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De-risking the energy transition

A fresh approach to risk engineering

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Typically, to be bankable a project needs to have an offer of insurance, underwriting the construction phase and then the operational phase, with each phase demanding a different risk focus on the stakeholder's design and solution implementation. So de-risking in the simplest form is exactly that, removing the commercial risk from the investor community and capital providers, so if the technology fails or the project location experiences a NATCAT (Natural Catastrophe) event the investment is protected; to some degree. But how does that look from the insurer's perspective? Of course, the risk remains with the insurance sector. De-risking needs to exist for the entire energy transition ecosystem, with each stakeholder feeling they have acceptable risk exposures.

Energy transition challenges

The global energy transition has created an energy sector where technical solutions are developed, deployed and determined at a pace the sector hasn't historically experienced. Increasingly, the solutions are reliant on multiple different technologies, for example, hybrid systems combining solar, wind, battery storage, hydrogen, and smart grid technologies; some of which are themselves unproven or prototypical. It is both the pace of deployment and the rate at which versions are updated that challenge the insurance sector, as underwriters and engineers react to understand and track the risk exposure.

The principal energy transition challenges are often discussed and debated. These challenges exist within the context of the energy trilemma, itself setting out the challenge of supply reliability, affordability and environmental sustainability. Figure 1 sets out the hierarchy of energy transition challenges. De-risking a project or technology can only be achieved if the insurer has risk-confidence in the project, and that means fully understanding the risk exposure. So how can the insurance sector achieve this?

Technology has historically been judged by the number of operating hours, with gas turbine 'fleet leaders' setting the benchmark and datum, and therefore the accepted risk exposure for insurers; the risk exposure contributing to the commercial terms of the insured. However, when the technology is 'first of a kind' or 'prototypical' insurers have an inherently higher risk exposure as there is insufficient data on technology performance and failure mechanisms.

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To address this, insurers often support development programmes, collaborating with OEMs (Original Equipment Manufacturers) to understand just how a gas turbine (for example) has been modified from one version to the next.

Such an approach allows the insurer to position themselves on the known risks and underwrite the technology accordingly. In addition, the OEMs often provide annual updates on the status of their technology, setting out known technical issues and any RCI (Root Cause Investigations) and advice.

But for some of the technologies at the centre of the energy transition, including with hybrid facility solutions this custom and practice is simply not established, leaving the insurance sector exposed to taking sometimes unquantified risk-based decisions.

The vulnerabilities in design, material selection, manufacturing or operational safety are instrumental in setting insurance policy terms, wordings and sensitivities.

But for some of the technologies at the centre of the energy transition, along with those hybrid technology solutions, this custom and practice is simply not established leaving the insurance sector exposed to taking sometimes unquantified risk-based decisions.

Vulnerabilities in design are key considerations for insurability

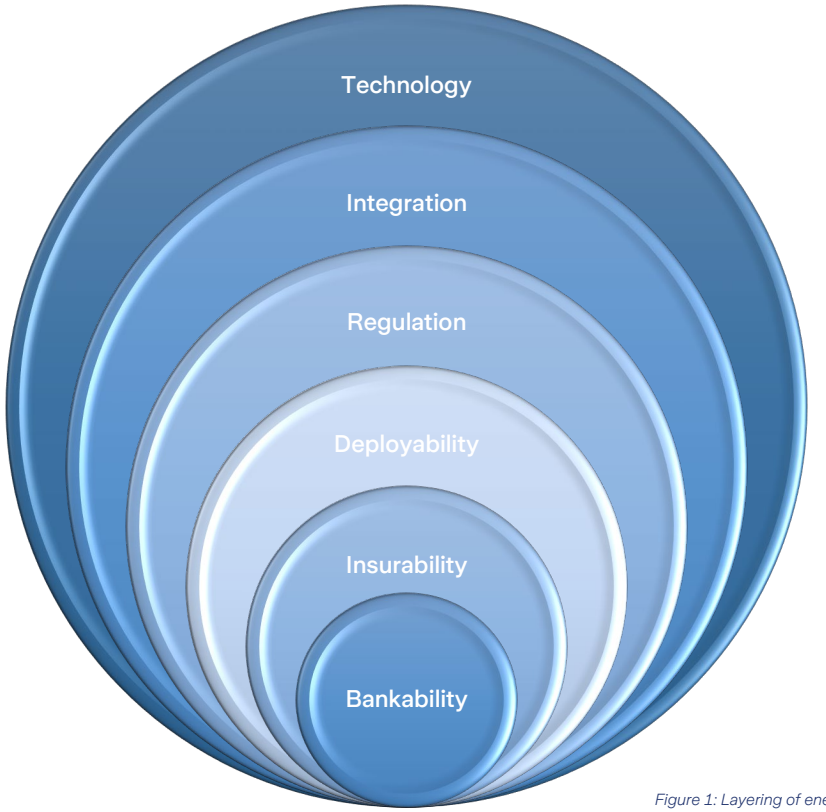

Figure 1: Layering of energy transition challenges

- Adoption of new technologies themselves experiencing a high rate of upgrading that leaves no time to demonstrate operational safety and reliability.
- The integration risk of multiple technologies into a single facility.
- Regulatory challenges where developers, owner operators hold back from investment plans due to a shifting governmental position on country strategies and the impacts to available incentivisation payments.
- Deployment of solutions has been challenged where system infrastructure either isn't available, isn't adequately rated or grid connections are not available.
- Insurability challenges where unproven plant, equipment and facility designs are brought to the market without the operational experience that conventional power generating technologies bring.
- Commerciality challenges from compliance related tariffs through to bankability.

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The rate of change risk

The pace of renewable technologies and hybrid-tech facilities has challenged the risk assessment process, with engineering teams being forced to play catch up in the understanding of the risk exposure.

For example, roughly every 2–3 years OEMs brought into commercial operation more powerful wind turbines. With offshore technology improving from 3.6 MW in 2010 to 14 MW in 2020.

Along the same lines, for hydrogen electrolysers, the past ten years saw a dramatic increase in electrolyser unit size and improvements in performance. PEM (Proton Exchange Membrane) electrolysers in 2014 were in the order of 1 MW to 2 MW per stack and by 2024 standard modules in the order of 5 MW to 20 MW. Full facilities are developed by assembling dozens of the modules to create >100 MW capacities.

When we consider facilities utilising hybrid solution, the integration risk is often the critical point and which no single OEM can mitigate. Hazard identification during design and planned operational phases is critical to developing the optimum controls solution and therefore driving down the risk exposure. There is a requirement here from OEMs (technology providers), but the accountability sits with the EPC or developer, who may or may not have the experience to comprehensively deliver.

We can see therefore how there is a polarised risk position between the requirement to de-risk the energy transition and the risk exposure presented to the insurance sector. If we then consider the nuanced needs of emerging economies, de-risking, through collaborative innovation becomes the principal challenge for the energy transition.

But just how can that be achieved? If insurability of technology and projects is the key to bankability, insurers must have the capacity and ability to understand the technical risk exposure across the transition spectrum. Figure 2 illustrates the how new and hybrid technology solutions are presenting a challenge to insurability.

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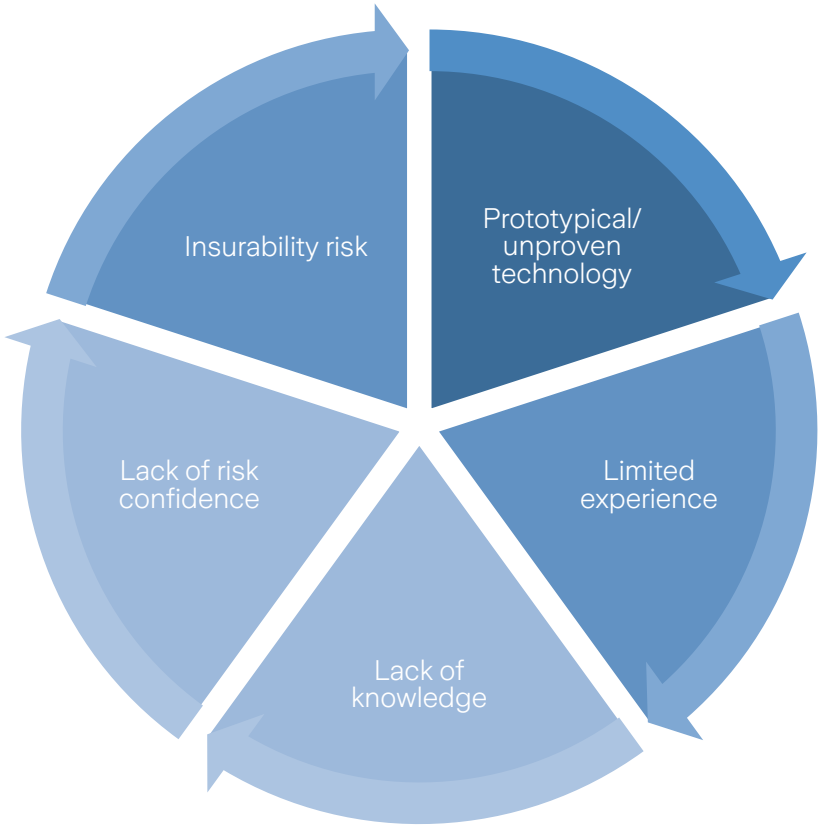


Figure 2: Insurability challenges for de-risking prototypical & unproven solutions

To build confidence, the insurers need to be able to make judgements based on known failure mechanisms.

It's not just about the rear-view mirror

If it isn't through the assessment of operational performance, how can the energy transition be supported through the de-risking of technology and facility solutions? Zurich Resilience Solutions understand that there is no single solution to this dilemma, in fact there are a range of approaches that should be developed and taken forward to drive effective de-risking.

Increasing the integration of the ecosystem is a first step, Lenders, insurers, OEMs, developers, EPCs, all collaborating to produce an insurable solution could remove some of the challenges that exists in demonstrating insurability. The integration could be, for example, at the development phase of new hydrogen electrolyser or a new BESS (Battery Energy Storage System) cell production technique. Insurer's risk engineers would be able to provide advisory input, contributing to a solution that meets the underwriters risk requirements, prior to seeking insurance.

To build confidence the insurers need to be able to make judgements based on known failure mechanisms. To facilitate this, harnessing the dual power of AI and digital twin technology would result in a platform that engineers can run scenario-based failures and observe how technology responds. Driving the digital twin to failure will allow product weaknesses to be identified and recommendations developed.

It is possible to see how AI can provide the point of failure after running repeated operations, driving revised maintenance plans and avoiding unplanned failures. In a similar way, facilities using a Hybrid-tech solution can be testing to see how the control system design responds to out of spec operating conditions.

Essentially, we create a digital HAZID/HAZOP running through the suite of, 'higher than, lower than', scenarios. Protection schemes can be confirmed, with modification to the design created in the moment.

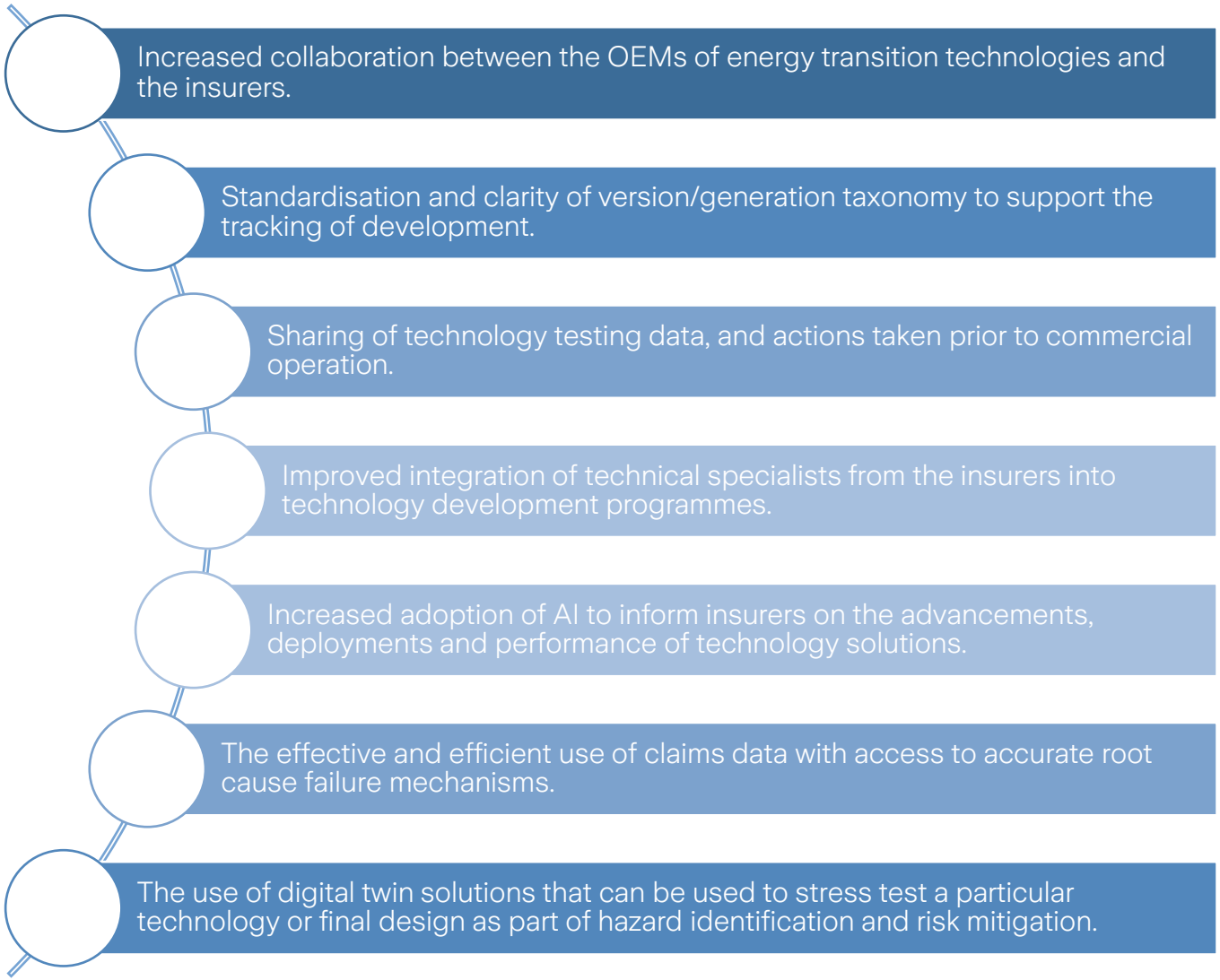


Figure 3: Rethinking the derisking techniques

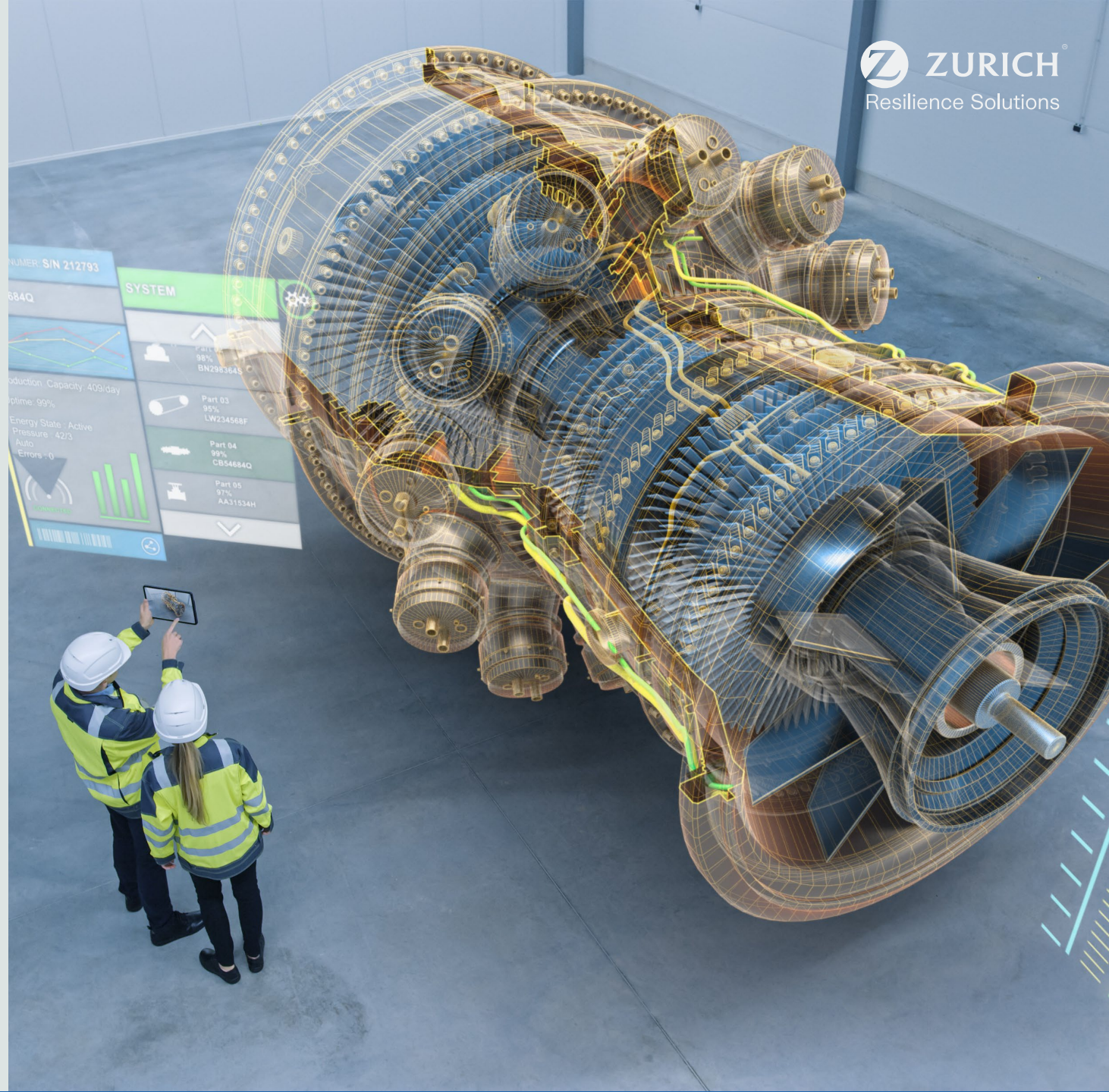
De-risking techniques

The additional benefit from harnessing a digital twin is the ability to prepare the operations and maintenance team, driving simulations on the hybrid-tech facility. It is not unusual to see facilities design with, hydrogen production, storage, liquefaction, BESS, and solar, creating a complex risk profile for the site and presenting an integration challenge for the stakeholders. Where experience is limited, the digital approach to risk and controls can play an essential role.

Optimising the use of known loss events plays a critical role in preventing recurrence, modifying designs and the de-risking of technology development. Different stakeholders hold different parts of the claims puzzle, but that puzzle is never pulled together for the benefit of all. So, it begs the question, how can the sector do this better? And how can AI be used to provide a globally accessible technology claims and events platform, providing up to date information on failures? Just a few years ago such a platform would have been impossible but with the AI revolution, the core technology is there to harvest the information, providing a level playing field for the ecosystem to reduce the risks of their designs.

We can therefore see how the traditional approach to gaining insurance [post development] does not support effective de-risking; when decisions and investments are already finalised.

De-risking the energy transition positions the insurance risk engineering community at the forefront of change and places new requirements on the integration of the ecosystem, remodelling relationships, and rethinking how we assess the energy transition solution risks.



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