

# Deploying Low Carbon Technologies: Private Sector Costs of Readiness

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### 1. Executive Summary

The Bali Action Plan has paved the way for the present dialogue on mechanisms to facilitate deployment of mitigation and adaptation technologies from developed to developing countries. This will be important in order to capture the mitigation potential, and especially the low cost mitigation opportunities, that exist in these countries.

Private investment will play an important role in deploying low carbon technologies. The nature of climate change projects necessitates a strong public-private partnership response, particularly in developing countries where risks are perceived to be higher.

Project developers tend to be 'first movers' in the development of climate change projects. These private sector actors play a critical role as 'pathfinders', catalysing policy development, leading larger 'later stage' investors into markets and creating readiness for subsequent transactions. The project development model is essentially a 'venture' business. Project developers typically develop projects with a view to exiting at or around financial close. Project developers have high project readiness costs and bear high risk over extended project development cycles.

This study seeks to (a) identify and conduct a conceptual analysis of private sector readiness costs, (b) develop a methodology for further study of these costs and (c) propose possible interventions by the development community to help governments and the private sector reduce readiness costs.

Climate change projects have many characteristics in common with conventional energy projects. However, it tends to be the characteristics on which climate change projects differ from conventional energy projects that give rise to barriers. These characteristics include: (i) smaller transaction size, (ii) non-traditional private sector actors, (iii) issues with respect to resource availability and assessment costs, (iv) a heavy reliance on regulatory support and an international carbon market, and (vi) in some instances, reliance on new technology. These barriers can result in higher transaction costs and risks to climate change project developers.

The study identified three areas in which climate change projects experience incremental costs of readiness: (A) proportionately higher project readiness costs due to smaller project size, (B) incremental readiness costs for 'first mover' transactions, and (C) higher costs of capital.

Typical readiness costs for a base-line climate change project are estimated to be about US\$ 60 / kW or about 3% – 5% of total project cost. Readiness costs for 'first mover' transactions are significantly higher at about US\$ 100 – US\$ 180 / kW (about 6% – 10 % of total project costs).

'First mover' transactions may take 2 – 3 times longer than a base-line project in an advanced policy environment. The increased cost, development time and risk of 'first mover' projects are likely to attract a 'first mover' risk premium. The cost of capital, coupled with longer project development cycles, serve to amplify the costs of readiness. The analysis suggests that the effect is to increase project costs for a 'first mover' project by 8% – 23% relative to a base-line project. These higher costs may result in projects failing to be realised.

An increase of 8% – 23 % in project costs is material, particularly in the context of a regulated energy supply industry, and warrants further study of readiness costs. A methodology is proposed for the conduct of this study, with the initial focus on the renewable energy supply sector. A parallel study may be considered for the energy efficiency sector given the mitigation potential that it offers and the fact that high readiness costs have been identified as a key barrier in this sector.

A number of interventions are proposed for consideration by the development community. Among these support for the development of policy and regulatory frameworks in developing countries, establishment of a climate change project development company and public finance interventions aimed at expanding access to project finance are considered to be crucial and urgently needed to accelerate deployment of low carbon technologies in developing countries.

## 2. Background

### 2.1 The Bali Action Plan

The Decision of the thirteenth Conference of the Parties (“COP 13”) to the United Nations Framework Convention on Climate Change (“UNFCCC”) known as the “Bali Action Plan” contained a number of key resolutions and decisions pertaining to the development, deployment<sup>1</sup> and transfer of technology. This will be a critical factor in reducing global carbon emissions.

The UNFCCC estimates that over two-thirds of the total mitigation potential, and over 80% of the low cost potential, is located in developing countries<sup>2</sup>. It also notes that a share of 46% of total investment flows directed at developing countries can bring about 68% of the needed global emission reductions in 2030<sup>3</sup>. Urgent action is needed to avoid locking-in more carbon-intensive infrastructure with long asset lives in developing countries that have significant and on-going infrastructure investment programmes to support development and economic expansion.

The Bali Action Plan has paved the way for the present dialogue on mechanisms to facilitate the deployment of mitigation and adaptation technologies from developed country Parties to developing countries Parties.

### 2.2 The Role of Private Sector Investment

The private sector is estimated to have contributed 86% of global investment and financial flows to address climate change<sup>4</sup>. In developing countries the private sector’s share of investment in renewable energy and energy efficiency has historically been marginally lower but, nevertheless still accounts for the vast majority of investment (about 77-78%).<sup>5</sup>

The UNFCCC estimates that the private sector will provide about 80% of investment for climate change mitigation and bear a significant share of adaptation investment<sup>6</sup>. Given the scale of investment needed this will require an “...unprecedented shift in private sector investment and behaviour ... within the next 10-15 years.”<sup>7</sup>

The investment community has recognised both the risk and opportunity of climate change. In a 2009 Investor statement the investment community has called for “[c]lear, credible long-term policies for investors to integrate climate change considerations into their decision-making processes and to support investment flows into a low carbon economy.”<sup>8</sup> It notes in particular that “... the

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<sup>1</sup> In this study technology “deployment” describes the process of putting into use or action technology. The literature reviewed also uses “diffusion” to describe this process.

<sup>2</sup> UNFCCC, *Investment and Financial Flows to Address Climate Change*, UNFCCC, 2007, p.80.

<sup>3</sup> *Ibid.* p.7

<sup>4</sup> *Ibid.* p.5

<sup>5</sup> World Bank, *Technical Report: Development and Climate Change – A Strategic Framework for the World Bank*, World Bank, 2008, p.39.

<sup>6</sup> UNFCCC, as cited in World Bank, *Technical Report: Development and Climate Change – A Strategic Framework for the World Bank*, *Ibid*

<sup>7</sup> World Economic Forum, *Task Force on Low-Carbon Prosperity – Summary of Recommendations*, World Economic Forum, Geneva, Switzerland, 2009, p. 5.

<sup>8</sup> Institutional Investor Group on Climate Change (IIGCC), Investor Network on Climate Risk (INCR), Investor Group on Climate Change (IGCC) and UNEP Finance Initiative, *2009 Investor Statement on the Urgent Need for a Global Agreement on Climate Change*, 2009, p.1.

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single most significant driver of private sector investment in renewable energy and other low carbon technology is strong, stable, transparent and credible national policy.”<sup>9</sup>

Recent financial market turbulence has disrupted private capital allocation, with the investment and financial markets evincing a heightened timidity towards risk. This has resulted in reduced flows of private sector investment to climate change projects, particularly to projects in development countries where risks are perceived to be higher.

The nature of carbon mitigation and adaptation – in particular, the heavy reliance on appropriate policy frameworks at both the international and national level – necessitates a public-private partnership approach to the development of climate change projects. This will be especially critical in developing countries. It will need to be underpinned by strong regulatory frameworks.

### 2.3 The Project Development Venture Business Model

Historically, private sector project developers have tended to be ‘first movers’ in the development of climate change projects, particularly in the renewable energy space. This has been the experience in developed countries (e.g., in Europe and the United States of America (USA)) and evidence suggests that a similar path is being followed in developing countries.

Project developers tend to be smaller and nimbler than larger investors (e.g., utilities) and, therefore, are better able and more willing to react quickly to uncertain and evolving policy environments where larger investors, including utility investors, may hold back, awaiting greater certainty. Project developers are also prepared to pursue smaller transactions which fall below the radar of larger investors, particularly at earlier stages in the project development lifecycle. This places project developers on the ‘front lines’ in the development of climate change projects particularly in countries where policy and regulatory development is nascent. These private sector actors play a critical role, acting as “pathfinders” and accelerating the development of markets and creating readiness for subsequent transactions.

Project developers tend to lead larger investor groups into a market by undertaking the high risk project development activity and, thus, creating project and aggregation opportunities at advanced stages for ‘later stage’ investors that would not have the resources, patience or risk appetite to pursue the projects through extended and expensive development cycles.

The project developer business model is essentially a ‘venture’ business model, akin in many ways to the venture capital model. They seek to develop projects to a point where the project can attract capital from or be sold to ‘later stage’ investors, including utility investors. This is particularly relevant to the climate change project sector in developing countries at the present time as lack of project development activity has been identified as a key barrier to the expansion of climate change projects in these countries.

Given the nature of their activity, project developers bear high readiness costs and high risk in preparing projects and, by extension, opening markets. These costs and risks are the focus of this study.

### 2.4 Purpose and Scope of Present Study

The objective of this study is to identify the private sector costs of creating readiness (i.e., learning and transaction costs) within the new climate change sectors and markets. Specifically, the objective of the study is to identify and organise, in a conceptual manner, private sector costs of readiness with a view:

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<sup>9</sup> Ibid. p.4.

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- (a) To support the present dialogue on mechanisms to facilitate the deployment of mitigation and adaptation technologies from developed country Parties to developing countries Parties;
- (b) To propose a methodological approach for understanding and aggregating the private sector readiness costs that may be used in a subsequent full scale research effort; and
- (c) To discuss possible interventions for the development community to help governments reduce private sector readiness costs.

As noted, the study focuses, in particular, on the “venture” model of project developers described in Section 2.3 as this is presently the dominant model for project development in developing countries. The examples used for analysis are renewable energy generation projects.

### 2.5 Definitions Used in this Study

**Cost of Capital:** The cost of a company's financing (debt and equity), or, from an investor's perspective the required rate of return on an investment, including an investment in a project.

**Costs of Readiness:** Learning and transactions costs associated with the preparation, development and implementation of climate change projects at early stages of market development. For the purposes of this study, costs of readiness are taken to be the project development costs incurred in conceptualising and preparing a project for implementation up to financial close.

**Climate Change Project:** A project aimed at mitigation (reducing carbon emissions) or adaptation in the context of the present or future international agreements responding to climate change.

**Project Developer:** An entity that engages in the development of climate change projects with a view to selling down its interest in the project, usually at or about financial close.

**Weighted Average Cost of Capital (WACC):** WACC is a measure of the average required rate of return of all the company's financing (equity, debt, and hybrid instruments), weighted in proportion to the company's total invested capital (see also Annex A).

## 3. Characteristics of Climate Change Projects

Climate change projects are similar in many respects to conventional energy projects. This is particularly true for mitigation projects which are directed at energy-supply infrastructure e.g., renewable energy transactions.

However, climate change projects, especially those in developing countries, do have important differences from conventional energy projects. Table 1 compares a number of characteristics of climate change projects with conventional energy projects.

**Table 1: Comparative characteristics of climate change projects and conventional energy projects in developing countries**

Project Characteristic	Conventional Energy Projects	Climate Change Projects
Scale / Transaction Size:	Typically large scale transactions	Generally smaller scale transactions
Private Sector Actors:	Larger utilities and experienced infrastructure developers	Typically non-traditional developers (driven by smaller scale transactions)
Resource Availability / Assessment:	Generally well defined, transportable, storable, internationally traded fuels	Typically localised, not easily transportable or storable, often poorly defined
Reliance on Policy and Regulatory Support:	Some reliance e.g., tariff setting, usually well developed	Heavy reliance, including potential subsidies / feed-in tariff, various stages of development (see Table 5)
Reliance on International Carbon Market:	Nil	Heavy reliance, carbon assets create supplementary revenue streams
Reliance on Technology:	Generally based on mature technologies	Some transactions based on newer technologies and / or mature technologies employed in an innovative manner

#### 4. Climate Change Project Characteristics Create Barriers

The differences identified in Table 1 can give rise to barriers to project implementation which, in turn, can result in higher transaction costs, longer development cycles and risks in implementing climate change projects. Examples of these barriers and the impact that they may have on project costs and risks are provided in Table 2. In some instances barriers are interconnected compounding challenges, costs and risks.

Table 2: Potential barriers and consequential incremental transaction costs relevant to climate change projects

Climate Change Project Characteristic	Potential Barriers	Incremental Transaction Costs / Risk
Scale / Transaction Size:	<ul style="list-style-type: none"> <li>▪ Small individual transaction size</li> <li>▪ Typically higher capital cost per unit output (e.g., renewable energy) – results in increased perceived risk</li> <li>▪ Inability to access financing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Higher project development / transaction costs per unit capacity / output</li> <li>▪ Inability to access debt finance increases project’s WACC</li> </ul>
Private Sector Actors:	<ul style="list-style-type: none"> <li>▪ Lack of information</li> <li>▪ Non-traditional developers – lack experience, knowledge and/or capital</li> <li>▪ Credit quality of smaller contracting counterparties, especially new technology companies</li> <li>▪ Inability to access financing e.g., non-traditional project developers lack relationships with financiers</li> <li>▪ Inexperience / lack of sector experience of local financiers</li> <li>▪ Inability to pay costs of financial advisors / intermediaries and other advisors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Increased project execution risk due to poor project preparation</li> <li>▪ Longer project development cycles</li> <li>▪ Inability to obtain bankable guarantees and warranties from suppliers</li> <li>▪ Costs of capital raising</li> <li>▪ Increased execution risk, resulting in projects failing to be realised</li> <li>▪ Inability to obtain financing – leading to higher WACC</li> </ul>
Reliance on Policy and Regulatory Support:	<ul style="list-style-type: none"> <li>▪ Lack of information</li> <li>▪ Lack of knowledge of how renewable energy technologies fit into energy supply</li> <li>▪ Lack of / poorly developed policy and regulation</li> <li>▪ Divergence in ROI expectations – unrealistic expectations of policymakers and regulators</li> <li>▪ Poor institutional structure</li> <li>▪ Lack of capacity within institutions</li> <li>▪ Lack of coordination between government agencies</li> </ul>	<ul style="list-style-type: none"> <li>▪ Advocacy and costs of learning / educating policymakers and regulators (particularly relevant to first-mover transactions)</li> <li>▪ Increased legal, permitting and compliance costs</li> <li>▪ Amplified political risk e.g., in context of change of or failure to enforce climate / environmental policy and regulation and/or breach of contract</li> </ul>

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Climate Change Project Characteristic	Potential Barriers	Incremental Transaction Costs / Risk
	<ul style="list-style-type: none"> <li>▪ Uncertainty on government commitment to and/or risk of change to policy and regulation</li> <li>▪ Failure to enforce environmental legislation</li> <li>▪ Energy sector subsidies</li> </ul>	
Resource Availability / Assessment:	<ul style="list-style-type: none"> <li>▪ Limited access to available data on resources</li> <li>▪ Poor quality data</li> </ul>	<ul style="list-style-type: none"> <li>▪ Costs and time required for resource assessment</li> <li>▪ Contracting risks</li> </ul>
Reliance on International Carbon Market:	<ul style="list-style-type: none"> <li>▪ Requirement to demonstrate “additionality” – and inability to do so absent confidence on carbon price</li> <li>▪ Uncertainty regarding existence of carbon market beyond 2012 (see Figure 3)</li> <li>▪ Lack of clear, long term carbon price signal</li> </ul>	<ul style="list-style-type: none"> <li>▪ Development of methodology and certification process time-consuming and expensive</li> <li>▪ Existence of bottlenecks and bureaucracy exacerbate inefficiencies which add to time and cost</li> <li>▪ Transaction costs take this out of reach of smaller projects</li> <li>▪ Increased compliance costs</li> </ul>
Reliance on Technology:	<ul style="list-style-type: none"> <li>▪ Lack of protections for intellectual property rights</li> <li>▪ Obtaining acceptance of technology</li> <li>▪ Possible ‘chicken and egg’ – require to obtain certification to build and operate project but need certification to enable financial close / construction</li> <li>▪ New / prototypical technologies difficult to insure and finance</li> <li>▪ Technology companies lack financial capacity to provide EPC ‘wrap’ / warranties</li> </ul>	<ul style="list-style-type: none"> <li>▪ Costs of patent filing and enforcement</li> <li>▪ Compliance costs in respect of standards and certification</li> <li>▪ Inability to obtain insurance and/or finance due to technology risk – necessitates balance sheet financing which increases WACC and possibly results in projects failing to be realised</li> </ul>

EPC = Engineering, procurement and construction; ROI = Return on investment; WACC = Weighted Average Cost of Capital

## 5. Costs of Creating Readiness

In the context of the barriers identified above, there are three areas in which climate change projects in developing countries may experience increased costs of readiness. These result from:

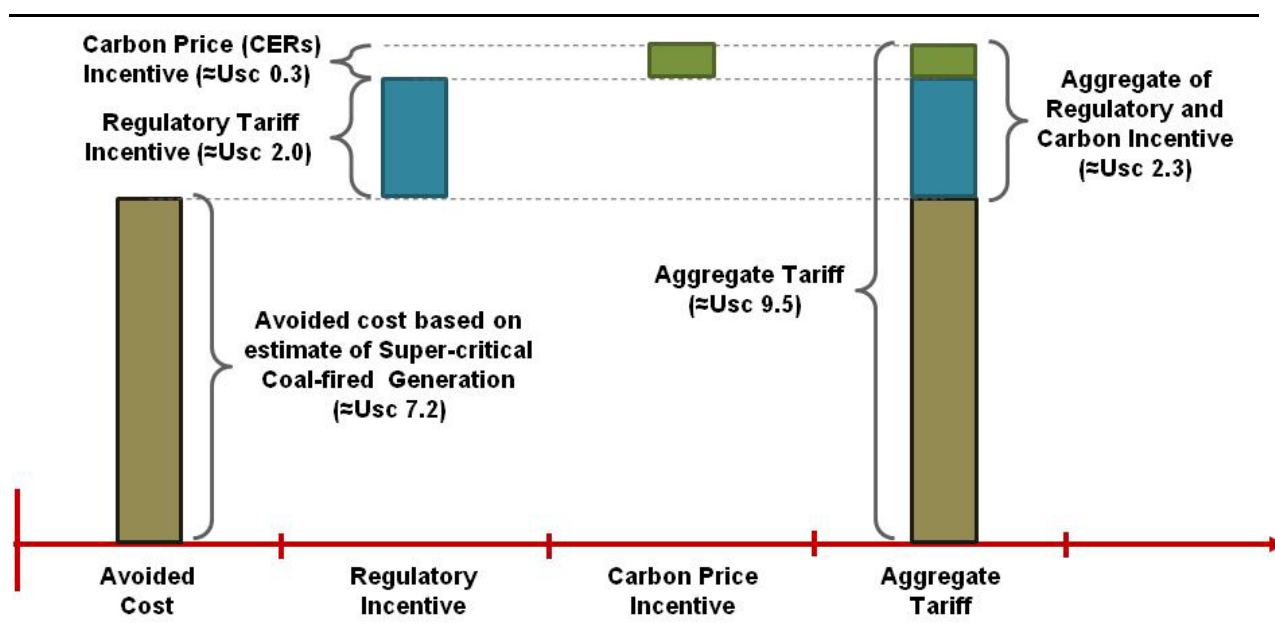
- A. Proportionately higher project readiness costs for smaller projects;
- B. Incremental readiness costs of and time to implement initial transactions i.e., elevated costs of ‘first mover’ transactions; and
- C. The cost of capital, which amplifies the effect of incremental readiness costs and related delays.

These are discussed at Sections 5.1 to 5.3 below.

It is widely acknowledged that projects based on renewable energy technologies have a higher capital costs than projects based on conventional technologies. These projects also typically have a higher cost of delivered energy than energy sourced from conventional sources.

One perspective of this cost differential is that it represents the failure to price in the cost of externalities e.g., the incremental emissions from coal, oil and gas-fired electricity generation. Policymakers and regulators have endeavoured to target regulatory intervention, coupled with a carbon market price signal, to level the playing field and promote the shift to a low carbon economy. Figure 1 illustrates how regulatory interventions (e.g., a feed-in tariff) and carbon price incentives operate to supplement a climate change project’s revenue.

**Figure 1: Conceptual renewable energy tariff construction, including regulatory and carbon incentives, for a biomass project in a developing country<sup>10</sup>**



CER = Certified Emissions Reductions; USc = United States cents

Given the reliance of climate change projects on revenue streams underpinned by regulatory intervention, uncertainty associated with the regulatory intervention mechanisms substantially

<sup>10</sup> Based on Certificate of Emissions Reduction (CER) price of US\$ 15 / tCO<sub>2</sub> in a developing country where gas is the dominant fuel source. Clean Development Mechanism (CDM) revenue spread over generation, but is only available during years when project is certified e.g., may only be for first 7-10 years under present CDM. Dispatch assumed to be base load at C. 88%.

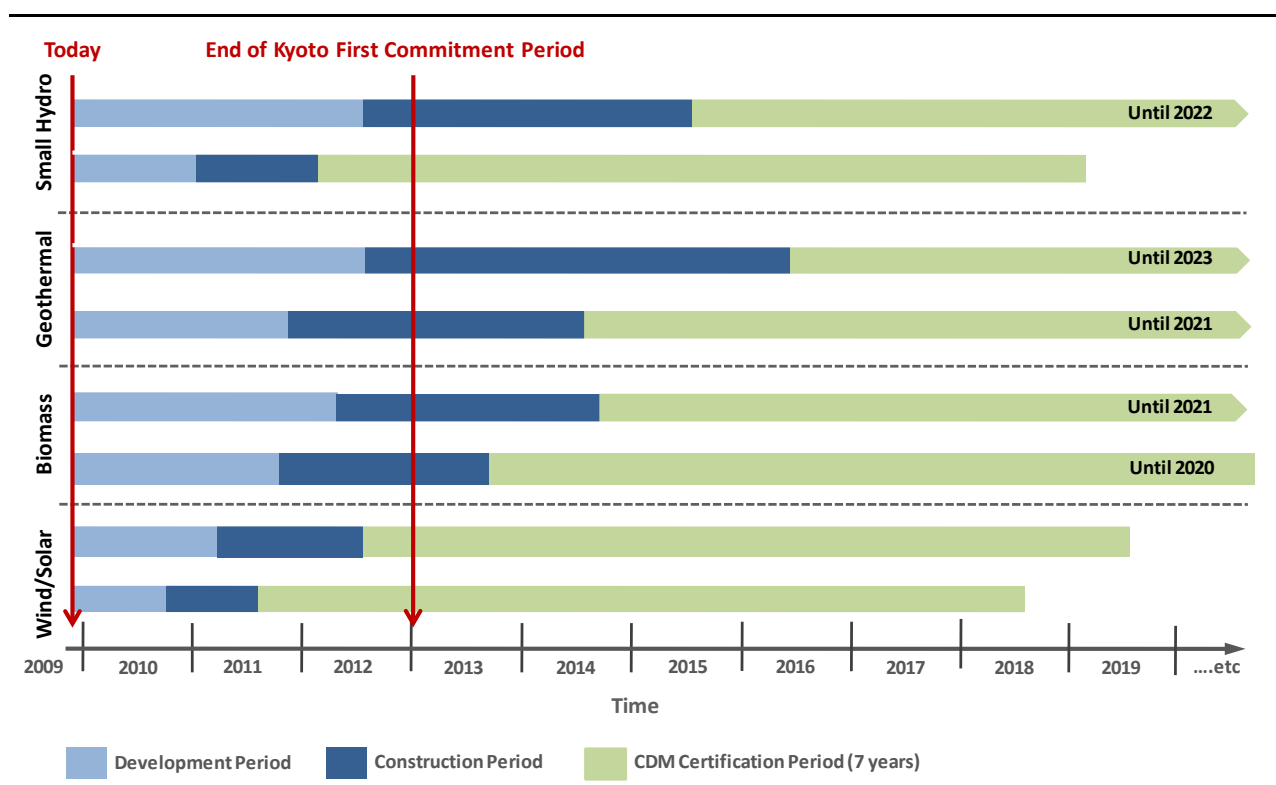
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increases the project risk. Project developers, particularly those active in nascent markets, bear significant cost and expend significant time to obtain clarity on regulatory frameworks, often being required to assist governments in formulating policy and regulation in support of the project activity. This is very much a ‘learning by doing’ activity for both the project developer and the regulator. Through this process policy and regulation evolves and capacity is developed among the project stakeholders, creating conditions for speedier and more efficient development of subsequent projects.

Present uncertainties regarding the future of carbon markets, specifically the Clean Development Mechanism (CDM), add risk to project development activity. Figure 2 illustrates the development, construction (long and short development and construction periods<sup>11</sup>) and CDM certification periods for a range of renewable energy technologies for projects initiated at the time of writing. It can be seen that only a fast-tracked wind or solar project (short development and construction periods) would get the benefit of more than one year of Certified Emissions Reductions (CER) under the first commitment period of the Kyoto Protocol. Biomass, geothermal and the majority of hydro projects would not get any benefit whatsoever. This highlights that delays in agreeing a post-2012 CDM regime pose considerable challenges (and risk) for climate change project developers that rely on a carbon price signal to achieve the financial viability of their projects.

Section 5.2 discusses the impact of elongated development timeframes on ‘first mover’ projects. Section 5.3 shows how the cost of capital can amplify the effects (cost) of these delays.

**Figure 2: Timeout for the CDM: development, construction and CDM certification periods for various renewable energy technologies**



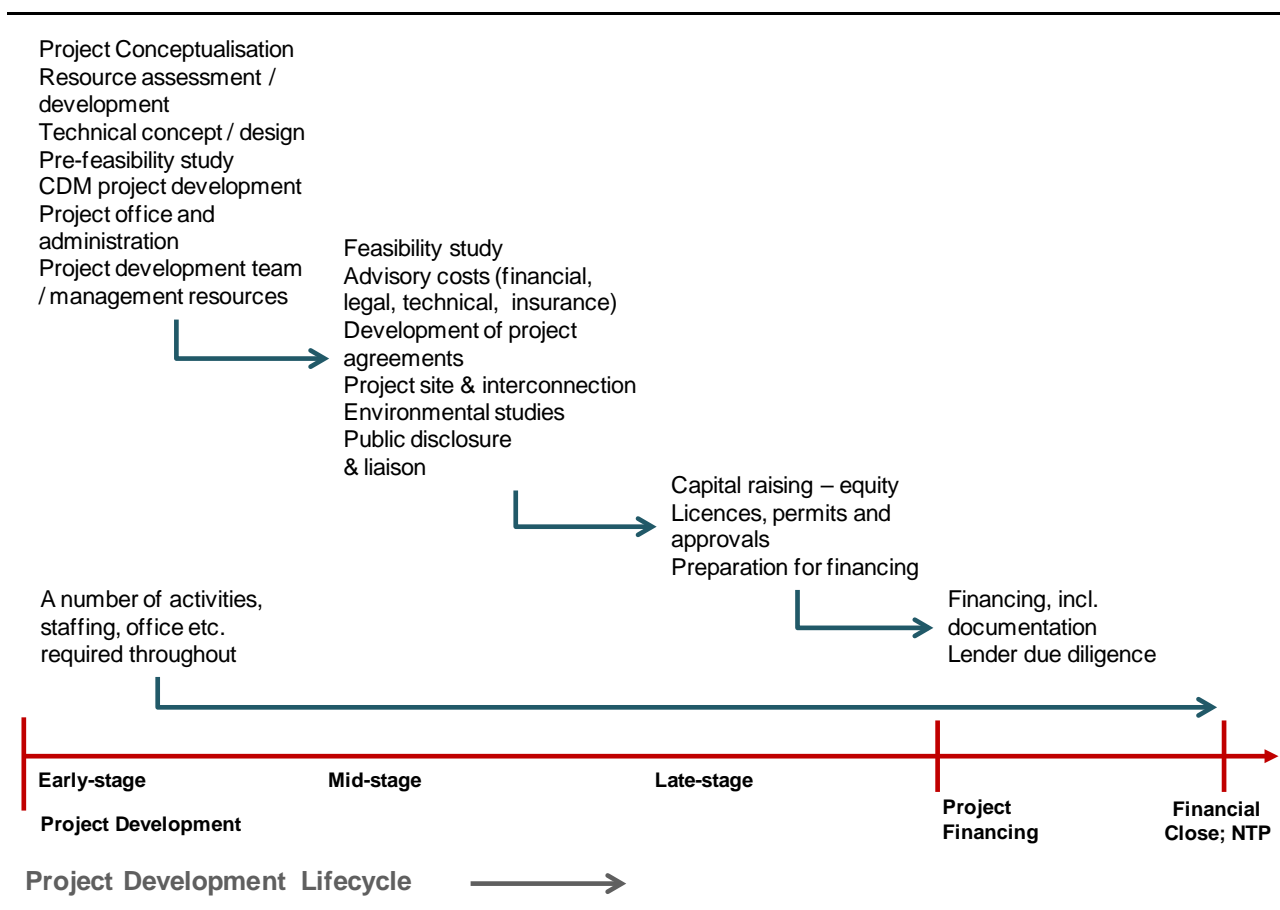
CDM = Clean Development Mechanism

<sup>11</sup> Shorter development and construction periods would relate to ‘best case’ scenarios for projects developed in advanced policy environments with technology specific transaction experience. Experience suggests that ‘first mover’ transactions would take even longer than the “long development periods” indicated in Figure 2.

### 5.1 Higher Project Readiness Costs for Smaller Transactions – Size Matters

Project development (transaction) costs are, as the name suggests, costs incurred in project development activities. Figure 3 illustrates the typical project development activities associated with a climate change project in a developing country. Table 3 provides an indication of cost implications for climate change projects for various project development activities relative to typically larger conventional energy projects.

**Figure 3: The project development lifecycle and typical project development activities / costs for a developing country climate change project**



CDM = Clean Development Mechanism: NTP = Notice to Proceed (to construction contractor)

Typically the cut-off for categorisation of project development costs is financial close, with costs incurred at or after financial close being allocated to other cost categories e.g., financing costs or engineering, procurement and construction (EPC) costs. Costs incurred in relation to capital raising activities, including the preparation and development of the financing facility(ies), may be regarded as project development costs. However, traditionally, financing costs incurred at financial close (e.g., success fees to financial advisors and up-front fees to lenders) are categorised as financing costs.

The majority of project development costs are often referred to as ‘soft costs’ because they are predominantly spent on ‘intellectual assets’, consultant costs, management time and other non-physical assets. They typically have little or no value if the project does not proceed and hence carry significant risk until certainty can be achieved that the project will reach financial close.

In general, project development costs tend to be under-reported as project developers often fail to (or are not permitted to) account the cost of management time in the project development effort.

**Table 3: Cost implications of project development activities for climate change projects**

Activity	Int./Ext. Cost	Cost Implications for Climate Change Projects (i.e., vs. Conventional Energy)
<b><u>Project Development: Early-stage</u></b>		
Project Conceptualisation	Int.	No change
Resource assessment / development	Int./ Ext.	Depending on level of resource development available from government, generally requires cost and time for assessment, analysis etc. (including independent assessment required by lenders)
Technical concept / design	Int. / Ext.	Generally higher cost proportionately for smaller projects
CDM project development	Ext.	Incremental cost to climate change projects – implications for time and cost
Project office and administration	Int.	Generally higher cost proportionately for smaller projects
Project development team / management resources	Int.	Generally higher cost proportionately for smaller projects, although usually project teams are lean
<b><u>Project Development: Mid-stage</u></b>		
Advisory costs (financial, legal, technical, insurance)	Ext.	Generally higher cost proportionately for smaller projects – may be out of reach of many project developers
Development of project agreements	Ext.	Depending on whether standard agreements have been developed by government
Project site & interconnection	Int./ Ext.	Generally higher cost proportionately for smaller projects. Interconnection may be challenging.
Environmental studies	Ext.	Required – may be proportionately higher cost depending on project complexity
Public disclosure & liaison	Int./ Ext.	Required – not significant
<b><u>Project Development: Late-stage</u></b>		
Capital raising – equity	Ext.	May be critical for project developers that don't have capital to complete projects – advisory fees usually out of reach of developers. Generally higher cost proportionately for smaller projects
Licences, permits and approvals	Int./ Ext.	Higher cost proportionately for smaller projects
Preparation for financing	Int./ Ext.	Higher cost proportionately for smaller projects
<b><u>Financing Phase</u></b>		
Assuming financing is available		
Financing, incl. documentation	External	Higher cost proportionately for smaller projects
Lender due diligence	External	Higher cost proportionately for smaller projects

Ext. = External cost; Int. = Internal cost

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Given the nature of project development expenditures, the scale of project development costs tends not to be linked directly to the scale of a transaction. Project development costs do increase in absolute terms for larger, more complex transactions. However, project development costs are proportionately higher for smaller scale projects in a given technology domain e.g., smaller wind projects will generally have proportionately higher development costs than larger wind projects.

**Table 4: Cost breakdown in percentages for energy projects utilising different technologies**

	Project A	Project B	Project C	Project D
Location	Developing Country	Developing Country	Developing Country	Developing Country
Technology	Super-critical Coal	CCGT	Biomass	Biomass
Project Size	Very Large, over 1,000 MW	Large, 500-1,000 MW	Medium-Small, 50-100 MW	Small, 20-50 MW
Policy / Regulatory Development	Nascent	Nascent	Nascent for project concept	Medium
Project is a first mover?	Yes	Yes	Yes	No
Project Development costs (US\$/kW)	17.5	17.5	58.9	60.0
Construction Period (months)	42	24	30	24
<b>Project Costs</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Project Development Costs	1.1	3.1	3.0	3.7
Construction Costs	80.0	74.4	74.8	76.5
Other Project Costs	1.7	9.6	10.0	9.8
Working Capital	0.4	1.8	1.6	1.5
Sub-total (capital costs)	82.8	88.9	89.2	91.4
Financing Costs	17.2	11.1	10.6	8.5
<b>Total Project Costs</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Table 4 provides a breakdown of project costs for a range of energy transactions based on different technologies and project scale. It is difficult to generalise from a very limited data set, nevertheless the following observations may be made:

- Project development costs for climate change projects (typically smaller projects) would typically fall within the range of 3 – 5% of total project costs. As noted, in general, smaller projects will tend to have higher project development costs. Larger projects benefit significantly from scale economies with respect to project development costs.
- The project technology has a significant bearing on the capital cost. This will have a bearing on the proportion of project development cost-to-total project cost.

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- As climate change projects typically have a higher per unit cost of installed capacity, a proportion of project development costs in the range indicated (3 – 5%) for climate change projects implies a higher project development cost per unit of installed capacity.
- Further, projects based on more complex technologies will have higher project development costs. Highly specialised technologies (e.g., geothermal and nuclear) tend to have inherently longer project development cycles and higher project development costs. They will also tend to the higher end of the capital cost spectrum.
- In addition to higher technology costs and higher project development costs, climate change projects will usually have higher grid interconnection and related infrastructure costs per unit output because of their smaller scale.

Large conventional energy projects are typically strategically sited (near large load centres) and/or factored into long-range energy planning (including transmission line development). Infrastructure can be developed to deliver fuel to the project site and evacuate energy via dedicated transmission lines.

Smaller renewable energy projects are not afforded this treatment. Siting is driven by the availability of resources (e.g., wind, solar, biomass), independent of demand centres and transmission infrastructure. The small scale of projects means that developers are typically required to provide for interconnection in order to make the project happen<sup>12</sup>.

- Projects that have longer construction periods will inherently have higher financing costs in view of the accumulation of interest during construction. This will tend to increase the total project cost and, thereby, diminish the project development cost as a proportion of the total project cost. Conversely, projects that can be developed and implemented quickly have the benefit of shorter construction timeframes and, therefore, reduced financing costs. Wind and solar projects are the principal beneficiaries in this regard (see Figure 2). Higher capital costs of climate change projects have a direct, proportional increase in financing costs.
- A comparison of development costs per unit of installed capacity (US\$ / kW) in Table 4 reveals that the smaller climate change projects in the sample have project development costs 2.0 – 3.5 times those of conventional energy projects on this measure. This means that readiness costs for climate change projects are significantly higher than those for conventional energy projects. These readiness costs are significantly greater for “first mover” transactions (see Section 5.2).

Given that most climate change projects are relatively small scale, especially in developing countries, it follows that such projects will tend to have proportionately higher project development costs. This adds an incremental hurdle to project developers implementing climate change projects, particularly given the inherently higher risk during the project development cycle. This further stacks the deck against climate change projects and in favour of conventional energy.

One obvious lesson from the above analysis is that size is important. Regulators in some countries have developed policies and built programmes that only “play around the edges”<sup>13</sup>. Small scale

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<sup>12</sup> A number of developing countries have regulated to obligate the grid operator to interconnect renewable energy projects. The cooperation of the grid operator in this regard is critically important. However, the reality is that it is within the purview of the grid operator to manage budgets, priorities and timeframes, thus exposing project developers to incremental risk and potential delay (and, therefore, cost). Most project developers would prefer to manage this risk and cost within the boundary of their project, provided they are appropriately compensated.

<sup>13</sup> Interview with Euan Low, Mott MacDonald.

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climate change projects developed under these regimes do almost nothing to move the meter on emission reductions and perpetuate, if not widen, the economic gap with conventional energy.<sup>14</sup>

As shown above, higher transactions costs for smaller scale projects means that these projects are inherently more expensive and are not the most cost effective opportunities for mitigation. This approach also constrains investment and financial flows as smaller transactions do not generally appeal to investors and small projects typically have difficulty in accessing financing (see also Section 5.3 below).

Regulators should focus on trying to scale up individual projects and provide for programmatic expansion of smaller projects i.e., enable innovative scalable business models based on replication strategies that bring down per transaction costs and enable more efficient capital raising and structuring. The war on climate change will not be won ‘in miniature’; the focus needs to shift to the bigger picture – bigger numbers, bigger planning<sup>15</sup>.

### 5.2 Incremental Costs of Readiness for ‘First Mover’ Transactions

In many developing countries climate change policy and regulatory regimes are still evolving. In theory this creates opportunities for climate change project developers to initiate projects and to ‘lead’ policy in support of the project activity. These projects have the potential to act as ‘pathfinders’ by creating readiness through instigating policy change and building capacity for subsequent projects.

In practice, however, there are few, if any, ‘first mover’ advantages in climate change project development. The reality is that the absence of policy and a constructive regulatory framework in support of a climate change project activity will result in significant incremental time and cost to the project development cycle. Inherently, there is also significant incremental risk in ‘first mover’ projects (see also Section 5.3).

Table 5 identifies the impact in terms of incremental time and cost to a ‘first mover’ project developer in different policy and regulatory environments – nascent, medium and advanced policy and regulatory development.

**Table 5: The impact of climate change policy development on projects in developing countries**

Policy / Regulatory Development:	Nascent Development – Dynamic, Uncertain	Medium Development – Some Uncertainties	Advanced Development – Stable, Certain
Incremental Project Timeframe	High impact, potentially factor of 2-3 times timeframe of a base-line project in an advanced market	Medium impact, but high impact where project not covered by existing regulation	Low impact
Incremental Project Development Cost	High impact, potentially factor of 2-3 times costs of a base-line project in an advanced market	Medium impact, but high impact where project not covered by existing regulation	Low impact

<sup>14</sup> For example, Thailand’s primary focus for the development of renewable energy projects is under the Very Small Power Producer (VSPP) programme which limits the installed capacity of projects to less than 10 MW.

<sup>15</sup> Interview with Euan Low, Mott MacDonald.

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Figure 4 illustrates this graphically. The incremental development cost and elongation of the development cycle act to directly increase total project costs (see also Table 6) and delay the realization of the project (and, therefore, carbon mitigation).

Time is a critical factor in project development. In general, development costs are a direct function of the development period. Delays in project implementation therefore directly add to project development costs. To some degree project developers may (and often need to) defer development expenditure to reduce their ‘burn rate’<sup>16</sup> over extended development periods but this can have the unintended effect of further elongating the development period.

**Figure 4: Time and transaction cost impacts for ‘first mover’ climate change projects relative to base-line projects undertaken in more evolved policy environments**

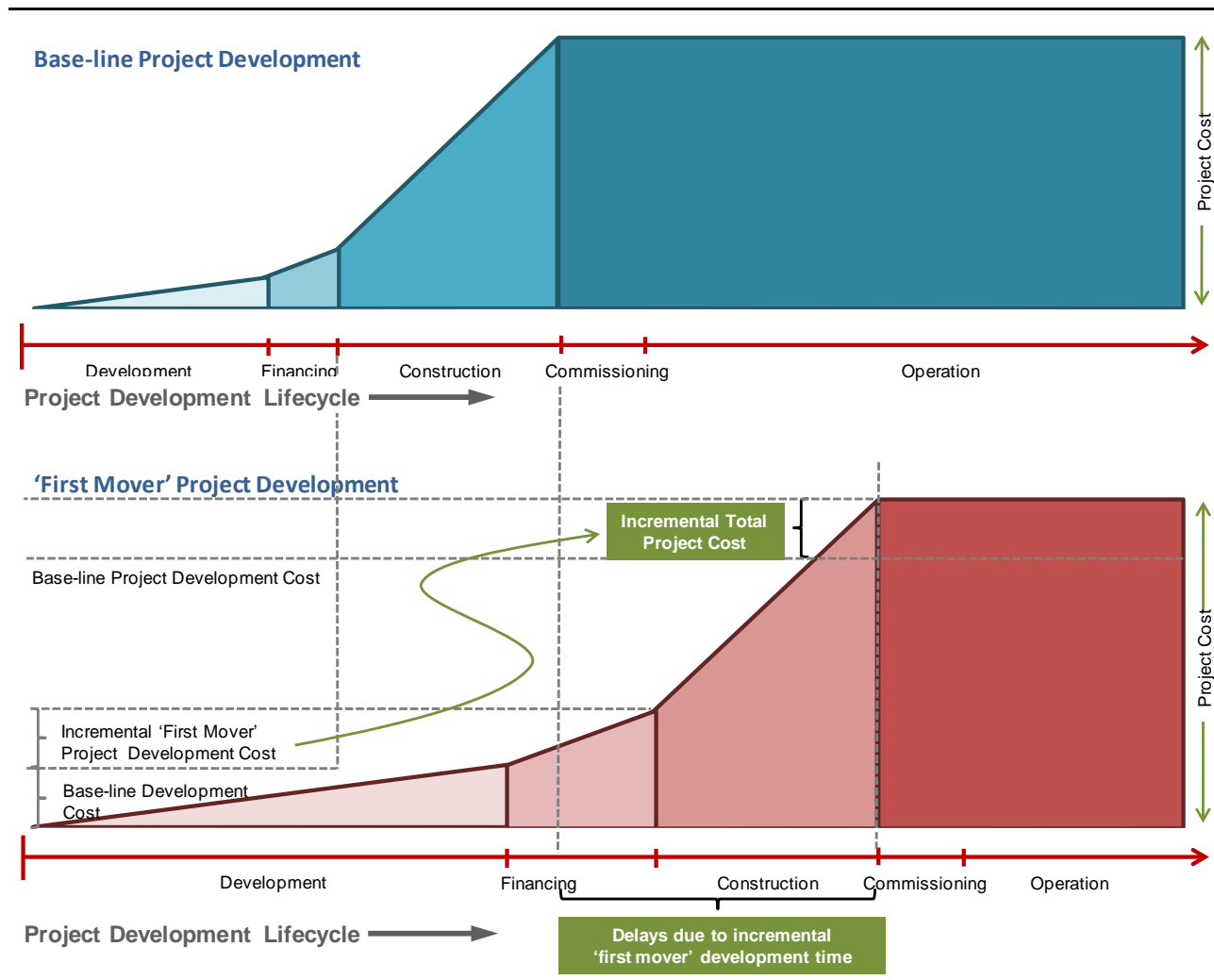


Table 6 shows the impact of incremental project development costs for a hypothetical ‘first mover’ project relative to a base-line project i.e. an equivalent project (technology, scale, etc) in an advanced policy market with relevant transaction experience. Low and high scenarios are considered for project development costs for each of the ‘first mover’ and base-line projects.

<sup>16</sup> The “burn rate” is the rate at which a project developer uses capital to finance overhead and project development costs before generating positive cash flow from operations. In other words, “burn rate” is a measure of negative cash flow during the project development cycle.

**Table 6: Comparison of hypothetical 25 MW ‘first mover’ project vs. equivalent base-line climate change project in an advanced policy market with relevant transaction experience**

	Base-line Project: Advanced Policy Environment		‘First Mover’ Project: Nascent Policy Environment	
Project Development Cost Scenario	Low Case	High Case	Low Case	High Case
Project Development Costs	1.5	2.0	2.5	4.5
Construction Costs		31.2		31.2
Other Project Costs		4.0		4.0
Working Capital		0.6		0.6
Sub-total		37.3 – 37.8		38.3 – 36.3
Financing Costs		3.5		3.5
Total Project Costs		40.8 – 41.3		41.8 – 43.8

Project Development Cost Scenario	Low Case	High Case	Low Case	High Case
Project Development Costs as factor (multiple) of base-line low case	1.0	1.25	1.67	3.0
Project Development Cost (%)	3.7	4.8	6.0	10.3
Project Development Cost US\$ / kW	60.0	80	100	180

The base-line project’s development costs are within the range of 3% – 5% of total project costs and at the upper end of the project development costs per kW (US\$ 60 – 80 / kW) indicated in the previous section, reflecting the small scale of the base-line climate change project.

Based on this example, the ‘first mover’ project development costs are about 1.7 – 3.0 times the base-line low case project development costs and about 1.25 – 2.25 times the base-line high case project development costs. The effect is that project development costs as a share of total project costs increase to 6% – 10% (vs. 3% – 5 % for the base-line project). Project development costs are US\$ 100 – 180 / kW of installed capacity (vs. US\$ 60 – 80 / kW for the base-line project).

Project developers tend to underestimate the time and high costs of project development, particularly for ‘first mover’ projects in markets with nascent policy environments. Non-traditional project developers that are active in climate change project development generally lack the experience to anticipate the many challenges, high transaction costs and extended development cycles associated with these projects. As a result many ‘first mover’ climate change projects fail to be realised because project developers simply do not have the resources to endure the cost and time of the development activity. Projects that are successfully developed are more expensive than projects developed in more mature markets with evolved policy environments.

For the purpose of the analysis in Table 6 all other costs are held constant in order to isolate the impact of increased project development costs. This may not, however, be the case in practice. It is possible (probable even) that contractors and financiers may add a premium for supply of equipment, services and financing to a ‘first mover’ project.

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

Equipment suppliers and other contractors, for example, will not have developed on-the-ground infrastructure, component supply chains and sub-contractor relationships and may, therefore, price in incremental cost and risk to their own ‘first mover’ activities in these areas.

Equally, financiers who have no experience of financing a particular technology in a particular country will likely weight financing terms to account for the higher perceived risk of financing ‘first mover’ transactions. This will be reflected in higher financing fees and interest rates (in addition to higher due diligence costs), probably coupled with more conservative financing terms, including the ratio of debt-to-equity (see Section 5.3).

Table 7 shows the potential impact on project development activities for ‘first mover’ projects and the reason for such impacts.

Policymakers and regulators can act to reduce costs to ‘first mover’ project developers by putting in place well considered, comprehensive climate change policy supported by implementing regulation, including for example model contracts based on international best practice. Enabling project developers to replicate project activities can also help to spread incremental ‘first mover’ readiness costs across multiple projects. Preliminary resource assessments and analysis can also serve to reduce project development costs and accelerate project development activity.

The development community can support governments in these activities through, *inter alia*, information dissemination, targeted technical assistance to develop policy and regulatory frameworks and capacity building programmes (see Table 8 for examples of potential development community interventions).

### 5.3 The Cost of Capital Amplifies Incremental Readiness Costs

Investors make investment decisions to allocate capital among alternate, competing investment opportunities based on their investment criteria. Investor criteria will dictate, *inter alia*, the point at which the investor may enter a transaction and the return hurdle that the investment must achieve.

Figure 5 illustrates the points of entry that different types of capital from different investor groups might typically be committed to a project. It can be seen that financial close is a critical milestone at which a number of equity and debt providers may enter a transaction. For project investments, financial close is usually a condition precedent for drawdown of financing from private equity and infrastructure funds<sup>17</sup>, mezzanine capital and senior lenders.

There is a significantly smaller universe of capital providers that are prepared to commit capital to projects which have residual development risk. This capital is generally expensive reflecting the higher risk of the transaction at the earlier stage of its development life.

Figure 5 also provides indicative ranges of return expectations for the different investor groups. Investors generally regard climate change projects to be riskier than conventional energy projects, given their reliance on incentives and uncertainties regarding regulation that governs these incentives (i.e., national policy and regulation and carbon markets). Incremental risk premiums of 2-5% are not uncommon for climate change projects, relative to conventional energy projects, depending on specific market circumstances.

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<sup>17</sup> Many private equity and infrastructure funds prefer to acquire operating assets, delaying their potential participation in projects until after commissioning.

Table 7: The potential impact on selected project activities for ‘first mover’ projects

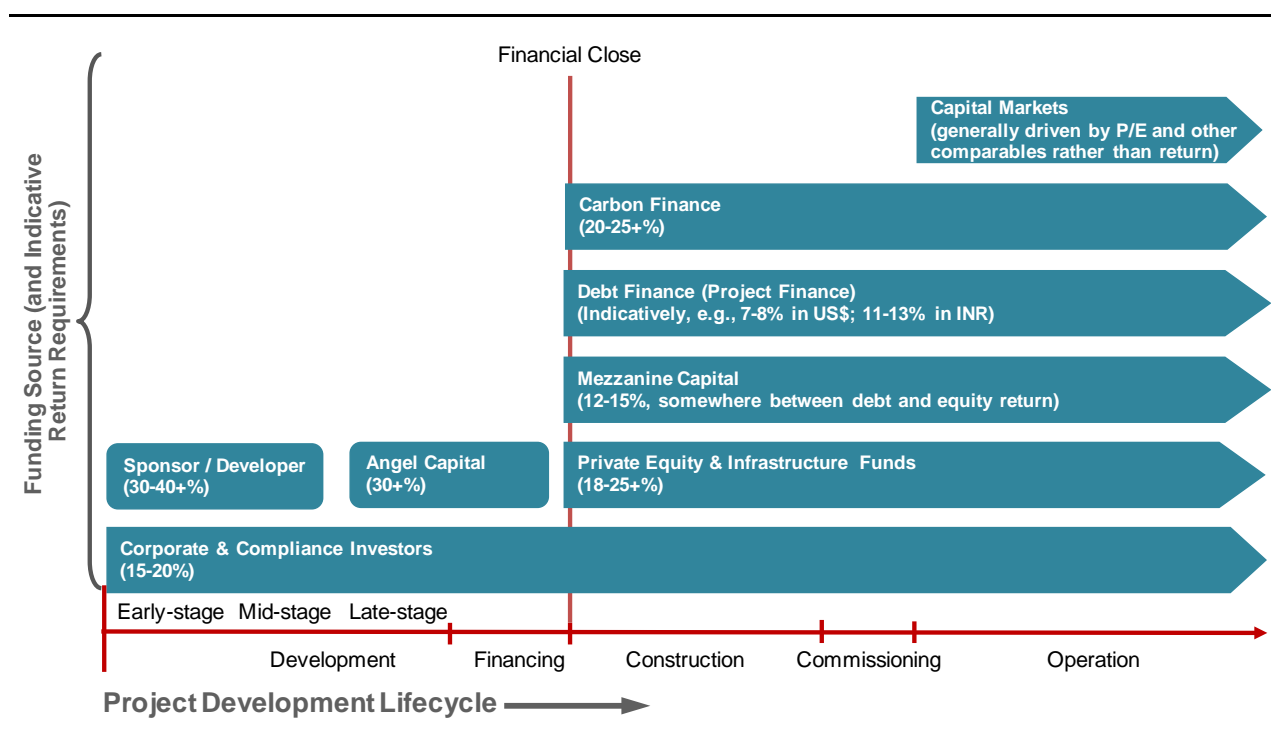
Cost Items	Int. / Ext. Cost	Potential Impact	Reason for Impact
<b>Development Activities / Costs</b>			
Policy advocacy	Ext.	Significant management resources over extended period – elongates project development substantially (single largest contributor to increase in development time)	Need to create climate awareness, advocacy for project activity, capacity development and related learning activities
Resource Assessment	Ext.	Increased time and cost	Lack of available data or poor quality data, likely zero work undertaken by government
CDM Project Development	Ext.	Increased time and cost	Need for advocacy, possible new methodology
Office / Administration	Int.	Increased cost	Function of time
Management resources	Int.	Increased cost	Management resources committed over longer time – function of time
Advisory costs	Ext.	Increased cost (external)	Lack of local experience on technology / project activity
Project contracts	Ext.	Increased cost (external)	No precedent contracts available, learning costs associated with dealing with off-takers, fit in energy mix
Project site / interconnection	Int. / Ext.	Increased time and cost	Learning associated with project needs, liaison with off-taker
Environmental / public disclosure	Ext.	Increased cost and time required	Learning costs, particularly on public disclosure, community acceptance – longer process
Licences, permits and approvals	Int. / Ext.	Increased time and cost	No precedent approval processes developed, requires learning on both sides – developer and government / regulators – longer process

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

Cost Items	Int. / Ext. Cost	Potential Impact	Reason for Impact
<b>Other Project Costs</b>			
EPC and supply contracts	Ext.	Increased cost	Suppliers lack on-the-ground infrastructure, networks
<b>Financing Activity / Costs</b>			
Capital Raising	Int. / Ext.	Increased cost	Risk to market participants for taking on significantly riskier 'first mover' project; limited number of players willing to take on such projects
Preparation for financing / due diligence	Ext.	Longer time required, increased due diligence costs	Education of financiers, learning costs, essentially developers paying for financiers to learn how to finance climate change project activity
Available Financing	Ext.	Smaller market, lower level of leverage i.e., debt-to-equity; potentially tighter project covenants	More conservative stance by financiers for 'first mover' project
Interest rates and fees	Ext.	Higher financing fees and interest rate	Perceived risk of supporting 'first mover' transaction

Ext. = External cost; Int. = Internal Cost

Figure 5: Indicative points of entry and return expectations for different investor groups<sup>18</sup>



INR = Indian Rupee; P/E = Price-earnings ratio; US\$ = United States dollar

Capital for projects at an earlier stage of development demands a higher rate of return than capital applied at a later stage in the development cycle when projects have progressed through certain milestones. Achievement of milestones – development, financing, construction, commissioning – removes elements of risk (de-risks) the project, thus lowering the required rate of return. This is illustrated in Figure 6. Figure 6 also illustrates the effect of a ‘first mover’ premium for ‘first mover’ projects discussed at Section 5.2.

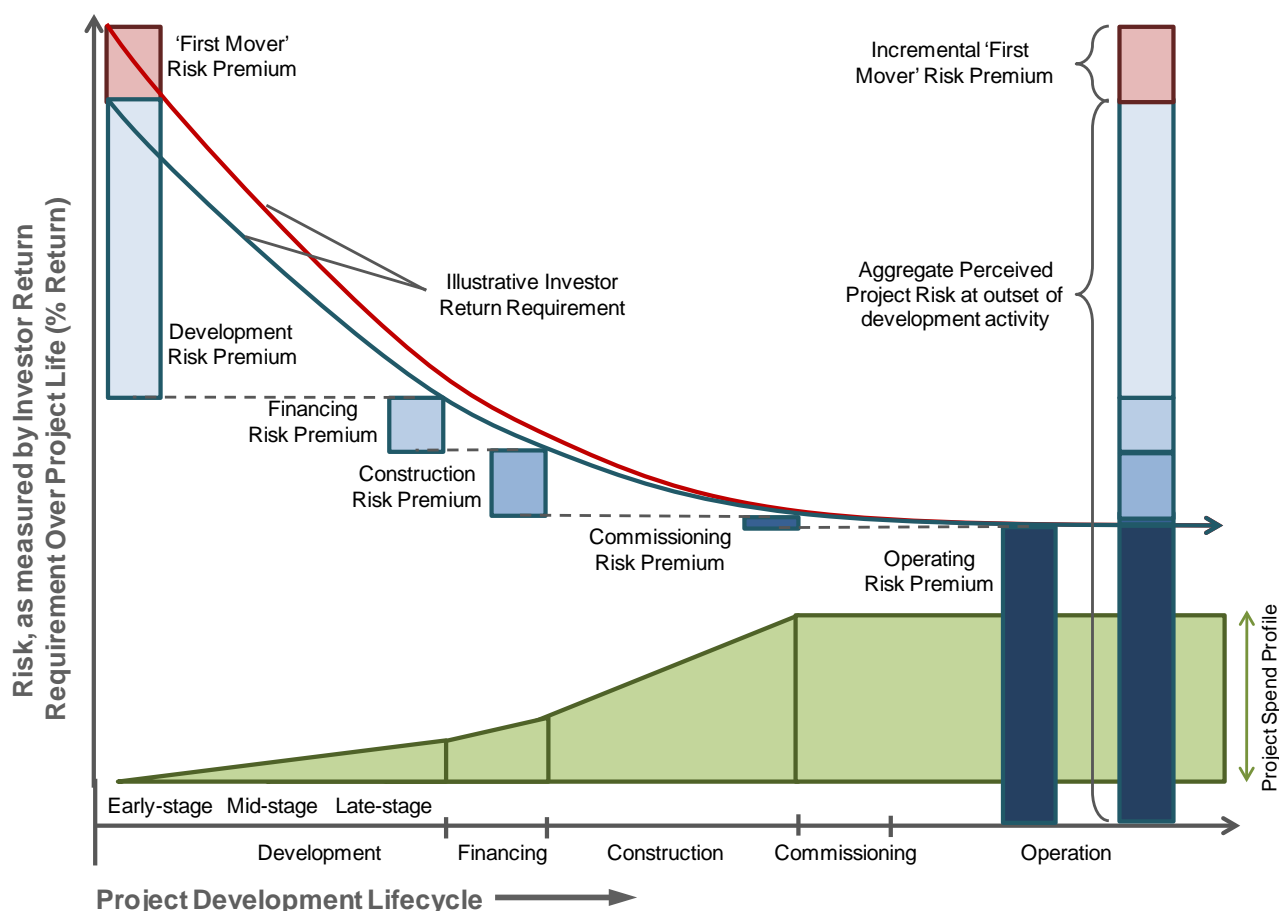
Estimating the rate of return required by project developers for climate change projects is complex (refer to Annex A for a description of some of the factors in this regard). As noted at Section 2.3, project development is essentially a ‘venture’ activity. Project developers assume risks which are similar in some respects to those experienced by venture capitalists (e.g., a probability that the investment may fail), albeit that the investments are in projects rather than early stage technologies. The rates of return required by project developers, therefore, will tend to be in the range of those sought by venture capitalists i.e., upwards of 30%.

Policymakers and regulators generally underestimate the cost of capital for climate change projects. This is based on experiences in the conventional energy sector where large utility investors are active and are prepared to accept ‘utility rates of return’, which tend to be in the ‘teens’ for developing countries (and may be less than 10% for developed countries)<sup>19</sup>.

<sup>18</sup> Rates of return can (and do) vary depending on individual market circumstances as these are generally a function of a risk premium over the ‘risk free’ rate of return. See Annex A for a fuller discussion of the cost of capital. Debt (project) finance interest rates are determined as a margin over a base rate. Wide variations in the base rate can lead to substantial differences in the cost of debt finance in different currencies.

<sup>19</sup> In theory, all investors (including utility investors) should apply different rates of return to capital costs incurred at different phases of the project lifecycle to reflect the risk associated with that investment at the time it is made.

Figure 6: Illustrative project development cycle risk-return profile (not to scale)



The small scale of climate change projects, particularly in developing countries, limits the participation of a number of investor groups in mitigation and adaptation activities. Utility investors (including their renewable energy subsidiaries) have tended to focus on larger scale opportunities in more developing markets. Institutional investors are generally impaired from supporting climate change projects in developing countries due to prudential limits on their activities and the small transaction size of these projects.

#### Implications for climate change projects

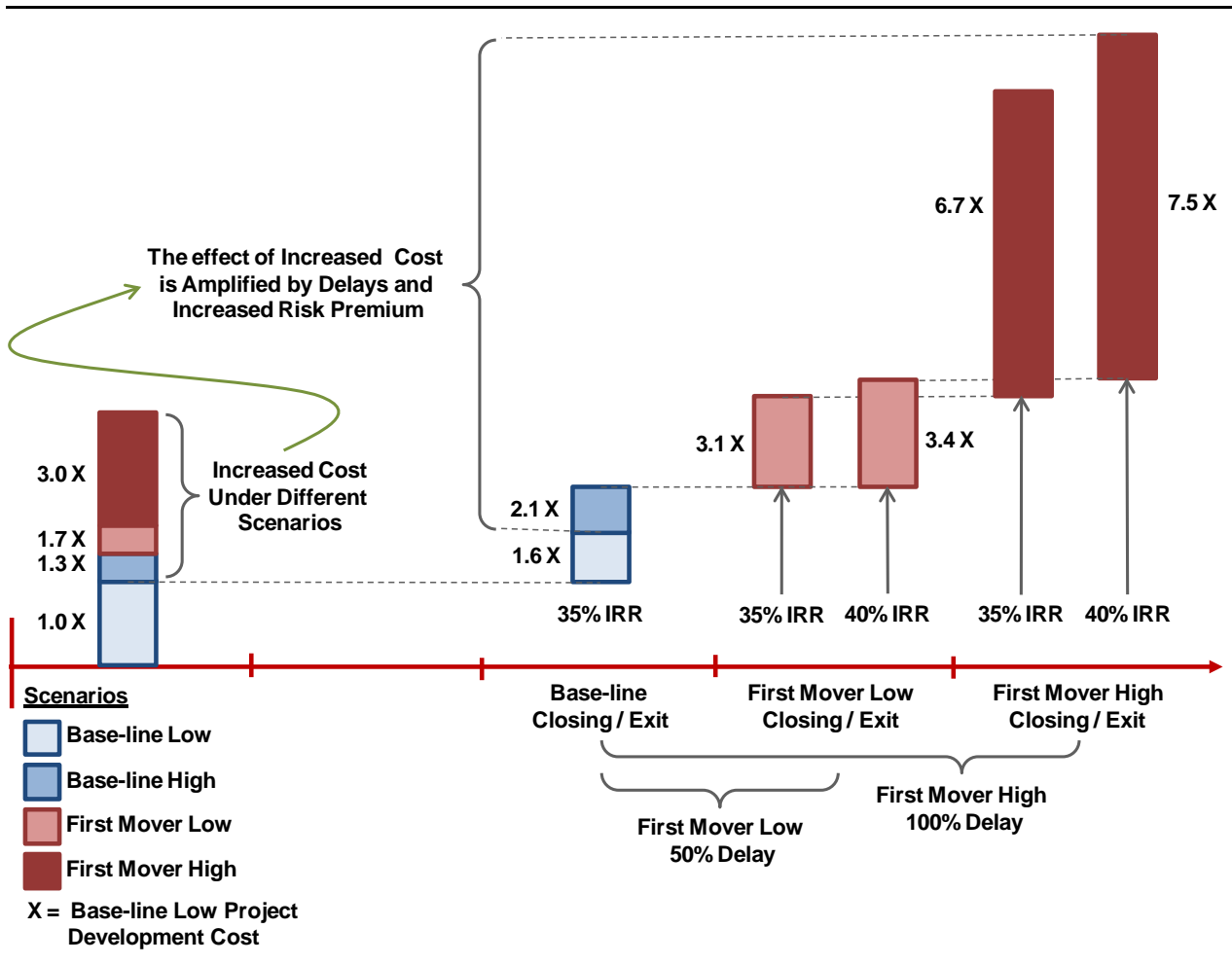
Investors' return expectations (which represent the cost of capital to the project company) have a number of important implications for climate change projects in developing countries:

- The cost of capital increases in countries with higher perceived political / country risk. A country's sovereign credit rating is generally a good measure of political / country risk. There will tend to be an inverse relationship between a country's credit rating and the cost of capital for transactions in that country (i.e., lower credit rating = higher cost of capital and *vice versa*, see Annex A).
- The cost of capital will tend to amplify incremental project costs – higher project development costs and higher capital costs – associated with climate change technologies. Figure 7 illustrates this for project development costs.
- Equally, the cost of capital will amplify incremental project costs associated with 'first mover' transactions.

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

- It would also be expected that a ‘first mover’ risk premium will be applied to ‘first mover’ transactions during the development, financing, construction and commissioning of such transactions (see Figure 6) further amplifying the incremental readiness costs of these projects. This is illustrated in Figure 9.
- The time value of money (see Annex A) also amplifies the impact of incremental time required to develop and implement projects by extending the distance in time between the incurrance of cost and the receipt of cash flows (i.e., dividends). This has particular relevance to first mover transactions.
- The WACC (see Annex A) will be higher for climate change projects that are unable to access financing or that are subjected to reduced debt-to-equity ratios. ‘First mover’ transactions face particular challenges in accessing financing so it is probable that their WACC would likely be higher than for projects developed in more advanced policy environments.
- A higher cost of capital will increase the cost of climate change projects which will translate, for example, into higher tariffs for mitigation projects in the supply of renewable energy.

**Figure 7: The effects of increased ‘first mover’ cost are amplified by delays and an increased risk premium**<sup>20</sup>



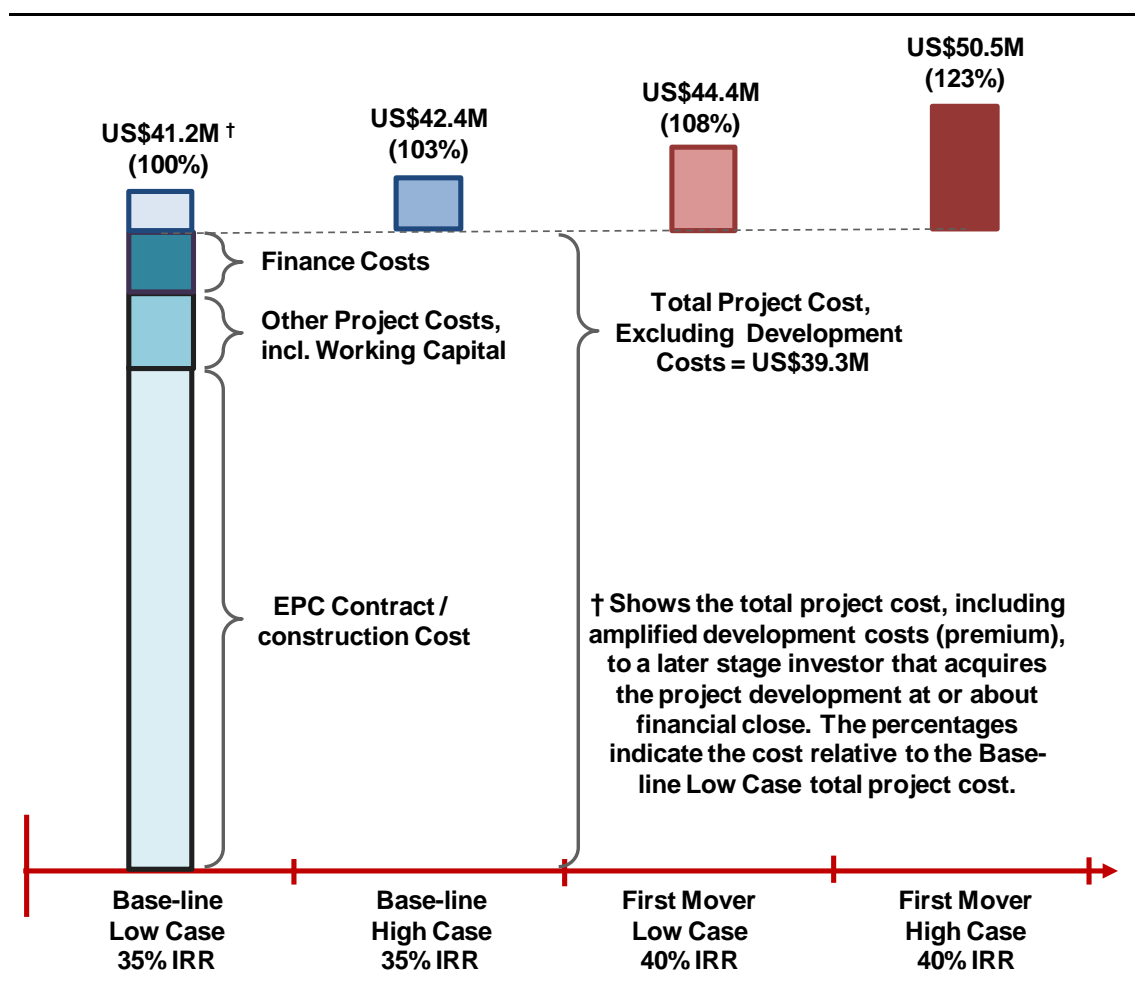
IRR = Internal Rate of Return

<sup>20</sup> “Closing / Exit” indicates the point at which the project developer exits the project at financial close. The multiples (e.g., 3.1 X) indicate the multiple of base-line low case project investment that the project developer would need to receive to achieve the indicated Internal Rate of Return (IRR) on its investment.

Figure 7 illustrates the amplifying effect of incremental cost and time of project development on a project venture business model. The assumptions in Figure 7 are based on the example set out at Table 6. For the purposes of illustration, the base-line low scenario project development costs have been deemed one unit (“1.0 X”). The effects of incremental cost and of delays and a higher risk premium (to reflect incremental ‘first mover’ risk) are shown as a multiple of this base unit. <sup>21</sup>

Figure 8 illustrates the incremental development cost to a ‘later stage’ investor based on data from Table 6 and Figure 7. Under the project development venture model, in its purest sense, the exit multiple required by the project developer (to achieve its required rate of return – see also footnote 23) determines the entry price paid by the ‘later stage’ investor to acquire the project. Figure 8 shows that for ‘first mover’ projects the impact to the total project costs, relative to the base-line low case, is to increase total project costs by 8% (‘first mover’ low case) to 23% (‘first mover’ high case).

Figure 8: Amplified ‘first mover’ costs directly increase total project costs



EPC = Engineering, Procurement and Construction; IRR = Internal Rate of Return

<sup>21</sup> In fact, project developers, like venture capitalists, tend to think in terms of ‘exit multiples’. One reason for this is that project developers must make on one transaction what they spend on developing 2 – 5 projects (possibly more) to account for the failure rate, plus a return on this expenditure. For example, if a project developer closes one in three projects (i.e., very successful) and spends an average of 50% of the development costs on the projects that do not close, the developer needs to achieve a multiple of 2.0 times just to break even, before accounting the cost of capital (i.e., developer has spent: 0.5 + 0.5 + 1.0 = 2.0, assuming all projects have equivalent project development costs = 1.0 unit).

This price paid by the 'later stage' investor effectively becomes the project development cost to that investor on which it will need to achieve its required rate of return. This will further amplify the impact of incremental development costs, delays and the risk premium of 'first mover' projects.

The estimated increase in total project costs (8% – 23%) is significant in the context of energy projects, especially in regulated markets (e.g., electricity generation) that set strict boundaries on tariffs and, therefore, project return parameters. The increased cost may limit the prospects for project developers to achieve a sale of the project that provides them with an adequate return on their investment. It is probable that a number of climate change projects will fail as a consequence.

## 6. Conclusions

The conceptual analysis above suggests that:

- Typical readiness costs for a base-line climate change project are about US\$ 60 / kW, representing about 3 – 5% of total project costs.
- Readiness costs for 'first mover' projects are significantly higher, in the range of US\$ 100 – 180 / kW (1.7 – 3.0 times the base-line) or, on a percentage basis, about 6 – 10% (about 2.0 times the base line).
- In addition to incremental readiness costs, project development cycles are typically 2 – 3 times longer for 'first mover' projects.
- 'First mover' projects are likely to attract a 'first mover risk premium' in respect of development costs.
- The effect of delays and a higher rate of return amplifies the effect of incremental readiness costs by a factor of 1.9 – 4.7 of the base-line project exit multiple, which can add 8% – 23% to the base-line total project cost for 'first mover' projects.

As noted, this analysis is conceptual in nature and is based on a number of assumptions regarding the example transactions. For this reason, the above conclusions should be regarded as indicative only. Nevertheless, the findings suggest that the incremental costs of readiness are potentially material and likely impair the deployment of low carbon technologies in developing countries, particularly in nascent policy environments.

Given that lack of suitable project developments is often cited by investors as an important reason why larger amounts of capital have not been directed to climate change projects in developing countries, further study in this area is warranted. A conceptual methodology for this study is suggested in Section 7.

## 7. Suggested Methodology for Measuring Private Sector Readiness Costs

**Study Objective:** The objective of the study will be to identify and measure the increased readiness costs<sup>22</sup> to project developers in developing climate change projects, in particular for 'first mover' transactions in nascent policy environments.

**Basis of analysis:** The study should seek to measure readiness costs of project developers against a base-line (see below) on a range of parameters, including:

- (a) As a proportion of total project costs;
- (b) Per unit of installed capacity;

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<sup>22</sup> As with the analysis contained herein project development costs may be used as a measure for readiness costs.

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

- (c) Per unit of delivered energy, potentially using discounted expected generation (or average generation) over the project life as the basis of analysis;
- (d) Per unit of carbon emission reduction achieved;
- (e) Time taken from project concept to financial closing; and
- (f) Exit multiple achieved by project developers<sup>23</sup> and impact on total project costs.

It is acknowledged that data in respect of (f) may be difficult to obtain. Nevertheless, a better understanding of investors return requirements and how these change over the project lifecycle will significantly benefit the analysis, especially in understanding the amplification effect that cost of capital and time have on readiness costs.

**Identifying suitable markets:** Developing countries with nascent policy environments are not likely to provide completed transactions for inclusion in the study sample. Markets in which policy evolution has or is presently occurring and in which a number of transactions have been completed will be better candidate markets for study. This may also enable analysis of the impact on readiness costs as policy evolution has occurred. The selection of markets will need to be made in parallel with the technology choice as transactions are also driven by resource endowment.

It may be interesting to broaden the analysis to contrast the experience of readiness costs in developed countries against those in developing countries.

It will be important to categorise markets as they have evolved over time in order to assess whether a completed transaction was a 'first mover' at the time of its development. The categorization set out in Table 5 – nascent, medium and advanced policy development – could be expanded to form the basis for categorization of markets.

**Technology choices:** It is unlikely to be feasible to assess all low carbon technologies within one study. The focus of this conceptual study has been on renewable energy generation transactions. The criteria proposed above assume that the initial focus of a subsequent study would be in this area. The technology choice should ensure that a suitably sized sample exists in the identified markets to make the analysis meaningful. Projects of different scales should be considered to ascertain the impact of transaction size on readiness costs.

It is recognised that the conclusions that may be drawn from a study of readiness costs for renewable energy transactions will have limited applicability for other low carbon technologies. Nevertheless, it may help to identify patterns in achieving market readiness which may be adapted for further study efforts in respect of other low carbon technologies.

Given the importance of energy efficiency in achieving mitigation and the acknowledgement that readiness costs act as a barrier to the broader deployment of energy efficiency technologies, there is merit in the conduct of a parallel study of readiness costs in this sector. The methodology (including the basis of analysis) would need to be adapted / modified to have applicability to energy efficiency transactions.

**Establishing the base-line:** The study will need to establish a base-line against which 'first mover' transactions may be compared. The base-line for renewable energy projects will be provided by the set of transactions completed in an advanced policy environment. Base-lines for each technology choice should be determined to compare the base-line across technologies.

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<sup>23</sup> In many instances a project developer does not exit (or only partially exits) the project at financial close as the later stage investor often prefers the developer to have "skin in the game" through construction and commissioning of the project and, sometime, beyond these milestones. Consideration will need to be given to the valuation of this residual interest maintained by the project developer to obtain a comparable valuation of the "exit multiple".

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Ideally, data on costs of readiness for conventional energy transactions should also be collected – e.g., for gas-fired and super-critical coal fired power generation – in order to have a base-line for conventional energy transactions against which costs of readiness of low carbon technologies may be compared. Items (d) of the basis for analysis will not be applicable to conventional energy transactions. Item (f) may also have less relevance as larger conventional energy generation transactions tend to be of sufficient scale to attract interest of utility companies from the initial stages of development.

### **8. Interventions for Development Community Consideration**

Table 8 presents a number of possible interventions for consideration by the development community. The interventions are aimed at reducing readiness costs, shortening project development lifecycles and reducing uncertainty and, therefore, risk to project developers. It is expected that these interventions, if appropriately conceived and implemented, will accelerate market readiness and create conducive conditions for more rapid deployment of low carbon technologies in developing countries.

It would be worthwhile to undertake a more detailed analysis of each intervention in parallel with the study proposed at Section 7 to determine (a) the most effective way to implement each intervention and (b) the cost implications of each intervention to the development community.

Table 8: Possible interventions for development community consideration

Intervention / Programme	Description of Activity	Impact on Project Readiness Costs, Time and Risk
<b><u>Policy Interventions</u></b>		
Support ‘best practice’ climate change policy development:	<ul style="list-style-type: none"> <li>▪ Put in place policy and regulatory frameworks targeted at specific technologies appropriate to individual developing countries needs / resource endowments, based on international best practice and experience in other markets</li> <li>▪ Provide assistance to develop and disseminate model contracts for climate change projects, incorporating appropriate risk allocation mechanisms</li> <li>▪ Promote better coordination among government agencies e.g., among expanding stakeholders in the energy sector</li> <li>▪ Aim activities and programmes particularly at programmatic opportunities that may significantly scale up deployment of low carbon technologies <sup>24</sup></li> <li>▪ Promote removal of constraints on climate change project size</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduce learning costs imposed on project developers to create public sector readiness</li> <li>▪ Reduce transaction costs e.g., advisory fees for development of project agreements</li> <li>▪ Shorten project development periods, thus reducing the amplifying effect of delays in project implementation</li> <li>▪ Enable readiness costs to be spread over programme activities and / or larger transactions</li> </ul>
Fuel price subsidies:	<ul style="list-style-type: none"> <li>▪ Provide advisory services to developing countries to develop roadmaps to remove fuel subsidies, acknowledging that this will be a gradual process taking account of the economic circumstances of each country</li> </ul>	<ul style="list-style-type: none"> <li>▪ Remove market distortions that favour incumbent conventional fuels, thus, reducing perceived risk of low carbon technologies and the risk premia applied to climate change projects</li> </ul>

<sup>24</sup> An example of this is the Indonesia: Geothermal Power Generation Development Programme under which the Global Environment Facility (GEF) has allocated US\$ 4 million to develop a policy framework, including a model power purchase agreement and a transparent and stable tariff setting mechanism, and transaction management for mobilizing investment in the geothermal sector in Indonesia. The objective is to support the development of approximately 4,733 MW of incremental geothermal capacity, of which about 70% is expected to be developed and financed by the private sector. The Japan International Cooperation Agency (JICA) has supported a complimentary programme to conduct a comprehensive geothermal resource assessment for Indonesia for the preparation of Government of Indonesia’s Master Plan for Geothermal Power Development.

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

Intervention / Programme	Description of Activity	Impact on Project Readiness Costs, Time and Risk
Carbon market price signal:	<ul style="list-style-type: none"> <li>Act quickly to achieve agreement on a post-2012 carbon regime, including appropriate changes to strengthen and streamline the CDM</li> </ul>	<ul style="list-style-type: none"> <li>Reduce perceived risk in respect of carbon market pricing signal and, therefore, project development risk</li> </ul>
Development of International standards:	<ul style="list-style-type: none"> <li>Develop universal standards and certifications for low carbon technologies and promote wide adoption of these among countries</li> <li>Facilitate international certification of promising new technologies to streamline deployment</li> </ul>	<ul style="list-style-type: none"> <li>Reduce certification and other technology learning and acceptance costs and timeframes</li> </ul>
Coordinated action by development community:	<ul style="list-style-type: none"> <li>Provide for coordinated action by development agencies (multilateral and bilateral) to provide appropriately focused solutions and programmes</li> </ul>	<ul style="list-style-type: none"> <li>Improve coordination, efficiencies and targeting of intervention programmes<sup>25</sup>, enabling more to be done with less</li> </ul>
<b><u>Capacity Building Interventions</u></b>		
Energy sector planning:	<ul style="list-style-type: none"> <li>Provide advisory services to developing countries to assist them in long-range energy planning</li> <li>Provide improved and dynamic modelling tools to enable analysis of low carbon technologies within energy mix;</li> <li>Facilitate better information on long-range projections of fuel prices and technology costs</li> <li>Consider an expanded role for IEA to facilitate this</li> </ul>	<ul style="list-style-type: none"> <li>Reduce learning and related readiness costs to project developers, particularly in understanding of risks and opportunities of different energy strategies and the role of low carbon technologies in the energy mix and strategies to achieve low carbon development<sup>26</sup></li> </ul>

<sup>25</sup> This applies to all interventions focused on deploying low carbon technologies in developing countries.

<sup>26</sup> Project developers are neither well-placed nor trusted to provide this input, especially if it is in support of their own project activity. This elongates the time to achieve acceptance by policymakers and regulators irrespective of how compelling the case for the project activity.

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

Intervention / Programme	Description of Activity	Impact on Project Readiness Costs, Time and Risk
Resource centre for project developers:	<ul style="list-style-type: none"> <li>Establish a resource centre for project developers</li> <li>Facilitate learning for project developers particularly in nascent policy markets with little or no climate change project experience</li> </ul>	<ul style="list-style-type: none"> <li>Provide learning to project developers leading to improved, more focused development activity and higher quality project preparation – thus reducing costs and shortening project development cycles</li> </ul>
Capacity building for domestic financial institutions:	<ul style="list-style-type: none"> <li>Facilitate capacity building on climate change project finance for domestic financial institutions <sup>27</sup></li> </ul>	<ul style="list-style-type: none"> <li>Improve prospects for accessing domestic finance, shorten financing timeframes and, therefore, project development cycles, reduce lender due diligence costs, reduce WACC</li> </ul>

### Public Finance Initiatives:

Climate Change Project Development Company (CC-PDC):	<ul style="list-style-type: none"> <li>Establish regional CC-PDCs to initiate and undertake climate change project development activities, including ‘first mover’ projects in nascent markets <sup>28</sup></li> </ul>	<ul style="list-style-type: none"> <li>Enable development partnering with domestic project developers, facilitate professionally managed project development activity leading to improved project preparation, reduced readiness costs and faster project implementation</li> </ul>
Technical assistance facilities:	<ul style="list-style-type: none"> <li>Provide flexible technical assistance facilities aimed at defraying the cost of readiness to project developers e.g., PFS / FS preparation, advisors fees and costs <sup>29</sup></li> </ul>	<ul style="list-style-type: none"> <li>Reduce readiness costs, improve the quality of project preparation</li> </ul>

<sup>27</sup> Asian Development Bank (ADB) has conducted workshops on clean energy and carbon finance and facilitated the development of a Clean Energy Finance Reference Guide for regional Export-Import Banks (conducted / prepared by Aequero). International Finance Corporation (IFC) also conducts capacity building for domestic financial institutions.

<sup>28</sup> The establishment of a CC-PDC is considered to be a particularly critical intervention to accelerate project preparation and development. This should be managed by the private sector (i.e., experienced project development professionals).

<sup>29</sup> United Nations Environment Programme (UNEP), ADB and African Development Bank have a Seed Capital Assistance Facility (SCAF) focused on defraying costs of private equity fund managers that engage in early stage project development. A similar, expanded facility targeted at project developers would be more effective as these are the private sector actors that lead project development activity. As noted above, private equity funds tend to follow, not lead, project development activity.

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

Intervention / Programme	Description of Activity	Impact on Project Readiness Costs, Time and Risk
Mobilise Local Financing:	<ul style="list-style-type: none"> <li>Develop innovative financing mechanisms to promote expansion of domestic financing for climate change projects e.g., structures that extend finance tenors or enable fixed rate financing</li> </ul>	<ul style="list-style-type: none"> <li>Improve prospects for accessing domestic finance, reduce WACC</li> </ul>
Interest rate swaps:	<ul style="list-style-type: none"> <li>Provide a facility for provision of interest rate swaps to support project finance – particularly applicable to developing countries with nascent financial markets</li> </ul>	<ul style="list-style-type: none"> <li>Improve prospects for accessing finance, reduce financing risks borne by climate change projects, reduce WACC</li> </ul>
Extend Scope of political risk guarantees:	<ul style="list-style-type: none"> <li>Expand political risk guarantee programmes and extend coverage to include policy / regulatory risk and, for example, approval / certification aspects of carbon asset development</li> </ul>	<ul style="list-style-type: none"> <li>Improve prospects for accessing project finance, including domestic finance, reduce WACC</li> </ul>
Support deployment of low carbon technologies:	<ul style="list-style-type: none"> <li>Provide flexible financing mechanisms to support promising new low carbon technologies on the cusp of commercialisation – the toolkit might include financing, insurance, reinsurance of performance guarantees and warranties<sup>30</sup></li> </ul>	<ul style="list-style-type: none"> <li>Reduce risk, improve bankability of projects based on newly commercialised low carbon technologies, improve prospects for accessing project financing, reduce WACC</li> </ul>
<b>Resource Assessment</b>		
Technical and financial assistance facilities:	<ul style="list-style-type: none"> <li>Directed at governments (public sector) to facilitate the identification, assessment and mapping of resources (e.g., wind, solar) as preparatory work to identify specific project opportunities for private sector development (refer Footnote 24 for an example)</li> <li>May be coupled with CC-PDC (see above) to play ‘first mover’ role</li> </ul>	<ul style="list-style-type: none"> <li>Improve availability and quality of resource data, shorten project development cycle, reduce project development risk and, therefore, WACC</li> </ul>

CC-PDC = Climate Change Project Development Company; CDM = Clean Development Mechanism; FS = Feasibility Study; IEA = International Energy Agency; PFS = Pre-Feasibility Study; WACC = Weighted Average Cost of Capital

<sup>30</sup> Possibly refocus the activity of the Clean Technology Fund (CTF) to conduct this activity.

## Annex A: The Cost of Capital

The cost of capital is the risk-adjusted rate of return required by an investor. This reflects the time value of money, risk-adjusted to account for the risk of an investment. It is an extremely important consideration as it is (one of) the basis on which investors make investment decisions and allocate capital among alternate, competing investment opportunities.

### Time Value of Money

The best way to illustrate the time value of money is with a simple example. Table A-1 illustrates the concept of the time value of money. It shows the value of an investment of US\$1,000 made today in 1-5 years at a rate of return (or discount rate) of 5% – 25%.

**Table A-1: The effect of time on the value of money – Value of US\$1,000 invested over 1-5 years**

Discount Rate (%)	Value of Investment in Year				
	1 (US\$)	2 (US\$)	3 (US\$)	4 (US\$)	5 (US\$)
5%	1,050	1,103	1,158	1,216	1,276
10%	1,100	1,210	1,331	1,464	1,611
15%	1,150	1,323	1,521	1,749	2,011
20%	1,200	1,440	1,728	2,074	2,488
25%	1,250	1,563	1,953	2,441	3,052

Investors’ return expectations are driven by the perceived risk of an investment in the context of rates of return available on alternative investments across markets and asset classes. The market for investment is competitive and investors allocate capital and resources to investments that provide an appropriate return for the perceived risk associated with the relevant investment i.e., a risk-adjusted return (cost of capital). There are many factors that are taken into consideration in deriving an appropriate risk-adjusted rate of return for an investment – some of these are considered below.

### The ‘Risk Free’ Rate of Return

The starting point is the ‘risk free’ rate of return i.e., the return available on a ‘risk free’ investment. Typically, long term local currency government bond yields are used as a proxy for the ‘risk free’ rate of return. Table A-2 sets out the local currency 10-year government bond yields for selected countries. Local currency government bond yields are used because, in theory, a government will always have the capacity to repay debt in its own currency – ultimately, it may print more currency – and so repayment is assured. Long term rates (10-year bonds below) are typically used for energy and infrastructure transactions to match the investment life of the underlying transaction<sup>31</sup>.

### Country / Political Risk Premium

Country / political risk is an important factor in determining an appropriate risk adjusted return for an investment in the relevant country. Table A-2 also provides the Standard & Poor sovereign credit rating for the selected countries and derives a risk premium for equity market investments from the

<sup>31</sup> In fact, energy and infrastructure assets generally have lives much longer than 10 years (e.g., 20-30 years). However, many countries do not have government bonds with maturities longer than 10 years or the market for bonds with maturities longer than 10 years lacks depth / liquidity.

## Deploying Low Carbon Technologies: Private Sector Costs of Readiness

cost of capital in those countries. Note that while the cost of capital provides a wide range between markets (about 10% – 21%), when the risk free rate is deducted the range narrows considerably (to about 6.5% – 12%).

It should be stressed that the indicative costs of capital provided in Table A-2 are long range benchmarks for investments in public equity markets. These are used for illustration only. They do not reflect the cost of capital for an unlisted project investment. However, public equity markets may be considered a competing investment and, to this extent, are relevant.

In general, markets with a higher sovereign credit rating (as a proxy for country / political risk) will have lower risk premia than countries with a lower sovereign credit rating. As developing countries tend to have lower sovereign credit ratings, this means that the cost of capital for investments in those countries will tend to be higher. Perversely, this increases the cost of climate change projects in these developing countries.

**Table A-2: 10 year local currency bond yields – a proxy for the risk-free rate, sovereign credit ratings and derived cost of capital for selected countries<sup>32</sup>**

Country	Sovereign Rating (S&P)	Bond Yield – Risk Free Proxy (%)	Cost of Capital (%) <sup>33</sup>	Equity Market Premium over Risk Free Rate (%)
China	A+	3.66	12.55	8.89
India	BBB-	7.29	15.97	8.68
Indonesia	BB-	10.27	19.66	9.39
Malaysia	A-	4.22	13.45	9.23
Philippines	BB-	7.80	19.82	12.02
Thailand	BBB+	4.30	16.11	11.81
Vietnam	BB	11.34	20.79	9.45
USA (Reference)	AAA	3.29	9.78	6.49

S&P = Standard & Poor's

Country / political risk also encompasses factors such as the rule of law, sanctity of contracts and confidence in processes for arbitration and legal resolution of disputes as well as policy and regulatory risk – the latter risks are usually amplified for climate change projects. A number of these risks interplay with specific transaction (project) risks.

### Domestic vs. Cross-border Funding

The source of capital is also an important consideration. Domestic investors typically have a higher tolerance for political / country risk and, therefore, require a lower risk premium in respect of such risks.

Cross-border investors have to repatriate capital and measure returns in their home or base currency (e.g., US\$). They, therefore, need to account within their cost of capital a premium for potential risks that may impair their ability to repatriate dividends and exchange rate risk i.e.,

<sup>32</sup> As at 1 December 2009. Sources: AsiaBondsOnline, ADB ([asianbondsonline.adb.org](http://asianbondsonline.adb.org)); Reuters India 1 December 2009 ([www.reuters.com](http://www.reuters.com)).

<sup>33</sup> Derived from Ibbotson Associates, *International Cost of Capital Perspectives 2009*.

movements in the rate of exchange at which dividends may be repatriated. This is an extension of political / country risk.

### Transaction (Project) Risk Premium

In deriving a suitable risk-adjusted return for an investment, investors will consider the risks associated with Individual projects. Investors seek to identify risks that may impact on the project's implementation and operation – including risks that may increase costs, reduce revenues or delay cash flows. Examples of risks that may be considered by investors include:

- Technology risk
- Resource / fuel supply risk
- Market and revenue risk (e.g., tariff, carbon revenue) – price and volume (e.g., dispatch)
- Counterparty credit risk – off-takers, purchasers, suppliers, contractors
- Permitting risks – linked to regulatory risk
- Legal risk – linked to country / political risk
- Financing risk – the ability to obtain financing and the terms and cost of financing, including changes in the cost of finance over time (i.e., interest rate movement risk)

### Equity and Debt Returns

Lenders in project finance transactions will generally take a security interest in the project assets and cash flows, giving them a senior position relative to providers of equity capital (investors). Investors have a subordinated position in a project's capital structure i.e., they are only entitled to dividend and other distributions after lenders (and other more senior capital – e.g., mezzanines finance, preference shares) have been paid.

It follows, therefore, that investors (equity) take on greater risk than lenders (debt) and the rate of return to these two groups reflects this. For example, lenders will typically charge a fixed rate of interest derived from a 'base rate' (or market swap rate, to provide fixed cost funding), reflecting their cost of funding, plus a 'margin', reflecting the perceived risk of the transaction. The lenders 'margin' essentially accounts the country / political risk and transaction (project) risk associated with the proposed loan. Margins of 1.5% – 3.5% have historically been common for project finance transactions in developing countries, although higher rates have been applied to "riskier" projects and have been increasingly common since the onset of the financial market crisis in the second half of 2008 (to the extent that project financing has been available during this period).

The currency of debt has a significant bearing on the cost and risk of the debt. The 'base rate' will be derived from the interest rate applied to government securities (risk free rate). Table A-2 demonstrates the wide variance of interest rates in different markets. If we assume, for illustrative purposes only, that a lender's base rate is 1.0% – 2.0% above the 10 year government bond yield then the base rates for the countries listed in Table A-2 would fall within the range of 4.3% – 5.3% (USA)<sup>34</sup> to 12.3% – 13.3% (Vietnam). It would be a mistake, however, to draw the apparently obvious conclusion that the solution is to finance projects in the currency exhibiting the lowest interest rates. This exposes the project to significant currency risk (unless the project receives its revenue in the

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<sup>34</sup> In fact historically the US\$ swap rate (i.e., the base rate for translating a variable interest rate obligation into a fixed interest rate obligation) has been about 40-60 basis points, depending substantially on the counterparty credit risk. This has widened materially over the past 2 years. Nevertheless, a US\$ swap rate at the lower end of the indicated range may be achievable.

proposed currency of the loan) – the objective, wherever possible, should be to match the currency of costs (including interest expense) to the currency of the project’s revenue.

Estimating the cost of capital for equity is significantly more complex. As noted above, there are a large number of variables that investors take into consideration. The cost of capital or required rate of return for a project will also vary over time as the project moves through the project development cycle. Figure 7 (page 22) provides an indication of target rates of return (cost of capital) for different investor groups. Generally, investors will be bound within a risk-return profile of their investments which reflects the market positioning and strategy of the investor.

### The Weighted Average Cost of Capital (WACC)

The WACC gives a measure of the average required rate of return of all the company’s financing (equity, debt, and hybrid instruments), weighted in proportion to the company’s total invested capital. The WACC is calculated by the following formula:

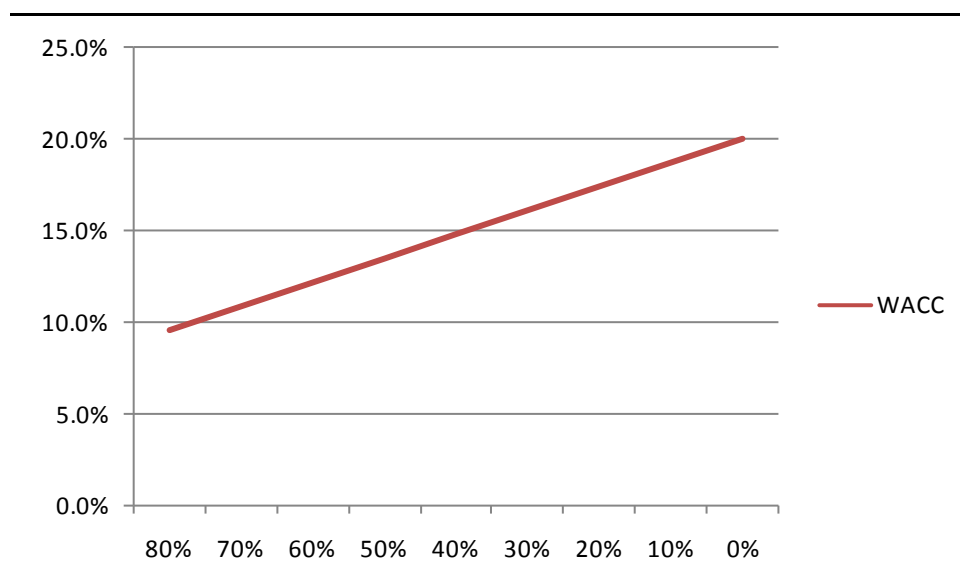
$$WACC = P_D k_D (1-t) + P_E k_E$$

Where:

- $P_D$  = the proportion of debt
- $P_E$  = the proportion of equity
- $k_D$  = the cost of debt
- $k_E$  = the cost of equity
- $t$  = the applicable corporate tax rate

To illustrate by example, a project with a 70:30 debt-to-equity ratio, with a cost of equity of 20%, a cost of debt of 10% and a corporate tax rate of 30% will have a WACC of 10.9%. The WACC for the same project with a debt-to-equity ratio of 50:50 is 13.5%. Figure A-1 shows changes in the WACC for the example project at different debt-to-equity ratios.

Figure A-1: The WACC of a project increases as the level of debt finance is reduced



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