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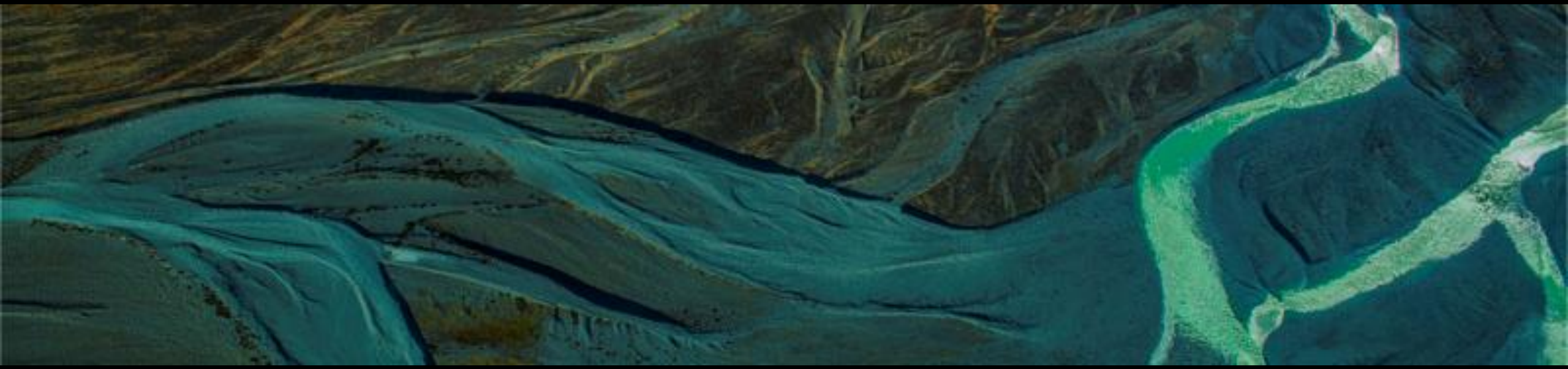
Navigating Operational & Supply Chain Resilience

Leveraging Data to Manage Climate and Sustainability Risks

Workshop at the Taiwan Stock Exchange

Rick Lord
Global Head of Sustainability Research
S&P Global Energy Horizons
11 June 2026



Navigating Operational & Supply Chain Resilience: Leveraging Data to Manage Climate and Sustainability Risks

June 11, 2026 • Taipei

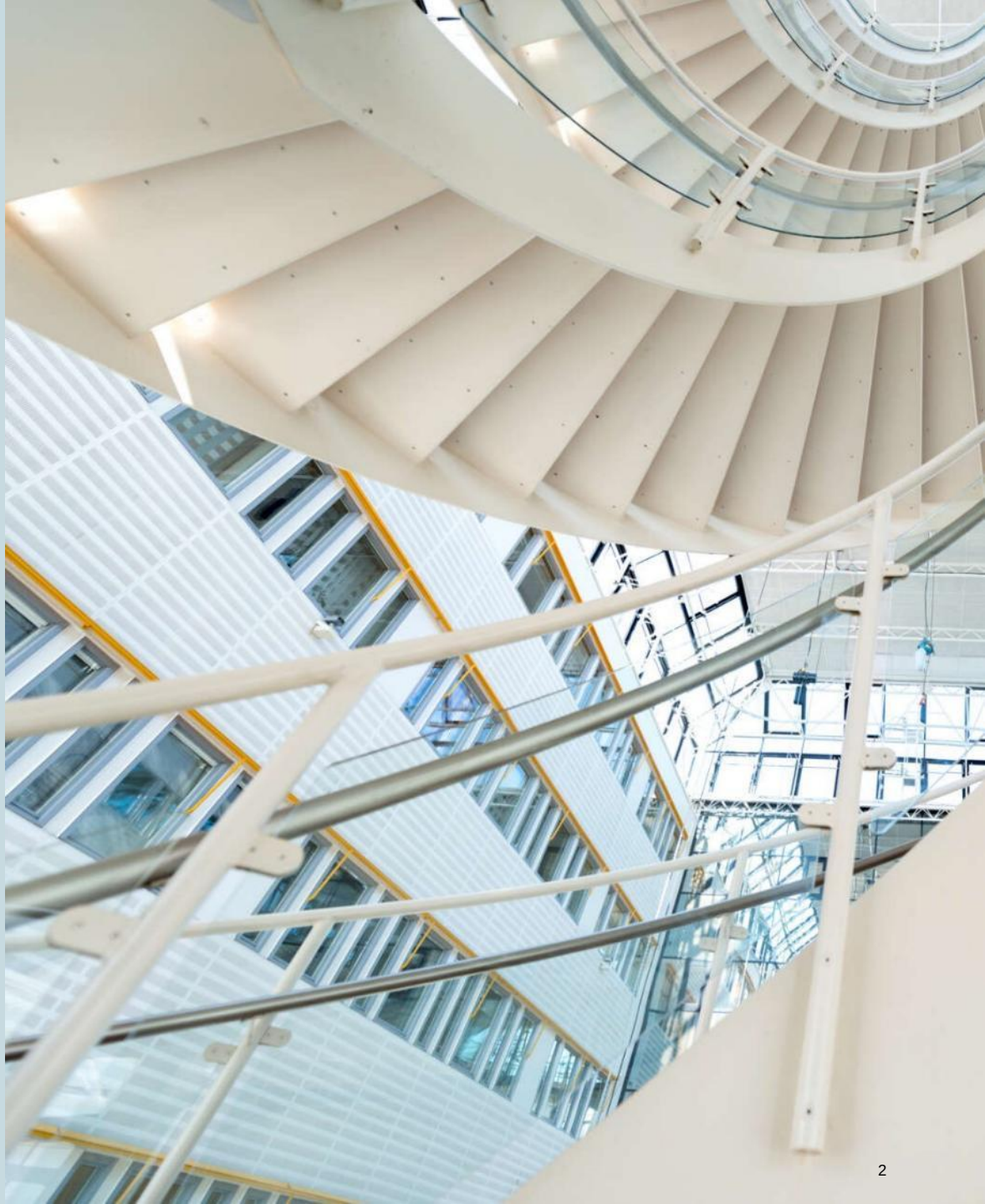
Taiwan at the Centre of the Global AI Boom

Risks to Taiwan in a Changing Climate

The Data Blueprint – From Models to Decisions

The Analytical Edge – Measuring the Blind Spots

Executive Playbook & Next Steps



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Session Host

Rick Lord

Global Head of Research & Innovation

Rick is a sustainability leader with over 15 years of experience spanning the public and private sectors in Australia and the United Kingdom. As Global Head of Research and Methodology for S&P Global Sustainable1, he leads a global multi-disciplinary team of over 100 analysts, scientists, and technical experts dedicated to building the models, methodologies and data frameworks that help the world's leading financial institutions and corporates navigate evolving sustainability challenges. Under his leadership, the team delivers high-impact solutions across a broad spectrum of sustainability topics, including ESG scores, controversy analysis, climate risk and opportunity analysis and environment & nature-related risks. Rick specializes in the intersection of climate science and finance, with particular expertise in developing methodologies that quantify the financial impact of climate physical and transition risks for assets, companies, and portfolios. Rick holds a Master's in Environmental Economics from Imperial College London and a Bachelor of Science from Queensland University of Technology.

Horizons

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Taiwan at the Centre of the Global AI Boom

The AI Boom Is Thirsty & Taiwan as the center of the AI buildout

Taiwan built the physical backbone of the AI era — from chips to servers to power and cooling
But the same boom is colliding with electricity bottlenecks, water stress, and climate volatility

Opening quote

“Taiwan’s rich ecosystem. The richest ecosystem, the world’s best supply chain ecosystem.”

— Jensen Huang, GTC Taipei 2026

AI Chip Supply Chain Concentration in Taiwan

EDA & Core IP

Software tools and foundational architectures used to design AI chips.

Chip Design

Designing the actual AI GPUs and accelerators

Advanced Memory

High Bandwidth Memory tightly integrated with AI GPUs

Advanced Fabrication

Physical printing of complex AI logic chips on silicon wafers.

Advanced Packaging

Combining the AI logic chip and HBM into a single, high-performance module.

Server ODM & Assembly

Building the final AI server racks (motherboards, cooling, power) for data centers.

PCB & Substrate Mfg

Manufacturing the complex boards the packaged chips sit on.

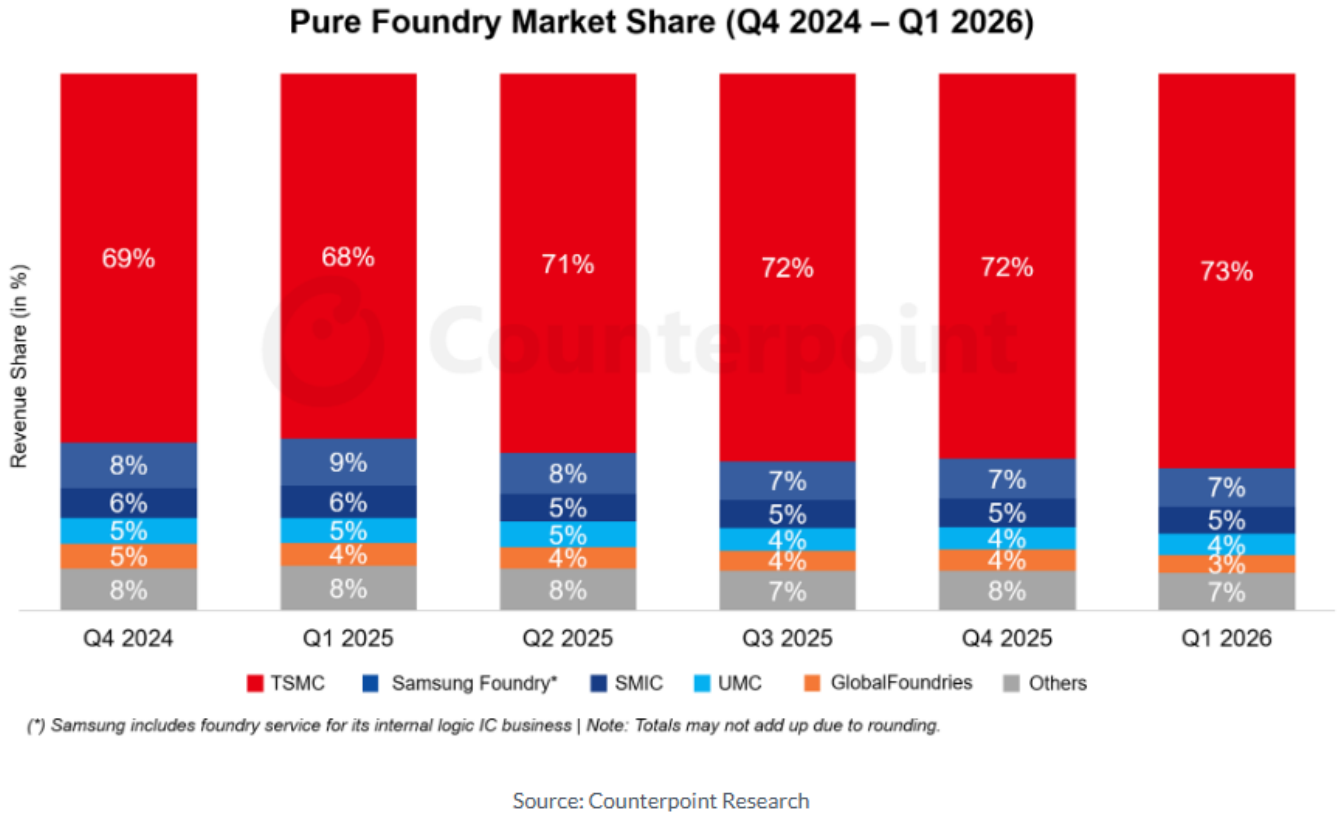
Highly Concentrated in Taiwan

Supply Chain Concentration in Taiwan

Taiwan remains a critical hub in the global semiconductor supply chain, accounting for over **60% of global foundry revenue** and more than **90% of leading-edge chip manufacturing**.

US. International Trade Administration (2025)

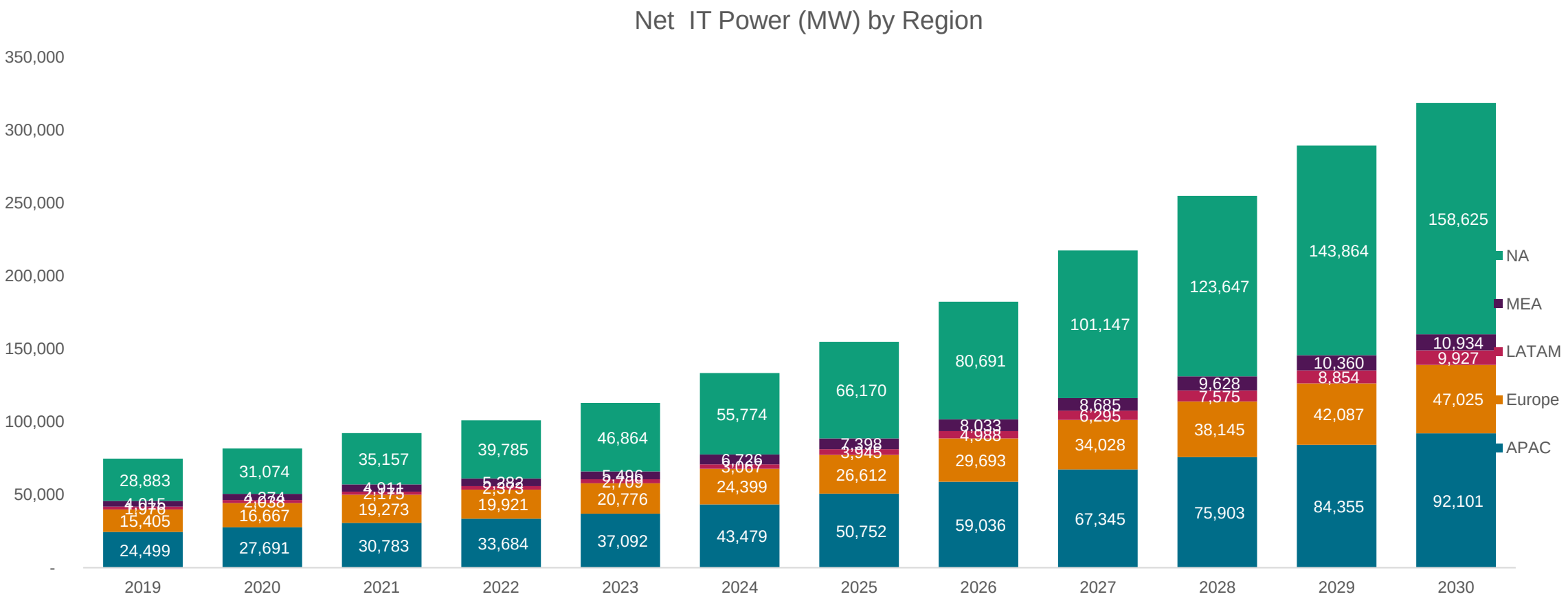
TSMC and partners such as **ASE Technology**, are also dominant in semiconductor packaging - molding, singulation, thermal management, and bumping. These steps require specialized packaging expertise and statistical process control skills that are scarce in the United States and Europe.



Source: Counterpoint Research

Global Data Center Buildout and Hardware Demand

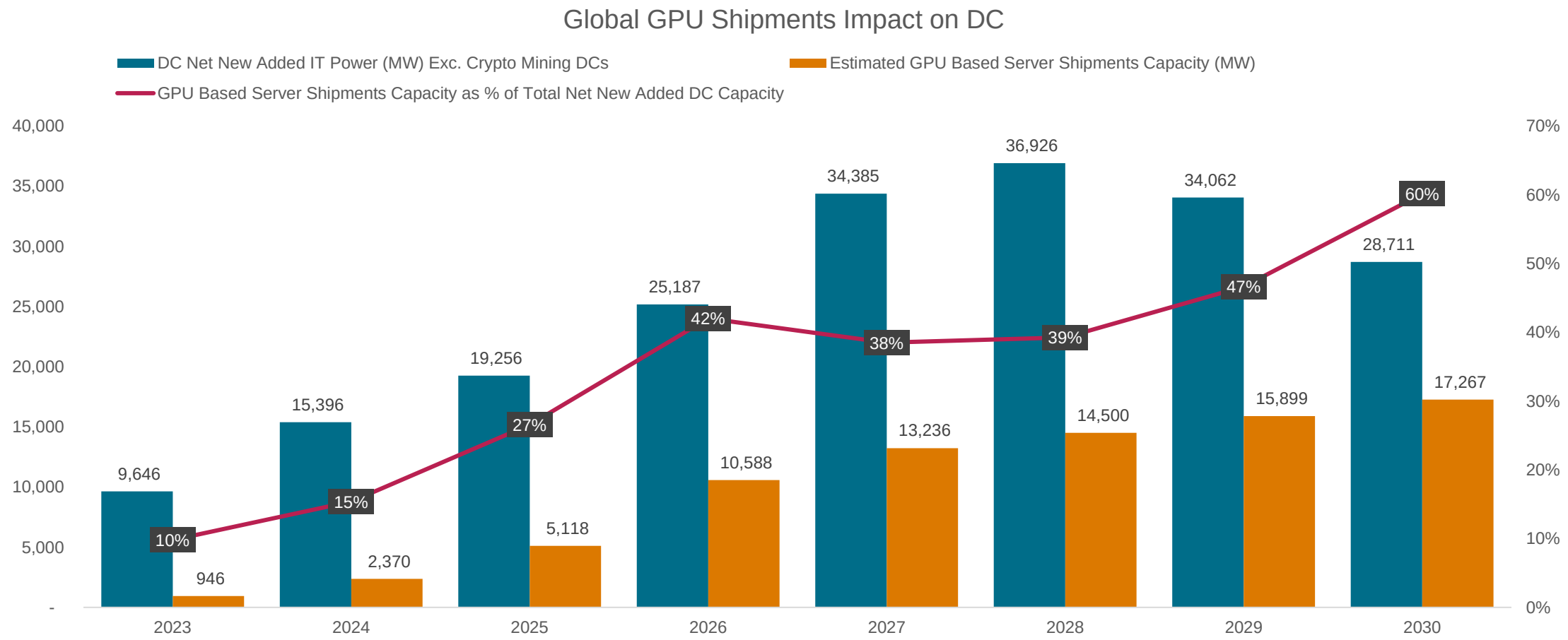
Global datacenter capacity (IT power) is projected to almost double by 2030 with the largest increases in North America and Asia Pacific



Source: 451 Research. S&P Global Energy

Global Data Center Buildout and Hardware Demand

New data center IT power additions (MW) are projected to exceed estimated GPU based server shipments (MW) by 58% in 2026 and 40% in 2030 – illustrating important production constraints under unprecedented demand



Source: 451 Research. S&P Global Energy

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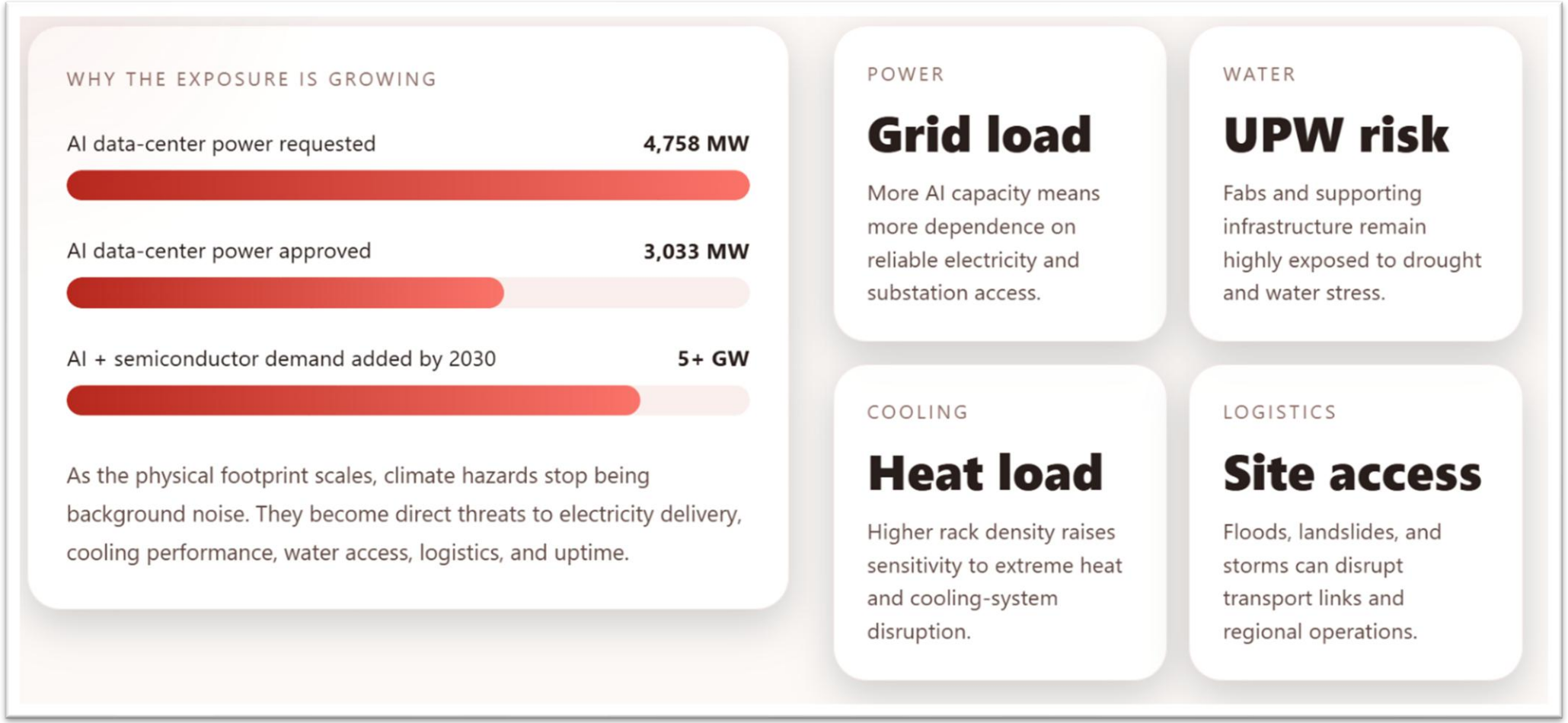
AI scale is turning resource stress into systemic exposure

The key message is not only that AI demand is large. It is that Taiwan's AI buildout is making more of the global technology stack dependent on power-intensive, cooling-intensive, and water-sensitive infrastructure concentrated on one climate-exposed island



Source: https://www.digitimes.com/news/a20260123PD237/taiwan-industrial-expansion-chairman-walsin-lihwa.html

Vulnerability: Climate and Environmental Stresses

Taiwan faces a unique combination of climate hazards which could threaten its central role in the AI buildout along with the unprecedented pace of GPU deployment globally

Less Frequent But More Severe Tropical Cyclones

Climate change is driving tropical cyclone paths North resulting in potentially fewer tropical cyclones making landfall in Taiwan, but with a greater proportion of category 4 and 5 storms impacting the island in future decades

Water Stress in Periods of Drought and Low Typhoon Activity

Typhoons approaching from the East pass over the Central Mountain Range resulting in high rainfall which is important to water supply and storage. Less frequent Typhoon landfalls may threaten this supply leading to increased freshwater scarcity

High Intensity Typhoons Increase Risk of Flood and Tropical Cyclone

Heavy rainfall deposits over the Central Mountain Range can produce rapid fluvial and pluvial flooding, and landslides, in Taiwan’s urban and industrial centers

Severe typhoons approaching from the South, combined with chronic sea level rise, increase the risk of inundation due to coastal flood in Southern Taiwan

Horizons

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Risks to Taiwan in a Changing Climate

State of the Climate in Taiwan

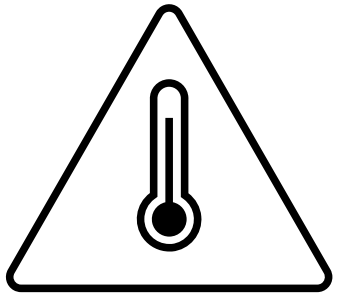
Leading Role in Climate Change Mitigation

- The Climate Change Response Act codified Taiwan's goal to achieve net zero emissions by 2050, supported by a mandatory carbon fee system beginning in 2026
- Taiwan's carbon intensity (per unit of economic activity) as decreased by over 44% below 2005 levels
- Absolute greenhouse gas emissions in 2026 estimated at 9% below 2005 levels

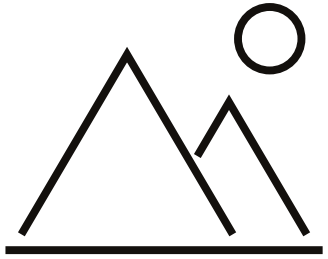
Climate Physical Hazard Impacts on Multiple Fronts

- Typhoon Kong-rey (November 2024) and Typhoon Gaemi (July 2024) produced severe regional flooding
- Pluvial flooding often accompanied by landslides
- Chronic water stress compounded by severe droughts in 2015 and 2021

State of the Climate in Taiwan: Key Regional Hazards

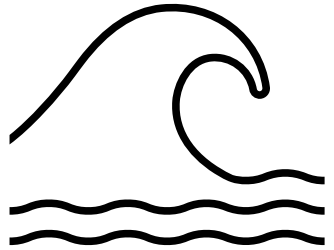


Extreme Heat



Landslides

Tropical Cyclones



Flooding

Fluvial

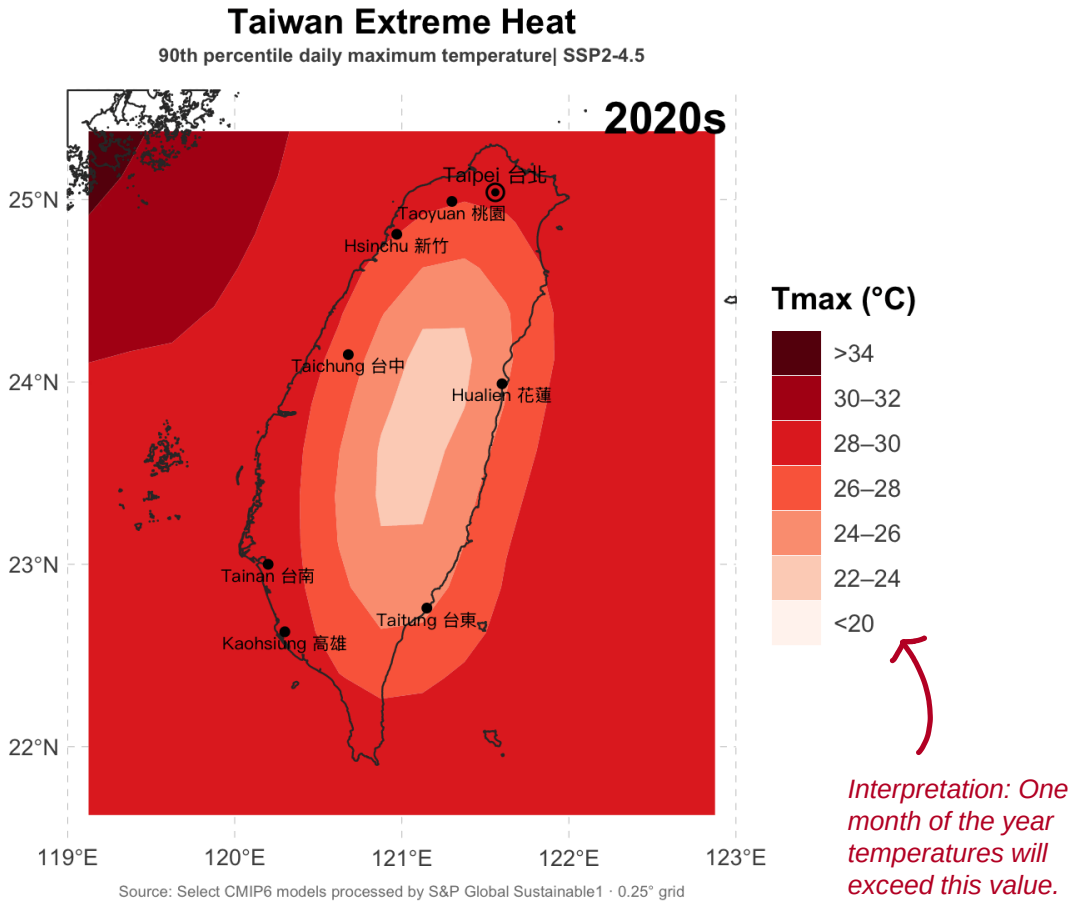
Pluvial

Coastal

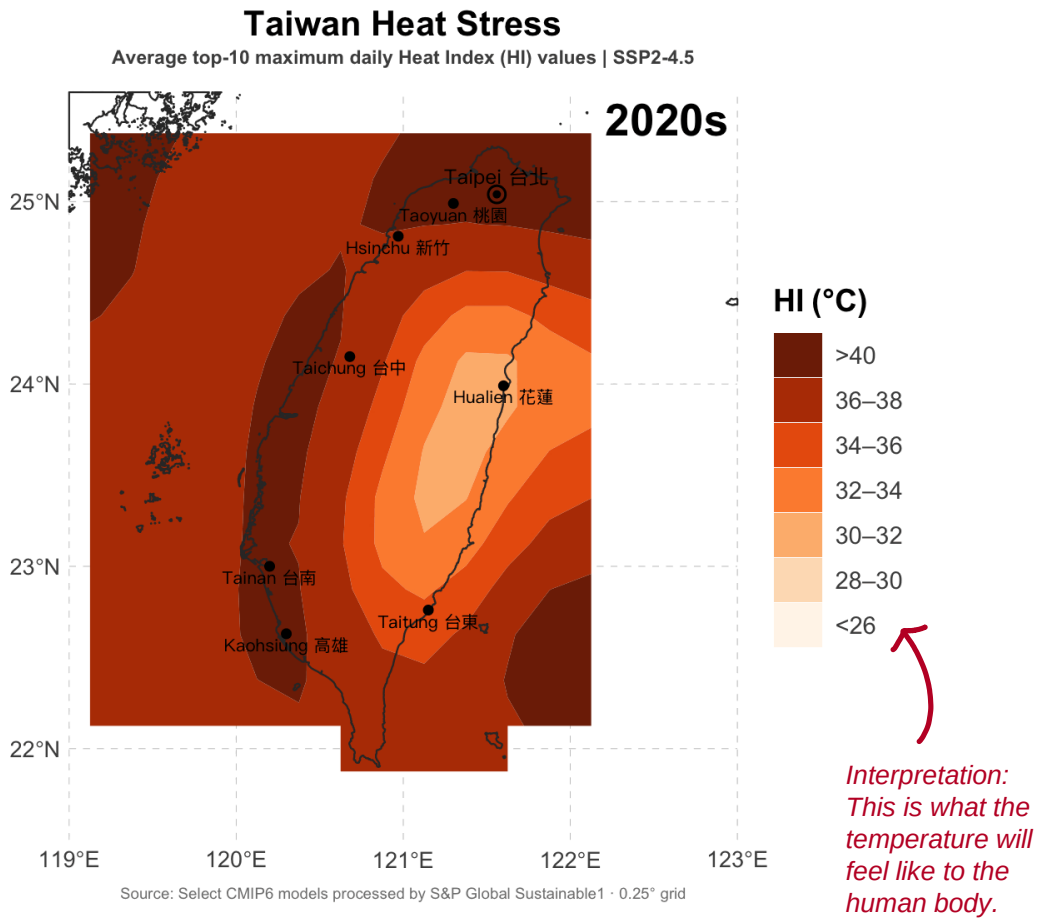
State of the Climate in Taiwan: Extreme Heat and Heat Stress

Incorporating the effects of humidity when examining the impact of extreme heat on the human body is crucial. Taipei, for example, faces an additional **9 weeks of unsafe outdoor labor conditions[1] by the 2050s**, increasing to 12 weeks by the 2090s.

[1]defined as days when the Heat Index exceeds 40°C



Interpretation: One month of the year temperatures will exceed this value.



Interpretation: This is what the temperature will feel like to the human body.

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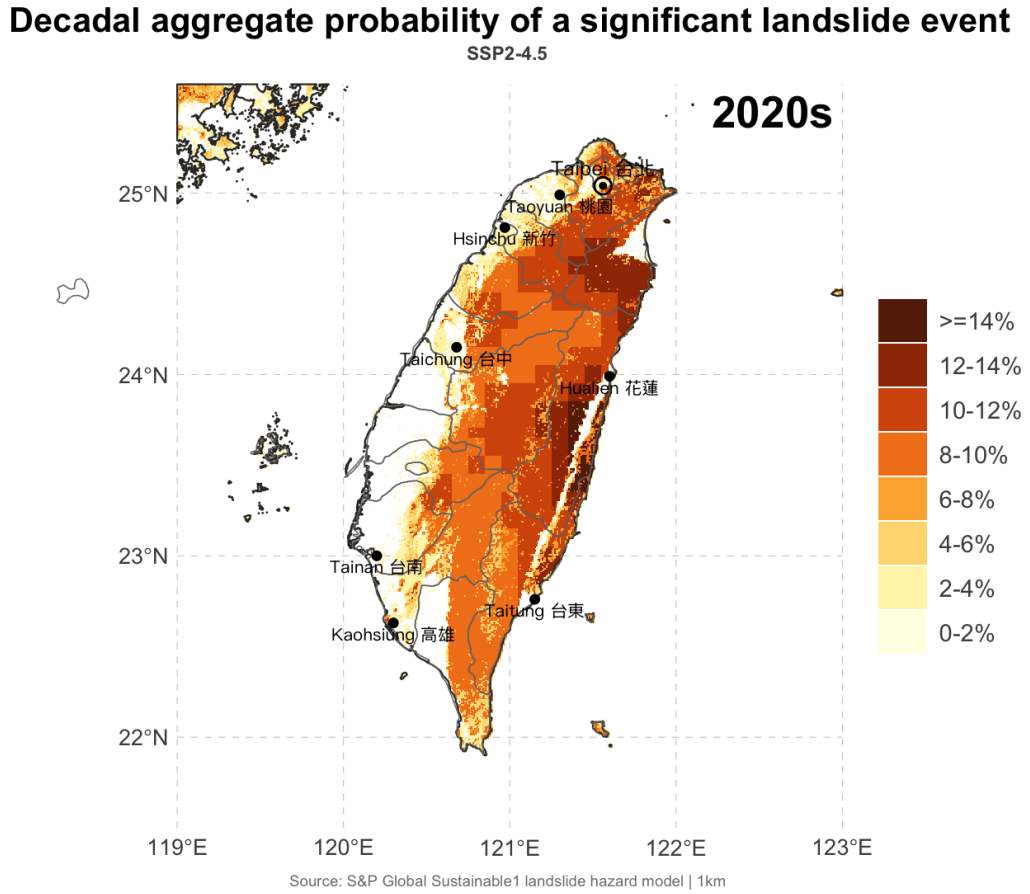
State of Climate Change in Taiwan: Landslides



- Projected shifts in rainfall pattern redistribute the landslide risk towards the northeast coast of Taiwan by the end of the century.
- Given the high resolution of this model, the probability of any particular cell being impacted is relatively low.
- Aggregated over the country, we see approximately **350 significant landslide events** per year.
- The granularity of the model allows for hyper-local risk assessment.

A comment on significant landslides: Our model is specifically calibrated to capture *significant, rainfall-triggered landslides*. Our methodology is anchored to a World Bank study that estimates **400,000 significant landslide events globally each year**. By focusing on these more impactful events, our model is designed to assess material risk to assets and infrastructure.

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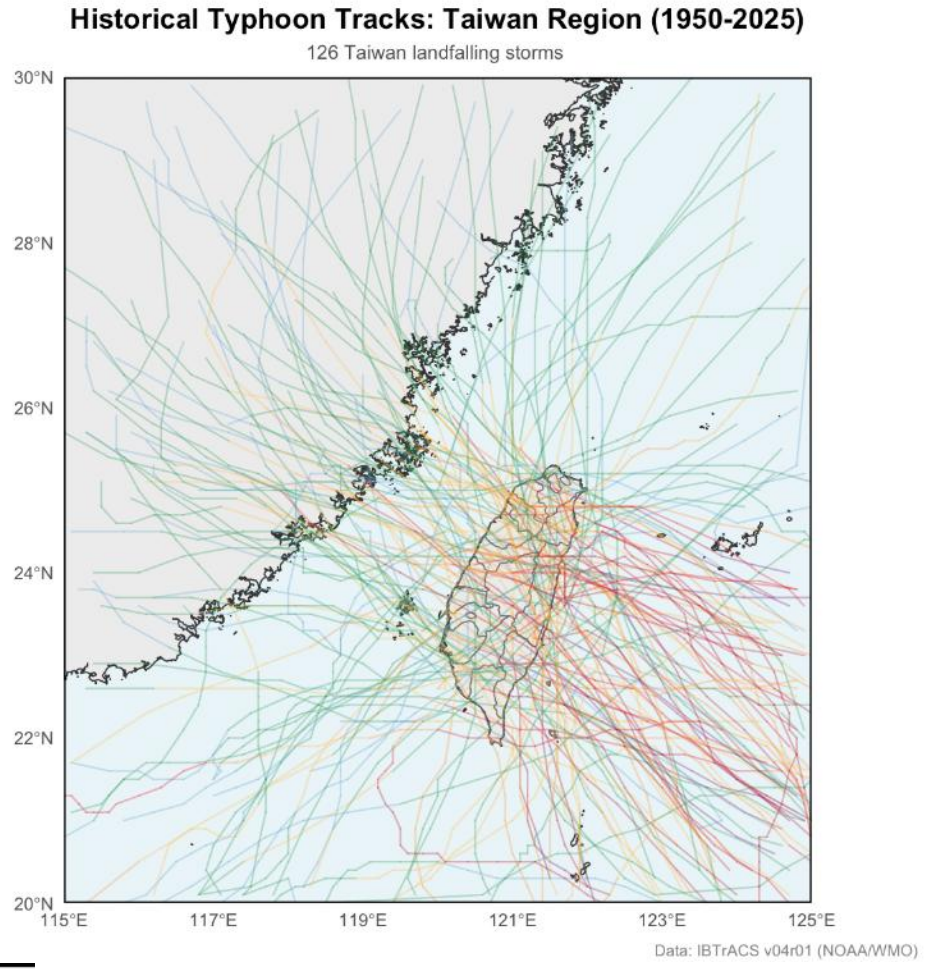
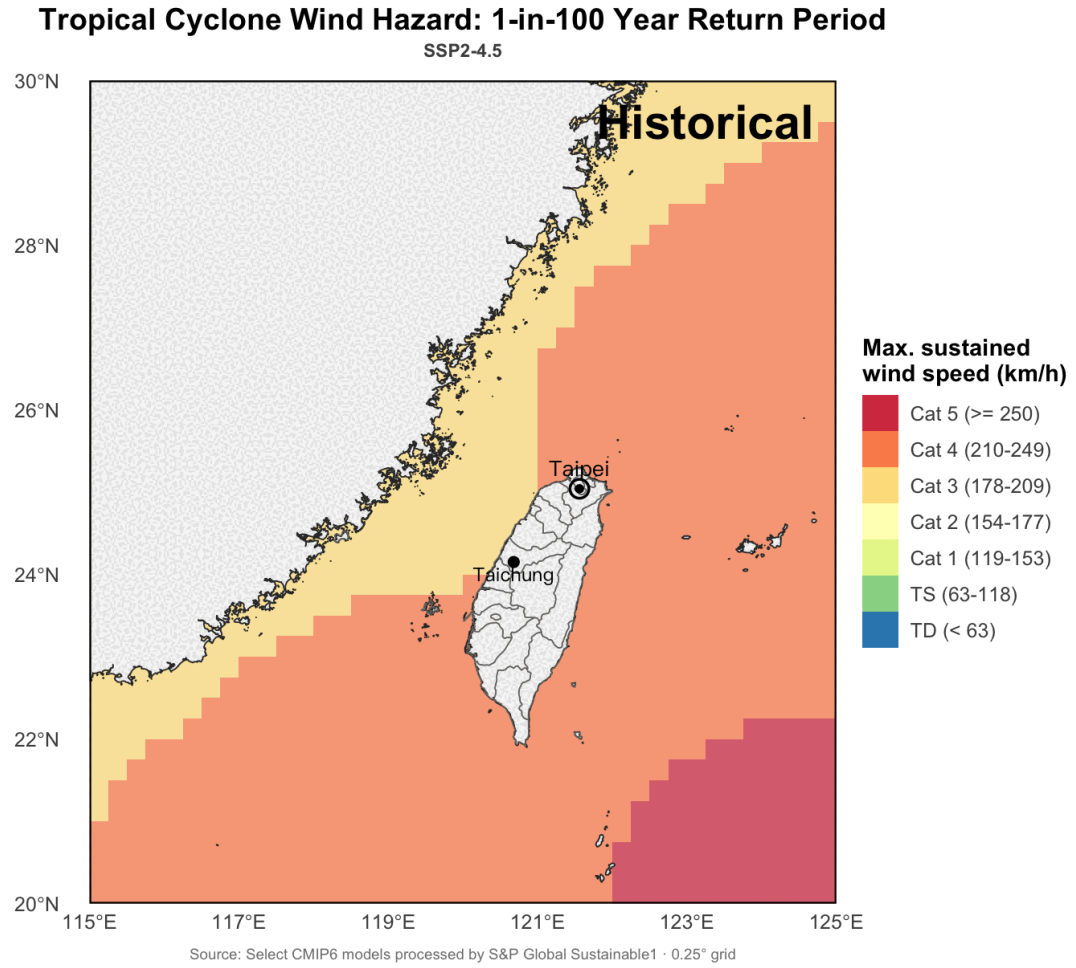
State of Climate Change in Taiwan: Typhoon

Taiwan is affected by several typhoons every year, with approximately two making direct landfall. Taiwan's agricultural sector and energy infrastructure is most impacted, for instance, Typhoon Danas in 2025 caused an estimated agricultural loss of USD95 million[1]. Projections indicate a northwestward shift in typhoons by the 2040s, exposing the the west coast of Taiwan to increased wind hazard levels over the next several decades. [1]Estimate published by TaiwanPlus News on July 16th, 2025





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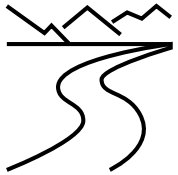
State of Climate Change in Taiwan: Flooding

Flooding Definitions

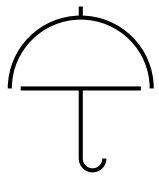


Fluvial Flood

Water rises when rivers and streams overtop their banks, typically after prolonged or intense rainfall across the upstream catchment.

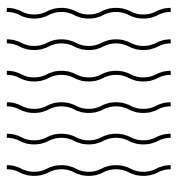
Fluvial Flood Defenses

flood walls, levees, canals, pumping stations, retention ponds, etc.



Pluvial Flood

Water pools on the surface when rainfall intensity exceeds local drainage or ground absorption capacity, independent of any river or coastline.



Coastal Flood

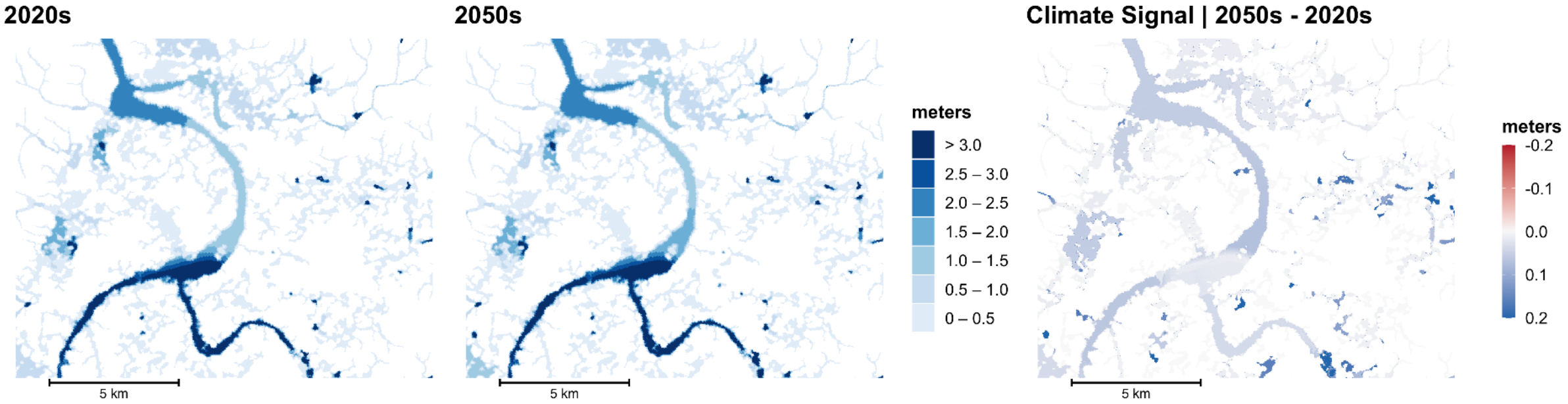
The sea itself pushes inland across low-lying coastal margins, driven by storm surge, extreme tides, or rising sea levels.

State of Climate Change in Taiwan: Fluvial Flood

Projected changes in the 1-in-50 year flood depth are on the order of 10s of centimeters over the next 30 years. Given the spatial variability of flood hazards, small increases in flood depths can overcome defenses and result in significant property damage and business interruption

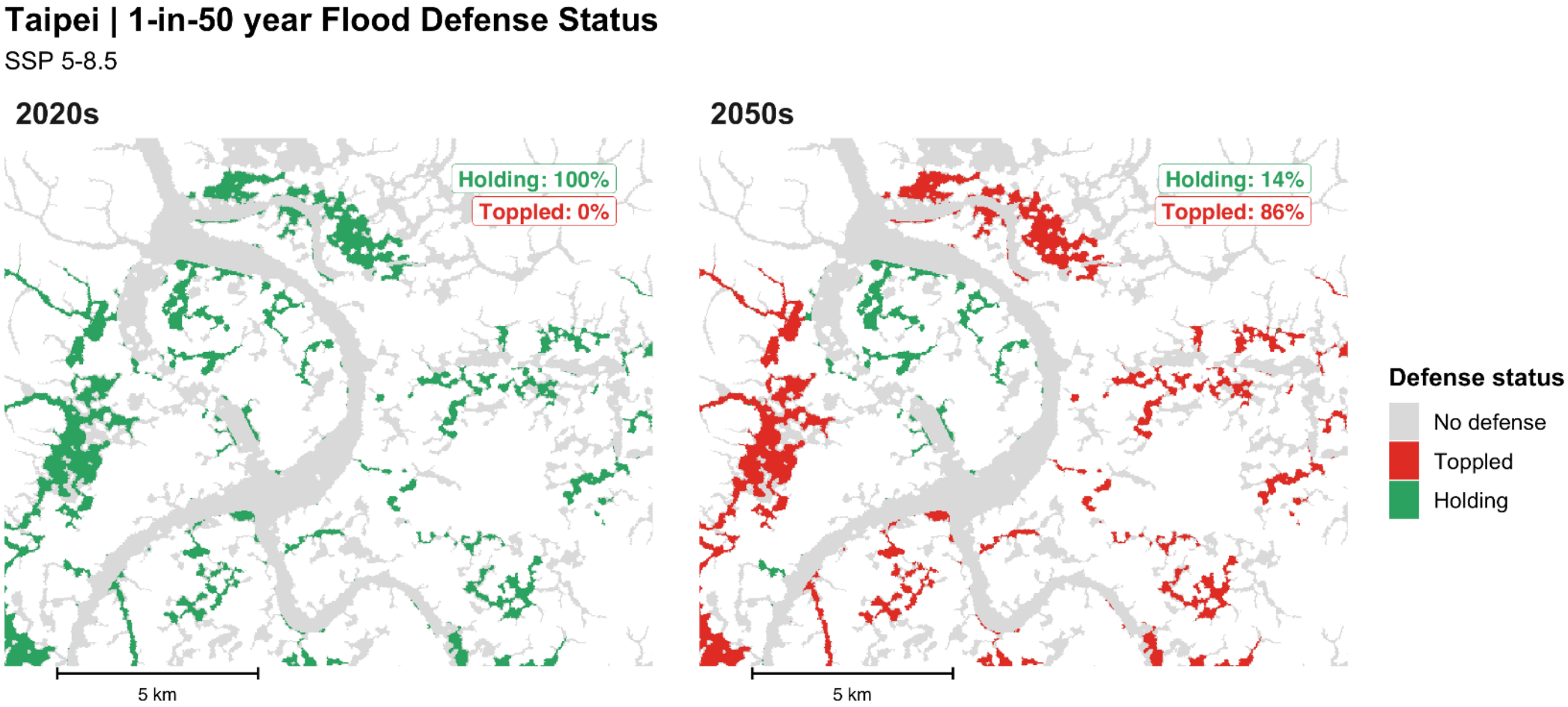
Taipei | 1-in-50 Year Flood Depth

SSP5-8.5



State of Climate Change in Taiwan: Fluvial Flood

This seemingly small increase in flood depth is projected to drive the percent of breached defenses in a 1-in-50-year flood from **0% in the 2020s to 86% in the 2050s.** Key message: Looking at where the system is already close to its limit is as important as investigating the climate signal.



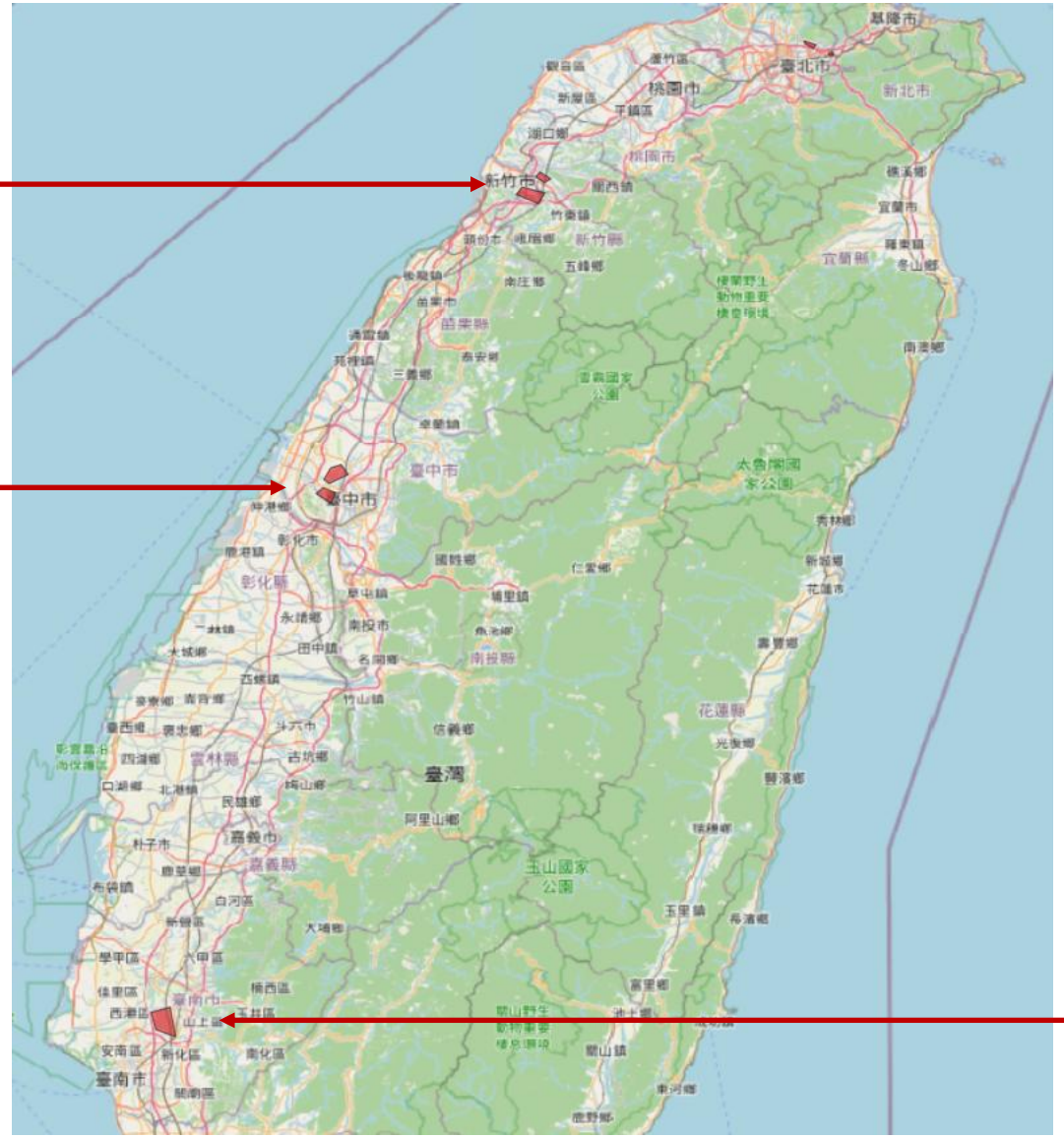
Key Semiconductor Industry Infrastructure Clusters

Hsinchu Science Park

Complete microelectronics chain - IC design, wafer fabrication, equipment manufacturing, and advanced packaging

Central Taiwan Science Park

High-end logic wafer fabrication, advanced packaging, and optoelectronics



Southern Taiwan Science Park

3nm and 5nm fabrication, Assembly, packaging and testing

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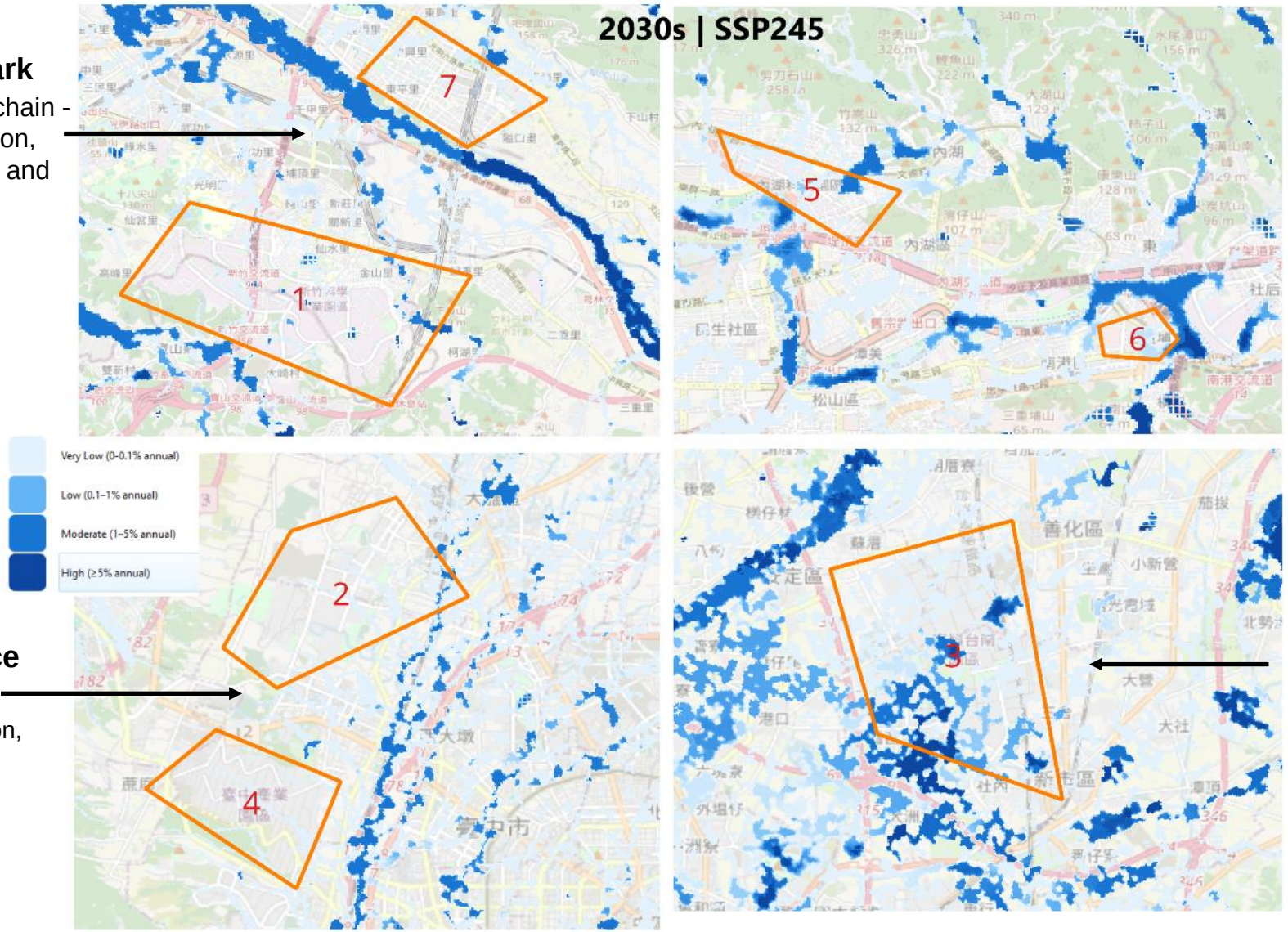
Key Semiconductor Industry Infrastructure Clusters: Flood Risk

Hsinchu Science Park

Complete microelectronics chain - IC design, wafer fabrication, equipment manufacturing, and advanced packaging



Central Taiwan Science Park

High-end logic wafer fabrication, advanced packaging, and optoelectronics

Southern Taiwan Science Park

3nm and 5nm fabrication, Assembly, packaging and testing

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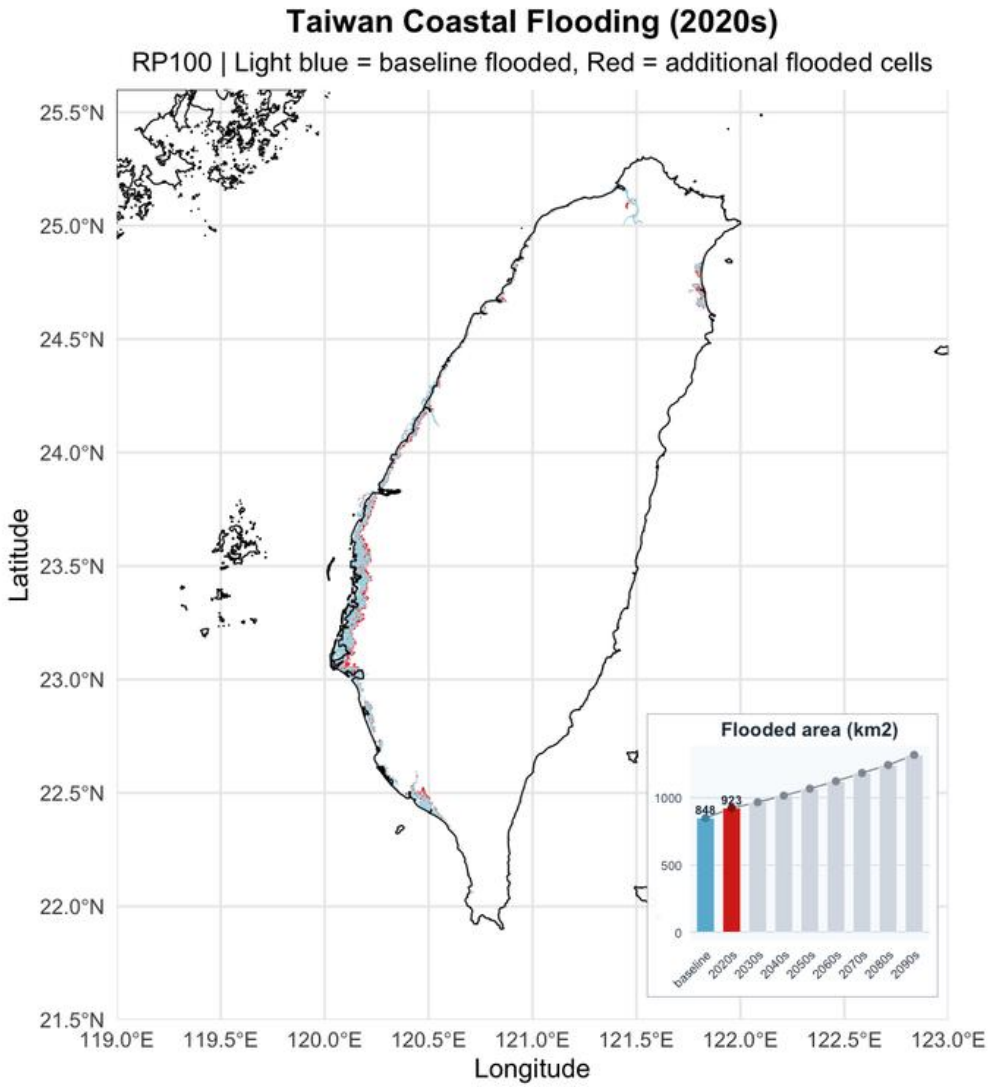
State of Climate Change in Taiwan: Coastal Flood



- The expansion of the coastal flood footprint is most prominent along Taiwan's west coast
- Under a medium emission scenario, by the 2050s, the flooded area increases by 26% over baseline and by the 2090s, flooded area increases by 55% over the baseline.

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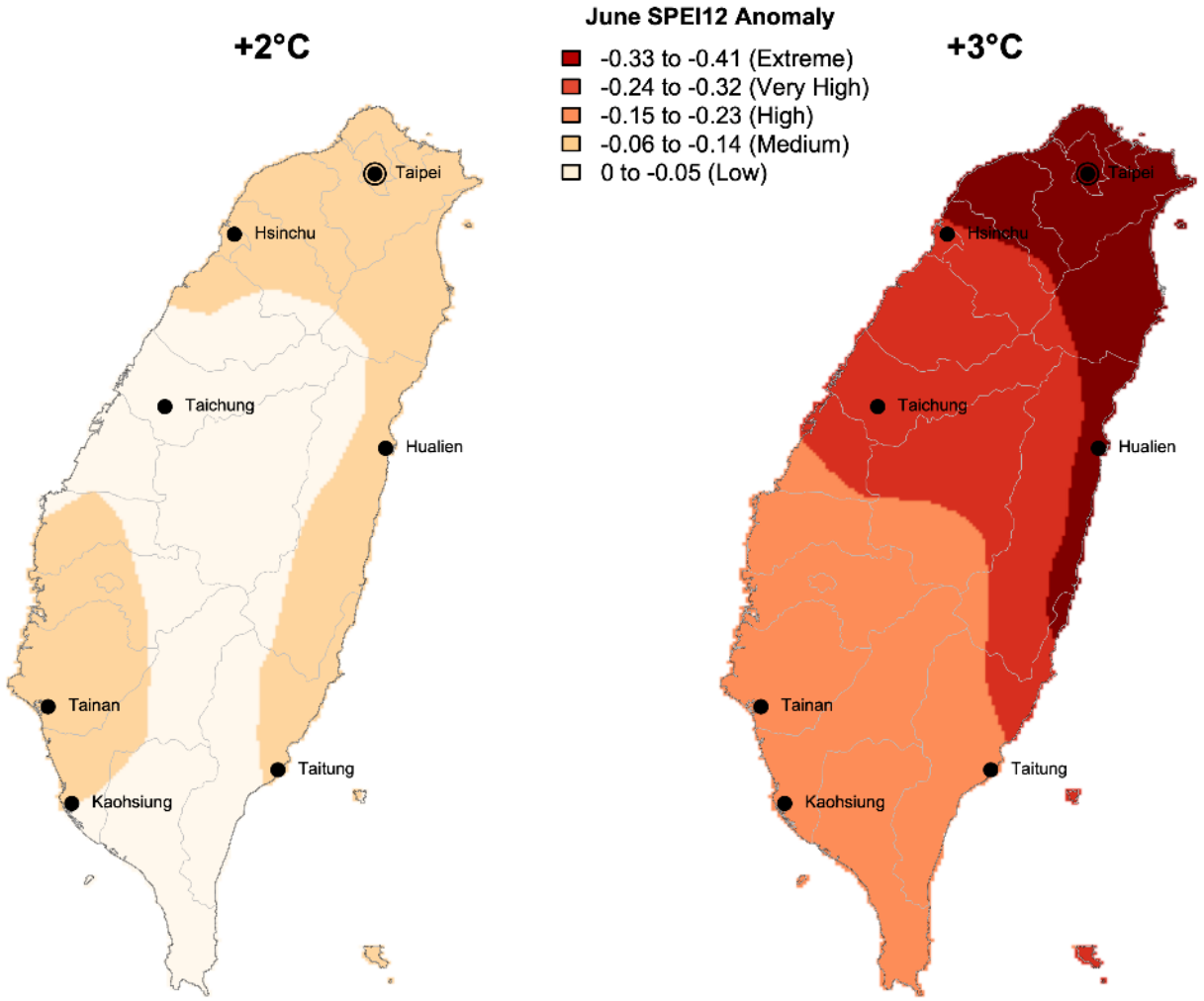
State of Climate Change in Taiwan: Drought



Source: S&P Global Sustainable1 Drought Model

The SPEI-12[1] is a drought index indicative of longer term or hydrological drought conditions.

With respect to current climate, drought conditions are projected to increase under 2°C and 3°C of global warming.

The semiconductor manufacturing industry in Taiwan has faced significant impacts from water shortages in the past, most notably during the 2021 drought.

Continued and prolonged water scarcity represents a significant physical risk to that industry.

[1]Standardized Potential Evapotranspiration Index

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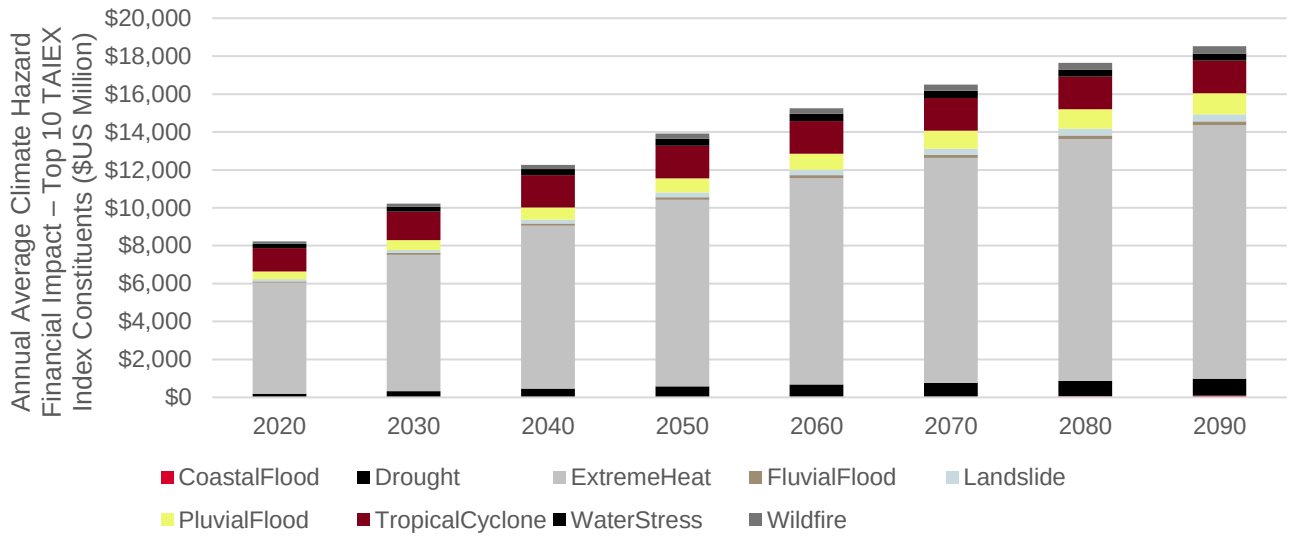
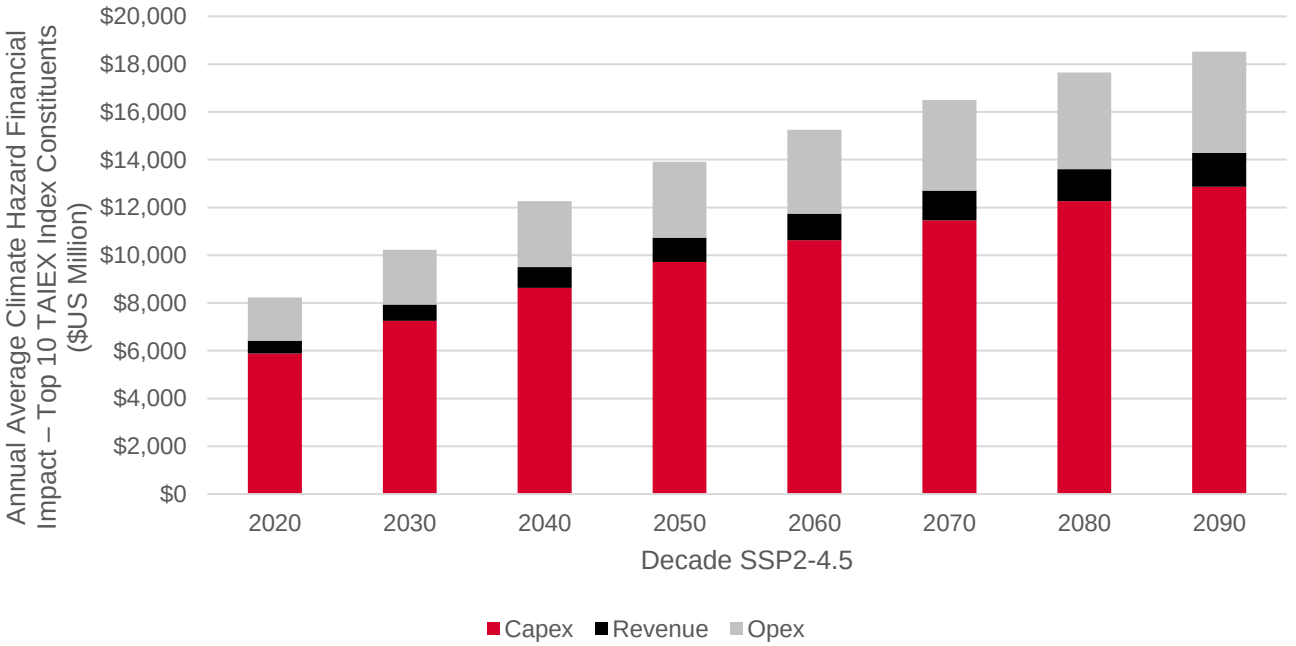
State of Climate Change in Taiwan: Projected Economic Impact

- The total annual cost of climate hazard exposure for the top 10 constituents of the TAIEX index are projected at almost **US$10 billion in the 2030s, rising to almost US$14 billion by the 2050s**
- This is equivalent to 2.3% of 2025 total annual revenue and 0.5% of total market capitalization per annum for these companies by the 2050s
- Extreme heat, tropical cyclone and flood are important drivers of losses
- Excess capex due to physical property damages dominate for this company group, while excess operating expenses and revenue impacts due to business interruptions are also important
- Climate hazard financial impacts increase materially between the 2030s and 2050s





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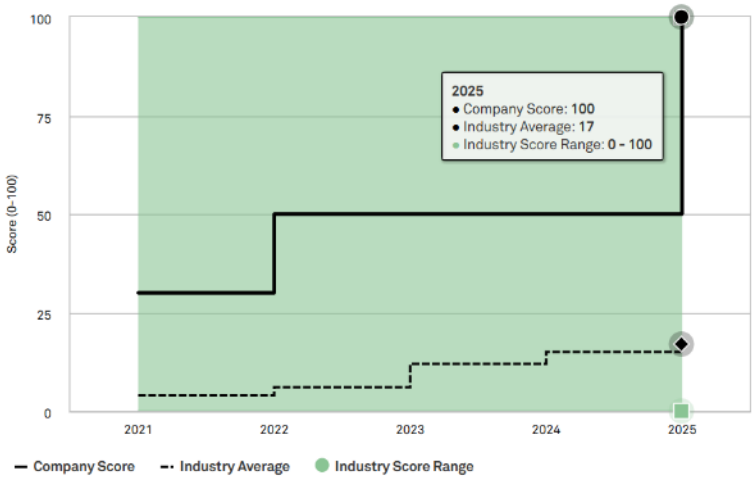
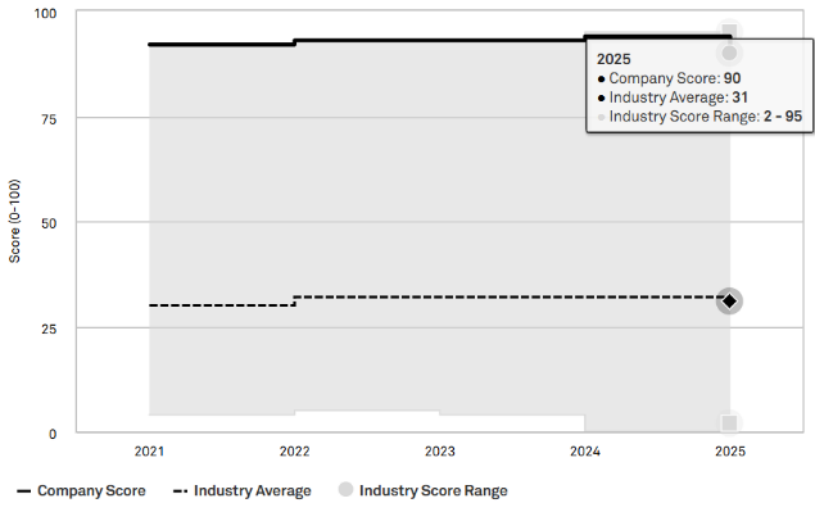
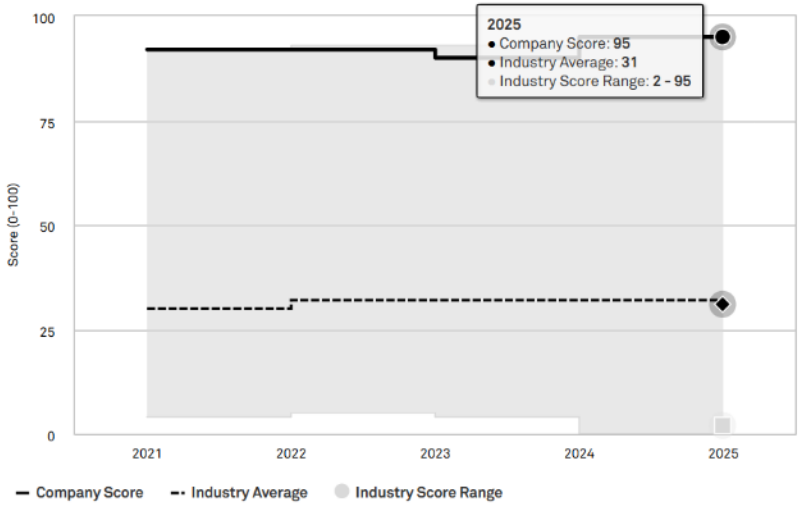
Investing in Adaptation and Resilience

Taiwan's semiconductor leaders have consistently outperformed sector peers on climate physical risk adaptation and resilience in the S&P Global Corporate Sustainability Assessment







Horizons

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The Data Blueprint – From Models to Decisions

Bridging the Gap From Climate Hazard Modelling to Financial Analysis

Hazard

Leading global climate science localized to impacts on your assets

How are company operations, supply chains and markets exposed to climate physical hazards?

Vulnerability

Asset-specific responses defined as impact pathways

How do different asset types, business activities and markets respond to changing exposure to climate physical hazards?

Impact

Modeled Average Annual Loss calculated for revenue, opex an capex

How do climate hazard exposures and vulnerabilities combine to impact revenue, capex and opex?

Adaptation & Resilience

Identify adaptation & resilience solutions and quantify ROI

How adaptation investments, new strategies and business process changes improve resilience?

Financial Performance

Integrate into financial analysis workflows to quantify impacts to valuation, credit risk & profitability

What are the projected impacts of climate change to investor critical measures of financial performance?

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Measuring Current and Future Climate Hazard Exposure

From terabytes of raw daily climate variable projections to globally consistent and decision useful climate hazard layers

Raw GCM Output
Daily projections of climate variables (e.g. Temperature, Precipitation, Humidity) by scenario from many climate models

NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP)
Downscaled to 0.25 degree / ~25km resolution

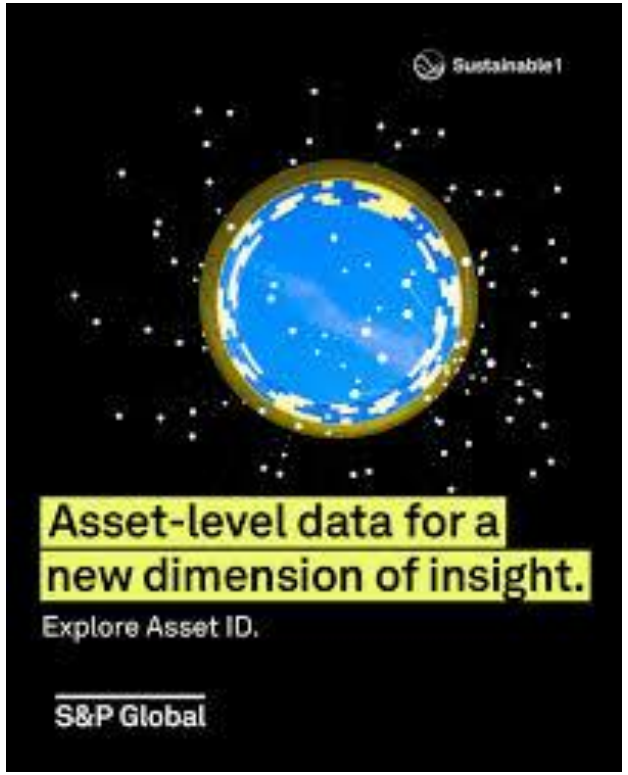
Proprietary Hazard Models
Converting downscaled daily projections to annual average hazard measures e.g. frequency of extreme heat days, frequency of high wildfire conditions days

Global Climate Hazard Layers
10 core climate hazards
Four scenarios and eight decades
Global coverage at consistent resolution
Resolution tailored to hazard characteristics - ~25km for Extreme Heat and 30m for Fluvial Flood

Data Vendors and Partners
Specialized data inputs such as high-resolution historical flood maps

Geolocate Asset Level Exposures

S&P Global is working to expand asset level data coverage to include complete coverage of all material asset locations for a universe of 20,000 companies and an expanding universe of subsidiaries, private companies and other corporate entities



Integration of over **30 proprietary asset databases** maintained by S&P Global sector experts

Analyst led research to fill gaps in coverage with the goal of covering **all material asset holdings** for a universe of 20,000 companies

Assignment of a unique, permanent and universal identifier for each asset

Integration of asset level data in **Climate Physical Risk** and **Nature & Biodiversity** solutions

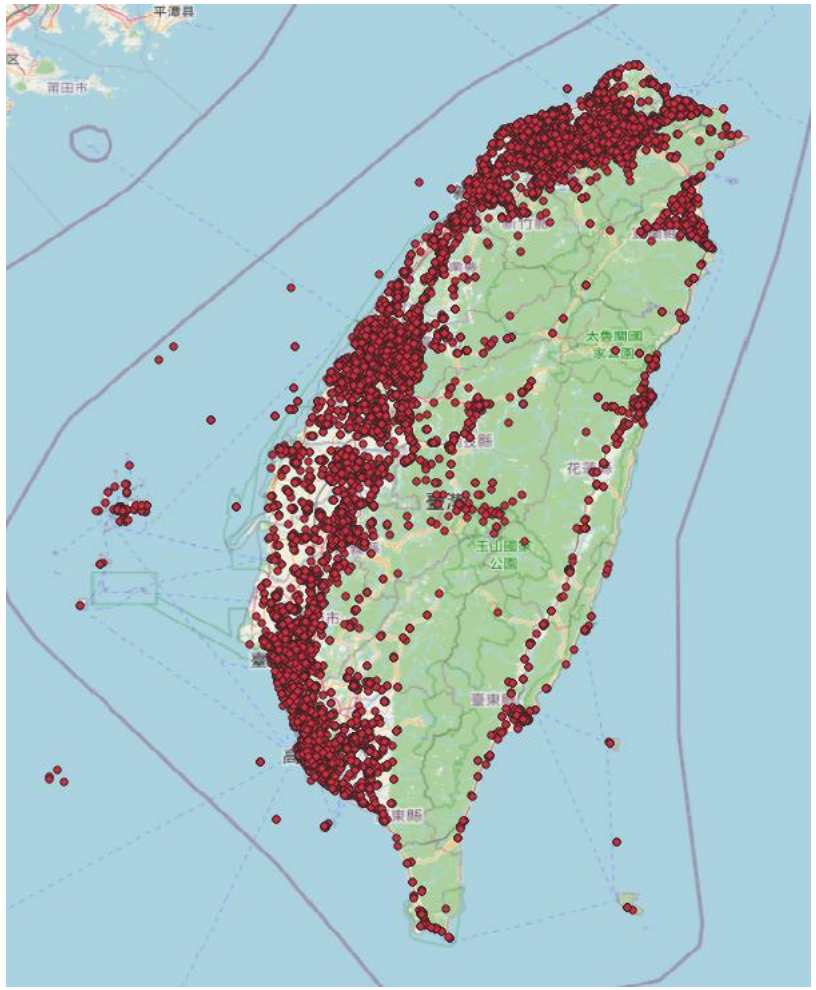
Asset ID databases were integrated in the 2025 Climate Physical Risk dataset release for 8,000 companies, increasing to 20,000 companies in the 2026 release

Linkage to corporate hierarchies, identifiers and financial data in **Capital IQ**

Linkage to deep sector specific datapoints such as asset production, capacity, attributes and economics

Geolocate Asset Level Exposures

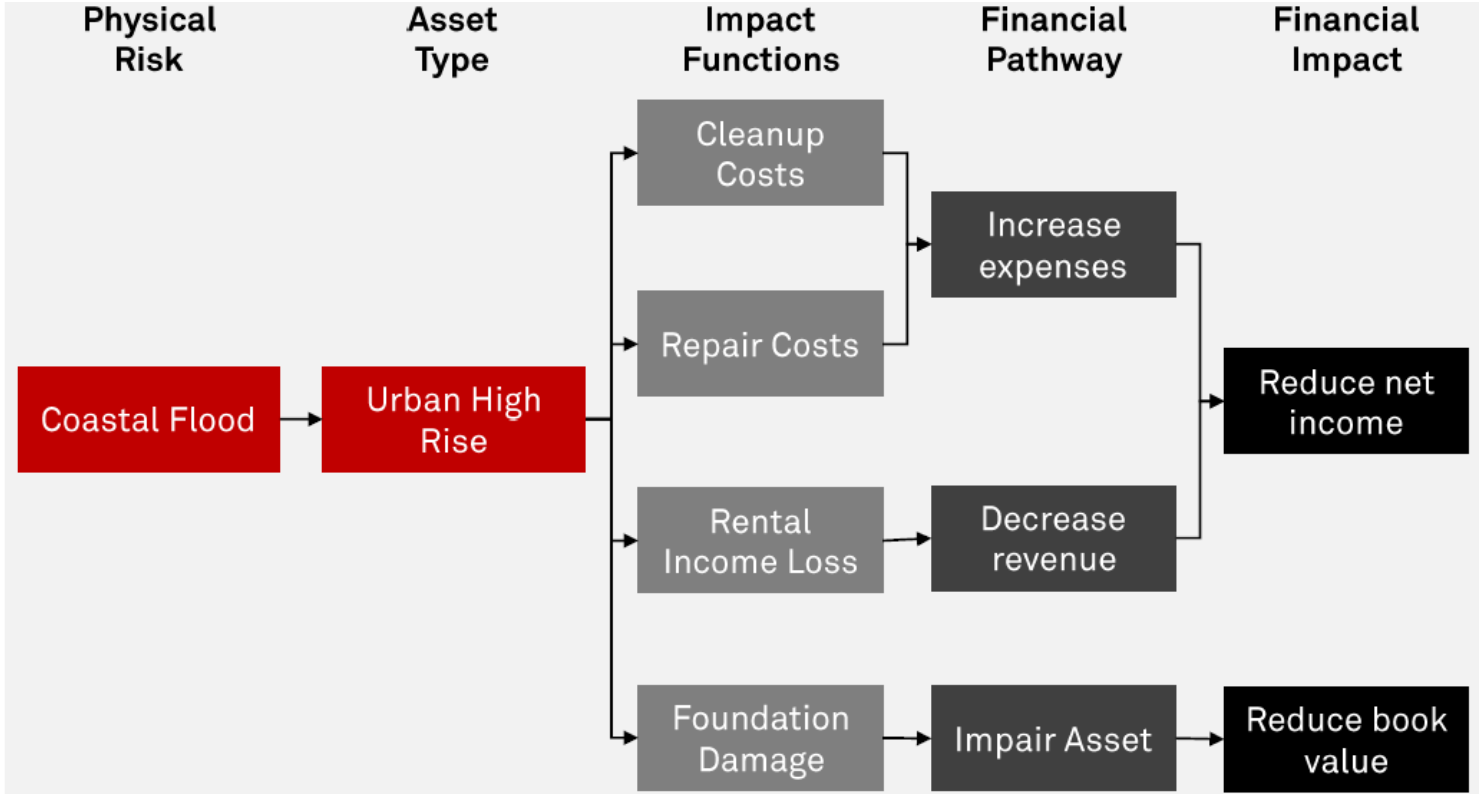
Over **49,000 asset locations** in Taiwan linked to **6,732 unique corporate entities**



Understanding Vulnerability of Critical Assets & Operations

- Impact pathway analysis can be used to model the vulnerability of different asset types to climate hazards
- Impact pathways describe the mechanism through which exposure to a hazard may disrupt or impair an asset, and the financial impacts that arise from this
- The chart to the right shows an example impact pathway for the effects of coastal flooding on an urban high rise building
- Impact pathways can be developed from literature research and S&P Global, along with other providers, have developed proprietary models

Example



Ten Climate Hazards

300+ Asset Archetypes

2000+ Impact Pathways

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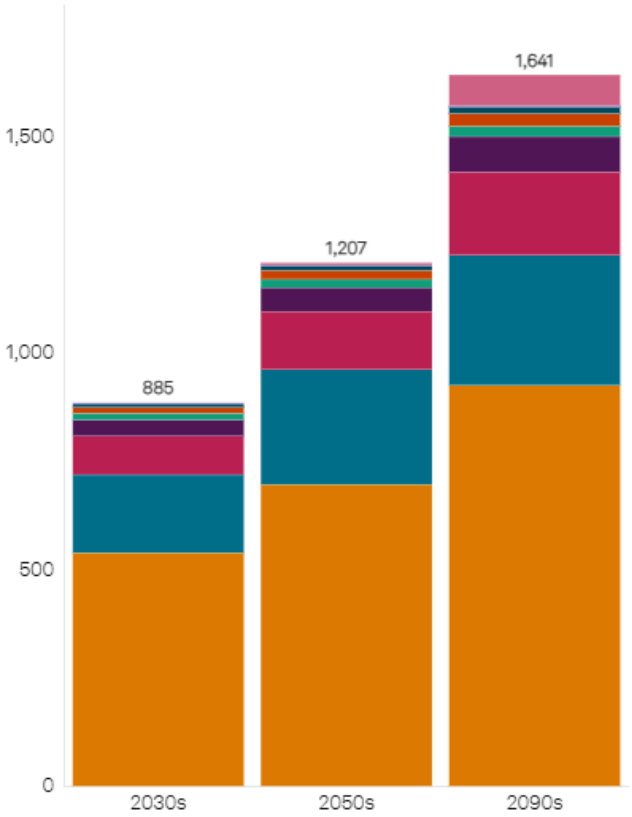
Quantifying Impacts in Monetary Terms

The world's largest public companies face annual financial costs due to climate physical risk of $1.2 trillion by the 2050s

Large companies projected to face $1.2 trillion in annual physical risk costs in the 2050s

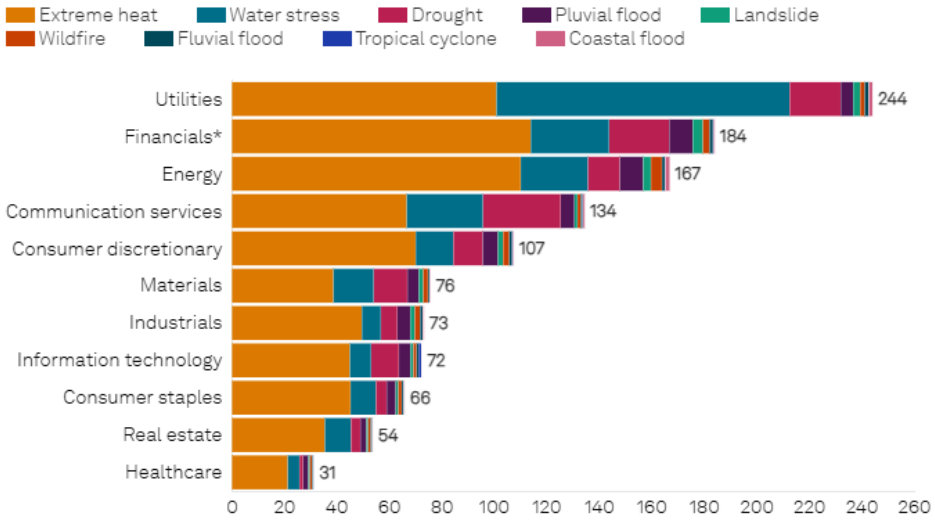
Total annual financial impact on S&P Global 1200 companies in the 2050s under the SSP2-4.5 scenario ($B)



As of Feb. 24, 2025.
SSP = Shared Socioeconomic Pathway.
SSP2-4.5 is a medium climate change scenario that contemplates strong mitigation, in which total greenhouse gas emissions stabilize at current levels until 2050 and then decline to 2100. This scenario is expected to result in global average temperatures rising by 2.7 degrees C (2.1 degrees C-3.5 degrees C) by the end of the century.
No inflation assumptions are applied and results are presented in nominal 2024 prices.
Source: S&P Global Sustainable1.

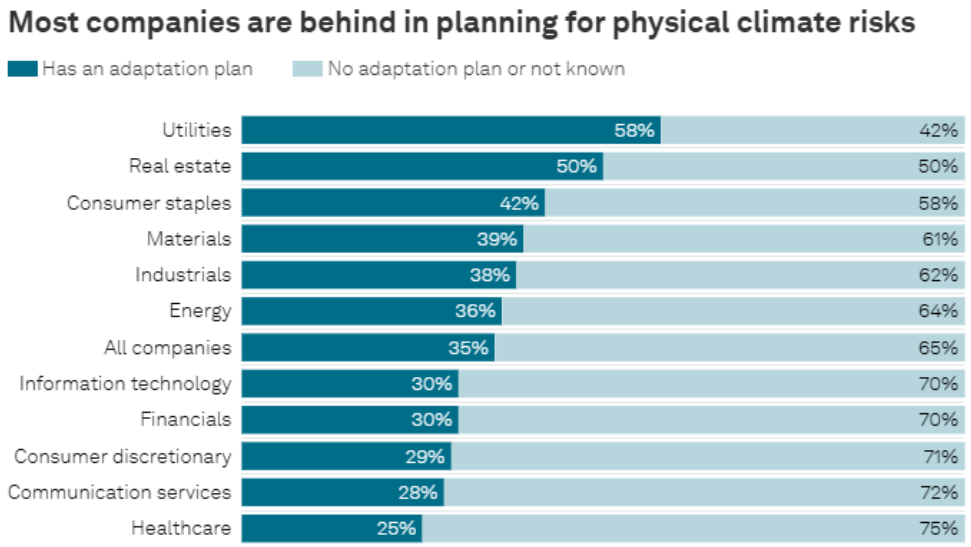
Extreme heat, water stress and drought projected to have the largest financial impact

Total annual financial impact on S&P Global 1200 companies in the 2050s under the SSP2-4.5 scenario ($B)



As of Feb. 24, 2025.
SSP = Shared Socioeconomic Pathway.
SSP2-4.5 is a medium climate change scenario that contemplates strong mitigation, in which total greenhouse gas emissions stabilize at current levels until 2050 and then decline to 2100. This scenario is expected to result in global average temperatures rising by 2.7 degrees C (2.1 degrees C-3.5 degrees C) by the end of the century.
No inflation assumptions are applied and results are presented in nominal 2024 prices.
* The S&P Global Sustainable1 Physical Climate Risk dataset captures the direct exposure of companies' assets to climate hazards; it therefore excludes any value-chain exposures, such as through banks' and insurance companies' financed assets.
Source: S&P Global Sustainable1.

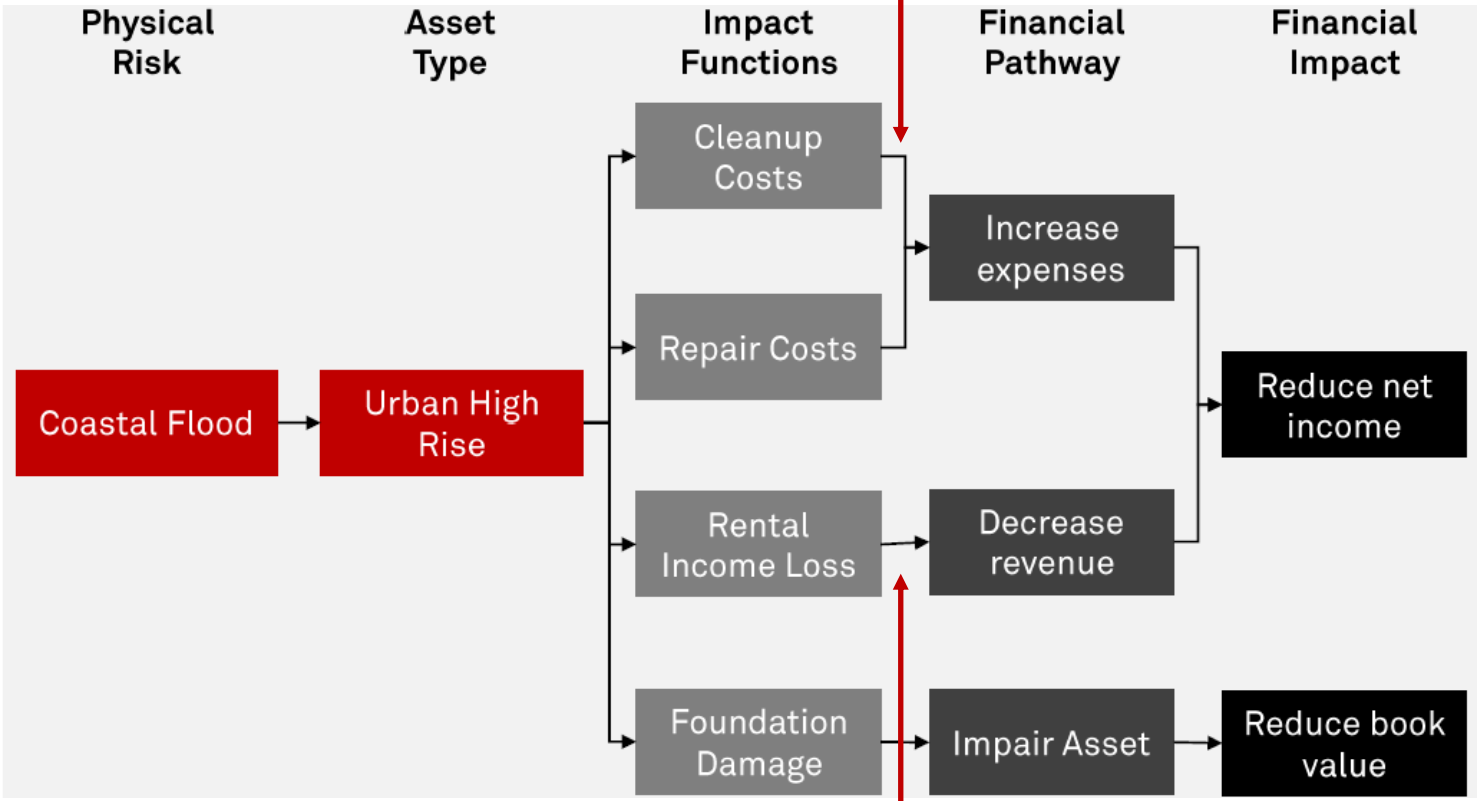
Explore Adaptation & Resilience Strategies



Data as of Jan. 22, 2025.
Results based on responses from 7,934 companies assessed in the 2024 S&P Global Corporate Sustainability Assessment.
"Not known" includes companies that responded "not known" in the assessment, companies that did not answer the physical risk adaptation plan question or left the question blank, and companies whose adaptation plans could not be verified using publicly available sources.
"No adaptation plan" includes companies that responded "no" or "not applicable" in the assessment and companies for which publicly available sources indicated there is no adaptation plan.
Source: S&P Global Sustainable1.

Wet floodproofing increases resilience to inundation and reduces clean-up/repair costs

Example



Wet floodproofing enables faster disaster recovery and reduces business interruption

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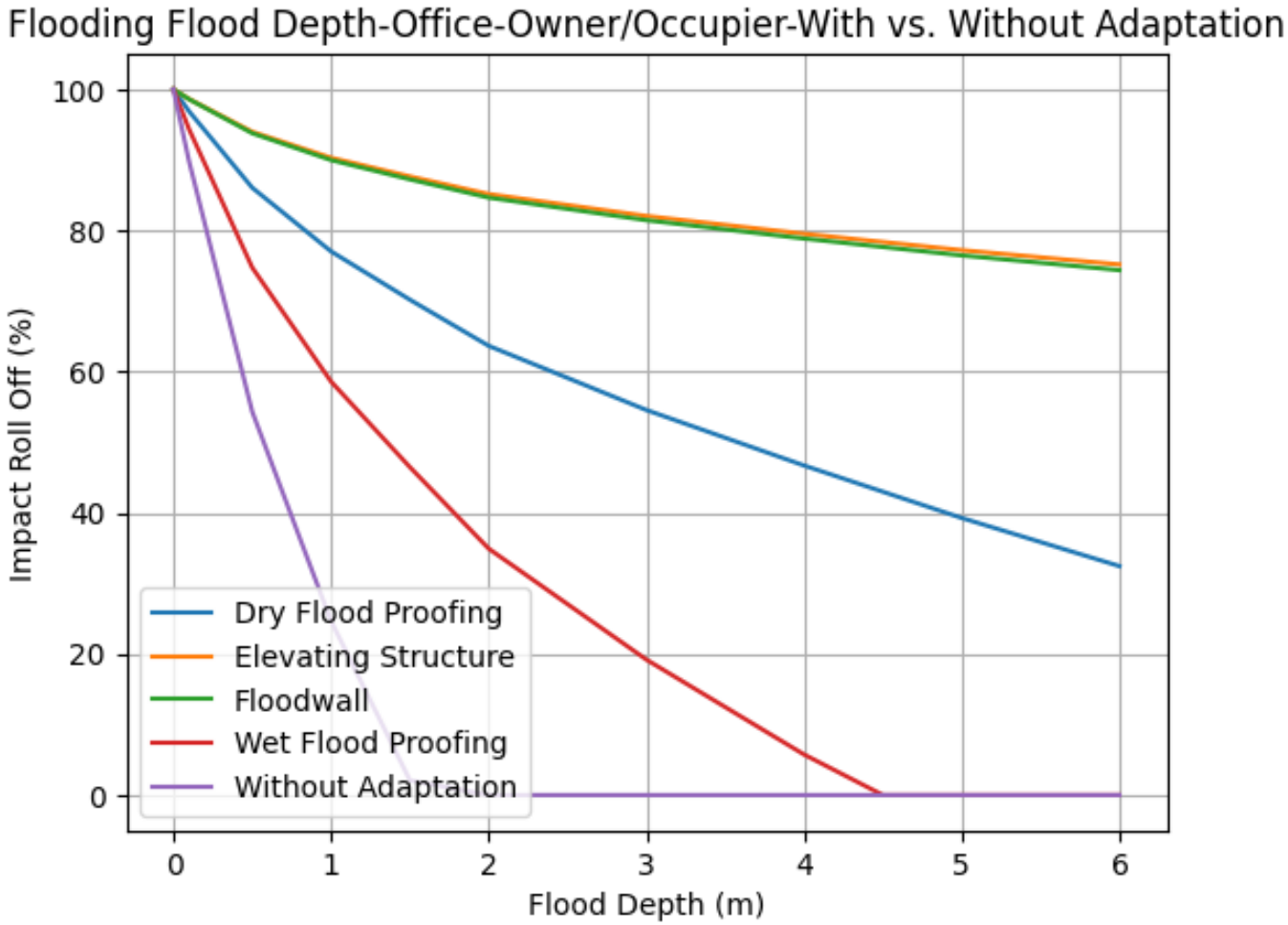
Explore Adaptation & Resilience Strategies

Climate hazard adaptations ‘flatten’ impact functions – reducing asset damages at a given hazard level



- Impact pathway are reduced based on research that quantifies the effect of each adaptation measure
- Cost of implementing each adaptation is included in the calculation

S&P Global
Energy

Integrate Into Financial Workflows

S&P Global Input Data

Climate scenarios

- NGFS and regulatory climate scenario variables (e.g., ECB, FRB, MAS)
- Short term carbon price based scenarios

Company fundamentals

- Financial and segmental data for **~2.2M public and private companies**, from S&P Global Market Intelligence

Emissions data

- Scope 1, 2, and 3 emissions data sourced from S&P Global Trucost

Physical Risk data

- **~3.1M asset locations and 270 asset types modeled for 7 physical risk hazards** sourced from S&P Global Sustainable1

Transition plans

- **~1,000 company emission transition plans**, pre-loaded from third-party sources alongside flexibility to input proprietary sources of such plans

Additional industry-specific data

- Industry data from S&P Global (e.g., fuel mix for power generation counterparties, break-even for oil reserves)
- Original Equipment Manufacturing data and production estimates from S&P Mobility/IHS Automotive

OLIVER WYMAN Climate Credit Analytics Methodology

1. **Key drivers**
2. **Financial statements** *(scenario-adjusted)*
3. **Financial metrics** *(scenario-adjusted)*

Transition Risk	Physical Risk	1 Key drivers	2 Financial statements	3 Financial metrics
		Price	Income Statement	Credit Scores[1]
		Volume	Cash Flow Statement	Bond Valuation
		Unit Cost	Balance Sheet	Equity Valuation
		Capital Expenditure		
		Asset Value		

Link scenario variables to drivers of performance based each company's characteristics

Produce annual financial statements for each company up to 2050

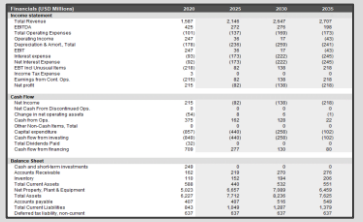
Assess company's scenario-adjusted credit scores or valuation

For each company

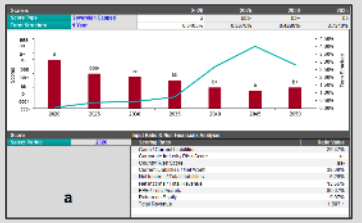
Key Outputs

Driver drill downs

Financial statements



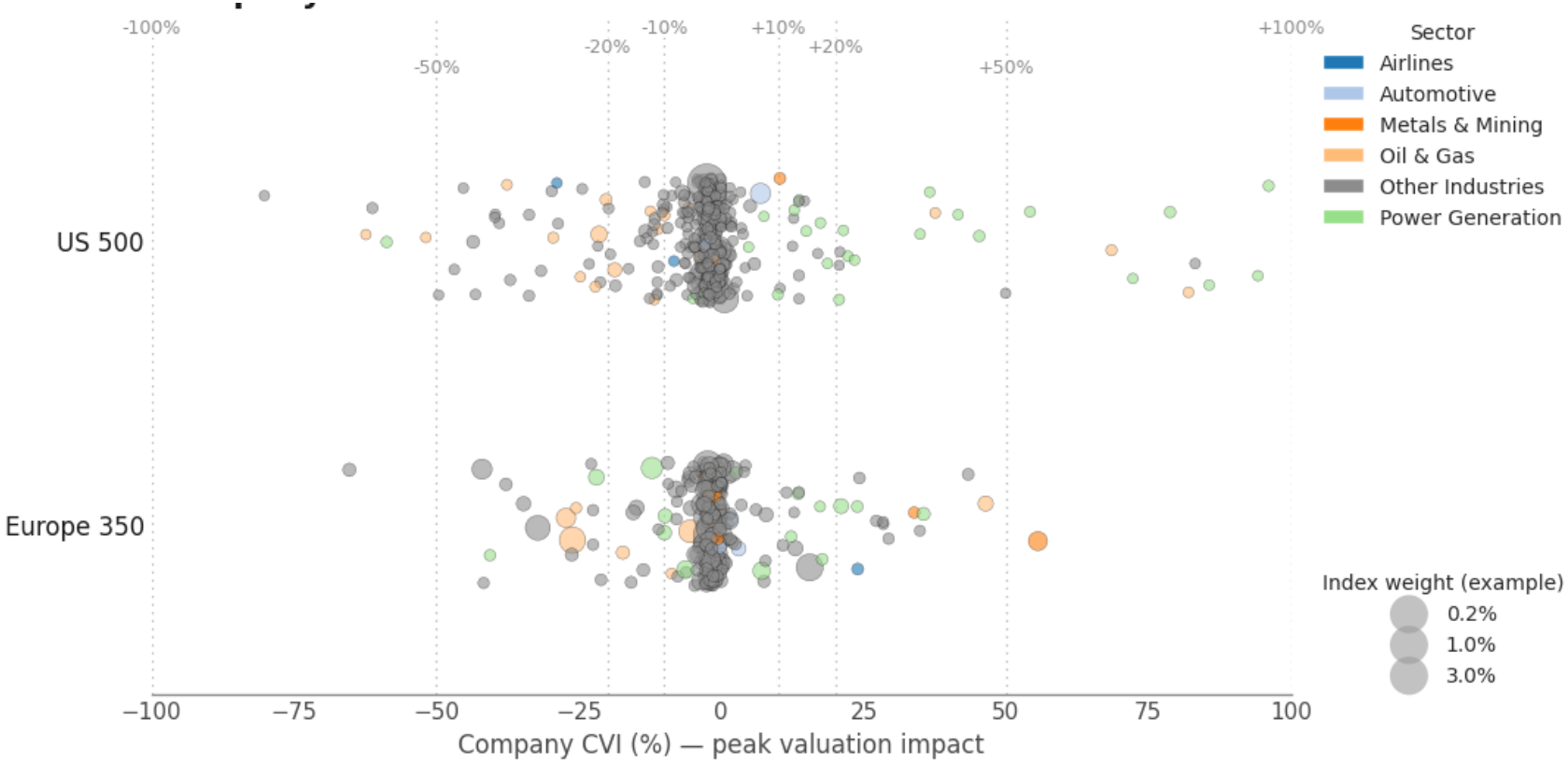
Financial metrics *(e.g., credit score)*



1. S&P Global Ratings does not contribute to or participate in the creation of credit scores generated by S&P Global Market Intelligence. Lowercase nomenclature is used to differentiate S&P Global Market Intelligence credit model scores from the credit ratings issued by S&P Global Ratings.

Integrate Into Financial Workflows: Climate Valuation Impact

Net Zero Scenario 2050: ~80% of Companies Face Valuation Losses (CVI < 0) — Losses Clustered at <10% but with Long Tail



For illustrative purposes, the graph is trimmed at -100 and +100%

~80% of companies face valuation headwinds under Net Zero 2050 (Europe: 79.9%; US: 81.1%)

A tail experiences more material downside (Europe 350: 0.5% in 50–100%; US 500: ~2.1% at ≥50%, including 0.6% beyond 100%).

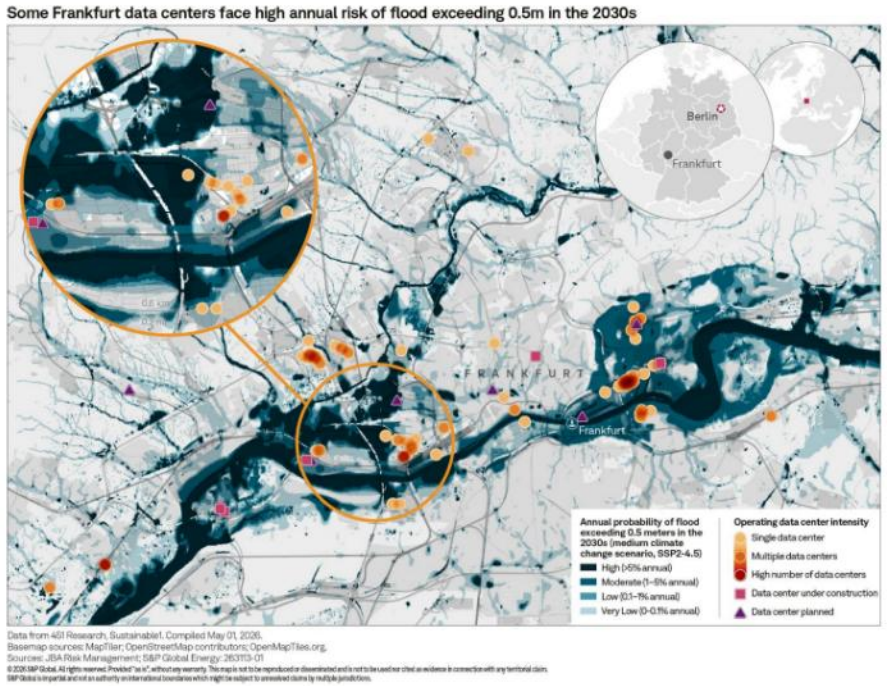
The US Holds the Extreme Outliers: European impacts are relatively bounded (no impacts >100%), while the US exhibits extreme "fat tails" in both directions:

Extreme Downside (>100% drops): Heavily concentrated in US legacy **Power Generation** and **Oil & Gas**. European downside rarely exceeds 50%.

Extreme Upside (>50% gains): Driven by US renewable **Power Generation** and pivoting **Oil & Gas** firms.

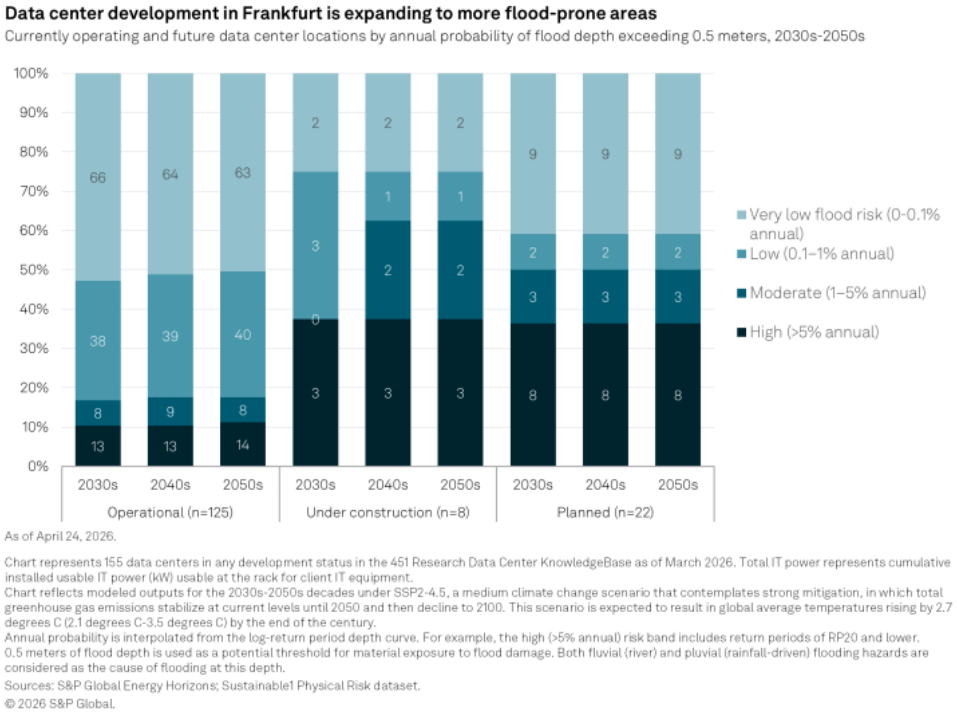
In Europe, extreme upside is rare but dominated by **Metals & Mining** (critical minerals), where half of the winners see 50–100% valuation boosts.

Investor Use Cases: Commercial Real Estate



- Global investment in datacenters is booming – driven by an massive AI demand
- Frankfurt is the most established and high capacity of the top datacenter clusters in Europe - along with London, Amsterdam, Paris and Dublin
- ‘Five Nines’ (99.999%) uptime performance critical to datacenter occupancy and profitability
- Floodwater intrusion into datacenter cable vaults can trigger Emergency Power Off (EPO) systems while more extensive flooding can damage server racks and power infrastructure leading to extended downtime

- S&P Global analysis finds that 13 operational data centers with about 282 MW of capacity are located in areas with greater than 5% annual probability of a disruptive flood event
- Datacenters planned or under construction in Frankfurt tend to be exposed to higher annual probabilities of disruptive flood – suggesting that datacenter development is expanding into higher flood risk areas
- Climate change is projected to exacerbate this risk in future decades



As of April 24, 2026.

Chart represents 155 data centers in any development status in the 451 Research Data Center KnowledgeBase as of March 2026. Total IT power represents cumulative installed usable IT power (kW) usable at the rack for client IT equipment.
Chart reflects modeled outputs for the 2030s-2050s decades under SSP2-4.5, a medium climate change scenario that contemplates strong mitigation, in which total greenhouse gas emissions stabilize at current levels until 2050 and then decline to 2100. This scenario is expected to result in global average temperatures rising by 2.7 degrees C (2.1 degrees C-3.5 degrees C) by the end of the century.
Annual probability is interpolated from the log-return period depth curve. For example, the high (>5% annual) risk band includes return periods of RP20 and lower.
0.5 meters of flood depth is used as a potential threshold for material exposure to flood damage. Both fluvial (river) and pluvial (rainfall-driven) flooding hazards are considered as the cause of flooding at this depth.
Sources: S&P Global Energy Horizons; Sustainable1 Physical Risk dataset.

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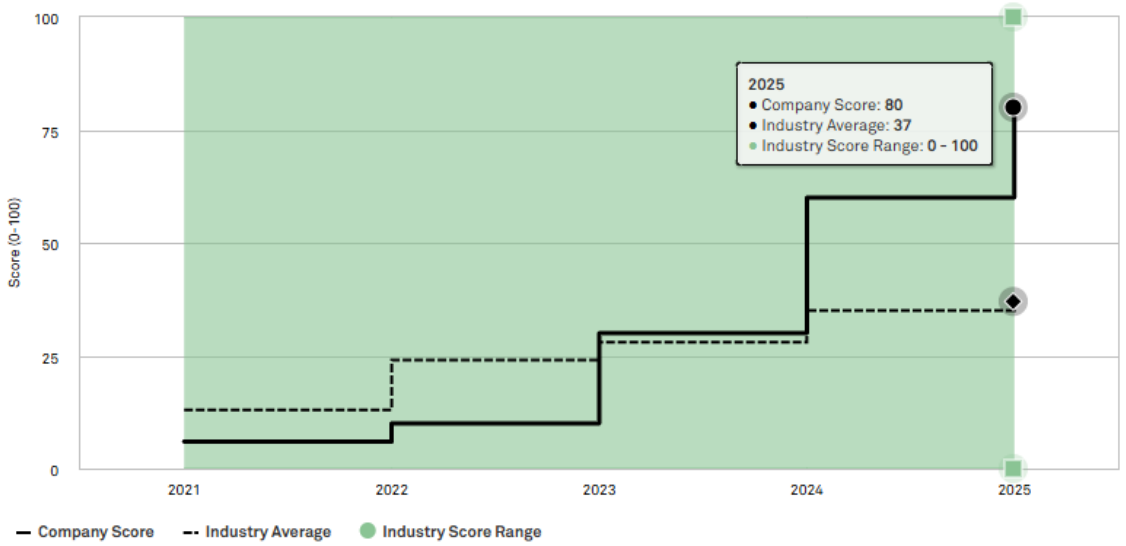
Investor Use Cases: Informing Engagement

Singapore headquartered telecommunications company

- Climate physical hazard concentration in Tokyo, Singapore, Sydney and Southern China
- Highest financial impacts associated with data center assets
- Key Hazards: Extreme Heat, Drought and Water Stress
- ESG Score performance on Climate Physical Risk Adaptation has risen in recent years and outperforms industry average → **Suggests management has identified and is actively addressing climate physical hazard vulnerabilities**



Datacenter Assets in Tokyo
Extreme Heat
Drought

Datacenter Assets in Singapore
Extreme Heat
Drought

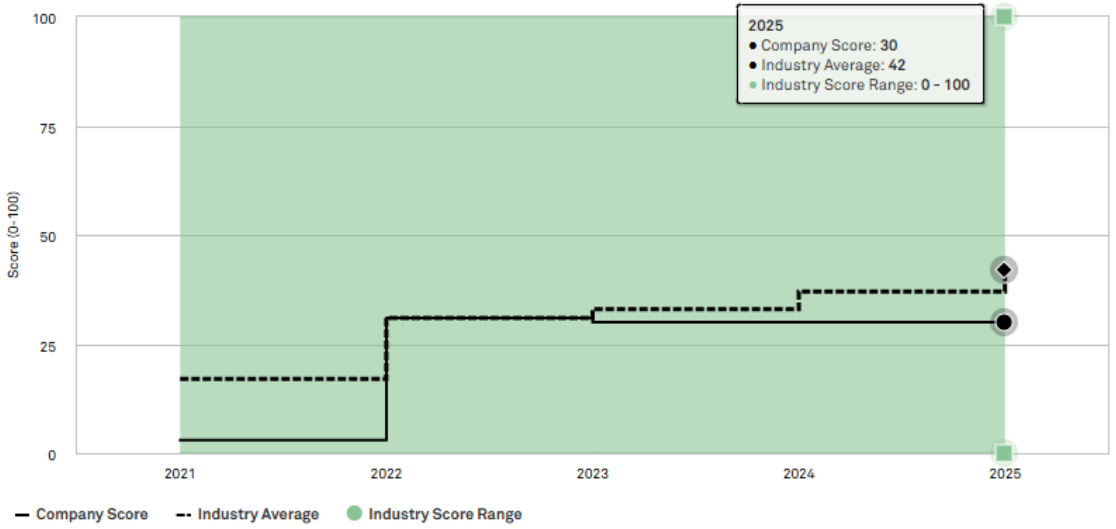
Datacenter Asset in Sydney
Water Stress
Extreme Heat

S&P Global Energy

Investor Use Cases: Climate Risk Aware Portfolio Strategy and Engagement

Malaysia headquartered electric power utility

- Climate physical hazard concentration in Malaysia, Turkey and the UK
- Risks to hydropower plants due to constrained water availability
- Efficiency/output losses to large scale photovoltaic plants due extreme heat
- ESG Score performance on Climate Physical Risk Adaptation lags industry average → **Opportunity for engagement to understand risk management strategy and improve performance**



Hydropower assets in Malaysia

Water Availability

Large Scale Photovoltaic Plant in Sabah

Extreme Heat

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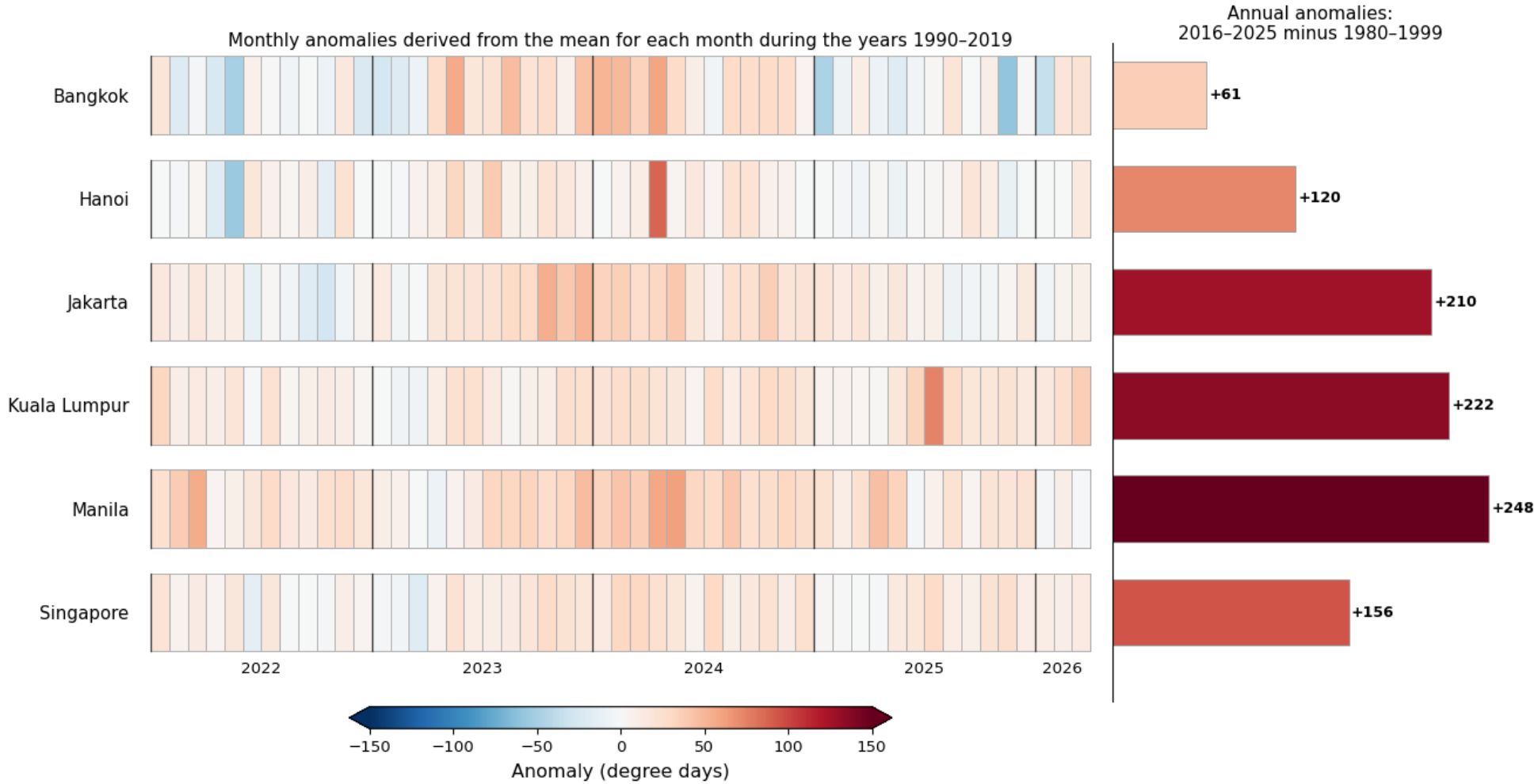
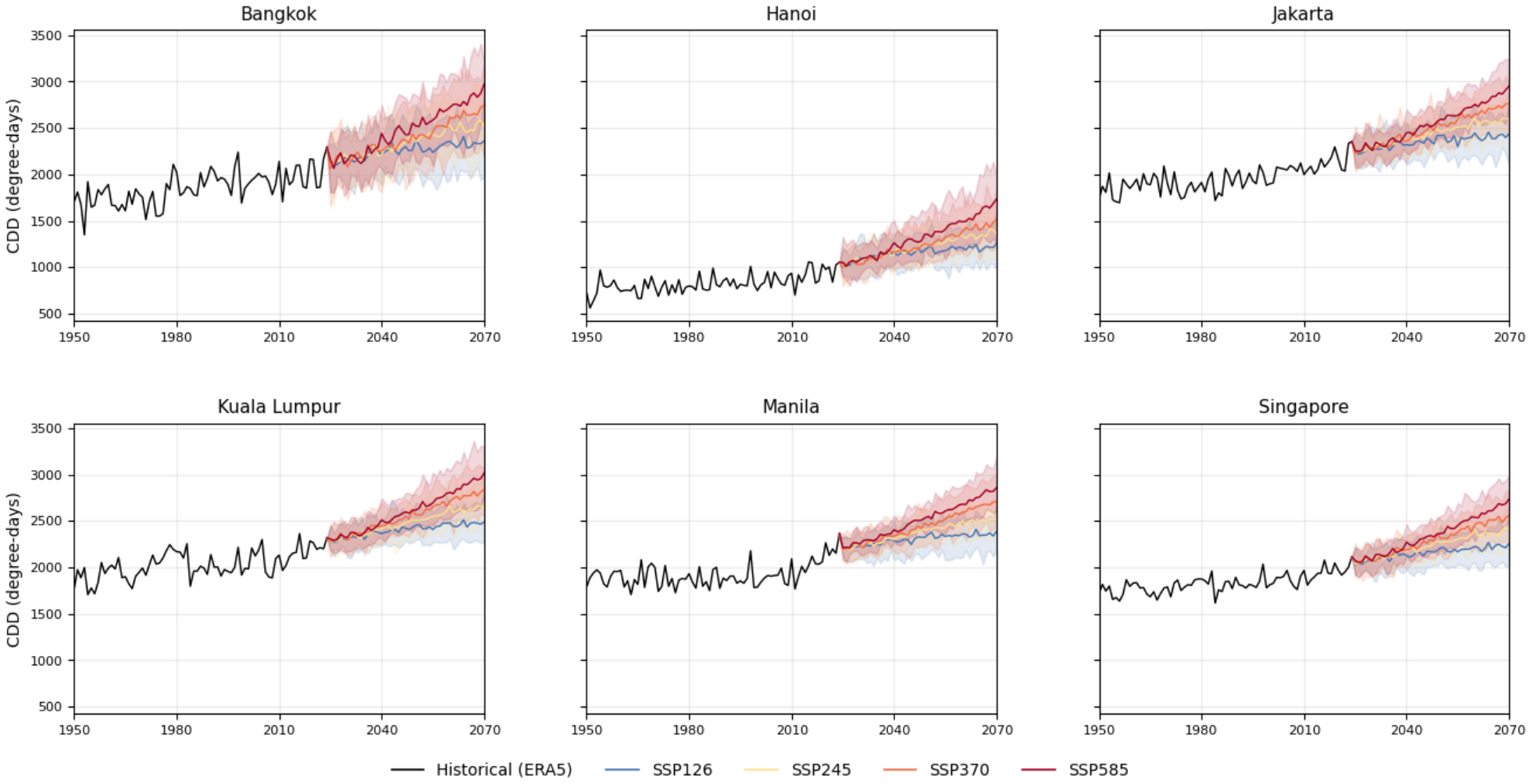
Corporate Use Case: Projecting Power Demand

Historical Cooling Degree Day (CDD) trends for select capital cities



Corporate Use Case: Projecting Power Demand

Projected Cooling Degree Day (CDD) trends for select capital cities



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Horizons

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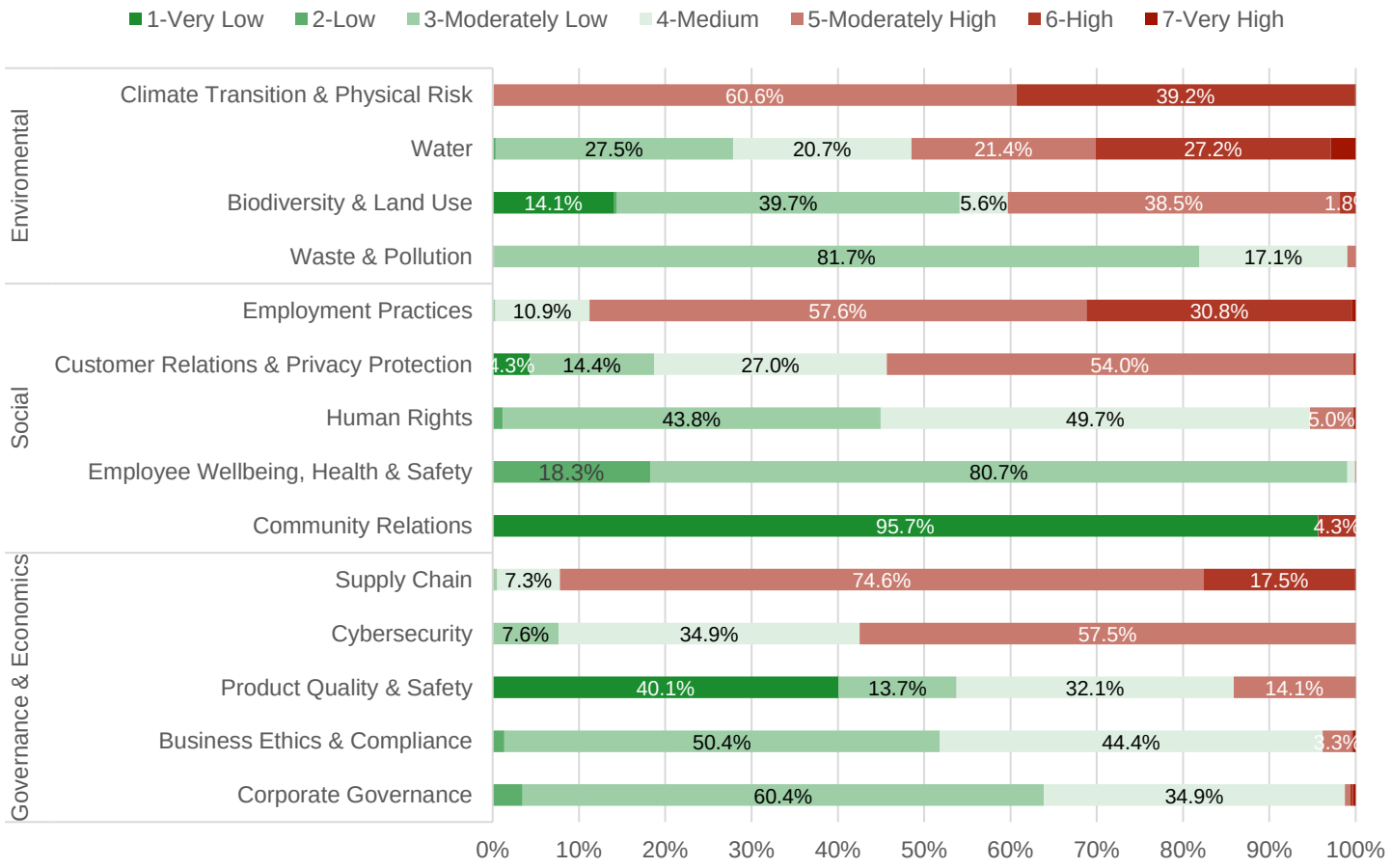
The Analytical Edge – Measuring the Blind Spots

Factory shutdown leads to labor and supply disruption in Information Technology sector

- **Labor violations triggered unrest:** Poor working conditions led to worker protests at a supplier of a global technology brand.
- **Operational disruption:** The plant was shut down for several weeks, halting production
- **Business impact:** Exposed the fragility in supply chain diversification strategy, creating supply disruption risk and reputational scrutiny of labor practices

Retail supply chain risk exposure



- S&P Global's Risk Exposure Assessment reveals that retail companies face significant environmental, social, and governance/economic risks across their supply chains.
- **Environmental risks**: Nearly 100% suppliers face moderately high to high climate transition and physical risks; water risks affect about half of the suppliers, and ca. 40% are exposed to considerable biodiversity and land use risks.
- **Social risks:** 90% of suppliers are exposed to moderate to high risks in employment practices; 54% in customer relations and privacy protection, while only a minority of evaluated suppliers are affected by other social risk factors.
- **Governance/economic risks:** Supply chain risk tops the list with 92% of suppliers exposed to moderate to high risk, followed by cybersecurity at 57%.

Data as of Nov 1, 2025

Results based on the S&P Global Risk Exposure Assessment of 4461 companies in Consumer Electronics, Home Furnishings, Homebuilding, Household Appliances, Housewares & Specialties, Leisure Products, Apparel, Accessories & Luxury Goods, Footwear, Textiles, Communications Equipment, Technology Hardware, Storage & Peripherals industries registered as suppliers in S&P Global Capital IQ Pro

Source: S&P Global Sustainable 1

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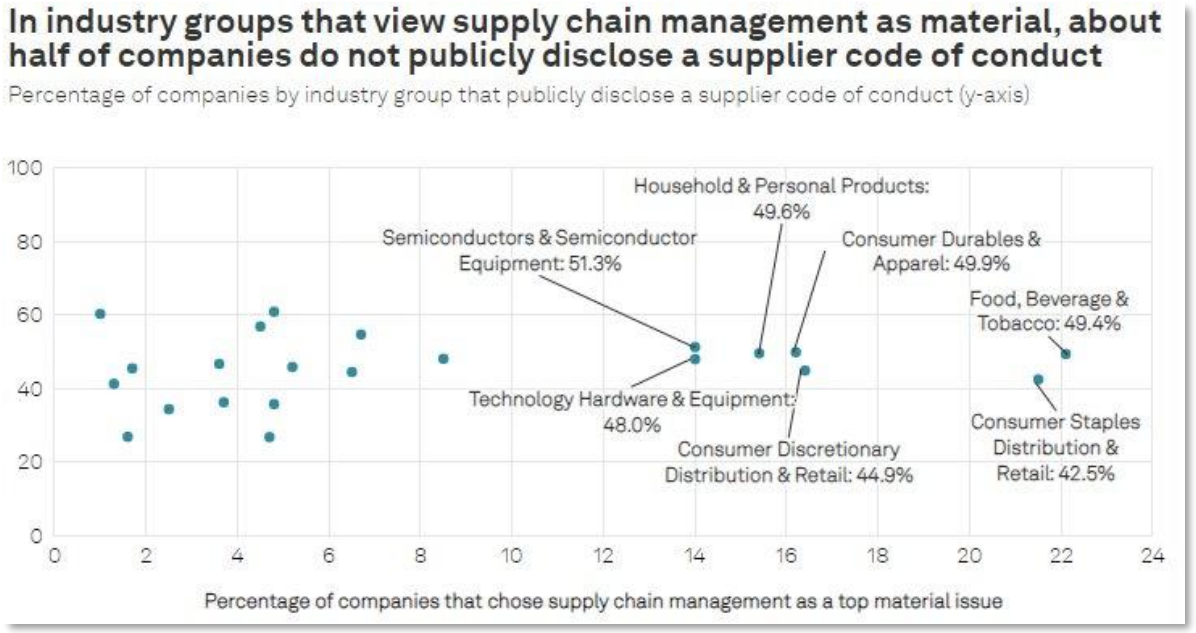
Supply chain sustainability risks are under-managed

~50%

of companies in high risk industries publish a supplier code of conduct
(a first step in supply chain due diligence)

Around half of the largest companies of the world in high-risk industries remain exposed to significant reputational, operational, and financial risks from their supply chains.



Data as of March 26, 2024.
Results based on responses from 9,688 listed companies assessed on whether they publicly disclose a supplier code of conduct and 12,490 companies assessed on their top material issues in the 2023 S&P Global Corporate Sustainability Assessment (CSA).
The CSA defines a supplier code of conduct as describing the principles, values, standards, or rules of behavior that guide the decisions, procedures, and systems of the supplier in a way that contributes to the welfare of its key stakeholders and respects the rights of all constituents affected by its operations. It usually includes at least three components: human rights and labor, environment, and business ethics.
To read the full text of CSA criteria and questions, click here.
Source: S&P Global Sustainable1. ESG Insight 'Assessing the missing links in sustainable supply chain management'

Efficiency potential for supply chain due diligence

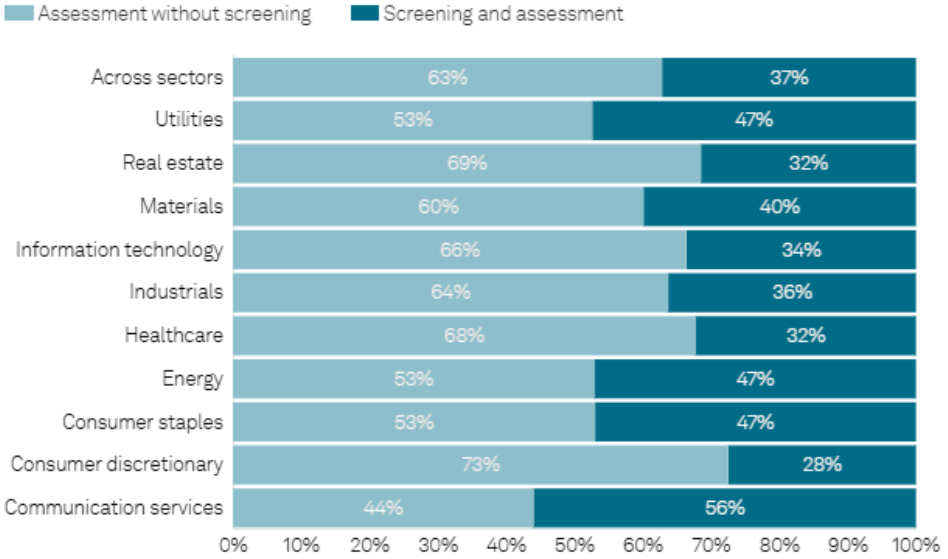
63%

of companies perform supplier assessments without conducting supplier screening beforehand

Supplier screening (with REA) can significantly reduce assessment effort for buyers and suppliers.

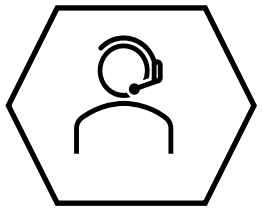
63% of companies perform supplier assessments without conducting supplier screening beforehand

Percentage of companies by sector that conduct supplier assessments without conducting a screening process in advance



Data as of Jan. 21, 2025.
Results based on responses from 2,726 listed companies assessed in the 2024 S&P Global Corporate Sustainability Assessment (CSA) that have a publicly available supplier assessment process.
The CSA defines supplier screening as systematic desk research of suppliers' risk for negative ESG impacts and their business relevance. Screening can be considered the initial step to identify potential sustainability risks in the supply chain and is then followed by assessing suppliers.
To read the full text of CSA criteria and questions, click here.
Source: S&P Global Sustainable1.

CSA as a Service – Risk Assessment solution
Supply Chain use case



The buyer submits a list of suppliers to be screened through the Risk Exposure Assessment and/or the more detailed Supplier Risk Management Assessment*º*

Entire supplier base

2'000 suppliers

1

Risk Exposure Assessment

Tool to **screen** an entity's **supplier base** and identify potential **ESG risks**, mostly driven by its business activities and geographic profile

Suppliers identified to be exposed to substantial sustainability risks

500 suppliers

2

Supplier Risk Management

Assessment of the **Supply Chain Management material ESG impacts** and **risks** on a focus-set of significant suppliers, potentially also leveraging existing CSA data

Suppliers assessed to have weak Sustainability Management

100 suppliers

3

Performance Overview and Gap Analysis

Overview of the **outcome** of the **Risk Assessment Solution** on the company's Supply Chain, highlighting **key patterns**, particularly **risky suppliers** and potentially analyzing **major gaps**

Suppliers with persistant gaps

30 suppliers

4

Audit & remediation plans*

Direct engagement on limited number of suppliers with low management score through on-site audits and remediation plans

Suppliers engaged in on-site audits and development

30 suppliers

- **Supply Chain ESG risks** can materialize as **reputational**, **operational**, and **regulatory risks** that can have significant financial consequences for buyers.
- The S&P Global **Risk Assessment Solution** helps buyers to **efficiently manage supply chain ESG risks** by identifying, assessing, preventing, and mitigating their suppliers' (potential) adverse impacts on the environment and people.

** Managed by procurement professionals via in-house auditors or third-party providers.*

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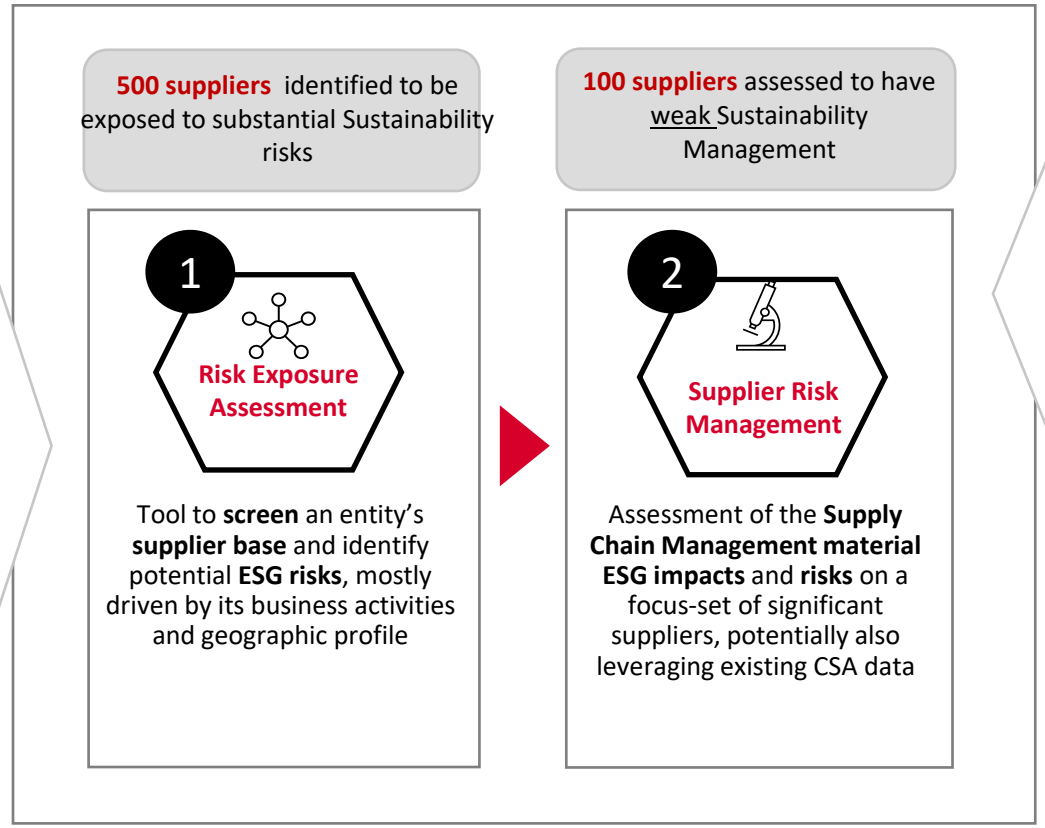
CSA as a Service – Risk Assessment solution
Supply Chain use case

Key Features

- **Transparent and robust methodology:** Public methodologies developed under S&P Global Sustainable1's rigorous Controlled Methodology and Models Governance Process.
- **Efficient supplier ESG risk identification:** Identify supplier ESG risk exposure rapidly, for large supplier portfolios, with minimal data input and no supplier engagement.
- **Thorough supplier ESG practices assessment:** Engage selected high risk suppliers with in-depth assessment of ESG management practices.
- **Leverage existing supplier ESG management data** using Pre-fill from CSA and regulatory disclosure questionnaires (future)
- **Regulation-aligned reports:** Produce reports aligned with sustainability due diligence and reporting regulation requirements.



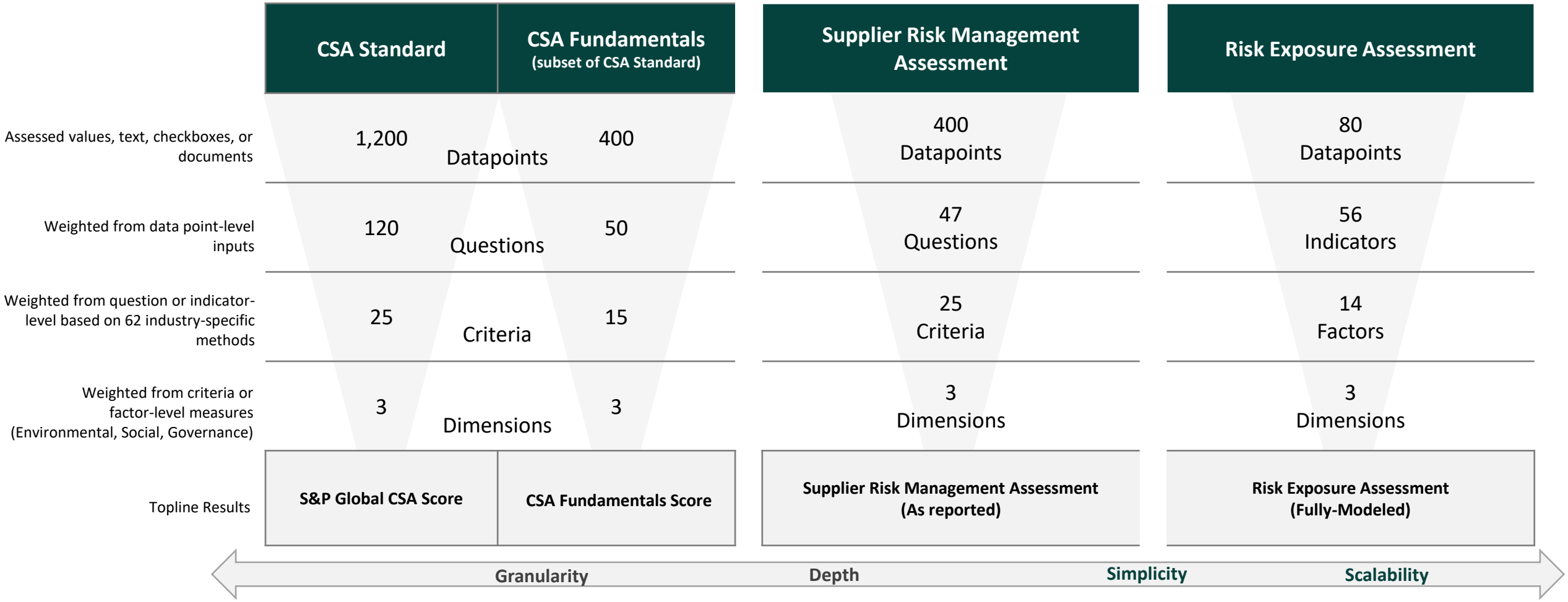
Main Benefits

- Helping corporates to enforce their **Supplier Code of Conduct** across the **supply chain**
- Enhancing **regulatory compliance**, **identifying** operational and reputational **risks** and **improving** the **Supply Chain Management process efficiency**
- Supporting companies either in performing a **high-level screening** of **ESG risks** of the entire supply chain and selected **deep dives** for **priority suppliers**

Our solutions supports with the following CSDDD requirements

- **Identify, assess and prioritize** actual and potential adverse impacts (§8,9)
- **Prevent & mitigate** potential adverse impacts (§10)
- **Engage** stakeholders (§13)
- **Monitoring** (§15)
- **Communication** (§16)
- **Climate transition** plan (§22)

Assessments as a Service
Methodology/Questionnaire types



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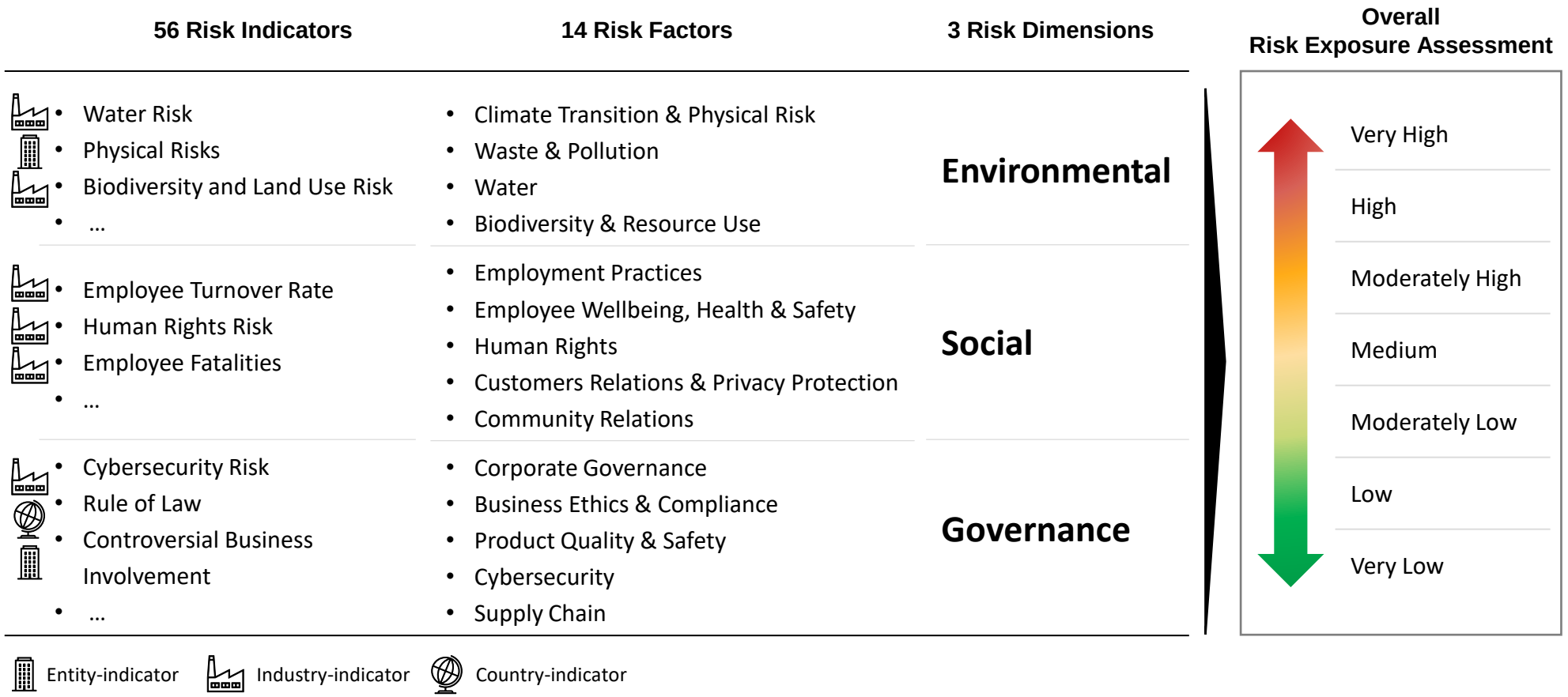
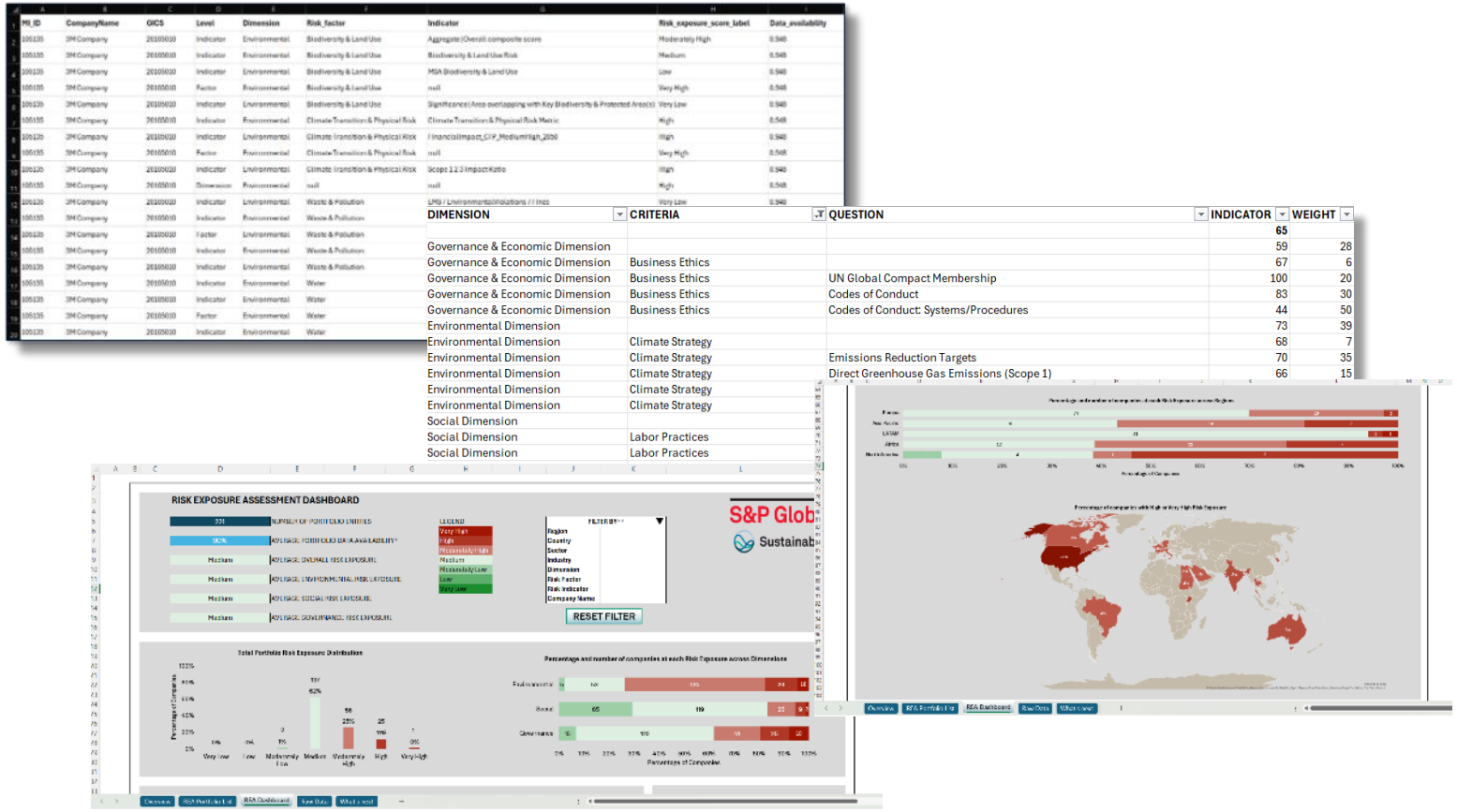
CSA as a Service – Risk Exposure Assessment (REA)

- The REA model outputs are generated on indicator level and then aggregated to risk factor and dimension level, with an overall risk exposure assessment as the overarching output



CSA as a Service – Risk Assessment solution
Results and Deliverables

- **Comprehensive and detailed output** including company information and details across indicators
- Output from **Risk Exposure Assessment and Supplier Risk Management** is a flat file including the **scores**, a **summary company lists** and a **dashboard** for buyers to get the first insights **on supply chain performance**
- Buyers can **pinpoint high-risk hotspots** and request additional services to understand **supplier-specific performance** and **gap analysis**



Pictures are for illustrative purposes only

Horizons

S&P Global
Energy

Executive Playbook & Next Steps

Understanding Risk and Building the Roadmap for Resilience

1. Identify Gaps and Blindspots
2. Select the Right Data and Tools
3. Quantify Risk and Prioritize Action
4. Build the Business Case for Adaptation
5. Monitor, Integrate, and Communicate

1. Identify Gaps and Blindspots

Geospatial Intelligence

- Mapping global operations and categorizing by asset type, criticality and activity profiles
- Identify linkages to critical infrastructure (roads, rail, power, water etc.)
- Map key supplier and customer relationships

Counterparty Intelligence

- Understanding counterparty corporate hierarchies to reveal potential climate physical risks to subsidiaries and joint venture partners
- Defining gap filling approaches for counterparties where disclosure is limited or difficult to access

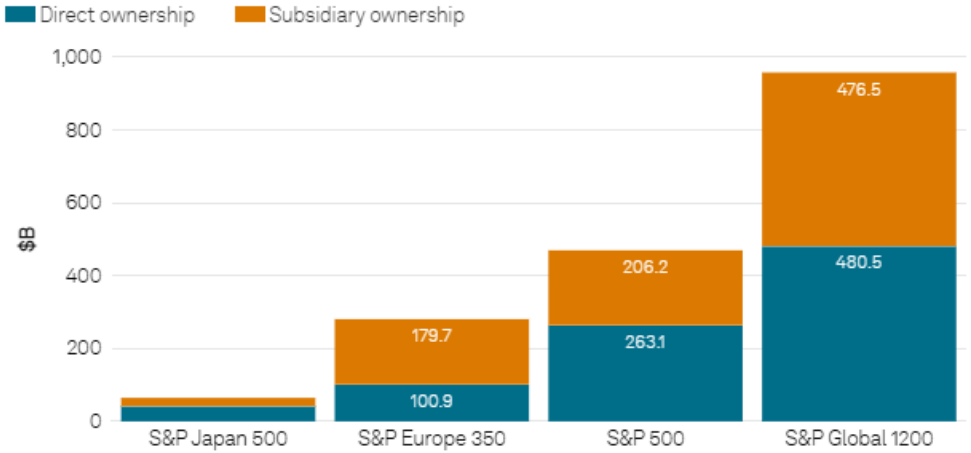
Hidden Dependencies

- Consider hidden dependencies on municipal or other infrastructure which is outside your direct control, such as
    - Flood walls and barriers
    - Levees
    - Drainage infrastructure
    - Water supply
    - Vegetation management / fuel reduction

Including subsidiary assets provides a more complete view of climate physical risk

Annual climate hazard financial impacts by asset ownership for constituent companies in four indices, under the SSP2-4.5 climate scenario in the 2050s

Hover over each bar for more information.



Data as of May 23, 2025.
These projections are modeled using the S&P Global Sustainable1 Physical Risk dataset under a climate change scenario that assumes strong greenhouse gas emissions reduction (SSP2-4.5).
Financial impact projections do not include adaptation measures.
Direct ownership refers to assets legally owned by the index constituent itself.
Subsidiary ownership refers to assets held by majority- or fully-owned entities within a broader corporate hierarchy.
Source: S&P Global Sustainable1.

2. Select the Right Data and Tools

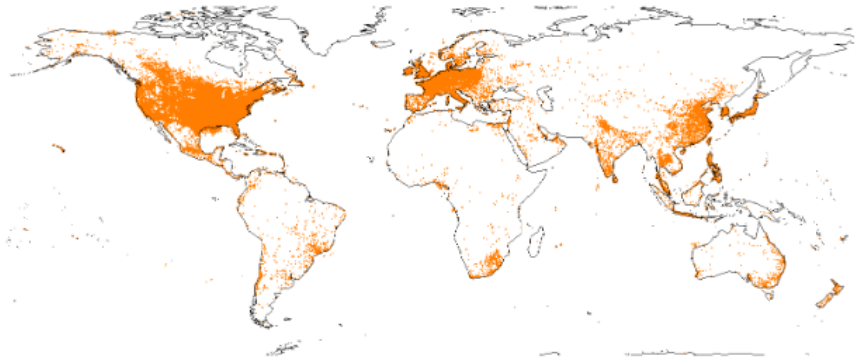
Resolution

- Chronic hazards such as extreme heat and drought can be adequately represented by downscaled CMIP6 data since these hazards tend to vary over large distances (baring localized exceptions such as Urban Heat Islands)
- Acute hazards such as flood and wildfire require higher levels of precision to differentiate exposure at the building scale or below.
- Flood exposure can radically differ between adjacent properties due to variation in elevation and flood flow paths

Global Comparability vs Local Precision

- Multinational corporates and global investors require globally comparable climate hazard and vulnerability data to effectively identify hotspots and prioritize action
- Localized modelling tools may add most value for companies and investors with highly concentrated exposures in one or more countries
- S1 climate physical risk models seek to strike a balance between global comparability and high-resolution localization for the hazards where this matters most

Assets owned by S&P 500 constituents and their subsidiaries



Data as of May 23, 2025.
Source: S&P Global Sustainable1.

3. Quantify Risk and Prioritize Action

Identify Exposure Hotspots

- Identify operational assets and investments with the greatest exposure to strategically important physical hazards

Distinguish High Risk and High Change Exposures

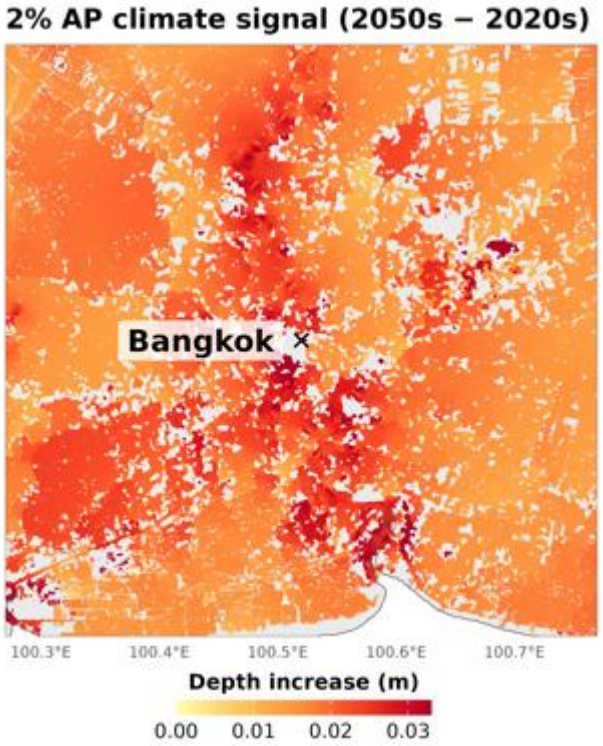
- Take note of both high absolute exposures assets and assets projected to see rapidly changing exposure in future decades
- Operations and investments facing hazard exposures not experienced in the past may be less well conditioned and prepared to manage in the future

Pinpoint Adaptation Limits

- Identify locations where current adaptation measures are already operating near design thresholds
- Even small changes in hazard exposure can push systems past their breaking point and create disproportionate impacts

Understand Transmission Pathways

- Trace pathways from the hazard exposure to the resulting impact on real assets, operations and value chains, and then to ultimate impact on financial performance
- Understanding the transmission pathways can aid in better targeting adaptation and resilience interventions



4. Build the Business Case for Adaptation

Quantify the Cost of Inaction

- Quantify the projected annual financial impact from key hazards on critical assets if no action is taken.

Model the Return on Resilience

- Identify adaptation and resilience interventions – insurance, retrofits, defenses etc.
- Quantify the cost of implementation for each intervention and the magnitude of hazard protection delivered
- Quantify the net present value of avoided future climate hazard financial impacts and the return on near term investments in resilience

Strategic Co-Benefits

- Adaptation and resilience investments often offer co-benefits such as operational efficiencies, enhanced brand reputation, and improved access to capital.

Figure 6: Dry and wet floodproofing

Design credit: Augusto Justiniano Jr.
FCL = flood construction level; DFL = defined flood level.
Source: S&P Global Sustainable1.

5. Monitor, Integrate, and Communicate

Integrate into Enterprise Risk Management

- Track climate physical risk and the return on resilience through ERM systems and standing committees a agenda items for the Board

Set Clear KPIs

- Establish and track metrics related to adaptation, such as the percentage of high-risk assets with resilience plans in place or the reduction in projected financial impact.

Communicate to Stakeholders

- Comply with emerging regulatory and voluntary climate risk disclosure frameworks
- Communicate and resilience strategy to stakeholders and investors
- Leverage resilience success to demonstrate effective risk management and improve access to capital e.g. favorable financing terms

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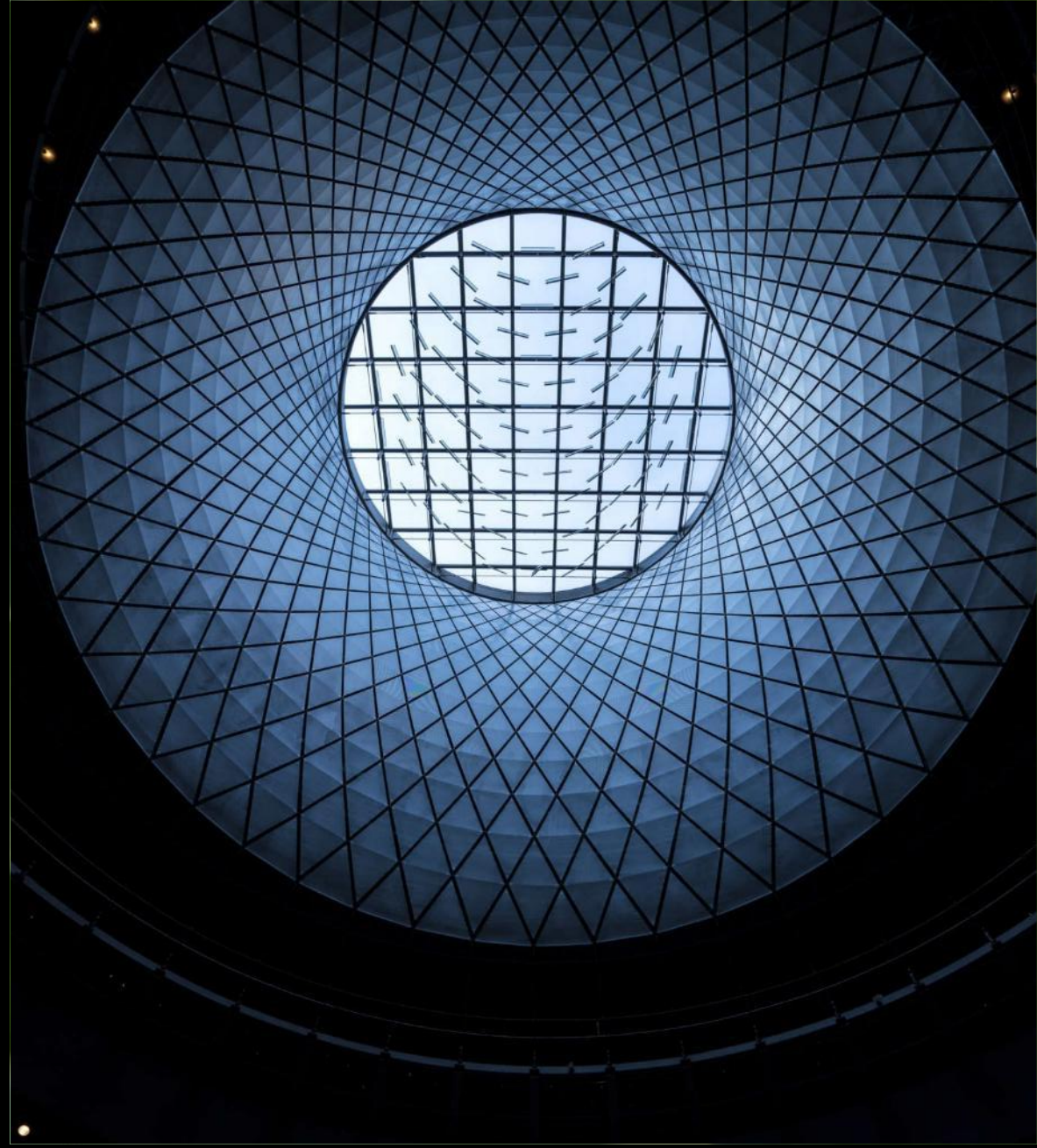

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