Successful Community Infrastructure Risk Management in a Decarbonized Future

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Abstract

It remains uncertain how a decarbonized economy will function and how organizational roles will need to adapt. Irrespective, the climate is forcing a changing risk context, and organizations and communities are in transition, whether actively engaged or not. Managing the emergent risks is critical to a successful transition and community survival. However, it requires a system of systems view. The asset and function-based investment practice does not reflect value. Community transition is complex and persistent efforts to simply aspects in isolation and project familiar models based on no-longer-valid assumptions that overcomplicate the calculus. Successful risk management of community transition to a decarbonized future requires a shared understanding of the outcome across all stakeholders to build a sense of ownership and partnership. Each step in that transition must follow a risk-sequenced progression that is measurable and transparent, ideally independently validated. Community transition risk management relies on social capital and delivers enhanced economic benefits. This article advocates an infrastructure system planning approach instead of an asset-based one.

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Introduction

Our world is changing. We know this; we are experiencing it. Irrespective of what we attribute our changing climate to, we can't deny the effects of more frequent and intense weather events, rising sea levels and catastrophic losses (IBC 2023).

Whether the concern is with flooding, extreme temperatures, intense wind storms, or precipitation, new experiences of extreme weather events defy expectations with the threat of worse weather to come (NOAA). Our design and planning norms are the codification of best practices arising from experience, on the assumption that the future will resemble the past. Amid the profound changes we now experience, the assumptions underlying those codes and standards are increasingly challenged. To quote Yogi Berra, “The future ain’t what it used to be.” One might say that humankind is in a liminal state, collectively on a rolling threshold of change, without knowing what that change means. There is a global recognition that humanity must reduce its negative impact on the planet while protecting health and prosperity. These are the foundations of sustainability.

Sustainability is about protecting the future for the next generation, affording an intergenerational equity of survivability and opportunity (WCED 1987). More prosaically, this is often represented as mitigation (of human impact on the environment), adaptation (protecting against anticipated risks) and resilience (ensuring that capabilities and operations continue despite disruption) to benefit people, planet and prosperity (UN). Each feeds the others and cannot be successfully delivered without them. Each reflects a dynamic of the socioeconomic fabric of communities if they are to survive and thrive. For a community to be sustainable and successful, these risks arising from change need to be managed into the future so the community will reliably continue.

Decarbonization is a core international mitigation thrust, specifically in energy (IEA 2021). It supports economic adaptation and resilience through greater diversity of supply and reduced sole source dependence, and it makes good financial sense system-wide. More often than not, decarbonization realizes value chain efficiencies and an overall improvement in productivity and profitability. Note the emphasis on systems rather than assets. Any transition affects the system as a whole, and each change is reflected in the value of the whole. When transition is measured by asset, one can only capture the direct [cashflow] return on investment in a change. When the transition is measured across the system, one sees the impact and the change in the value of the whole; the impact value is an aggregate of each indirect consequence of the particular asset or functional change that stimulates other efficiencies and improvements. To make the right investment decisions that improve the value of a system, one not only needs to understand how the system works, but one also needs an objective, evidenced understanding of the world around and what change means. This is not a new idea. In fact, it’s how infrastructure is planned for socioeconomic development (Hay 2021, CAF). It is worth exploring how infrastructure planning works to examine how it applies to sustainable energy transition and decarbonization at the community level.

Understanding Infrastructure[1]

Infrastructure is the physical manifestation of a system. That system provides a service or capability. The infrastructure simply enables the service, providing the conduits that carry and deliver a resource provided by the service. Similarly, the service supports the community and its socioeconomic fabric. When the infrastructure is a closed network, it can enable equilibrium between consumers and generators (Ostrom 1990). More prosaically, one can define the infrastructure by its purpose. There are three graduations of purpose. The functional purpose is what the infrastructure does, such as a bridge spans a river. The operational purpose is the service or capability the infrastructure enables. To follow the previous example, the operational purpose of the bridge may be to enable timely emergency response to the residents on the far side of the river. Note that other functional purposes could support this operational purpose, such as a ferry though not as effectively. Finally, there is the strategic purpose of the infrastructure, which articulates the desired outcome it supports. Generally speaking, Health[2] is taken as the strategic purpose or outcome and is sometimes referred to as the *unifying purpose*. This layering of purpose is reflected in resilience planning. For example, if the bridge is damaged [and functional purpose compromised], how is the operational purpose still fulfilled?

Purpose also defines value. When a system delivers a service, it is the demand for that service that determines its value. Therefore, an electricity transmission line that costs $1Bn to build yet isn't used has zero value irrespective of the cost. That should be no surprise since the value is defined as function/use divided by cost. Conversely, if infrastructure is viewed as a portfolio of assets, the value of each is defined by its land value. It is the system aspect of infrastructure that changes its financial parameters. The value of a system is represented by the function of the system as a whole, not by its component assets. For example, removing the substation from an electricity supply network compromises the system as a whole unless the function of the substation is first replicated. That means infrastructure must be functionally and financially considered as a whole system in its context, which changes the investment calculations. It fits a basic hierarchy. Infrastructure enables the services upon which the socioeconomic fabric of the community depends. It is the demand for those services that define the value of the enabling infrastructure and its capacity. So, how do we understand these systems?

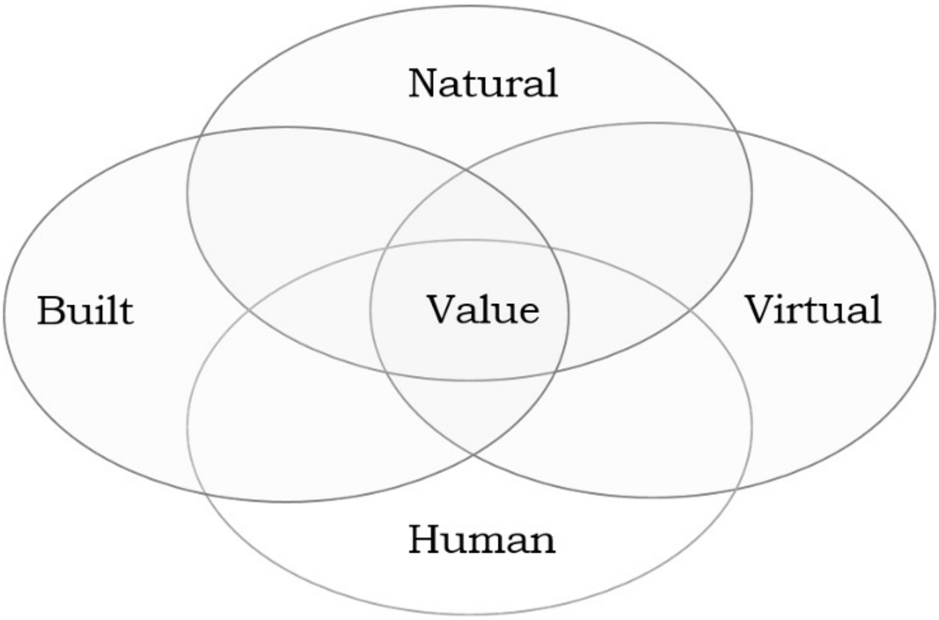

Figure 1. *Illustration of the three domains of infrastructure and their interaction with the human domain to realize value. Reproduced by permission of the author (Hay 2021).*

The infrastructure exists across the three domains, natural, physical and virtual, and interacts with the human domain. It is these domains that provide the foundational evidence upon which our modelling and understanding depend. The natural domain comprises all that exists in nature and is leveraged to enable the service. The physical domain is everything that is built to enable the service, from roads and bridges to the Internet. The virtual domain is what is collectively imagined and believed true, from laws and customs to procedures and money. These virtual things have no intrinsic value but exist because society has a shared belief in their existence and value. The data collected across these domains informs three models. The tableau represents all that physically exists in time and space. The interdependency model describes the service operations and all that each function depends upon to several orders of removal. Each entity in this interdependency model is georeferenced to the tableau so that each action/function is similarly defined in time and space. Finally, there is the governance model that describes the organization and management of the system/operation. It, too, is georeferenced. However, the governance model describes how society says things should work. With stakeholder engagement, mental modelling, and similar tools, the governance model develops into an influence model, providing an accurate description of how decisions are made, why they are made, and the biases involved. (Morgan et al. 2001) Together, these integrated models are known as the common reference. They provide an evidential shared understanding of how something works that can be used by all stakeholders. Having a shared understanding of what exists means that stakeholders can identify what a particular scenario might mean for their particular interests and communicate concerns and proposals to other stakeholders against a shared recognition of consequence and impact. Common reference forms the basis of the vitae system of systems.

The vitae system of systems describes the entirety of the infrastructure-service-community relationship. (Bristow 2015) Critically, it provides insight into how changes to infrastructure, community and services influence the context over time and vice versa. Each change represents the stress of a component and a shift in the risk profile. It also provides an understanding of how the value of the whole changes over time, subject to different influences and risk trends, such as a changing climate or the planned transition to the electric city. (Stewart et al. 2017) There can be little surprise that the VSOS is often viewed as an ecosystem and measured by the flows of energy and other resources through it.

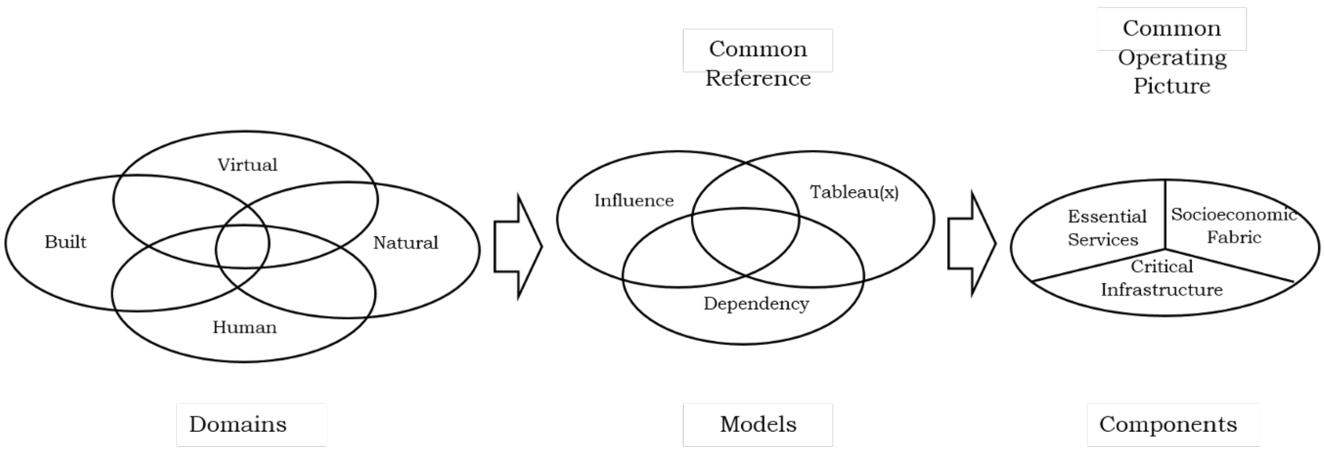

Figure 2. *Illustration of the data flows from collection across the domains to build the common reference models, which inform the VSOS components. Reproduced by permission of the author (Hay 2021).*

Understanding the risks

Risk exists in all changes. The risks can be positive or negative, reflecting a rebalancing of the VSOS. Being an evidenced model, the VSOS can expose the risks arising from any scenario, whether it reflects a planned course of action or the effects of a changing risk context. This risk exposure is not just possible; it is plausible, and the closer one is to the effect, the more probable it becomes. (Gall 2022) Either way, the risks are knowable, as is the mechanism. Consequently, the first analysis of risk in any assembled VSOS is the inherent fragility in the system, that is, the entity that causes a cascade of failure if compromised. Any planned development or transition strategy needs to address inherent risks and fragilities, followed by the incremental treatment of each successive emergent risk prior to its realization. Since each emergent risk has its indicators, one can bundle risk treatments with development objectives in each risk horizon. It means that one can align the key risk indicators (leading indicators of approaching hazards) with the key performance indicators (a measure of progress towards an objective) for each objective. This provides the business with a 360^{o} understanding of progress at any moment in time and ensures the necessary resources are allocated in advance of an emergent risk. This is predictive adaptation.

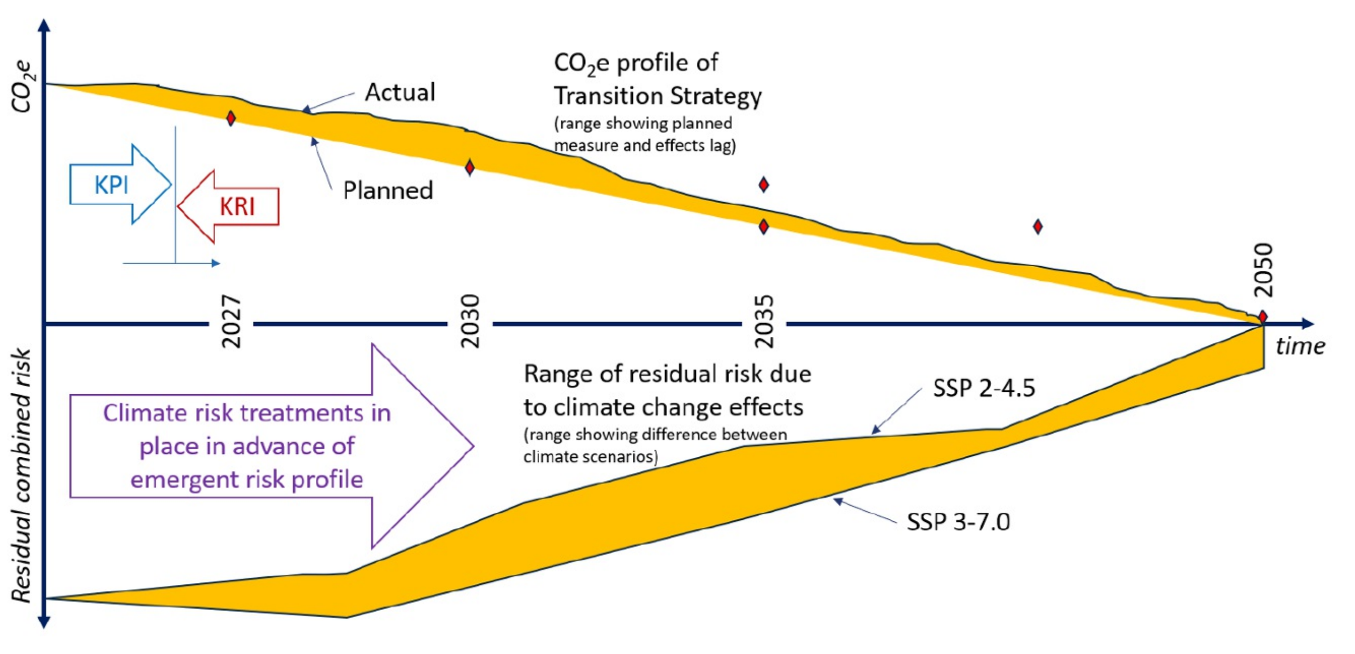

Figure 3. *Example of a measurable climate risk and decarbonization transition strategy. The CO_2e profile above the horizontal axis shows stage objectives with idealized and sequenced decarbonization profiles; the key performance indicators and key risk indicators are aligned by objective to provide 360^{o} reporting. The residual risk profiles for two climate change scenarios are shown against the stage objectives below the horizontal axis. Substantive and transparent business transitions can be measured and independently verified. Reproduced by kind permission of Southern Harbour Ltd.*

In the same process, one can trace the sequence of functional recovery and associated resource burden to assess the business interruption loss exposure. (Hay 2016) Paired with the property loss exposure, the business is now equipped with a full audit trail of evidence and analysis to inform the intelligent transfer of risk with their insurance partners. Aside from enabling development and transition, it demonstrates operational resilience to business clients who can see that essential contracted service will continue even in a crisis. It is the same dynamic that protects against loss and preserves future equity. As Peter Drucker put it, the first fiduciary responsibility is to protect against loss.

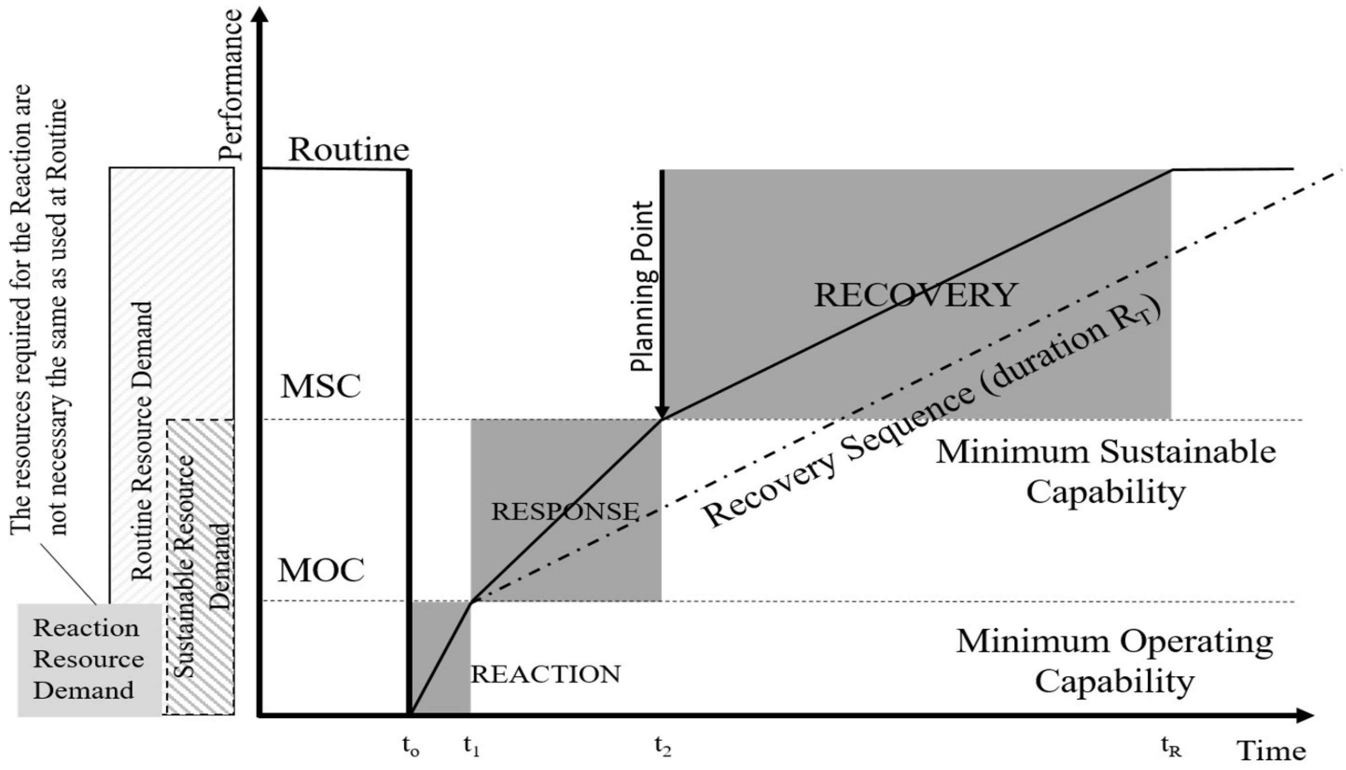

Figure 4. *Illustration of the Incident Sequence. Adapted from (Hay 2016) and reproduced by permission of the author.*

The common reference makes this intelligently and demonstrably possible, cost-effective, and satisfying the ever-stricter material disclosure requirements for financial reporting. Life cycle analysis (LCA) of the CO_2e profile through the full value chain becomes simply another dimension to the VSOS, allowing the user to not only satisfy the recent ISSB international financial reporting standard (IFRS) *S2 Climate-related disclosures* and EU corporate sustainability reporting directive (CSRD), but the proposed and emergent national requirements such as the UK's Transition Plan Taskforce (TPT) disclosure framework or the US Securities Exchange Commission (SEC) directives.

When combined, transition risks and climate risks are integrated into the strategic business development arc to a defined future outcome, affording full tracking, reporting and informed corporate decision-making. However, the VSOS in context describes socioeconomic outcomes, and one can extend the same analysis beyond corporate governance to the environmental and social impact of corporate decisions and changes. This is the essence of *IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information*. While IFRS S2 has become the de facto international norm for financial reporting of climate risks, IFRS S1 is where it's headed.

Understanding cause and effect, however indirect, is one thing; sustainable implementation is another. The delivery of any transition plan needs to be financially, corporately and socially sticky; stakeholders need to have a sense of ownership, and the corporation needs to demonstrate its environmental and social responsibilities to avoid accusations of greenwashing or hollowing equity value. The Roman architect Vitruvius wrote some 2,000 years ago that one should plan to use locally available resources (materials and trades) to reduce costs and recover more rapidly following damage. Today, this concept is known as intelligent resourcing and has proven to be a far more powerful tool than Vitruvius may have realized. Adapting a performance-defined design to what is locally resourceable does not compromise that performance, but it does instill local ownership. It leads to a shared infrastructure future between corporations and the community.

Applying intelligent resourcing requires a locally defined approach to development. This is known as beneficial capability. There are three components to beneficial capability. (1) There must be a facility that the locals can benefit from, such as a range of employment opportunities reflecting the corporate needs and community capacities. (2) Those intended beneficiaries must have access to the opportunity to benefit, and (3) they must be capable of benefiting. In some instances, this has included the provision of after-school services so single parents and dual-working parents could benefit without compromising child care. Alternatively, it can be as simple as adjusting shifts to align with school programming and providing a minibus service to collect workers; the corporate cost is negligible, but the community benefit is significant. Such community benefit looks good in annual environmental, societal and governance (ESG) reporting and market goodwill, but it is also the local insurance policy (sic) for when things go badly—influencing whether the community supports the corporation or not. It's the difference between a corporation surviving a catastrophe and not. When the bottom line is calculated across the enterprise, the argument is inescapable but opaque to those locked in an asset/function-based calculation of return on investment. So what?

Compliance & Ownership

All publicly listed corporations are subject to financial reporting standards that provide shareholders and potential investors with a material understanding of the corporation's financial position and risks. Increasingly, municipalities and public bodies are committing to climate-related disclosures to demonstrate responsible stewardship on behalf of the tax-payer. There is a similar reputational benefit for privately owned corporations to demonstrate good citizenship and an alignment of principles with the market and their customer base. One can view financial reporting through a pure compliance lens, to be undertaken only when legally obligated. Conversely, these reporting standards reflect little more than the type of evidence collection on performance and risks ordinarily associated with a high-performance organization.

Actively investigating, measuring, understanding and managing the inherent and emerging risks to the enterprise is the basis of that first fiduciary responsibility. While it is certainly true that some fear an evidential approach because it may not support their narrative, a common reference does establish a shared understanding of the current situation and the consequences of action/change. Therefore, any transition plan is demonstrably informed and transparent to all stakeholders. That is the basis of successful community infrastructure risk management; all stakeholders having a shared understanding of risk and benefit, cost and outcome. Decarbonization, which is the global socioeconomic aspiration and trajectory, is simply a future risk context that the community transitions to.

Pulling it Together

In drawing these concept models and risk frameworks together, a consolidated list of prerequisites emerges to enable a successful decarbonization transition. The first is the need for a shared outcome across all stakeholders. Conventionally, one might have said the community implicitly owns the outcome because the council/owner represents them. As Arnstein showed, there is a significant difference between consultation and partnership. (Arnstein 1969) One must involve community stakeholders in developing a shared outcome based on a shared understanding of the current circumstance and emerging requirements, trends and risks. It illustrates the [second] need for an enterprise-wide approach involving operators, owners and beneficiaries. It also exposes the [third] need for a shared digital model that maintains currency and is the authoritative source for development information.

The practicable realization of these prerequisites in a community infrastructure delivery model requires a capable owner (an authority/agency/corporation that can own both infrastructure and an enterprise approach), clear and transparent governance and organization. It is less a question of traditional contract delivery and more about a partnership to deliver the service (operational purpose) over the projected life of the infrastructure. There are various models used to deliver this, most notably with the growing popularity of Project 13, which promotes partnership over transaction to identify and resolve through-life issues.

Project 13 was developed by the [UK] Infrastructure Owners Group under the concept paper "From Transactions to Enterprises." (Crudgington A 2017) It brings together partners in the delivery and through-life operation of the project as core to the enterprise; each incentivized to optimize performance to collective benefit and outcome. It resembles integrated project delivery in certain aspects but has greater emphasis on the broader stakeholder identification and ownership of the beneficial outcome. This emphasis reflects a growing interest in care ethics and its success in sustainable development applications. (Gardiner & Thompson 2017) The realization of successful community risk management is less about one model approach or another, as it is about the essential components that make it sustainable.

Conclusion

Many of the issues that impede our transition to a low-carbon economy and the associated health, social, economic and environmental benefits it entails centre on our asset focus. Assessing the direct return on investment one item at a time leads nowhere since the consequences, positive and negative, are represented across the system. It needs a holistic view, which is complex. Using evidence to understand the nature of the issues in context allows us to see a mutually beneficial way forward that achieves the shared outcome. A shared outcome is the essential building block of community ownership, without which community transition cannot be sustainable. The *how* of infrastructure delivery in any transition strategy is as important, if not more important, than *what* is delivered.

We need a common reference, we need systems thinking, and we need clarity of purpose. Breaking complexity into simplified pieces makes the whole excessively complicated. We need to accept that we are dealing with complex systems and model accordingly. After all, it's just a different calculus from the one we are familiar with. The resulting strategy is far simpler and more cost/resource efficient than the asset approach, and it is socially sticky. The result is better for people, the planet and our prosperity, which, ultimately, is what sustainable development is all about.

Footnotes

[1] This section is based on Chapter 2 of Planning Resilient Infrastructure Systems (Hay 2021).

[2] As defined in the World Health Organization charter (1948), Health is physical, mental and social wellbeing, not merely the absence of disease or infirmity.

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