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CLIMATE TECH FOR INDUSTRIAL DECARBONISATION:
The powerful role of insurance

Research summary
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Meeting global climate targets requires industries to adopt a range of new technologies and processes that accelerate their decarbonisation. Substantial efforts are underway to expedite the decarbonisation of heavy industries, such as steel, aluminium and aviation, which contribute to over 30% of global carbon emissions. As climate risks intensify and the window to cap global warming at 1.5°C above pre-industrial levels closes, the need to accelerate the deployment of climate technologies widely and at scale is becoming more acute.

Challenges of deploying climate technologies

Though significant progress has been made in developing innovative climate technologies, most remain in the pre-commercialisation stages. Reasons for this include huge funding gaps, challenges with scaling and scarcity of data on the risks.

Huge amounts of funding need to be deployed annually towards financing climate tech innovation and demonstration. But financing pilot projects from the demonstration and early deployment stages is capital and risk intensive. It is at this stage – the 'Valley of Death' – that many potentially viable technologies die and never make it to market. Closing this gap will require massive amounts of private capital; relying solely on public capital will not be sufficient.

Demonstrating and deploying emerging technologies at scale will also require new ways of doing business as well as changes to traditional commercialisation pathways – specifically, the Technology Readiness Level (TRL) framework (Figure 1), which does not capture many risks that hinder the market readiness of climate tech. Strong cross-sectoral collaboration will be needed to assess and manage risks from very early phases of projects to attract investors, expedite execution and achieve scale.

FIGURE 1: THE TRADITIONAL TECHNOLOGY READINESS LEVEL FRAMEWORK AND VALLEY OF DEATH

Technology stage	Technology Readiness Level (TRL)	
At-scale commercial deployment	9	Wide-scale commercial deployment
	8	Early commercial deployment
Demonstration and early deployment	7	Complete system demonstration in an operational environment
	6	Early field demonstration and system refinement completed
	5	Early system validation demonstrated in a laboratory or limited field application
	4	Subsystem or component validation in a laboraory environment to simulate service conditions
Research and development	3	Proof-of-concept validation
	2	Technology concepts and/or application formulated
	1	Exploratory research transitioning basic science into laboratory applications

Valley of Death

Early engagement of insurance companies' risk engineering teams from TRL 6 could be mutually beneficial for all stakeholders

Source: Modified from NASA[1]

1 NASA 2023.

Benefits of engaging re/insurers from earlier stages

Re/insurers can play a key role in helping to accelerate the deployment of climate tech through the provision of risk engineering services. A Geneva Association survey of insurance C-level executives indicated that early engagement of re/insurers in climate tech projects – from the demonstration and early deployment stages – is critical.

At the industry level, this would enhance data sharing and allow re/insurers to increase their knowledge in this space; facilitate the identification of data needs and monitoring requirements for risk assessment; strengthen collaboration between re/insurers and climate tech stakeholders; give re/insurers exposure to more projects as technologies mature; allow the development of 'pools of projects' for better risk transfer and spreading; help with the identification of tech-specific insurance needs for product innovation; and expedite the development of risk management standards, guidelines and codes of practice.

At the project level, very early engagement of re/insurers would ensure that risks are considered, assessed and managed more holistically to enhance the project's insurability and potentially shorten the due diligence period for obtaining insurance. By getting involved before the project site is selected and approved, re/insurers can provide important feedback on decisions such as where and how to build facilities and what risk mitigation strategies to consider to maximise insurability against extreme weather events.

TABLE 1: ADOPTION READINESS LEVEL FRAMEWORK WITH INSURANCE INCLUDED AS A KEY ELEMENT

Value proposition	Market acceptance
1. Delivered cost Risks associated with achieving delivered cost competitiveness when produced at full scale, including amortisation of incurred development and capital costs, and accounting for switching costs (if any). **2. Functional performance** Risks associated with the ability of the technology solution to meet or exceed the performance and feature-set of incumbent solutions or create new end-use markets. **3. Ease of use/complexity** Risks associated with operational switching costs; the ability of a new user (e.g. individual, company, system integrator) to adopt and operationalise the technology solution with limited training, few new requirements, or special resources (e.g. tools, workforce, contract structures).	**4. Demand maturity/market openness** Risks associated with demand certainty and access to standardised sales & contracting mechanisms (if required), as well as with natural (e.g. network effects, first-mover-advantages) and/or structural (e.g. existing monopolies/oligopolies) barriers to entry in the market(s) to which the technology solution can be applied. **5. Market size** Risks associated with the overall size of the market that can be served by the technology, and the level of uncertainty with which it will materialise. **6. Downstream value chain** Risks associated with the projected path to get the product from a producer to a customer along the value chain (e.g. considering split incentives, technology acceptance, business model changes).

Source: Modified from U.S. DoE[2]

2 U.S. DoE 2023.

Rethinking traditional approaches to climate tech development and financing

Efforts are underway to enhance approaches to climate tech financing and deployment:

- Project finance is increasingly being used to address project complexities and large capital requirements.
- The 'Adoption Readiness Level' (ARL) framework, launched by the U.S. Department of Energy (DoE) as a complement to the TRL framework, identifies 17 risks that hinder market readiness (Table 1).

Affordable insurance solutions are essential for getting climate technologies market ready, securing financing and managing project liabilities. Assessing the insurability conditions and developing insurance solutions for new climate technologies is complex and time consuming. Greater risk sharing among stakeholders in the early stages could lead to the development of structured risk management solutions and better risk allocation among parties based on risk appetite and ability to bear risk, thereby attracting more capital and ensuring optimal risk financing. As technologies mature, deployment increases and standards are developed, insurability will increase, allowing insurers to take a greater share of the overall risk pool. Specific risks may not be insurable through the commercial insurance market and may require other interventions.

Resource maturity	Licence to operate
7. Capital flow & availability Risks associated with the availability of capital needed to move the technology solution from its current state to production at scale, including total investment required, availability of willing investors, availability of associated financial & insurance products, and the speed of capital flow.	**13. Regulatory environment** Risks associated with local, state and federal regulations or other requirements/standards that must be met to deploy the technology at scale.
8. Project development, integration & management Risks associated with the existence of processes and capabilities to successfully and repeatably execute projects using the technology solution.	**14. Policy environment** Risks associated with local, state and federal government policy actions that support or hinder the adoption of the technology at scale.
9. Infrastructure Risks associated with the physical and digital large-scale systems that need to be in place to support, enable, or facilitate deployment at full scale (e.g. pipelines, transmission lines, roads and bridges).	**15. Permitting & siting** Risks associated with the process to secure approval to site and build equipment and infrastructure associated with deploying the technology at scale.
10. Manufacturing & supply chain Risks associated with all the entities and processes that will produce the end product, including integrators, component and sub-component manufacturers and providers.	**16. Environmental & safety** Risks associated with the potential for hazardous side effects or adverse events inherent to the production, transport or use of the technology solution or end product in the absence of sufficient controls.
11. Materials sourcing Risks associated with the availability of critical materials required by the technology (e.g. rare earth and other limited availability materials).	**17. Community perception** Risks associated with the general perception by global and local communities of the technology solution and its risks or impact, whether founded or unfounded.
12. Workforce Risks associated with the human capital and capabilities required to design, produce, install, maintain and operate the technology solution at scale.	
18. Insurability and availability of affordable insurance Risks associated with the lack of data and technical capacity to identify, frame and assess risks of new climate technologies and related insurability conditions; delays with the development of risk management frameworks, standards and codes of practice for project replication; addressing unique insurance needs on a tech-by-tech basis which could delay scaling; and the development and availability of a full range of insurance solutions to meet financing and market needs.	

An Insurability Readiness Framework – Viewing climate tech risks through an insurance lens

To help view the risks of climate tech projects from an insurance perspective, The Geneva Association developed a novel 'Insurability Readiness Framework' (IRF) through multi-stakeholder collaborations. The IRF breaks down risks into seven insurance-relevant categories and demonstrates how they relate to risks identified in the ARL framework (Table 1). These categories are: 1) technology risk; 2) project information and organisation risk; 3) legal, finance and compliance risk; 4) location-specific physical climate risks; 5) business interruption and supply chain risk; 6) long-term risk; and 7) environmental, social and governance risk.

For each of the seven categories, the IRF specifies key issues that need to be considered by climate tech stakeholders when framing risks in their dialogue with re/insurers as well as in the information project developers compile for risk and insurability assessment.

At the strategic level, the IRF will enable more informed conversations among climate tech stakeholders and re/insurers and help identify the most challenging risks from an insurability perspective. It can also help to pinpoint risks that may be uninsurable from a commercial insurance market perspective and therefore require different interventions, such as public-private partnerships or government backstops.

At the project level, transparency around insurance requirements will enable climate tech project developers, their partners and investors to identify and address project risks in a more targeted way to ensure that insurance considerations and risk mitigation strategies are reflected in project design.

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