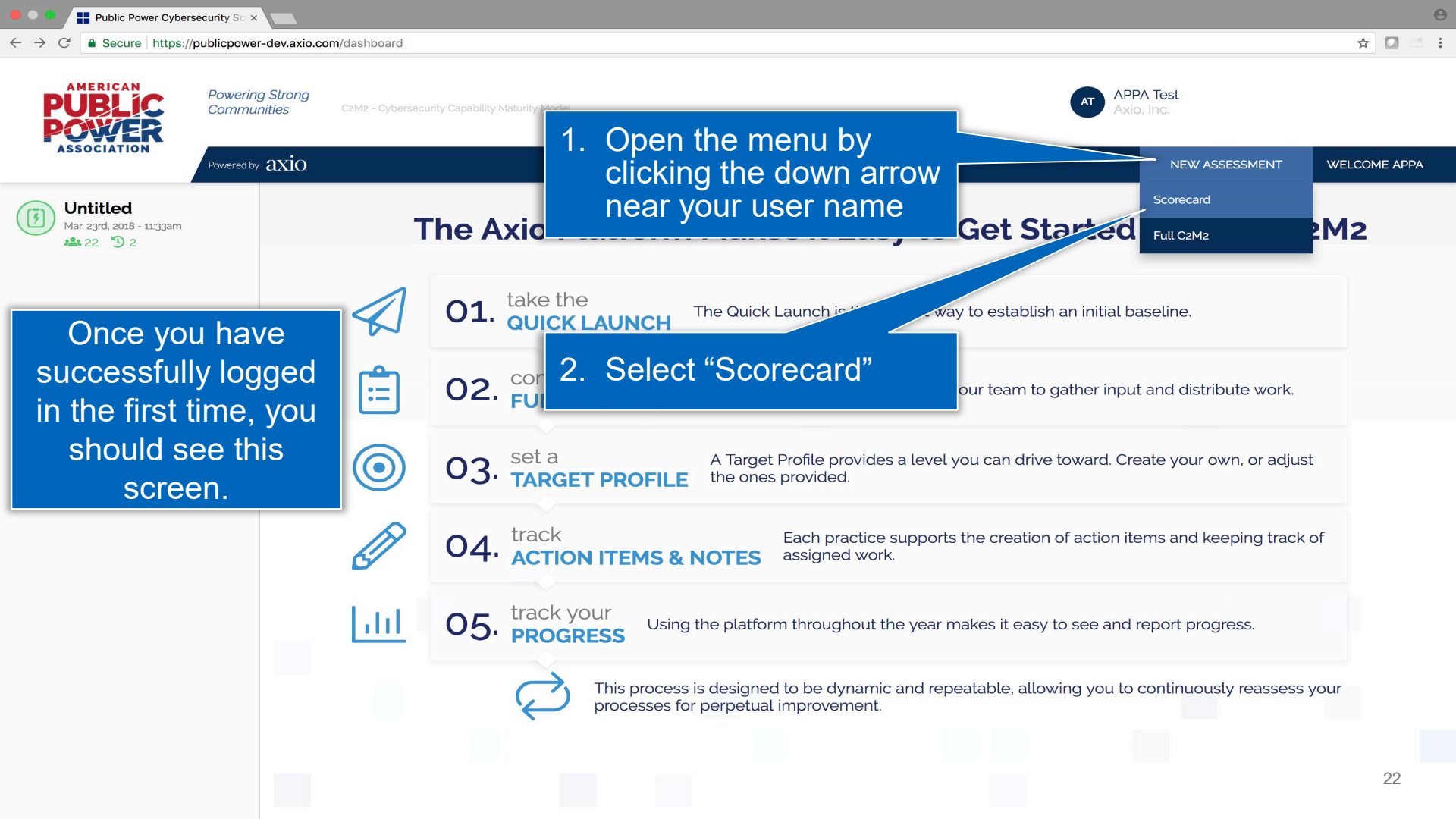
ONLINE PORTAL FEATURES

- Take notes for each practice within the platform.
- Assign tasks to individuals with deadlines.
- Help text in each section including definitions and concepts.
- User dashboard showcasing each assessment and various statistics in real time.
- Ability to do multiple internal assessments and benchmarking.
- Improvement toolkit including document templates, policies and example policies.
- Regional workshops to provide additional help and guidance.
- Suggestions for cybersecurity training.
- Expert coaching
- Ability to tie to other association projects, such as technology deployments and vulnerability assessments.
- Each level is capable of being a fully sustainable cybersecurity program and can be reassessed on a regular basis to track improvements.


Public Power Cybersecurity Sc
Secure
https://publicpower.axio.com/login?redirect=%2Fdashboard
1. Browse to
https://publicpower.axio.com
2. Click 'Register'
a. Register with your work email (you will need access to your email)
b. Set a password ≥ 12 characters
c. Check email for verification code, enter code in browser
d. Login
AMERICAN PUBLIC POWER ASSOCIATION
Cybersecurity Scorecard Login
dphillips@axio.com
Register
Forgot password?
21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Secure | https://publicpower-dev.axio.com/dashboard
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C2M2 - Cybersecurity Capability Maturity Model
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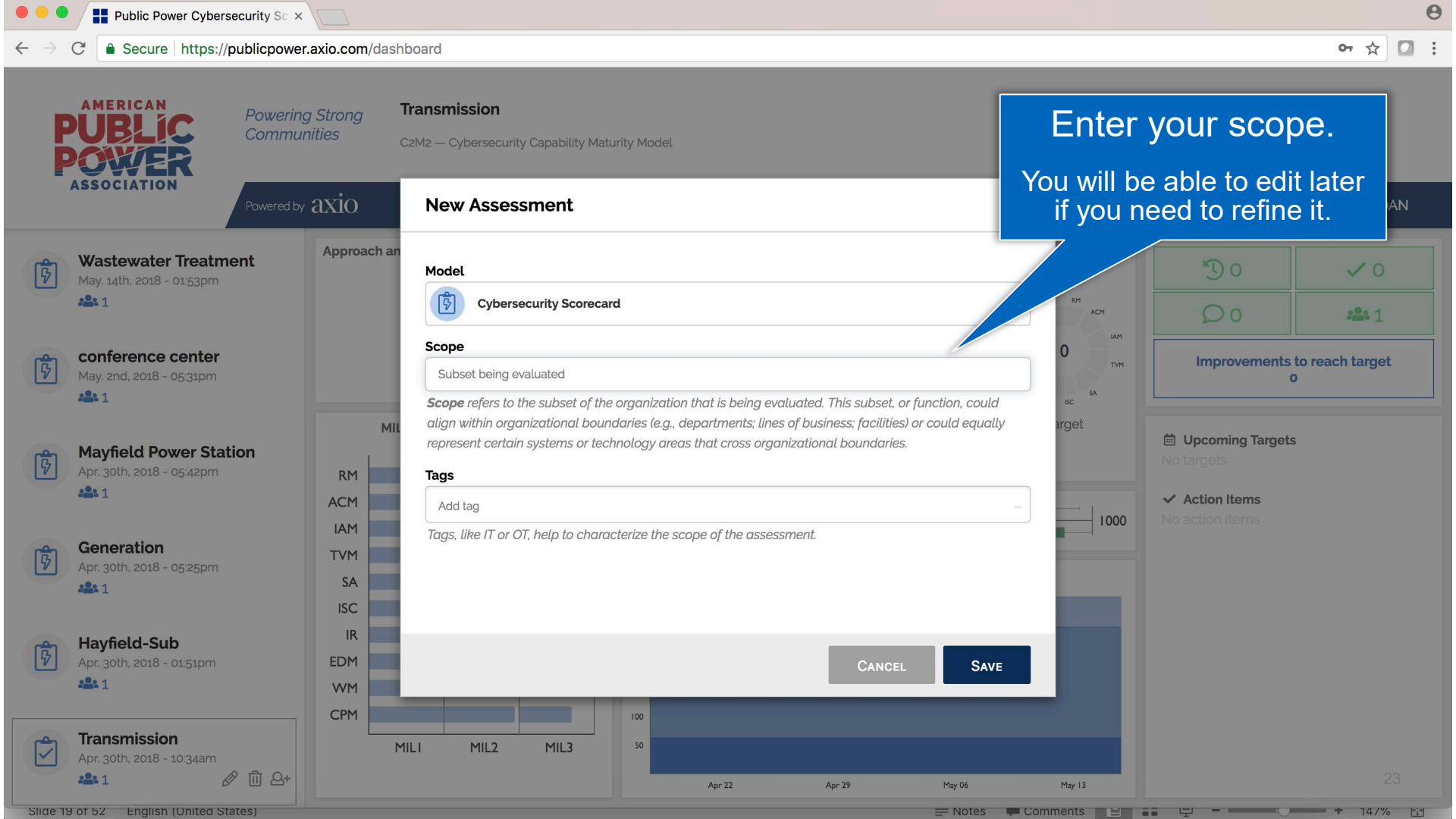
AT
APPA Test
Axio, Inc.
NEW ASSESSMENT
WELCOME APPA
Scorecard
Full C2M2
1. Open the menu by clicking the down arrow near your user name
2. Select "Scorecard"
Untitled
Mar. 23rd, 2018 - 11:33am
22
2
Once you have successfully logged in the first time, you should see this screen.
Get Started
01. take the QUICK LAUNCH
The Quick Launch is
way to establish an initial baseline.
02.
our team to gather input and distribute work.
03. set a TARGET PROFILE
A Target Profile provides a level you can drive toward. Create your own, or adjust the ones provided.
04. track ACTION ITEMS & NOTES
Each practice supports the creation of action items and keeping track of assigned work.
05. track your PROGRESS
Using the platform throughout the year makes it easy to see and report progress.
This process is designed to be dynamic and repeatable, allowing you to continuously reassess your processes for perpetual improvement.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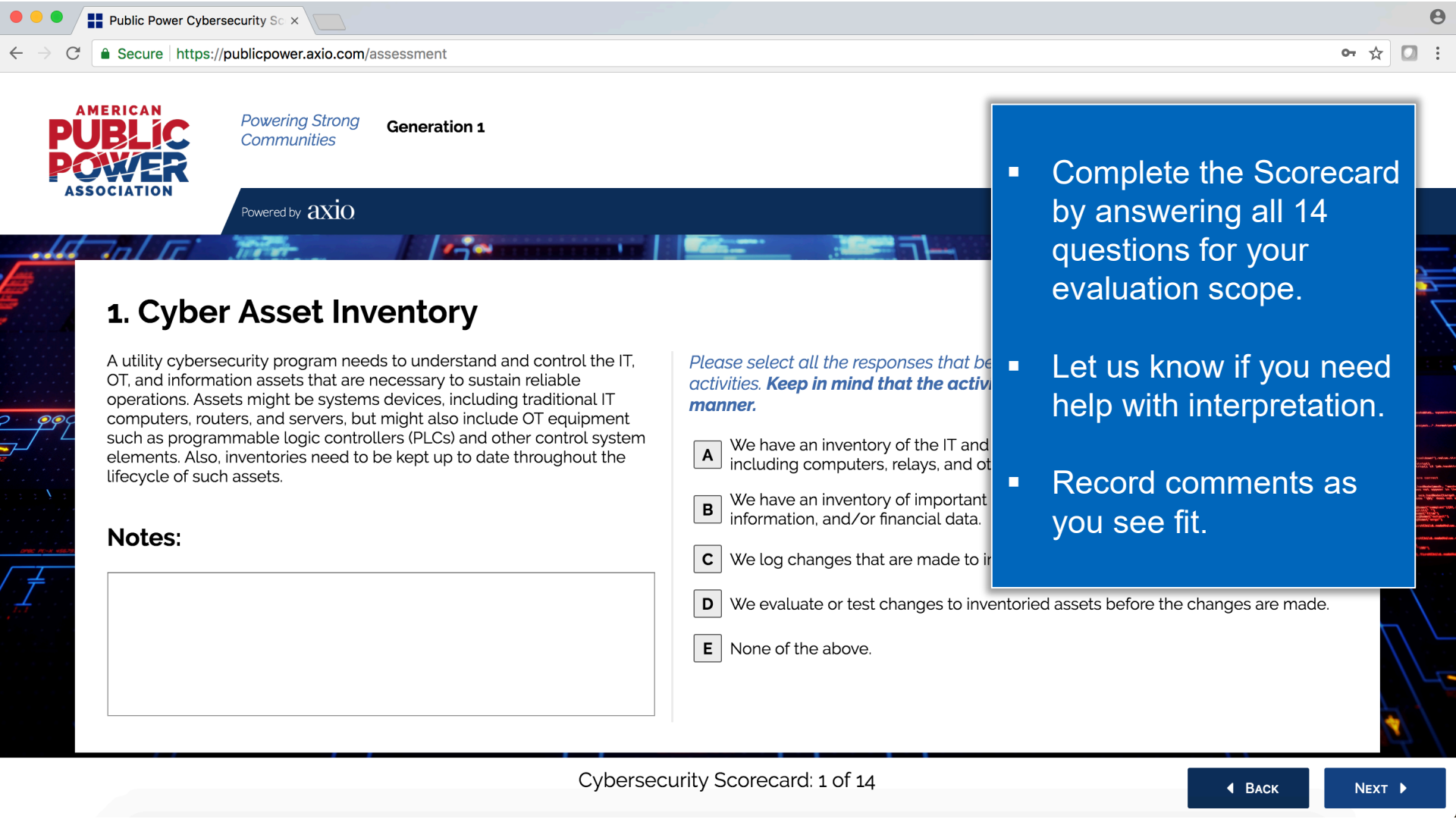
Transmission
C2M2 — Cybersecurity Capability Maturity Model
Powered by axio
Enter your scope.
You will be able to edit later if you need to refine it.
New Assessment
Model
Cybersecurity Scorecard
Scope
Subset being evaluated
Scope refers to the subset of the organization that is being evaluated. This subset, or function, could align within organizational boundaries (e.g., departments; lines of business; facilities) or could equally represent certain systems or technology areas that cross organizational boundaries.
Tags
Add tag
Tags, like IT or OT, help to characterize the scope of the assessment.
CANCEL
SAVE
Wastewater Treatment
May. 14th, 2018 - 01:53pm
conference center
May. 2nd, 2018 - 05:31pm
Mayfield Power Station
Apr. 30th, 2018 - 05:42pm
Generation
Apr. 30th, 2018 - 05:25pm
Hayfield-Sub
Apr. 30th, 2018 - 01:51pm
Transmission
Apr. 30th, 2018 - 10:34am
Improvements to reach target
0
Upcoming Targets
No targets
Action Items
No action items
RM
ACM
IAM
TVM
SA
ISC
IR
EDM
WM
CPM
MIL1
MIL2
MIL3
Apr 22
Apr 29
May 06
May 13
23
Slide 19 of 52
English (United States)
Notes
Comments
147%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Secure https://publicpower.axio.com/assessment
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Powering Strong Communities
Generation 1
Powered by axio
1. Cyber Asset Inventory
A utility cybersecurity program needs to understand and control the IT, OT, and information assets that are necessary to sustain reliable operations. Assets might be systems devices, including traditional IT computers, routers, and servers, but might also include OT equipment such as programmable logic controllers (PLCs) and other control system elements. Also, inventories need to be kept up to date throughout the lifecycle of such assets.
Notes:
Please select all the responses that be
activities. Keep in mind that the activ
manner.
A We have an inventory of the IT and
including computers, relays, and ot
B We have an inventory of important
information, and/or financial data.
C We log changes that are made to ir
D We evaluate or test changes to inventoried assets before the changes are made.
E None of the above.
Complete the Scorecard by answering all 14 questions for your evaluation scope.
Let us know if you need help with interpretation.
Record comments as you see fit.
Cybersecurity Scorecard: 1 of 14
Back
Next

14. Cyber Security Program Management

A cybersecurity program is a managed set of activities designed to provide governance for the utility. Such a program would typically include objectives for improving cybersecurity over time and a foundational strategy for managing cybersecurity and would provide leadership and resources for cybersecurity activities across the utility.

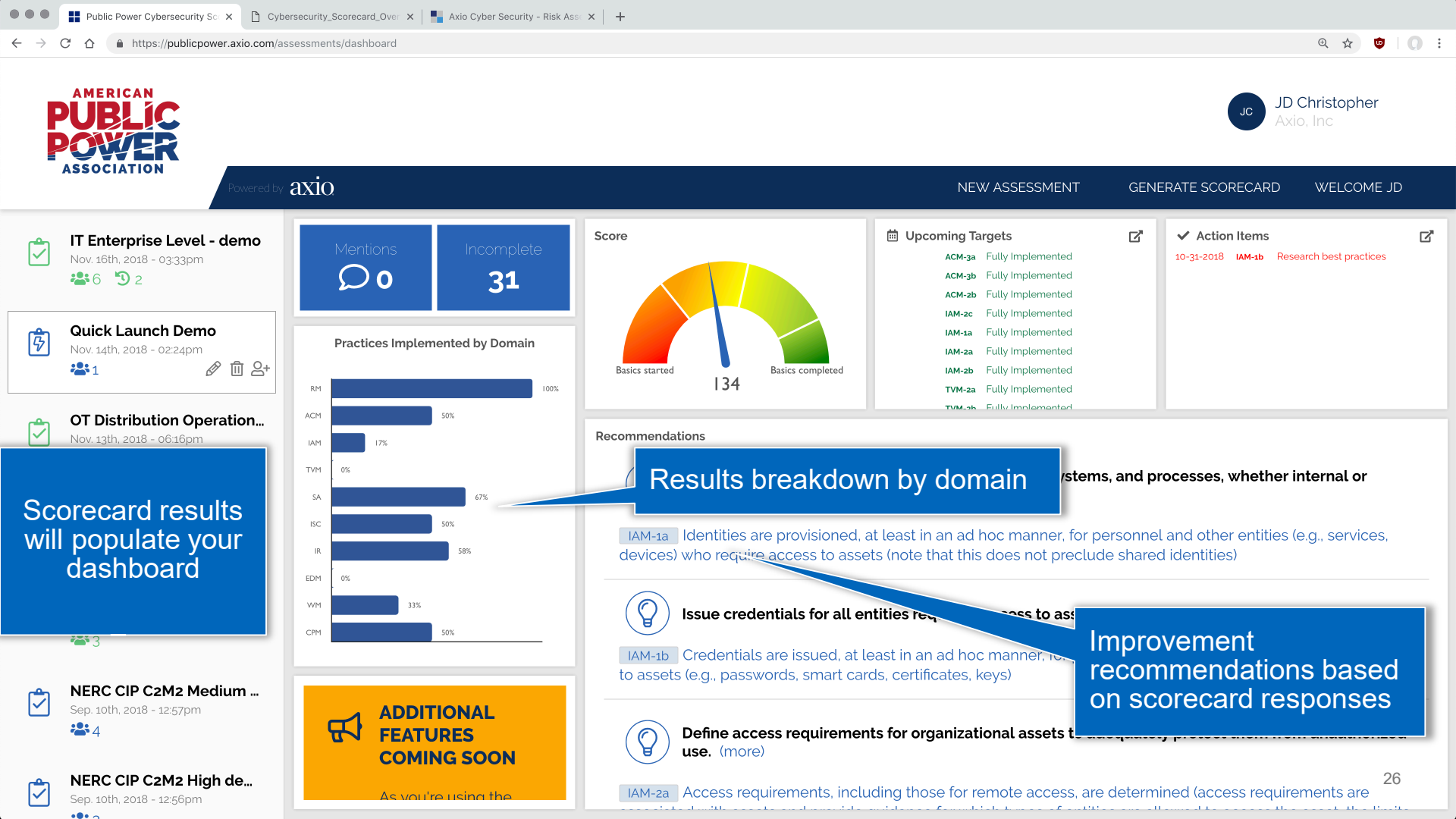
Notes:

Please select the response(s) that best describe your cybersecurity program capabilities. ***Keep in mind that the activities may be performed in an ad hoc manner.***

- **A** We have a strategy for our cybersecurity program.
- **B** We have resources (people, funding, and tools) for our cybersecurity program.
- **C**
- **D**
- **E**

ems.

When you've answered all 14 questions, click the "Finish" button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Axio Cyber Security - Risk Ass
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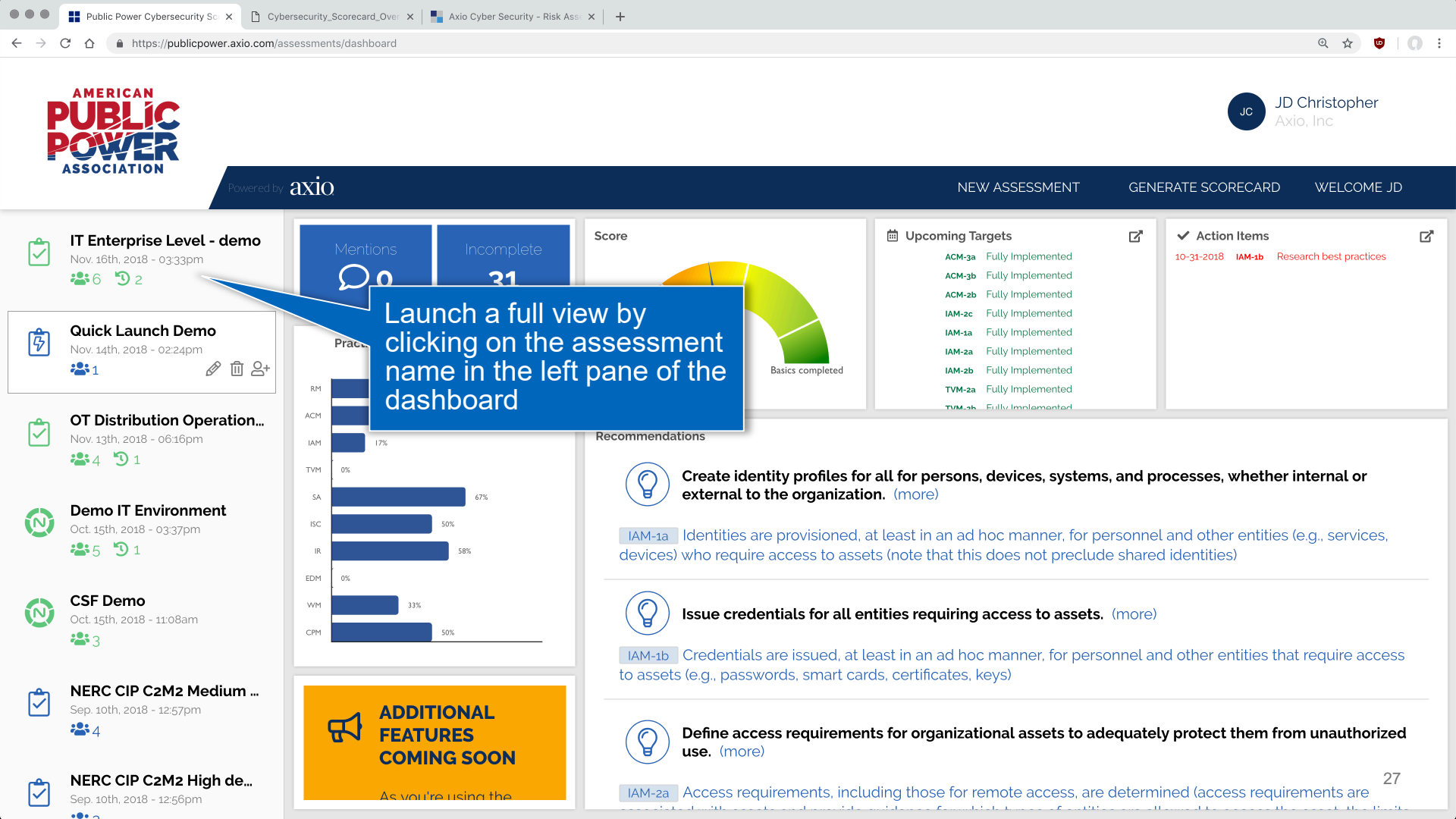
AMERICAN PUBLIC POWER ASSOCIATION
Powered by axio
JD Christopher
Axio, Inc
NEW ASSESSMENT
GENERATE SCORECARD
WELCOME JD
IT Enterprise Level - demo
Nov. 16th, 2018 - 03:33pm
6
2
Quick Launch Demo
Nov. 14th, 2018 - 02:24pm
1
OT Distribution Operation...
Nov. 13th, 2018 - 06:16pm
3
NERC CIP C2M2 Medium ...
Sep. 10th, 2018 - 12:57pm
4
NERC CIP C2M2 High de...
Sep. 10th, 2018 - 12:56pm
Scorecard results will populate your dashboard
Mentions
0
Incomplete
31
Practices Implemented by Domain
RM 100%
ACM 50%
IAM 17%
TVM 0%
SA 67%
ISC 50%
IR 58%
EDM 0%
WM 33%
CPM 50%
ADDITIONAL FEATURES COMING SOON
As you're using the
Score
Basics started
Basics completed
134
Upcoming Targets
ACM-3a Fully Implemented
ACM-3b Fully Implemented
ACM-2b Fully Implemented
IAM-2c Fully Implemented
IAM-1a Fully Implemented
IAM-2a Fully Implemented
IAM-2b Fully Implemented
TVM-2a Fully Implemented
Action Items
10-31-2018 IAM-1b Research best practices
Recommendations
Results breakdown by domain
IAM-1a Identities are provisioned, at least in an ad hoc manner, for personnel and other entities (e.g., services, devices) who require access to assets (note that this does not preclude shared identities)
IAM-1b Credentials are issued, at least in an ad hoc manner, fo
to assets (e.g., passwords, smart cards, certificates, keys)
Improvement recommendations based on scorecard responses
use. (more)
IAM-2a Access requirements, including those for remote access, are determined (access requirements are
26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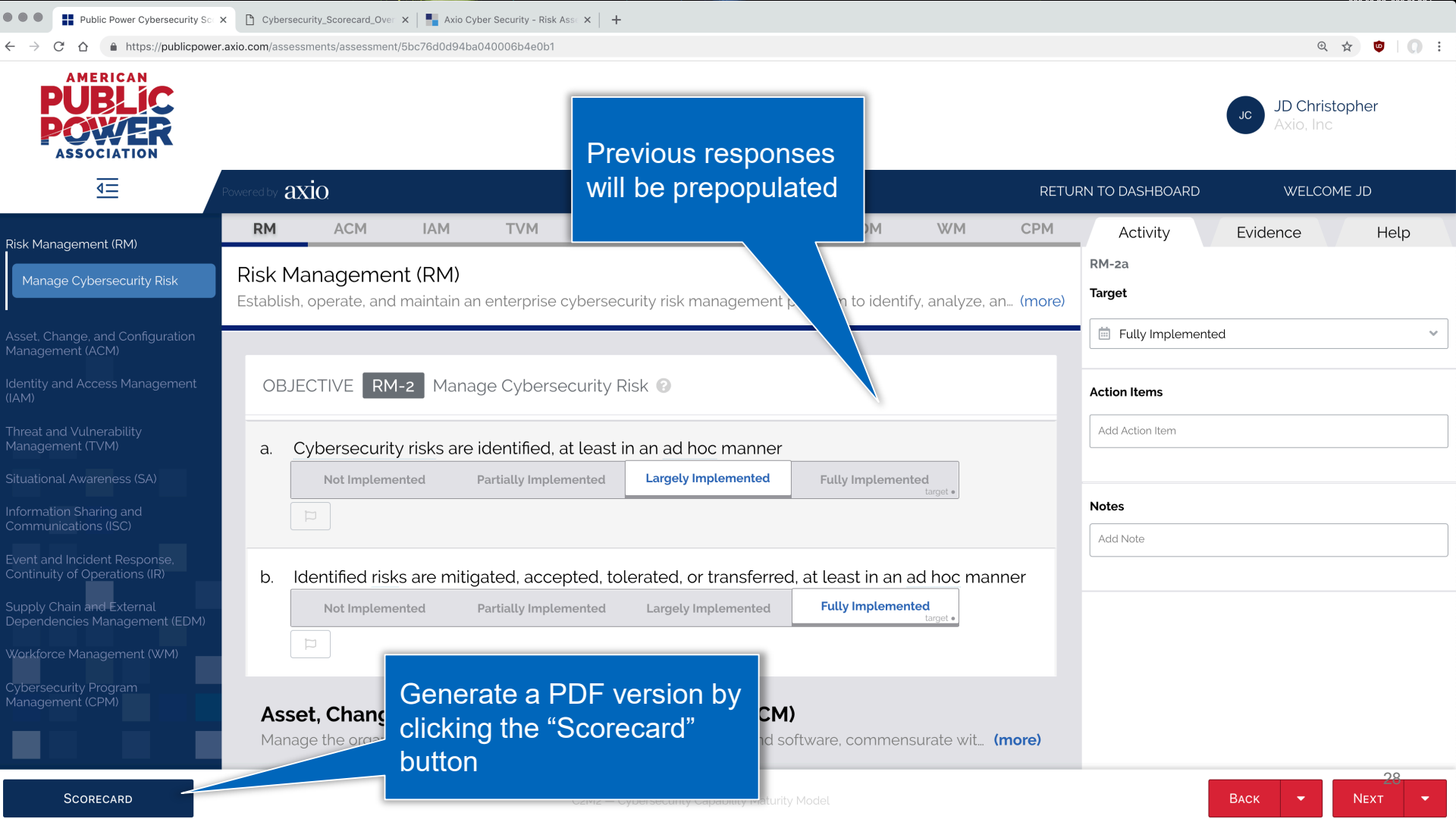
JD Christopher
Axio, Inc
NEW ASSESSMENT
GENERATE SCORECARD
WELCOME JD
IT Enterprise Level - demo
Nov. 16th, 2018 - 03:33pm
6 2
Quick Launch Demo
Nov. 14th, 2018 - 02:24pm
1
OT Distribution Operation...
Nov. 13th, 2018 - 06:16pm
4 1
Demo IT Environment
Oct. 15th, 2018 - 03:37pm
5 1
CSF Demo
Oct. 15th, 2018 - 11:08am
3
NERC CIP C2M2 Medium ...
Sep. 10th, 2018 - 12:57pm
4
NERC CIP C2M2 High de...
Sep. 10th, 2018 - 12:56pm
Launch a full view by clicking on the assessment name in the left pane of the dashboard
Mentions
0
Incomplete
31
RM
ACM
IAM
17%
TVM
0%
SA
67%
ISC
50%
IR
58%
EDM
0%
WM
33%
CPM
50%
ADDITIONAL FEATURES COMING SOON
Score
Basics completed
Upcoming Targets
ACM-3a Fully Implemented
ACM-3b Fully Implemented
ACM-2b Fully Implemented
IAM-2c Fully Implemented
IAM-1a Fully Implemented
IAM-2a Fully Implemented
IAM-2b Fully Implemented
TVM-2a Fully Implemented
Action Items
10-31-2018 IAM-1b Research best practices
Recommendations
Create identity profiles for all for persons, devices, systems, and processes, whether internal or external to the organization. (more)
IAM-1a Identities are provisioned, at least in an ad hoc manner, for personnel and other entities (e.g., services, devices) who require access to assets (note that this does not preclude shared identities)
Issue credentials for all entities requiring access to assets. (more)
IAM-1b Credentials are issued, at least in an ad hoc manner, for personnel and other entities that require access to assets (e.g., passwords, smart cards, certificates, keys)
Define access requirements for organizational assets to adequately protect them from unauthorized use. (more)
IAM-2a Access requirements, including those for remote access, are determined (access requirements are
27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Cybersecurity_Scorecard_Over
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AMERICAN PUBLIC POWER ASSOCIATION
JC
JD Christopher
Axio, Inc
Previous responses will be prepopulated
Powered by axio
RETURN TO DASHBOARD
WELCOME JD
RM
ACM
IAM
TVM
WM
CPM
Activity
Evidence
Help
Risk Management (RM)
Manage Cybersecurity Risk
Asset, Change, and Configuration Management (ACM)
Identity and Access Management (IAM)
Threat and Vulnerability Management (TVM)
Situational Awareness (SA)
Information Sharing and Communications (ISC)
Event and Incident Response, Continuity of Operations (IR)
Supply Chain and External Dependencies Management (EDM)
Workforce Management (WM)
Cybersecurity Program Management (CPM)
Risk Management (RM)
Establish, operate, and maintain an enterprise cybersecurity risk management p
to identify, analyze, an...
(more)
OBJECTIVE
RM-2
Manage Cybersecurity Risk
a. Cybersecurity risks are identified, at least in an ad hoc manner
Not Implemented
Partially Implemented
Largely Implemented
Fully Implemented
target
b. Identified risks are mitigated, accepted, tolerated, or transferred, at least in an ad hoc manner
Not Implemented
Partially Implemented
Largely Implemented
Fully Implemented
target
Asset, Chang
CM)
Manage the orga
d software, commensurate wit...
(more)
RM-2a
Target
Fully Implemented
Action Items
Add Action Item
Notes
Add Note
Generate a PDF version by clicking the “Scorecard” button
SCORECARD
C2M2 – Cybersecurity Capability Maturity Model
BACK
NEXT
28

Results: Scorecard

Resilience & Security Pilot

Introduction

Welcome to the pilot version of the Public Power Resilience and Security Maturity Model. This pilot is designed to test the Stage 1 survey for all public power utilities, regardless of size of electric grid functionality. Your participation and insights are invaluable to this effort. The scope defined for this evaluation includes the following: IT OT .

Questions

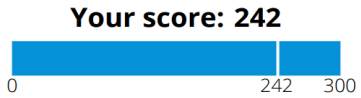
Each question has descriptive text to help inform participants as they progress through the survey. Respondents have been instructed to select all answers that apply for each question, as each activity adds to the general score. The survey is intended to capture what activities are performed at a utility, even if they are performed in an ad hoc manner.

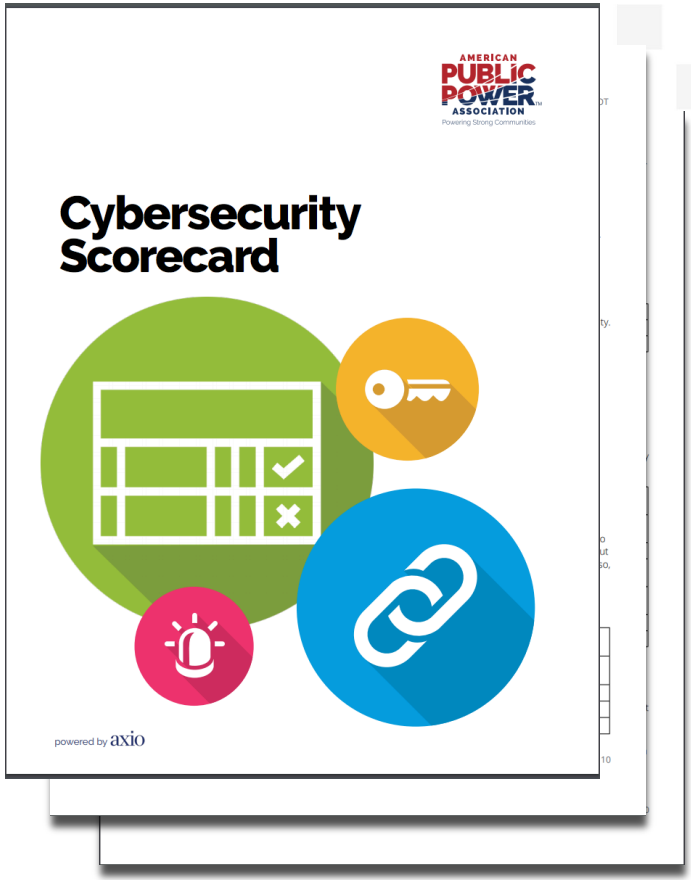
Each question maps to a MIL1 practice in the full C2M2. The associated C2M2 practice designation is included in the last column of the tables below. MIL1 practices address basics that experts believe are necessary and within reach of all utilities. A list of specific recommendations is included at the end of this report.

Scoring

The score for this model is plotted along a simple index ranging from 0-300 (similar to credit score reporting). Respondents who attain a score of at least 240 or higher should consider moving to the next phase of the Public Power Resilience and Security Maturity Model.

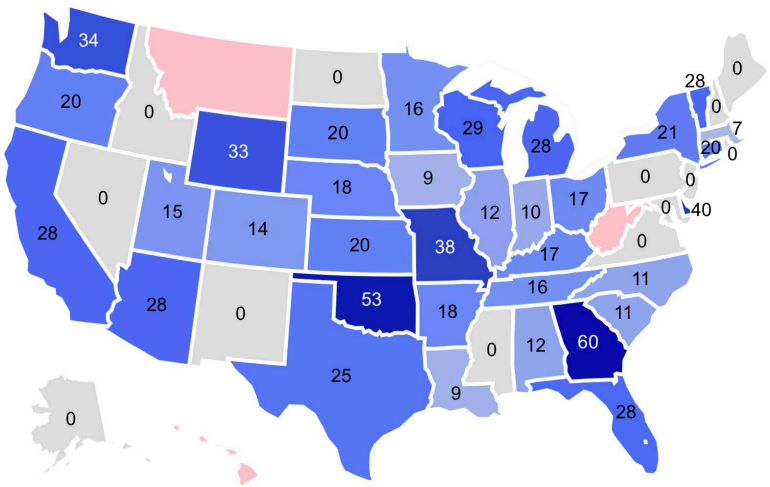
Respondents who receive scores lower than 240 should address additional foundational cybersecurity practices before moving forward. Supporting resources can be found at: https://www.publicpower.org/topic/cybersecurity.

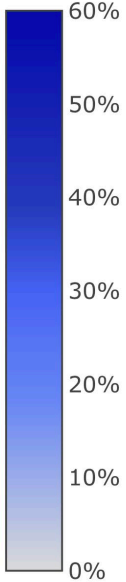


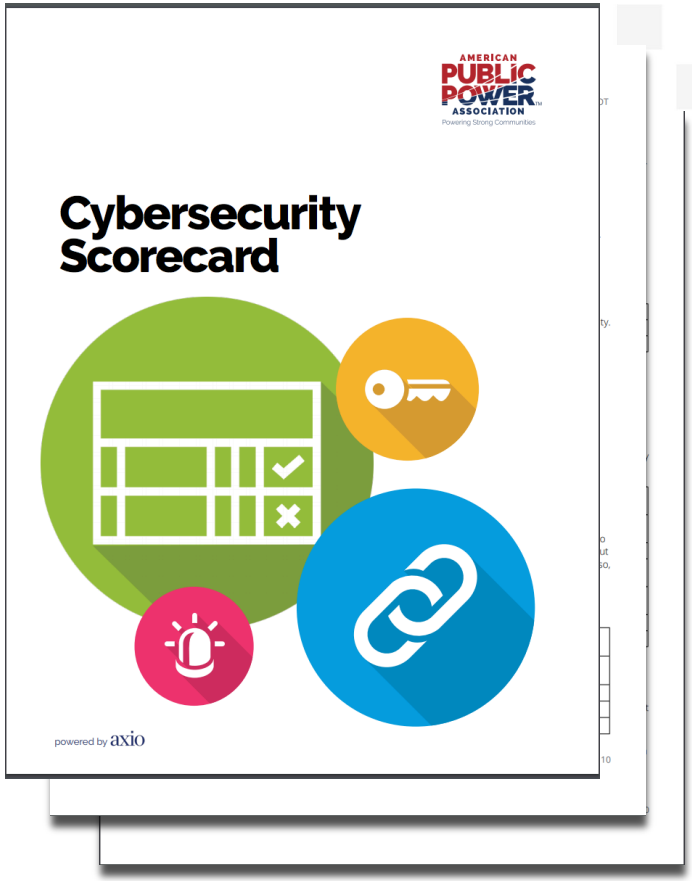


Cybersecurity Scorecard Today

Platform Users as Percent of all Medium and Large Municipal Utilities







team and resource

CONSIDERATIONS

C2M2 AND MEASUREMENT

does subjectivity count?

Crawl-walk-run with reds-and-greens

Level	Approach Practices from ACM-1	Management Practices from ACM-4
MIL0		
MIL1	1a. There is an inventory of OT and IT assets that are important to the delivery of the function; management of the inventory may be ad hoc 1b. There is an inventory of information assets that are important to the delivery of the function (e.g., SCADA set points, customer information, financial data); management of the inventory may be ad hoc	*Initial practices are performed, but may be ad hoc*
MIL2	1c. Inventory attributes include information to support the cybersecurity strategy (e.g., location, asset owner, applicable security requirements, service dependencies, service level agreements, and conformance of assets to relevant industry standards) 1d. Inventoried assets are prioritized based on their importance to the delivery of the function	a. Documented practices are followed for ACM activities b. Stakeholders for ACM activities are identified and involved c. Adequate resources (people, funding, and tools) are provided to suppor ACM activities d. Standards and/or guidelines have been identified to inform ACM activit
MIL3	1e. There is an inventory for all connected IT and OT assets related to the delivery of the function 1f. The asset inventory is current (as defined by the organization)	e. ACM activities are guided by policy (or other directives) f. ACM policies include compliance requirements for specified standards guidelines g. ACM activities are periodically reviewed for conformance to policy h. Responsibility & authority for ACM activities are assigned to personnel i. Personnel performing ACM activities have adequate skills & knowledge

C2M2 AND MEASUREMENT

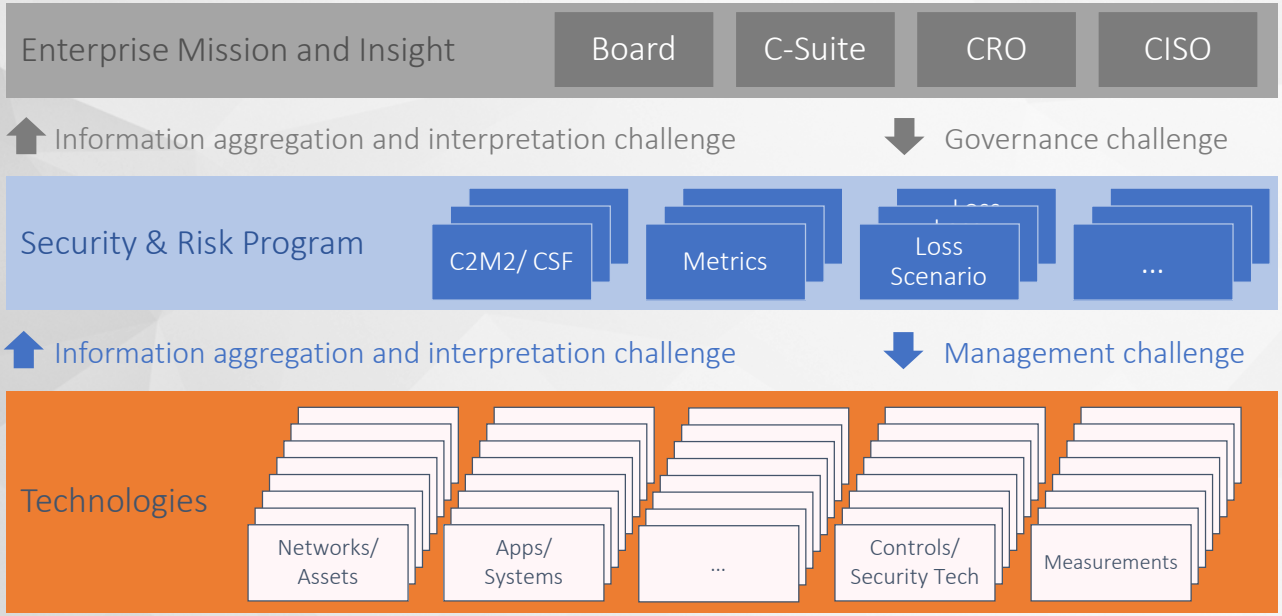
does subjectivity count?

Crawl-walk-run with reds-and-greens

Level	Approach Practices from ACM-1	Management Practices from ACM-4
MIL0	**Mature capability requires both:**	
MIL1	1a. There is an inventory of OT and IT assets that are important to the delivery of the function; management of the inventory may be ad hoc 1b. There is an inventory of information assets that are important to the delivery of the function (e.g., SCADA set points, custom configuration, personal data); management of the inventory may be ad hoc	*Initial practices are performed, but may be ad hoc*
MIL2	1c. Inventory attributes include information to support the cybersecurity strategy (e.g., location, asset owner, applicable security requirements, service dependencies, service level agreements, criticality, performance of assets to relevant industry standards) 1d. Inventoried assets are prioritized based on their importance to the delivery of the function	a. Documented practices are followed for ACM activities b. Stakeholders for ACM activities are identified and involved c. Adequate resources (people, funding, and tools) are provided to support ACM activities d. Standards and/or guidelines have been identified to inform ACM activities
MIL3	1e. There is an inventory for all organizational IT and OT assets related to the delivery of the function 1f. The asset inventory is current (as defined by the organization)	e. ACM activities are guided by policy (or other organizational directives) f. ACM policies include compliance requirements for specified standards or guidelines g. ACM activities are periodically reviewed for conformance to policy h. Responsibility & authority for ACM activities are assigned to personnel i. Personnel performing ACM activities have adequate skills & knowledge

CAN YOU RUN?

CAN YOU KEEP RUNNING?



ARCHITECTURE OF TRUTH

when making sense doesn't make sense

ARCHITECTURE OF TRUTH

when making sense doesn't make sense

BOARD TRUTH

Information aggregation and interpretation challenge

Governance challenge

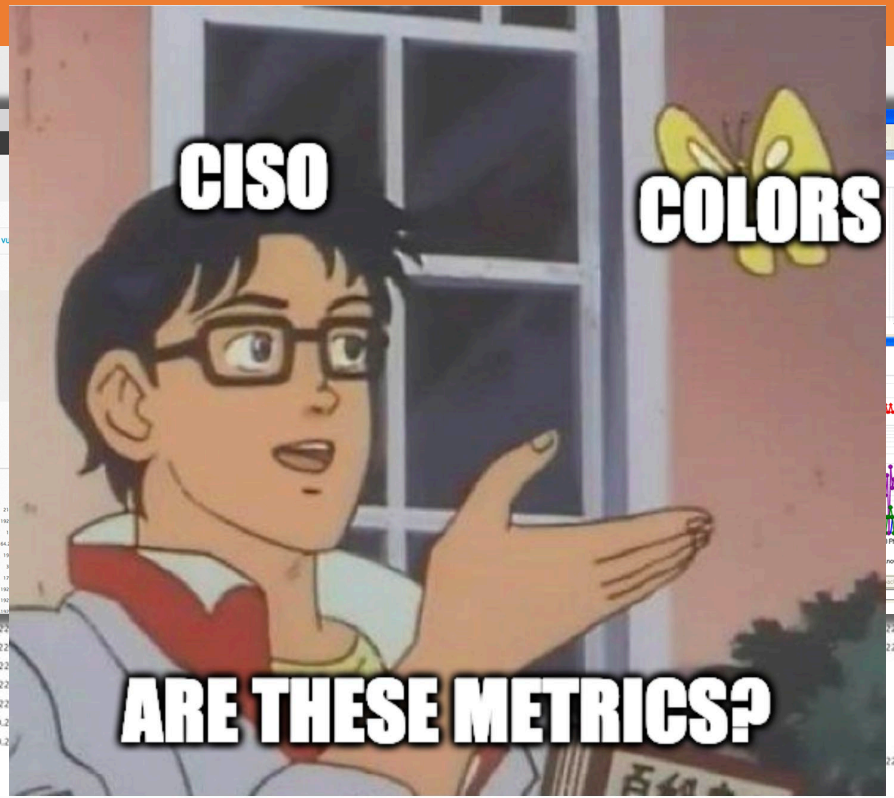
MANAGEMENT TRUTH

Information aggregation and interpretation challenge

Management challenge

GROUND TRUTH

GROUND TRUTH?



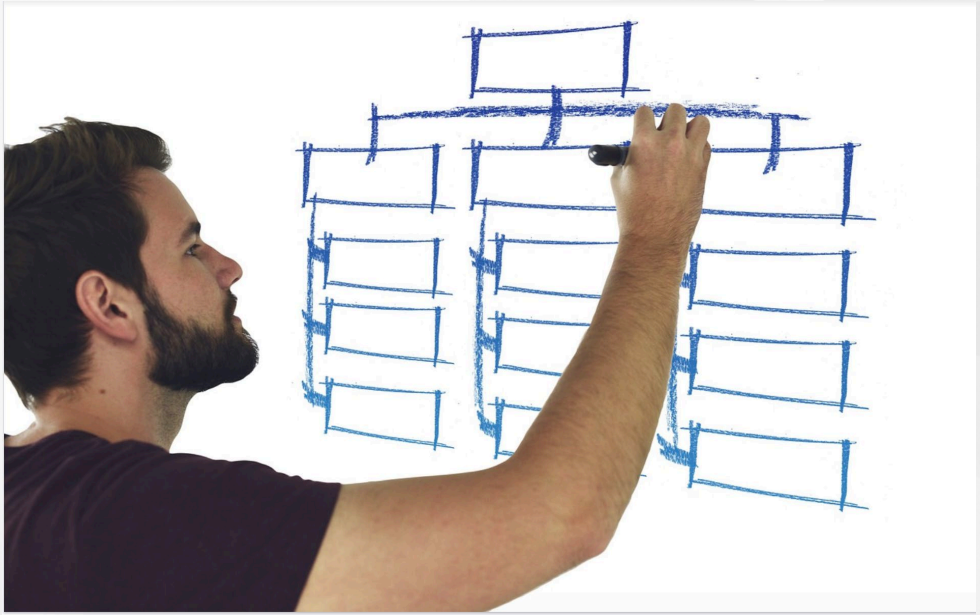
“METRICS” & MORE COLORS

it’s a start…?

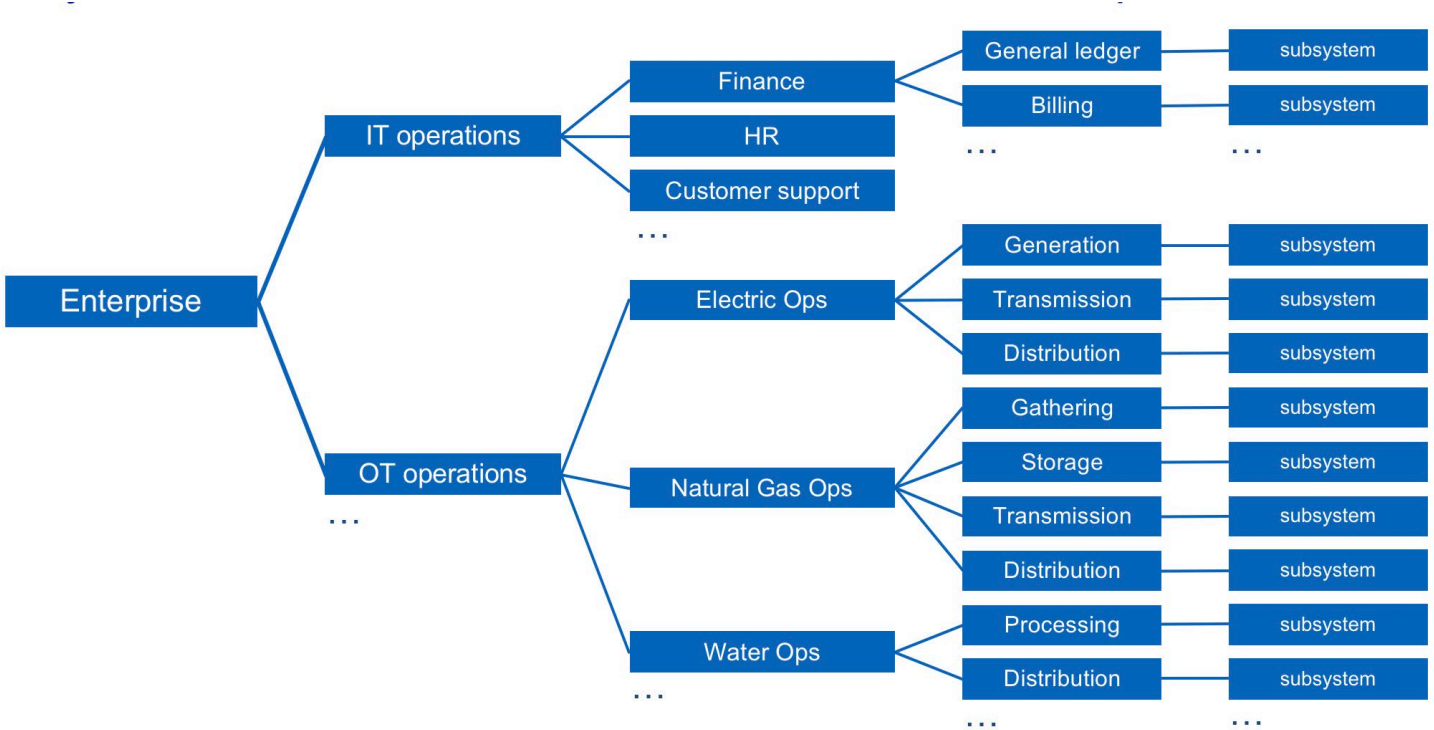
different scopes
FOR DIFFERENT FOLKS

Recall from Engineering 101:
"Optimize within your constraints."

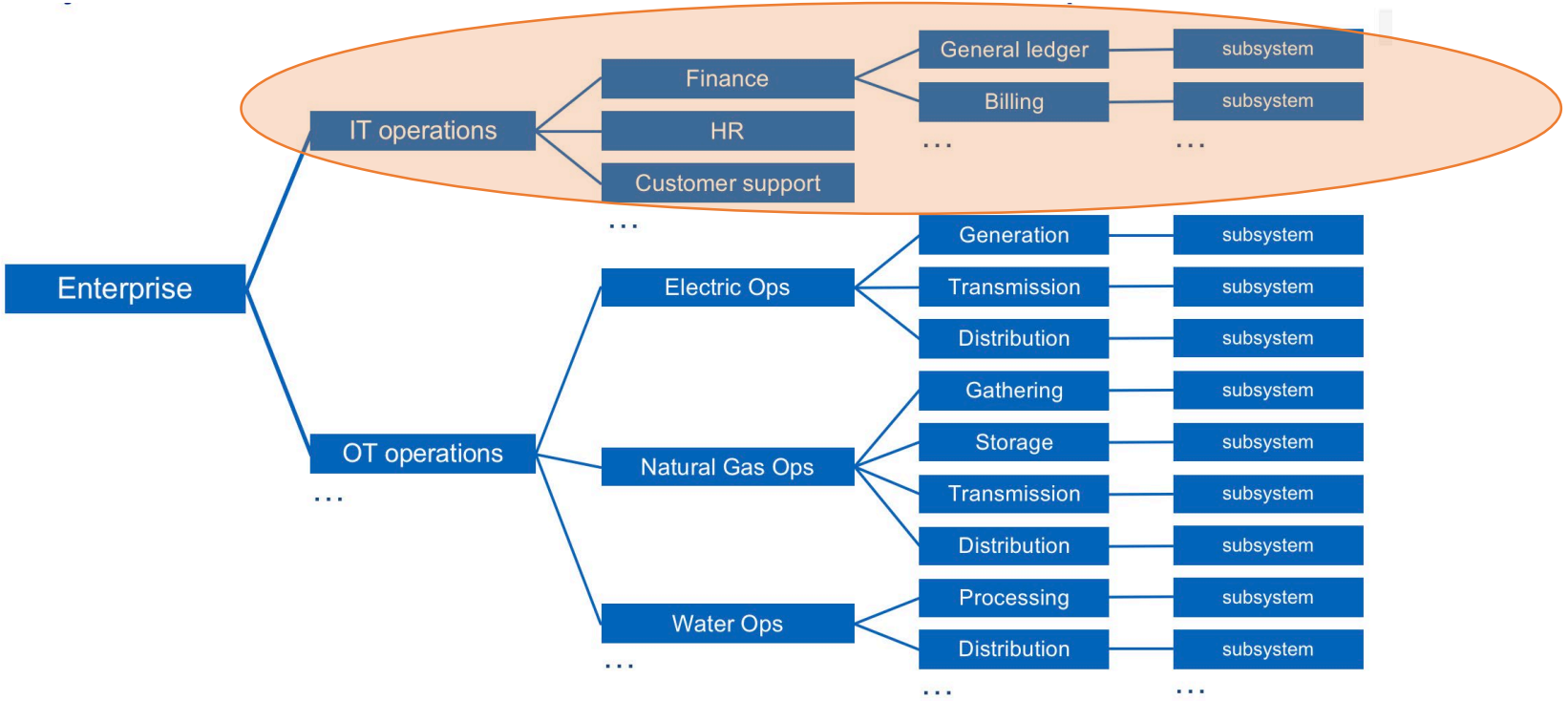
- **Who is responsible for what? Can they answer the questions? Some peers to consider:**
  - Plant Managers
  - Cybersecurity Program Mangers
  - SCADA Engineers
  - Communications Technicians
  - Human Resource Managers
  - Risk Managers



different scopes
FOR DIFFERENT FOLKS



different scopes
FOR DIFFERENT FOLKS



Open Discussion

Questions, Comments, or Concerns?

axio®

THANK YOU

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