

## HOW TO MAKE INFRASTRUCTURE CLIMATE RESILIENT

*In emerging markets, climate change threatens infrastructure that is critical for development. Roads, airports, water systems, and power plants are vulnerable to weather changes. Severe storms and major droughts can disrupt economic activity. Because private companies and investors in emerging markets often manage infrastructure projects through public-private partnerships, they will now need to address climate change risks when planning and building these projects. The uncertainty of such risks has made incorporating them into project planning a challenge, but new tools and approaches, including insurance, are helping PPPs better respond to climate risks.*

Well-functioning infrastructure, such as roads, airports, water systems, and power plants, is a pre-requisite to economic development. Yet in many emerging economies, weak governance, regulatory uncertainty, poor public credit ratings, and a shortage of bankable projects have hampered investment in infrastructure. As a result, emerging-market governments have long turned to partnerships with private companies to help fill the gap in infrastructure financing.

These public-private partnerships have evolved over the years with public and private entities shouldering various levels of financial and management responsibility. Some are long-term partnerships with defined roles and responsibilities, while others are more fluid with private enterprises receiving performance or output-based payments.

In emerging markets, climate change is now one more challenge that these projects face in designing, operating, and maintaining infrastructure crucial to growth. Water related projects are especially at risk. Water systems, hydropower plants, and coastal infrastructure will need to be overhauled to withstand the strain of storms, floods, and droughts. But the changing climate and warming temperatures will affect all types of infrastructure projects. Extremely hot days, for example, are cutting construction workdays short and high winds and severe storms threaten cell phone towers. As a result, public-private partnerships will need to account for climate risks in infrastructure planning, making sure that projects are resilient to the effects of climate change.

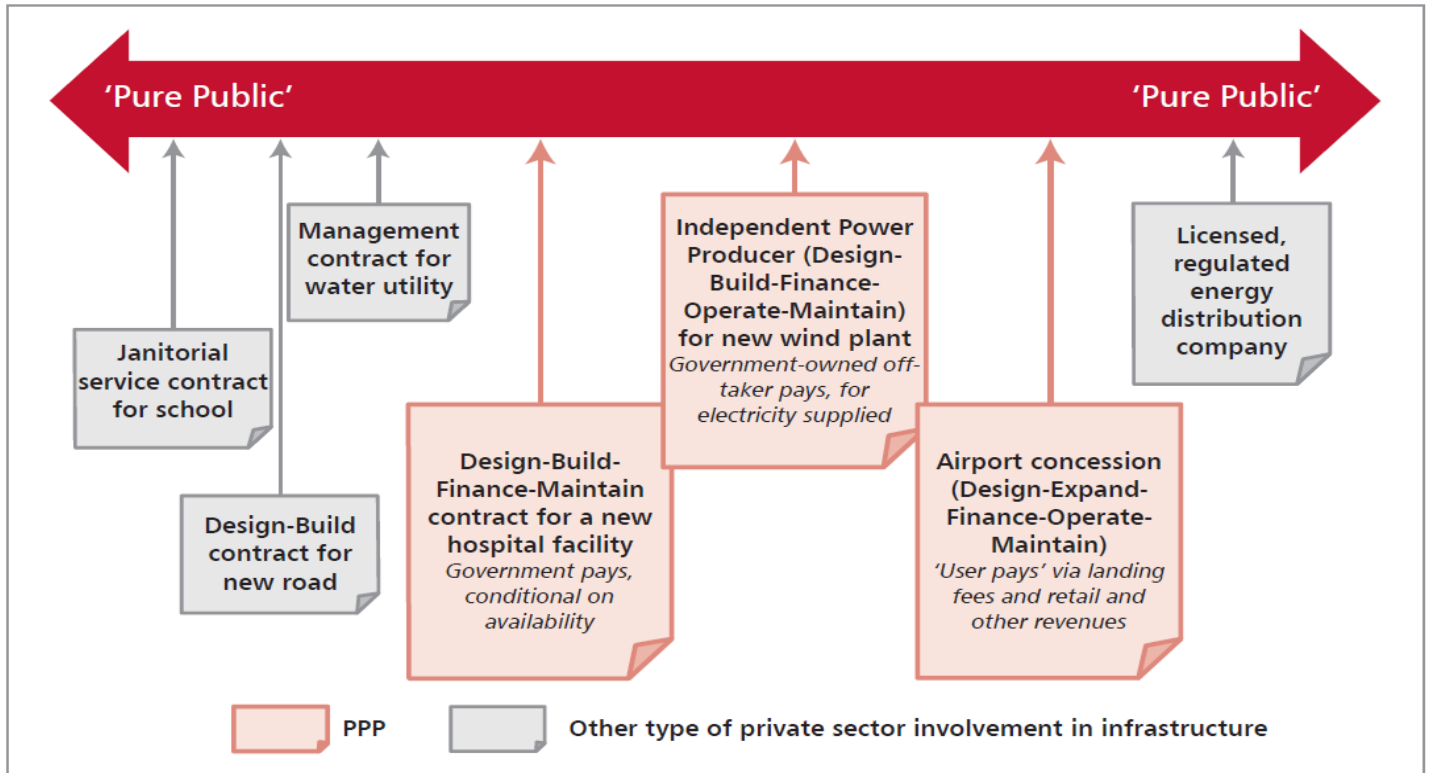
The lack of certainty about how temperatures and precipitation will change makes planning for long-term projects and designing

public-private partnerships even more problematic. Historically PPP contracts have allocated risks to the party in the best position to manage them, but ambiguity about the timing and severity of climate risks presents major challenges for designing and pricing PPP contracts that promote economic development in emerging markets.

In particular, private players have little incentive to account for climate risks in project planning. Often private players in PPP contracts are only paid for the life of the contract, not for the life of the project. As a result of that compensation structure, a private player may not make decisions in the design and planning phase that increase a project's longevity if they also increase costs. Public entities reinforce this behavior because they often choose less expensive proposals and resilience measures can be costly. Finally, if the private player does want additional compensation to manage climate change risks, the PPP structure might not be cost effective for emerging-market governments.

In general, the challenge of incorporating climate risks into PPP contracts is that these contracts are ill suited to managing unpredictability. Uncertain and rare events outside the contract, such as political unrest or floods, are often handled through force majeure provisions and insurance. With such provisions, "both parties get equitable rights to terminate a PPP contract after a prolonged risk event, perhaps lasting 180 days or longer. In a typical [force majeure] termination, both parties share the financial impact; the public sector pays out debt obligations of lenders, paid-in equity including any breakage costs of investors (who forego future profits) in lieu of an affected infrastructure asset," according to a 2016 World Bank report.<sup>1</sup>

## Examples of Public-Private Partnership Contracts



Source: Public-Private Partnerships Reference Guide, Version 2.0 (2014)

Climate change, however, is not easily managed through force majeure provisions because extreme and unpredictable weather events in the present may become normal in the future. In addition, because no standard definition for these provisions exists in legislation and there is no standard approach to how they work in reality, force majeure clauses will likely be inadequate to covering all types of weather and climate risks.

When it comes to climate change, however, decisions made in the present have an impact on future risks. The lack of planning for climate risks has already undermined some PPPs. In 2008, for example, IFC reviewed and helped finance the \$2.3 billion expansion of the Panama Canal. Even though climate experts from IFC raised questions about the impact of the region's changing climate on the project, the project sponsors didn't account for climate risks. As a result, the canal closed in December 2010 due to flooding, when Panama received more rain than at any time in its recorded history, causing significant disruptions and losses.<sup>2</sup>

### Analytical Tools to Address Uncertainties

Because PPPs are not equipped to deal with such types of unpredictability, creating more certainty around climate risks is the key to building infrastructure projects that can withstand

changing weather patterns. Improved tools that provide more accurate forecasts—even decades into the future—will help all parties better evaluate risks from the outset.<sup>3</sup> And scenario planning will also help parties better evaluate a range of possible climate situations. International financial institutions, including IFC and the World Bank, are looking at new tools to better plan for climate risks in infrastructure projects. A World Bank conference in 2015, for example, focused on how investors can incorporate climate risks into infrastructure essential for economic development in Africa. And a diverse group of experts addressed challenges associated with conflicting climate model forecasts.<sup>4</sup>

For some regions, short-term predictions of changes in precipitation are not consistent, but present day investment decisions differ widely based on each prediction. For example, if the future climate involves more rain, an emerging-market government might expand hydropower. Yet if that rain didn't materialize, investments into hydropower plants could be wasted. The experts found that one way to approach such a decision is to weigh the costs of making the investment, with the potential impact if it wasn't made. If the benefits of reduced risk outweigh the costs, then the investment makes sense.<sup>5</sup>

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**TABLE 1: Gaps in PPP Measures to Address Climate Risks**

| MEASURE               | GAP   |
|-----------------------|---|
| Relief & Compensation | <ul style="list-style-type: none"> <li>Lack of a comprehensive list to capture all climate risks exposes the PPP asset to not being able to qualify certain events (e.g., storm, hail damage) as relief or compensation events</li> </ul>   |
| Force Majeure         | <ul style="list-style-type: none"> <li>Non-standardized treatment of FM provisions across different jurisdictions creates investment uncertainty</li> <li>Lack of standard catch-all provisions or itemized lists that fail to fully capture all climate risks under FM limits the extent of FM coverage</li> <li>Due to increasing climate trends, rare climate events in the past may become normal events in the future, making current FM provisions inappropriate</li> </ul> |
| Insurance             | <ul style="list-style-type: none"> <li>Lack of access by developing countries to commercial insurance markets exposes PPP assets to long-term climate risks</li> <li>Limited access and affordability of insurance increases risks in PPP projects and dissuades investors from investing in risky PPPs</li> </ul>  |
| Uninsurability        | <ul style="list-style-type: none"> <li>Uninsurability provision can disincentivize the private sector from developing climate-resilient infrastructure and proactively managing climate risks</li> <li>When the public sector assumes insurance risk under uninsurability provisions, it does not have the same ability and capacity of a commercial insurer to enforce a disciplined approach to risk management</li> </ul>  |

Source: The World Bank Group and PPIAF Public-Private infrastructure Advisory Facility

Another approach to dealing with climate change uncertainty is to weigh different views based on their probability. This approach has been used in other fields where uncertainty is coupled with the need for accurate forecasting. In this approach, different expert opinions are “weighted” based on their accuracy and then aggregated to create a projection.<sup>6</sup>

### Insurance and PPPs

Because insurance companies specialize in risk management, their analytical methods can be adapted to help public-private partnerships assess and manage climate risks for infrastructure projects. Traditional insurance products are most relevant for short-term risks relevant to the design and approval of upfront financing. Insurance companies can also encourage developers to incorporate climate risk measures into infrastructure projects by offering more favorable terms such as lower premiums. As the availability of risk mitigation instruments grows, insurers can advise project companies and governments on the products they could use to better manage long-term risks.

Insurers will have to experiment beyond traditional products and pricing to better match the climate change risks of infrastructure projects in emerging markets. Lenders that fund a project generally require insurance to cover risks and ensure that their interests are protected. When it comes to risks from climate change, lenders will want new types of insurance in order to protect themselves against ongoing risks such as

droughts that may reduce hydropower generation and low wind years that reduce wind power generation.

Surety bond insurance may be one model for the broader and longer coverage relevant to climate risks. This is a type of insurance that guarantees completion of a project in the event of financial default.<sup>7</sup> IFC, together with Munich Re, established a Risk Sharing Facility in both Brazil and Colombia for this type of project completion risk. However, such coverage is not widely available in emerging markets and has yet to be applied to climate risks.

Ultimately financiers, governments, and insurers will need to come together to identify innovative new products and approaches to deal with climate change risks. The United Nations Economic Commission for Europe, for example, created the International Public Private Partnership Center in New Orleans to share lessons from Hurricane Katrina with developing nations.

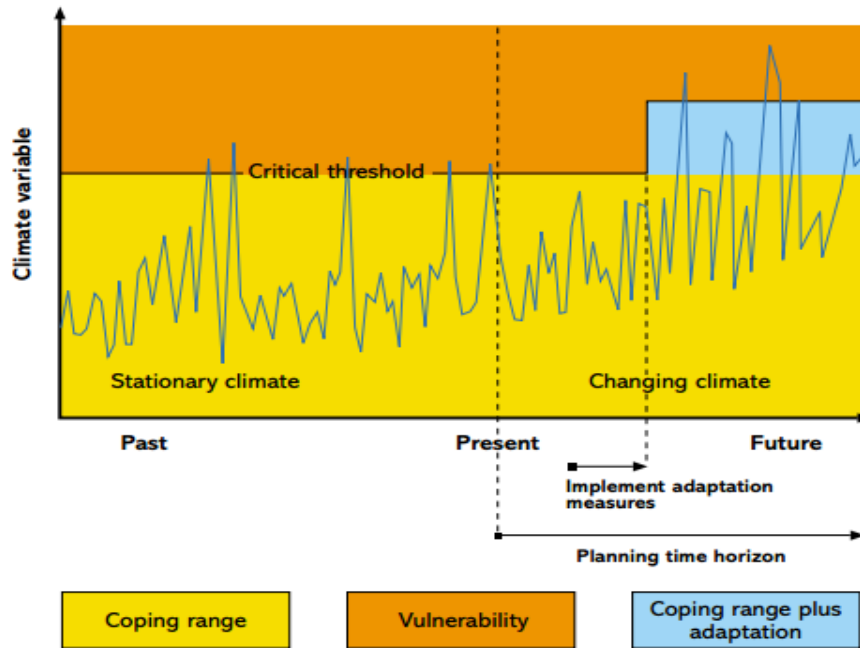
In Uruguay, the World Bank, insurer Swiss Re, and state-owned utility company UTE, designed a way to adapt insurance to boost the resilience of its hydropower systems, which supply most of the country’s energy needs. When there is little rain the utility purchases oil and gas as an alternative energy source meaning that high oil prices during dry conditions can severely affect the national economy. In 2012, a year of water shortages, the utility spent \$1.4 billion to meet the country’s energy needs,

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beyond original projections of \$953 million. In order to cover the gap, UTE borrowed funds, drew down the country's Energy Stabilization Fund, and increased rates to consumers. To help avoid such a destabilizing situation in the future, the World Bank executed a \$450 million weather and oil price insurance transaction, insuring UTE for 18 months against drought and

high oil prices. To gauge the extent of a drought and potential insurance payouts to the company, daily rainfall data at 39 weather stations spread throughout two river basins are measured regularly. If precipitation falls below the level set up as trigger of the contract, UTE receives a payout of up to \$450 million based on the severity of the drought and oil prices.<sup>8</sup>

**The ability of infrastructure to cope with the changing climate erodes over time, unless adaption measures are put in place**



Source: United Kingdom Climate Impacts Programme

Finally the PPP procurement process can include insurance requirements that lower losses from disasters. This can help public entities ensure that private companies include structural and financial resilience measures in procurement proposals.

**Conclusion**

The need to address climate risks in infrastructure projects is becoming increasingly urgent for economic development in emerging markets. Countries most vulnerable to severe storms and rising sea levels are also among those with the greatest need for new roads, ports, power plants, and other forms of infrastructure to reduce poverty. The World Bank Group and other

international financial institutions are well placed to address the intersection of climate risks and infrastructure. They are screening such investments for climate risks, providing analytical tools to measure those risks, and designing measures to respond to those risks, including innovative insurance approaches. ■

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<sup>1</sup> Satheesh Sundararajan, Nuwan Suriyagoda, "Climate Risks and Resilience in Infrastructure PPPs: Issues to be Considered," PPIAF Issue Brief, March 2016.

<sup>2</sup> The World Bank, "Emerging Trends in Mainstreaming Climate Resilience in Large Scale, Multi-sector Infrastructure PPPs," World Bank Group and PPIAF Public-Private Infrastructure Advisory Facility, 2016.

<sup>3</sup> Handshake: IFC's Quarterly Journal on Public-Private Partnerships, "Climate Change and PPPs," 2011.

<sup>4</sup> Raffaello Cervigni, Rikard Liden, James E. Neumann, and Kenneth M. Strzepek, "Enhancing the Climate Resilience of Africa's Infrastructure," *United Nations Economic Commission for Africa*, 2015

<sup>5</sup> Ibid.

<sup>6</sup> M. Oppenheimer, C. Little, and R. Cooke, "Expert judgement and uncertainty quantification for climate change," *Nature Climate Change*, April 27, 2016.

<sup>7</sup> Ace Report, "Using Surety to Facilitate Infrastructure Investment," 2015.

<sup>8</sup> The World Bank, "Mitigating the Impact of Drought on Energy Production in Uruguay," 2015.

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