ClimateWise

Insuring a sustainable future

Transition risk framework

Managing the impacts of the low carbon transition on infrastructure investments

Practitioners' Step-by-Step Guide

UNIVERSITY OF CAMBRIDGE
INSTITUTE FOR SUSTAINABILITY LEADERSHIP

ClimateWise

ClimateWise is a global network of leading insurers, reinsurers, brokers and industry service providers who share a commitment to reduce the impact of climate change on the insurance industry and society.

ClimateWise is a voluntary initiative, driven directly by its members and facilitated by the University of Cambridge Institute for Sustainability Leadership (CISL). All members produce a detailed annual report providing evidence of action against the ClimateWise Principles. As of 2019, the ClimateWise Principles are fully aligned with the Task Force on Climate-related Financial Disclosures (TCFD) recommendations.

In 2016, the ClimateWise Insurance Advisory Council was established to lead research into ways the insurance industry can support the transition to a low carbon economy. The Council is formed of a group of C-suite executives from across the ClimateWise membership and is currently chaired by Dominic Christian, Global Chairman, Reinsurance Solutions at Aon.

The University of Cambridge Institute for Sustainability Leadership

The University of Cambridge Institute for Sustainability Leadership (CISL) is a globally influential Institute developing leadership and solutions for a sustainable economy. We believe the economy can be 'rewired', through focused collaboration between business, government and finance institutions, to deliver positive outcomes for people and environment. For over three decades we have built the leadership capacity and capabilities of individuals and organisations, and created industry-leading collaborations, to catalyse change and accelerate the path to a sustainable economy. Our interdisciplinary research engagement builds the evidence base for practical action.

Rewiring the Economy

Rewiring the Economy is our ten-year plan to lay the foundations for a sustainable economy. The plan is built on ten interdependent tasks, delivered by business, government, and finance leaders co-operatively over the next decade to create an economy that encourages sustainable business practices and delivers positive outcomes for people and societies.

Publication details

Disclaimer
The opinions expressed here are those of the authors and do not represent an official position of their companies, CISL, the wider University of Cambridge or clients.

Authors and acknowledgements
The study design and editorial process was led by Dr Tom Herbstein, Rachel Austin, Amy Nicholass, Dr Bronwyn Claire and Kajetan Czyz with input from Adele Williams and James Cole at the University of Cambridge Institute for Sustainability Leadership.

The authors of this report and the accompanying framework were Tara Schmidt, Charles Allison, Molly Iliffe, Max Crawford and Ivet Manolova at ERM, with input from colleagues James Stacey, Alex Cox and Lee Solsbery. We are grateful for the guidance of the ClimateWise Insurance Advisory Council and for the advice and feedback received from members of the Advisory Panel which was established for this project. With special thanks to Finance Dialogue for their support.

ERM
ERM (www.erm.com) is the largest global management consultant with a core focus on sustainability. ERM's deep experience of supporting client companies to prepare for climate change and low-carbon transition led to it being invited to author the TCFD Technical Supplement on scenario analysis.

Reference
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Executive summary

"With better information and risk management as the foundations, a virtuous circle is being built with better understanding of tomorrow's risks, better pricing for investors, better decisions by policymakers and a smooth transition to a low carbon economy."

Mark Carney, Chair of the G20 Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD) and Governor of the Bank of England; April 2018.

The transition to a low carbon economy carries both risk and opportunity and could unfold gradually over time or through sudden shocks. Transition risks include policy changes, reputational impacts, and shifts in market preferences, norms and technology. Transition opportunities include those driven by resource efficiency and the development of new technologies, products and services, which could capture new markets and sources of funding. These risks and opportunities vary across geographies, sectors, time horizons and in line with government and business commitments to limit global temperature rises.

In today's low-interest-rate environment, investment in infrastructure offers stable income and portfolio diversification. However, several types of infrastructure asset are likely to be exposed to significant transition risk, with implications for financial returns. Further, infrastructure will need to play a key role in delivering a lower carbon economy. This exposure could grow significantly in the decade to 2030 as the market recognises these emerging risks and opportunities. This is particularly true in a 2°C scenario, in which more aggressive government policies and more rapid changes in technology and markets move the global economy away from business-as-usual to limit as far as possible global temperature rise. Consequently, investors will be under increasing pressure to enhance their capabilities to manage transition risks and capture opportunities from the transition to a low carbon economy.

The ClimateWise Transition Risk Framework helps investors and regulators manage risks and capture emerging opportunities from the low carbon transition. This unique framework was developed through the ClimateWise Insurance Advisory Council, and builds on the recommendations from the Task Force on Climate-related Financial Disclosures (TCFD). The ClimateWise Transition Risk Framework is designed to help investors to:

1. assess the breadth of asset types exposed to transition risk and opportunity across an investor's portfolio (across different sub-sectors, regions and time frames)
2. define the potential financial impact from the low carbon transition down to an asset level
3. incorporate transition impacts into their asset financial models.

The framework is set out in three steps, which can be used independently or combined to explore transition risks and opportunities. Each of the three steps highlights practical actions investors might take in order to manage risks and capture opportunities. The framework applies this analysis to an array of global infrastructure asset types.

By applying the framework, investors will benefit from an enhanced understanding of how the costs and revenue drivers of assets within their portfolios could be impacted by the low carbon transition. This should lead to beneficial outcomes for investors: an increased ability to manage risk, to capture opportunity and (in alignment with the TCFD) to disclose the impact of transition risk.

Investors can use and adapt the framework in multiple ways, depending on their specific needs. To demonstrate the practicality of the developed methodology, the framework has been applied to three real-life portfolios. This includes the portfolios of two of the world's largest insurance companies and one of the global top five investors in infrastructure. Feedback from regulatory bodies and industry stakeholders has been used to confirm that the framework is applicable to a broad range of investments.

While this report focuses on the application of the framework to infrastructure portfolios, the approach could be adapted to have wider applications across the financial community. It could also be expanded to cover physical risks and a greater variety of low carbon transition scenarios.

ClimateWise members 2019

Contents

Forewords

Dominic Christian

We convened the ClimateWise Insurance Advisory Council to help understand the increasingly complex nature of risk affecting the financial services sector.

Our aim is to inform stakeholders of the true nature of the 'physical', 'transition' and 'liability' risks affecting our industry while identifying ways that insurance expertise can support other parts of the financial services sector in their response. The ClimateWise Transition Risk Framework is one of the first of our outputs.

The G20's Global Infrastructure Hub estimates that US$94 trillion will be required globally, by 2040, to meet the world's growing infrastructure needs. Yet it is crucial that this infrastructure both supports our transition to a low carbon future and is financially resilient to the inevitable (social, economic and technological) impacts this transition will bring.

Exposure to infrastructure investments stretches across the financial services sector. Yet few asset owners are truly considering transition risk. This framework provides an open-source model for how infrastructure assets are likely to be impacted. The accompanying Practitioners' Step-by-Step Guide directly supports asset owners to integrate transition risk into their own financial models. We would like to see this open-source ClimateWise Transition Risk Framework be further adopted and developed.

There is no question our industry faces unprecedented challenges, on both the underwriting and investment sides of our business. However, this project highlights how effective the insurance industry can be when working collaboratively on a response.

Dominic Christian
Chair, ClimateWise
Global Chairman Reinsurance Solutions at Aon

Geoff Summerhayes

Climate change – and society's responses to it – are now widely recognised as foundational drivers of risk and opportunity within the global economy.

Over the past two years, I have witnessed a critical paradigm shift in the way financial supervisors and regulators consider climate change as a core prudential risk. Many of the world's leading supervisory authorities and central banks are seeking to build their understanding of how physical, transition and liability risks may affect the safety and soundness of individual firms, and of the sector as a whole. At the global level, the Sustainable Insurance Forum (SIF) is working with the International Association of Insurance Supervisors (IAIS) to explore how climate change poses risks to insurance firms, and how supervisors may seek to respond to challenging issues such as transition risks.

As chair of the SIF, and a representative of a supervisory authority, I recognise the importance of having multi-stakeholder approaches to the climate risk challenge, which will be critical to delivering the innovative solutions that industry and supervisors can draw upon in their efforts to better understand and address climate-related financial risks. The ClimateWise Transition Risk Framework introduces a compelling methodology, and accompanying tools, to help asset owners and managers gain a better understanding of transition risk, and integrate into their own financial decision-making. I welcome the work of the ClimateWise Insurance Advisory Council in facilitating collaboration that can support our collective response to climate risk, not only within the insurance industry, but further afield across the financial services sector.

Geoff Summerhayes
Chair, UNEP Sustainable Insurance Forum
Executive Board Member,
Australian Prudential Regulation Authority

UNEP

ClimateWise Insurance Advisory Council (2018)

Dominic Christian	Chair, ClimateWise and Global Chairman Reinsurance Solutions at Aon
Jon Dye	CEO, Allianz UK
Stephen Catlin	Special Advisor to XL's Chief Executive Officer, XL Group plc
Charles Franks	Group CEO, Tokio Marine Kiln
Patrick Tiernan	Managing Director, Aviva Global Corporate & Specialty
William McDonnell	Chief Risk Officer, RSA Insurance Group
Rowan Douglas	CEO for Capital, Science and Policy Practice, Willis Research Network, Willis Group
Alex Hindson	Chief Risk Officer, Argo Group International Holdings, Ltd
Huw Evans	Director General, Association of British Insurers (ABI)
John Parry	Chief Financial Officer, Lloyds
Martyn Parker	Chairman Global Partnerships, Swiss Re
John Scott	Chief Risk Officer, Zurich Insurance plc
Simon Beale	CEO, MS Amlin
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Steve Weinstein	Group General Counsel and Chief Compliance Officer, RenaissanceRe

With thanks to previous representatives of the ClimateWise Insurance Advisory Council.

Maurice Tulloch	Chair of ClimateWise (2015-2017), CEO International Insurance, Aviva
Scott Egan	Chief Financial Officer, RSA
Charles Philipps	previously CEO, MS Amlin

ClimateWise Transition Risk Advisory Panel

Andrew Davison	Senior Vice President, Project and Infrastructure Finance, Moody's
Jon Duncan	Head of Responsible Investment, Old Mutual
Franz Fuerst	Reader (Associate Professor) in Housing & Real Estate Finance, University of Cambridge
Santosh Pandit	Senior Technical Specialist, Bank of England, Prudential Regulation Authority
Alexander Novistskiy	Lead Data Scientist, Prudential Regulation Authority
Cedric Pacheco	Manager, Association for Financial Markets in Europe (AFME)

ClimateWise Transition Risk Framework

The ClimateWise Transition Risk Framework is aligned with the Task Force on Climate-related Financial Disclosures (TCFD) recommendations and can support investors in assessing climate-related financial risks and opportunities from the portfolio to the asset level; informing their investment strategies; and preparing their climate-related financial disclosures. The following guide provides a step-by-step approach on how to apply the framework.

Using the framework

Investors can apply the framework for assessing transition risk impact in three key steps. While each step can be completed independently to inform investment strategies, investors who undertake all three steps will benefit in gaining a full understanding of the materiality of transition risk and opportunities for their assets.

The process for applying the framework to an investor's portfolio is summarised in Figure 1 below. Companies with a large portfolio of assets are advised to start with Step 1, while companies with a smaller number of investments could start the assessment directly at Step 2.

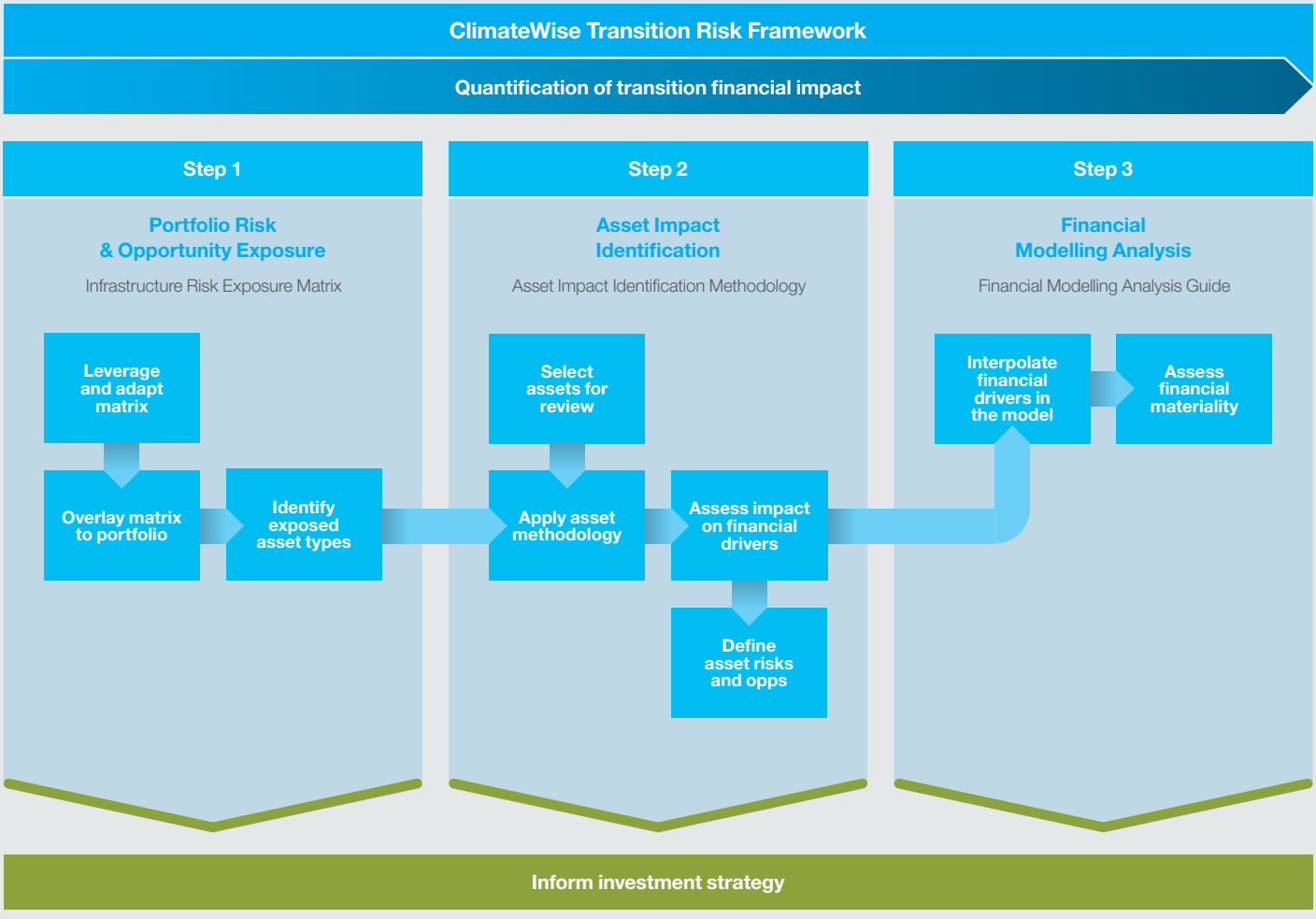

Figure 1: Process for applying the framework

Step 1 2 3
Portfolio risk and opportunity exposure

Step 1 of the framework enables investors and regulators to quickly identify where there could be exposure to material financial risks or opportunities, across a large portfolio of assets. This consists of applying the Infrastructure Risk Exposure Matrix, a tool developed to quantify the transition impact on asset financial drivers (i.e. revenue and costs).

The matrix is also used as a starting point for Steps 2 and 3 of the framework, to define the potential transition impact at an asset-specific level and to incorporate asset-specific financial drivers into a financial model. (See the www.cisl.cam.ac.uk/transition-risk, provided with open-source access to all investor practitioners.)

Step 1(a): Leverage and adapt the matrix

The process followed to leverage and adapt the matrix is summarised in Figure 2 below.

Set the scope	Identify financial drivers	Assess financial drivers	Estimate impact on asset type
Select scenarios; Options to expand coverage to other scenarios, asset types, timeframes and regions	Identify which revenue and cost drivers could be materially impacted by TCFD-defined transition risk	Analyse change in trajectory between business-as-usual baseline and a low carbon transition scenario	Weight the potential impact of each financial driver on asset financial performance

Figure 2: Methodology for Infrastructure Risk Exposure Matrix

Set the scope

Scenarios provide plausible alternative views of how the future could evolve – in this instance, the transition to a low carbon economy. The scenarios are not a 'what if' exercise for one uncertainty, and neither do they assess outcome probability. But rather, they provide a holistic view of potential risk impacts on future investments in infrastructure. A variety of transition risk factors (as defined by the TCFD) are considered: market and technology shifts, regulatory and policy changes, reputational impacts and investor sentiment.

Scenarios can be developed either in-house (eg scenario business planning) or in leveraging publicly referenced scenarios (eg International Energy Agency (IEA), Greenpeace). The latter provides greater transparency to investor stakeholders and potential for shareholder disclosure, and is therefore recommended in the TCFD guidelines.

The matrix is built on the World Energy Outlook (WEO) scenarios developed by the IEA, due to:

1. the transparency as a publicly referenced source
2. the potential as an emerging benchmark for investors and the TCFD, and
3. theiability to provide a holistic view on global market demand, supply, prices and technology shifts across the broad range of energy-intensive sectors.

Where sector-specific data was limited in the WEO, data was sourced from the IEA's Energy Technology Perspectives (ETP) scenarios. Since the WEO and ETP scenarios are based on different modelling techniques, harmonisation across the two data sets was required. Correlations were developed to align data, based on energy supply/demand and carbon emission trends, by geography, sector and sub-sector. (In Step 2 for asset-specific analysis, it was necessary to use a further set of scenario data sets.)

To test a range of views on the pace of low carbon transition, two scenarios were defined for the risk assessment: a less ambitious Paris Agreement scenario (based on achieving current country targets) and a more ambitious 2°C scenario. Data were taken from the IEA scenarios to better understand potential shifts in market demand, supply, prices (eg carbon) and technological advances (eg energy storage capacity).

One benefit of the framework is that it can be adapted to investors' specific needs – and this includes expanding the matrix coverage to other scenarios, asset types, time frames and regions. Investor practitioners can apply the matrix to other scenarios or asset types, provided the scenario data set sufficiently covers indicators for the asset type financial drivers (see following section). Practitioners can also use the Infrastructure Risk Exposure Matrix as a starting point and update financial drivers from their own sources. Alternatively, practitioners can discount assumptions of financial impacts where there is a house view contrary to that of the sources used to build up the matrix. This flexible 'plug-and-play' approach allows users to align the matrix with their world view or to substitute policy-led with event- or technology-based scenarios in assessing impact on asset types. With global scenario data sets, users can typically expand the matrix time frames and geographical coverage – as many provide year-by-year data and cover most geographies at a regional level.

Identify financial drivers

For each asset type, financial cost and revenue drivers are first identified based on:

- typical inputs for a financial model of that asset type; and
- where transition risks could significantly impact future asset revenues and costs.

Transition risks have been defined in line with the TCFD transition risk categories: market and technology shifts, emerging policy and legal requirements, mounting reputational pressures and investor sentiment. The impacts on the financial drivers are assessed by comparing the trajectory of a business-as-usual baseline to the transition scenarios (Figure 3).

Transition and physical risks on financial performance		Transition scenarios and baseline
Market and Technology Shifts Policies and investments to deliver a low carbon emissions economy. • Reduced market demand for higher carbon products/ commodities • Increased demand for energy efficient lower carbon products and services • New technologies that disrupt markets	**Reputation** Growing expectations for responsible conduct from stakeholders, including investors, lenders and consumers. • Opportunity to enhance reputation and brand value • Risk of loss of trust and confidence in management	**Business as Usual** • Basline to compare against the low carbon transition scenarios • Based on the IEA WEO Current Policies scenario, and ETP 6DS scenario for transport • IEA states the baseline is roughly in line with IPCC (RCP8.5) scenario of 3.7°C (mean) global warming by 2100
Policy and Legal An evolving patchwork of requirements at international, national and state level. • Increased inpit/operating costs for hugh carbon activities • Threats to securing licence to operate for high carbon activities • Emerging concern about liabilities	**Physical Risks** Chronic changes and more frequent and severe extremes of climate. • Increased business interruption and damage across operations and supply chains with consequences for input costs, revenues, asset values and insurance claims	**Paris Agreement** • Sets out an energy pathway consistent with the nationally determined contributions (NDCs) from signatory countries • Based on the IEA New Policies scenario, and ETP Reference Technology scenario for transport • Forecasted to limit global warming to 2.7°C **2°C scenario** • Constrains to within a 50% probability global warming to 2°C, by limiting concentration of GHG to ~450 ppm CO2 • Based on IEA WEO 450 scenario, and ETP 2DS scenario for transport

Figure 3: Transition risks to financial performance, defined by the variation in baseline key assumptions and transition scenarios
Source: G20 Financial Stability Board Task Force on Climate-related Financial Disclosures; Technical Supplement authored by ERM

An illustrative list of financial drivers impacted by transition risk is shown in Figure 4 below.

Financial impacts	Transition risk	Financial drivers
Revenue	Market and technology shifts	Consumer and market demand (eg number of cars on the road)
CapEx	Emerging policy and legal requirements/ Mounting reputational pressures	Property, plant or equipment related costs (eg emission reduction technologies)
OpEx	Emerging policy and legal requirements	Regulatory and compliance costs (eg emissions monitoring, carbon pricing)

Figure 4: Examples of financial drivers impacted by transition risk

Quantify financial drivers and estimate impact on asset type

Once the financial drivers have been identified, the impact on the particular asset type can be assessed following the methodology outlined below.

Risk impact			Region	Trend		
Financial category	Financial driver	Methodology	Scenario indicator & data set	2020	2030	2040
Revenue	Plant utilisation	(1) Quantify changes in coal-fired power demand (IEA Paris Agreement (PA) vs BAU scenarios) to determine macro risk	Coal-fired power demand (IEA WEO NP vs CP) decreases by more than 25% by 2040, as coal is squeezed by continuing strong demand for natural gas and increasing uptake of renewables and nuclear			

Figure 5: Quantifying the transition impact on financial drivers

1. Assess the potential impact on each asset type's financial driver (eg one revenue driver for a coal-fired power plant is plant utilisation) by calculating the difference in the trajectory between a business-as-usual baseline and the low carbon transition scenarios using the scenario indicators and data sets as illustrated in Figure 5.

2. Define the scale of positive/negative impact on each financial driver, based on changes to the scenario indicator (eg coal-fired power demand in a region or country):

   Low carbon scenario vs business-as-usual impact on scenario indicator

   - High negative impact on the financial driver
   - Medium negative impact on the financial driver
   - Low negative impact on the financial driver
   - Minimal impact on the financial driver
   - Low positive impact on the financial driver
   - Medium positive impact on the financial driver
   - High positive impact on the financial driver

3. Assign risk weighting on the estimated relative contribution of each financial driver to the financial performance of each asset type:

   Financial driver contribution to asset financial performance:

   - High
   - Medium
   - Low

   Note: The risk weighting used in the Infrastructure Risk Exposure Matrix represents an initial view of the importance of the financial driver to the overall asset financial performance, based on a simplified financial model for a generic asset. Therefore, the weightings have to be validated once Step 3 of the framework – Interpolate financial drivers in the model – is completed.

4. Classify the overall exposure from transition risks and opportunities on the asset financial performance, based on cumulative net impact of the drivers associated with each asset type, for each region, scenario and timeline.

   Risk/Opp

   - High Opp
   - Medium Opp
   - Low Opp
   - Minimal
   - Low Risk
   - Med Risk
   - High Risk

Illustrative example

Typical inputs and the use of scenario data in assessing risk (and opportunity) exposure for a specific asset type in a specific geography are shown in Figure 6 below.

Asset Types	Risk Impact					India	Trend			
	Impact Category	Financial Driver	Transition Risk Impact 2C vs BAU scenarios	Methodology	Definitions	Scenario Indicator & Dataset	Comments	2020	2030	2040
Toll roads	Revenue	**Rev - Passenger demand**	Rising or falling number of car journeys on the toll roads	(1) Quantify changes in passenger kilometres (IEA 2C vs BAU) to determine macro risk	Toll road revenue is driven by the number of car journeys on the road in a year, which could be impacted by changes in transport patterns including: a rise in mass transit demand, uptake in electric vehicles, autonomous driving technology and/or the sharing economy	**IEA ETP** Total passenger kilometres travelled per year	India faces a rapid increase in private car ownership; however, under the 2DS scenario some transport demand will shift to the rail sector, driving a 30% fall in total kilometres travelled by road (IEA 2DS vs 6DS)			
		Rev - Freight demand	Freight tonne kilometres impacted by changes in transport patterns	(1) Quantify changes in freight tonne kilometres (2DS vs 6DS scenarios) to determine macro risk	Toll road revenue is also driven by freight transport on the road in a year, which could be impacted by changes in freight transport (e.g. via rail or shipping)	**IEA ETP** Total freight tonne kilometres per year	Some transport demand will shift to the rail sector in the 2DS vs 6DS, driving more than a 15% fall in freight tonne kilometres per year by 2040			
	Cost	**CapEx & OpEx - provisions for lower carbon transport**	Capex/opex costs linked to shifts in new, lower carbon transport patterns	(1) Assess the affect of low carbon transport policies on investment in toll roads	Any additional cost is assumed to be negligible (and could be offset with toll road price); where there is a substantial fall in demand, revenue losses could be potentially offset with reduced need for operations and maintenance costs					

Financial driver contribution to asset returns:
High Medium Low

Scenario vs BAU impact on financial driver:
High Risk Med Risk Low Risk
Minimal impact (<10%) Low Opp (10-25%) Med Opp (25-50%) High Opp (>50%)

Figure 6: Illustrative example of the inputs for the Infrastructure Risk Exposure Matrix assessment on toll roads in India

Step 1(b): Overlay matrix to portfolio

Use the Infrastructure Risk Exposure Matrix to determine which asset types within the investor portfolio are likely to be exposed to the highest degree of transition risk and/or opportunity (Figure 7).

Infrastructure investment										
Transition risk by infrastructure type				Paris Agreement (NDCs)			2°C Scenario			
Sector	Sub-sector	Geography	Asset Types	2020	2030	2040	2020	2030	2040	
Power Generation	Renewables	EU	Utility-scale wind and solar farms	Low Opp	Med Opp	Med Opp	Low Opp	Med Opp	Med Opp	
Power Generation	Renewables	US	Utility-scale wind and solar farms	Low Opp	Med Opp	Med Opp	Low Opp	Med Opp	High Opp	
Oil & Gas Infrastructure	Gas	EU	Gas distribution infrastructure	Low Risk	Med Risk	Med Risk	Med Risk	Med Risk	High Risk	
Social	Buildings	EU	Hospitals, schools, nursing homes, military	Minimal	Minimal	Minimal	Minimal	Minimal	Minimal	
Transportation	Mass Transit Systems	EU	Railways, subways, trams (excludes buses)	Minimal	Minimal	Minimal	Minimal	Minimal	Low Opp	
Transportation	Roads	EU	Toll roads	Minimal	Minimal	Minimal	Minimal	Minimal	Low Risk	
Transportation	Roads	US	Toll roads	Minimal	Minimal	Minimal	Minimal	Minimal	Low Risk	

Figure 7: Key outputs from application of portfolio-specific assets to the Infrastructure Risk Exposure Matrix

Case study: portfolio risk and opportunity exposure

Overlaying the matrix with a company's portfolio of assets (risk level and asset value) shows how the potential risk and/or opportunity exposures could significantly increase through time and with the pace of change in a low carbon transition scenario.

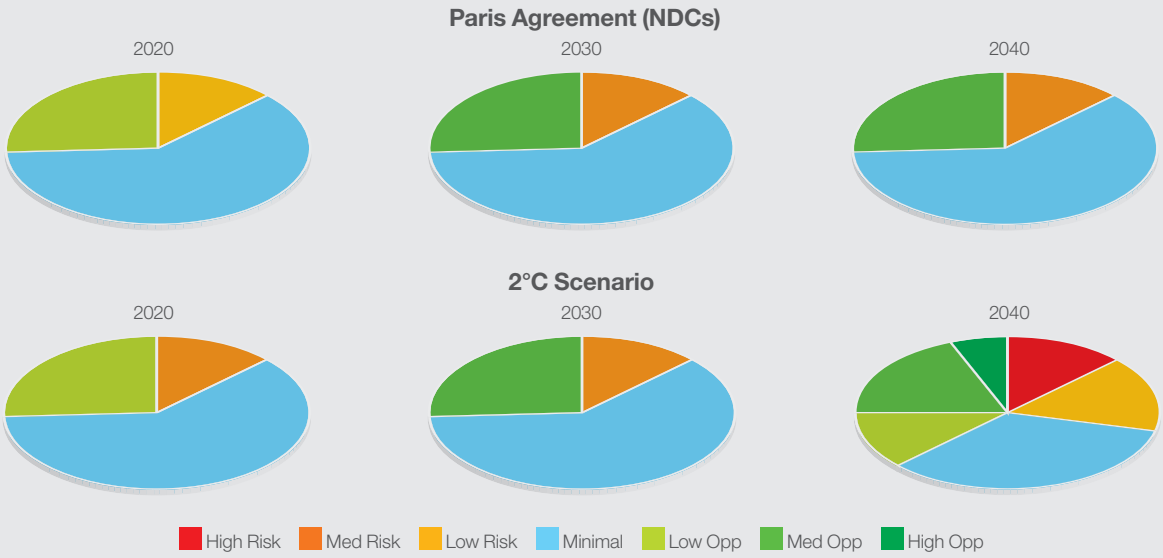

Figure 8: Overlaying the matrix to an investor portfolio identifies transition risk and opportunity exposure over time

Step 1(c): Identify exposed asset types

Identify the assets from the portfolio that are highlighted as having high financial risk or opportunity accounting for transition risk and material value in the portfolio. The results can be used to: (1) inform future portfolio investment strategy – including allocation of funds or divestments – and (2) select assets for more granular assessment in Steps 2 and 3 of the framework.

Step 1 2 3
Asset Impact Identification

Step 2 allows asset managers and owners to assess the financial impact from the low carbon transition at an asset-by-asset level. This provides insights on ways to improve asset resilience.

Risks vary considerably between assets of the same type, depending on their geography, carbon intensity, technology (eg solar versus wind), and competitive positioning in the local market. Therefore, investors gain significant benefit in conducting asset-level specific analysis.

Step 2(a): Select assets for review

Select assets from the portfolio that are highlighted as having high risk or opportunity, and/or make up a significant part of the portfolio in terms of financial value.

Step 2(b): Apply the asset methodology

Re-apply the methodology outlined in the Infrastructure Risk Exposure Matrix, to assess the impact on financial drivers for the specific asset. Take into account where possible:

- local geography (eg country, or state/province)
- asset carbon intensity (particularly for asset types where the matrix highlights carbon reduction as a key factor)
- technological factors that may come into play (eg solar versus wind in the renewable sector)
- competitive positioning in the market (eg lowest cost provider, government-regulated asset).

Step 2(c): Quantify impact on financial drivers

Where available, use publicly referenced scenarios that can provide more asset-specific insights to analyse potential impact on the financial drivers. For instance, if the asset is in the UK power sector, the UK National Grid and UK Fifth Carbon Budget scenarios could be applied – taking into account technology-driven and specific government policy scenarios.

Step 2(d): Define asset risks and opportunities

Once Step 2(c) is complete, the user can identify which financial cost and revenue drivers for the asset could be most financially impacted. Referencing the key underlying factors from the selected scenario data sets, the user can use this insight to inform investment options to improve asset resilience, or improve portfolio management processes to monitor for emerging risks and opportunities.

Case study: airports in the EU

The Asset Impact Identification Methodology provides the investor with a more accurate, in-depth assessment on the scale of risk or opportunity for a specific asset. Take for instance an airport in Europe. If the selected scenario shows a fall in aviation demand in the EU driven by an uptake in high-speed electric rail infrastructure, then an airport could diversify more into long-haul versus short-haul flights (with the latter more risk exposed).

Alternatively, an airport's competitive positioning could drive a gain in demand, as other airports more focused on short-haul flights are potentially driven to closure.

Infrastructure Risk Exposure Matrix

Sector	Asset Types	Region / City	Details	Risk Impact: Impact Category	Risk Impact: Financial Driver	Risk Impact: Transition Risk Impact 2C vs BAU scenarios	Asset Class Region	Data Sources & Indicators: IEA Regional Assessment	Data Sources & Indicators: Comments	Trend: 2020	Trend: 2030	Trend: 2040	Asset Geography	Comments	Trend: 2020	Trend: 2030	Trend: 2040
Transportation	Airports	[city]	[other details, regarding operation]	Revenue	Rev - flight demand	Decreasing number of flights passing through an airport	EU	**IEA ETP** Total passenger kilometres travelled	Total distance travelled by flights in the EU could be reduced up to 30% by 2040 (IEA 2DS vs 6DS)				UK	While flight demand across the EU is expected to start to decline substanatially by 2030, this airport is expected to be minimially impacted. Given it's location and its surface transport links, it is competitively positioned to capture upside from the risk of rationalisation of airport infrastructure due to falling demand. Additionally, demand for shorter-haul flights are likely to be more negatively impacted by the low-carbon transition (competing against alternative options such as rail) - and put other airports with a focus on shorter-haul flights more at risk.			
						Regulatory and strategic changes to city and intercity networks driving demand for high or low carbon transport options		**IEA ETP 2016** Share of passenger kilometres travelled by air to the total passenger kilometres travelled	Some air travel could shift to high-speed rail (IEA 2DS vs 6DS)					Airport risk exposure would be lower than EU average, leading to smaller changes to market share compared to an average EU airport.			
				Cost	CapEx & OpEx - Emission reduction require-ments	Potential technology improvements in airplanes (to reduce emissions), leading to required investments in the airport infrastructure		**IEA ETP** Investment options to reduce flight carbon intensity	Although improvements in aircraft design could require new infrastructure investments, that change is unlikely in the 2DS scenario					Investment will be required if the ETP 2DS target of 66% decrease in total jet fuel consumption by 2040 (vs BAU) is to be met. This will require investment in fleet renewal and alternative or more efficient fuels. It is unlikely these issues will directly affect an airport's financial drivers.			
					OpEx - Fuel provision for flights	Potential technol-ogy improvements in airplanes fuel requirements, leading to potential increases in providing fuel pro-visions for flights								UK aviation Strategy to 2050 ran a public consultation on sector responses to a range of technological, security, environmental and customer service challenges. The results of this are yet to be published.			

Investment Strategy

CIO Investment Guidance	CIO Investment Strategy	Asset Management Resilience Investment Opportunities
Market leading indicators aligned with the scenario datasets should be developed to monitor the airport asset risk profile. An active monitoring of indicators can help assess the effects from technology shifts on market demand, which could drive a step-change in the transition of this infrastructure type.	This kind of UK airport presents minimal risk to 2040, due to its scale, connection with rail links, and number of long-haul flight routes. However, asset returns could be substantially impacted in the long-term under a 2C scenario - consequently, monitoring is recommended.	While this airport has a competitive advantage to other UK airports in mitigating transition risk, investments to continue to stay ahead of competition would be advisable. One option could include an increase in longer-haul flight routes.

Figure 7: Defining asset impact can uncover differences in risk profile due to local market considerations and opportunities to improve resilience

Step 1 2 3
Financial modelling analysis

Step 3(a): Interpolate financial drivers in the model

Asset managers can incorporate risks to financial drivers of revenue and costs into their own asset financial model, referring to the outputs from the Infrastructure Risk Exposure Matrix, Asset Impact Identification Methodology and the relevant scenario data sets.

Take, for instance, a gas distribution company in Germany. Referring to the Infrastructure Risk Exposure Matrix, there are three key financial drivers that need to be interpolated into the financial model to account for potential transition risk impacts (Figure 8).

Infrastructure Asset Type				Risk Impact		Trend		
Sector	Country	Region / City	Asset Types	Impact Category	Financial driver	2020	2030	2040
Oil & Gas Infrastructure	[Country]	[Region]	High-pressure gas distribution	Revenue	Rev - Utilisation of gas distribution infrastructure			
				Cost	CapEx & OpEx - Emission reduction requirements			
					OpEx - Carbon pricing			

Financial drivers impacted by the low carbon transition for gas distribution company:

- Pipeline utilisation
- Carbon price
- Costly emission reduction requirements

Note: Not all drivers of an asset's revenue and costs are listed in the matrix as they are either not impacted by the low carbon transition or their expected changes are already accounted in another financial driver (eg gas price impact on the asset is incorporated in utilisation changes).

Figure 8: Financial drivers for scenario analysis in a financial model

The potential risk impact on each financial driver in a low carbon transition scenario can be estimated on an annual basis, referring to the methodology provided in the Infrastructure Risk Exposure Matrix and refined where possible to an asset-specific level based on the Asset Impact Identification Methodology (Figure 9). Note: to simplify this example, we have used the matrix which is provided in open-source access to the public (see Infrastructure Risk Exposure Matrix). If the Asset Impact Identification Methodology was used, the user could shift from the EU regional scenario data sets (mainly IEA) as shown in this example, to a more detailed assessment with the European Commission scenario data sets, which provide a focus on Germany at country level.

Risk Impact			Scenario data sets
Impact Category	**Financial Driver**	**Methodology**	**IEA Regional Assessment**
Revenue	Rev - Utilisation of gas distribution infrastructure	(1) Quantify changes in natural gas demand (IEA PA vs BAU scenario) to determine macro risk	**IEA WEO** Natural gas demand (Total Primary Energy Demand)
Cost	CapEx & OpEx - Emission reduction requirements	(1) Review existing government policies and future projections	**National NDCs Paris Agreement Target** Emission reduction requirements and estimated associated costs
	OpEx - Carbon pricing	(1) Incorporate latest views on carbon pricing outlook by country	**Government ETS** Historic data set of carbon pricing; government policy to achieve Paris Agreement target **IEA WEO** Carbon pricing assumption

Figure 9: Potential impact on asset financial drivers is determined using scenarios

Leveraging the methodology provided and scenario data sets, investor practitioners can incorporate the financial drivers most materially impacted by the transition scenarios directly into their own financial models – as depicted in the simplified example in Figure 10 below.

Asset Scenarios: Gas Distribution Asset									
Year ended 31 December	**[Unit]**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Revenue assumptions									
Relative utilisation									
Client base case	**1**		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Client base case	%		100%	100%	100%	100%	100%	100%	100%
Paris Agreement	%		100%	97%	96%	95%	94%	93%	92%
2C Scenario	%		100%	96%	95%	93%	91%	89%	87%
Cost assumptions									
Opex impact of carbon pricing									
Client base case	**1**		**–**	**–**	**–**	**–**	**–**	**–**	**–**
Client base case	EUR million		–	–	–	–	–	–	–
Paris Agreement	EUR million		–	–	–	–	–	–	2.6
2C Scenario	EUR million		–	–	2.9	3.5	4.2	5.0	6.1
Emission reduction requirements (capex and opex)									
Client base case	**1**		**–**	**–**	**–**	**–**	**–**	**–**	**–**
Client base case	EUR million		–	–	–	–	–	–	–
Paris Agreement	EUR million		–	1.7	1.7	1.7	1.7	1.7	1.7
2C Scenario	EUR million		–	1.9	1.9	1.9	1.9	1.9	2.0

Figure 10: Financial drivers can be interpolated into the asset financial model

Step 3(b): Assess financial materiality

Once the financial drivers are incorporated into the model, a key output is the ability to assess the financial materiality of transition risks (and opportunities) for a specific asset. Asset managers and owners could then assess how the low carbon transition could impact a variety of the asset's financial metrics (Figure 11); and leverage the work to consider exit strategies where risk is high, or develop investment options to improve asset resilience.

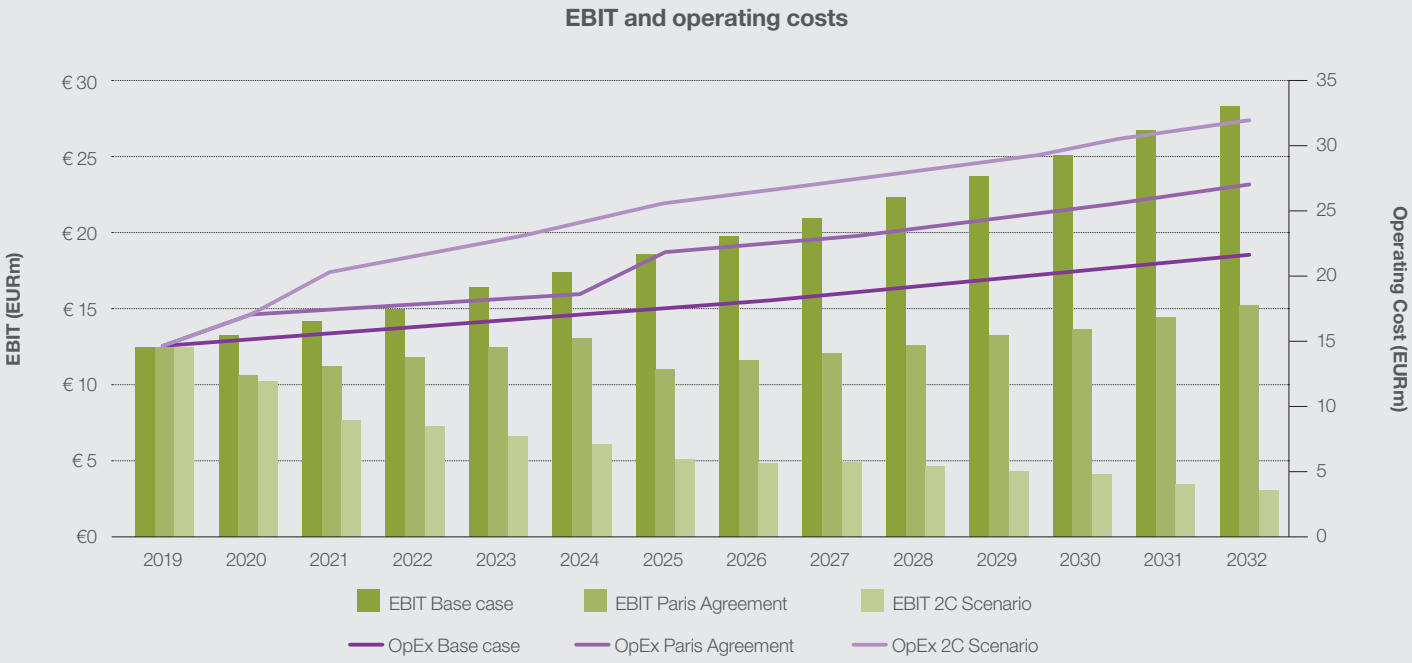

Figure 11: Effect of transition risk on asset returns and costs

Feedback from interviews with regulators, investors and organisations participating in the case studies has indicated how key stakeholders regard the framework, helping to inform investment strategies and risk management:

"If we can efficiently and effectively measure transition risk, we can better manage it. This approach is a good step forward in achieving this."

A major EU regulator

"Transition risk is becoming a material factor; this approach really helps to demonstrate how transition risk plays out at an asset level and what options are available to mitigate the risk. I want to share this framework with one of our asset managers."

One of the world's largest insurance companies

"I love this framework. Portfolio managers will wake up when I show them the potential transition impact on financial metrics."

A multinational bank

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