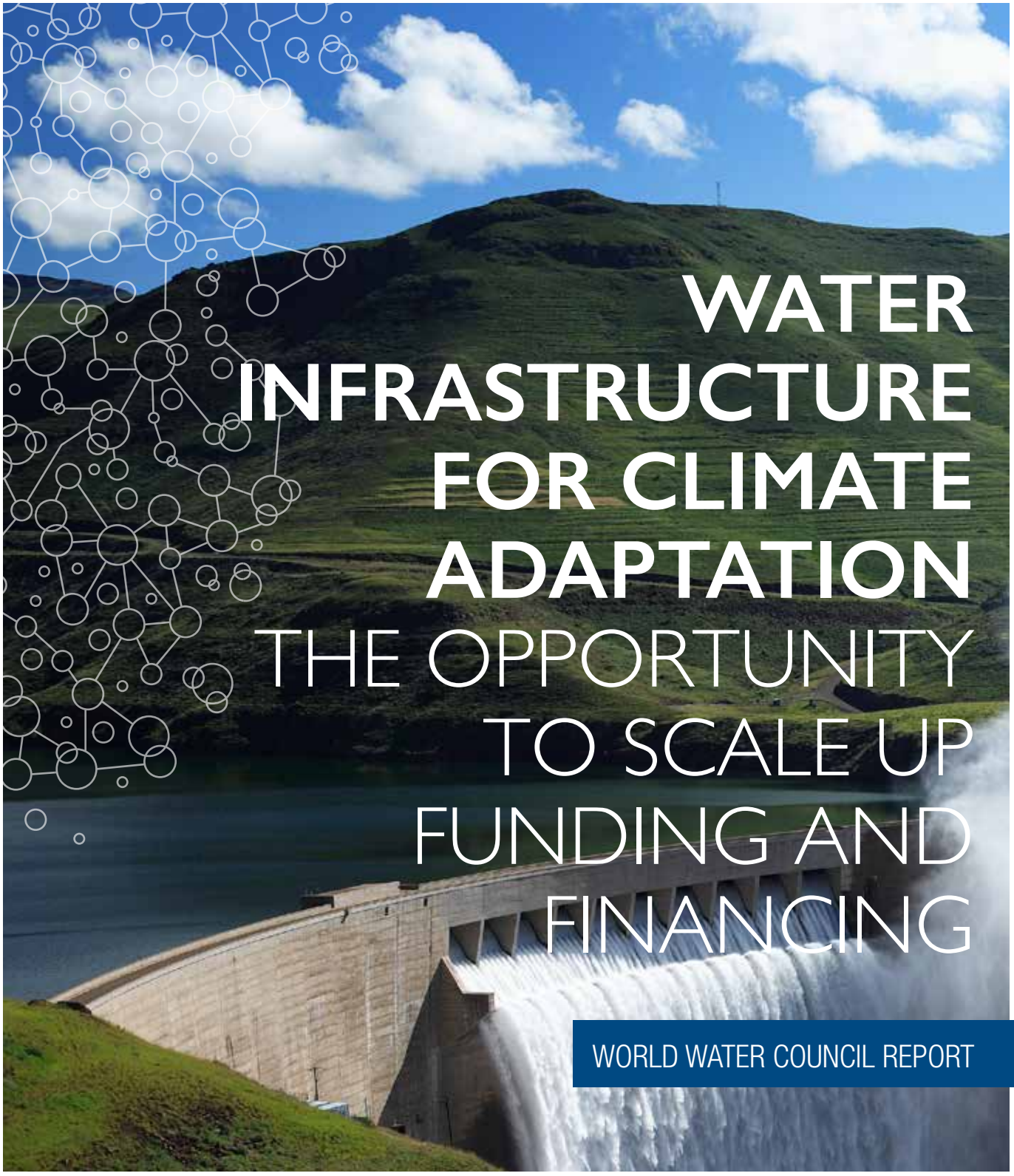

WATER INFRASTRUCTURE FOR CLIMATE ADAPTATION

THE OPPORTUNITY TO SCALE UP FUNDING AND FINANCING

WORLD WATER COUNCIL REPORT

Global Water Partnership

WORLD WATER COUNCIL

The World Water Council is an international multi-stakeholder platform organization, the founder and co-organizer of the World Water Forum. The Council's mission is to mobilize action on critical water issues at all levels, including the highest decision-making level, by engaging people in debate and challenging conventional thinking. The World Water Council, headquartered in Marseille, France, was created in 1996. It brings together over 300 member organizations from more than 50 different countries.
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The Global Water Partnership is an international network that was created in 1996 to foster the implementation of integrated water resources management: the coordinated development and management of water, land, and related resources in order to maximize economic and social welfare without compromising the sustainability of ecosystems and the environment.
The Network has 13 Regional Water Partnerships, 85 Country Water Partnerships, and more than 3,000 Partners located in 182 countries.
www.gwp.org

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WATER INFRASTRUCTURE FOR CLIMATE ADAPTATION

THE OPPORTUNITY TO SCALE UP FUNDING AND FINANCING

REPORT

November 2018

Prepared by
Ben Caldecott

CONTENTS

PREFACE

The climatic impacts will disrupt water supplies and be felt across ecosystems, human communities and economies. Countries and communities with lack of water infrastructure, poor water management and governance will suffer the most as climate extremes are felt through the water cycle. At the same time, even without considering the impacts of climate change, the world is not on track to ensure a secure and sustainably managed water supply for all. Billions of people lack safe drinking water and sanitation facilities, water pollution is on the rise, and water resources systems are under stress.

Investments in water infrastructure are both critical and urgent for countries to adapt to rapidly developing climatic changes and, as we highlight in this report, the current efforts in financing are not enough by far.

Our call does not stop here. Management and governance structures are needed for water systems to address increased variability, reduced predictability, more frequent and intense extreme events, and new hydrological regimes associated with a changing climate. With the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction and the Paris Agreement we have the international frameworks in place to focus our attention. It will now take a coming together of actors to bring a call for investment with the necessary institutional capacity into action.

The past has become an unreliable predictor for the future. Our call for investment into infrastructure thus points to the need to focus on smart and adaptable approaches. We need to look closely at the vulnerabilities that infrastructure investments aim to address, combining infrastructure know-how with the best possible climate science. The resulting investment decisions need to take a step-wise approach that is adaptable and cognizant of the uncertainty humankind faces.

The infrastructure investments we call for have an important climate mitigation dimension, too. Investment is needed in structural and non-structural measures, and both often reduce the energy requirements of other systems. The water–energy–food–environment nexus offers a framework to plan for such co-benefits concisely. Examples are abound in waste water treatment, forestry and agroforestry practices, soil and water conservation measures, and properly scaled bioenergy projects for rural communities.

For these co-benefits to happen and for water infrastructure investments to be targeted and useful, we call, with the release of this report, for an integrated approach that brings together governments, water users and the society at large including the private sector, non-governmental organizations and academia across disciplines and sectors to design smart, adaptable and sustainable solutions.

Benedito Braga
President
World Water Council

Professor Amadou Hama Maiga
Chair of Regional Chairs
Global Water Partnership (GWP)

ACKNOWLEDGEMENTS

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This report was written by Dr. Ben Caldecott, founding Director of the Oxford Sustainable Finance Programme at the University of Oxford Smith School of Enterprise and the Environment; and consultant for this work programme.

Global Water Partnership, the World Water Council and the author thank all the partner organizations and their contractors for their invaluable contributions to the report: the World Water Council Water and Climate Change Task Force members, OECD and AGWA.

EXECUTIVE SUMMARY

Climate adaptation has risen up the agenda globally as facts on the ground change and societies see and feel the impact of climate variability and change. Yet the global climate finance architecture is not currently delivering the scale and pace of funding and finance required.

This must change. New and existing funding models must be scaled up, together with new and existing mechanisms for providing finance.

Water is the predominant means through which the impacts of climate change will be felt. Water Infrastructure for Climate Adaptation (WI4A) is a new term to help bound and foreground a necessary discourse on scaling up action in water infrastructure to support climate adaptation. WI4A are investments designed to increase the climate resilience of water systems whether through entirely new infrastructure, replaced or retrofitted infrastructure, or enhancements and upgrades to existing infrastructure. WI4A includes built infrastructure assets and nature-based solutions of different sizes and at different scales operating in tandem within a water system.

The next two years are essential for shaping new and existing climate initiatives that could support WI4A and help close the acute funding and financing gaps that exist.

The new Global Commission on Adaptation and the UN Secretary General's Climate Summit in 2019 are key. Both processes, and many related ones feeding into them, are intended to help build momentum in advance of the UNFCCC COP26 in 2020. This is five years after the Paris Agreement and levels of climate ambition will be reviewed and revised with the aim of closing the gap between current climate commitments and the well below 2∞C objective. Key to securing these commitments will be demonstrable and significantly increased funding and finance for climate adaptation in developing countries.

Given that these processes are now 'live', we have a window of opportunity to influence them and ensure that the climate finance architecture can support WI4A, particularly in developing countries. There is also an opportunity to shape more established processes and initiatives such as the replenishment of the Green Climate Fund and China's rapidly growing Belt & Road Initiative.

There is a further opportunity to be realised by embedding WI4A within new international processes designed to align the financial system with global environmental sustainability. In many of these forums and initiatives, WI4A is largely absent or entirely missing. As these processes establish themselves, it is important that climate adaptation and WI4A are integrated.

WI4A will require both funding and financing. The funding (i.e. income or cash flows) for WI4A projects can be generated, for example, from user charges and levies on water use, changes in land value, or insurance premiums; local or central government taxation; the trading of water rights; and transfers (such as Official Development Assistance (ODA)).

Financing the cash flows of WI4A can come from a variety of sources depending on the risk profile of projects, where projects are located, and the condition of local and international capital markets. Sources of finance include company balance sheets; equity markets; debt capital markets; bank loans from public, multilateral, or public banks; and government finance.

Funding and financing work together and affect each other. Efficient and low-cost finance reduces the cost of projects and the funding requirement for water infrastructure. While well-structured, predictable, and credible funding streams make it easier to secure low-cost finance. There is a virtuous cycle and positive relationship between the two.

At a global level we unquestionably have both the funding and financing capacity necessary to deliver the required investment in WI4A. Sufficient income exists, and the global financial system has a glut of capital seeking investment opportunities.

The challenge is that while these conditions may hold globally, there are significant variations in the quality and availability of cash flows, particularly in many developing countries. There are also issues with availability (i.e. liquidity) and cost of capital, again in many developing countries, and this can make it extremely hard or impossible for WI4A projects to succeed.

To scale up funding and finance for WI4A and to improve the quality of existing efforts, we recommend that a variety of activities are undertaken concurrently, including the following:

1. The multilateral climate finance architecture needs to consider how to scale up funding and finance for water infrastructure that can support climate adaptation. **WI4A should be a specific theme within the Global Commission on Adaptation and should be part of the Climate Resilience stream of the UN Secretary-General's Climate Summit in 2019 being led by the UK Government.** As well as ensuring that WI4A is a specific theme within the Global Commission on Adaptation's final report, the international water policy community should offer to undertake activities as part of its Year of Action.

2. **Basin-level funding and financing plans are required for climate adaptation and WI4A.** These should be detailed plans setting out built infrastructure and nature-based solution investment requirements at a basin-level and their funding needs. Multilateral developments banks, particularly regional development banks (e.g. Asian Development Bank, African Development Bank, European Bank for Reconstruction and Development, European Investment Bank, and the Inter-American Development Bank) should be tasked with host countries to develop viable financing plans and then work to raise the funding and finance to implement them within three to five years. Companies the use or benefit from more climate resilient water systems have a key role to play in supporting WI4A. **The international water policy community should mobilise companies internationally and in specific basins to actively support basin-level funding and financing plans.**

3. **There is a significant funding gap and the multilateral climate finance architecture should work to develop new funding mechanisms for WI4A. This could include new WI4A results-based payments mechanisms.** These could be created nationally, regionally, or internationally. New market places enabling results-based payments to remunerate WI4A projects and which then underpin financing are absolutely key. A comprehensive programme of pilots and market design work, leveraging existing results-based payments schemes, should be coordinated for WI4A.

4. Hybridity and blended finance could have a key role to play in scaling up the funding and financing of WI4A. It is essential that there are more pilots showcasing how different forms of funding and finance can come together to deliver WI4A projects successfully, with benefits accruing to different stakeholders in the intended way. **Five major pilot WI4A projects pioneering different forms of hybridity and blended finance should be identified and prioritised for support by the climate finance architecture in order to prove concept and demonstrate scalability.**

5. Low cost debt is key for many WI4A projects. This is because WI4A often requires significant upfront capital investment. Ensuring that debt is available at different stages of project development through to operation is fundamental to the viability of projects and the ability of project sponsors to exist projects and recycle capital back into the construction and development phase of other projects, creating a virtuous cycle. **Multilateral funds and development banks, together with national governments, should examine what interventions are required to ensure the smooth refinancing of WI4A projects with low cost debt.** This could entail coordinated purchasing of subordinated tranches of debt from early issuances and/or forms of bond or securities insurance.

6. **The replenishment of the Green Climate Fund is an opportunity to scale up funding and finance for climate adaptation, particularly WI4A.** This is critical for progress to be made on ratcheting up levels of ambition and commitment at COP26. WI4A, given its co-benefits for multiple SDGs [1], would be a natural area for the GCF to expand activities. The GCF has already made investments in WI4A and

these should be reviewed and lessons for the next replenishment and disbursement cycle learnt. **The international water policy community should undertake this work and insert the findings into the GCF process to secure further resources for WI4A.**

7. China's Belt & Road Initiative is a massive investment programme taking place in many of the developing country jurisdictions with the biggest WI4A requirements. **Built infrastructure and nature-based solutions to WI4A should be integrated into efforts to green BRI.** This is potentially a very attractive way for China to show its commitments towards water security , reduce the risk of asset stranding, and secure positive socioeconomic impacts for host countries. **The international water policy community could produce an analysis of WI4A in the context of BRI, highlighting the economic and political opportunity and the very tangible resilience benefits of WI4A for current and planned BRI investments.**

8. In 2020 China is hosting CBD COP15 and this provides an opportunity to explore scaled up funding and finance for both built infrastructure and nature-based solutions as part of WI4A. **COP15 is a major opportunity to align international action on both climate, water and nature, with significant potential prizes for the climate adaptation agenda. This process should be much more actively prioritised in the context of WI4A.**

9. It is critical that all investments are 'water proofed' and that the lock-in of physical climate-related risks are avoided to minimise the risk of future stranded assets. This will require mainstreaming physical climate-related risk assessment into all public and private sector investments. **The water policy community should work with the Central Banks and Supervisors Network for Greening the Financial System to ensure that emerging supervisory theory and practice on climate change and financial institutions takes account of the water risks associated with climate change. It is also critical that these risks are properly disclosed as part of implementation and adoption of the Task Force on Climate-related Financial Disclosures.** The water policy community should be more engaged with the TCFD and the TCFD Secretariat should support this greater engagement.

10. Fiduciaries and company directors have legal duties to manage physical climate-related risks. The water policy community should work with legal theorists and jurists, as well as corporate lawyers, to ensure that emerging guidelines concerning climate-related legal obligations take account of water-related risks associated with climate change. **Options for WI4A that can help meet the legal obligations of fiduciaries and company directors to manage climate change should be identified and associated guidance prepared.** This has the potential to be a very significant driver of demand for WI4A.

11. WI4A can reduce physical climate-related risks and thus reduce insured losses, resulting in lower insurance premiums. This is critical for affordability and increasing insurance coverage, particularly in developing countries. The insurance industry has a key role to play in supporting WI4A. Insurance-linked loans or 'resilience' bonds, where the interest payments are based partly on WI4A investments, and mechanisms to fund WI4A via savings in long term insurance premiums both have significant potential. **The international water policy community can work with insurers and re-insurers and other stakeholders in the insurance community to identify and realise these opportunities.**

12. Capturing increases in land value, partly created as a result of WI4A investments, could be used to fund such investments in the first place. **Land value capture is widely used in many countries and could be tailored to WI4A requirements in developing countries**. This should be urgently explored.

1 SDGs 2 (Zero Hunger), 3 (Good Health and Well-Being), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 9 (Industry, Innovation, and Infrastructure), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), 13 (Climate Action), 14 (Life Below Water), and 15 (Life on Land).

INTRODUCTION

Climate adaptation has risen up the agenda globally as facts on the ground change and societies see and feel the impact of climate variability and change. The last year has seen a growing awareness in part due to recent extreme weather events. This has included Cape Town narrowly escaping 'Day Zero', the prolonged Northern Hemisphere Heatwave, Hurricane Florence, and Typhoon Manghut, among many others.

The recently published Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5ºC highlights how we have already "baked-in" more than 1ºC of average warming globally and that meeting a 1.5ºC carbon budget will require steep reductions in global emissions reaching net zero emissions by mid-century (IPCC, 2018). Adaptation will continue to rise up the agenda as climate impacts increase and will remain a major global concern even if we achieve net zero.

To successfully make our societies and economies resilient to climate variability and change a significant scaling up of investment is required in almost every sector of the global economy. Estimates of the investments needed for climate resilience are large and vary significantly. According to the UNFCCC (2006) the additional investment needed to adapt new infrastructure vulnerable to climate change is estimated at 5 to 20 percent of its cost. The World Bank (2010) estimates that the incremental cost of adapting to a 2ºC warmer world by 2050 is in the range of $75 billion to $100 billion a year.

Yet the global climate finance architecture – encompassing multilateral, plurilateral, bilateral, national, and sub-national mechanisms, institutions, and programmes – is not currently delivering the scale and pace of funding and finance required to ensure either successful climate mitigation or climate adaptation.

This must change. New and existing funding models must be scaled up, together with new and existing mechanisms for providing finance.

This timely report focuses on the climate adaptation part of the challenge, and within that specifically the requirement for water infrastructure. Water is the predominant means through which the impacts of climate change will be felt.

We set out the opportunity for the global climate finance architecture to scale up funding and financing of water infrastructure for climate adaptation (WI4A). WI4A is a new term to help bound and foreground a necessary discourse on scaling up action in water infrastructure to support climate adaptation. WI4A are investments designed to increase the climate resilience of water systems whether through entirely new infrastructure, replaced or retrofitted infrastructure, or enhancements and upgrades to existing infrastructure. WI4A includes built infrastructure assets and nature-based solutions of different sizes and at different scales operating in tandem within a water system.

The next two years are key for shaping new and existing climate initiatives that could support WI4A and help close the acute funding and financing gaps that exist.

The new Global Commission on Adaptation and the publication of its final report in September 2019 is designed to coincide with and support the UN Secretary General's Climate Summit taking place at the same time. Both processes, and many related ones feeding into them, are intended to help build momentum in advance of the UN Framework Convention on Climate Change (UNFCCC) 26th Conference of the Parties (COP26) in 2020. This will be five years after the Paris Agreement and levels of climate ambition will be reviewed and revised with the aim of closing the gap between current climate commitments and the well below 2ºC objective. Key to securing these commitments will be demonstrable and significantly increased funding and finance for climate adaptation in developing countries.

In 2020 China is also hosting the Convention on Biological Diversity (CBD) 15th Conference of the Parties (COP15) and this provides an opportunity to explore scaled up funding and finance for both built infrastructure and nature-based solutions as part of WI4A. COP15 is a major opportunity to align international action on both climate, water and nature, with significant potential prizes for the climate adaptation agenda. Other processes of relevance include the replenishment of the Green Climate Fund (Waslander & Quijano Vallejos, 2018) and China's rapidly growing Belt & Road Initiative (BRI) that is celebrating its five year anniversary this year.

Given that these processes are now 'live', this short report aims to arms actors involved with ideas to scale up WI4A funding and finance. The report proceeds as follows. Section 1 reviews the multilateral climate finance architecture and then explores the opportunities associated with new and existing multilateral processes and initiatives that could create opportunities for WI4A.

Section 2 provides a taxonomy of funding and financing solutions and explains how funding and finance could interact with each other to deliver timely and effective WI4A at the required scales.

Section 3 concludes with recommendations for action. Here we build on other recent work done by the World Water Council and set out some specific recommendations to improve the climate finance architecture so it can support WI4A, particularly in developing countries.

It should be noted that this report is not designed to be a comprehensive review of the literature on climate finance or WI4A. We merely set out quickly and clearly the nature of the challenge, some of the key processes and initiatives (many of which are new) in the climate finance architecture that can improve WI4A outcomes, and identify some effective and practicable solutions.

SECTION I: THE CLIMATE FINANCE ARCHITECTURE

The climate finance architecture is complex and evolving. It encompasses a range of mechanisms, institutions, vehicles, programmes, and activities at multiple scales: multilateral, plurilateral, bilateral, national, and sub-national.

This report focuses on the multilateral climate finance architecture, not least because these processes are active with key dates and decision windows in 2019 and 2020, but also because this helps to guide and inform activities at other scales.

This section begins with a brief introduction to the multilateral climate finance architecture and then explores the opportunities associated with new and existing multilateral processes and initiatives that could create opportunities for WI4A.

MULTILATERAL CLIMATE FINANCE

Multilateral climate finance has so far largely meant the provision of funding and grants for activities in developing countries, rather than the financing of such activities with debt and equity.

The climate finance architecture has developed over the last 25 years through both the creation of new mechanisms and entities dedicated to different aspects of climate mitigation and adaptation, and by making existing institutions better aligned with climate change objectives. The development of the multilateral climate finance architecture can be roughly split into three overlapping phases.

Arguably the first phase for the development of the multilateral climate finance architecture began place in the early 1990s. The Multilateral Fund of the Montreal Protocol was created in 1991 to assist developing countries meet their Montreal Protocol commitments (Multilateral Fund, 2018). The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs). Since 1991, the Multilateral Fund has approved activities including industrial conversion, technical assistance, training, and capacity building worth over US$3.6 billion (*Ibid.*).

The Global Environment Facility (GEF) was established on the eve of the 1992 Rio Earth Summit. Since then, the GEF has provided over US$17.9 billion in grants and mobilized an additional US$93.2 billion in co-financing for more than 4,500 projects in 170 countries (Global Environment Facility, 2018). GEF has supported a wide range of climate-related projects. On climate mitigation GEF has supported 940 projects expected to contribute 8.4 billion tonnes of direct and indirect greenhouse gas (GHG) emission reductions; contributed to projects that support the sustainable management of 43 transboundary river basins in 84 countries; and improved climate resilience for more than 11 million people in 130 countries (*Ibid.*).

The second phase in the development of the multilateral climate architecture was driven by innovations in funding mechanisms, in particular international carbon markets and specifically the Clean Development Mechanism (CDM). The CDM was created as part of the Kyoto Protocol and is a means for climate mitigation projects in developing countries to secure revenues from the sale of Certified Emission Reduction (CER) credits, each equivalent to one tonne of CO2 (UN, 2018d). CERs can be traded and sold, and used by developed countries to

meet a part of their emission reduction targets under the Kyoto Protocol (*Ibid.*).

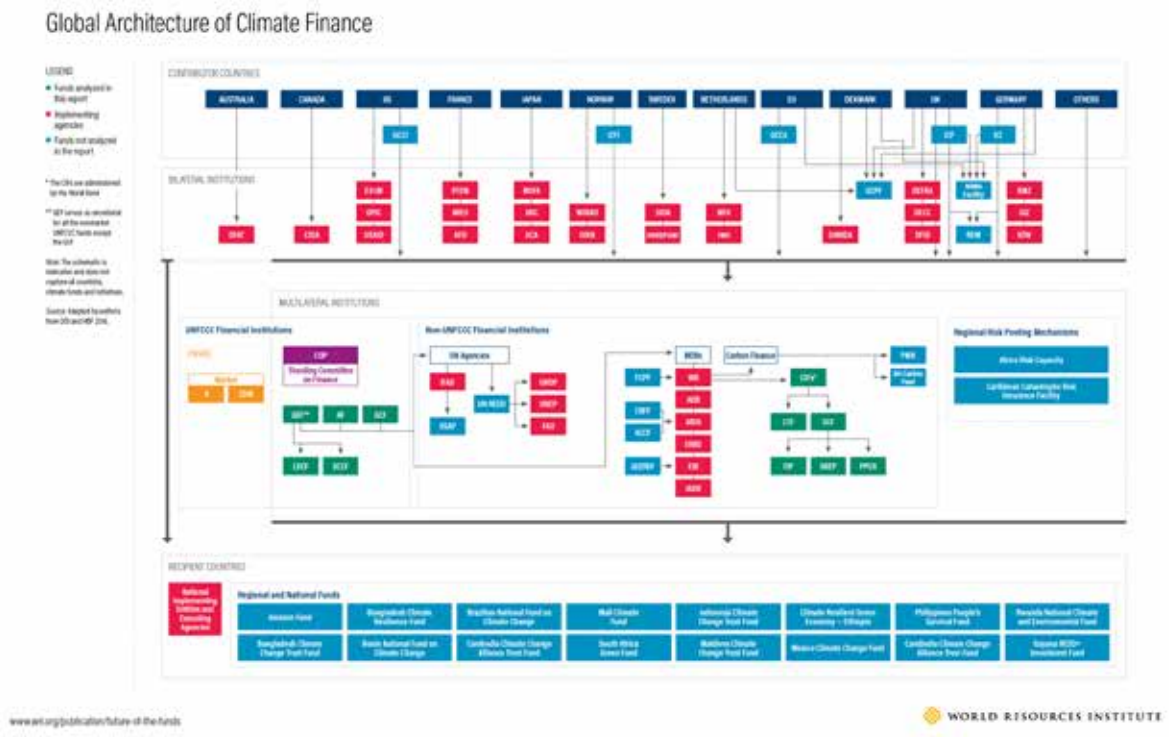
The CDM, via a 2% levy on CERs, is the main source of income for the UNFCCC Adaptation Fund, which was established to fund adaptation projects and programmes in developing countries that are particularly vulnerable to the adverse effects of climate change (*Ibid.*).

The CDM has led to the registration of more than 8,100 climate projects and programmes in 111 developing countries, investment of more than US$300 billion, and the reduction or avoidance of 2 billion tonnes of CO2 (UNFCCC, 2018). But since restrictions on the use of CERs for compliance purposes were introduced after 2012 by the European Union Emissions Trading Scheme (the largest market for CERs) demands for CERs have collapsed together with their price. This has meant that the CDM is now an immaterial contributor to new climate mitigation projects in developing countries.

While this may change if demand for CERs increases, the CDM was instructive in demonstrating how a market mechanism could generate significant cash flows and motivate primary and secondary market investment in climate mitigation projects in developing countries. It also highlighted some of the implementation issues that need to be overcome in future or reformed mechanisms.

At the high point of CDM activity in 2008, the Climate Investment Funds (CIFs) were established by 14 donor countries contributing over $8 billion to support climate mitigation and adaptation action in developing and middle-income countries (Climate Investment Funds, 2008). These public funds are held in trust by the World Bank, and they are disbursed as grants, highly concessional loans, and risk mitigation instruments to recipient countries through multilateral development banks (MDBs) (*Ibid*.). The CIF is the only multilateral climate fund to work exclusively with MDBs as implementing agencies (*Ibid*.). The MDBs involved include: African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, and World Bank Group (including the International Finance Corporation).

Figure 1: Multilateral Climate Finance Architecture



Source: World Resources Institute, 2018

A third phase in the development of the multilateral climate finance architecture arguably began after the failure of UNFCCC COP 15 hosted in Copenhagen in December 2009 and up to and beyond the Paris Agreement secured at UNFCCC COP21 in December 2015.

This phase has focused on finding resources to meet the US$100bn a year by 2020 for climate mitigation and adaptation in developing countries agreed as part of the Copenhagen Accord, as well as delivering US$30bn to developing nations in 'fast-start finance' from 2010-2012 (UNFCCC, 2014).

The UN Secretary-General (UNSG) established a High-level Advisory Group on Climate Change Financing (AGF) in 2010 to identify potential sources of revenue for the scaling up of new and additional resources from developed countries for funding actions in the spirit of the Copenhagen Accord (UN, 2018a).

This period has been particularly focused on creating and scaling up a new Green Climate Fund (see subsequent subsection), bilateral programmes between developed countries and developing countries, and scaling up MDB activities. There has also been much greater focus on private investment, rather than just the provision of public funding in the form of development assistance. Figure 1 left represents the current multilateral climate finance architecture, including how contributing donor countries relate to different entities and mechanisms.

Throughout each phase the primary focus has been on climate mitigation and there has been significantly less focus and money allocated to climate adaptation. In subsequent phases climate adaptation should have a much larger role to play.

The reality is that no one mechanism or fund can do all the heavy lifting and the key to success will be an ecosystem of sizeable mechanisms and entities delivering individually and collectively in different sectors across different parts of the global economy.

UNFCCC COP26

COP26 will be held five years after the Paris Agreement was negotiated at COP21 and levels of climate ambition will be reviewed and revised with the aim of closing the gap between current climate commitments and the well below 2ºC objective established in Paris. Key to securing these commitments will be demonstrable and significantly increased funding and finance for climate adaptation in developing countries.

As a result, 2020 is a key year and many of the processes and initiatives discussed in this report are about 'landing' announcements and commitments at COP26 and creating the political conditions for a high-ambition COP. This means that the next two years provide a significant opportunity for the international water policy community, particularly in terms of climate adaptation and WI4A specifically.

UN SECRETARY-GENERAL'S CLIMATE SUMMIT

The UNSG António Guterres will convene a Climate Summit to mobilise climate action and finance in September 2019, one year before countries have to enhance their national climate pledges under the Paris Agreement (UN, 2018c). The Summit will offer heads of state and government, as well as companies and investors, an opportunity showcase their ambition and commitment to accelerated action on climate mitigation and adaptation. The UNSG will particularly focus on raising levels of ambition from the leaders of the G20, which accounts for approximately 80 percent of global GHG emissions (*Ibid.*)

Different governments are leading efforts in specific areas. The UK Prime Minister confirmed that the UK is leading international efforts on climate resilience for the UNSG Climate Summit and will be responsible for bringing together a package of announcements on climate adaptation.

This creates an opportunity for the inclusion of WI4A and the international water policy community should engage with the UNSG's team, as well as the UK Government, to foreground the issues discussed in this report.

Box 1: How does climate adaptation relate to the SDGs and the Sendai Framework?

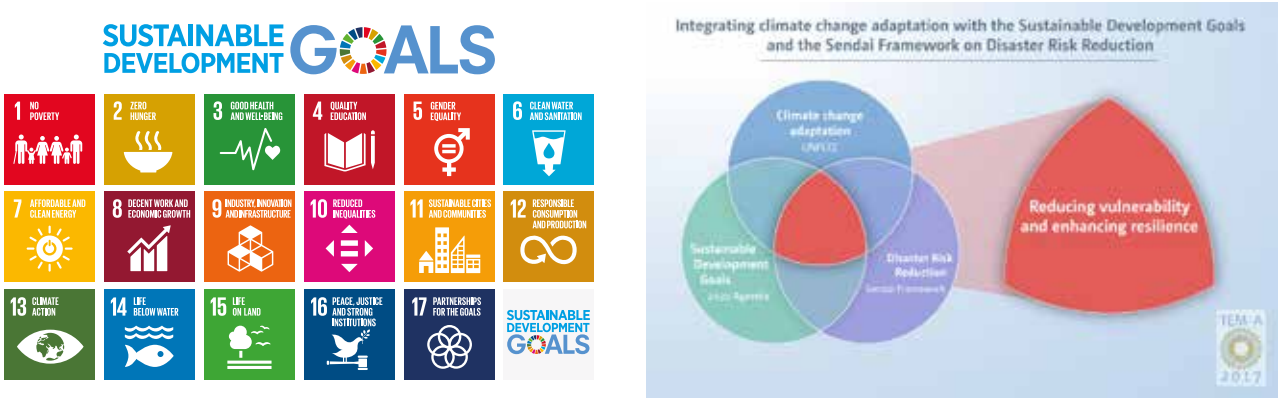
In 2015 the international community agreed to three global agendas: the Paris Agreement on Climate Change; the Sustainable Development Goals (SDGs); and the Sendai Framework for Disaster Risk Reduction.

The 17 SDGs were adopted by all UN Member States and provide a shared blueprint for peace and prosperity for people and the planet, now and into the future (UN, 2018b). Climate adaptation is arguably key for achieving many of the SDGs, including SDGs 2 (Zero Hunger), 3 (Good Health and Well-Being), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 9 (Industry, Innovation, and Infrastructure), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), 13 (Climate Action), 14 (Life Below Water), and 15 (Life on Land).

The Sendai Framework captures the paradigm shift from managing disasters to managing current and future risks, with countries agreeing to pursue four priorities: understanding disaster risk; strengthening disaster risk governance; investing in resilience; and enhancing and leveraging disaster preparedness.

Integrating climate adaptation with the SDGs and the Sendai Framework ensures climate resilience is properly embedded across the three post-2015 frameworks. Improved coherence of action between the three frameworks can enhance efficiency and further enable adaptation action (UNFCCC, 2017). Figure 2 shows the SDGs and illustrates how climate adaptation relates to the SDGs and the Sendai Framework.

Figure 2: Adaptation with the Sustainable Development Goals and Sendai Framework



Sources: UN, 2018b; UNFCCC, 2017

THE GLOBAL COMMISSION ON ADAPTATION

The Global Commission on Adaptation was launched in October 2018. In September 2019, the Commission will issue a 'Flagship Report' setting out why adapting to climate risks is important, what new actions need to be taken, and what existing actions must be done differently (Global Commission on Adaptation, 2018). This is designed to coincide with and support the UNSG's Climate Summit taking place at the same time (see above).

The Commission (2018) will work to address four major roadblocks slowing adaptation that:

1. Decision-makers and the wider public are not yet aware of all the opportunities to be gained from becoming more resilient and less vulnerable to climate impacts and natural hazards;
2. Governments and businesses fail to incorporate climate change risks into their social and economic development plans and investments;
3. Adaptation efforts fall short of those who need them most, the world's poorest and most vulnerable people; and
4. Although adaptation is a global challenge, global leadership on the issue is scarce. In short, the world is falling short of the transformation required to adapt to a changing climate.

The Commission is led by Ban Ki-moon (8th UNSG), Bill Gates (co-chair of the Bill & Melinda Gates Foundation), and Kristalina Georgieva (CEO of the World Bank) (*Ibid.*). It includes 17 convening countries and 28 commissioners representing all regions of the globe and a variety of sectors (*Ibid.*).

From October 2019 through to December 2020, the Commission will also advance a 'Year of Action' to help shift the way decision-makers and citizens think about and act on adaptation (Ibid.). The exact nature and scope of the Year of Action has yet to be determined.

The Commission is a mechanism to raise the profile of climate adaptation and to identify and promote key policy recommendations that can drive improved climate resilience internationally. Given this, the international water policy community should ensure that WI4A is a specific theme within the Commission's report and offer to undertake activities as part of its Year of Action.

CBD COP15

The Convention on Biological Diversity (CBD) COP15 takes places in China in 2020. At COP15 a post-2020 global biodiversity framework to succeed the current framework and targets agreed at Aichi in 2010 are set to be finalised.

2020 is an opportunity to push for a new international agreement on biodiversity, similar in scale and scope as the Paris Agreement on climate change, but focused on halting and then reversing the crisis facing habitats and species.

Historically the UN climate change and biodiversity processes have not been closely linked despite the fact that we cannot successfully mitigate or adapt to climate change without nature and nature-based solutions, and climate change is an existential threat to many species and habitats.

Two major UNFCCC and CBD COPs taking place in the same year (i.e. 2020) could, therefore, create an opportunity to bring these processes closer together. In the context of climate resilience, nature-based WI4A could find common cause in both the UNFCCC and CBD processes and thus be something that can be used to straddle both agendas.

GREEN CLIMATE FUND

The Green Climate Fund (GCF) was established after the failure of UNFCCC COP15 at Copenhagen as the centre-piece of multilateral efforts to meet the US$100 billion per year for climate mitigation and adaptation in developing countries.

The GCF started its first commitment period in November 2014 with US$10.3 billion and to date the GCF has approved 93 projects with a total of US$4.6 billion (Green Climate Fund, 2018). The first replenishment negotiations will start when the GCF exceeds 60 percent of the original US$10.3 billion contribution made by developed country governments (Green Climate Fund, 2014). At the time of writing it is currently at 45 percent.

The first replenishment cycle will in all likelihood begin in the next 12 months and it will be important that the scale of funding meets developing country expectations, that

funding priorities reflect the need to support both climate mitigation and climate adaptation, and that governance reforms are made to provide comfort to donors that funds will be dispersed efficiently and effectively (Waslander & Quijano Vallejos, 2018).

As the GCF replenishment negotiations begin it is important that climate adaptation and WI4A are foregrounded as priorities. The GCF has already made investments in WI4A and these should be reviewed and lessons for the next replenishment and disbursement cycle learnt. The international water policy community should undertake this work and insert the findings into the GCF process to secure further resources for WI4A.

CHINA'S BELT & ROAD INITIATIVE

The Belt and Road Initiative ('BRI') or 'One Belt, One Road' is a core part of China's ambition to play a more constructive role in international affairs, and a way for China to contribute to the development of infrastructure and trade linkage overseas. Anticipated cumulative investment in BRI-related projects is estimated to be up to US$8 trillion (Hillman, 2018).

BRI is structured along several international land corridors, and the "maritime silk road" encompassing in total around 60 countries, primarily in Asia and Europe but also including Oceania and East Africa (Ibid.)

BRI is celebrating its fifth year anniversary this year (Xinhua, 2018). The initiative is receiving greater interest and scrutiny given the scale of the infrastructure programme, including whether successful implementation of the Paris Agreement and the Sustainable Development Goals are even possible if BRI projects are inconsistent with climate change and sustainable development. BRI is therefore a priority of global significance.

UN Environment and the Chinese Government have established a new International Coalition for Green Development on the Belt and Road (UN Environment, 2018). This creates one opportunity to engage with BRI on a systematic basis.
If BRI could be reoriented towards climate mitigation and adaptation projects, then this could be a significant enabler for built and nature-based WI4A. It will be critical to engage with Chinese institutions leading on BRI, in particular the Silk Road Fund (SRF), the China Development Bank (CDB), and the Export-Import Bank of China (China Eximbank), as well as host countries, to highlight the opportunities of WI4A and the risks of ignoring climate adaptation and mitigation.

The international water policy community could produce an analysis of WI4A in the context of BRI, highlighting the economic and political opportunity and the very tangible resilience benefits of WI4A for current and planned BRI investments.

MAINSTREAMING IN FINANCE

It is critical that all investments are 'water-proofed' and that the lock-in of physical climate-related risks are avoided. Doing so will require institutions to embed climate resilience into their decision-making processes thereby creating demand and supply for WI4A.

Over the last three years there has been a significant scaling up of efforts by policymakers, financial regulators, and financial institutions to ensure that the financial system can measure and manage climate-related risks. This is relevant to directly improving the multilateral climate finance architecture itself, but more importantly can reform mainstream finance and financial institution decision-making.

One of the key levers for changing behaviours are company directors and fiduciaries understanding and then meeting their legal obligations in relation to climate risk. Fiduciaries and company directors have these legal duties though they differ by jurisdiction and common or civil law principles and traditions.

In 2015 the Bank of England Prudential Regulation Authority highlighted that parties who have suffered loss and damage from climate change could seek to recover losses from others who they believe may have been responsible. This could have implications for financial institutions, particularly insurers who insure company directors and officers against legal actions and associated liabilities.

Corporate reporting generally requires listed companies to disclose information that is materially relevant to financial performance. Corporate reporting on climate-

related information is increasingly seen as a mandatory requirement as climate-related risks are becoming more clearly material to financial performance across different sectors of the global economy.

In light of this, the G20 Financial Stability Board (FSB) established the Task Force on Climate-related Financial Disclosures (TCFD). In June 2017, the TCFD released its final recommendations, providing a framework for disclosures of climate-related financial risks for all corporate entities. The intention is that clear, consistent and reliable disclosures in line with the TCFD recommendations will improve market participants' economic decision-making, thereby ensuring a more efficient allocation of capital – for example, by identifying potentially stranded assets (Staker, Garton, & Barker, 2018).

Financial regulators have recently gone further. The Central Banks and Supervisors Network for Greening the Financial System (NGFS) was established at the Paris "One Planet Summit" in December 2017 and is a group of 18 central banks and supervisors and 5 international organizations "willing, on a voluntary basis, to contribute to the analysis and management of climate and environment-related risks in the financial sector, and to mobilize mainstream finance to support the transition toward a sustainable economy." (NGFS, 2018) NGFS have acknowledged that climate-related risks are a source of financial risk and that it is within their mandates to ensure the financial system is resilient to these risks. A recent stock-taking exercise conducted across NGFS members showed that supervisors are starting to actively assess the prudential risks associated with climate change and have begun to set supervisory expectations to enhance financial risk management of supervised firms (*Ibid.*). This is a major development. For example, the Bank of England (2018a) recently published new supervisory expectations that set out clearly for the first time what it expects from the banks and insurers it supervises, including:

- A firm's response to the financial risks from climate change should be proportionate to the nature, scale and complexity of its business;
- As expertise develops, a firm's approach to managing the financial risks from climate change should mature over time;
- The Supervisor intends to embed the measurement and monitoring of these expectations into its existing supervisory framework;
- A firm's board should understand and assess the financial risks from climate change that affect the firm, and to be able to address and oversee these risks within the firm's overall business strategy and risk appetite;
- The board and the highest level of executive management should identify and allocate responsibility for identifying and managing financial risks from climate change; and
- The board should ensure that adequate resources and sufficient skills and expertise are devoted to managing the financial risks from climate change

The involvement of central banks and regulators has also helped to shift the terms of the dialogue within financial institutions. It has been the norm in many institutions for Environment, Social, and Governance (ESG) specialists to 'sell upwards' to their senior management. This means they identify topics or ideas that are likely to be approved by their superiors – which inevitably means that some topics or ideas are rejected and that the ambition of what is sold up is lower than they might want in order to secure internal support. In most organisations this inevitably places a premium on low cost, uncontroversial, and non-disruptive proposals. These may also be the least effective proposals for the integration of climate-related risks into decision-making.

This situation is now changing. The Bank of England (2018b) recently conducted a survey covering 90% of the UK banking sector representing over £11 trillion in assets and found that 30% are being 'responsible' (an approach primarily driven by a Corporate Social Responsibility); 60% are being 'responsive' (an approach where climate change is viewed as a financial risk, albeit from a relatively narrow, short-term perspective); and 10% are being 'strategic' (a more comprehensive approach taking a long-term view of the financial risks. This includes engaging at board level and taking action in the long-term financial interests of the firm).

While these numbers show there is a long way to go, there is much more board and senior management-level engagement from many more institutions than has previously been the case. Few if any firms would have been 'strategic' just three years ago.

The involvement of the central bank, for example in convening meetings at these levels, means that there are new opportunities for boards and senior management CEOs and CIOs to be more ambitious and also be competitive with each other in person. They can then instruct downwards and get their teams to implement what they have committed to voluntarily with their peers and with the regulator.

The water policy community should work with the NGFS to ensure that emerging supervisory theory and practice on climate change takes account of the water-related risks associated with climate change. It is also critical that these risks are properly disclosed as part of the implementation and adoption of the TCFD.

The water policy community should be more engaged with the TCFD and the TCFD Secretariat should support this greater engagement. It is also important for the water policy community to engage with legal theorists and jurists, as well as corporate lawyers, to ensure that emerging guidelines concerning climate-related legal obligations take account of water-related risks associated with climate change. This has the potential to be a very significant driver of demand for WI4A.

SECTION II:
FUNDING AND FINANCING WI4A

WI4A will require both funding and financing. The funding (i.e. income or cash flows) for WI4A projects can be generated, for example, from user charges and levies on water use, changes in land value, or insurance premiums; local or central government taxation; the trading of water rights; and transfers (such as Official Development Assistance (ODA)).

Financing the cash flows of WI4A can come from a variety of sources depending on the risk profile of projects, where projects are located, and the condition of local and international capital markets. Sources of finance include company balance sheets; equity markets; debt capital markets; bank loans from public, multilateral, or public banks; and government finance.

Funding and financing work together and affect each other. Efficient and low-cost finance reduces the cost of projects and the funding requirement for water infrastructure. While well-structured, predictable, and credible funding streams make it easier to secure low-cost finance. There is a virtuous cycle and positive relationship between the two.

At a global level we unquestionably have both the funding and financing capacity necessary to deliver the required investment in WI4A. Sufficient income exists, and the global financial system has a glut of capital seeking investment opportunities.

The challenge is that while these conditions may hold globally, there are significant variations in the quality and availability of cash flows, particularly in many developing countries. There are also issues with availability (i.e. liquidity) and cost of capital, again in many developing countries, and this can make it extremely hard or impossible for WI4A projects to succeed.

This section is split into three sub-sections. The first briefly examines the WI4A funding gap and reviews the various mechanisms through which funding can be generated. The second examines financing: the investors that could provide capital; blended finance models; and significantly, what interventions can reduce the cost of capital for WI4A projects. The final sub-section proposes the creation of basin-level funding and financing plans.

THE WI4A FUNDING GAP

The present value of the additional investments needed until 2030 to achieve SDG 6.1 of achieving universal and equitable access to safe and affordable drinking water for all is estimated at approximately US$1.7 trillion (Hutton & Varughese, 2016). This is about three times the current investment levels (OECD, 2018). The estimate represents only a fraction of the water agenda with projections of global financing needs for water infrastructure ranging from US$6.7 trillion by 2030 to US$22.6 trillion by 2050 (*Ibid.*).

Estimates of the investments needed for climate resilience are also large and vary significantly. According to the UNFCCC (2006) the additional investment needed to adapt new infrastructure vulnerable to climate change is estimated at 5 to 20 percent of its cost. The World Bank (2010) estimates that the cost of adapting to an approximately 2ºC warmer world by 2050 is in the range of US$75 billion to US$100 billion a year.

Needless to say, there are very significant uncertainties in all of these studies. In terms of WI4A we do not know the exact investment requirement by solution (whether build infrastructure or nature-based) and how this varies from country to country or region to region. The exact WI4A investment requirement, a subset of estimates for water infrastructure and climate adaptation, is not known. But there is some consensus that the overall 'infrastructure gap' approximates to US$ 1 trillion per annum, of which water accounts for 15-30% compared to a historic investment share of 6% (Money, 2018).

We do know, however, that in 2015/16 (the last financial year where data was available) US$22 billion was spent by governments and multilateral institutions on all climate adaptation, with 51% of this allocated to water and wastewater infrastructure (Buchner et al., 2017). This is significantly less than the US$112 billion of public funds spent on climate mitigation and is nowhere near meeting any estimated funding requirement for either climate mitigation or adaptation (*Ibid.*).

FUNDING WI4A

The funding (i.e. income or cash flows) for WI4A projects can be generated from a variety of sources, including user charges and levies on water use, changes in land value, or insurance premiums; local or central government taxation; the trading of water rights; and transfers (such as ODA).

The choice of funding mechanism depends on a variety of factors that encompass political preferences, the nature and quality of regulation, the role of central government, and affordability.

The quality and credibility of cash flows matters. Uncertain and volatile funding increases risk and makes projects much harder and more expensive, if not impossible, to finance.

It is also clear that the quality and certainty of cash flows are much clearer for built infrastructure than nature-based solutions, and that this is a major impediment to the scaling up of nature-based solutions even when they are the most cost-effective intervention.

The OECD & WWC (2015) provide a comprehensive overview of the different sources of funding for water infrastructure. Tariffs or user charges, general or local taxation, and property charges are by far the most common and intuitive ways of funding water infrastructure, including WI4A. In developing countries ODA from developed country governments and philanthropy can also provide important funding for water infrastructure. Instead of covering in detail all of these funding sources, here we instead elaborate on innovative funding mechanisms for WI4A that could be supported by the multilateral climate finance architecture: results-based payments; mutualised insurance; resilience bonds; and land value capture.

Results-based payments

Results-based payments is funding unlocked when measurable and pre-defined outcomes are achieved. In the case of WI4A it could be outcomes associated with enhanced climate resilience, such as reduced surface run-off or reduced flood risk.

The international climate finance architecture should work with the water policy community to develop new results-based funding mechanisms for WI4A. These could be created nationally, regionally, or internationally. Ideally, they would be underpinned with public funding and in the case of developing countries, with ODA. But schemes could be trialled without such support.

New results-based payment mechanisms should be particularly targeted at nature-based solutions, where the gap between current funding and funding need is likely to be greatest.

Based on proposals from Caldecott et al (2018) voluntary or mandatory markets could be established where 'suppliers' bid together or individually to supply climate resilience outcomes to paying 'beneficiaries' in specific catchments via online market-places. Suppliers could include farmers, land owners, and land managers. Beneficiaries would include the general public (represented by central, devolved, and local government), private interests (such as water companies, other land managers, and insurers), and other groups (such as conservation NGOs, civil society groups, land trusts, philanthropists, local communities via town and village halls, or crowd funders).

A comprehensive list of nature-based WI4A outcomes could be developed and agreed and suppliers would bid for them in a catchment-based market place. Suppliers would then receive contracts to deliver outcomes to beneficiaries and these could be verified by third parties and transactions cleared transparently and securely on a distributed public ledger. Bids in the market places can be managed and undertaken using well-designed web-based apps that could be deployed on smart phones.

New market places enabling results-based payments to remunerate WI4A projects which then underpin financing could be transformative. A comprehensive programme of pilots and market design work, leveraging existing results-based payments schemes, should be coordinated for WI4A.

Insurance

Built infrastructure and nature-based WI4A can reduce physical climate-related risks and thus reduce insured losses. This should result in lower insurance premiums. This is critical for affordability and increasing insurance coverage, particularly in developing countries.

The challenge is capturing this income (i.e. the difference between insurance premiums before and after the risk reducing WI4A investment). There are a number of ways this could be done.

Mutualised insurance or re-insurance companies, where all policyholders are also owners of a mutual insurance or re-insurance company, would allow policyholders to capture the benefit of WI4A investments. Some of the earliest insurance companies were mutuals and this is a well-tested model of organising insurance provision (Insurance Information Institute, 2018).

The mutual insurance or re-insurance company would, as part of its mission, undertake to support and invest in WI4A that could reduce physical climate-related risks and thus reduce premiums for policyholders (or provide a share in any insurance profits). For this to work effectively the mutual would only provide insurance in a specific area where it could make a material difference to levels of risk.

Insurance-linked or 'resilience' bonds, where the interest payments are based partly on WI4A investments, is another complementary model (Cashman, Souvignet, Schuster, & Zwick, 2018; Hermann, Köferl, & Mairhöfer, 2016; Refocus Partners, 2015). Once WI4A investments are made this reduces bond interest payments reflecting the lower risk. In the event of an eligible disaster event, investors lose all or a portion of the capital value of their insurance-linked bond. WI4A investments would reduce the likelihood of eligible disaster events.

The international water policy community can work with insurers and re-insurers and other stakeholders in the insurance community to identify and realise these potential opportunities.

Land value capture

Investment in WI4A can create local economic benefits due to a reduction in physical risk and/or an improvement in the provision of water services. This can result in increases in land value and in property prices. Capturing a proportion of this increase to make the investments that increase land values in the first place is widely used in many countries, particularly for transport infrastructure investments, such as trainline extensions.

Land value capture approaches could be tailored to WI4A requirements in developing countries. Capturing land value increases is usually done through additional property taxes or charges. Multilateral development banks and donors could explore underwriting or insuring these future revenues, enabling the upfront investments to take place.

These approaches could have significant co-benefits for economic development. Moreover, WI4A projects could be part of a wider package of land value enhancements, including transport, amenities, and social infrastructure (such as schools and hospitals). This would mean that WI4A is more effectively embedded into urban development and planning from the very start, avoiding development that is maladapted to climate change.

FINANCING WI4A

The type of financing (along the continuum from debt to equity and listed to unlisted) and potential investors in WI4A projects, whether banks, national and multilateral development banks, pension funds, sovereign wealth funds, insurers, asset managers, or family offices, will depend on a range of variables. These include the type of cash flow available, the risk profile of the project, the maturity of the project, where the project is located, the credit quality and financial capacity of project sponsors, and the availability of capital in different jurisdictions.

There are two major opportunities for improving the cost and availability of capital for WI4A. Hybridity and blended capital approaches on the one hand and interventions that support the efficient re-financing of WI4A assets on the other.

Hybridity and blended finance

Hybridity is a collaborative multi-stakeholder approach that brings together different sources of financial, human, and societal capital to help execute projects in a way that maximises financial and non-financial objectives (Money, 2018). A key argument in favour of hybridity is that models of stakeholder collaboration aligning the interests

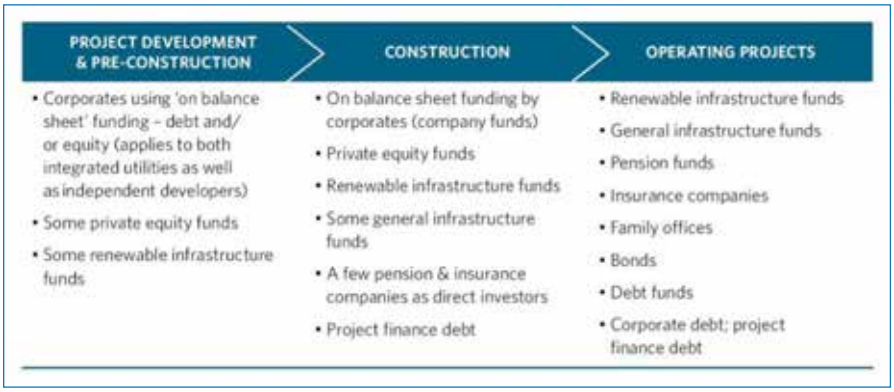
Box 2: A primer on infrastructure finance for climate mitigation and adaptation

In many cases a significant proportion of WI4A project costs are upfront at construction and marginal costs are low. Although risk profiles differ considerably between different WI4A technologies and geographies, the typical project lifecycle will be as follows: it is characterized by higher levels of risk in development and construction phases due to technology and construction risks. Risk levels decrease once a project becomes operational and produces predictable and stable cash flows to service debt and generate returns. Since investors demand compensation for higher levels of risk, the risk profile of infrastructure projects directly translates into the cost of capital over time: projects face higher cost of capital in development and construction phases and lower cost of capital in the operational phase (WEF, 2013; Hamilton & Zindler, 2016).

Debt capital plays a considerably more important role in financing infrastructure projects than equity capital. For example, McKinsey (2016) has found that the average debt-to-equity ratio of 3,700 renewables projects receiving financing between 2000 and 2015 is 70-to-30 debt to equity ratio.

In the development and construction phases, projects are commonly financed directly by corporations through on balance sheet-financing and bank loans (Hamilton & Zindler, 2016), while public equity and debt capital markets have played only a minor role in financing projects over the last decade (Louw, 2018).

Figure 3: Project stages and investor ecosystems (Hamilton & Zindler, 2016)



Once projects are operating and delivering stable cash flows, refinancing equity and debt at lower costs (due to lower risks) and to avoid maturity mismatches (i.e. financing long-term assets with short-term debt) becomes a critical issue.

The unparalleled scale of investment needed to finance climate mitigation and adaptation will exceed capabilities of the post-crises banking sector and constrained balance sheets of utilities, which is why public equity and particularly debt capital markets will have to play a key role to facilitate the refinancing of operating projects by providing long-term capital (OECD, 2017).

of different actors are more likely to deliver the desired outcomes on a sustainable basis (*Ibid.*).

Hybridity can be supported by blended finance, which is when sources of capital with a social or environmental purpose is combined with more traditional forms of capital. Capital with a social or environmental purpose often comes from philanthropic foundations or governments and is often concessional, i.e. willing to accept below market rates of return.

However, investors willing to accept below market returns to ensure that social and/or environmental outcomes are small relative to the total investment requirement. This is certainly true for WI4A. While they do not have the capacity to finance many or all projects, these providers of concessional finance can take smaller positions in many more projects. This can be enough to make previously unattractive projects attractive to traditional sources of capital only seeking market rates of return. This means that concessional finance can have a catalytic effect and crowd-in capital from non-concessional sources.

Blended finance and hybridity can be further combined with funding to support the cash flows of projects, such as ODA or philanthropy.

While hybridity has not been properly tested, each element has been: blended capital structures, mixed income models including elements of grant funding, and multi-stakeholder governance models.

Hybridity and blended finance could have a key role to play in scaling up the funding and financing of WI4A. It is essential that there are more pilots showcasing how different forms of funding and finance can come together to deliver WI4A projects successfully, with benefits accruing to different stakeholders in the intended way. Opportunities for major pilots pioneering different forms of hybridity and blended finance for WI4A should be identified and prioritised for support by the multilateral climate finance architecture in order to demonstrate proof-of-concept and scalability.

Lowering the cost of capital

Ensuring that low cost capital is available at different stages of project development through to operation is fundamental to the viability of WI4A projects. There are three significant prizes for policymakers associated with the smooth and efficient financing and re-financing of WI4A projects: 1) reducing the overall cost of WI4A to meet a given climate resilience objective, 2) making available the scale of capital required for WI4A deployment, and 3) freeing up equity and bank loans to be recycled back into the construction and development phase of the WI4A project lifecycle to ensure there is a robust pipeline of projects. These three benefits are briefly discussed further below.

The smooth and efficient refinancing of operational cash-flow producing assets can reduce the average cost of capital over the lifetime of projects, reducing the total amount ratepayers and taxpayers have to pay to make projects economic. This is incredibly important for reducing the total cost of projects that are capital intensive – as most WI4A projects are.

As well as making a material difference to individual projects, in aggregate across a national infrastructure investment programme large savings can be realised by reducing the cost of capital. For example, being able to reduce the average cost of capital for the US$10bn WI4A investment programme by just 1% is the equivalent of saving US$100 million per year in interest payments. This is spending that consumers, companies and the public sector (depending on who is ultimately remunerating WI4A projects) can deploy elsewhere. This scale of reduction in the average cost of capital is entirely plausible (see Box 4 above for further details).

The scale of capital needed to finance the quantity of WI4A required means that large pools of capital, particularly in global debt capital markets, must be accessed. The value of the global investment-grade bond market is worth US$33 trillion. [2] This is essential as the balance sheet of many traditional project sponsors, such as utilities, are increasingly constrained and banks cannot provide loans with tenors that match the lifetime of projects due to capital requirements and capital charges [3] associated with holding such loans. Creating mechanisms for the debt capital markets to finance projects (or portfolios of projects) can ensure the scale of private capital required is there.

Finally, refinancing at operation (once there is no longer any development or construction risk) means that higher cost equity and debt (such as bank loans or mezzanine

Box 3: How efficient refinancing changes the Weighted Average Cost of Capital (WACC)

Refinancing an operating asset via cheaper, longer-term debt can significantly reduce the project's weighted average cost of capital (WACC).

$$WACC = \frac{EQ}{V} * r^{EQ} + \frac{DE}{V} * r^{DE} * (1\text{-}T)$$

EQ = Market Value of Equity; DE = Market Value of Debt; V = Market Value of the Firm's total capital (Equity + Debt); r^{EQ} = Return on Equity (ROE); r^{DE} = Return on Debt (i.e. interest); T = Tax Rate; (1 – T) = Tax Shield

The WACC is determined by the cost of equity (r^{EQ}), i.e. the return on equity (ROE) the project sponsor has to pay to equity investors, and by the cost of debt (r^{DE}), i.e. the interest the project sponsor has to pay to debt investors.[1] Assuming a constant debt-to-equity ratio after refinancing (e.g. 70-to-30, see Box 2) and tax rate, the WACC will decrease if the project sponsor can secure a cheaper form of either equity and/or debt financing, which means decreasing r^{EQ} and/or r^{DE}. There are two forms of debt refinancing available which can lower the cost of debt (r^{DE}) and thus the WACC.

Bonds

Refinancing projects through project bonds can be cheaper than through commercial loans. According to the OECD (2017a), the yield of investment-grade project bonds is estimated to be on average 0.5% lower than the cost of a long-term project loan with similar credit quality (e.g. BBB-). Refinancing commercial loans with project bonds can reduce the cost of debt (r^{DE}) and lead to a decrease in the WACC (OECD, 2017a; WEF, 2013).[2]

Securitization

Securitization refers to the process of creating a new tradable financial instrument (security) by bundling together a pool of typically illiquid assets representing claims on future cash flows (e.g. receivables), dividing the repackaged instrument into different tranches (with different risk-return profiles) and marketing those to investors by matching risk preferences.

Typically, a company (the "originator") transfers assets (e.g. mortgages) to a separate legal entity (i.e. a special purpose vehicle (SPV)), which bundles those assets together into a debt security and issues it in the capital markets. The debt security is bought by investors, who are paid by the SPV through the future cash flows of the underlying assets (e.g. mortgage payments).

If the SPV can raise funds by issuing debt securities at lower interest rates than the originator could by raising debt through other available sources (e.g. bank loans), then the originator can effectively reduce its cost of debt (rDE). Thus, asset securitization can reduce a firm's WACC, particularly if the availability of alternative funding sources is limited. [3]

Empirical evidence shows the impact securitization can have on financing costs. Lemmon, Liu, Mao, & Nini (2014) for instance found that securitization permits non-financial firms to lower their cost of capital without transferring value from existing creditors. Moreover, Nadauld & Weisbach (2012) showed that the securitization of corporate bank loan facilities can have an impact on the price of corporate debt (with a credit spread of 17bp), which underlines that securitization causes reduction in capital costs.

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1 For a more detailed discussion of the cost of capital see for instance Brealey, Myers, & Allen (2017), Ch. 9. The cost of capital approach builds upon the original work of Modigliani & Miller (1958).

2 Moreover, Miller Smith et al. (2015) sampled several transport infrastructure projects globally to highlight project bonds as one of the primary means of debt refinancing post-construction, which reflects the potential of project bonds to reduce capital costs. Deloitte (2013) argues that bank lending is increasingly becoming more expensive for projects than bond financing since banks pass on to costumers additional lending costs occurring under Basel III regulations.

3 See Schwarcz (1994) and Hill (1997).

Figure 4: Releasing capital back into project development and construction

finance) can be recycled by project sponsors and their financial partners back into the development and construction of new projects. This virtuous cycle (see Figure 4 above) will help ensure there is strong pipeline of WI4A projects being developed.

There are several mechanisms available to public sector institutions to support the efficient financing and re-financing of WI4A projects at scale.

There are two general types of intervention: i) risk mitigation mechanisms (RMM) and ii) transaction enabling mechanisms (TEM). Below we briefly describe the main mechanisms most relevant to the smooth re-financing WI4A projects and give a brief assessment of the pros and cons of each mechanism.

Risk mitigation and transaction enabling

The OECD (2016) conducted a comprehensive review of institutional investment in green infrastructure projects where the public sector deployed policy mechanisms to support transactions.

Building on a framework developed by the OECD (2015), the policy mechanisms fall broadly in two categories: reducing barriers to investment for the private sector (risk mitigation mechanisms) and supporting the development of investment channels (transaction enabling mechanisms).

The study examined a sample of 33 case studies and found 44 different examples of public policy mechanisms to support risk mitigation (for an overview see Table 1). These mechanisms provided coverage or mitigation of risks which were not sufficiently (or not at all) addressed by financial market actors or which would have increased transaction costs for investors substantially. By deploying risk mitigating mechanisms, public sector organisations were able to attract investments of traditionally risk-averse institutional investors (e.g. pension funds) by enhancing the risk-return profiles of the projects in the sample.

Green infrastructure projects are broadly defined and extend from energy efficiency to sustainable agriculture. While this sample is not focused on WI4A, many of the deals have very similar characteristics to WI4A projects and so are relevant to identifying effective interventions that can address WI4A financing challenges.

2 As of 31 Dec 2017. This includes all bonds with a minimum credit rating of BBB-, except Mortgage-Backed Securities(MBS), as tracked by the Citigroup's World Broad Investment-Grade Bond Index Excluding MBS (Non-MBS WorldBIG), see Citigroup (2017).

3 Developed in response to the global financial crises 2007/08, Basel III is a global regulatory framework to increase bank liquidity and decrease bank leverage by introducing more restrictive capital requirements for the banking sector. The new capital requirements negatively affect banks' ability to provide long-term project finance (e.g. through infrastructure loans), particularly due to increasing funding costs for banks (Ma, 2016; Wilkins, 2017). This further strengthens the need for capital markets to fill the infrastructure finance gap.

Table 1: Summary and typology of risk mitigation mechanisms identified by OECD (2016)

Risk Mitigation mechanism	Short description of public or official sector intervention	Deal Example (Name)	Sector	Financing Channel	Actor that deployed the mechanism	Institutional investor involved
Credit enhancement (23 out of 44 in total)						
Layered fund subordination	Taking a subordinated position in a fund to give priority to private investors with regard to claims on assets.	GIB Offshore Wind Fund	Sustainable energy	Intermediated unlisted project equity	UK Green Investment Bank	Strathclyde Pension Fund, undisclosed Sovereign Wealth Fund
		AATIF (Africa Agriculture and Trade Investment Fund)	Sustainable agriculture	Intermediated private equity fund	KfW & German Federal Ministry for Economic Cooperation and Development (BMZ)	Undisclosed institutional investors, Deutsche Bank
Partial credit guarantee	Guaranteeing payments for the principal and interest on debt issuance up to certain percentage.	Hindustan Solar	Sustainable energy	Listed project bond	IIFCL, ADB	Yes Bank and other institutional investors
		Energy Efficiency Securitization by the IABD	Energy efficiency	ABS	IADB	Undisclosed institutional investors
		Greater Gabbard offshore transmission link	Sustainable energy	Listed project bond	EIB, EC	Numerous undisclosed institutional investors
Loan guarantee	A legally binding agreement under which the guarantor agrees to pay any or the entire amount due on a loan instrument in the event of non-payment by the borrower.	Crescent Dunes Solar CSP	Sustainable energy	Direct investment in unlisted equity of a project developer	US Department of Energy	Public Sector Pension Investment Board (Canada) and Ontario Teachers' Pension Plan
Revenue guarantee	Guaranteeing certain cash flows for a project	Consorcio Agua Azul	Sustainable water	Direct investment in listed project bonds	Government of Peru	Undisclosed local pension funds
		Cestas Solar	Sustainable energy	Direct equity co-investment in asset	French Treasury	Mirova, KKB, ACofi, Omnes
Public Investment (21 out of 44 in total)						
Cornerstone stake	An investment in an offering that occurs early in the investment process so as to increase chances of success and to play a demonstration role to attract other investors.	Lake Turkana wind farm	Sustainable energy	Intermediated unlisted equity investment in project	Danish government, DCIF (a government-owned fund)	DCIF, Danish pension funds
		Cheltenham General Hospital	Energy efficiency	intermediated unlisted equity investment in project	UK Green Investment Bank	Aviva Investors
		Hines Poland Sustainable Income Fund	Green buildings	Intermediated private equity fund	EBRD	Undisclosed "foreign institutional investor"
Blending	Strategic mixing of concessional, non-concessional and for profit financing to attract risk-capital	Albion Community Power	Sustainable energy	Direct investment in unlisted equity of a pure-play corporate	UK Green Investment Bank	The Greater Manchester Pension Fund, Strathclyde Pension Fund
Grant	Concessional funds allocation	Off grid electric Tanzania	Sustainable energy	Unlisted debt investment intermediated through a debt vehicle	U.S. Agency for International Development	The Packard Foundation, Ceniarth, Calvert Foundation.
Fund seeding	Public investment to help establish private equity funds that specialise in green projects.	GEEREF	Sustainable energy and energy efficiency	Equity: unlisted intermediated fund of funds	EIB	At least 8 private equity funds with institutional investor limited partners

The risk mitigation mechanisms deployed by public sector organisations in the sample were divided by the OECD into credit enhancements (23 out of 44) and public investments (21 out of 44). While credit enhancements describe any form of public intervention to increase the likelihood of debt repayment, public investments refer to any form of direct public financing or taking part in the deal structure. The most common credit enhancement used were partial credit guarantees, while cornerstone stakes being the public investment mechanism most present in the sample.

Besides those risk mitigation mechanisms, the OECD study also identified 19 cases in which transaction enablers were deployed by public sector organisations to mobilise institutional investment through either reducing transaction costs or developing new investment channels (for an overview see Table 2). As institutional investors often lack internal resources to assess transactions on the project level, high transaction costs may lead to the exclusion of such investments from the investment universe. The transaction enabling tools help institutional investors to overcome this barrier to investing in green infrastructure projects.

The most commonly applied transaction enabling mechanisms were securitisation and warehousing (used in 6 transactions), as well as co-investment and loan syndication (also used in 6 transactions). The overall most frequently used debt investment channel was

Table 2: Summary and typology of transaction enabling mechanisms identified by OECD (2016)

Transaction Enabler Type	Short description	Deal Example (Name)	Sector	Financing channel	Actor that deployed the transaction enabler	Institutional investor involved
Securitisation	A technique whereby illiquid or small-scale assets are transformed into securitised products.	Energy efficiency securitisation in Mexico	Energy efficiency	Unlisted debt investment, intermediated	IDB	Numerous institutional investors
Warehousing, pooling	Bundle together smaller projects to get them to a commercial scale that is attractive for institutional investors.	Off Grid Electric	Sustainable energy	Unlisted debt investment, intermediated	Off Grid Electric set up a debt investment vehicle	The David and Lucile Packard Foundation and other family offices
		Greencoat UK Wind	Sustainable energy	Intermediated listed project equity	Greencoat UK Wind (a listed infrastructure fund)	Numerous institutional investors
Co-investment, joint-ventures, partnerships, consortiums and loan syndication	Institutional investors partner up with other investors to invest in an asset.	Ararat Australia Wind	Sustainable energy	Unlisted direct project debt financing (loan) project	Australia Clean Energy Finance Corporation	OPSEU Pension Trust
		NY WHEEL (Warehouse for Energy Efficiency Loans)	Energy efficiency	Direct unlisted debt investment in project company structure	NY Green Bank	Undisclosed Institutional Investors, Citigroup
Co-operation and collaboration	Informal sharing of knowledge and resources between actors.	Electric public transport system in Québec	Low-carbon mobility	Unlisted equity investment	LISEA (a concession company created for this project), EIB	Caisse de dépôt et placement du Québec
Conduit aggregation	Leveraging a larger or more specialised public institution to access normally unavailable channels	Kommuninvest aggregator	Mixed green finance	Intermediated, listed SSA green bond	Kommuninvest (Swedish Local Funding Authority)	AP3, AP4, CalSTRS, UN Joint Staff Pension Fund
		CT Green Bank C-PACE	Sustainable energy	Intermediated, unlisted non-rated pooled project bonds	Connecticut Green Bank	Undisclosed institutional investors

specific project-related bond structures (13 out of 33). On the equity side, the most frequently used investment channel was unlisted investments in projects through intermediated funds (8 out of 33).

The study found a wide range of different actors participating in the analysed transactions. Besides institutional investors (pension funds, insurance companies, and asset managers) providing debt and/or equity capital, several different types of public sector actors facilitated the investments in green infrastructure via the mechanisms outlined above. Among them are six multilateral development bank (ADB, AfDB, EBRD, EIB, IDB, and WBG), which were involved in 12 transactions; five public green investment banks (UK GIB, Australia CEFC, NY Green Bank, Connecticut Green Bank, Hawaii GEMS), which were involved in 8 deals; [4] seven public financial institutions such as national development banks and export credit agencies (ONDD, EDC, EKF, KfW, IIFCL, SACE, and Kommuninvest) were part of 9 deals; and agencies related to seven national and two regional governments, which were involved in 11 transactions.

Risk mitigation or transaction enabling?

RMM and TEM have different pros and cons. Risk mitigation is inherently a form a risk transfer – shifting risks from the private sector to the public sector. Given that in many cases the underlying cash flows that remunerate projects are underpinned by the public sector, it might seem odd to effectively subsidise both sides of the balance sheet (i.e. assets and liabilities). The case for RMM therefore hinges on whether the public sector knows the risks better or is better able to manage them than the private sector, at least temporarily. There can be a compelling case for a temporary transfer of risk and if this then leads to risk being sustainably managed by the private sector over the long term.

Transaction enabling is arguably also a form of risk transfer, though it is not generally directly subsidised, and public support is paid for on commercial terms, with co-investment happening pari-passu (where private and public sectors take on equal terms in a transaction). TEM is therefore likely to be more desirable from a policymaker perspective, but precisely because REM is a form of subsidy (albeit temporary) it can have a much more significant impact on market development.

Mechanisms

Here we look in more detail at mechanisms relevant to re-financing operational cash flow producing WI4A projects. The mechanisms we look at are: green infrastructure bonds (including asset-backed securitisation), partial credit guarantees, loan guarantees, YieldCos, layered fund subordination, and warehousing and pooling.

- Green infrastructure bonds

  Green infrastructure bonds are a means to attract long-term debt capital from bond markets and represent a small subset of the larger green bond market. To issue green infrastructure bonds, the project developer (or sponsor) has to create a special purpose vehicle (SPV) and inject equity capital, as well as obtain a sufficiently high credit rating from a rating agency. Green infrastructure bonds can be used to finance the development of or re-financing of already built and operating green infrastructure projects, including WI4A. They can be structured either as project-specific bonds, in which case investors are exposed to project risks, or as asset-backed securities (ABSs), collateralizing assets of a pool of green infrastructure projects (OECD, 2017).

  Case study of green infrastructure bonds

  An example of efforts to support green infrastructure bonds include the Europe 2020 Project Bond Initiative (the "Initiative") established by the European Commission (EC) and the European Investment Bank (EIB). This aimed to mobilise institutional investment for large-scale infrastructure projects in Europe by offering credit enhancements within project debt financing structures. Under this initiative, the EIB supported for instance the debt financing of the Greater Gabbard offshore transmission link project in the UK in 2013 to connect the offshore windfarm with the UK mainland (see Table 2). The EIB provided a partial credit guarantee of 15% of the bond issued by the project company, which led to Moody's upgrading the project's rating, which in turn attracted debt capital investments from institutional investors (EIB, 2013; OECD, 2016b). With its credit enhancement model, the EIB exclusively supports large-scale infrastructure projects in the energy and transport sectors, as well as information and communication (EIB, 2012; G20 Green Finance Study Group/OECD, 2016).

4 For further examples of green infrastructure investments supported by green investment banks and their potential to support financing through interventions or co-investments (as highlighted in Tables 1 and 2) to crowd in private investments see (OECD, 2016a).

Green infrastructure bonds offer promising potential to help closing the green infrastructure funding gap, particularly for re-financing operational cash flow-producing assets with cheaper long-term debt to decrease cost of capital (Caldecott, 2017). Credit enhancement mechanisms (as shown in Table 2) are the most common form to support the bond financing of green infrastructure projects and are applied by a range of actors, including multilateral development banks (Aravamuthan, Ruete, & Dominguez, 2015).

- Asset-backed securities

  An ABS is a bond collateralized by a specific or a pool of project assets which are generating cash flows. [5] The total volume of green ABS issued increased from around US$5bn in 2016 to over US$30bn in 2017 (Climate Bonds Initiative, 2017, 2018b) while the OECD estimates that annual issuance of green ABS could reach between US$280 – 380bn by 2035 for energy efficiency, renewable energy and electric vehicles (OECD, 2017).

  Case studies of ABS

  In recent years, there have been several examples of green ABSs issued in the US, Canada, Australia and Europe. In the US, several solar panel companies such as Tesla's subsidiary SolarCity or Sunrun issued solar-energy ABS backed by residential solar systems, which raised over US$1.3bn in 2017 (Bloomberg, 2017). Securitizing residential solar systems allows issuing companies to realize expected cash flows from long-term contracts with residential customers by re-financing them through capital markets. Alafita & Pearce (2014) showed that the securitization of residential Solar PV assets in the form of ABS can reduce capital costs. This is one example to show that green ABS have substantial potential to pool small scale renewable energy projects (or for instance energy efficiency mortgages) into tradable investment products to address the considerable funding gap at the consumer-related demand side of the energy market (Aldersgate Group, 2018).

  Another example is a green bond structured as an ABS and issued by the Green Climate Fund (GCF) and the Inter-American Development Bank (IDB) in 2015 to finance demand-side energy efficiency applications in Latin America and the Caribbean. By bundling and securitizing cash flows of numerous energy efficiency projects across a country or a region, the ABS allows to attract funding in capital markets on better terms, due to the GCF and IDB providing credit enhancements. (GIZ, 2017, p. 45)

  There are several public policy options to foster the green securitization to unlock finance in debt capital markets. Governments can for instance standardize green loan contracts, such as PPAs for residential solar installations, to facilitate securitization processes, provide credit enhancements to green ABSs through guarantees or make cornerstone investments in initial green ABS transactions to increase investor demand (Kidney, Giuliani, & Sonerud, 2017).

  Particularly green ABSs recently gained momentum and is one of the main topics addressed by the G20 Sustainable Finance Study Group (SFSG) [6] under Argentina's G20 Presidency in 2018. [7]

- Partial credit guarantee

  A partial credit guarantee is a credit enhancement mechanism for debt instruments (bonds and loans). It is a legally binding agreement for instance by a public sector institution such as an MDB to pay for the principal and interest on debt issued up to a certain, pre-determined amount, in the event of non-payment by the borrower or issuer.

  Case study of partial credit guarantees

  In 2015, Hindustan Solar, the renewable energy-focused subsidiary of Hindustan Power, was the first Indian solar utility to successfully issue a credit enhanced bond instrument for three AA+ rated solar projects in Gujarat, India. The bond was fully underwritten by YES Bank and includes a "first loss" partial credit guarantee by the Indian Infrastructure Finance Company Ltd (IIFCL), which is also backed by the Asian Development Bank (ADB) via a counter-guarantee. The aims of the structured project financing via bonds were twofold: to open up a new market for infrastructure financing in India to attract institutional investments and to substantially reduce the projects' cost of capital. (Hindustan Power, 2016; Lambert, 2016)

5 For a more detailed description of how securitization in the case of the solar industry works see O'Sullivan & Warren (2016) and Lowder & Mendelsohn (2013).
6 Formerly known as the G20 Green Finance Study Group (GFSG).
7 See http://www.pbc.gov.cn/english/130721/3487189/index.html

- Loan guarantee
  A loan guarantee is a credit enhancement mechanism for debt instruments (loans). It is a legally binding agreement for instance by a public sector institution to cover loan payments in the case of default of the borrower.

  Case study of partial credit guarantees
  In 2011, the US Department of Energy issued a USD 737 million loan guarantee for debt payments of the US company SolarReserve to build Crescent Dunes, the first utility-scale concentrated solar power (CSP) plant (110 MW nominal capacity) near Tonopah, Nevada (US Department of Energy, 2011). SolarReserve also secured long-term stable revenues via an PPA with Nevada's utility NV Energy to purchase the electricity generated by the Crescent Dunes plant for 25 years. After construction was completed in 2014 and the plant started to commercially operate in 2015, the Capital One Bank bought an equity stake in the project company to utilize long-term tax benefits of the project and diversify its renewable energy portfolio (SolarReserve, 2017).

- YieldCos
  A 'yield company' or YieldCo provides a structure to bundle together and own a portfolio of operating assets (e.g. renewable energy projects) as a separate legal entity which is publicly-traded on a stock exchange after an initial public offering (IPO). The assets held by the YieldCo generate stable, predictable cash flows which are distributed to investors in form of dividends. The financial benefits from YieldCos' financial structure for investors include liquidity, stable cash flows, expected dividend growth over time [8], and tax benefits.

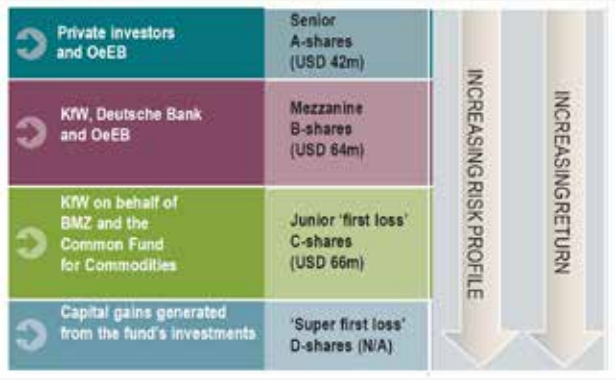
  Case study of YieldCos
  Selling stakes in operational renewable energy assets proved to be a valid strategy for utilities seeking to recycle capital for further asset developments. A good case study is the UK utility SSE which sold a 49% stake in its Clyde windfarm in Scotland to a consortium of UK pension funds and the YieldCo Greencoat, allowing SSE to recycle capital to expanding the wind farm asset (SSE, 2017).
  The renewable infrastructure fund Greencoat UK Wind is an example of a YieldCo pooling together individual, operating wind energy assets via a listed investment vehicle to attract institutional investments (see Table 2). Greencoat owns over 30 onshore and offshore small to mid-sized wind farms totalling net installed capacity of 741 MW (Greencoat UK Wind, 2018). The YieldCo vehicle allows institutional investors to invest in a structured pool of otherwise potentially unsuitable individual wind energy assets.

- Layered fund subordination
  Mezzanine capital describes financial instruments which lay in-between senior debt and equity ("hybrid instruments") in regard to priority of payment, including subordinated bonds, convertible bonds and preferred stock. Those instruments are inferior positioned to senior debt, as the latter is paid back first from assets in the case of default, but superior to common stocks (equity). Subordinated debt (e.g. bonds) is a credit enhancement mechanism that supports attracting investors for senior debt tranches. As subordinated tranches absorb losses first, the credit quality of senior tranches is higher than in a uniform debt structure without subordinated tranches, which is reflected in higher credit ratings. (OECD, 2015a)

  Case studies of layered fund subordination
  The Africa Agriculture and Trade Investment Fund (AATIF) is a public-private structured debt fund sponsored by the German Federal Ministry for Economic Cooperation and Development (BMZ) and managed by Deutsch Bank, with USD 172 million in assets under management (AUM) as of March 2017 (Morgado & Lasfargues, 2017). The funds' target asset class is development debt while its investment objective is contribute to sustainable agricultural development by providing loans to small, mid and large scale agricultural farms and businesses in different African countries. (AATIF, 2017)
  The fund's capital structure contains three main tranches with different risk and return profiles (see Figure 5 above). Acting as the public sponsor of the fund, the BMZ invests through the German DFI Kreditanstalt für Wiederaufbau (KfW) in the fund's

8 Growth expectations result from sponsor companies (typically utilities or energy providers, such as NRG Energy) setting up a YieldCo subsidiary while promising investors to develop or acquire a green asset product pipeline and transferring those assets to the YieldCo, which would translate into growing dividends over time. The aim of the sponsor company is to recycle capital for new developments (Varadarajan, Nelson, Goggins, & Hervé-Mignucci, 2016).

Figure 5: The shareholder structure of the AATIF (adapted from Morgado & Lasfargues, 2017)



junior tranche (C-shares), providing a "first loss" buffer to attract private investments in more senior tranches. Deutsche Bank, the Austrian DFI Österreichische Entwicklungsbank AG (OeEB) and KfW invest in the mezzanine tranche (B-shares). A range of non-disclosed private investors and the OeEB invest in the senior tranche (A-shares). Moreover, all three tranches are protected by an additional layer of capital, the "super first loss" tranche (D-shares), which is fuelled by capital gains of the funds equity investments. (Morgado & Lasfargues, 2017)

The fund's success has made him to a role model of blended finance and encouraged Deutsche Bank to propose the Universal Green Energy Access Program fund for Africa (to be set up together with the GCF) with a similar capital structure, targeting USD 500 million in investments over 5 years (Deutsche Bank, 2016). The GCF approved the fund and has agreed to act as an anchor investor by investing USD 78.4 million in a subordinated tranche (Class B capital), which encouraged co-financing of over USD 200 million in the form of private institutional investment into senior tranches (GCF, 2016, 2017). [9]

- Warehousing and pooling

  Warehousing and pooling refers to transaction enabling mechanisms to bundle together a number of usually small-scale projects or assets to make them a suitable debt or equity investment for institutional investors. Warehousing and pooling is also often an intermediate step in the process of securitization (see above).

Case study of warehousing

An example for warehousing is the transaction undertaken by a lending consortium including the New York Green Bank (NYGB) in 2016, which provided a warehouse credit facility of US$ 240 million to Solar Mosaic, a US financial technology provider. Solar Mosaic uses the debt capital of the credit facility to provide loans for residential solar PV installations in New York State (US) with the aim to aggregate all loans to a sizable portfolio. The warehousing structure of the debt facility allowed the securitization of individual loans into a tradable instrument, which can increase market liquidity, drive down financing costs of further transaction, and attract new participants in the clean energy market. The participation of NYGB attracted private sector investments (by BNP Paribas and DZ Bank) on a scale usually lacking in the residential solar sector in the US. (New York Green Bank, 2016)

Preferred options

There a variety of ways for public policymakers to support the financing and re-financing of green infrastructure projects, including WI4A. Debt should be the primary focus for policymakers, specifically developing liquid markets in green infrastructure bonds and ABSs.

The main reason to focus on debt is that lower cost debt is likely to have a much larger impact on project economics than lower cost equity. This is primarily

9 Additionally, the Swedish International Development Agency (SIDA) provides a partial credit guarantee covering Class B capital, which facilitated private sector co-investment into the subordinated tranche (GCF, 2016).

because it is a much larger proportion of overall infrastructure financing, with debt to equity ratios often being greater than 80%.

Supplementary reasons include the depth of debt capital markets relative to the scale of equity markets, particularly non-listed equity markets that are usually used for infrastructure finance.

Government (or a government-backed institution) could purchase subordinated tranches (i.e. first-loss tranches) in the first series of green infrastructure bonds or ABS issuances associated with WI4A. This would provide comfort to investors in senior tranches.

This intervention would help to create a market for WI4A bonds or ABSs by improving their risk profile and lowering their price. The main benefit of this approach is that it forces market participants to gain familiarity with the underlying cash flows of the WI4A project (and technology) and once that expertise is developed, there are strong institutional (and individual) incentives to repeat similar transactions.
As the market becomes familiar with the asset class and the technologies, the first loss tranches could be sold back into a liquid market, potentially at a premium. If a third party is holding these assets on behalf of government, they could be incentivised in ways that would help ensure a higher return for government.

The cost to government are the potential losses associated with subordinated tranches should project(s) fail. But the success of WI4A projects will likely be dependent on government policy itself, and so this is largely an endogenous risk controllable by the government.

Multilateral funds and development banks, together with national governments, should examine exactly what interventions, including the ones suggested above, are required to ensure the smooth refinancing of WI4A projects with low cost debt.

BASIN-LEVEL FUNDING AND FINANCING PLANS

We need to turn theoretical funding and financing ideas into actionable plans. As WI4A investments will only work or work best when developed as part of an interconnected system-level solution, it is important to develop plans at an appropriate level: the river basin or catchment.

In each basin it is possible to understand what investments are required, where the funding can come from, the financing requirement, and the appetite of different providers of capital.

Basin-level funding and financing plans should be trialled. These should be detailed plans setting out the built infrastructure and nature-based solution WI4A investment requirements at a basin level and their funding needs. Multilateral developments banks, particularly regional development banks (e.g. Asian Development Bank, African Development Bank, European Bank for Reconstruction and Development, European Investment Bank, and the Inter-American Development Bank) are well placed to support these efforts together with host countries and donors.

Basin-level funding and financing plans are also the perfect vehicle for trialling hybridity and blended finance for WI4A at scale. It is essential that there are more pilots showcasing how different forms of funding and finance can come together to deliver WI4A projects successfully, with benefits accruing to different stakeholders in the intended way. Major pilot WI4A projects, nested in basin-level funding and financing plans, can test different forms of hybridity and blended finance to prove concept and demonstrate scalability.

Companies that use or benefit from more climate resilient water systems have a key role to play in supporting WI4A. Basin-level funding and financing plans, developed with all the key stakeholders using and managing water systems, could be a very effective vehicle for mobilising support from companies and being clear about what they need to do and what they can contribute to. One of the barriers to company engagement is a clear strategy supported by governments. Basin-level funding and financing plans, when backed by governments and other stakeholders, would address this barrier.

SECTION III: CONCLUSION AND RECOMMENDATIONS

The global climate finance architecture – encompassing multilateral, plurilateral, bilateral, national, and sub-national mechanisms, institutions, and programmes – is not currently delivering the scale and pace of funding and finance required to ensure either successful climate mitigation or climate adaptation.

This must change. New and existing funding models must be scaled up, together with new and existing mechanisms for providing finance.

This short and timely report has focused on the climate adaptation part of the challenge, and within that specifically the requirements for water infrastructure.

WI4A are investments designed to increase the climate resilience of water systems whether through entirely new infrastructure, replaced or retrofitted infrastructure, or enhancements and upgrades to existing infrastructure. WI4A includes built infrastructure assets and nature-based solutions.

The next two years are essential for shaping new and existing climate initiatives that could support WI4A and help close the acute funding and financing gaps that exist. The new Global Commission on Adaptation and the UN Secretary General's Climate Summit in 2019 are key. Both processes, and many related ones feeding into them, are intended to help build momentum in advance of the UNFCCC COP26 in 2020.

This is five years after the Paris Agreement and levels of climate ambition will be reviewed and revised with the aim of closing the gap between current climate commitments and the well below 2ºC objective. Key to securing these commitments will be demonstrable and significantly increased funding and finance for climate adaptation in developing countries.

Given that these processes are now 'live', we have a window of opportunity to influence them and ensure that the climate finance architecture can support WI4A, particularly in developing countries. There is also an opportunity to shape more established processes and initiatives such as the replenishment of the Green Climate Fund and China's rapidly growing Belt & Road Initiative that is celebrating its five-year anniversary this year.

There is a further opportunity to be realised by embedding WI4A within new international processes designed to align the financial system with global environmental sustainability. In many of these forums and initiatives, WI4A is largely absent or entirely missing. As these processes establish themselves, it is important that climate adaptation and WI4A are integrated.

To scale up funding and finance for WI4A and to improve the quality of existing efforts, we recommend that a variety of activities are undertaken concurrently, including the following:

1. The multilateral climate finance architecture needs to consider how to scale up funding and finance for water infrastructure that can support climate adaptation. **WI4A should be a specific theme within the Global Commission on Adaptation and should be part of the Climate Resilience stream of the UN Secretary-General's Climate Summit in 2019 being led by the UK Government.** As well as ensuring that WI4A is a specific theme within the Global Commission on Adaptation's final report, the international water policy community should offer to undertake activities as part of its Year of Action.

2. **Basin-level funding and financing plans are required for climate adaptation and WI4A.** These should be detailed plans setting out built

infrastructure and nature-based solution investment requirements at a basin-level and their funding needs. Multilateral developments banks, particularly regional development banks (e.g. Asian Development Bank, African Development Bank, European Bank for Reconstruction and Development, European Investment Bank, and the Inter-American Development Bank) should be tasked with host countries to develop viable financing plans and then work to raise the funding and finance to implement them within three to five years. Companies the use or benefit from more climate resilient water systems have a key role to play in supporting WI4A. The international water policy community should mobilise companies internationally and in specific basins to actively support basin-level funding and financing plans.

3. **There is a significant funding gap and the multilateral climate finance architecture should work to develop new funding mechanisms for WI4A. This could include new WI4A results-based payments mechanisms.** These could be created nationally, regionally, or internationally. New market places enabling results-based payments to remunerate WI4A projects and which then underpin financing are absolutely key. A comprehensive programme of pilots and market design work, leveraging existing results-based payments schemes, should be coordinated for WI4A.

4. Hybridity and blended finance could have a key role to play in scaling up the funding and financing of WI4A. It is essential that there are more pilots showcasing how different forms of funding and finance can come together to deliver WI4A projects successfully, with benefits accruing to different stakeholders in the intended way. **Five major pilot WI4A projects pioneering different forms of hybridity and blended finance should be identified and prioritised for support by the climate finance architecture in order to prove concept and demonstrate scalability.**

5. Low cost debt is key for many WI4A projects. This is because WI4A often requires significant upfront capital investment. Ensuring that debt is available at different stages of project development through to operation is fundamental to the viability of projects and the ability of project sponsors to exist projects and recycle capital back into the construction and development phase of other projects, creating a virtuous cycle. **Multilateral funds and development banks, together with national governments, should examine what interventions are required to ensure the smooth refinancing of WI4A projects with low cost debt.** This could entail coordinated purchasing of subordinated tranches of debt from early issuances and/or forms of bond or securities insurance.

6. **The replenishment of the Green Climate Fund is an opportunity to scale up funding and finance for climate adaptation, particularly WI4A.** This is critical for progress to be made on ratcheting up levels of ambition and commitment at COP26. WI4A, given its co-benefits for multiple SDGs [10], would be a natural area for the GCF to expand activities. The GCF has already made investments in WI4A and these should be reviewed and lessons for the next replenishment and disbursement cycle learnt. **The international water policy community should undertake this work and insert the findings into the GCF process to secure further resources for WI4A.**

7. China's Belt & Road Initiative is a massive investment programme taking place in many of the developing country jurisdictions with the biggest WI4A requirements. **Built infrastructure and nature-based solutions to WI4A should be integrated into efforts to green BRI.** This is potentially a very attractive way for China to show its commitments towards water security, reduce the risk of asset stranding, and secure positive social impacts for host countries. **The international water policy community could produce an analysis of WI4A in the context of BRI, highlighting the economic and political opportunity and the very tangible resilience benefits of WI4A for current and planned BRI investments.**

10 SDGs 2 (Zero Hunger), 3 (Good Health and Well-Being), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 9 (Industry, Innovation, and Infrastructure), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), 13 (Climate Action), 14 (Life Below Water), and 15 (Life on Land).

8. In 2020 China is hosting CBD COP15 and this provides an opportunity to explore scaled up funding and finance for both traditional infrastructure and nature-based solutions as part of WI4A. **COP15 is a major opportunity to align international action on both climate, water and nature, with significant potential prizes for the climate adaptation agenda. This process should be much more actively prioritised in the context of WI4A.**

9. It is critical that all investments are 'water proofed' and that the lock-in of physical climate-related risks are avoided to minimise the risk of future stranded assets. This will require mainstreaming physical climate-related risk assessment into all public and private sector investments. **The water policy community should work with the Central Banks and Supervisors Network for Greening the Financial System to ensure that emerging supervisory theory and practice on climate change and financial institutions takes account of the water risks associated with climate change. It is also critical that these risks are properly disclosed as part of implementation and adoption of the Task Force on Climate-related Financial Disclosures**. The water policy community should be more engaged with the TCFD and the TCFD Secretariat should support this greater engagement.

10. Fiduciaries and company directors have legal duties to manage physical climate-related risks. The water policy community should work with legal theorists and jurists, as well as corporate lawyers, to ensure that emerging guidelines concerning climate-related legal obligations take account of water-related risks associated with climate change. **Options for WI4A that can help meet the legal obligations of fiduciaries and company directors to manage climate change should be identified and associated guidance prepared**. This has the potential to be a very significant driver of demand for WI4A.

11. WI4A can reduce physical climate-related risks and thus reduce insured losses, resulting in lower insurance premiums. This is critical for affordability and increasing insurance coverage, particularly in developing countries. The insurance industry has a key role to play in supporting WI4A. Insurance-linked loans or 'resilience' bonds, where the interest payments are based partly on WI4A investments, and mechanisms to fund WI4A via savings in long term insurance premiums both have significant potential. **The international water policy community can work with insurers and re-insurers and other stakeholders in the insurance community to identify and realise these opportunities**.

12. Capturing increases in land value, partly created as a result of WI4A investments, could be used to fund such investments in the first place. **Land value capture is widely used in many countries and could be tailored to WI4A requirements in developing countries**. This should be urgently explored.

REFERENCES

AATIF. (2017). *Annual Report 2016/17*.

Alafita, T., & Pearce, J. M. (2014). Securitization of residential solar photovoltaic assets: Costs, risks and uncertainty. *Energy Policy*, 67, 488–498.

Aldersgate Group. (2018). Towards the new Normal: Increasing Investment in the UK's green infrastructure.

Aravamuthan, M., Ruete, M., & Dominguez, C. (2015). *Credit Enhancement for Green Projects: Promoting Credit-Enhanced Financing from Multilateral Development Banks for Green Infrastructure Financing*. IISD.

Bank of England. (2015). *The impact of climate change on the UK insurance sector A Climate Change Adaptation Report by the Prudential Regulation Authority*.

Bank of England. (2018a). *Enhancing banks' and insurers' approaches to managing the financial risks from climate change: Consultation Paper | 23/18*. Retrieved from https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/consultation-paper/2018/cp2318.pdf?la=en&hash=8663D2D47A725C395F71FD5688E5667399C48E08

Bank of England. (2018b). *Transition in thinking: The impact of climate change on the UK banking sector.* Retrieved from https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/report/transition-in-thinking-the-impact-of-climate-change-on-the-uk-banking-sector.pdf?la=en&hash=A0C99529978C94AC8E1C6B4CE1EECD8C05CBF40D

Bielenberg, A., Kerlin, M., Oppenheim, J., & Roberts, M. (2016). *Financing change: How to mobilize privatesector financing for sustainable infrastructure*.

Bloomberg. (2017). *Tesla Leads Surge in U.S. Asset-Backed Securities*.

Brealey, R. A., Myers, S. C., & Allen, F. (2017). *Principles of Corporate Finance* (12th ed.). London: McGraw-Hill Education.

Buchner, B., Oliver, P., Wang, X., Carswell, C., Meattle, C., & Mazza, F. (2017). *Global Landscape of Climate Finance 2017*. Retrieved from www.climatepolicyinitiative.org

Caldecott, B. (2017). *Despite the best of intentions green "use of proceeds" bonds are a distraction and a false hope. Economist Intelligence Unit: Perspectives*.

Caldecott, B., Hall, S., & Ives, E. (2018). *A greener, more pleasant land: A new market-based commissioning scheme for rural payments*. Bright Blue. Retrieved from www.brightblue.org.uk

Cashman, A., Souvignet, M., Schuster, S., & Zwick, S. (2018). *Climate insurance and water-related disaster risk management-Unlikely partners in promoting development?* Retrieved from www.gwp.orgwww.gwptoolbox.org

Citigroup. (2017). Index profile: World Broad Investment-Grade Bond Index Excluding MBS.

Climate Bonds Initiative. (2017). Green Securitisation: unlocking finance for small-scale low carbon projects.

Climate Bonds Initiative. (2018a). Climate Bonds Initiative | Water Infrastructure Criteria under the Climate Bonds Standard Criteria Document. Retrieved from https://www.climatebonds.net/files/files/Climate Bonds Water Infrastructure Full Criteria.pdf

Climate Bonds Initiative. (2018b). *Green Bond Highlights 2017*.

Climate Investment Funds. (2008). DONORS MDBS | Climate Investment Funds. Retrieved November 11, 2018, from https://www.climateinvestmentfunds.org/finances

Deloitte. (2013). *Project Bonds: An alternative source of financing infrastructure projects.*

Deutsche Bank. (2016). *Deutsche Bank submits Sustainable Energy for Africa proposal to Green Climate Fund.*

EIB. (2012). *An outline guide to Project Bonds Credit Enhancement and the Project Bond Initiative.*

EIB. (2013). Second project bond issue for Greater Gabbard OFTO demonstrates strong investor interest.

G20 Green Finance Study Group/OECD. (2016). *Green Bonds: Country Experiences, Barriers and Options. Paris.*

GCF. (2016). *FP027: Universal Green Energy Access Programme.*

GCF. (2017). *Project FP027: Universal Green Energy Access Programme.*

GIZ. (2017). *The Potential of Green Bonds: A Climate Finance Instrument for the Implementation of Nationally Determined Contributions? Discussion Paper.*

Global Commission on Adaptation. (2018). Global Commission on Adaptation. Retrieved November 10, 2018, from https://gca.org/global-commission-on-adaptation

Global Environment Facility. (2018). About Us | Global Environment Facility. Retrieved November 11, 2018, from https://www.thegef.org/about-us

Green Climate Fund. (2014). *Decisions of the Board – Eighth Meeting of the Board*, 14-17 October 2014. Retrieved from https://www.greenclimate.fund/documents/20182/24946/GCF_B.08_45_-_Decisions_of_the_Board_-_Eighth_Meeting_of_the_Board__14-17_October_2014.pdf

Green Climate Fund. (2018). Portfolio dashboard - Green Climate Fund. Retrieved November 11, 2018, from https://www.greenclimate.fund/what-we-do/portfolio-dashboard

Greencoat UK Wind. (2018). *Fund overview*.

Hamilton, K., & Zindler, E. (2016). *Finance Guide for Policy-Makers: Renewable Energy, Green Infrastructure*. Retrieved from http://fs-unep-centre.org/publications/finance-guide-policy-makers-renewable-energy-green-infrastructure

Hermann, A., Köferl, P., & Mairhöfer, J. P. (2016). *Climate Risk Insurance: New Approaches and Schemes*. Retrieved from https://www.allianz.com/content/dam/onemarketing/azcom/Allianz_com/migration/media/economic_research/publications/working_papers/en/ClimateRisk.pdf

Hill, C. A. (1997). Securitization: A Low-Cost Sweetener for Lemons. *Journal of Applied Corporate Finance*, 10(1), 64–71.

Hillman, J. E. (2018). How Big Is China's Belt and Road? Retrieved November 11, 2018, from https://www.csis.org/analysis/how-big-chinas-belt-and-road

Hindustan Power. (2016). *Clean energy arm of Hindustan Power projects first to place credit enhanced infrastructure bond.*

Hutton, G., & Varughese, M. (2016). *The Costs of Meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation, and Hygiene*. Retrieved from www.worldbank.org/water

Insurance Information Institute. (2018). Brief History. Retrieved November 9, 2018, from https://www.iii.org/publications/insurance-handbook/brief-history

IPCC. (2018). *GLOBAL WARMING OF 1.5 °C*. Retrieved from http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

Kidney, S., Giuliani, D., & Sonerud, B. (2017). *Public sector agenda for stimulating private market development in green securitisation in Europe*.

Lambert, D. (2016). *Yes, we need a dedicated bond guarantee fund for Indian infrastructure.*

Lemmon, M., Liu, L. X., Mao, M. Q., & Nini, G. (2014). Securitization and Capital Structure in Nonfinancial Firms: An Empirical Investigation. *Journal of Finance*, 69(4), 1787–1825.

Louw, A. (2018). *Clean Energy Investment Trends 2017*.

Lowder, T., & Mendelsohn, M. (2013). *The Potential of Securitization in Solar PV Finance*. National Renewable Energy Laboratory (NREL) Technical Report.

Ma, T. (2016). Basel III and the Future of Project Finance Funding. *Michigan Business & Entrepreneurial Law Review*, 6(1), 109–126.

Miller Smith, C., McLean, G., Paule Biensan, Johnson, S., Millerman, E., Donald, B., & Neaher, N. (2015). *Project bonds: Their growing role in global infrastructure finance*.

Modigliani, F., & Miller, M. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, 48(3), 261–297.

Money, A. (2018). *Hybridity and Blended Finance*. Retrieved from www.worldwatercouncil.org

Morgado, N. C., & Lasfargues, B. (2017). *Engaging the Private Sector for Green Growth and Climate Action: An Overview of Development Co-Operation Efforts*. Paris.

Multilateral Fund. (2018). Multilateral Fund for the Implementation of the Montreal Protocol. Retrieved November 11, 2018, from http://www.multilateralfund.org/default.aspx

Nadauld, T. D., & Weisbach, M. S. (2012). Did securitization affect the cost of corporate debt? *Journal of Financial Economics*, 105(2), 332–352. https://doi.org/10.1016/J.JFINECO.2012.03.002

New York Green Bank. (2016). *Scaling Residential Solar & a New Asset Class to Advance New York's Clean Energy Goals.*

NGFS. (2018). *NGFS First Progress Report*. Retrieved from https://www.banque-france.fr/sites/default/files/media/2018/10/11/818366-ngfs-first-progress-report-20181011.pdf

O'Sullivan, F. M., & Warren, C. H. (2016). *Solar Securitization: An Innovation in Renewable Energy Finance* (MIT Energy Initiative Working Paper). Cambridge, MA.

OECD. (2013). *Water and climate change adaptation : policies to navigate uncharted waters*. OECD.

OECD. (2015a). *Infrastructure Financing Instruments and Incentives.*

OECD. (2015b). *Mapping Channels to Mobilise Institutional Investment in Sustainable Energy, OECD Report to G20 Finance Ministers and Central Bank Governors*. Paris.

OECD. (2016a). *Green Investment Banks: Scaling up Private Investment in Low-carbon, Climate-resilient Infrastructure. OECD Publishing*, Paris.

OECD. (2016b). *Progress Report on Approaches to mobilising Institutional Investment for Green Infrastructure*. Paris.

OECD. (2017). *Mobilising Bond Markets for a Low-Carbon Transition, Green Finance and Investment*. Paris.

OECD. (2018). *OECD ENVIRONMENT POLICY PAPER NO. 11: Financing water Investing in sustainable growth.* Retrieved from https://www.oecd.org/water/Policy-Paper-Financing-Water-Investing-in-Sustainable-Growth.pdf

OECD, & WWC. (2015). *Water: Fit To Finance ? Catalyzing National Growth Through Investment in Water Security*. Retrieved from http://www.worldwatercouncil.org/sites/default/files/2017-10/WWC_OECD_Water-fit-to-finance_Report.pdf

Refocus Partners. (2015). *Leveraging Catastrophe Bonds: As a Mechanism for Resilient Infrastructure Project Finance.* Retrieved from www.refocuspartners.com.

SolarReserve. (2017). *SolarReserve's Crescent Dunes Solar Energy Project with U.S.-developed Storage Technology receives up to $78 million Investment from Capital One*. Press Release.

SSE. (2017). *Further Sale of a Stake in the Clyde Wind Farm to Greencoat and GLIL*. Press Release.

Staker, A., Garton, A., & Barker, S. (2018). *Concerns misplaced: Will compliance with the TCFD recommendations really expose companies and directors to liability risk?* Retrieved from https://ccli.ouce.ox.ac.uk/wp-content/uploads/2017/10/CCLI-TCFD-Concerns-Misplaced-Report-Final-Briefing.pdf

UN. (2018a). High-level Advisory Group on Climate Change Financing (AGF). Retrieved November 11, 2018, from https://unngls.org/index.php/consultations/climate-finance/405-4156

UN. (2018b). SDG - United Nations Population Division | Department of Economic and Social Affairs. Retrieved November 18, 2018, from http://www.un.org/en/development/desa/population/theme/sdg/index.shtml

UN. (2018c). Secretary-General outlines vision for 2019 Climate Change Summit | Permanent Missions. Retrieved November 10, 2018, from https://www.un.int/news/secretary-general-outlines-vision-2019-climate-change-summit

UN. (2018d). The Clean Development Mechanism | UNFCCC. Retrieved November 11, 2018, from https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism

UN Environment. (2018). International Coalition for Green Development on the Belt and Road. Retrieved November 11, 2018, from https://www.unenvironment.org/regions/asia-and-pacific/regional-initiatives/international-coalition-green-development-belt-and

UNFCCC. (2006). *Investment and Financial Flows to Address Climate Change: An Overview of Investment and Financial Flows Needed fro Adaptation.* Retrieved from https://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/adaptation.pdf

UNFCCC. (2014). Fast-start finance | UNFCCC. Retrieved November 11, 2018, from https://unfccc.int/topics/climate-finance/resources/fast-start-finance

UNFCCC. (2017). *Climate change adaptation UNFCCC Sustainable Development Goals 2030 Agenda Reducing vulnerability and enhancing resilience Opportunities and options for integrating climate change adaptation with the Sustainable Development Goals and the Sendai*. Retrieved from https://unfccc.int/sites/default/files/resource/techpaper_adaptation.pdf

UNFCCC. (2018). Clean Development Mechanism Passes New Milestone | UNFCCC. Retrieved November 11, 2018, from https://unfccc.int/news/clean-development-mechanism-passes-new-milestone

US Department of Energy. (2011). *Loan Program Office: Crescent Dunes.*

Varadarajan, U., Nelson, D., Goggins, A., & Hervé-Mignucci, M. (2016). *Beyond YieldCos*.

Waslander, J., & Quijano Vallejos, P. (2018). *Setting the stage for the Green Climate Fund's first replenishment.* Retrieved from http://www.wri.org/

WEF. (2013). *The Green Investment Report: The ways and means to unlock private finance for green growth*. A Report of the Green Growth Action Alliance.

Wilkins, M. (2017). *Can the capital markets step in to plug the infrastructure finance gap?*

World Bank. (2010). *The Cost to Developing Countries of Adapting to Climate Change New Methods and Estimates*. Retrieved from www.worldbank.org

World Resources Institute. (2018). *Global Architecture of Climate Finance*. Retrieved from https://wriorg.s3.amazonaws.com/s3fs-public/Funds_flowchart_v2.png?_ga=2.14040254.867891087.1540053681-1010704371.1540053681

Xinhua. (2018). Xi pledges to bring benefits to people through Belt and Road Initiative. Retrieved November 11, 2018, from http://english.scio.gov.cn/topnews/2018-08/28/content_60655974.htm

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