



Cyber Update and ESG Overview

TGFOA

Orlie Prince, *Vice President – Senior Credit Officer*
Christopher Coviello, *Vice President – Senior Analyst*

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Agenda

Cyber Update

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ESG Overview

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Analyzing Cyber Risk

CYBER UPDATE – SECTION ONE

Cyber risk and credit

3 distinct global trends drive cyber risk and raise the likelihood of credit impacting events for issuers

1

Growing attack surface

Digitization, reliance on data, and interconnectivity means traditional geographical and sectoral boundaries are becoming less meaningful and increasing our issuers' exposure to both targeted and untargeted cyber attacks. Without the commensurate investments to mitigate the risk, they are also become more vulnerable.

2

Attackers are becoming ever more sophisticated and capable

Sophisticated cyber weaponry are no longer tools solely available to nation states. The successful ransomware campaigns launched over the last few years have netted attackers billions of dollars that they have reinvest in their own R&D.

3

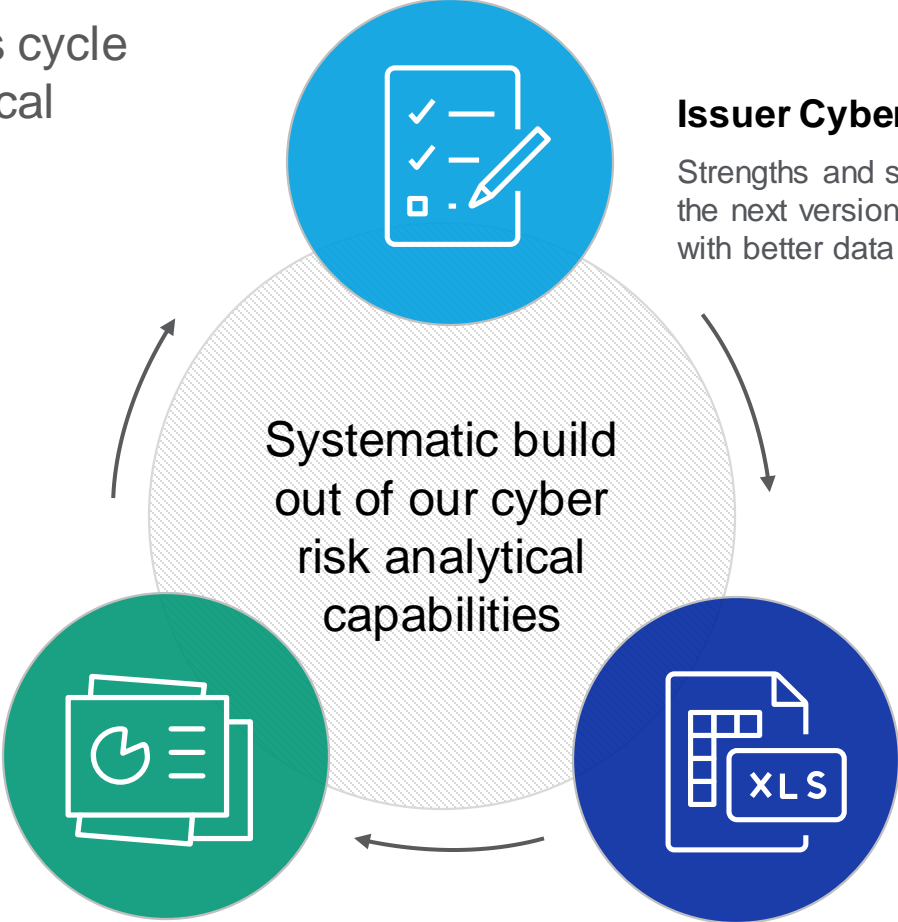
Financial cost of cyber attacks is trending upward

While still manageable for the majority of our rated issuers, the trend towards greater ransom payments, as well as business disruption related costs, forensic and equipment replacement expenses, as well as legal costs and regulatory fine are all driving the cost of a cyber attack in the tens and occasionally hundreds of millions of dollars.



Enriching our cyber analytical capabilities

Our approach generates a virtuous cycle that enriches our cyber risk analytical capability at every turn



Issuer Cyber Survey

Strengths and shortcomings of Cyber Heatmap report help fine tune the next version of the Issuer Survey, the results of which provides us with better data to analyze.

Cyber Heatmap Report

The Cyber Heatmap builds on the Medians Report, includes RMS data and qualitative R&R assessments to produce a relative cyber risk exposure score.

Cyber Medians Report

The Medians Report uses the Issuer Survey results as well as BitSight data to produce a unique global, cross-sector benchmarking report.

About BitSight

- » Leading global provider of cybersecurity ratings and analytics
- » 625+ global employees
- » 2,500+ customers including 25% of the Global Fortune 1000 and 120 Government Institutions
- » Moody's is a minority owner of BitSight

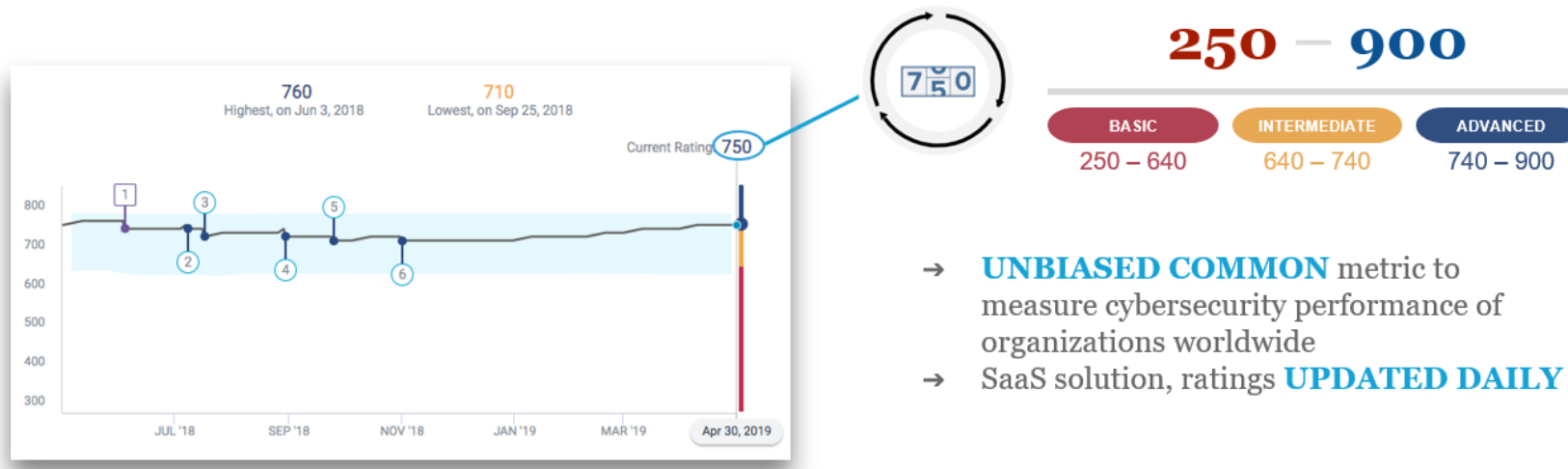
✓ **OBJECTIVE**

✓ **CONTINUOUS**

✓ **DATA-DRIVEN**

✓ **QUANTITATIVE**

Measurement of Organizational Security Performance



Cyber Heatmap Report

CYBER UPDATE – SECTION TWO

2019 cyber heatmap identifies 13 elevated risk sectors

Cyber risk is Event Risk but there is a rising tide

The growing frequency, scale, and sophistication of cyber attacks raises increases the chance that issuers will face successful attacks.

Cyber Risk is Enterprise-wide Risk

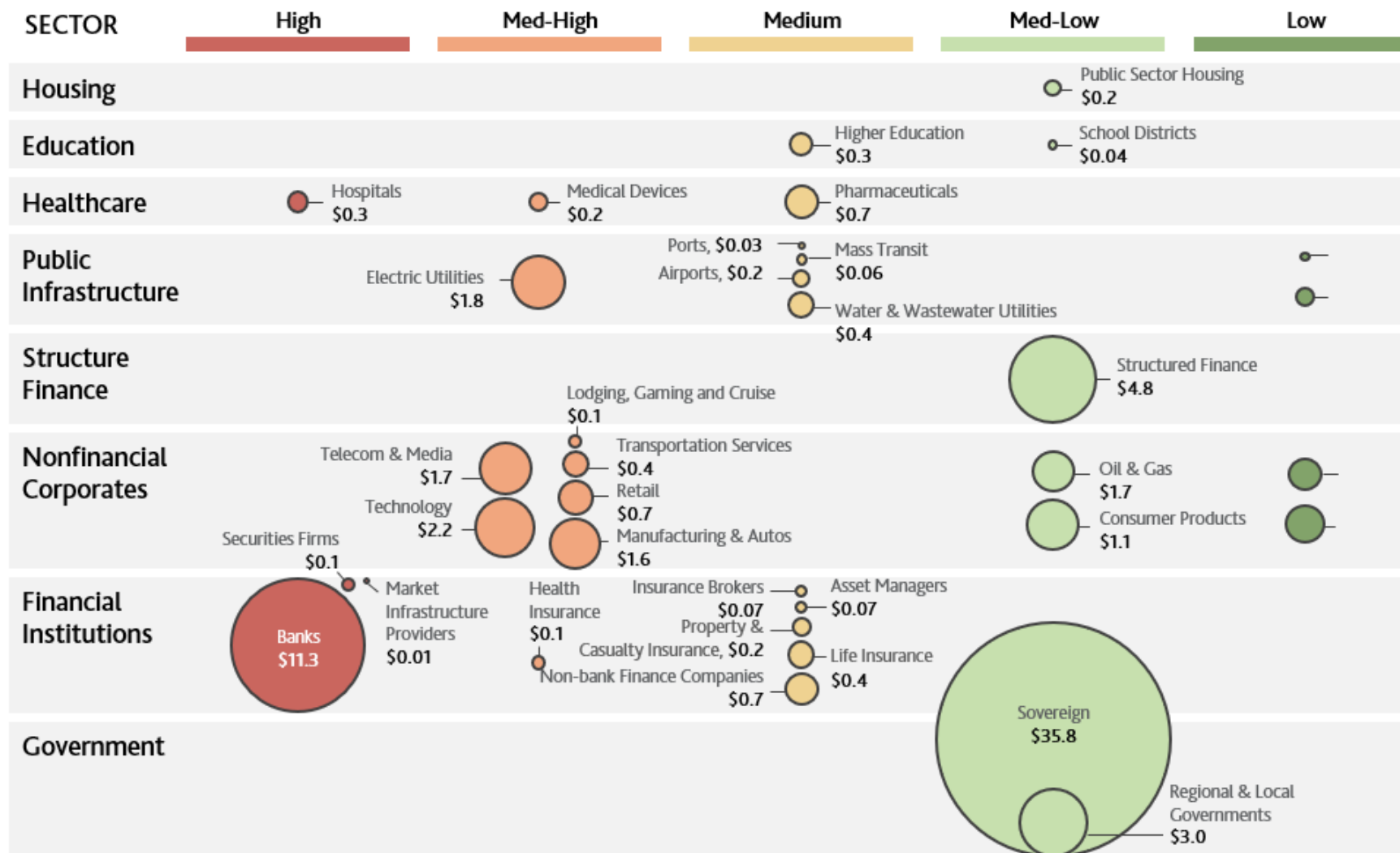
Broad adoption of digital solutions converts cyber risk from an IT-centric responsibility to an enterprise-wide responsibility.

A successful attack can lead to a weaker credit profile

Our assessment considers the financial, reputational, and regulatory impact of a cyber attack and its potential negative credit implications.

Thirteen sectors identified as having elevated cyber risk

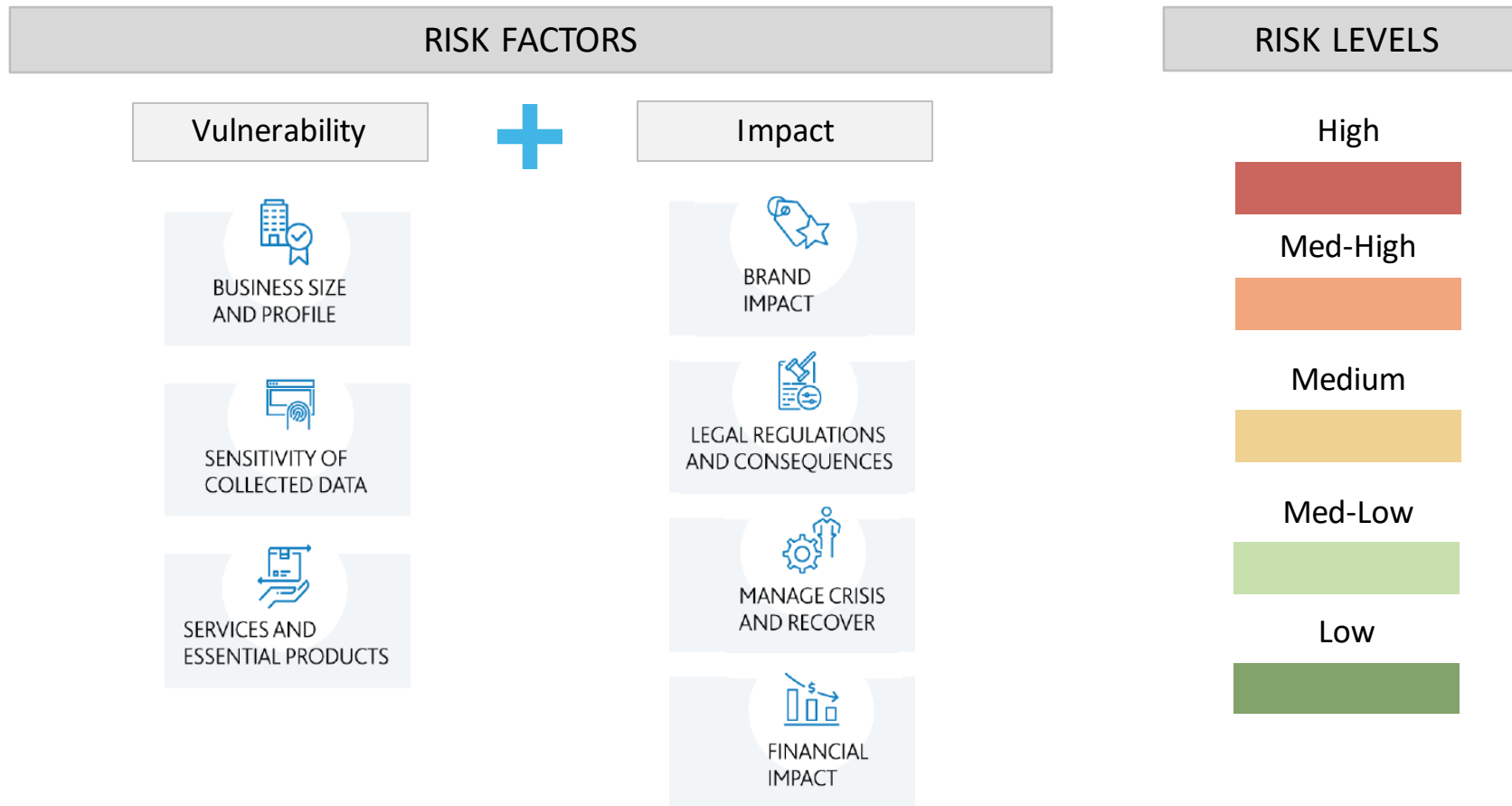
Per Moody's 2019 cyber heatmap, thirteen sectors carry elevated cyber risk. Common attributes include significant reliance on technology / data; limited ability to fall back on manual processes; represent critical global infrastructure.



Source: Moody's Investors Service

Cyber risk factors

We evaluated each sector for vulnerability and impact



Source: Moody's Investors Service

Of 12 Public Finance sectors assessed, 2 fall in elevated risk categories

Hospitals are most at risk, followed by electric utilities

Sector	Vulnerability	Impact	Overall
Hospitals	HIGH	HIGH	HIGH
Electric Utilities*	HIGH	MEDIUM	MEDIUM-HIGH
Higher Education	HIGH	LOW	MEDIUM
Airports	MEDIUM	MEDIUM	MEDIUM
Ports	MEDIUM	MEDIUM	MEDIUM
Mass Transit	MEDIUM	MEDIUM	MEDIUM
Water and Wastewater Util.*	MEDIUM	MEDIUM	MEDIUM
Regional and Local Gvts	MEDIUM	LOW	MEDIUM-LOW
School Districts	MEDIUM	LOW	MEDIUM-LOW
Toll Roads	LOW	LOW	LOW
PPP	LOW	LOW	LOW
States	LOW	LOW	LOW

- Includes investor privately-owned utilities
- Data as of 2019

Source: Moody's Investors Service

Partially automated, quantitatively-driven cyber heatmap update



Systemic Risk (25%)

Analyst derived qualitative assessment of the critical nature of a sector relative to the broader economy.



Digitization (25%)

Analyst derived qualitative assessment of the rate of digitization of the key business services and processes of a sector.



Vulnerability (16.67%)

Quantitatively derived score based on BitSight collected data on 2-3 pre-identified key vulnerability drivers.



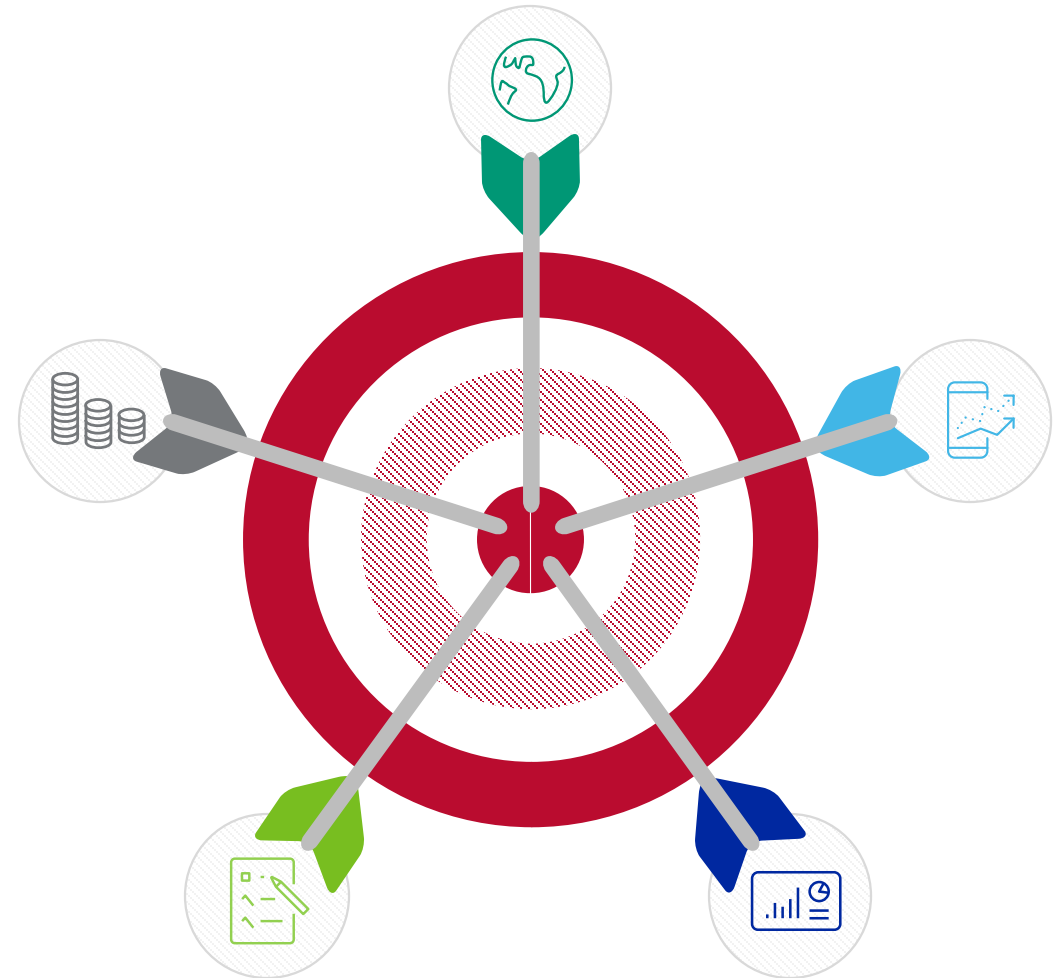
Resilience (16.67%)

Quantitatively derived score based on the data collected via the issuer survey.



Relative loss (16.67%)

Calculated based on data collected by partners BitSight, RMS, and BVD.

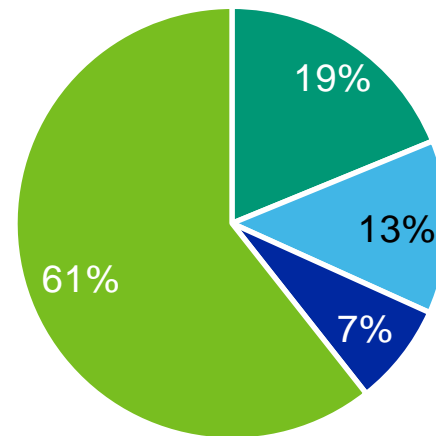


Preliminary aggregate 2022 cyber heatmap results

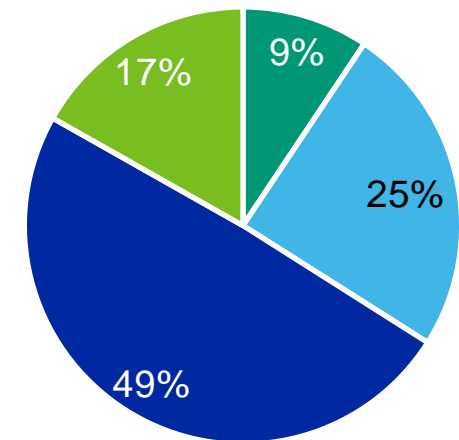
Based on rated debt

- Cyber risk has grown across the board, largely driven by rapid adoption of digitization across all sectors globally spurred by the pandemic
- High and moderate risk categories increase most as more sectors digitize, while previously identified very high-risk sectors bear fruit of investments in cyber readiness
- Increase in the risk profile of industrial sectors, utilities, oil and gas, and manufacturing appear to be most pronounced as the number of OT capable threat actors grows
- Previously identified low risk sectors such as basic commodities and regional and local governments see their cyber risk profile weaken on the heels of an increase in the number of cyber attacks

2019 cyber heatmap results



2022 draft cyber heatmap results



■ Very High ■ High ■ Moderate ■ Low

Issuer Cyber Survey Report

CYBER UPDATE – SECTION THREE

Moody's Issuer Cyber Survey Report

- **To assess US state and local governments' cyber risk preparedness, Moody's surveyed 122 governmental bodies, including states, counties, cities, school districts, utilities and transit authorities**
- **Key Takeaways**
 - ✓ **Larger governments are better positioned to address cyber risks than smaller governments.** Larger entities such as state governments and transit authorities tend to have greater resources and revenue-raising ability, allowing them to maintain well-rounded cybersecurity practices
 - ✓ **Testing an entity's infrastructure for cyber weakness varies widely across sectors surveyed.** System testing for weakness was most common for states and transit systems, with substantial gaps across the remaining cohorts
 - ✓ **School districts trail other governmental sectors in protecting systems and data.** Based on survey results, 86% of districts have incidence response plans, but they trail in key metrics such as use of multi-factor authentication and data backups

Moody's Issuer Cyber Survey Report

- ✓ **Head count and budget allocated to cybersecurity is generally increasing** across most sectors
- ✓ **Most governmental entities have standalone cyber insurance**, but our highest rated issuers such as state governments are the most likely to carry policies
- ✓ **Adoption of cloud technology is relatively slow but is likely to grow.** The shift will allow smaller governments that may not have the resources to invest in regular technology upgrades to better protect their assets

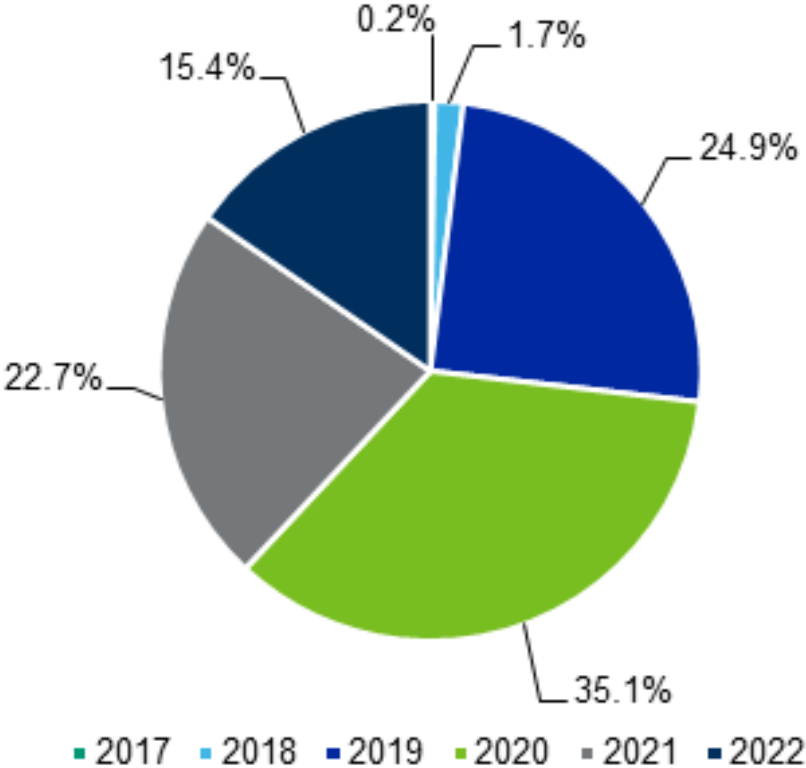
Cyber Attack Research

CYBER UPDATE – SECTION FOUR

Cyberattack Research Overview

- Total of 410 attacks since Feb 2018
- Increasing frequency
- **Average of 8.2 attacks per state**
- Most commonly targeted states:

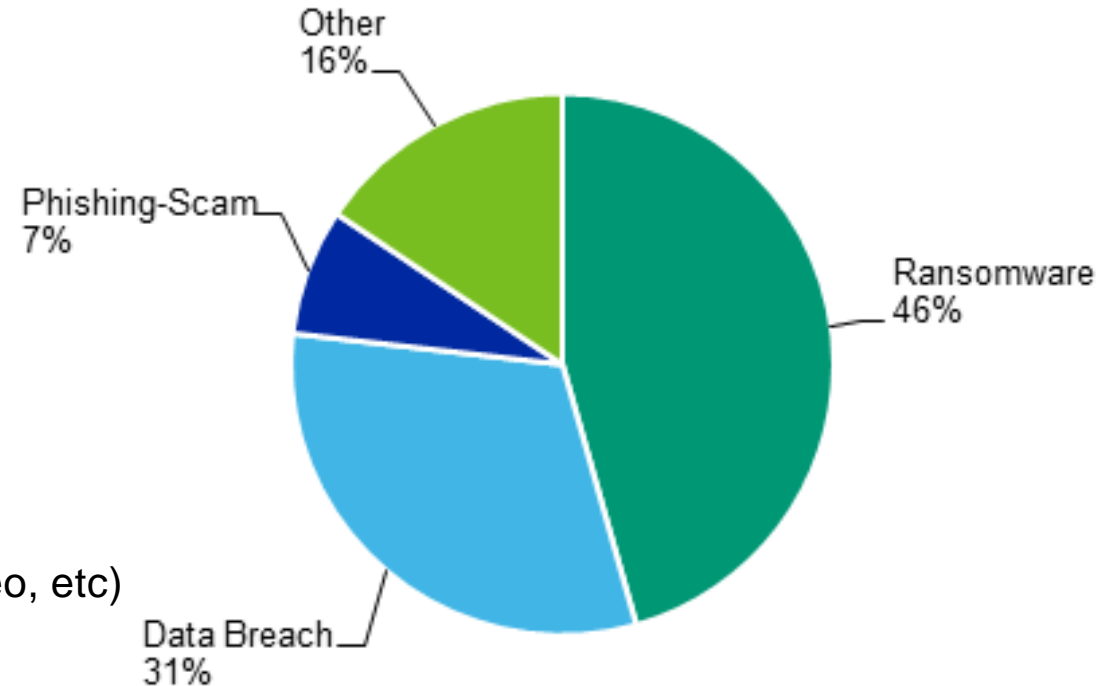
Texas	56
California	27
New York	25
Florida	23
Pennsylvania	21



Cyberattack Research Overview

Types of Attack

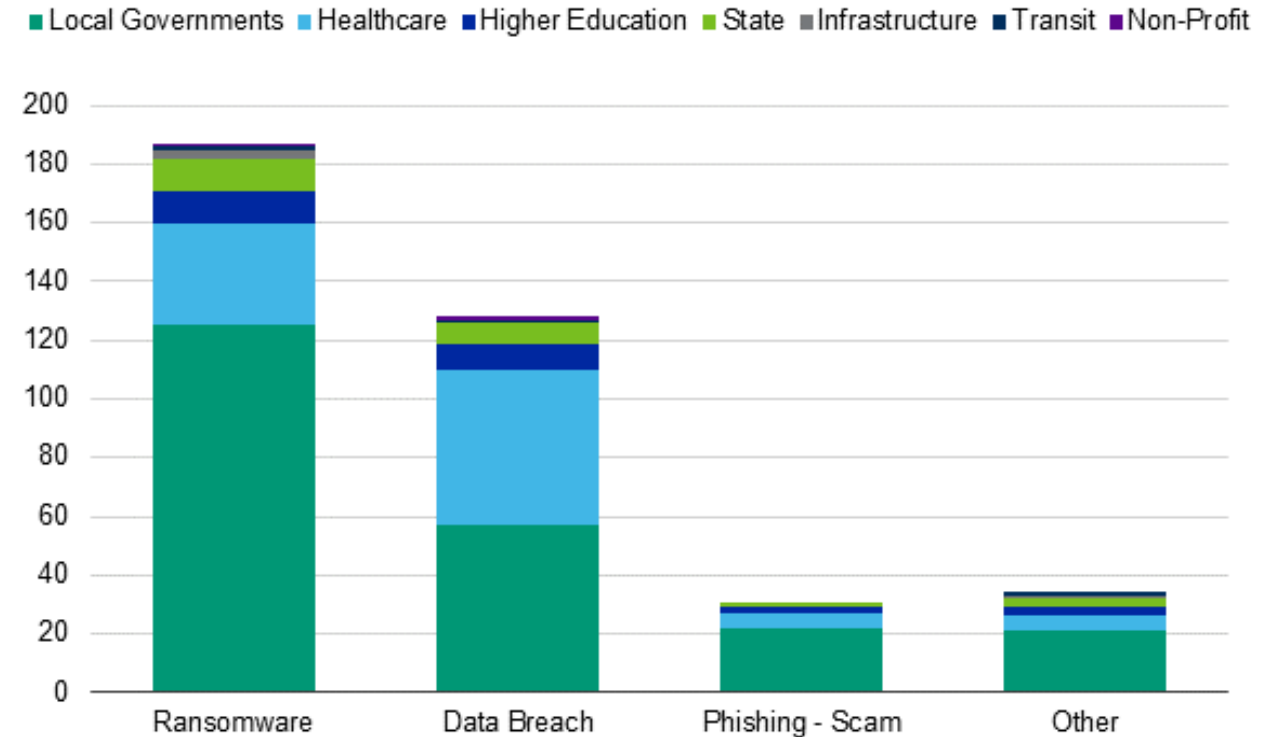
- The most lucrative hacks are more common
- Various situations and viruses are represented within each category.
- “Other” includes the following:
 - General malware
 - Menace-type hacking (website, breaking into a video, etc)
 - Denial of Service
 - Events disclosed as cyberattack only



Cyberattack Research Overview

Sectors

- Majority of attacks are on local government issuers followed by healthcare
- Healthcare attacks tend to be related to stealing and/or demanding ransom for sensitive data.
- State attacks are on specific departments, not the state as whole



ESG Overview

US Regional and Local Governments

An aerial photograph showing a vibrant turquoise ocean meeting a white sandy beach. A paved road with white lane markings curves through a dense, lush green forest that borders the beach.

MIS ESG Integration into Credit

ESG OVERVIEW – SECTION FIVE

Four Components to MIS Integration of ESG

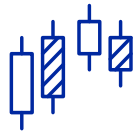
ESG scores will assist in transparently and systematically demonstrating the impact of ESG on credit ratings



Credit Ratings & Research

How is ESG integrated into credit ratings?

ESG factors taken into consideration for all credit ratings. Greater transparency in PRs, as well as Credit opinions. Credit Impact Score (CIS) is an output of the rating process that indicates the extent, if any, to which ESG factors impact the rating of an issuer or transaction.



ESG Scores

How is a specific issuer exposed to ESG risks/benefits?

Issuer Profile Scores (IPS) are issuer-specific scores that assess an entity's exposure to the categories of risks in the ESG classification from a credit perspective. IPSs, where available, are inputs to credit ratings.



ESG Classification

What is ESG?



Our classification reports describe how we define and categorize E, S and G considerations that are material to credit quality. Environmental classification sharpens focus on physical climate risks.

Heat Maps

Is ESG material to credit quality?



Heat maps provide relative ranking of various sectors along the E and S classification of risks.

ESG Classification System Incorporates Credit Relevant Considerations

Our assessment of ESG risks is framed by the classification



Environmental

Physical climate risks
Carbon transition
Water management
Waste and pollution
Natural capital



Social

Private sector	Public sector
Customer relations	Access to basic services
Demographic and societal trends	Demographics
Human capital	Education
Health and safety	Health and safety
Responsible production	Housing
	Labor and income



Governance

Private sector	Public sector
Financial strategy & risk management	Institutional structure
Management credibility & track record	Policy credibility and effectiveness
Organizational structure	Budget management
Board structure, policies & procedures	Transparency and disclosure
Compliance & reporting	

Source: Moody's Investors Service






An aerial photograph showing a vibrant turquoise ocean meeting a white sandy beach. A paved road with white lane markings curves through a dense, lush green forest that borders the beach.

ESG Issuer Profile Scores and Credit Impact Score Overview

ESG OVERVIEW – SECTION SIX

E, S and G Issuer Profile Scoring Scale

Assessed on a five-point scale from positive to negative exposure

	Score	Definition
 POSITIVE	E-1 S-1 G-1	<p>Issuers or transactions with a Positive E or S issuer profile score typically have exposures to E or S issues that carry material credit benefits.</p> <p>For G, issuers or transactions typically have exposure to G considerations that, in the context of their sector, positions them strongly, with material credit benefits.</p>
 NEUTRAL-TO-LOW	E-2 S-2 G-2	<p>Issuers or transactions with a Neutral-to-Low E or S issuer profile score typically have exposures to E or S issues that are not material in differentiating credit quality. In other words, they could be overall slightly credit-positive, credit-neutral, or slightly credit-negative. An issuer or transaction may have a Neutral-to-Low score because the exposure is not material or because there are mitigants specifically related to any E or S risks that are sufficient to offset those risks.</p> <p>Issuers or transactions with a Neutral-to-Low G issuer profile score typically have exposure to G considerations that, in the context of their sector, positions them as average, and the exposure is overall neither credit-positive nor negative.</p>
 MODERATELY NEGATIVE	E-3 S-3 G-3	<p>Issuers or transactions with a Moderately Negative E or S issuer profile score typically have exposures to E or S issues that carry moderately negative credit risks. These issuers may demonstrate some mitigants specifically related to the identified E or S risks, but they are not sufficiently material to fully offset the risks.</p> <p>Issuers or transactions with a Moderately Negative G issuer profile score typically have exposure to G considerations that, in the context of the sector, positions them below average and the exposure carries overall moderately negative credit risks.</p>
 HIGHLY NEGATIVE	E-4 S-4 G-4	<p>Issuers or transactions with a Highly Negative E or S issuer profile score typically have exposures to E or S issues that carry high credit risks. These issuers may demonstrate some mitigants specifically tied to the E or S risks identified, but they generally have limited effect on the risks.</p> <p>Issuers or transactions with a Highly Negative G issuer profile score typically have exposure to G considerations that, in the context of their sector, positions them weakly and the exposure carries overall highly negative credit risks.</p>
 VERY HIGHLY NEGATIVE	E-5 S-5 G-5	<p>Issuers or transactions with a Very Highly Negative E or S issuer profile score typically have exposures to E or S issues that carry very high credit risks. While these issuers or transactions may demonstrate some mitigants specifically related to the identified E or S risks, they are not meaningful relative to the magnitude of the risks.</p> <p>Issuers or transactions with a Very Highly Negative G issuer profile score typically have exposure to G considerations that, in the context of their sector, positions them very poorly and the exposure carries overall very high credit risks.</p>

Source: Moody's Investors Service

ESG Category scores and Aggregation into IPS

- » **Sector Category Scores Provide a General Reference Point**

Sector category scores are the outcome of qualitative analytical judgment and place each sector in the context of all other rated sectors and can be useful in fostering E and S IPSs that are consistent across sectors

- » **Qualitative judgment used to derive category scores and overall E, S and G issuer profile score**

Although our assessment may be informed by metrics, E, S and G category scores, and issuer profile scores are substantially driven by our qualitative assessment of the risks, benefits and ESG-specific mitigants in each category for that issuer against the scoring scale definitions.

- » **Aggregation for E and S issuer profile scores typically emphasizes the worst category score**

We typically put greater weight on the worst categories scores, reflecting our view that the highest risks often outweigh other considerations. Because E and S risks can be additive, our overall view may be worse than the worst category score. In some cases, interplay and correlation among categories may lead to a better score than the worst category.

- » **Sector-specific issuer profile considerations**

For some asset classes (e.g., sovereign), greater data availability allows quantitative weighting and rank ordering approaches.

- » **Scoring and aggregation methods for G issuer profile to vary by issuer or transaction**

G IPS analysis starts at the issuer- or transaction-level. In some sectors, we may directly use scorecard factor or sub-factor scores, where relevant, and map those to our category scores. The governance IPS may more often be better than the worst category score because strengths in some governance categories may provide resilience to other governance categories.

What the Moody's ESG scores are, and are not?






The Issuer Profile Scores incorporate:

- A credit perspective ✓
- Analysis of ESG issues material to credit risk ✓
- Emphasis on the most material credit risks ✓
- Global and cross-sector comparability ✓
- Management's actions to specifically address Issues ✓
- ESG risks and opportunities ✓

The Issuer Profile Score is not an opinion about:

- ✗ A company's sustainability performance
- ✗ The impact of sustainability practices on stakeholders
- ✗ The quality of a company's ESG disclosures
- ✗ Alignment with specific goals and targets such as the UN SDGs
- ✗ The impact of ESG on the credit rating. The CIS explains that

ESG Credit Impact Score (CIS) Scale

	Score	Definition
 <p>POSITIVE</p>	CIS-1	For an issuer scored CIS-1 (Positive), its ESG attributes are overall considered as having a positive impact on the rating. The overall positive influence from its ESG attributes on the rating is material.
 <p>NEUTRAL-TO-LOW</p>	CIS-2	For an issuer scored CIS-2 (Neutral-to-Low), its ESG attributes are overall considered as having a neutral-to-low impact on the current rating; i.e., the overall influence of these attributes on the rating is non-material.
 <p>MODERATELY NEGATIVE</p>	CIS-3	For an issuer scored CIS-3 (Moderately Negative), its ESG attributes are overall considered as having a limited impact on the current rating, with greater potential for future negative impact over time. The negative influence of the overall ESG attributes on the rating is more pronounced compared to an issuer scored CIS-2.
 <p>HIGHLY NEGATIVE</p>	CIS-4	For an issuer scored CIS-4 (Highly Negative), its ESG attributes are overall considered as having a discernible negative impact on the current rating. The negative influence of the overall ESG attributes on the rating is more pronounced compared to an issuer scored CIS-3.
 <p>VERY HIGHLY NEGATIVE</p>	CIS-5	For an issuer scored CIS-5 (Very Highly Negative), its ESG attributes are overall considered as having a very high negative impact on the current rating. The negative influence of the overall ESG attributes on the rating is more pronounced compared to an issuer scored CIS-4.

What the Moody's ESG scores are, and are not?

The Credit Impact Score:

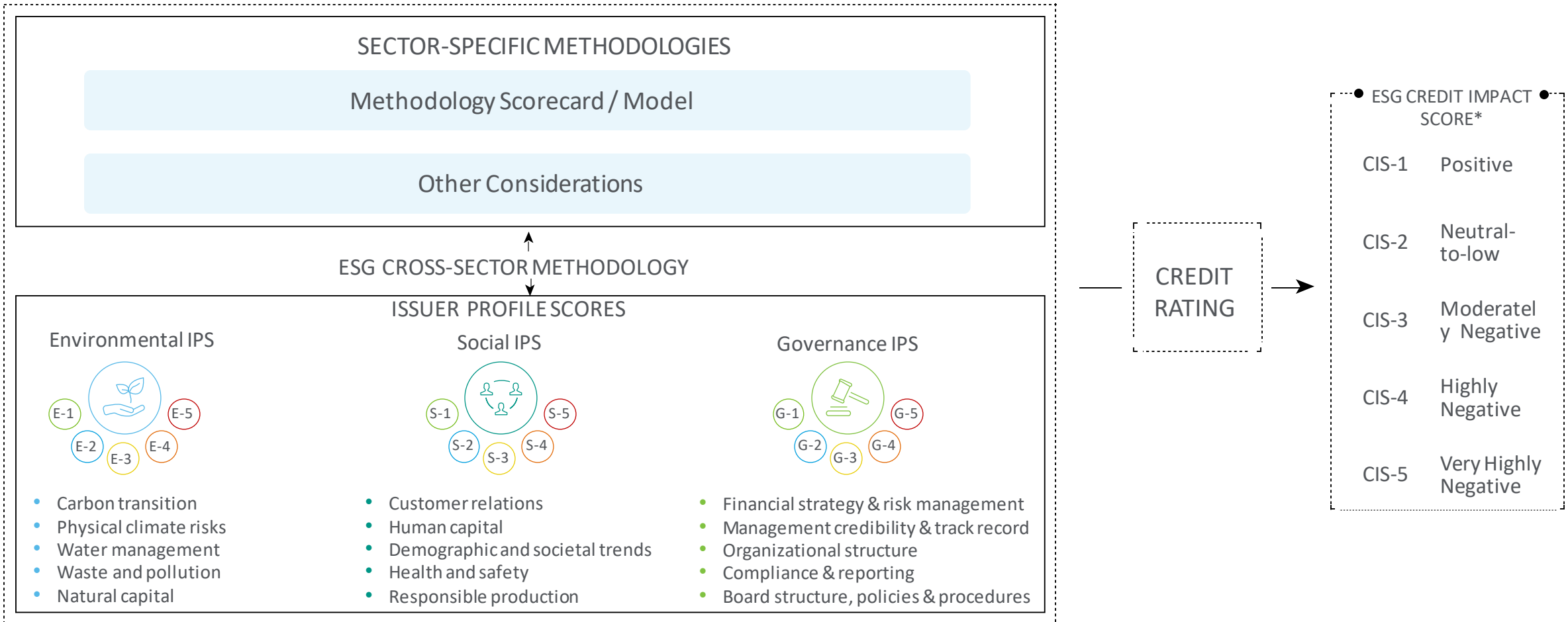
- Reflects the impact of ESG on the credit rating ✓
- Indicates the extent to which the credit rating would have been different in the absence of ESG issues ✓
- Places ESG in the context of other rating considerations ✓

The Credit Impact Score:

- ✗ Is not the combination of the E,S and G IPS scores
- ✗ Does not have a systematic relationship to the credit rating
 - i.e., a strong credit rating can go with a weak CIS score, and vice versa
- ✗ Does not have a systematic relationship to the IPS scores

ESG Integration into Credit Analysis

Our rating analysis considers all material credit considerations, including ESG



The ESG credit impact score (CIS) is an output of the rating process that more transparently communicates the impact of ESG considerations on the credit rating of an issuer or transaction.

An aerial photograph showing a winding asphalt road through a dense green forest. The road curves from the bottom left towards the top right. In the upper left corner, the road meets a bright turquoise body of water, likely a beach or coastal area.

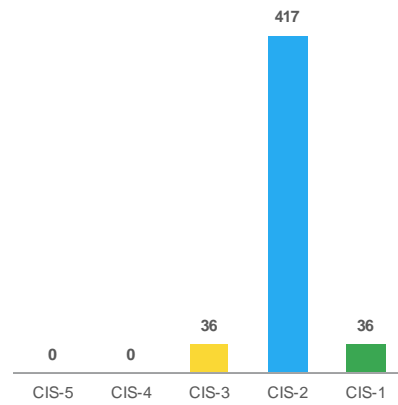
ESG IPS and CIS Distribution US Counties

ESG OVERVIEW – SECTION SEVEN

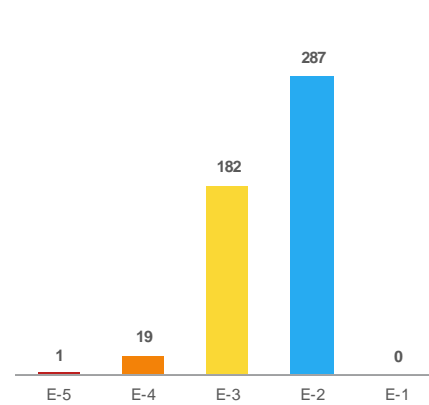
Risk category distribution by IPS and CIS

US Counties

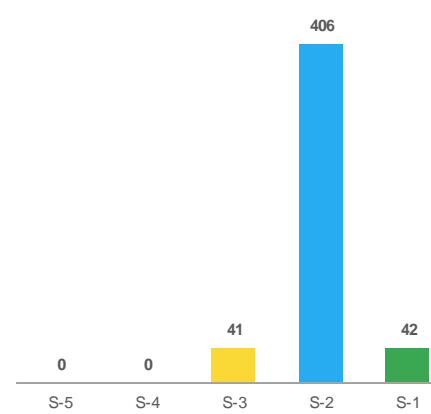
Credit Impact Score (CIS)



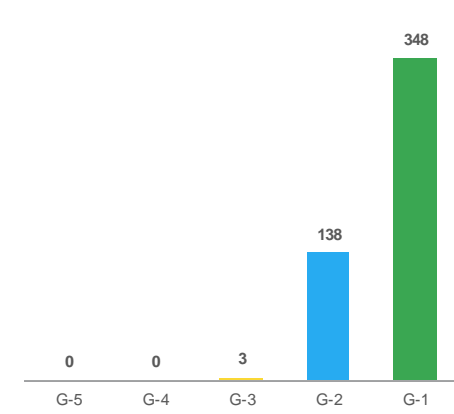
Environmental Issuer Profile Score



Social Issuer Profile Score



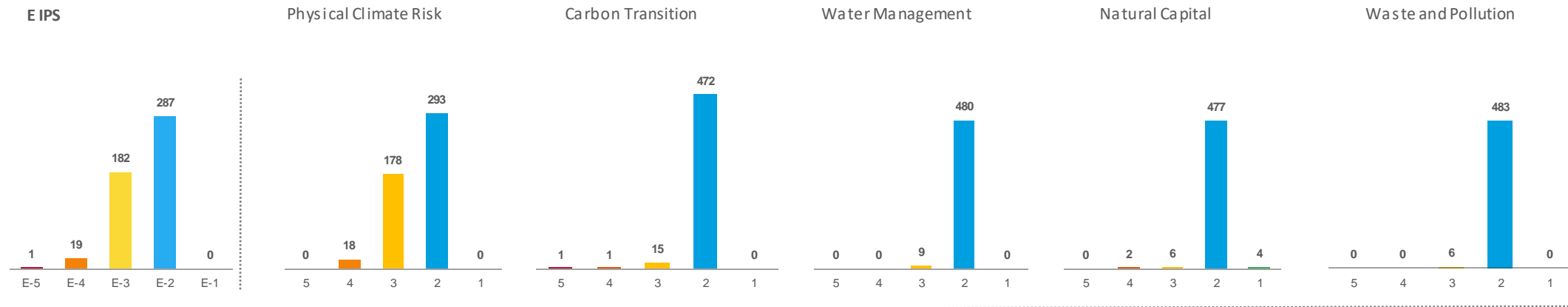
Governance Issuer Profile Score



Source: Moody's Investors Services

Environmental Issuer Profile Score (E IPS)

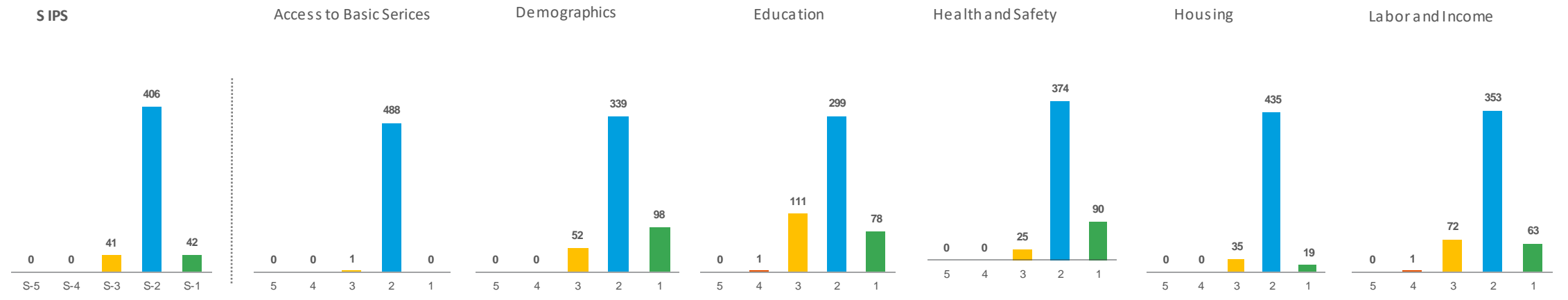
US Counties



Source: Moody's Investors Services

Social Issuer Profile Score (S IPS)

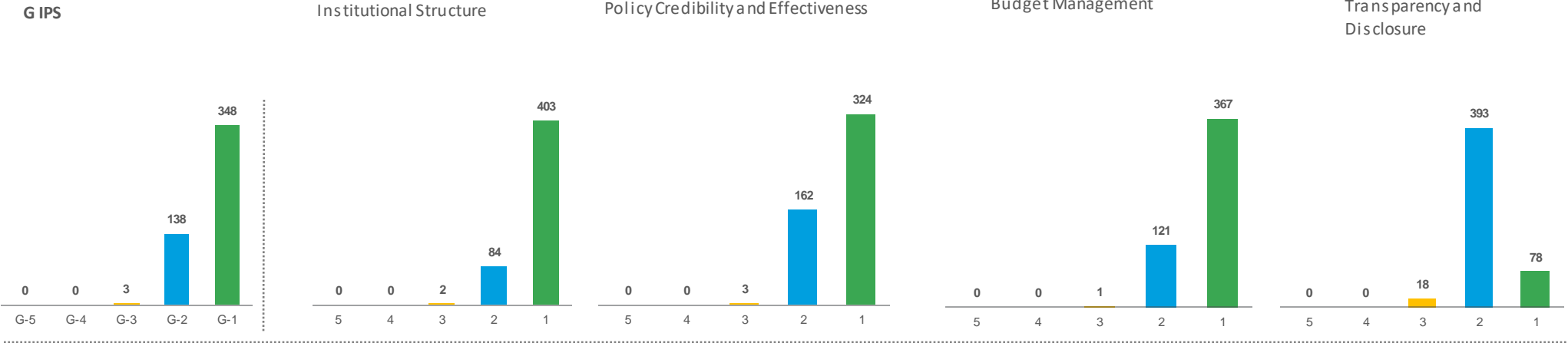
US Counties



Source: Moody's Investors Services

Governance Issuer Profile Score (G IPS)

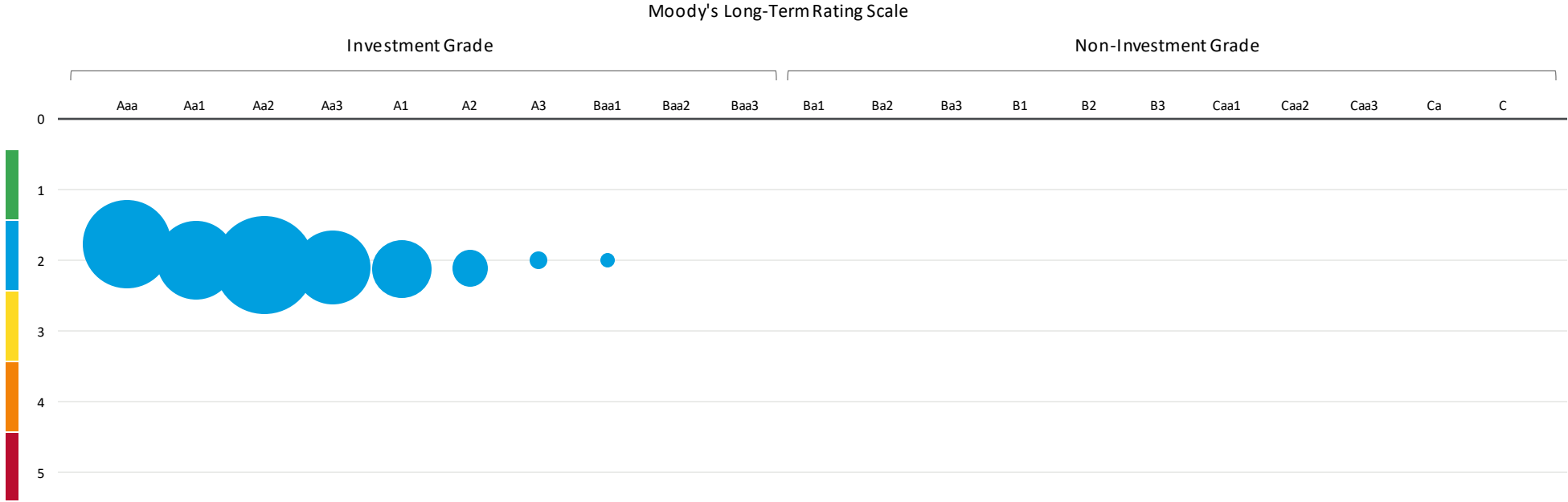
US Counties



Source: Moody's Investors Services

Correlation Between CIS and Credit Ratings

US Counties



Source: Moody's Investors Services





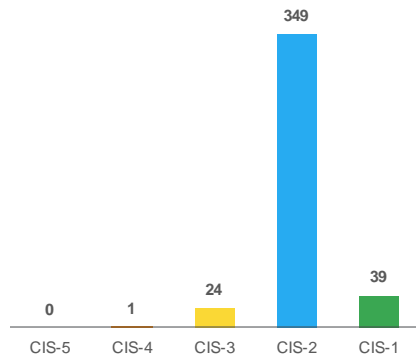
ESG IPS and CIS Distribution US Cities

ESG OVERVIEW – SECTION EIGHT

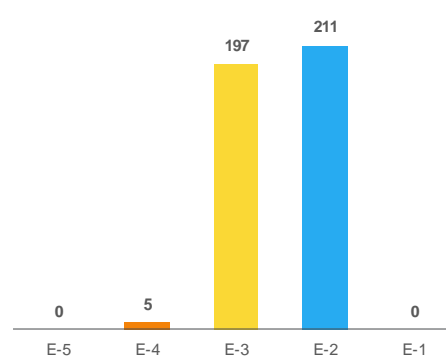
Risk category distribution by IPS and CIS

US Cities

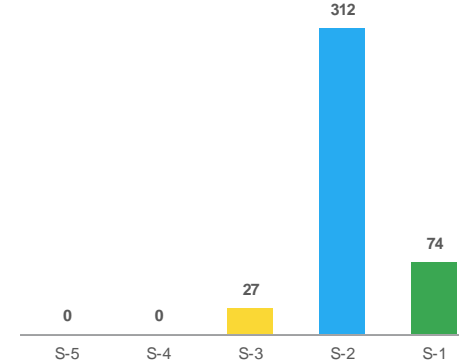
Credit Impact Score (CIS)



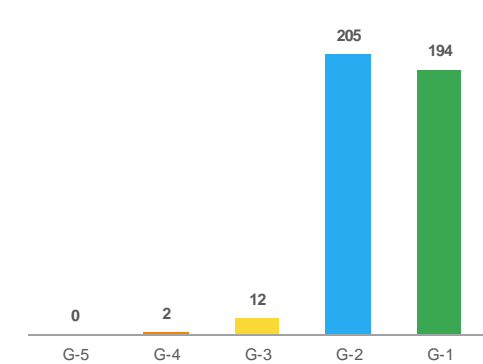
Environmental Issuer Profile Score



Social Issuer Profile Score



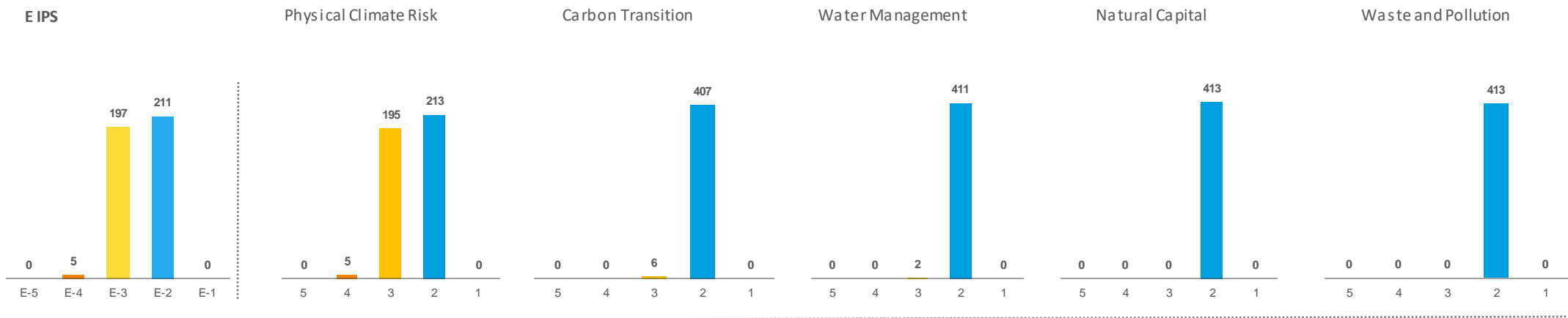
Governance Issuer Profile Score



Source: Moody's Investors Services

Environmental Issuer Profile Score (E IPS)

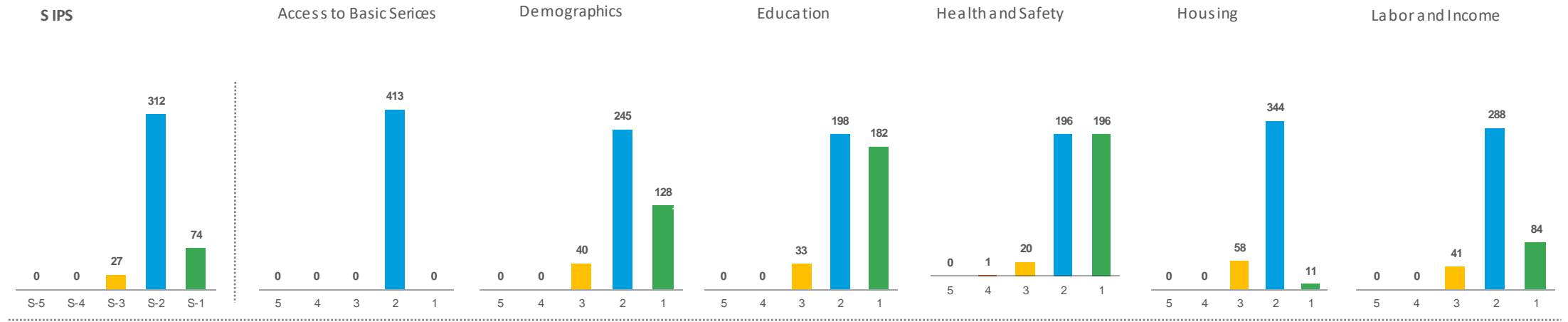
US Cities



Source: Moody's Investors Services

Social Issuer Profile Score (S IPS)

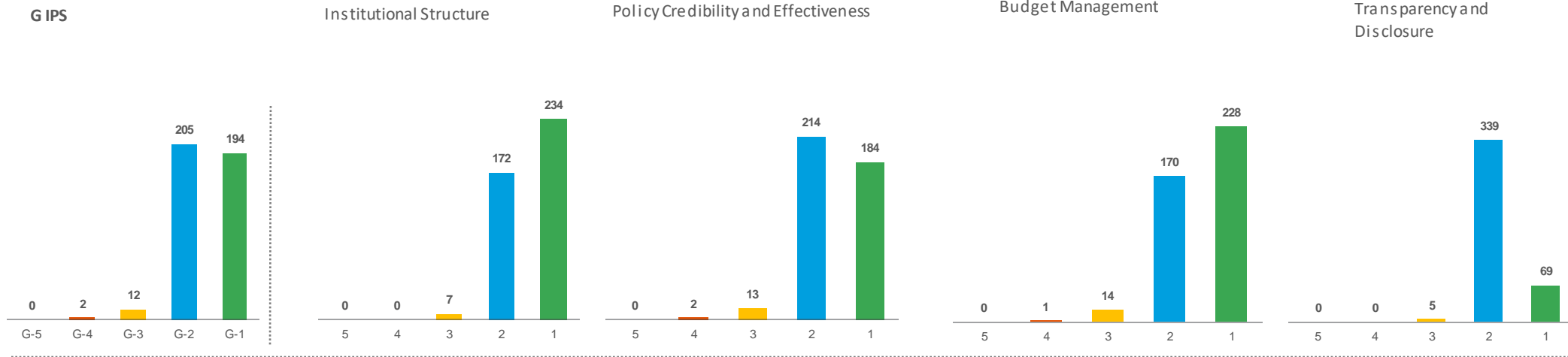
US Cities



Source: Moody's Investors Services

Governance Issuer Profile Score (G IPS)

US Cities



Source: Moody's Investors Services

Correlation Between CIS and Credit Ratings

US Cities



Source: Moody's Investors Services



An aerial photograph showing a winding asphalt road through a dense green forest. The road curves from the bottom left towards the top right. To the right of the road, a body of water with a vibrant turquoise color is visible, meeting a sandy or rocky shoreline.

State of Tennessee Example

ESG OVERVIEW – SECTION NINE

Tennessee (State of) – (Aaa/stable)

ESG Scores

from Moody's Investors Service

ESG CREDIT IMPACT SCORE (CIS) ⓘ

CIS-2

Neutral-to-Low

21 JUL 2021

ESG ISSUER PROFILE SCORES (IPS) ⓘ

21 JUL 2021

ENVIRONMENTAL	SOCIAL	GOVERNANCE
E-2	S-2	G-1
Neutral-to-Low	Neutral-to-Low	Positive

[ESGView](#) | [Methodology](#) | [ESG Peer Comparison](#)

Source: Moody's Investors Service



Credit Impact Score

[Learn More](#)

Outputs of the credit rating process that communicates whether and how much ESG considerations impact the credit rating

CIS-2

Neutral-to-Low

Analyst Commentary

Tennessee's ESG Credit Impact Score is neutral-to-low (CIS-2) reflecting its neutral-to-low environmental exposures and social exposure and positive governance profile.... [View More](#)

Issuer Profile Scores

Inputs to the credit rating process which assess exposure to credit material E, S and G considerations

[Learn More](#)

[Material Risks](#) [View All](#)

ENVIRONMENTAL	SOCIAL	GOVERNANCE
E-2	S-2	G-1
Neutral-to-Low	Neutral-to-Low	Positive
Analyst Commentary	Analyst Commentary	Analyst Commentary
Tennessee's E issuer profile score is neutral-to-low (E-2). As a landlocked state, Tennessee does not have any coastal counties. Nonetheless, Tennessee is moderately exposed to severe storms and droug... View More	Tennessee's S issuer profile score is neutral-to-low (S-2). The state benefits from strong total population growth and prime working age population growth. This contributes to the state's attractiveness... View More	Tennessee's G issuer profile score is positive (G-1). The state's low debt levels and increasing reserves are a result of a history of conservative financial management. Tennessee has a number of gove... View More
Risk Categories	Risk Categories	Risk Categories
Physical Climate Risks 5 4 3 2 1	Demographics 5 4 3 2 1	Institutional Structure 5 4 3 2 1
Carbon Transition 5 4 3 2 1	Labor and Income 5 4 3 2 1	Policy Credibility & Effectiveness 5 4 3 2 1
Water Management 5 4 3 2 1	Education 5 4 3 2 1	Budget Management 5 4 3 2 1
Natural Capital 5 4 3 2 1	Housing 5 4 3 2 1	Transparency and Disclosure 5 4 3 2 1
Waste and Pollution 5 4 3 2 1	Health and Safety 5 4 3 2 1	
	Access to Basic Services 5 4 3 2 1	

An aerial photograph showing a winding asphalt road through a dense, lush green forest. The road curves from the bottom left towards the top right. In the upper left corner, the road meets a bright turquoise body of water, possibly a lake or a bay, with a small sandy beach area visible.

Q&A

ESG OVERVIEW – SECTION TEN

Orlie Prince
Orlie.Prince@moodys.com
+1 (212) 553-7738

Christopher Coviello
Christopher.Coviello@moodys.com
+ (212) 553-0575

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