

RESPONDING TO CLIMATE CHANGE IN MOZAMBIQUE



REPUBLIC OF MOZAMBIQUE
MINISTRY OF STATE ADMINISTRATION
NATIONAL INSTITUTE OF DISASTER MANAGEMENT



Instituto Nacional de
Gestão de Calamidades



National Institute for Disaster Management (INGC)
PHASE II

THEME 4B Building Resilience with the Private Sector

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THEME 4B

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SLIDE 1

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*Mozambique:
Building resilience
with the private sector*

March, 2012



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0 Executive Summary – Methodology

Arthur D. Little was asked by INGC to engage the private sector in building climate change resilience in Mozambique

- Mozambique is frequently burdened by natural hazards that have a major impact on the country's development.
- Due to climate change, the country's exposure to natural hazards is expected to increase - significantly affecting the country's development potential.
- In 2009, INGC (Instituto Nacional de Gestão de Catástrofes) performed a study in to climate change impact in the risk of calamities in Mozambique
- Afterwards, nine different themes were defined with the main goal of covering all the areas that climate change might impact and a second phase of the project started
- ADL was asked to help build climate change resilience in Mozambique through private sector investment in attractive and sustainable business opportunities (Theme 4)
- The scope of this project can be divided in 3 phases:
 1. Diagnosis and formulation
 2. Evaluation
 3. Implementation support
- The focus of this document is to show the most relevant methodological steps undertaken
 - In the first phase we identified High Climate Change Risk / High Climate Change Impact areas and private investment opportunities for adaptation and mitigation measures.
 - In the second phase we performed feasibility and cost-benefit analysis on the long list of adaptation measures, studied the main barriers to investment and contacted several financing entities
 - In the third phase we analyzed options for investment Programs and detailed the most promising ones and laid out recommendations for implementation

Source: INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report



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0 Executive Summary – Methodology

We defined a blueprint process that allowed us to answer a set of key questions about risks and impacts of climate change and to develop adaptation projects for several areas

Main outputs of the project	
The main outputs of this project allow us to answer key questions such as:
A 'blueprint process' with tools and steps for arriving at a portfolio of adaptation options, which can be applied in other geographical areas to identify suitable and viable adaptation projects	<ul style="list-style-type: none"> ■ How can we arrive at a portfolio of adaptation options?
A high-risk impact map by geographical area and an 'industry response plan'	<ul style="list-style-type: none"> ■ What are the specific implications of climate change in this geographical area? ■ What are the key sectors at risk? ■ How is my investment at risk (how often, how soon, etc)?
A portfolio of viable, 'climate proof' adaptation options identified, with input from scientists, private sector and policy makers	<ul style="list-style-type: none"> ■ What do I need to do to change? ■ How does financing this project help me achieve my strategic aims? ■ Should I invest, where and how?
Several priority adaptation measures worked out in detail to prepare for implementation, should funds become available	<ul style="list-style-type: none"> ■ What is the needed investment to ensure adaptation to climate change? ■ Are these type of projects financed in favorable conditions?
Analysis of barriers to investment and policy and strategy recommendations to help reduce those barriers	<ul style="list-style-type: none"> ■ What are the existing barriers to attracting private investors? ■ How can we attract investors who are committed to helping Mozambique achieve sustainable development and adapt to climate change, and reject investors who are not?



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0 Executive Summary – Methodology

The process defined comprised a detailed analysis by region, the identification of a long-list of adaptation measures, the selection of top priority projects and policy change suggestions

High-level blueprint process

Phase	Main steps	Key tools
Regional Analysis	<ul style="list-style-type: none"> Country context analysis Climate Change analysis Business context analysis 	<ul style="list-style-type: none"> Assessment of economic and social indicators Exposure analysis based on historical analysis and future trends Vulnerability analysis was based on the historical impact and expected economic and social development Analysis of the economic context and main private investments
Long list of adaptation options	<ul style="list-style-type: none"> Portfolio of adaptation options identification Combination of the High Climate Change Risk / High Climate Change Impact areas 	<ul style="list-style-type: none"> Benchmarking of case-studies of adaptation options Input from experts
Top priority projects identification	<ul style="list-style-type: none"> Screening analysis Options evaluation 	<ul style="list-style-type: none"> Analysis of adaptation measure's strategic fit and operational viability Feasibility and cost-benefit analysis
3-5 projects selection	<ul style="list-style-type: none"> Barriers to investment analysis Financing options assessment 	<ul style="list-style-type: none"> Country risks and barriers, province constraints, currency and sector risks and government strategic areas identification Orientation of investment, limitation of the total amount available and financial products and services analysis
Policy change suggestions	<ul style="list-style-type: none"> Government support needed to implement adaptation projects in each area 	<ul style="list-style-type: none"> Analysis of barriers to investment Feedback from private investors and financial institutions

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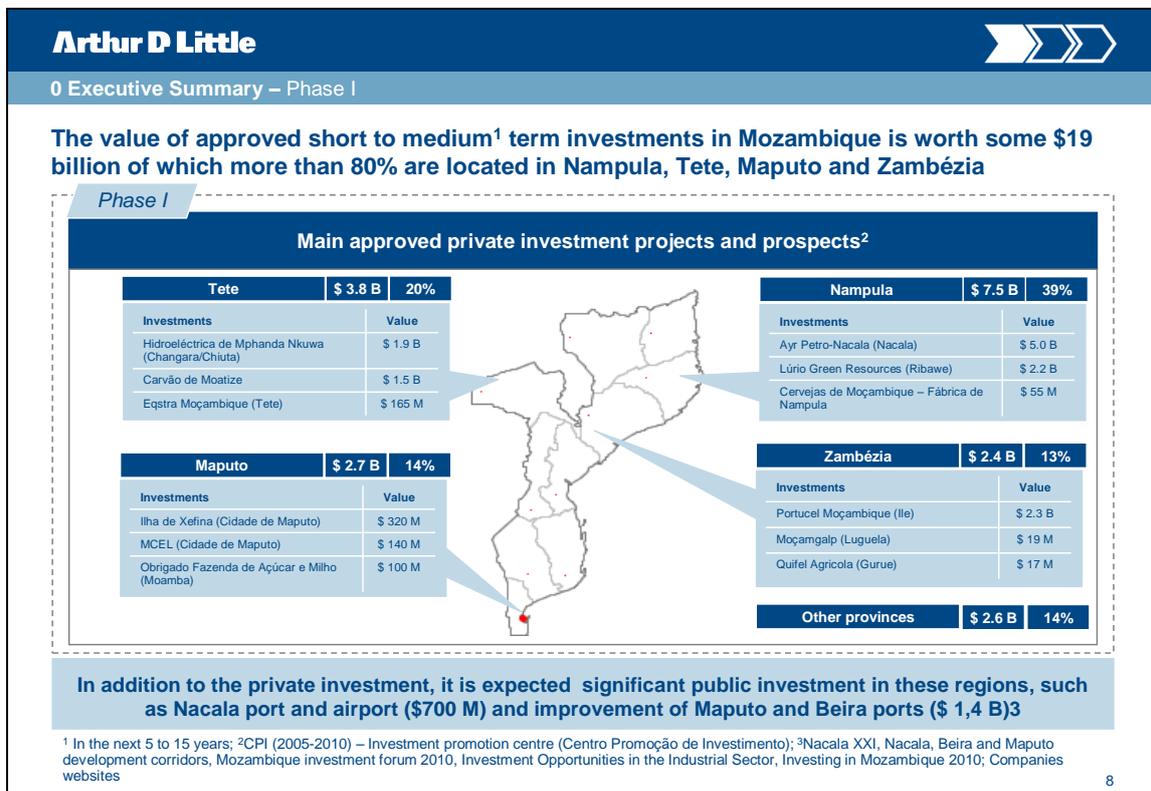
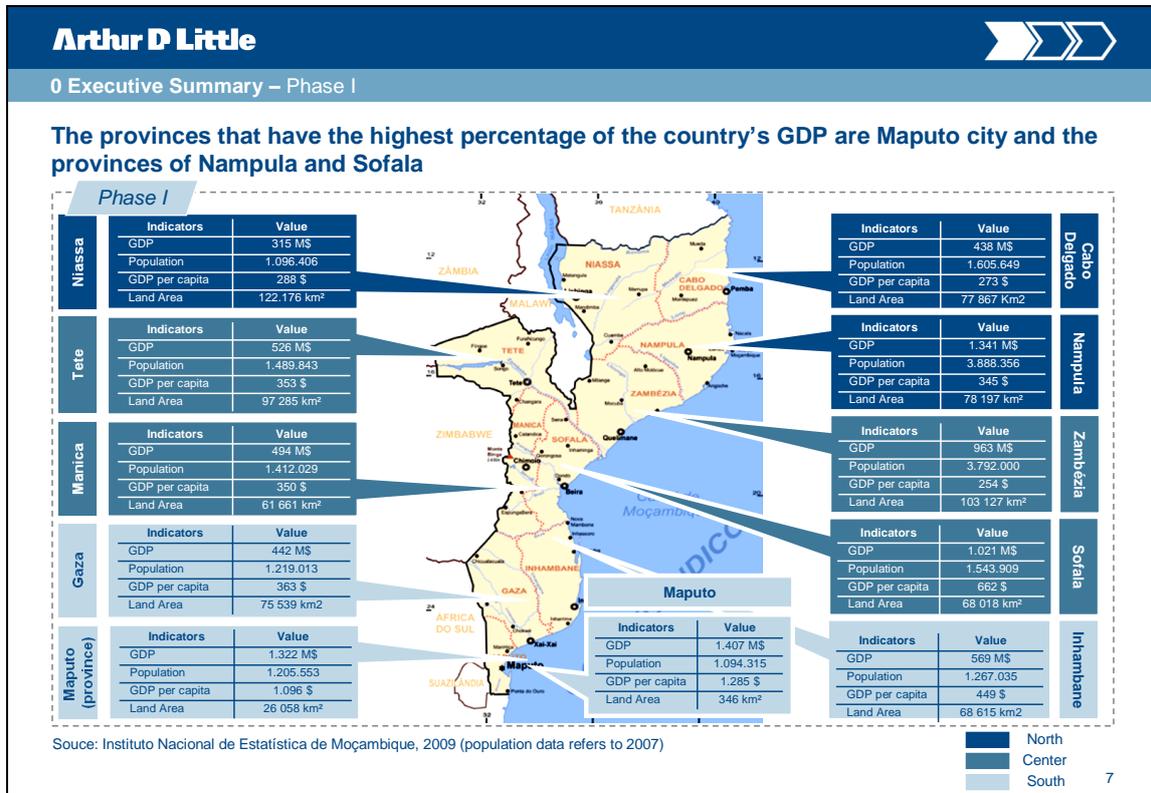
0 Executive Summary – Methodology

Arthur D. Little designed a 3 Phase approach to the development of our blueprint process in order to identify and prioritize a portfolio of adaptation options

High-level project approach

	Phase 0 Setup project	Phase I Creation of portfolio of adaptation options	Phase II Analysis & selection of portfolio options	Phase III Design of detailed adaptation programs
Process	<ul style="list-style-type: none"> Desk research Benchmarking 	<ul style="list-style-type: none"> Identification of key business risks from main climate change risks Develop long-list of adaptation options Benchmarking from countries and agencies 	<ul style="list-style-type: none"> Perform cost-benefit and feasibility analysis of adaptation options Analyze financing options and barriers to investment Meeting with stakeholders to select final options 	<ul style="list-style-type: none"> Perform detailed cost-benefit and feasibility analysis for 3 to 5 options Identify changes to national policy and strategy to facilitate private investment Presentation to decision-makers
Output	<ul style="list-style-type: none"> Research findings Detailed scope and plan definitions for Phase I 	<ul style="list-style-type: none"> Key business risks prioritized by region Portfolio of adaptation options 	<ul style="list-style-type: none"> Portfolios evaluated and prioritized Short-list of options with financing options 	<ul style="list-style-type: none"> 3 to 5 adaptation options «ready to implement» Guidelines for national policy and strategy

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2.1 Executive Summary

To design initiatives with a country-wide impact, the projects were aggregated into themes to address some of Mozambique's most strategic challenges: energy, water, agriculture/forestry, tourism

Projects	Areas	Energy	Water	Tourism	Forestry/ agriculture
Bioethanol Production		X	X		
Increase crops yield			X		
Reforestation with agricultural activities					X
Development of agro forestry					X
Development of agro forestry					X
Solar panels for irrigation		X			
Introduction of Resilient crops for the production of Biofuel		X	X		
Construction of Mini Dams in Búzi River		X	X		
Small Scale Solar Plant		X			
Insurance sector		X	X	X	X
New programs		X	X	X	X

From the 4 forestry projects in the top list, 3 are related with **agro forestry** and if analyzed together may have a significant impact in the country

All the projects are focused on **clean energy generation** and if considered in a aggregated fashion can constitute a clean energy program with major impact for the country

The water projects range from **infrastructural projects** like floods control to correlated measures like the use of resilient crops but all deal with water management

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0 Executive Summary – Phase I

We analyzed climate change impacts for the private sector and developed a set of 16 “no-regret” measures to build climate change resilience in key sectors of the country

Phase I

Risks/Impacts analyzed

- The goal of this theme was to analyze risks and impacts of climate change for the private sector.
- We analyzed the impact of floods (inland and coastal), droughts and cyclones in the high impact areas by overlapping the risk map with the investment map of the country

Methodology

- To identify the no-regret measures for the private sector, we performed a screening in order to reduce the long list of adaptation options to a more meaningful and manageable size, followed by CBA and feasibility analysis
- To guarantee country-wide impact, we carried out an impact analysis and grouped the no-regret measures in to programs

No regret measures

- Microcredit for adaptation
- Develop fertilizers by composting of organic waste
- Construction of a Bridge in Búzi
- Reforestation of Quirimbas National Park
- Bio-ethanol Production
- Develop ecotourism resort
- Increase crop yields
- Reforestation with agricultural activities
- Development of agro forestry in Búzi
- Construction of Macuti houses on the Island of Mozambique
- Solar panels for irrigation
- Resilient crops for the production of Biofuels
- “Stone and Clay” city resilience on the Island of Mozambique
- Construction of Mini Dams in the Búzi River
- Small Scale Solar Plants

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0 Executive Summary – Phase II

The priority adaptation projects were grouped into Programs with a nation-wide impact, covering the most relevant private sectors in Mozambique

Phase I

No regret measures	Feasibility	CBA	Impact	Sector	Comments	Programs
Microcredit for adaptation	●	●	Nationwide	Financial	The projects are by nature replicable all over the country and can reach a large target population	Microcredit
Composting of organic waste	●	●	Nationwide	Waste Mng		Waste Management
Construction of a Bridge	●	●	Nationwide	Infrastructure		Infrastructure
Reforestation with agriculture	●	●	Local	Forestry	All the projects are related with forestry management and will involve local communities	Agro-Forestry Fund
Agro forestry in Nampula	●	●	Local	Forestry		
Agro forestry in Cabo Delgado	●	●	Local	Forestry		
Small Scale Solar Plant	●	●	Local	Tourism	All the projects are focused on community tourism and the fund would have a major impact on rural communities development	Community tourism
Solar panels for irrigation	●	●	Local	Energy	• If considered in a aggregated fashion these projects constitute a clean energy program with major impact • A water management program has major impact for the country	Clean energy Water Management
Bioethanol Production	●	●	Local	Energy/Water		
Resilient crops for Biofuel	●	●	Local	Energy/Water		
Construction of Mini Dams in Búzi	●	●	Local	Energy/Water		
Increase crops yield	●	●	Local	Water		

To select the top projects, a forced ranking was executed against predefined evaluation criterion and the portfolio was presented to the CTA and to the international financial and donor community

Source: Arthur D. Little analysis

CBA: ○ >1 ● 0.5 to 1 ● 0 to 0.5 Feasibility: ○ Low ● Medium ● High

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0 Executive Summary – Phase II

Following project screening, an overarching theme of “Community Energy” was identified with four main target projects: Clean Energy, Small Scale-Lending, Composting and Insurance

Phase II

Community Energy Program

Clean Energy	Micro & Small Scale Lending	Composting	Insurance	New Programs/Unique Point of Contact
<ul style="list-style-type: none"> Target projects of this program will be focused on creating energy independence for agriculture, tourism and other sectors, as well as for rural communities, via the promotion of sustainable electricity generation 	<ul style="list-style-type: none"> The target segment of the population is mainly micro and small companies and communities working as companies in sectors like tourism, agriculture, industry or energy 	<ul style="list-style-type: none"> The program will be nationwide and cover all the major cities of the country and will be developed through several concurrent pilot projects The main products are organic fertilizer and methane emissions reduction 	<ul style="list-style-type: none"> No major insurance player has a real presence in Mozambique and similarly to the investment sector, many comment on the need for a stable regulatory framework and strong governance if a more penetration of products is to develop. 	<ul style="list-style-type: none"> After these initial Programs, the next Programs scouted should meet a list of selection criteria: sustainability impact, interest for Mozambique and the investors and capacity to build resilience to climate change with the private sector

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0 Executive Summary – Phase II

The “Community Energy” Program comprises three subject specific programs, an insurance work stream and a fifth program designed to evaluate future opportunities

Phase II

“Community Energy”

Clean Energy	Micro & Small Scale Lending	Composting	Insurance	New Programs/Unique Point of Contact
<ul style="list-style-type: none"> A reliable energy source is critical to running and growing business Well built and maintained energy sources will have a significant impact on resilience Local, distributed energy, built by the private sector will have major community impact 	<ul style="list-style-type: none"> The microfinance program will support multiple adaptation needs but will have a specific focus on funding small scale energy production The program can assist in delivering broad based energy production at an SME level 	<ul style="list-style-type: none"> Composting and “waste to energy” programs are closely linked 	<ul style="list-style-type: none"> Appropriately priced and delivered insurance products will be vital to ensure the long term viability and security of all three of the subject specific programs 	<ul style="list-style-type: none"> This fifth work stream will analyze additional opportunities either for future expansion of the three subject specific programs, new programs relevant to the “community energy theme” or arising from the insurance work stream

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0 Executive Summary – Phase III

The Phase III should take 24 months, with the initial 3-6 devoted to the Programs’ set up, 9-12 to pilot projects execution and the remaining with populating the programs with new projects

Quarters	1	2	3	4	5	6	7	8
Step 1: Program set up Select the personnel for each Program Identify training needs, logistics, etc Secure funding for capability building Short-list investors for pilots and Programs Liaise with partners and Government institutions	■							
Step 2: Pilot Projects Start the pilot project’s implementation Road show for fund raising Identifying new projects for Program portfolio Feedback cycle of lessons learned			■					
Step 3: Pipeline of Projects Allocation of funds New projects scoping and build out Mid term Program’s evaluation and report Build autonomy in local resources					■			

Source: Arthur D. Little analysis

Timescales

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0 Executive Summary – Phase III

The Clean Energy Program will address insufficiencies in electricity supply in Mozambique by taking advantage of the country's tremendous natural resources

Phase III

Clean Energy Program	
Project Summary	
<ul style="list-style-type: none"> ■ Mozambique has tremendous untapped natural resources for the development of renewable energy (wind, solar, hydro,...) ■ With this Program, the Mozambican Government aims to boost a sector that is crucial for building resilience to climate change through security of electricity supply – an area that has not been widely addressed to date ■ The Program will allow investment in micro (1-10 kW)/mini scale (10-100 kW) and distributed utilities (100-1.000 kW) projects. These installations are crucial for the development of some social services (hospitals, schools) and the flourishing of commerce, industry, agriculture and fishing, thereby building resilience to climate change 	
Forecasted Investment	175-200 M€
Major Investors	Specialized funds, Private Equity, National & Multilateral Development Finance, Industry players
Pilot Project	Construction of a 1MW on-grid PV plant in Maputo

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0 Executive Summary – Phase III

The Micro and Small Scale Lending Program will help finance projects that help build resilience to climate change in Mozambique and deliver energy to drive private sector growth

Phase III

Micro & Small Scale Lending	
Project Summary	
<ul style="list-style-type: none"> ■ Mozambique is one of the world's countries with the lowest access to financing, which hinders the birth and growth of entrepreneurs/SMEs, the backbone of any country's economy ■ The Program aims to help fund projects that foster resilience to climate change and at the same time fortify Mozambique's economy ■ By creating pre-negotiated packs with suppliers of irrigation, energy, transport and other equipment, we plan to be able to offer attractive loan conditions for stimulating micro and small-scale financing of resilience building initiatives and projects nationwide 	
Forecasted Investment	25-50 M€
Major Investors	Regional and international wholesale banks, National & Multilateral Development Finance Institutions, Micro-Finance Funds
Pilot Project	Partnership to be established with two of the biggest banks in Mozambique (Socremo or Novobanco)

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0 Executive Summary – Phase III

The two main goals of the Composting Program are the improvement of waste management procedures and the increase in fertilizer usage in agriculture

Phase III

Composting	
Project Summary	
<ul style="list-style-type: none"> Low agricultural yields and waste management are two significant problems in Mozambique To address both, the Mozambican Government will launch this Program which addresses solid organic waste treatment and builds resilience to climate change by incentivizing the wider usage of fertilizers in agriculture, increasing yields and economic returns The composting sites will use waste from households, communities, commerce and industry, in order to produce fertilizers that will then be sold to farmers and cooperatives Side products are relevant to the waste to energy industry 	
Forecasted Investment	15-30 M€
Major Investors	Environmental Funds, Private Impact, Grants & Foundations, National & Multilateral Development Finance
Pilot Project	Pilot project in Pemba, in partnership with the Aga Khan Foundation

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0 Executive Summary – Phase III

Penetration of insurance products into developing markets is extremely low but a growing number of players are ready to embark on a pilot project in Mozambique

Phase III

Summary of activities					
A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed					
Interviewed parties					
AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk					
Insurance	Data mapping	Governance and regulation	Pricing and value	Products versus events	Distribution and collection
	Availability of reliable, historic data remain a critical factor in determining risk and understanding where product risks end and insurance can take over	As with other financial products, a stable, enforceable regulatory framework remains a requisite for scalable corporate transactions.	Lack of data, cluster risks and a challenging operating environment make pricing risk extremely difficult for climate related risks	Involvement of the insurance sector varies across the pilot projects. Factors that are product-related e.g. for the renewables or composting programs are easier to insure than weather or climate related factors e.g. agroforestry	For programs with higher volume collection and product distribution e.g. microfinance and agro-forestry local partnership with trusted players with an understanding of the operating environment will be key
Pilot project approach					
A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of "investment"					

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0 Executive Summary – Phase III

A crucial aspect for the success of these Programs is the creation of a sound support structure, to ensure efficient communication and a swift decision making process

Phase III

Strategic Recommendations

- INGC has a **dedicated team** working exclusively on the set-up of each of these Programs
- A **Unique Point of Contact (UPC)** will be established to support international investment in to these and other climate change adaptation and resilience building programs, ensuring a clear and effective channel for investment.
- This UPC is supported by a team of experts that will manage the economic, technical and legal aspects of the projects in each Program and the relationship between international investors and local promoters, authorities and communities.
- In addition to building climate change resilience, another important target of these Programs is **to build the required skills and capabilities** in Mozambique to ensure the execution and continuity of these Programs, as well as to develop future initiatives. With this in mind, a Capability-Building project is to be launched where local resources will receive appropriate training, side-by-side learning with external experts and necessary technical assistance
- However, without a portion of **public funding** to start these initial four Programs and without ensuring **proactive Government support**, the private sector will not be interested to make the investments on their side as the costs/barriers will be too great

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graph TD
    PM[Prime Minister] --> UPC[Unique Point of Contact (UPC)]
    UPC --> TT[Transversal Team]
    TT --> ST1[Specific Team]
    TT --> ST2[Specific Team]
    TT --> ST3[Specific Team]
    TT --> ST4[Specific Team]
    ST1 --- MSLE[Micro & Small Scale Lending]
    ST2 --- COMP[Composting]
    ST3 --- INS[Insurance]
    ST4 --- CE[Clean Energy]
            
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0 Executive Summary – Report structure

Each of the three phases is subdivided into four chapters, that for each phase give an in depth view of the theme and build up to a final recommendation

Blueprint structure

Phase I <i>Creation of a portfolio of adaptation options</i>	Phase II <i>Analysis & selection of the portfolio options</i>	Phase III <i>Design of detailed adaptation programs</i>
Strategic Assessment	Screening Phase	Design of Selected Program
Benchmarking	Evaluation Phase	Barriers to business analysis
Risks and opportunities for private investors	Adaptation measures shortlist	Strategic recommendations
Potential adaptation options	Selection Phase	

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1.1 Executive Summary – *Project scope*

Aim of the project: to build climate change resilience in Mozambique through private sector investment in attractive business opportunities

Project scope and approach

- Diagnosis and Formulation**: To identify **private investment opportunities** for adaptation and mitigation measures in high climate risk and impact areas
- Evaluation**: To **evaluate private sector's investment levels and cost-benefit** of the adaptation and mitigation measures
- Implementation Support**: To recommend **changes in government policy and strategy** to facilitate the implementation of the adaptation and mitigation measures

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1.1 Executive Summary – *Key Activities & Deliverables Progress*

The Phase I consisted in the identification of key business risks and in the creation of portfolio of adaptation options

High-level project approach

	Phase 0 Setup project	Phase I Creation of portfolio of adaptation options	Phase II Analysis & selection of adaptation options	Phase III Design of detailed adaptation program
Input <i>Main sources</i>	UKCIP, IPCC, DEFRA, SKCC, ONU and regional agencies	INE, CPI, Cities development corridors, PES, OFDA/CRED; INGC; stakeholder meetings; Phase II teams consultations; private sector workgroup; Strategic environmental assessment and adaptation to climate change © OECD 2008	Phase II Teams consultations; private sector workgroup; Benchmark; private investors meetings and workshops; Project promoters; Key reports (e.g. Catalysing low-carbon growth; Worldbank reports)	Phase II Teams consultations; private sector workgroup; private investors meetings and workshops; Project promoters; Stakeholder meetings
Process	<ul style="list-style-type: none"> Desk research Benchmarking Project management meetings 	<ul style="list-style-type: none"> Identification of key business risks from main climate change risks Develop long-list of adaptation options Benchmarking from countries and agencies 	<ul style="list-style-type: none"> Perform cost-benefit and feasibility analysis of adaptation options Analyze financing options and barriers to investment Meeting with stakeholders to select final options 	<ul style="list-style-type: none"> Perform detailed cost-benefit and feasibility analysis for 3 to 5 options Identify changes to national policy and strategy to facilitate private investment Presentation to decision-makers
Technique	Arthur D. Little "Project Management Office" proprietary methodology	ADL Risk Management, Benchmarking and Idea Generation methodologies, methods of SEA framework,	ADL fundraising framework and business case methodologies, methods of SEA framework;	ADL business cases frameworks, funding meetings and private investors workshops
Output	<ul style="list-style-type: none"> Research findings Detailed scope and plan definitions for Phase I 	<ul style="list-style-type: none"> Key business risks prioritized by region Portfolio of adaptation options 	<ul style="list-style-type: none"> Portfolio evaluated and prioritized Short-list of options with financing options 	<ul style="list-style-type: none"> 3 to 5 adaptation options «ready to implement» Guidelines for national policy and strategy

Team focus in Phase I

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1.1 Executive Summary – *Key questions*

Theme 4 has a set of key questions that guides the project approach through all the phases

Key questions

- What should be the set of adaptation measures to increase resilience to climate change in priority geographic areas of Mozambique, in each of the 8 themes?
- What role should the private sector play in the adaptation to climate change in Mozambique, in the priority geographic areas of the country?
- What are the barriers to private investment in the priority geographic areas?
- What are the solutions and possibilities for public-private funding for the selected adaptation measures?
- What are the recommendations for changes in government policy and strategy to facilitate the implementation of the adaptation and mitigation measures identified by the public and private sector?

Source: Construindo Resiliência com o Sector Privado – Technical proposal adenda



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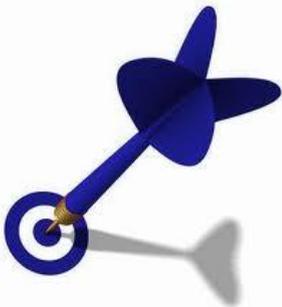
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1.1 Executive Summary – *Strategic objectives*

For Phase I, we aim to achieve three strategic objectives

Strategic objectives



- ▶ To **prioritize geographical areas and sectors** in Mozambique by combining high climate risk (in terms of exposure and vulnerability) with high business risks for the private sector (in terms of value of investments at risk)
- ▶ To **assess the private sector's risks and opportunities**, in each prioritized geographical area and sector, based on the strategic assessment (country, climate change and business analysis) and the benchmarking of international best practices
- ▶ To **identify a long-list of adaptation and mitigation options** with the potential to involve the private sector in increasing Mozambique's resilience to climate change

Source: Construindo Resiliência com o Sector Privado – Technical proposal adenda



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1.1 Executive Summary – Approach for Phase I

For Phase I, ADL designed an approach that addresses the Business context, Climate Change analysis, Impact and Opportunities for investment and Adaptation measures identification...

Arthur D. Little approach for Phase I

Strategic objectives → Mozambique analysis → Country context analysis → Climate Change analysis → Business context analysis → Global analysis → Benchmarking → Risks and opportunities for private investors → Adaptation measures identification

Each methodological step is explained in detail in each of the following chapters of the document

Source: Based on Arthur D. Little Methodologies, SEA - Strategic Environmental Assessment – Good Practices Guide, EACC - Economics of Adaptation to Climate Change, OECD – SEA and adaptation to climate change, ECA - Climate Adaptation Working Group, WBCSD – Adaptation, ECA – Enhancing the climate risk and adaptation fact base for the Caribbean

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1.1 Executive Summary – Approach for Phase I

.... with the following objectives:

Document Structure

Strategic objectives	Focused on the definition of key questions and strategic objectives
Strategic assessment	Focused on country context analysis (analysis of the economic, social and geographical indicators), climate change analysis (analysis of the vulnerability and exposure of the regions) and business context analysis (analysis of the GDP and main approved private investment projects)
Benchmarking	Focused on benchmarking analysis from other countries and agencies
Risks and opportunities for private investment	Focused on the identification of Key “High Climate Change Risk / High Climate Change Impact” areas in the North, Centre and South and opportunities for private investment on these areas
Potential adaptation options	Focused on adaptation measures identification by combining the benchmarking with other themes input in order to define a long-list of adaptation measures

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1.1 Executive Summary – Key findings

Key findings

- **Mozambique has approximately 22 million people and a GDP of about \$9 billion**, of which more than 50% comes from agriculture, trading and manufacturing. **The provinces that have the most percentage of country's GDP are Maputo city and provinces, Nampula and Sofala**
- The value of approved **investments that will take place** in the short to medium term is **worth some \$19 B**, of which more than **80% are located in Nampula, Tete, Maputo e Zambézia**
- **Climate change risk analysis indicates** that the North is more affected by cyclones while Center and South are more affected by floods and droughts
- The overlap between “climate risk map” and “investment map” indicates **6 priority areas** because of its High Climate Change Risk / High Climate Change Impact profile: **Nacala, Moatize, Motarara and Changara, Beira (Buzi and Dondo), Vilanculos, Gaza and Maputo**
- **Nacala's most significant business risks are failure in distribution channels and production interruption** with an estimated **value at risk of some \$5B and people affected of 305.000**
- **Moatize's most significant risks are interruption in production and operations and failure in logistics** with an estimated **value at risk of some \$5B and people affected of 950.000**
- The most significant business risks for **Beira** are **failure in logistics and raw material defectiveness** with an estimated **value at risk of \$1B and people affected of 937.000**

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1.1 Executive Summary – Key findings

Key findings

- **Vilanculos's most significant business risks are quality decrease in products and services and workforce absenteeism** with an estimated **value at risk of \$120 M and people affected of 843.000**
- The most significant business risks for **Gaza** are **raw material defectiveness and quality decrease in products and services** with an estimated **value at risk of \$870 M and people affected of 3.550.000**
- Maputo city 's most significant business risks are **failure in logistics and workforce absenteeism** with an estimated **value at risk of some \$2B and people affected of 720.000**
- **The SWOT analysis for Mozambique indicates** an attractive set of **business opportunities** for the key sectors at risk namely **Mineral Resources, Transport, Agriculture, Energy and Tourism**
- These opportunities were complemented with a **benchmarking analysis** that **highlighted 75 case-studies with the potential to integrate Mozambique's portfolio of adaptation options**
- By combining the benchmarking with other themes input and with the priority areas, **we identified a long-list of 70 adaptation and mitigations measures**
- The long-list of potential measures for the **North includes 17 measures**, of which **7 options are at Nacala**
- For the **Central region, there is a long-list of 26 potential measures**, including **15 adaptation options for the priority areas of Beira, Buzi and Dondo, and Moatize, Motarara and Changara**
- In the **South**, we identified 27 potential measures, of which **21 adaptation and mitigation options are directed at the priority areas of Maputo city, Vilanculos and Gaza**

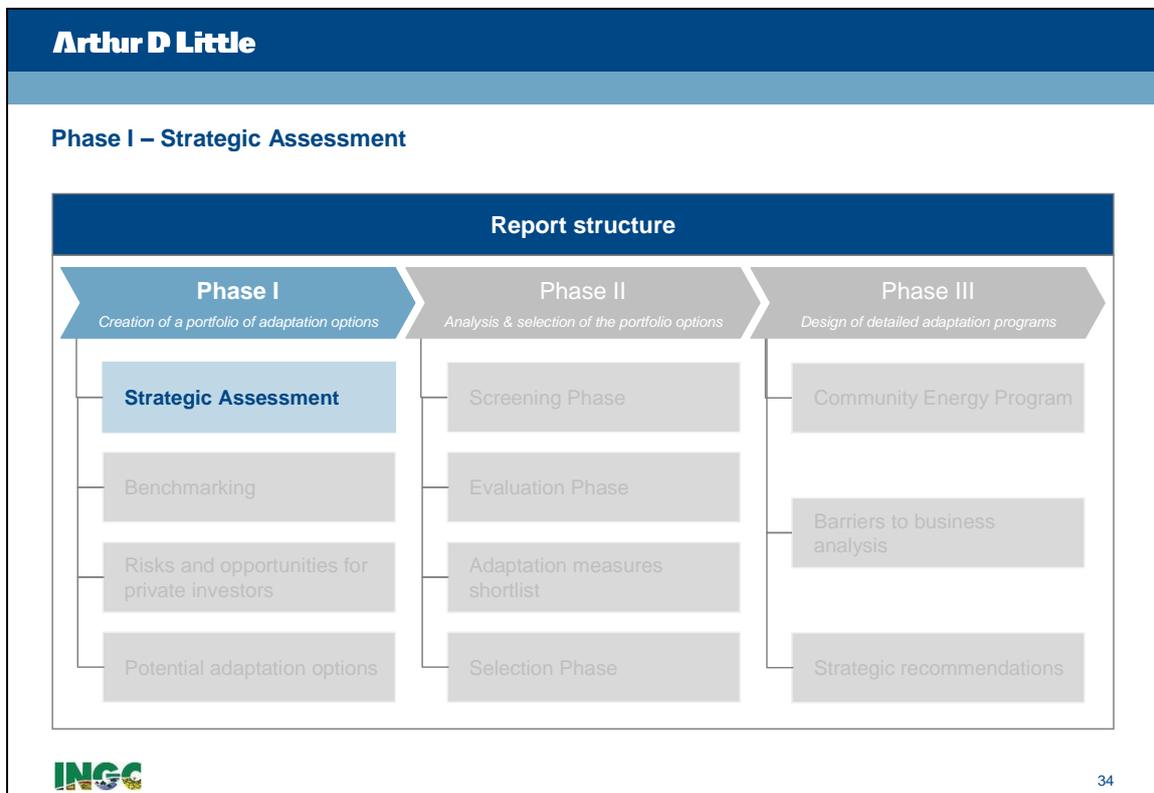
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1.2 Strategic assessment – Introduction

Introduction to “Strategic assessment”:

Country context analysis:
In this phase, we have done an assessment on economic and social indicators of the country in order to be used as an input for the following phases. The main document used in support of our analysis was «EACC - Economics of Adaptation to Climate report»

Climate change analysis:
In the beginning of this phase we researched the best practices to perform a climate change analysis focused on private sector engagement. The framework selected (SEA)¹ is best suited to a local than to a country level but we decided to adapt it to the country level selecting the methodologies with best fit.
In order to perform a climate change analysis we started by getting a regional perspective of the climate change impacts and then drilled down to specific areas. We considered this as the best approach since it allows us to get a global perspective (where there is more consistent data) and then focus on the most risky areas

- The exposure analysis was based on historical analysis of each region (North, Center and South) and future climate scenarios
 - For the historical analysis we crossed the information of an international database (EM-DAT) with a National Database that is being developed by INGC (Desconsultar) in order to guarantee the consistency of the data we used from each source
 - For the future scenarios we used the scenarios and conclusions of INGC Phase I report
- The vulnerability analysis was based on the historical impact of each district / province and expected economic and social development (e.g. urban / rural population change). Once again we crossed the information from the different sources in order to guarantee the consistency of the data.

Business context analysis:
In this phase, we have analyzed Mozambique's economic context and main private investments. This analysis was based on methodologies from “ECA – Shaping climate-resilient development” and “EACC - Economics of Adaptation to Climate Change”. We focused on relevant documentation about Mozambique economy structure, top companies and private investments related information (e.g. CPI), meetings with private investors, phone interviews which conclusions will be validated in the workshop with a target of 20 private investors

Source: EACC - Economics of Adaptation to Climate Change, ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group
INGC Strategic environmental assessment and adaptation to climate change © OECD 2008, Strategic Environmental Assessment
Good Practices Guide - Maria do Rosário Partidário

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1.2 Strategic assessment – Country context analysis

Mozambique has approximately 22 million people and a GDP per capita of about \$ 900, which positions the country as one of the poorest countries in the world

Mozambique brief context



Economic Indicators	Value
GDP	US\$ 9 B
GDP per capita	US\$ 897
Social Indicators	Value
Population	22 Million
Human development index	Low (0,284)
Geographical Indicators	Value
Land area	799,380 sq km
Population density	24 p./sq km

Source: Ranking do IDH 2010 - PNUD, Instituto Nacional de Estatística, Banco Central da República de Moçambique, Portal do Governo de Moçambique

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1.2 Strategic assessment – Country context analysis

There are considerable inequalities among Mozambique's regions: the South region is the one that contributes the most for the country's GDP

Region contribution to GDP (INE, 2009)

Average GDP contribution per region

North	Central	South
22%	34%	44%

GDP per region (10³ MT)

Year	North	Central	South
2005	28226	43953	57585
2006	30858	48208	61966
2007	33281	51861	66158
2008	35819	54775	71041
2009	38168	58491	75396

Social context

Current status

- Mozambique continues to be one of the poorest countries in the world and the social context is not following the economic growth despite the fast economic development.
- The human development index 2010 ranked Mozambique in 165^o out of 169 countries
- HIV epidemics is a huge concern and it is estimated that 500 people get infected per day in Mozambique.
- 80% of the population is dedicated to agriculture and fisheries and lack the technical skills to work in other areas that private companies need

Socio Economic Scenarios for the future¹

Population growth

Urbanisation

The different stages of development of Mozambique regions is reflected in the comparative importance of each sector for the regional GDP

There are consistent trends between both scenarios: the decline of agriculture in the South, negative externalities, of agricultural expansion and intensification, the vulnerable coastal zone and rapid urbanization and population growth

Source INE Mozambique; - Human development index 2010 from UNDP, INGC Climate Change Report

¹ Regional Economic - represents a differentiated world, characterized low trade flows, relatively slow capital stock turnover, and slow technological change
Global Sustainable - represents a world with a high level of environmental and social consciousness combined with a globally coherent approach to a more sustainable development

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1.2 Strategic assessment – Country context analysis

In more detail, the provinces that have the higher percentage of country's GDP are Maputo city and province, Nampula and Sofala

Province	Indicators	Value
Niassa	GDP	315 M\$
	Population	1.096.406
	GDP per capita	288 \$
	Land Area	122.176 km ²
Tete	GDP	526 M\$
	Population	1.489.843
	GDP per capita	353 \$
	Land Area	97.285 km ²
Manica	GDP	494 M\$
	Population	1.412.029
	GDP per capita	350 \$
	Land Area	61.661 km ²
Gaza	GDP	442 M\$
	Population	1.219.013
	GDP per capita	363 \$
	Land Area	75.539 km ²
Maputo (provincia)	GDP	1.222 M\$
	Population	1.205.553
	GDP per capita	1.096 \$
	Land Area	26.058 km ²

Province	Indicators	Value
Cabo Delgado	GDP	438 M\$
	Population	1.605.649
	GDP per capita	273 \$
	Land Area	77.867 Km ²
Nampula	GDP	1.241 M\$
	Population	3.888.356
	GDP per capita	345 \$
	Land Area	78.197 km ²
Zambézia	GDP	963 M\$
	Population	3.792.000
	GDP per capita	254 \$
	Land Area	103.127 km ²
Sofala	GDP	1.021 M\$
	Population	1.543.909
	GDP per capita	662 \$
	Land Area	68.018 km ²
Maputo (city)	GDP	1.407 M\$
	Population	1.094.315
	GDP per capita	1.285 \$
	Land Area	346 km ²
Inhambane	GDP	569 M\$
	Population	1.267.035
	GDP per capita	449 \$
	Land Area	68.615 km ²

Source: Instituto Nacional de Estatística de Moçambique, 2009 (population data refers to 2007)

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Legend: North (Yellow), Center (Light Blue), South (Light Green)

Arthur D Little Exposure Vulnerability Climate Risk

1.2 Strategic assessment – *Climate change analysis*

Climate change analysis was performed considering exposure and vulnerability to each type of event as well as the future climate scenarios for Mozambique

	Exposure	Vulnerability	Climate Change Risk
Input	<ul style="list-style-type: none"> EM-DAT: The OFDA/CRED International Disaster Database; INGC report Desconsular database (developed by INGC) 	<ul style="list-style-type: none"> Desconsular database; INGC report; World Bank reports, Mozambique government reports INE 	<ul style="list-style-type: none"> INGC report World Bank reports Desconsular database;
Process	<ul style="list-style-type: none"> First, we developed a model based on the data regarding natural events existent in EM-DAT and INGC Phase I report Secondly, we cross-checked it with the information contained in Desconsular to guarantee the consistency of the data from the different sources Finally, by aggregating the results of INGC Phase I report we applied scenario development 	<ul style="list-style-type: none"> First, we designed a model with the data regarding the impact of natural events on the populations and in terms of number of deaths Secondly, we cross-checked the information contained in the databases to guarantee the consistency of the data from the different sources Finally, by aggregating the results of INGC Phase I report with socio-economic development scenarios, we applied scenario development 	<ul style="list-style-type: none"> First, with the outputs of the last two steps we built the risk matrix for each region Secondly, using our model with Desconsular indicators we were able to drill down to a district level and determine the risk for each district Finally, we developed a risk matrix for the areas most at risk in each region
Technique	<ul style="list-style-type: none"> Trends analysis, Consistency analysis Aggregation methods 	<ul style="list-style-type: none"> Vulnerability analysis Consistency analysis Cross impact analysis – socio-economic development vs human impact SEA methodology 	<ul style="list-style-type: none"> Risk Management Methodology Consistency analysis Experts consultations SEA methodology
Output	<ul style="list-style-type: none"> Historical frequency of droughts, floods and cyclones in Mozambique Future likely scenarios for this events and sea level rise 	<ul style="list-style-type: none"> Historical affected population due to droughts, floods and cyclones in Mozambique Future likely scenarios considering climate hazards and economic development 	<ul style="list-style-type: none"> Risk matrix for the present and future trends

Source: Strategic environmental assessment and adaptation to climate change © OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets

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Arthur D Little Exposure Vulnerability Climate Risk
North Center South

1.2 Strategic assessment – *Events frequency in the North*

The North is historically the region with less burden due to natural hazards. With climate change this region is likely to increase the frequency of floods due to storms and cyclones

Frequency of natural hazards in the North	Comments								
<table border="1"> <caption>Frequency of natural hazards in the North</caption> <thead> <tr> <th>Hazard Type</th> <th>Frequency (Events per year)</th> </tr> </thead> <tbody> <tr> <td>Cyclone</td> <td>1 event every 6 years (approx. 0.167)</td> </tr> <tr> <td>Flood</td> <td>1 event every 10 years (0.1)</td> </tr> <tr> <td>Drought</td> <td>1 event every 45 years (approx. 0.022)</td> </tr> </tbody> </table>	Hazard Type	Frequency (Events per year)	Cyclone	1 event every 6 years (approx. 0.167)	Flood	1 event every 10 years (0.1)	Drought	1 event every 45 years (approx. 0.022)	<ul style="list-style-type: none"> The Northern region is the region with less burden regarding natural hazards. Still, this region had 15% of the flood events that occurred in Mozambique and 25% of the tropical cyclone events With climate change, there is a general expectation of increased flood peaks in small watersheds wherever storms make landfall in this region Regarding cyclones, there is not a representative sample to enable us to get to a conclusion regarding frequency, there seems to be more confidence that the relative frequency of category 4-5 cyclones versus 1-3 cyclones will increase
Hazard Type	Frequency (Events per year)								
Cyclone	1 event every 6 years (approx. 0.167)								
Flood	1 event every 10 years (0.1)								
Drought	1 event every 45 years (approx. 0.022)								

Source: EM-DAT: The OFDA/CRED International Disaster Database www.emdat.be - Université Catholique de Louvain - Brussels - Belgium
INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change © OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário;

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Exposure

Vulnerability

Climate Risk

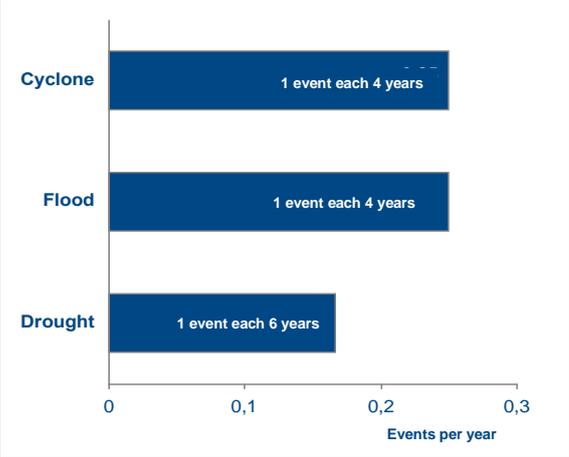
North

Center

South

1.2 Strategic assessment – Events frequency in the Center

The Center is historically the region with more burden due to natural hazards. With climate change this region is likely to increase the risk of droughts and cyclones

Frequency of natural hazards in the Center	Comments								
 <table border="1" style="margin-top: 10px; font-size: 0.8em;"> <caption>Data for Slide 41 Chart</caption> <thead> <tr> <th>Hazard Type</th> <th>Frequency (Events per year)</th> </tr> </thead> <tbody> <tr> <td>Cyclone</td> <td>0.25</td> </tr> <tr> <td>Flood</td> <td>0.25</td> </tr> <tr> <td>Drought</td> <td>0.167</td> </tr> </tbody> </table>	Hazard Type	Frequency (Events per year)	Cyclone	0.25	Flood	0.25	Drought	0.167	<ul style="list-style-type: none"> ■ The central region is frequently impacted by floods and cyclones and less frequently (1 event in each 6 years) by droughts. ■ With climate change this region is likely to increase the risk of droughts and crop failure ■ Moreover, although some slight increase in rainfall is expected in most of the Central region, six out of 7 models predict a 15% reduction of Zambezi flow which is likely to have an impact in hydroelectric production ■ Regarding cyclones, there is not a representative sample to enable us to get to a conclusion regarding frequency, there seems to be more confidence that the relative frequency of category 4-5 cyclones versus 1-3 cyclones will increase
Hazard Type	Frequency (Events per year)								
Cyclone	0.25								
Flood	0.25								
Drought	0.167								

Source: EM-DAT: The OFDA/CRED International Disaster Database www.emdat.be - Université Catholique de Louvain - Brussels - Belgium
 INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change © OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; 41

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Exposure

Vulnerability

Climate Risk

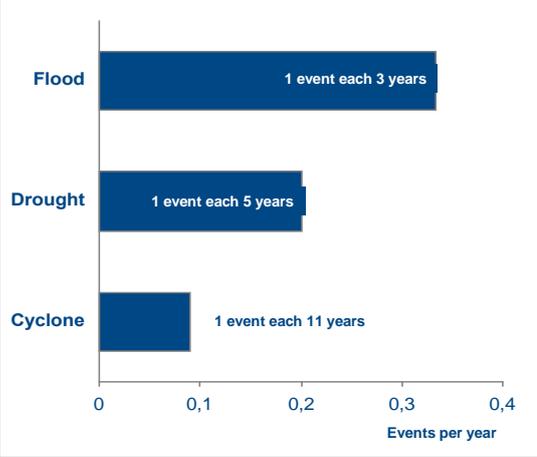
North

Center

South

1.2 Strategic assessment – Events frequency in the South

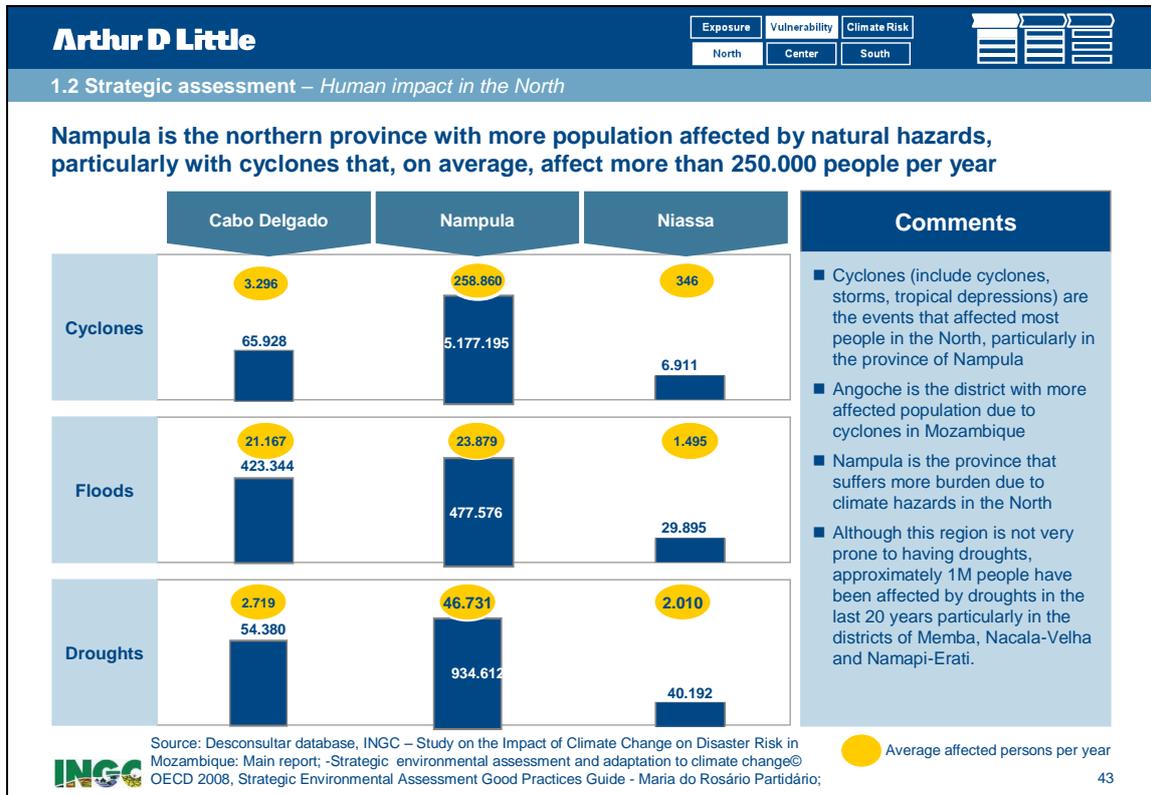
The South is mainly impacted by floods and droughts and with climate change this region is likely to suffer from more floods and more intense cyclones

Frequency of natural hazards in the South	Comments								
 <table border="1" style="margin-top: 10px; font-size: 0.8em;"> <caption>Data for Slide 42 Chart</caption> <thead> <tr> <th>Hazard Type</th> <th>Frequency (Events per year)</th> </tr> </thead> <tbody> <tr> <td>Flood</td> <td>0.333</td> </tr> <tr> <td>Drought</td> <td>0.2</td> </tr> <tr> <td>Cyclone</td> <td>0.091</td> </tr> </tbody> </table>	Hazard Type	Frequency (Events per year)	Flood	0.333	Drought	0.2	Cyclone	0.091	<ul style="list-style-type: none"> ■ The south is more impacted by floods and droughts and less frequently (1 event in each 11 years) by cyclones. ■ With climate change the south is likely to have more floods and cyclones are likely to increase intensity. ■ Drought frequency is uncertain but drought intensity is likely to increase at least in the near future. ■ The risk of floods is likely to increase not in terms of frequency but in terms of intensity of each event. ■ Regarding cyclones, there is not a representative sample to enable us to get to a conclusion regarding frequency, there seems to be more confidence that the relative frequency of category 4-5 cyclones versus 1-3 cyclones will increase
Hazard Type	Frequency (Events per year)								
Flood	0.333								
Drought	0.2								
Cyclone	0.091								

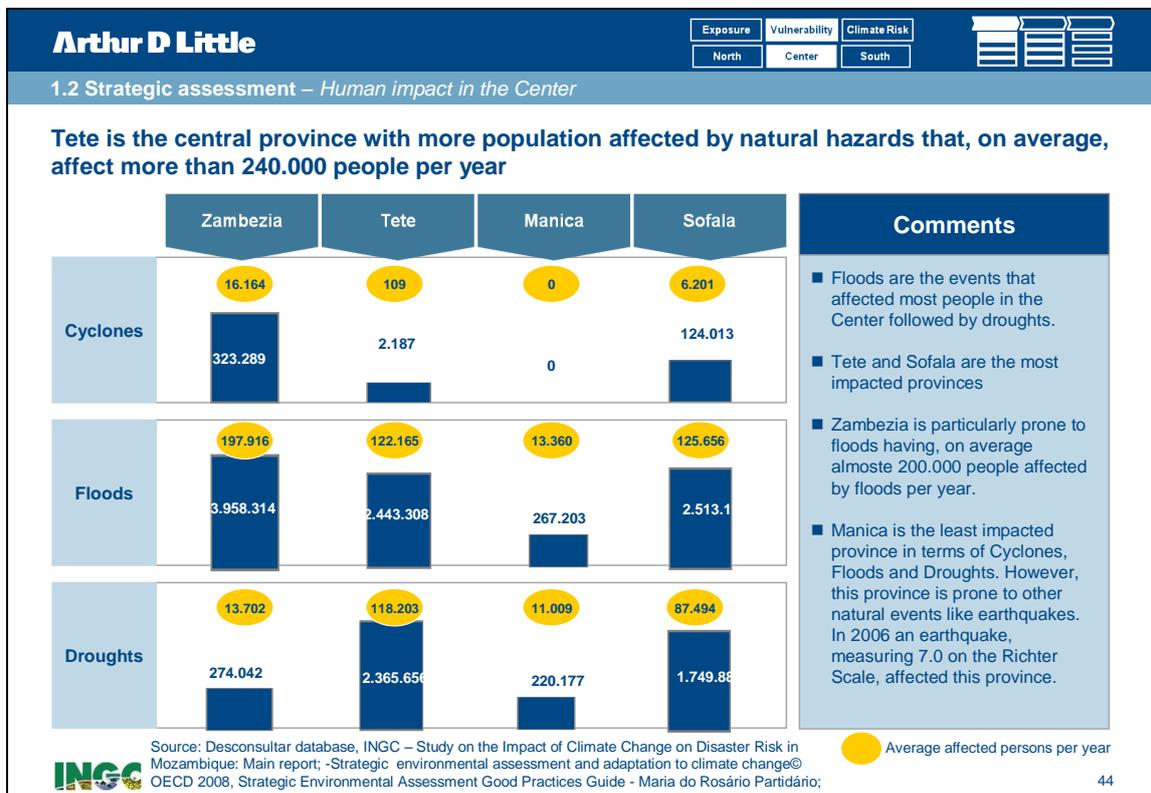
Source: EM-DAT: The OFDA/CRED International Disaster Database www.emdat.be - Université Catholique de Louvain - Brussels - Belgium
 INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change © OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; 42

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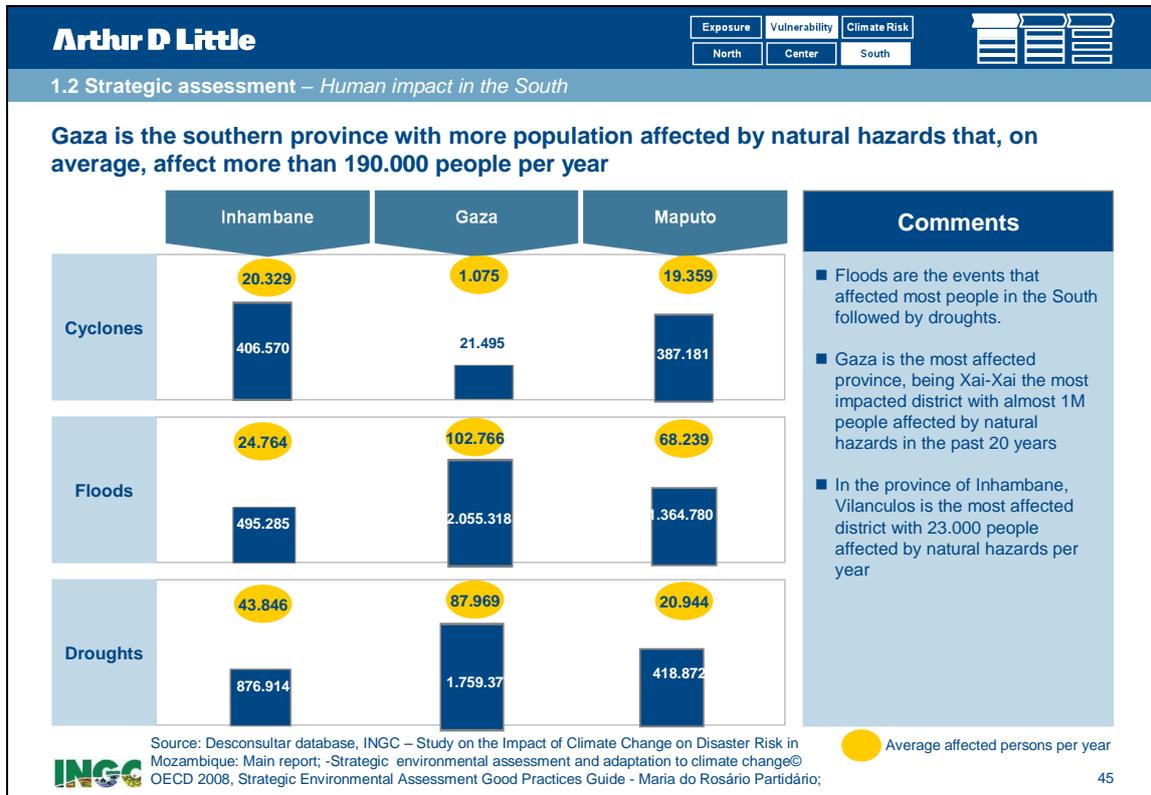
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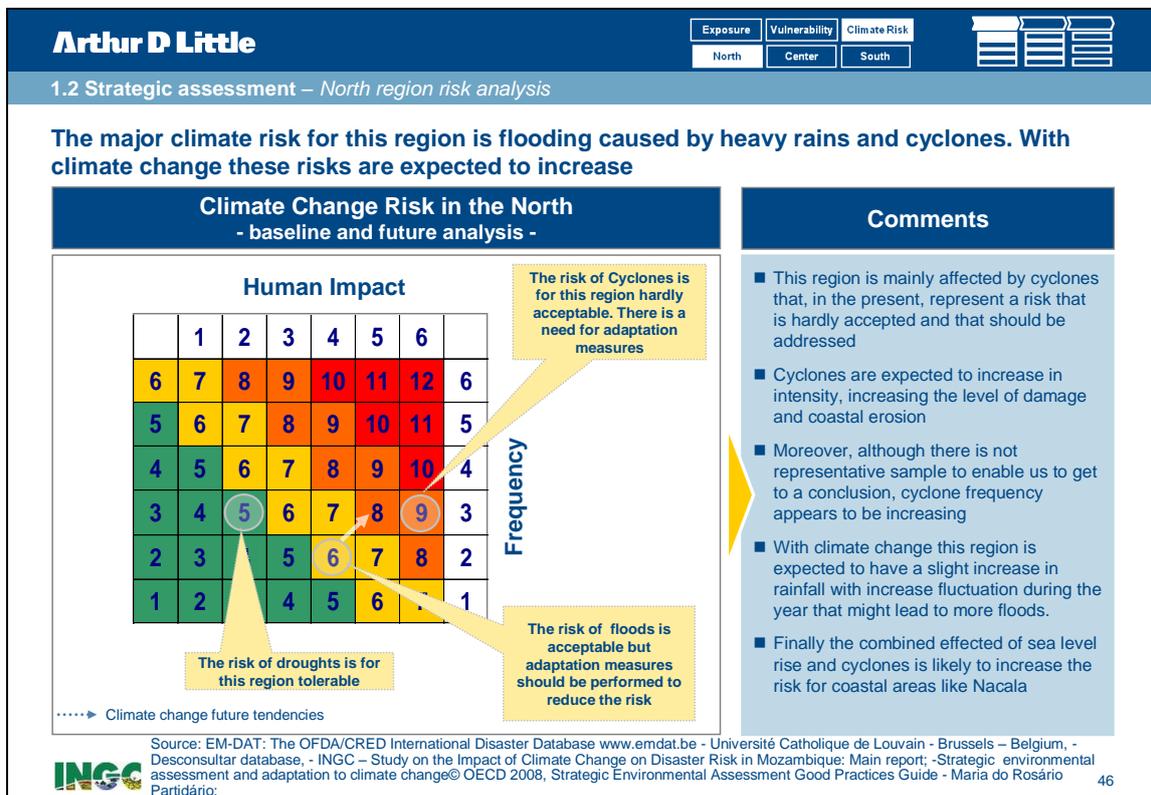
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SLIDE 45



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Arthur D Little Exposure Vulnerability Climate Risk
North Center South

1.2 Strategic assessment – North region risk analysis

Although the risks are very similar in the most affected areas of the Northern region, Nacala seems to be the most affected area because it is impacted by cyclones, floods and droughts

Climate risk in selected areas in the North - baseline and future analysis -

Quirimba National Park

Human Impact		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
Cyclones		4	5	6	7	8	9	10	4
Droughts		3	4	5	6	7	8	9	3
	Frequency	1	2	3	4	5	6	7	1

Cabo Delgado

Human Impact		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
Cyclones		4	5	6	7	8	9	10	4
Droughts		3	4	5	6	7	8	9	3
	Frequency	1	2	3	4	5	6	7	1

Nampula

Human Impact		1	2	3	4	5	6		
Cyclones		6	7	8	9	10	11	12	6
Floods		4	5	6	7	8	9	10	4
Droughts		3	4	5	6	7	8	9	3
	Frequency	1	2	3	4	5	6	7	1

Nacala

Human Impact		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
Cyclones		4	5	6	7	8	9	10	4
Droughts		3	4	5	6	7	8	9	3
	Frequency	1	2	3	4	5	6	7	1

Nacala has events of cyclones, floods and droughts with more human impact than the other regions

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Arthur D Little Exposure Vulnerability Climate Risk
North Center South

1.2 Strategic assessment – Central region risk analysis

The major climate risks for this region are flooding and water scarcity. With climate changes this region is likely to increase the frequency of droughts and cyclones

Climate Change Risk in the Center - baseline and future analysis -

Consequence		1	2	3	4	5	6		
		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1
	Frequency	1	2	3	4	5	6	7	1

The risk of Cyclones is acceptable but adaptation measures should be performed to reduce the risk

The risk of Floods is not acceptable. There is a need to develop a plan to eliminate or reduce the risk

The risk of Droughts is hardly acceptable. There is a need for adaptation measures

Climate change future tendencies

Comments

- This region is mainly affected by floods and droughts being cyclones the event that cause the least impact on the population.
- With climate change this region is likely to increase the risk of droughts in Buzi and Pungue basins as well as in Zambezi basin.
- Moreover, the risk of cyclones will increase mainly due to two facts:
 - Cyclone intensity is expected to increase
 - Population concentration is likely to increase in coastal zones, leading to an increase number of population affected when a cyclone or a storm hit
- The combined effect of sea level rise and cyclones is likely to increase the risk for coastal areas like Beira
- Finally, the risk of floods is not expected to change

Source: EM-DAT: The OFDA/CRED International Disaster Database www.emdat.be - Université Catholique de Louvain - Brussels - Belgium, - Desconsultar database, - INGC - Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; 48

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Arthur D Little Exposure Vulnerability Climate Risk
North Center South

1.2 Strategic assessment – Central region risk analysis

The region of Moatize, Motarara and Changara seems to have floods and droughts events with more human impact than the other regions in the Center

Climate risk in selected areas in the Center - baseline and future analysis -

Moatize, Motarara and Changara

Human Impact		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	4
		4	5	6	7	8	9	10	3
Droughts		3	4	5	6	7	8	9	3
		2	3	4	5	6	7	8	1
		1	2	3	4	5	6	7	1

Frequency

Beira (Buzi and Dondo)

Human Impact		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
Cyclones		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
Droughts		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

Frequency

Chinde, Mopeia and Morrumbala

Human Impact		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
Cyclones		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
Droughts		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

Frequency

Maganja, Namacurra and Nicoadala

Human Impact		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
Cyclones		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
Droughts		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

Frequency

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Arthur D Little Exposure Vulnerability Climate Risk
North Center South

1.2 Strategic assessment – South region risk analysis

The major climate risks for this region are flooding and water scarcity. With climate change this region is likely to suffer more impact from floods and cyclones

Climate Change Risk in the South - baseline and future analysis -

Consequence		1	2	3	4	5	6		
		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

Frequency

The risk of floods is intolerable and a plan to reduce risks must be performed

The risk of cyclones is for this region tolerable.

The risk of droughts is intolerable and a plan to reduce risks must be performed

.....> Climate change future tendencies

Comments

- This region is mainly affected by floods and droughts
- With climate change this region is likely to increase the risk of floods not in terms of frequency but in terms of intensity of each event. A 25% increase in the magnitude of large flood peaks was identified along the main stems of both the Limpopo and Save rivers in 5 of the 7 models
- Moreover, the risk of cyclones will increase mainly due to two facts:
 - Cyclone intensity is expected to increase
 - Population concentration is likely to increase in coastal zones, leading to an increase number of population affected when a cyclone or a storm hit
- The combined effect of sea level rise and cyclones is likely to increase the risk for coastal areas like Vilanculos, Xai-Xai or Maputo
- Finally although drought frequency is uncertain, drought intensity is likely to increase at least in the near future.

Source: EM-DAT: The OFDA/CRED International Disaster Database www.emdat.be - Université Catholique de Louvain - Brussels - Belgium, - Desconsultar database, - INGC - Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; -Strategic environmental assessment and adaptation to climate change© OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; 50

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Arthur D Little Exposure Vulnerability Climate Risk
North Center South

1.2 Strategic assessment – South region risk analysis

The region of Vilanculos seems to have cyclones and flood events with more human impact than the other regions in the South

Climate risk in selected areas in the South - baseline and future analysis -

Vilanculos

		Human Impact							
		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
Droughts		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
Cyclones		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

Gaza

		Human Impact							
		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
Droughts		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
Cyclones		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

Matola

		Human Impact							
		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
Droughts		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
Cyclones		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

Maputo

		Human Impact							
		1	2	3	4	5	6		
Floods		6	7	8	9	10	11	12	6
		5	6	7	8	9	10	11	5
Droughts		4	5	6	7	8	9	10	4
		3	4	5	6	7	8	9	3
Cyclones		2	3	4	5	6	7	8	2
		1	2	3	4	5	6	7	1

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1.2 Strategic assessment – Mozambique economy and investments

Mozambique has approximately 22 million people and a gross domestic product of about \$9 billion, of which more than 50% comes from agriculture, trading and manufacturing

Mozambique brief economic context

Country key figures	Land area	799,380 sq km
	Population	22 Million
	GDP	\$ 9 B (270 B MT ¹)
Main towns and population	Maputo (1,8 million)	Represent 44% of the total GDP ²
	Nampula (530 thousands)	
	Beira (440 thousands)	

GDP – Production View

In the "others" category, the most representative are the real estate and the electricity and water businesses

- Agriculture, animal livestock, hunting and forestry
- Trading businesses
- Industry / Manufacturing
- Transportation and communications
- Others

Main industries of the Top 100 Mozambique's companies³

Sector	Main Companies	% revenues
Industry	■ Mozal (from Maputo) ■ Cimentos de Moçambique (from Matola) ■ British American Tobacco Mozambique, Lda (from Chimioio)	29 %
Energy	■ Petromoc-Petróleos de Moçambique ■ Hidroeléctrica de Cahora Bassa (Tete) ■ BP Moçambique (Maputo, Beira e Nacala)	25 %
Transportation	■ LAM-Linhas Aéreas de Moçambique ■ CFM-Portos e Caminhos de Ferro de Moçambique E.P. ■ Mocargo - Empresa Moçambicana de Cargas	10 %
Others	■ Moçambique Celular ■ Cervejas de Moçambique ■ BIM-Banco Internacional de Moçambique ■ Mozambique Leaf Tobacco	37 %

Nevertheless, some of the top companies in the country belong to Energy and Transportation sectors

Source: INE, 100 maiores empresas de Moçambique – documento KPMG

INGC ¹Meticais ²Considered the GDP of Maputo city, Nampula and Sofala regions ³ Measured by percentage of revenues 52

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1.2 Strategic assessment – Mozambique economy and investments

The value of approved investments that will take place in the short to medium term¹ is worth some \$19 B, of which more than 80% are located in Nampula, Tete, Maputo e Zambézia

Main approved private investment projects and prospects²

Province	Total Value	Percentage
Tete	\$ 3.8 B	20%
Nampula	\$ 7.5 B	39%
Maputo	\$ 2.7 B	14%
Zambézia	\$ 2.4 B	13%
Other provinces	\$ 2.6 B	14%

Tete (\$ 3.8 B, 20%)

Investments	Value
Hidroeléctrica de Mphanda Nkuwa (Changara/Chiuta)	\$ 1.9 B
Carvão de Moatize	\$ 1.5 B
Eqstra Moçambique (Tete)	\$ 165 M

investments concentrated in two major projects

Nampula (\$ 7.5 B, 39%)

Investments	Value
Ayr Petro-Nacala (Nacala)	\$ 5.0 B
Lúrio Green Resources (Ribawe)	\$ 2.2 B
Cervejas de Moçambique – Fábrica de Nampula	\$ 55 M

investments concentrated in two major projects

Maputo (\$ 2.7 B, 14%)

Investments	Value
Ilha de Xefina (Cidade de Maputo)	\$ 320 M
MCEL (Cidade de Maputo)	\$ 140 M
Obrigado Fazenda de Açúcar e Milho (Moamba)	\$ 100 M

investment diluted in several projects

Zambézia (\$ 2.4 B, 13%)

Investments	Value
Portucel Moçambique (Ile)	\$ 2.3 B
Moçamgalp (Luguela)	\$ 19 M
Quifel Agrícola (Gurue)	\$ 17 M

investments concentrated in one major project

Other provinces (\$ 2.6 B, 14%)

In addition to the private investment, it is expected significant public investment in these regions, such as Nacala port and airport (\$700 M) and improvement of Maputo and Beira ports (\$ 1,4 B)²

Source: ¹ in the next 5 to 15 years
²CPI (2005-2010) – Investment promotion centre (Centro Promoção de Investimento)

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²Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010, companies websites

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1.2 Strategic assessment – Mozambique economy and investments

The most significant investments belong to mineral resources, energy and agriculture companies (1/2)

Region	Province	Sector	Value
North	Niassa	Agriculture, Forestry and Livestock	\$185M
	Niassa	Tourism	\$8M
	Cabo Delgado	Agriculture, Forestry and Livestock	\$110M
	Cabo Delgado	Tourism	\$60M
	Nampula	Mineral resources and Energy	\$5B
	Nampula	Agriculture, Forestry and Livestock	\$2.3B
Center	Nampula	Transports and Communications	\$700M
	Tete	Mineral resources and Energy	\$7.3B
	Tete	Services	\$240M
	Tete	Tourism	\$60M
	Zambeze	Agriculture, Forestry and Livestock	\$2,4B
	Zambeze	Industry	\$25M
	Manica	Agriculture, Forestry and Livestock	\$310M
	Manica	Industry	\$60M
	Sofala	Transports and Communications	\$620M
	Sofala	Agriculture, Forestry and Livestock	\$440M
Sofala	Tourism	\$120M	
Sofala	Industry	\$90M	

Source: ¹CPI (2005-2010) – Investment promotion centre (Centro Promoção de Investimento)

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²Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010, companies websites

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1.2 Strategic assessment – Mozambique economy and investments

The most significant investments belong to mineral resources, energy and agriculture companies (2/2)

Region	Province	Sector	Value
South	Gaza	Agriculture, Forestry and Livestock	\$630M
	Gaza	Tourism	\$230M
	Inhambane	Tourism	\$190M
	Inhambane	Agriculture, Forestry and Livestock	\$22M
	Maputo	Transports and Communications	\$1.2B
	Maputo	Tourism	\$710M
	Maputo	Industry	\$660M
	Maputo	Agriculture	\$320M
	Maputo	Services	\$220M
	Maputo	Construction	\$130M
	Maputo	Banking	\$115M

Source: ¹CPI (2005-2010) – Investment promotion centre (Centro Promoção de Investimento) ²Nacala XXI, Nacala, Beira and Maputo development corridors, Mozambique investment forum 2010, Investment Opportunities in the Industrial Sector, Investing in Mozambique 2010, companies websites

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1.2 Strategic assessment – Mozambique economy and investments

The leading economic sectors in 2011 seem to be Financial services, Transport and communications and Fishing

Expected Growth in 2011

Sector	Expected Growth (%)
Financial Services	20,5%
Transport and Communications	10,4%
Fishing	8,8%
Extractive Industries	0,9%
Government services	0,0%
Electricity & Water	-3,7%
Total expected growth	6,7%

Source: Government of Mozambique, Economic and Social Plan (PES), 2011

Comments

- The Economist Intelligence Unit is optimistic about the growth in **financial services, demand for which will be driven by both consumers and large investment projects** – although the EIU expect a more modest growth of **around 12%**
- Regarding **Transport and Communications, there is a match between the Government and EIU expectations** – transport is a priority sector for public investment, and communications will continue to be buoyed by unmet demand for mobile-phone and Internet services
- With regard to **Extractive Industries expectations, the EIU team believes that the government's growth projection is overly pessimistic, rather EIU expects an expansion of around 6-8%**

Source: The Economist Intelligence Unit

- The three industries with the most significant growth rate
- The three industries with the lowest growth rate

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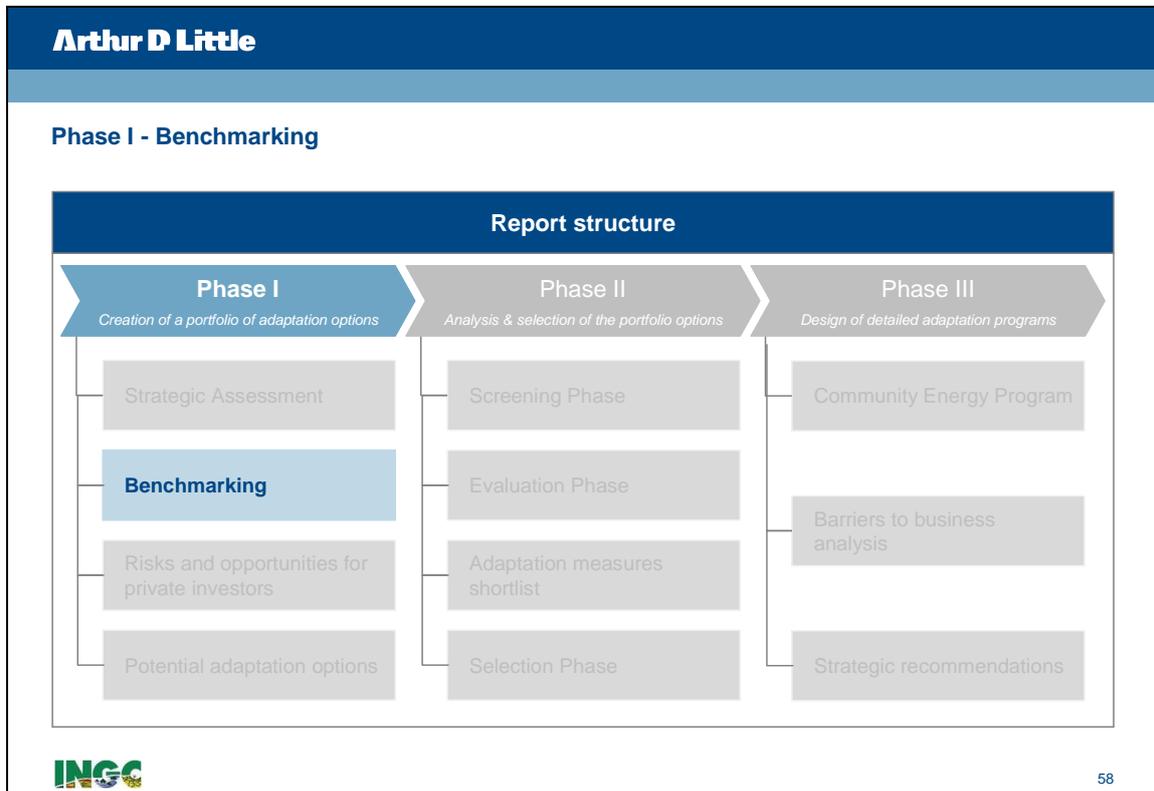
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1.3 Benchmarking – Introduction

Introduction to “Benchmarking”:

In this phase we identified adaptation measures in countries with similar natural hazards events. To do that we based our methodology on the study from Economics of Climate Adaptation entitled «Shaping Climate Resilient Development»

- In a first step, we focused on the methodologies and facts described on the document cited above in order to structure our desk research
- Secondly, we have replicated the approach for other relevant documentation focusing our analysis on case-studies of adaptation measures on countries with similar natural hazards events. Some examples of the sources we used are: World bank documentation, Shaping climate-resilient development – a framework for decision-making, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, United Nations Framework Convention on Climate Change, Food and Agriculture Organization of the United Nations
- Finally, we have compiled the more suitable case-studies and done a case comparison in order to identify the potential adaptation measures – we identified which climate impacts were subject to each adaptation measure considered

Source: ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group

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1.3 Benchmarking – Case studies

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (1/15)

Examples

The map displays the following adaptation measures by region:

- USA:** Altering the timing of planting dates to adapt to changing growing conditions
- South America (Argentina):** Inclusion of drought-resistant plants such as agave and aloe
- West Africa:** Conserving grazing and fodder lands through reforestation
- East Africa:** Building of shelter-belts and wind-breaks to improve resilience of rangelands
- India:** Construction of dams
- South Asia:** Utilizing intercropping and agro forestry
- East Asia:** Use of alternative crops and low-technology water filters
- Philippines:** Rainwater harvesting
- Australia:** Storm water harvesting for management of recreational facilities

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (2/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Argentina 	Adjustment of planting dates and crop variety - e.g. Inclusion of drought-resistant plants such as agave and aloe	Drought	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Accumulation of commodity stocks as economic reserve		
	Spatially separated plots for cropping and grazing to diversify exposures		
	Diversification of income by adding livestock operations		
	Set-up/provision of crop insurance		
Creation of local financial pools (as alternative to commercial crop insurance)			

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (3/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Australia 	Storm water harvesting for management of recreational facilities	Water scarcity	Australia - climate change adaptation actions for local government
	Storm water recycling through wetlands	Water stress	
Bangladesh 	Flood tolerant crops	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Flood-resilient aquaculture in Faridpur	Low productivity of fisheries	
	Flood-resistant housing in Faridpur	Damage to human settlements	
	Flood-resistant housing through micro-loans	Damage to human settlements	

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (4/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Bangladesh 	Use of alternative crops and low-technology water filters	Sea-level rise and salt-water intrusion	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Building of flow regulators in coastal embankments	Sea-level rise and salt-water intrusion	
Botswana 	Domesticating wild fruit trees	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
Brazil 	Preventing soil erosion and landslides by reforestation in Rio de Janeiro	Soil erosion	
Burkina Faso 	Forestation through vegetative propagation	Land degradation	
Caribbean islands - Grenada 	Establishing grass barriers to minimize soil loss and associated degradation and conserve limited water resources	Soil erosion	FAO (Food and Agriculture Organization)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 63



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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (5/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Caribbean islands - Grenada 	Integrating agro-forestry practices in the farming system	Loss of crops - soil erosion	UNFCCC (United Nations Framework Convention on Climate Change)
	Building a hurricane-resistant poultry pen	Increasing farmers' likelihood to recover from disaster by protecting an important source of income and food security.	FAO (Food and Agriculture Organization)
China 	Water resources management in Yangtze River Basin	Water management	International Cooperation Bureau Yangtze (Changjing) Water Resources Commission, MWR, China
	Tree-planting pits in the Loess Highlands	Soil erosion	UNFCCC (United Nations Framework Convention on Climate Change)
	Rainwater harvesting	Water scarcity	The World Bank
	Wind and solar thermal power	Reduction of oil dependence	Eskom

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 64



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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (6/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
China 	Improve drought resistance of wheat cultivations in Shandong Province	Water shortage	FAO (Food and Agriculture Organization)
	Enhanced resilience of water drainage and irrigation system for Disaster Risk Management in Shandong	Water stress	FAO (Food and Agriculture Organization)
Egypt 	Installation of hard structures in areas vulnerable to coastal erosion	Sea level rise - regulation of setback distances for coastal infrastructure	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
El Salvador 	Drought-resistant agriculture	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Addressing drought problems by reforesting areas with fruit trees to protect soil from erosion caused by water and wind while augmenting the local food supply	Soil erosion	The World Bank
Fiji 	Coral gardening in Cuvu Mina	Coastal inundation/erosion	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (7/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
India 	Flood tolerant crops pilot project	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Using bamboo to transport stream and spring water to irrigate plantations in Northeast India	Loss of crops, water shortage, higher crop yields	
	Bajra millet in Rajasthan	Loss of crops	
	Anicuts in India	Water shortage	
	Harvesting water and recharging ground water through earthen dams in India	Water management	http://www.rainwaterharvesting.org/
Jamaica 	Alley cropping - planting trees in rows with food or cash crops between them	Land degradation and soil erosion	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (8/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Kenya 	Crop diversification	Loss of crops	UNFCCC (United Nations Framework Convention on Climate Change)
	Adoption of drought resistant/escaping crops	Loss of crops	
	Improving sustainable livelihoods in dry land areas	Loss of crops	FAO (Food and Agriculture Organization)
Mexico 	Adjustment of planting dates and crop variety - e.g. Inclusion of drought-resistant plants such as agave and aloe)	Drought	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Accumulation of commodity stocks as economic reserve	Drought	
	Spatially separated plots for cropping and grazing to diversify exposures	Drought	

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (9/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Mexico 	Diversification of income by adding livestock operations	Drought	Working Group II Contribution of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Set-up/provision of crop insurance	Drought	
	Creation of local financial pools (as alternative to commercial crop insurance)	Drought	
Netherlands 	Construction of Dykes	Loss of land, coastal inundation/erosion	UNFCCC (United Nations Framework Convention on Climate Change)
Peru 	Utilizing an ancient irrigation and drainage system in Waru waru	Loss of crops (droughts and floods)	UNESCO

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (10/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Philippines 	Community-based disaster preparedness	Damage to human settlements	UNFCCC (United Nations Framework Convention on Climate Change)
	Typhoon-resistant housing	Damage to human settlements	
	Adjustment of siccultural treatment schedules to suit climate variations	Drought and floods	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Use of shallow tube wells	Drought and floods	
	Rotation method of irrigation during water shortage	Drought and floods	
Construction of water impounding basins	Drought and floods		

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (11/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Philippines 	Construction of fire lines and controlled burning	Drought / Floods	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Adoption of soil and water conservation measures for upland farming		
	Rainwater harvesting	Drought and salt-water intrusion	
	Leakage reduction		
	Hydroponic farming		
Bank loans allowing for purchase of rainwater storage tanks			

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (12/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Philippines 	Capacity building for shoreline defence system design	Sea-level rise and storm surges	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
	Introduction of participatory risk assessment	Sea-level rise and storm surges	
	Provision of grants to strengthen coastal resilience and rehabilitation of infrastructures	Sea-level rise and storm surges	
	Construction of cyclone-resistant housing units	Sea-level rise and storm surges	
	Retrofit of buildings to improved hazard standards	Sea-level rise and storm surges	
Review of building codes	Sea-level rise and storm surges		

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (13/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Philippines 	Reforestation of mangroves	Sea-level rise and storm surges	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
Sudan 	Traditional rainwater harvesting and water conserving techniques	Drought	
	Building of shelter-belts and wind-breaks to improve resilience of rangelands	Drought	
	Monitoring of the number of grazing animals and cut trees	Drought	
	Set-up of revolving credit funds	Drought	
Sri Lanka 	Introduction of Agro forestry	Land degradation, water shortage	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (14/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Tanzania 	Conserving grazing and fodder lands through reforestation	Land degradation	UNFCCC (United Nations Framework Convention on Climate Change)
Thailand 	Mangrove reforestation in southern Thailand	Coastal inundation/erosion	
East Timor 	Seed selection	Loss of crops	
UK 	Coastal realignment - converting arable farmland into salt marsh and grassland to provide sustainable sea defences	Floods and sea-level rise	Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change
USA 	Altering the timing of planting dates to adapt to changing growing conditions	Loss of crops	Environmental protecting agency USA
Vietnam 	Building forecasting capacity and building an adaptation strategy for the Mekong Delta	Loss of land and damage to human settlements	UNFCCC (United Nations Framework Convention on Climate Change)

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.3 Benchmarking – Adaptation measures

From the available studies and reports on adaptation measures for climate change impacts, we identified more than 75 case-studies for our portfolio of adaptation options (15/15)

Country	Adaptation measures	Adaptation to the following climate impacts	Source
Yemen 	Introduction of spate irrigation	Water shortage, higher crop yields	UNFCCC (United Nations Framework Convention on Climate Change)
Zimbabwe 	Utilizing intercropping and agro forestry	Improving water efficiency and reduce land degradation	

Main sources: ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

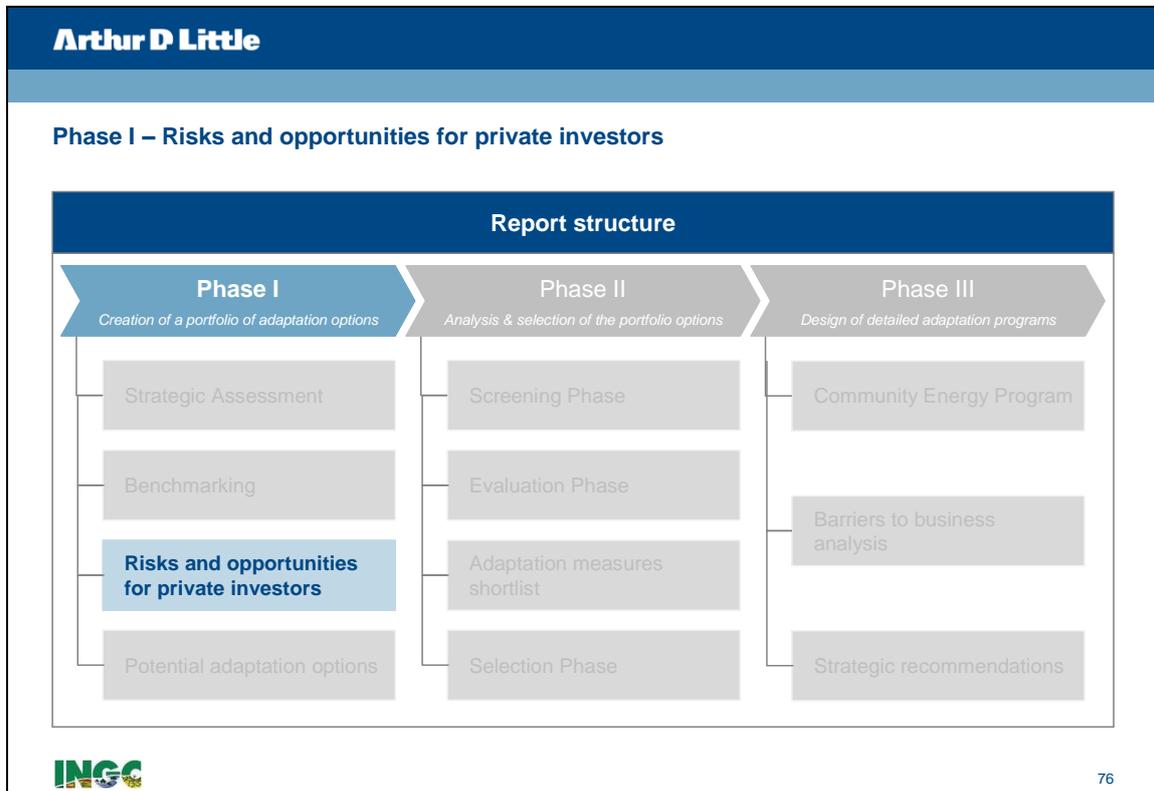
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1.4 Risks and opportunities for private investors – Introduction

Introduction to “Risks and opportunities for private investors”:

In this phase we have done a SWOT analysis for each “High Climate Change Risk / High Climate Change Impact area” focused on the business risks and opportunities per sector. To support us in doing that we used the report «Adaptation - An issue brief for business» that systematize a way of approaching business risks and opportunities

Risks for private investors

To assess the risks for private investors we identified the riskier areas and economic sectors in Mozambique as well as the business risks associated with it.

High Climate Change Risk / High Climate Change Impact areas identification:

We identified High Climate Change Risk / High Climate Change Impact areas in each region of Mozambique by overlapping the climate risk maps and the investment maps developed in previous phases.

We had meetings with other themes (themes 1- Google, 2 – Coastal Protection, 4- Ecoenergia, 6 - Agriculture and 9 - strategy) and had a second round of meetings with themes 2 and 4 where we debated our preliminary results.

In addition we validated our preliminary findings with a group of private investors

We will have a final validation after the meetings and workshops we are promoting with private and public sectors players.

Key sectors at risk identification:

We identified key sectors at risk by crossing the high risk areas with investments per sector

Opportunities for private investors

We identified business opportunities for private investors in the most at risk sectors in each “High Climate Change Risk / High Climate Change Impact” area

We had meetings with themes 2 and 4 and with a group of investors where we debated our preliminary results

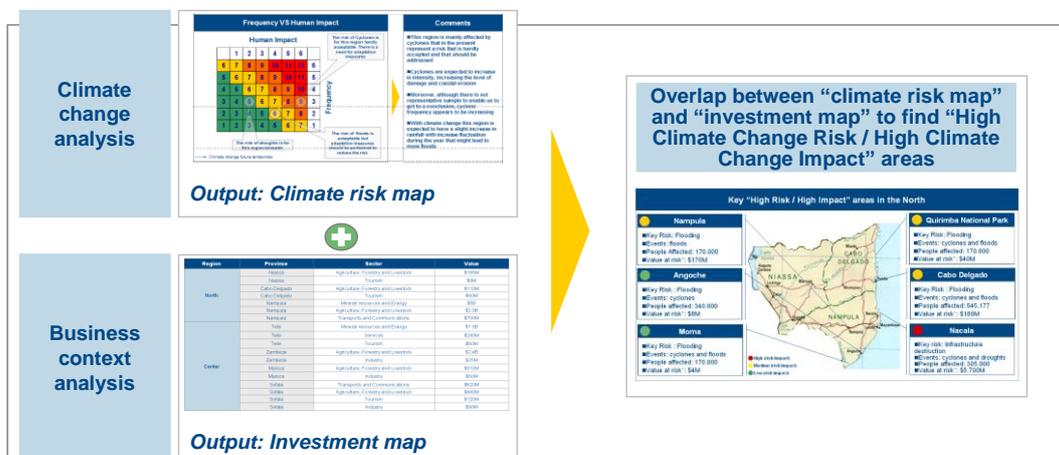
Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development



1.4 Risks and opportunities for private investors – High CC Risk / High CC Impact areas identification

The overlap between climate change and business context analysis inputs allowed the identification of High Climate Change Risk / High Climate Change Impact areas

High Climate Change Risk / High Impact areas identification



Source: SEA - Strategic Environmental Assessment – Good Practices Guide, EACC - Economics of Adaptation to Climate Change, OECD – SEA and adaptation to climate change, ECA - Climate Adaptation Working Group



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1.4 Risks and opportunities for private investors – High CC Risk / High CC Impact areas identification

The classification of the High Climate Change Risk / High Climate Change Impact areas was developed considering climate risks and value at risk and was applied regionally

Classification of High Climate Change Risk / High Climate Change Impact areas

- The classification was developed considering climate change risks (exposure and vulnerability) and value at risk (private and public investments).
- The classification is the following:

● High risk / impact	○ Areas that in the climate risk map were considered as the areas most at risk in the region and that have highest strategic and economic value at risk
● Medium risk / impact	○ Areas that in the climate risk map were among the areas considered at risk in the region and that have medium strategic and economic value at risk
● Low risk / impact	○ Areas that in the climate risk map were considered as being at risk and had low strategic and economic value at risk
- The classification of the areas at risk was made taking in consideration the importance of each region for the development of the country and the regional climate change scenarios leading to the decision of classifying the risk areas per region
 - The Northern region represents 22% of the country's GDP and is the region less burdened from climate hazards. Moreover, this region is likely to suffer the least from climate change
 - The Central region represents 34% of the country's GDP and is heavily burdened by climate hazards.
 - The South represents 44% of the country's GDP and is heavily burdened by climate hazards.

Source: Strategic environmental assessment and adaptation to climate change © OECD 2008, Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets

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North Center South

1.4 Risks and opportunities for private investors – Priority areas in the North region

Nampula is the Northern province most affected by climate events, being Nacala the district with higher Climate Change risk / impact

Key “High Climate Change Risk / High Climate Change Impact” areas in the North

<p>Nampula</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: floods People Affected: 170.000 Value at risk¹: \$170M 		<p>Quirimba National Park</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: cyclones and floods People affected: 170.000 Value at risk¹: \$40M
<p>Angoche</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: cyclones People affected: 340.000 Value at risk¹: \$8M 		<p>Cabo Delgado</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: cyclones and floods People affected: 545.177 Value at risk¹: \$180M
<p>Moma</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: cyclones and floods People affected: 170.000 Value at risk¹: \$4M 		<p>Nacala</p> <ul style="list-style-type: none"> Key risk: Infrastructure destruction Events: cyclones and droughts People affected: 305.000 Value at risk¹: \$5.700M
<p>● High (risk/impact) ● Medium (risk/impact) ● Low (risk/impact)</p>		

Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsultar database.

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¹ Value at risk – this value does not consider the multiplier effect.

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1.4 Risks and opportunities for private investors – Priority areas in the North region

The most significant business risks for Nacala are failure in distribution channels and production interruption

Nacala Business Risks		Key sectors at risk																	
Climate change risks	Cyclones and droughts	Sector	Main companies and projects at risk	Value at risk ¹															
	<table border="1"> <thead> <tr> <th>Main climate impacts</th> <th>Business risks</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> Infrastructure destruction Breakdown of equipment Communications cuts Energy cuts Transportation failure </td> <td> <ul style="list-style-type: none"> Failure in distribution channel </td> </tr> <tr> <td> <ul style="list-style-type: none"> Energy cuts Damage to properties Reduction of working force Loss of crops Loss of livestock Erosion of the soil Crops pests </td> <td> <ul style="list-style-type: none"> Production interruption </td> </tr> </tbody> </table>	Main climate impacts	Business risks	<ul style="list-style-type: none"> Infrastructure destruction Breakdown of equipment Communications cuts Energy cuts Transportation failure 	<ul style="list-style-type: none"> Failure in distribution channel 	<ul style="list-style-type: none"> Energy cuts Damage to properties Reduction of working force Loss of crops Loss of livestock Erosion of the soil Crops pests 	<ul style="list-style-type: none"> Production interruption 	<table border="1"> <tbody> <tr> <td>Mineral Resources</td> <td>Ayr Petro-Nacala or other oil company</td> <td>\$5B</td> </tr> <tr> <td>Industry</td> <td>Sociedade Algodoeira de Nampula Shizan super plast Compagri Bakhresa grain milling Others</td> <td>\$40M</td> </tr> <tr> <td>Agriculture</td> <td>Aviam Bilacom</td> <td>\$20M</td> </tr> <tr> <td>Transports</td> <td>Nacala port investment International airport</td> <td>\$700M</td> </tr> </tbody> </table>	Mineral Resources	Ayr Petro-Nacala or other oil company	\$5B	Industry	Sociedade Algodoeira de Nampula Shizan super plast Compagri Bakhresa grain milling Others	\$40M	Agriculture	Aviam Bilacom	\$20M	Transports	Nacala port investment International airport
Main climate impacts	Business risks																		
<ul style="list-style-type: none"> Infrastructure destruction Breakdown of equipment Communications cuts Energy cuts Transportation failure 	<ul style="list-style-type: none"> Failure in distribution channel 																		
<ul style="list-style-type: none"> Energy cuts Damage to properties Reduction of working force Loss of crops Loss of livestock Erosion of the soil Crops pests 	<ul style="list-style-type: none"> Production interruption 																		
Mineral Resources	Ayr Petro-Nacala or other oil company	\$5B																	
Industry	Sociedade Algodoeira de Nampula Shizan super plast Compagri Bakhresa grain milling Others	\$40M																	
Agriculture	Aviam Bilacom	\$20M																	
Transports	Nacala port investment International airport	\$700M																	

Source: CPI, approved projects from 2005 till November 2010

Legend: High (Red), Moderate (Yellow), Low (Green)

INGC ¹ The value at risk is a rough estimation based on the revenues of an established company or the investment predicted in a project

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1.4 Risks and opportunities for private investors – Priority areas in the Central region

Tete and Sofala are the provinces most affected by climate events in the Center being Moatize and Beira the districts with higher Climate Change risk / impact

Key “High Climate Change Risk / High Climate Change Impact” areas in the Center

<p>Moatize, Motarara and Changara</p> <ul style="list-style-type: none"> Key Risk: Water stress Events: floods and droughts People affected: 950.000 Value at risk¹: \$5.400M 		<p>Maganja, Namacurra and Nicoadala</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: Cyclones, floods and droughts People affected: 500.000 Value at risk¹: \$22M
<p>Chinde, Mopeia and Morrumbala</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: floods People affected: 843.000 Value at risk¹: \$7M 		<p>Beira (Buzi and Dondo)</p> <ul style="list-style-type: none"> Key Risk: Infrastructure destruction Events: cyclones, floods and droughts People affected: 937.000 Value at risk¹: \$1.000M
<p>Machaze and Chimoio</p> <ul style="list-style-type: none"> Key Risk: Water scarcity Events: droughts People affected: 170.000 Value at risk¹: \$50M 		<p>Machanga</p> <ul style="list-style-type: none"> Key Risk: Flooding Events: floods People affected: 793.000 Value at risk¹: \$0M²
<p>Legend: High (risk/impact) (Red), Medium (risk/impact) (Yellow), Low (risk/impact) (Green)</p>		

Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsular database.

¹ Value at risk – this value does not consider the multiplier effect. ² Machanga value at risk refers only to significant private and public investments and most important companies of the country.

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Arthur D Little North Center South

1.4 Risks and opportunities for private investors – Priority areas in the Central region

The most significant business risks for Moatize are interruption in production and operations and failure in logistics

Moatize / Changara Business Risks		Key sectors at risk		
Climate change risks	Floods and droughts	Sector	Main companies and projects at risk	Value at risk ¹
Main climate impacts		Business risks		
<ul style="list-style-type: none"> Energy cuts Communications cuts Damage to properties Breakdown of equipment Reduction of workforce due to reconstruction efforts 	<ul style="list-style-type: none"> Production / Operations interruption 	Mineral resources	Moatize coal Benga Project Zambezi project	\$4,3B
<ul style="list-style-type: none"> Blockage of roads Damages in railways Navigability of the river 		<ul style="list-style-type: none"> Failure in logistics 	Energy	Thermoelectric power station Hidroeléctrica de Mphanda Nkuwa
		Industry	CPZ Mozambique Fábrica de Explosivos	\$11M

Source: CPI, approved projects from 2005 till November 2010, government presentations, companies websites
Key projects in Beira corridor

● High ● Moderate ● Low

INGC ¹ The value at risk is a rough estimation based on the revenues of an established company or the investment predicted in a project

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Arthur D Little North Center South

1.4 Risks and opportunities for private investors – Priority areas in the Central region

The most significant business risks for Beira are failure in logistics and raw material defectiveness

Beira Business Risks		Key sectors at risk		
Climate change risks	Cyclones Floods and droughts	Sector	Main companies and projects at risk	Value at risk ¹
Main climate impacts		Business risks		
<ul style="list-style-type: none"> Infrastructure destruction Blockage of roads Damages in railway Breakdown of equipment Closure of the port Transportation failure Reduction of working force due to reconstruction efforts 	<ul style="list-style-type: none"> Failure in Logistics 	Agriculture	Mozambique Principle Energy Priu Agricultura Buzi Marronte- Empresa Agricola de Moçambique Companhia do Buzi Lamego Others	\$420M
<ul style="list-style-type: none"> Loss of crops Loss of livestock Erosion of the soil Salinization of the soil Crops pests Contamination of water supplies 		<ul style="list-style-type: none"> Raw material defectiveness 	Mineral Resources	Petrobeira
		Tourism	Maria Lagoon Resort Others	\$120M
		Transports	Beira Port Investment Beira Grain Terminal Others	\$620M

Source: CPI, approved projects from 2005 till November 2010
Key projects in Beira corridor

● High ● Moderate ● Low

INGC ¹ The value at risk is a rough estimation based on the revenues of an established company or the investment predicted in a project

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1.4 Risks and opportunities for private investors – Priority areas in the South region

In the South, the coastal areas are the most impacted by climate events mainly caused by cyclones and floods

Key “High Climate Change Risk / High Climate Change Impact” areas in the South

Area	Risk	Events	People affected	Value at risk ¹
Bilene	Water stress	Floods and droughts	610.000	\$120M
Chokwe	Flooding	Floods	495.000	\$30M
Matola	Flooding	Floods	1.200.000	\$330M
Vilanculos	Water stress	Cyclones, floods and droughts	843.000	\$120M
Gaza	Water stress	Cyclones, floods and droughts	3.550.000	\$870M
Maputo city	Flooding	Cyclones and floods	720.000	\$2.300M

Source: EM-DAT: The OFDA/CRED International Disaster Database; INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique; Desconsular database.
¹ Value at risk – this value is not considering the multiplier effect.
² The information regarding People affected in Maputo and Matola considered only one event. We used a proxy to all the events

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1.4 Risks and opportunities for private investors – Priority areas in the South region

The most significant business risks for Vilanculos are quality decrease in products and services and workforce absenteeism

Vilanculos Business Risks		Key sectors at risk							
Climate change risks	Cyclones and droughts	Sector	Main companies and projects at risk						
	<table border="1"> <thead> <tr> <th>Main climate impacts</th> <th>Business risks</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> Damage to properties Breakdown of equipment Coastal erosion Loss of biomass Energy cuts Communications cuts Difficulty in the access to quality intermediary products Reduction of working force </td> <td> <ul style="list-style-type: none"> Quality decrease in products and services </td> </tr> <tr> <td> <ul style="list-style-type: none"> Development of water born diseases Reduction of working force due to reconstruction efforts </td> <td> <ul style="list-style-type: none"> Workforce absenteeism </td> </tr> </tbody> </table>	Main climate impacts	Business risks	<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Coastal erosion Loss of biomass Energy cuts Communications cuts Difficulty in the access to quality intermediary products Reduction of working force 	<ul style="list-style-type: none"> Quality decrease in products and services 	<ul style="list-style-type: none"> Development of water born diseases Reduction of working force due to reconstruction efforts 	<ul style="list-style-type: none"> Workforce absenteeism 		
Main climate impacts	Business risks								
<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Coastal erosion Loss of biomass Energy cuts Communications cuts Difficulty in the access to quality intermediary products Reduction of working force 	<ul style="list-style-type: none"> Quality decrease in products and services 								
<ul style="list-style-type: none"> Development of water born diseases Reduction of working force due to reconstruction efforts 	<ul style="list-style-type: none"> Workforce absenteeism 								
		Tourism	<ul style="list-style-type: none"> Complexo Turístico Praia do Paraíso Comune Golf Estate Dona Ana Development VilanKulo Bazaruto Village Benguerra Villas Blue Paradise Mozambique 						
			\$110M						

Source: CPI, approved projects from 2005 till November 2010

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¹ The value at risk is a rough estimation based on the revenues of an established company or the investment predicted in a project

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1.4 Risks and opportunities for private investors – Priority areas in the South region

The most significant business risks for Gaza are raw material defectiveness and quality decrease in products and services

Gaza Business Risks		Key sectors at risk		
Climate change risks	Cyclones, floods and droughts	Sector	Main companies and projects at risk	Value at risk ¹
Main climate impacts		Business risks		
<ul style="list-style-type: none"> Loss of crops Loss of livestock Erosion of the soil Salinization of the soil Crops pests Contamination of water supplies 	<ul style="list-style-type: none"> Raw material defectiveness 	Agriculture	Procana CAM- Companhia agro-empresarial de Moçambique Arromoz Chicualala Agri Farm Companhia Agro-social Igo Sammartini Hubei Liefeng Mozambique Others	\$630M
<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Coastal erosion Loss of biomass Energy cuts Communications cuts Difficulty in the access to quality intermediary products Reduction of working force 	<ul style="list-style-type: none"> Quality decrease in products and services 	Tourism	São Martinho Beach Club Chongoene Resorts Dunas de Bilene Coco beach resort Monte Belo Village Complexo Turístico Vista da Lagoa Others	\$230M

Source: CPI, approved projects from 2005 till November 2010

Legend: ● High ● Moderate ● Low

INGC ¹ The value at risk is a rough estimation based on the revenues of an established company or the investment predicted in a project

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1.4 Risks and opportunities for private investors – Priority areas in the South region

The most significant business risks for Maputo are failure in logistics and workforce absenteeism

Maputo Business Risks		Key sectors at risk		
Climate change risks	Cyclones and floods	Sector	Main companies and projects at risk	Value at risk ¹
Main climate impacts		Business risks		
<ul style="list-style-type: none"> Infrastructure destruction Blockage of roads Damages in railway Breakdown of equipment Closure of the port Transportation failure Reduction of working force due to reconstruction efforts 	<ul style="list-style-type: none"> Failure in Logistics 	Tourism	Ilha de Xefina The Horizon Hotel Karibo Others	\$460M
<ul style="list-style-type: none"> Development of water born diseases Reduction of working force due to reconstruction efforts 	<ul style="list-style-type: none"> Workforce absenteeism 	Services	Semlex – Biometric system EDPM – dragagem do porto de Maputo MCNET Mozambique community network	\$140M
		Industry	Pembe Mozambique Fasorel-fase I Hipermáquinas Moçambique Others	\$100M
		Banking	Banco único Moza Banco Banco Terra Others	\$115M
		Transport and communications	Maputo Port Mcel Mintiro International	\$1,1B

Source: CPI, approved projects from 2005 till November 2010

Legend: ● High ● Moderate ● Low

INGC ¹ The value at risk is a rough estimation based on the revenues of an established company or the investment predicted in a project

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1.4 Risks and opportunities for private investors – *Key sectors at risk identification method*

The overlap between the locals at risk and investments per sector inputs allowed the identification of key sectors at risk

Key sectors at risk identification method

High risk high impact areas

Output: High climate change risk high climate change impact areas

Value at risk

Region	Province	Sector	Value
North	Inhambane	Agriculture	\$170M
	Maputo	Transport	\$100M
Center	Maputo	Agriculture	\$240M
	Maputo	Agriculture	\$240M

Output: Investment map

Overlap between "high climate change risk high climate change impact areas" and "value at risk map" to find "the key sectors at risk"

Key sectors at risk due to natural hazards

Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development, SEA - Strategic Environmental Assessment – Good Practices Guide, EACC - Economics of Adaptation to Climate Change, OECD – SEA and adaptation to climate change, ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group

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1.4 Risks and opportunities for private investors – *Classification of High CC Risk / High CC Impact areas*

The classification of the high risk sectors was developed considering the value at risk per sector and the High Climate Change Risk / High Climate Change Impact areas

Classification of High Climate Change Risk / High Climate Change Impact areas

- The classification was developed considering the climate change risks in each high risk area and the value at risk of the projects in that area
- The classification is the following:
 - High risk sector**

 - Sectors with high value at risk in high risk areas
 - Medium risk sector**

 - Sectors with medium to high value at risk in medium risk/ impact areas
 - Low risk sector**

 - Sectors with low value at risk in medium risk/ impact areas
- The classification of the sectors at risk was made taking in consideration the value of the investment projects in each sector of each area at risk.
 - Low risk – The value of the investments in the sector is below \$20M
 - Medium risk – The value of the investments in the sector is below \$200M
 - High risk – The value of the investments in the sector is higher than \$200M

Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development

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1.4 Risks and opportunities for private investors – *SWOT for Nacala*

In Nacala, the most at risk industries are Mineral Resources and Transports with production / operation interruption and workforce absenteeism being the main business risks

<u>Nacala</u>	Business Risks	Business Opportunities
Mineral Resources	<ul style="list-style-type: none"> Production interruption – impacts on physical assets and breakdown of equipment due to floods and cyclones Workforce absenteeism – unhealthy workforce due to flood related diseases Failure in distribution channels – inaccessibility of roads and ports due to floods, heavy rains and cyclones 	<ul style="list-style-type: none"> Coastal protection (e.g. construction of revetments or seawalls) Improve healthcare conditions of the employees Creation of new shipping routes
Transport	<ul style="list-style-type: none"> Operations' interruption – impacts on physical assets such as ports infrastructure mainly due to cyclones Workforce absenteeism – unhealthy workforce due to flood related diseases Quality decrease in services – a consequence of the breakdown of equipment and productivity reduction due to the increase in diseases incidence 	<ul style="list-style-type: none"> Coastal protection (e.g. construction of revetments or seawalls) Development of anti-flood plans

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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1.4 Risks and opportunities for private investors – *SWOT for Beira*

In Beira, the most at risk industries are Transport and Agriculture with quality of products and services decrease and workforce absenteeism being the main business risks

<u>Beira</u>	Business Risks	Business Opportunities
Transport	<ul style="list-style-type: none"> Operations' interruption – impacts on physical assets such as ports infrastructure mainly due to cyclones Workforce absenteeism – unhealthy workforce due to flood related diseases Quality decrease in services – a consequence of the breakdown of equipment's and productivity reduction due to the increase in diseases incidence 	<ul style="list-style-type: none"> Coastal protection (e.g. construction of revetments or seawalls) Development of near shore breakwaters Development of a sustainable urban drainage system Development of anti-flood plans
Agriculture	<ul style="list-style-type: none"> Raw material defectiveness – failure of crops due to droughts and floods Quality decrease in products – decrease in crops quality Workforce absenteeism – unhealthy workforce due to flood related diseases 	<ul style="list-style-type: none"> Diversifying crop types and varieties and produce high-resistance crops (e.g. salinity tolerant seeds) Increasing yields through optimal management of crop calendars Construction of mini dams to control floods

▶ Although Transport and Agriculture seem to be the main sectors at risk, the economic value of Tourism and Mineral Resources indicates that they are also important sectors to take into consideration

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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1.4 Risks and opportunities for private investors – SWOT for Moatize

In Moatize, the most at risk industries are Mineral Resources and Energy with production interruption and failure in distribution channels being the main business risks

Moatize	Business Risks	Business Opportunities
Mineral Resources	<ul style="list-style-type: none"> Production interruption – impacts on physical assets and breakdown of equipment due to floods Workforce absenteeism – unhealthy workforce due to flood related diseases Failure in distribution channels – inaccessibility of roads and ports due to floods and heavy rains 	<ul style="list-style-type: none"> Improve healthcare conditions of the employees Construction of floodgates and mini dams to improve water management Support community plans to improve food security Creation of new shipping routes
Energy	<ul style="list-style-type: none"> Production interruption Failure in distribution channels Raw material defectiveness – lack of water may affect the production of energy production 	<ul style="list-style-type: none"> Increase demand for other types of energy sources (e.g. "green" energy) Increase revenues associated with the increase demand for energy

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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1.4 Risks and opportunities for private investors – SWOT for Vilanculos

In Vilanculos, the most at risk industries are Tourism and Agriculture with quality decrease in products and services being the main business risk

Vilanculos	Business Risks	Business Opportunities
Tourism	<ul style="list-style-type: none"> Quality decrease in services – supply chain interruptions due to inaccessibility of transports and degradation of areas of interest to tourists Failures in logistics – water and food scarcity due to supply chain interruptions Operations interruption – Damage to tourism infrastructure due to cyclones 	<ul style="list-style-type: none"> Development of sustainable resorts Coastal protection (e.g. construction of revetments or seawalls) Support of the development of the local markets for food (e.g. support local agriculture to improve access to food in extreme weather events)
Agriculture	<ul style="list-style-type: none"> Raw material defectiveness – failure of crops due to droughts and floods Quality decrease in products – decrease in crops quality Workforce absenteeism – unhealthy workforce due to flood related diseases 	<ul style="list-style-type: none"> Diversifying crop types and varieties and produce high-resistance crops (e.g. salinity tolerant seeds) Increasing yields through optimal management of crop calendars Construction of mini dams to control floods

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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1.4 Risks and opportunities for private investors – SWOT for Gaza

In Gaza, the most at risk industries are Agriculture and Tourism with quality decrease in products / services being the main business risk

<u>Gaza</u>	Business Risks	Business Opportunities
Agriculture	<ul style="list-style-type: none"> Raw material defectiveness – failure of crops due to droughts and floods Quality decrease in products – decrease in crops quality Workforce absenteeism – unhealthy workforce due to flood related diseases 	<ul style="list-style-type: none"> Diversifying crop types and varieties and produce high-resistance crops (e.g. salinity tolerant seeds) Introduction of water filters to address water salinization issues Construction of mini dams to control floods
Tourism	<ul style="list-style-type: none"> Quality decrease in services – supply chain interruptions due to inaccessibility of transports and degradation of areas of interest to tourists Failures in logistics – water and food scarcity due to supply chain interruptions Operations interruption – Damage to tourism infrastructure due to cyclones 	<ul style="list-style-type: none"> Development of sustainable resorts Coastal protection (e.g. construction of revetments or seawalls) Support of the development of the local markets for food (e.g. support local agriculture to improve access to food in extreme weather events)

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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1.4 Risks and opportunities for private investors – SWOT for Maputo city

In Maputo, the most at risk industries are Transport and Tourism with quality decrease in services and operations interruption being the main business risks

<u>Maputo city</u>	Business Risks	Business Opportunities
Transport	<ul style="list-style-type: none"> Operations interruption – impacts on physical assets such as ports infrastructure mainly due to cyclones Workforce absenteeism – unhealthy workforce due to flood related diseases Quality decrease in services – a consequence of the breakdown of equipments and productivity reduction due to the increase in diseases incidence 	<ul style="list-style-type: none"> Coastal protection (e.g. construction of revetments or seawalls) Development of near shore breakwaters Development of a sustainable urban drainage system Development of anti-flood plans
Tourism	<ul style="list-style-type: none"> Quality decrease in services – supply chain interruptions due to inaccessibility of transports and degradation of areas of interest to tourists Failures in logistics – water and food scarcity due to supply chain interruptions Operations interruption – Damage to tourism infrastructure due to cyclones 	<ul style="list-style-type: none"> Development of sustainable resorts Coastal protection (e.g. construction of revetments or seawalls)

▶ Although Transport and Tourism seem to be the main sectors at risk, the economic value of Banking, Services and Industry indicates that they are also important sectors to take into consideration

Source: ADL analysis, World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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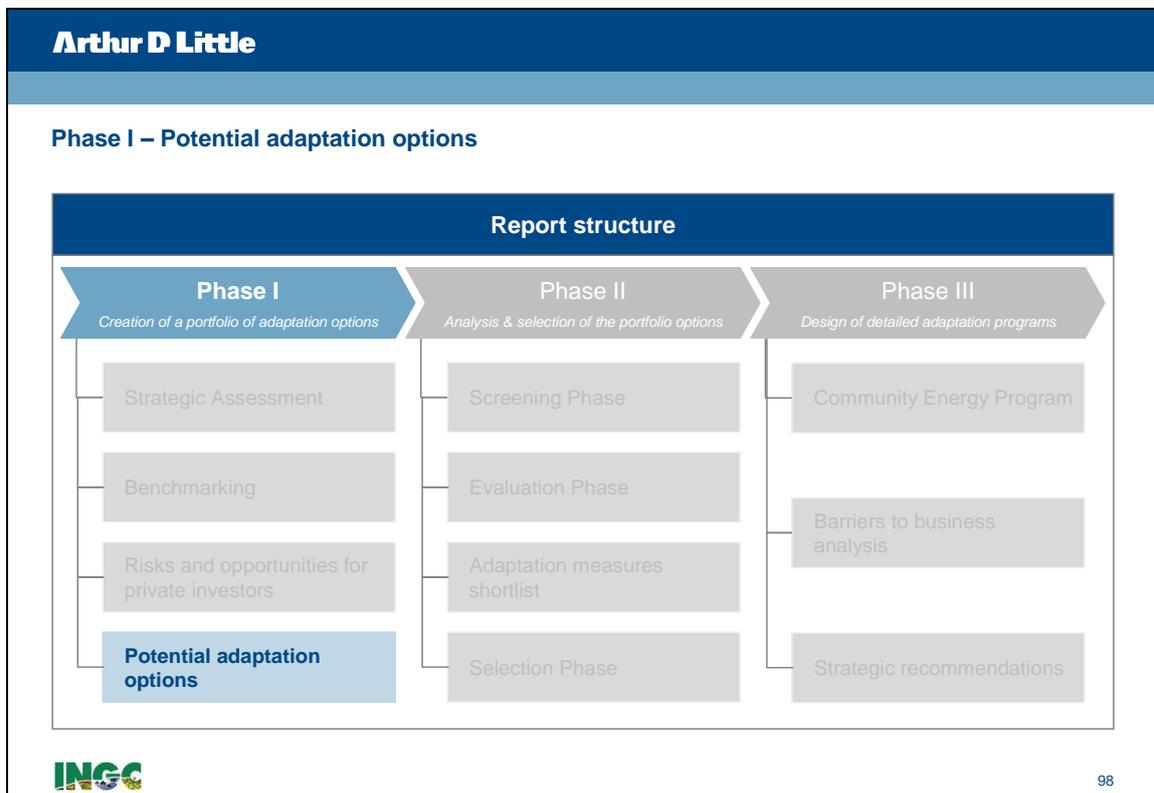
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1.5 Potential adaptation options – Introduction

Introduction to “Potential adaptation options”

In this phase, we identified potential adaptation options. To support the process of identifying a long-list of potential adaptation measures we based our methodology in two main sources: «Economics of Adaptation to Climate Change» and «SEA and adaptation to climate change»

- Firstly, we focused on the relevant information we had identified in the benchmarking phase
- Secondly, we had meetings with theme 2 – “Coastal Protection”, theme 4 – Ecoenergia – “Building Resilience in Partnership with the Private Sector and theme 6 – “Food – Meeting Demands” in order to obtain their inputs on adaptation measures and incorporate them in our analysis and document
- Thirdly, we crossed-checked the information gathered in the two steps above with our analysis of “High Climate Change Risk / High Climate Change Impact” areas in order to define the long-list of adaptation measures
- Finally, we have discussed our preliminary adaptation measures with three potential private investors who have investments/are interested to invest in Mozambique to validate our hypothesis and incorporate their ideas and potential prospects

EACC - Economics of Adaptation to Climate Change, OECD – SEA and adaptation to climate change



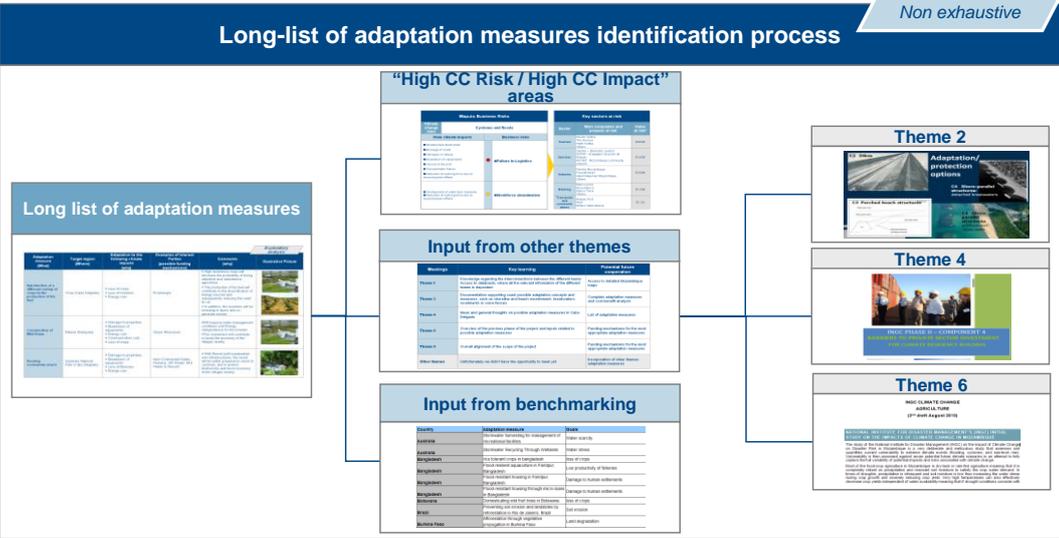
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1.5 Potential adaptation options – Long-list of adaptation measures identification process

By combining the benchmarking with other themes inputs and with the “High Climate Change Risk / High Climate Change Impact” areas, we identified a long-list of adaptation measures

Long-list of adaptation measures identification process *Non exhaustive*



Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change



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1.5 Potential adaptation options – *Potential adaptation measures – long list*

We identified a long-list of potential adaptation measures for the “High Climate Change Risk / High Climate Change Impact” areas

Non-exhaustive

North	Center	South
<ul style="list-style-type: none"> Introduction of rainwater harvesting techniques in Nacala Construction of seawall or revetments (e.g.: Rock Revetments) in Nacala Introduce emergency phones along the railway in Nacala Build roads from Pemba to Nacala Introduction of different crops for the production of Biofuel in Nacala Improvement of climate forecast infrastructure in Nacala¹ Develop ecotourism resort with energy and communications independence in Nacala 	<ul style="list-style-type: none"> Increase crops yield in Beira Develop storage facilities in Beira port Produce solar energy at tourist facilities to decrease energy dependence in Beira Construction of floodgate / river breakwater wall (Buzi and Dondo) Introduce water filters techniques in Upgrade main routes ahead of predicted occurrences of floods in Buzi Reforestation with product diversity in Buzi Construction of mini dam in Moatize and Buzi Construction of floodgate / river breakwater wall in Moatize Increase crops yield in Moatize Introduce redundancy and business continuity in railways in Moatize Introduce emergency phones along the railway in Moatize 	<ul style="list-style-type: none"> Introduction of water filters techniques in Gaza (Xai-Xai) Introduction of Drainage Systems in Gaza Construction of a pharmaceutical factory / supply channels in Gaza Develop dams and upgrade roads in Gaza Diversifying crop types and varieties and produce high-resistance crops in Vilanculos Conversion of arable farmland into salt marsh and grassland to provide sustainable defences in Vilanculos Conversion of arable farmland into aquaculture areas Reforestation of mangroves in Vilanculos Develop ecotourism resort with energy and communications independence in Vilanculos Construction of sustainable urban drainage systems in Maputo Construction of near shore breakwaters in Maputo Development of a fast reestablishment plan for financial transactions in Maputo Produce solar energy at tourist facilities to decrease energy dependence in Maputo Increase of storage facilities in Maputo port Strengthening of pharmaceutical supply channels in Maputo Introduce redundancy and business continuity in key buildings, roads and railways in Maputo

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

¹ Pilot Project to be expanded for other areas

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1.5 Potential adaptation options – *Preliminary adaptation measures*

We identified a long-list of potential adaptation measures for the most at risk areas in the North

Long-list of adaptation measures in the North

● Nacala	<ul style="list-style-type: none"> Introduction of rainwater harvesting techniques Construction of seawall or revetments (e.g.: rock revetments) Introduce emergency phones along the railway Build roads from Pemba to Nacala Project scope of different crops for the production of Biofuel Improvement of climate forecast infrastructure Develop ecotourism resort with energy and communications independence in Nacala
● Quirimba National Park	<ul style="list-style-type: none"> Develop ecotourism resort Production of solar energy Production of Energy based on Biomass
● Cabo Delgado	<ul style="list-style-type: none"> Project scope of a different variety of crops in the production of bio fuel Construction of Mini Dams Develop storage facilities in Pemba port Produce solar energy at tourist facilities to decrease energy dependence Development of agro forestry
● Nampula	<ul style="list-style-type: none"> Construction of Mini Dams Increase crops yield through the reduction of ground-level ozone Construction of a pharmaceutical factory / supply channels

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

● High (risk / impact)
● Medium (risk / impact)

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1.5 Potential adaptation options – Long-list of adaptation measures in the North

Rainwater harvesting techniques can be introduced by agricultural companies improving water management in a region affected by floods and droughts

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
Rainwater harvesting	Nacala (Nampula)	<ul style="list-style-type: none"> loss of crops loss of livestock 	Matanuska Moçambique, Afoils corporation, Aviam	<ul style="list-style-type: none"> Will improve water management conditions for the Nacala Industry Will contribute for the improvement of subsistence agriculture (there is a significant number of droughts reported in this area) 	
Revetments (e.g.: Rock Revetments) or Seawall	Nacala (Nampula)	<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Energy cuts 	Ayr PetroNacala, other petro companies	<ul style="list-style-type: none"> Revetments will contribute to decrease the probability of a calamity in the Nacala oil refinery 	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.5 Potential adaptation options – Long-list of adaptation measures in the North

Introduction of different variety of crops and development of ecotourism resorts in Cabo Delgado could be attractive adaptation measures for private investors

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
Introduction of a different variety of crops in the production of bio fuel	Ocuca (Cabo Delgado)	<ul style="list-style-type: none"> Loss of crops Loss of livestock Energy cuts 	Ecoenergia	<ul style="list-style-type: none"> High resistance crops will decrease the probability of losing industrial and subsistence agriculture The production of bio fuel will contribute to the diversification of energy sources and subsequently reducing the need for oil In addition, the investors will be investing in dams and co-generate energy 	
Construction of Mini Dams	Ribaue (Nampula)	<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Energy cuts Communication cuts Loss of crops 	Green Resources	<ul style="list-style-type: none"> Will improve water management conditions and Energy independence for the investor This investment will contribute to boost the economy of the villages nearby 	
Develop ecotourism resort	Quirimba National Park (Cabo Delgado)	<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Loss of Biomass Energy cuts 	Inter-Continental Hotels, Pestana, VIP Hotels, RIU Hotels & Resorts	<ul style="list-style-type: none"> With Resort (self sustainable) own infrastructures, the resort will be better prepared to resist to cyclones, and to protect biodiversity and boost economy of the villages nearby 	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.5 Potential adaptation measures – Preliminary adaptation measures

We identified a long-list of potential adaptation measures for the most at risk areas in the Center (1/2)

Long-list of adaptation measures in the Centre

● Beira	<ul style="list-style-type: none"> ■ Increase crops yield through reduction of ground-level ozone in critical growth period ■ Coastal protection measures identified by the coastal protection team ■ Emergency communication along the railway ■ Adapt storage facilities in Beira port ■ Produce solar energy at tourist facilities to decrease energy dependence
● Buzi and Dondo	<ul style="list-style-type: none"> ■ Construction of floodgate / river breakwater wall ■ Construction of mini dam ■ Introduce water filters techniques ■ Upgrade main routes (e.g.: Bridges) ■ Forestation with product diversity (softwood / hardwood and / or short / long rotation)
● Moatize, Motarara and Changara	<ul style="list-style-type: none"> ■ Construction of mini dams ■ Construction of floodgate / river breakwater wall ■ Increase crops yield through the reduction of ground-level ozone ■ Introduce redundancy and business continuity in railways ■ Introduce emergency phones along the railway

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

● High (risk / impact)
● Medium (risk / impact)

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1.5 Potential adaptation options – Preliminary adaptation measures

We identified a long-list of potential adaptation measures for the most at risk areas in the Center (2/2)

Long-list of adaptation measures in the Centre

● Manganja, Namacurra and Nicoadala	<ul style="list-style-type: none"> ■ Introduction of drought-resistance seeds ■ Upgrade main routes ahead of predicted occurrences of floods ■ Develop and implement an integrated fire management system ■ Construction of mini dams ■ Produce solar energy at tourist facilities to decrease energy dependence
● Chinde, Mopeia and Morrumbaia	<ul style="list-style-type: none"> ■ Construction of mini dams ■ Introduction of flood-resistance seeds ■ Develop irrigation / drainage system
● Machanga	<ul style="list-style-type: none"> ■ Introduction of flood-resistance seeds ■ Forestation of mangroves ■ Increase crops yield through the reduction of ground-level ozone

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaptation actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

● High (risk / impact)
● Medium (risk / impact)

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1.5 Potential adaptation options – Long-list of adaptation measures in the Centre

The construction of floodgates and the increase of crop yields could be attractive adaptation measures for private investors in Moatize

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
Construction of Mini Dams	Moatize (Tete)	<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Energy cuts Communication cuts Loss of crops 	Carvão de Moatize	<ul style="list-style-type: none"> Will improve water management conditions and Energy independence for the investor This investment will contribute to boost the economy of the villages nearby 	
Floodgate / River breakwater wall	Moatize (Tete)	<ul style="list-style-type: none"> Energy cuts Communication cuts Breakdown of equipment Blockage of roads 	Carvão de Moatize	<ul style="list-style-type: none"> Will improve water management and decrease the probability of floods and failure in operations of Carvão de Moatize and other industries in the area Will contribute to improve transportation of goods by the river channels 	
Increase crop yields	Moatize (Tete)	<ul style="list-style-type: none"> Loss of crops 	Moçambique Leaf Tobacco	<ul style="list-style-type: none"> The increase in crops yield will be beneficial for the industries and population in the area 	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.5 Potential adaptation options – Long-list of adaptation measures in the Centre

The construction of mini dams could be attractive adaptation measures for private investors in Búzi, Sofala

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
Introduction of drought-resistance seeds	Machaze and Chimoio (Manica)	<ul style="list-style-type: none"> Loss of crops 	Mozbife	<ul style="list-style-type: none"> The introduction of drought-resistance crops will influence the agricultural industry in Manica 	
Increase crops yield	Beira (Sofala)	<ul style="list-style-type: none"> Loss of crops 	Moçambique Leaf Tobacco	<ul style="list-style-type: none"> The increase in crops yield will be beneficial for the industries and population in the area 	
Floodgate / River breakwater wall	Buzi and Dondo (Sofala)	<ul style="list-style-type: none"> Energy cuts Communication cuts Breakdown of equipment Blockage of roads 	Prio Agricultura, Búzi Açucar	<ul style="list-style-type: none"> Will improve water management and decrease the probability of floods Will contribute to improve transportation of goods by the river channels 	
Construction of Mini Dams	Buzi (Sofala)	<ul style="list-style-type: none"> Damage to properties Breakdown of equipments Energy cuts Communication cuts Loss of crops 	Búzi Açucar	<ul style="list-style-type: none"> Will improve water management conditions and Energy independence for the investor This investment will contribute to boost the economy of the villages nearby 	
Revetments (e.g.: Rock revetments) or Seawall	Beira (Sofala)	<ul style="list-style-type: none"> Damage to properties Breakdown of equipments Energy cuts 	Maria Lagoon Resort, Petro Beira	<ul style="list-style-type: none"> Beira is one of the most in danger areas - Cyclones and Floods are expected to become more frequent and intensive Revetments will contribute to decrease the probability of a calamity in the city infrastructures (e.g. it is important for the tourists operators) 	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.5 Potential adaptation options – Preliminary adaptation measures

We identified a long-list of potential adaptation measures for the most at risk areas in the South (1/2)

Long-list of adaptation measures in the South

● Gaza	<ul style="list-style-type: none"> ■ Introduce water filters techniques ■ Construction of a pharmaceutical factory / supply channels ■ Develop dams in Limpopo ■ Upgrade roads ■ Construction of storage facilities ■ Introduction of drainage systems
● Vilanculos	<ul style="list-style-type: none"> ■ Diversifying crop types / varieties and produce high-resistance crops ■ Conversion of arable farmland into salt marsh and grassland to provide sustainable defenses ■ Conversion of arable farmland into aquaculture areas ■ Develop ecotourism resort with energy and communications independence ■ Reforestation of mangroves
● Maputo city	<ul style="list-style-type: none"> ■ Improvement of sustainable urban drainage systems ■ Construction of near shore breakwaters ■ Development of a fast reestablishment plan for financial transactions ■ Produce solar energy at tourist facilities to decrease energy dependence ■ Increase of storage facilities in Maputo port ■ Strengthening of pharmaceutical supply channels ■ Introduce redundancy and business continuity in key buildings, roads and railways

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

● High (risk / impact)
● Medium (risk / impact)

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1.5 Potential adaptation options – Preliminary adaptation measures

We identified a long-list of potential adaptation measures for the most at risk areas in the South (2/2)

Long-list of adaptation measures in the South

● Bilene	<ul style="list-style-type: none"> ■ Develop irrigation system ■ Introduction of drought-resistance seeds ■ Produce solar energy at tourist facilities to decrease energy dependence
● Chokwe	<ul style="list-style-type: none"> ■ Construction of mini dams ■ Construction of floodgates ■ Improvement of existing irrigation system
● Matola	<ul style="list-style-type: none"> ■ Increase crops yield through the reduction of ground-level ozone ■ Construction of seawall or revetments (e.g.: rock revetments) ■ Increase of storage facilities in Matola port

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

● High (risk / impact)
● Medium (risk / impact)

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1.5 Potential adaptation options – Long-list of adaptation measures in the South

Diversifying crop types and varieties and produce high-resistance crops can be introduced by agricultural companies improving water management in a region affected by cyclones

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
Diversifying crop types and varieties and produce high-resistance crops (or reforestation)	Vilanculos (Inhambane)	<ul style="list-style-type: none"> Crops pests Loss of crops Loss of livestock 	Companhia Agro-empresarial de Moçambique, Obrigado, Fazenda de Açúcar e Milho,	<ul style="list-style-type: none"> Vilanculos is the town in the south region that suffers more damage in crops from cyclone events High resistance crops will decrease the probability of loss of industrial and subsistence agriculture" 	
Coastal realignment - conversion of arable farmland	Vilanculos (Inhambane)	<ul style="list-style-type: none"> Damage to properties Breakdown of equipment Energy cuts 	<i>to be investigated</i>	<ul style="list-style-type: none"> Vilanculos is one of the most affected by sea floods The conversion of arable land into salt marsh will protect the coast of Vilanculos 	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.5 Potential adaptation options – Long-list of adaptation measures in the South

The introduction of water filters in Xai-Xai could prevent further salinization of the soil and the construction of SUDS in Maputo would help to reduce the effect of heavy rains and floods

Adaptation measure (What)	Target region (Where)	Adaptation to the following climate impacts (why)	Examples of Interest Parties (possible funding mechanisms)	Comments (why)	Illustrative Picture
Water filters	Gaza (Xai-Xai)	<ul style="list-style-type: none"> Salinization of the soil Contamination of water supplies 	Chongoene Resorts, Companhia Agro-Social Igo Sammartini, J.F.S	<ul style="list-style-type: none"> Water desalination technologies will give access to clean water for the investors This investment will contribute to boost the agriculture 	
Sustainable Urban Drainage Systems (SUDS)	Maputo City	<ul style="list-style-type: none"> Development of water born diseases Damage to properties Salinization of the soil 	<i>to be investigated</i>	<ul style="list-style-type: none"> Drainage systems would help expel the water to the sea again 	
Near shore breakwaters	Maputo City	<ul style="list-style-type: none"> Blockage of roads Damages in railways Damages in harbours / ports Damage to properties Breakdown of equipments Coastal erosion 	The Horizon, Hotel Karibo, Mozal	<ul style="list-style-type: none"> Near shore breakwaters would contribute more successfully to the protection of the infrastructure and equipment 	

Main sources: Meetings with private investors, other themes' input, ECA - Climate Adaptation Working Group, OECD – SEA and adaptation to climate change, Australia - climate change adaption actions for local government, UNFCCC, FAO, The WorldBank, Environmental protecting agency USA, Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

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1.5 Potential adaptation options – Example of potential projects

We are already working with private investors to identify potential projects for the adaptation measures to be further evaluated and detailed in the second phase of the project

	Description	Adaptation & Benefits
<p>A Self Energy with other partner (e.g. Vale)</p> <p><i>Mini Dams in Tete (e.g. Moatize)</i></p>	<ul style="list-style-type: none"> Construction of two mini dams to address energy cuts, communication cuts and loss of agriculture production with a potential of about 2 and 7,5 MW 	<ul style="list-style-type: none"> Energy security Better irrigation Less dependency on rain fed agriculture Infrastructure and value chain protection
<p>B Ecoenergia (extension)</p> <p><i>Introduction of a different variety of crops in the production of bio fuel (Cabo Delgado)</i></p>	<ul style="list-style-type: none"> The project is an expansion of an existing sugar cane and sweet sorghum test plantation in Cabo Delgado The agricultural operations will involve 400 ha of sugar cane and, for the ethanol production at the second phase (from year three), 50 up to 100 ha of Sweet Sorghum 	<ul style="list-style-type: none"> Water security Crop resilience Energy security Better irrigation
<p>C Companhia do Búzi</p> <p><i>New sugar factory with bridge and mini-dam construction</i></p>	<ul style="list-style-type: none"> Production of sugar cane and construction of a sugar factory with an annual projected production capacity of 150.000 tons Currently, the group is performing final studies for the evaluation of the economic-financial and technical viability 	<ul style="list-style-type: none"> Energy security Better irrigation Infrastructure and value chain protection

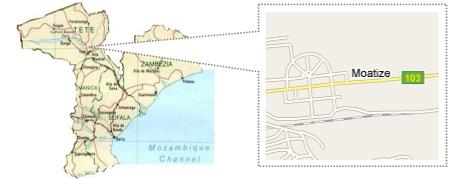
Source: Meetings with private investors and investor's documentation

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1.5 Potential adaptation options – Example of potential projects

Construction of two mini dams to address energy and communication cuts and loss of agriculture production in Moatize

<p>A</p>	<p>Project brief description</p>	<p>Main potential benefits</p>						
		<p>Private sector benefit - Inside the Fence -</p>	<p>Community benefits - Beyond the Fence -</p>	<p>Country benefits - Beyond the Horizon -</p>				
	 <p>Construction of two mini dams to address energy cuts, communication cuts and loss of agriculture production with a potential of about 2 and 7,5 MW</p>	<ul style="list-style-type: none"> Investment return close to 8% of capital employed Capital gains superior to €2.000.000 	<ul style="list-style-type: none"> Income generating activities for local communities Direct and Indirect jobs increase 	<ul style="list-style-type: none"> Better irrigation - half of the world's dams are built exclusively for irrigation Control floods - in at least 75 countries dams have been built to control floods. 				
	<p>High impact area</p> 	<p>Funding mechanisms</p> <table border="1"> <thead> <tr> <th>Promoters</th> <th>Examples of funding parties</th> </tr> </thead> <tbody> <tr> <td>   </td> <td>   <p>Member of the BARCLAYS Group</p>   </td> </tr> </tbody> </table>			Promoters	Examples of funding parties	 	  <p>Member of the BARCLAYS Group</p>  
Promoters	Examples of funding parties							
 	  <p>Member of the BARCLAYS Group</p>  							

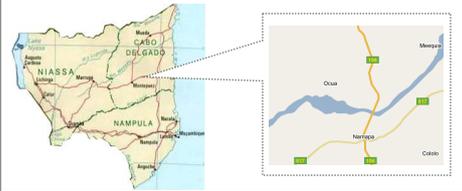
Source: Dams and Development: – A New Framework for Decision-Making, The Report of the World Commission on Dams

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1.5 Potential adaptation options – Example of potential projects

Introduction of a different variety of crops in the production of bio fuel by expanding an existing sugar cane and sweet sorghum test plantation in Cabo Delgado

<p>Project brief description</p>  <p>Expansion of an existing sugar cane and sweet sorghum test plantation in Cabo Delgado for the introduction of a different variety of crops in the production of bio fuel</p>	<p>Main potential benefits</p> <table border="1"> <tr> <th>Private sector benefit - Inside the Fence -</th> <th>Community benefits - Beyond the Fence -</th> <th>Country benefits - Beyond the Horizon -</th> </tr> <tr> <td> <ul style="list-style-type: none"> Investment return superior to 10% of capital employed Capital gains superior to €4.000.000 </td> <td> <ul style="list-style-type: none"> Income generating activities for local communities Direct and Indirect jobs increase </td> <td> <ul style="list-style-type: none"> Less dependence on oil which contributes to country's energy security Reduction in greenhouse gas emissions </td> </tr> </table>			Private sector benefit - Inside the Fence -	Community benefits - Beyond the Fence -	Country benefits - Beyond the Horizon -	<ul style="list-style-type: none"> Investment return superior to 10% of capital employed Capital gains superior to €4.000.000 	<ul style="list-style-type: none"> Income generating activities for local communities Direct and Indirect jobs increase 	<ul style="list-style-type: none"> Less dependence on oil which contributes to country's energy security Reduction in greenhouse gas emissions
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Promoters	Examples of funding parties								
 	 								

Source: EPA's Renewable Fuel Standards Program Regulatory Impact Analysis, released in February 2010

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1.5 Potential adaptation options – Example of potential projects

New sugar factory with bridge and mini-dam construction in Buzi

<p>Project brief description</p>  <p>Production of sugar cane and construction of a sugar factory with an annual projected production capacity of 150.000 tons. Additionally, a bridge and a mini dam will be constructed.</p>	<p>Main potential benefits</p> <table border="1"> <tr> <th>Private sector benefit - Inside the Fence -</th> <th>Community benefits - Beyond the Fence -</th> <th>Country benefits - Beyond the Horizon -</th> </tr> <tr> <td> <ul style="list-style-type: none"> Annual revenues of \$50.000.000 through sugar cane exports, which have an attractive profit margin </td> <td> <ul style="list-style-type: none"> 3.000 to 4.000 direct jobs creation Energy security and better irrigation options for the region and small agriculture </td> <td> <ul style="list-style-type: none"> Infrastructure and value chain protection Less dependence on oil which contributes to country's energy security </td> </tr> </table>			Private sector benefit - Inside the Fence -	Community benefits - Beyond the Fence -	Country benefits - Beyond the Horizon -	<ul style="list-style-type: none"> Annual revenues of \$50.000.000 through sugar cane exports, which have an attractive profit margin 	<ul style="list-style-type: none"> 3.000 to 4.000 direct jobs creation Energy security and better irrigation options for the region and small agriculture 	<ul style="list-style-type: none"> Infrastructure and value chain protection Less dependence on oil which contributes to country's energy security
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Source: EPA's Renewable Fuel Standards Program Regulatory Impact Analysis, released in February 2010

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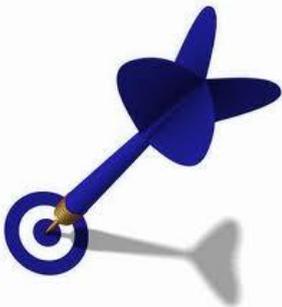
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Arthur D Little

2.1 Executive Summary – Strategic Objectives

For Phase II, we aimed to achieve four strategic objectives

Strategic objectives for Phase II



- ▶ To develop a screening methodology to apply to the **adaptation measures portfolio** in order to get a more manageable short-list of adaptation options
- ▶ To perform an **evaluation of the adaptation measures portfolio** based on the **high-level cost-benefit analysis** and a **feasibility evaluation** on the options included in the long-list of adaptation measures
- ▶ To **involve private investors in the evaluation** of each shortlisted adaptation measure and **develop participation plans** for individual or groups of private investors to each final adaptation option
- ▶ To **select 3 to 5 adaptation and mitigation options** to be detailed in the project's next phase

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2.1 Executive Summary – Approach for Phase II

The approach designed to select 3-5 adaptation projects to detail from an original long list has three main steps: Screening, Evaluation and Selection

Arthur D. Little approach for Phase II

Source: Based on Arthur D. little Methodologies, ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group, ECA – Enhancing the climate risk and adaptation fact base for the Caribbean, And yet it moves – UNEPFI; Catalyzing low-carbon growth in developing economies - UNEP

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2.1 Executive Summary – Approach for Phase II

The selection of the 3 to 5 adaptation projects for Phase III is supported in our methodology and the continuous involvement of public and private sector *stakeholders*

High Level overview of project selection methodology

Private sector stakeholders were deeply involved in all the steps of the selection process

Source: Mozambique Investment Climate Assessment – World Bank –October2009; Catalyzing low-carbon growth in developing economies – UNEP –October2009, Business Confidence Index 2010, UNEP, SEFI – Public Finance Mechanisms to mobilize investment in climate change mitigation

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Arthur D Little

2.1 Executive Summary

We are now in the end of the evaluation phase, having performed site visits to 10 of the 12 short-listed projects and having had meetings with the investors associated with all projects

A Water Security through mini dam construction

- Region: Búzi (Beira)
- Investor: Búzi Açúcar
- Focus: water security, irrigation



B Access during Floods through bridge construction

- Region: Búzi (Beira)
- Investor: Búzi Açúcar
- Focus: access during floods



C Reforestation with agricultural activities

- Region: Búzi (Beira)
- Investor: Búzi Açúcar
- Focus: income diversification, food security, carbon reduction



D Income diversification through waste composting

- Region: Pemba
- Investor: Aga Khan
- Focus: food security, income diversification, soil recovery



E Alternative food and energy Production

- Region: Ocuia (Chiure)
- Investor: Ecoenergia
- Focus: adaptation to climate variability, food security, income diversification, clean energy



F Irrigation with solar panels

- Region: Ocuia (Chiure)
- Investor: Ecoenergia
- Focus: water security, irrigation, food security, clean energy



Source: Arthur D. Little analysis

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2.1 Executive Summary

We are now at the end of the evaluation phase, having performed site visits to 10 of the 12 short-listed projects and having had meetings with the investors associated with all projects

G Alternative energy supply through small-scale solar plant

- Region: Maputo district
- Investor: Selfenergy
- Focus: energy supply, carbon emissions reduction



H Agro forestry in Cabo Delgado

- Region: Cabo Delgado
- Investor: Pemba Sun / Technoserve
- Focus: income diversification, food security, carbon reduction



I Income diversification through micro credit for adaptation

- Region: Nation wide
- Investor: Aga Kan
- Focus: Finance adaptation at a micro level



J Resilient crops

- Region: Nacala
- Investor: Aviam
- Focus: drought resistant crops



K Increased crop yields

- Region: Ocuia
- Investor: Ouro verde
- Focus: Food security, yield increase through ozone reduction



L Agro forestry in Nampula

- Region: Nampula
- Investor: Green resources / Technoserve
- Focus: income diversification, food security, carbon reduction



Source: Arthur D. Little analysis

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2.1 Executive Summary

To design initiatives with a country-wide impact, the projects were aggregated into themes to address some of Mozambique's most strategic challenges: energy, water, forestry, tourism

Project aggregation by strategic area

Projects	Areas	Energy	Water	Tourism	Forestry/ agriculture	New Programs
Alternative food and (renewable) energy production, CD		X	X		X	
Increase crop yields, nationwide					X	
Reforestation with agricultural activities, Buzi					X	
Development of agro forestry, CD, Nampula					X	
Income diversification with waste composting, nationwide					X	
Irrigation with solar panels, Gaza, CD		X	X			
Resilient crops, Nacala, Gaza			X			
Water security and energy with Mini Dams in Búzi River		X	X	X		
Small Scale Solar Plant, Maputo		X		X		
Access during floods through bridge construction, Buzi			X			
Income diversification through microcredit for adaptation, nationwide				X		
Identification of new programs e.g. insurance, company early warning systems, other						X



SLIDE 124

Arthur D Little

2.1 Executive Summary

We developed project sheets for all of the selected projects and presented them to a sample of entities from the international financing community

Microcredit for adaptation

Illustrative

Arthur D Little INGC

Project Purpose: Microcredit for adaptation

Issue/Challenge: The purpose of the project is to develop a successful program for adaptation in Mozambique, supported by international donors and the private sector (INGC).

Standards for success: The project will be successful if it results in increased income and improved livelihoods for the target population.

Standards for impact: The project will be successful if it results in increased income and improved livelihoods for the target population.

Standards for sustainability: The project will be successful if it results in increased income and improved livelihoods for the target population.

Standards for innovation: The project will be successful if it results in increased income and improved livelihoods for the target population.

Waste management and production of organic fertilizers

Arthur D Little INGC

Project Purpose: This program will be designed to improve the waste management and production of organic fertilizers in Mozambique.

Issue/Challenge: The main goal of the program is to improve the waste management and production of organic fertilizers in Mozambique.

Standards for success: The program will be successful if it results in improved waste management and production of organic fertilizers.

Standards for impact: The program will be successful if it results in improved waste management and production of organic fertilizers.

Standards for sustainability: The program will be successful if it results in improved waste management and production of organic fertilizers.

Standards for innovation: The program will be successful if it results in improved waste management and production of organic fertilizers.

Clean energy program

Arthur D Little INGC

Project Purpose: Clean energy program

Issue/Challenge: The main goal of the program is to improve the clean energy program in Mozambique.

Standards for success: The program will be successful if it results in improved clean energy program in Mozambique.

Standards for impact: The program will be successful if it results in improved clean energy program in Mozambique.

Standards for sustainability: The program will be successful if it results in improved clean energy program in Mozambique.

Standards for innovation: The program will be successful if it results in improved clean energy program in Mozambique.

Insurance

Arthur D Little INGC

Project Purpose: Development of Agri Insurance in Mozambique

Issue/Challenge: The main goal of the project is to develop a successful program for Agri Insurance in Mozambique.

Standards for success: The project will be successful if it results in increased income and improved livelihoods for the target population.

Standards for impact: The project will be successful if it results in increased income and improved livelihoods for the target population.

Standards for sustainability: The project will be successful if it results in increased income and improved livelihoods for the target population.

Standards for innovation: The project will be successful if it results in increased income and improved livelihoods for the target population.



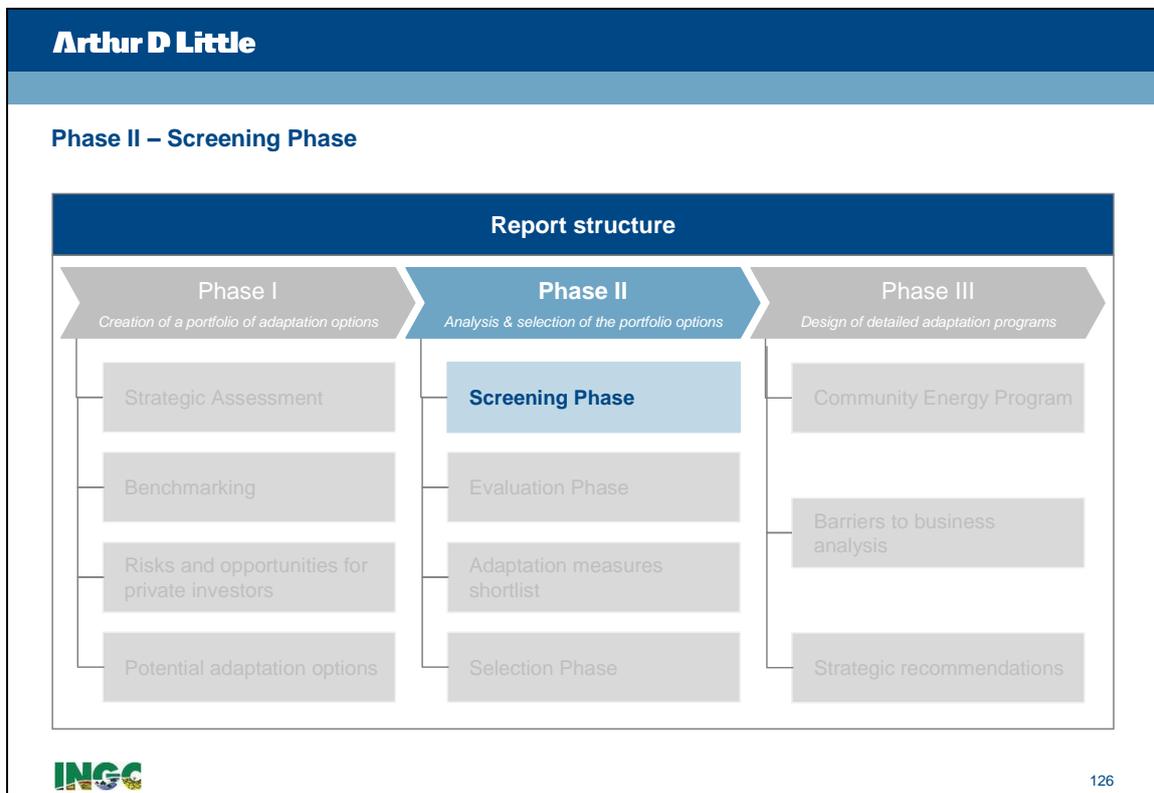
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2.2 Screening phase – Process

The screening process is based on “ ECA shaping climate-resilience development” document which suggests to reduce the long list to a more manageable size before cost-benefit analysis

Overview

Screening phase process					
Screening start	Strategic filter		Operational filter		Screening results
Working hypothesis Which long-list projects should be considered for a cost-benefit and feasibility analysis?	Is the potential project strategic aligned with INGC’s goals? Which regional priority projects have a contribution to the country’s climate resilience?		Is the potential project ready to start during INGC’s timelines? Which projects have solid conditions to start implementation during INGC’s project timeframe?		Top 30 list • Construction of near shore breakwaters • Reforestation of mangroves in Vilankulos • Construction of Mini Dams in Nampula • Develop ecotourism resort • Introduction of drainage systems in Gaza •
Criteria to apply The criteria employed follows “ ECA shaping climate-resilience development” document which uses two main criteria to screen: - Importance of the project to INGC’s goals - Readiness to comply with INGC project’s one year timeframe?	Is it in a INGC priority region? The projects are evaluated in a basis of “yes/no” in terms of their presence in a INGC priority region list	It contributes to resilience? The projects are evaluated by local players and other INGC’s themes in terms of regional and country resilience	It has a short timeframe? The projects are evaluated on the basis of the time required until successful project launch	It has potential private investors? The projects are evaluated in terms of the existence of potential private investors with interest in that project	

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2.2 Screening phase – Process

The long-list projects that stay in the screening phase have a set of actions to promote their implementation in the medium-term

Overview

Screening phase is a continuous process			
Work Hypothesis	Key Milestones	Project typology	Next actions
Screening phase Which long-list projects should be considered for a cost-benefit and feasibility analysis?	Go to next phase ✓ Projects with the best conditions to achieve INGC’s goals while complying with the one year timeframe?	Projects with potential high cost-benefit and feasibility	• Evaluate projects in greater detail in terms of investments, costs, losses averted, increased benefits and feasibility
	Stay in this phase ✗ Projects without one or more critical conditions to achieve success under INGC’s goals and timings	Projects in non-priority regions Projects with low resilience contribution Projects with long timeframe Projects without clear interested private investors	• Push projects to be included in a package with projects in priority regions • “Force” project as a requirement or fiscal benefit for new investments in that region • Group a number of low resilience projects to achieve one “critical mass project” • “Force” project as a requirement or fiscal benefit for new investments in that region • Monitor projects every year to understand best timing to support project’s roll-out • Pitch projects for public sector and not-for-profit support • Evaluate insurance options

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2.2 Screening phase – Strategic Filter – Priority areas

Firstly, we aligned the potential projects with INGC’s goals and eliminated all the potential projects planned for non strategic areas

Example of eliminated projects

Excluded areas / projects

<p>Chinde, Mopeia and Morrumbala</p> <ul style="list-style-type: none"> Develop irrigation / drainage system Introduction of flood tolerant crops Construction of Mini Dams 		<p>Maganja, Namacurra and Nicoadala</p> <ul style="list-style-type: none"> Develop and implement an integrated fire management system Introduction of drought tolerant crops Upgrade main routes ahead of predicted occurrences of floods
<p>Machanga</p> <ul style="list-style-type: none"> Introduction of flood tolerant crops Forestation of mangroves Increase crops yield through the reduction of ground-level ozone 		<p>Matola</p> <ul style="list-style-type: none"> Increase crops yield through the reduction of ground-level ozone Increase of storage facilities in Matola port
<p>Bilene</p> <ul style="list-style-type: none"> Develop irrigation system Produce solar energy at tourist facilities to decrease energy dependence Introduction of drought tolerant crops 		

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2.2 Screening phase – Strategic Filter – Priority areas

We eliminated the potential adaptation projects planned for areas that were not considered a priority for INGC (1/3)

Overlap between INGC priority areas and Arthur D. Little areas in the North

<p>Cabo Delgado ✓</p> <ul style="list-style-type: none"> Includes two priority areas (Pemba and Ecoenergia Pilot area) Examples of selected projects: <ul style="list-style-type: none"> Development of agro forestry Produce solar energy at tourist facilities to decrease energy dependence 		<p>Nacala ✓</p> <ul style="list-style-type: none"> One of the priority areas Example of the selected projects: <ul style="list-style-type: none"> Develop ecotourism resort Improvement of climate forecast infrastructure Introduction of different crops for the production of Biofuel
<p>Nampula ✓</p> <ul style="list-style-type: none"> Includes two priority areas (Angoche e Nacala) Example of the selected projects: <ul style="list-style-type: none"> Construction of a pharmaceutical factory / supply channels Construction of Mini Dams 		

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2.2 Screening phase – Strategic Filter – Priority areas

We eliminated the potential adaptation projects planned for areas that were not considered a priority for INGC (2/3)

Overlap between INGC priority areas and Arthur D. Little areas in the Center

<p>Moatize, Motarara and Changara ✓</p> <ul style="list-style-type: none"> One of the priority areas Example of the selected projects: <ul style="list-style-type: none"> Construction of floodgate / river breakwater wall Introduce redundancy and business continuity in railways Construction of Mini Dams 		<p>Maganja, Namacurra and Nicoadala ✗</p> <ul style="list-style-type: none"> Not considered as a priority area Example of projects that were eliminated: <ul style="list-style-type: none"> Develop and implement an integrated fire management system Introduction of drought tolerant crops
<p>Chinde, Mopeia and Morrumbala ✗</p> <ul style="list-style-type: none"> Not considered as a priority area Example of projects that were eliminated: <ul style="list-style-type: none"> Develop irrigation / drainage system Introduction of flood tolerant crops 		<p>Beira Buzi and Dondo ✓</p> <ul style="list-style-type: none"> Includes two priority areas (Beira and Buzi) Example of the selected projects: <ul style="list-style-type: none"> Develop storage facilities in Beira port Increase crops yield through the reduction of ground-level ozone
<p>Machanga ✗</p> <ul style="list-style-type: none"> Not considered as a priority area Example of projects that were eliminated: <ul style="list-style-type: none"> Introduction of flood tolerant crops Forestation of mangroves 		

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2.2 Screening phase – Strategic Filter – Priority areas

We eliminated the potential adaptation projects planned for areas that were not considered a priority for INGC (3/3)

Overlap between INGC priority areas and Arthur D. Little areas in the South

<p>Gaza ✓</p> <ul style="list-style-type: none"> One of the priority areas (Limpopo river area) Example of the selected projects: <ul style="list-style-type: none"> Development dams in Limpopo Introduction of drainage systems Upgrade roads 		<p>Vilanculos ✓</p> <ul style="list-style-type: none"> Considered as a priority area Example of projects for this area: <ul style="list-style-type: none"> Conversion of arable farmland into salt marsh and grassland to provide sustainable defenses Develop ecotourism resort Reforestation of mangroves
<p>Bilene ✗</p> <ul style="list-style-type: none"> Not considered as a priority area Example of projects that were eliminated: <ul style="list-style-type: none"> Develop irrigation system Produce solar energy at tourist facilities to decrease energy dependence 		<p>Maputo ✓</p> <ul style="list-style-type: none"> Considered as a priority area Example of the selected projects: <ul style="list-style-type: none"> Development of a fast reestablishment plan for financial transactions Strengthening of pharmaceutical supply channels
<p>Matola ✗</p> <ul style="list-style-type: none"> Not considered as a priority area Example of projects that were eliminated: <ul style="list-style-type: none"> Increase crops yield through the reduction of ground-level ozone 		

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2.2 Screening phase – Strategic Filter – Contribution to resilience

Based on validations with sector experts, we then eliminated all of the potential projects considered of low significance for resilience

Regional and country resilience significance

"Floodgates improve water management and decrease the probability of floods and also control salt intrusion that will and is already a problem in many places along the coast"

"I agree that the introduction of tolerant crops is a very important issue"

Rui Brito (Crops Theme)

"Desalination plants are expensive and need a lot of electricity,"

Laurie Barwell (Coastal Theme)

- "Desalination do not have interest for this region"

Carlos Henriques (MozFood)

- "desalination is extremely expensive both to build and to operate and needs strong technology understanding for running the plant. Capable staff needs to be available"

Georg Peterson (Water Theme)

"Rain water harvesting and the improvement of climate forecast infrastructure are projects of very high interest and very high importance, we definitely support each of them as they are very critical in terms of operations and could help also all the sub region specially on forecast weather and develop new culture with the rainfall harvesting"

Stephane Derweduwén (AVIAM)

"The development of these projects:

- 1 - Forestation / Reforestation with product diversity
- 2 - Construction of a bridge and
- 3 - Increase crops yield through the reduction of ground-level ozone

I believe that they will be of high importance for the region"

Jorge Petiz (Buzi Açucar)

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2.2 Screening phase – Operational Filter

Finally, we eliminated all the adaptation measures that could not be implemented in a short-term future or that could not be linked to any private sector investor

Adaptation measure	Timeframe	Private investor that might be interested?	Continue to next step?
Construction of a pharmaceutical factory in Nampula	Long – Any pharma company will need to perform multiple strategy studies before deciding to develop a factory in Mozambique	<ul style="list-style-type: none"> ■ GlaxoSmithKline ■ Pfizer ■ Generic pharma companies 	
Development of a drainage system in Gaza (Chokwé)	Short – A local company that is already feeling the need of this type of project might commit with it in the short term	<ul style="list-style-type: none"> ■ MozFoods ■ J.F.S. 	
Introduction of drought tolerant crops	Short – A local company that is already feeling the need of this type of project might commit with it in the short term	We could not identify any private investor that might be interested in this project for this particular area	
Rainwater Harvesting	Short – A local company could support development of this project, as it does not require high technology to implement	<ul style="list-style-type: none"> ■ Aviam 	
Increase crops yield through the reduction of ground-level ozone in Beira	Short – A local company could support development of this project and the results are seen in a crop cycle	<ul style="list-style-type: none"> ■ Buzi Açucar ■ Mafambisse ■ Priu Agriculture 	

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2.2 Screening phase – Operational Filter

From the long list of approximately 70 potential adaptation options we identified a list of 40 projects that were then evaluated in terms of cost benefit and feasibility

Screening phase

Step 1 Strategic Filter

Adaptation measure 1
Adaptation measure 2
...
Adaptation measure 70

Eliminated Projects (e.g.)

- Develop irrigation system in Bilene
- Introduction of flood tolerant crops in Machanga
- Construction of a pharmaceutical factory

Step 2 Operational Filter

Adaptation measure 1
Adaptation measure 2
...
Adaptation measure x

Eliminated Projects (e.g.)

- Construction of floodgate in Chokwé
- Introduce water filters techniques in Chokwé

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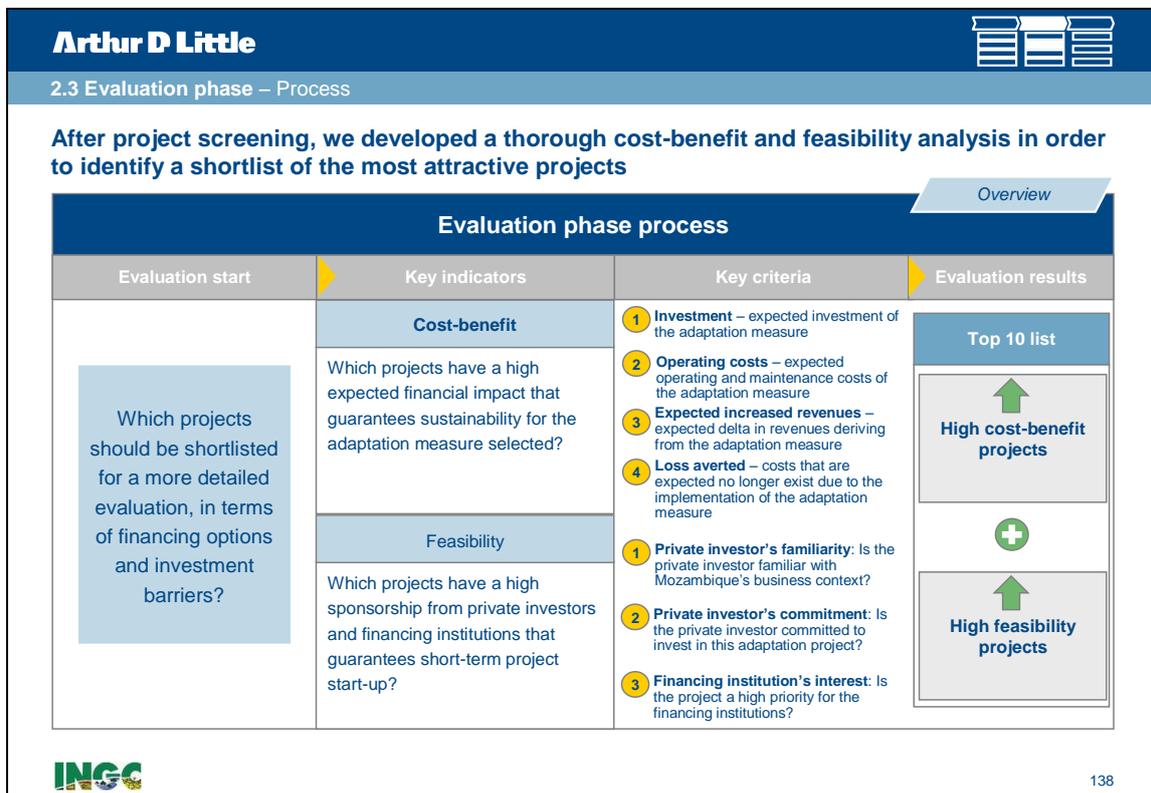
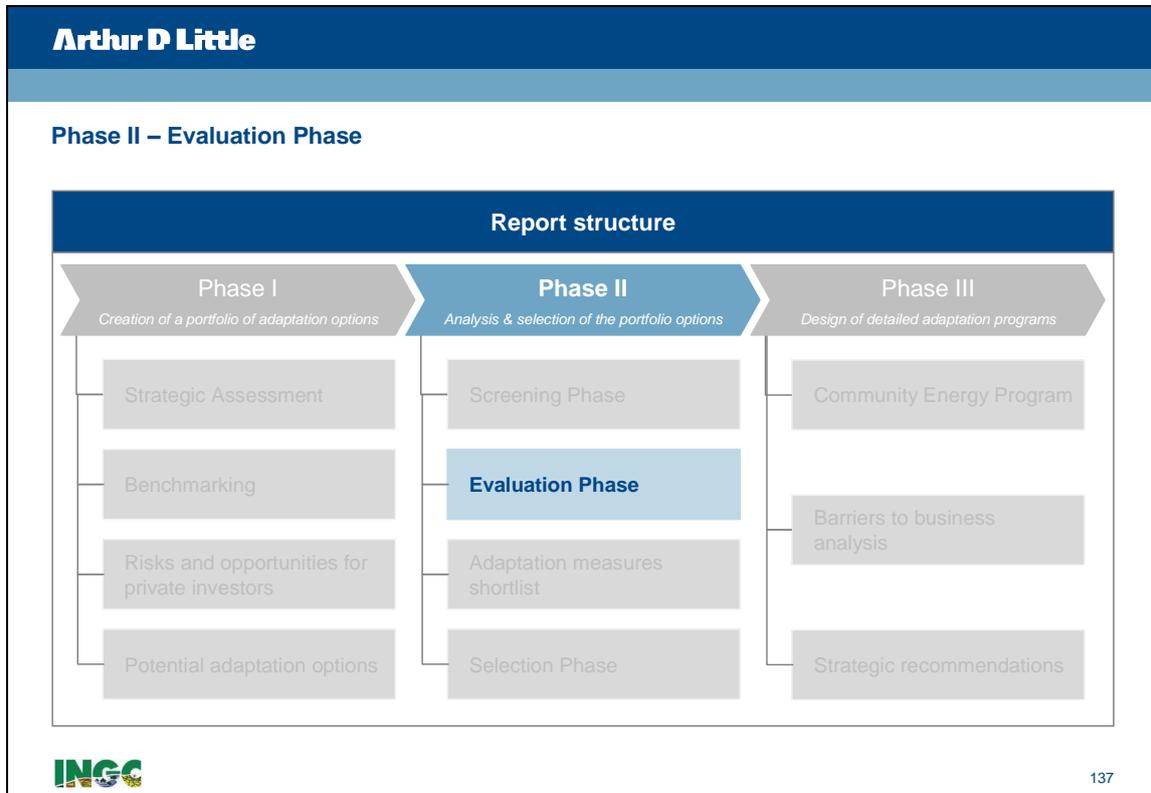
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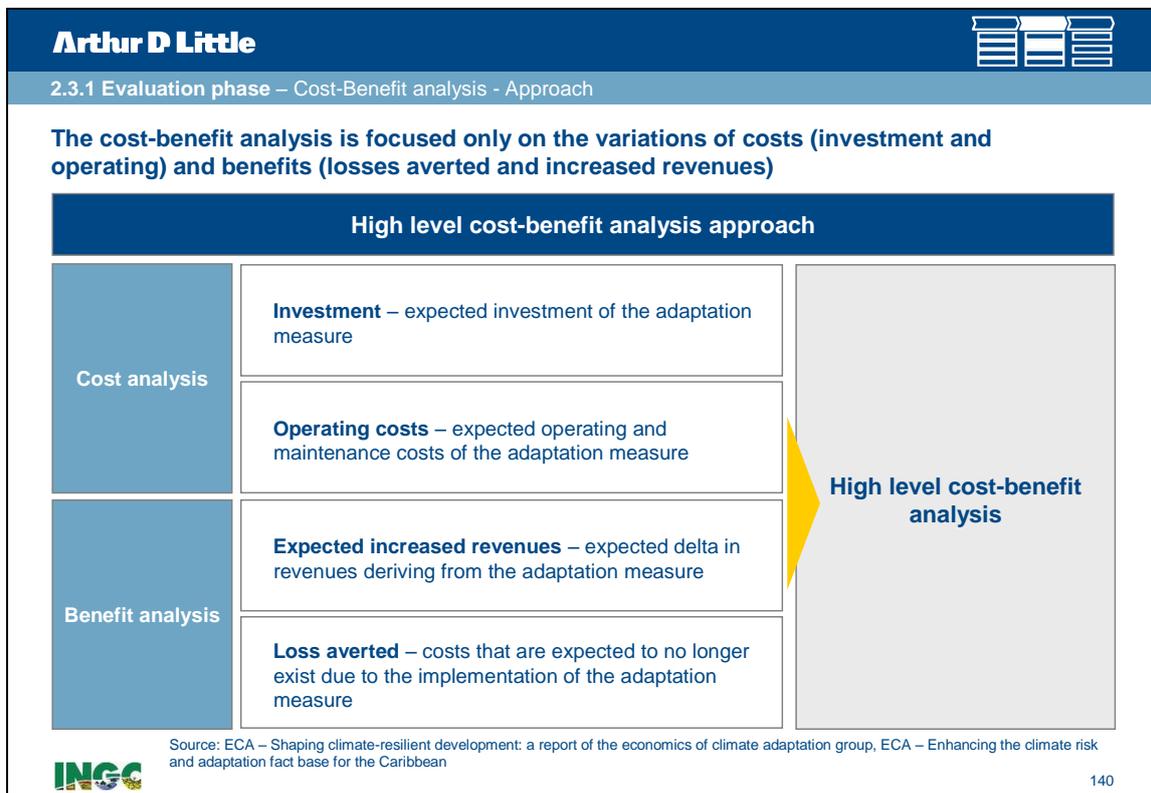


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2.3.1 Evaluation phase – Cost-Benefit analysis

The 33 potential projects that were selected in the screening phase, were then grouped into 19 sets of similar measures for cost-benefit analysis (1/2)

Nº	Adaptation Measures	Projects grouped into 19 sets of similar measures	
1	Construction of Mini Dams in Búzi	Construction of Mini Dams	
	Construction of Mini Dams in Cabo Delgado		
	Construction of Mini Dams in Nampula		
2	Construction of Coastal protections Beira	Construction of Seawalls	
	Construction of Coastal protections Nacala		
3	Construction of Coastal protections Maputo	Construction of near shore breakwaters	
4	Conversion of arable farmland into salt marsh and grassland to provide sustainable defenses in Vilanculos	Conversion of arable farmland into salt marsh and grassland	
5	Construction of Macuti houses in Mozambique island	Mozambique island	Develop tourism resort
	"Stone and Clay" city resilience in Mozambique island		
	Resettlement to the Coastal Land in Mozambique island		
	Develop ecotourism resort in Maputo	Ecotourism	
Develop ecotourism resort with energy and communications independence in Vilanculos			
6	Reforestation with agricultural activities in Buzi	Development of Agro forestry	
	Development of agro forestry in Cabo Delgado		
	Development of agro forestry in Nampula		
7	Development of microcredit solutions for adaptation	Development of microcredit solutions for adaptation	
8	Reforestation of mangroves in Vilanculos	Reforestation	
	Reforestation of Quirimbas National Park		

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2.3.1 Evaluation phase – Cost-Benefit analysis

The 33 potential projects that were selected in the screening phase, were then grouped into 19 sets of similar measures for cost-benefit analysis (2/2)

Nº	Adaptation Measures	Projects grouped into 19 sets of similar measures	
9	Increase crops yield through the reduction of ground-level ozone in Cabo Delgado	Increase crops yield through the reduction of ground-level ozone	
	Increase crops yield through the reduction of ground-level ozone in Búzi		
10	Small scale solar plant in Maputo	Small scale solar plant	
11	Introduce water filters techniques in Búzi	Introduce water filters techniques	
12	Introduction of a different variety of crops in the production of bio fuel in Cabo Delgado	Introduction of resilient crops for the production of Biofuel	
	Introduction of Resilient crops for the production of Biofuel in Nacala		
13	Introduction of rainwater harvesting techniques in Nacala	Introduction of rainwater harvesting techniques	
14	Produce solar energy at tourist facilities to decrease energy dependence in Quirimbas National Park	Produce solar energy at tourist facilities to decrease energy dependence	
	Produce solar energy at tourist facilities to decrease energy dependence in Vilanculos		
	Produce solar energy at tourist facilities to decrease energy dependence in Beira		
15	Production of Energy based on Biomass in Quirimbas National Park	Production of Energy based on Biomass	
16	Solar panels for irrigation in Cabo Delgado	Solar panels for irrigation	
17	Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges) in Búzi	Small infrastructures development	
18	Introduction of drainage systems in Gaza	Introduction of drainage systems	
19	Development of fertilizers by composting of organic waste	Development of fertilizers by composting of organic waste	

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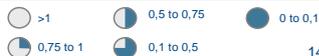
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2.3.1 Evaluation phase – Cost-Benefit analysis

The construction of a mini dams will improve water management and produce energy – the cost-benefit analysis shows that the measure is worthwhile

1 Construction of mini-dams Cost-benefit 

Description	A mini dam is a small hydroelectric power that generates energy, helps to improve irrigation and control floods
Potential Benefits	The construction of a mini dam will improve water management conditions helping in flood control and contributing to the reduction of energy dependence for the investor. This investment can also contribute to boost the economy of the villages nearby
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Meetings with private investor Private investor documentation with a detailed business case on the implementation of mini dams construction
Main sources	<ul style="list-style-type: none"> Private investor documentation

INGC Cost/Benefit ratio:  143

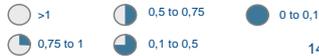
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2.3.1 Evaluation phase – Cost-Benefit analysis

Seawalls will contribute to the protection of the infrastructure and equipments near the coast – the cost-benefit analysis shows a negative cost-benefit

2 Construction of Seawalls Cost-benefit 

Description	Form of coastal defense constructed where the sea impacts directly upon the landforms of the coast. Its prime purpose is to modify the potentially destructive action of tides and waves such that areas of human habitation, conservation, leisure and economic activities, are protected in the long term from the effects of erosion and / or flooding
Potential Benefits	Seawalls will contribute more successfully to the protection of the infrastructure and equipments
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Benchmarking of levels of investment and operating costs Considered cost-benefit ratio based on EACC report estimations of total adaptation costs and total damage costs due to sea level rise with and without adaptation measures Benchmarking of Seawalls construction in similar countries – We have seen that cost-benefit ratio is negative in the great majority of the benchmark cases identified <ul style="list-style-type: none"> Minimum cost-benefit observed 1,4:1
Main sources	<ul style="list-style-type: none"> Theme 2 presentation: information on costs and potential benefits from the adaptation measures Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures Economics of Climate Adaptation reports: case studies proxys of cost-benefit

INGC Cost/Benefit ratio:  144

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2.3.1 Evaluation phase – Cost-Benefit analysis

Construction of breakwaters will contribute to the protection of infrastructures and equipments – the cost-benefit analysis shows a negative cost-benefit

3 Construction of near shore breakwaters Cost-benefit

Description	Near shore breakwaters are segmented, shore parallel structures built along the upper beach at approximately high water mark. They are normally built of rock, but can be formed of concrete armour units
Potential Benefits	Near shore breakwaters will contribute successfully to the protection of infrastructure and equipments
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Benchmarking of levels of investment and operating costs ■ Benchmarking of construction of near shore breakwaters in similar countries – We have seen that cost-benefit ratio is negative in the great majority of the benchmark cases identified <ul style="list-style-type: none"> – Case studies indicate a range of cost-benefit ratio between 1:1 (in Cayman islands and Jamaica) and 55:1 (in Dominica) ■ The coastal protection measures (including the construction of near shore breakwaters) were based on the Bermuda case study <ul style="list-style-type: none"> – This case study reveals a cost-benefit ratio similar to Mozambique's reality on coastal protection measures that were considered in EACC (e.g. sea walls and dikes)
Main sources	<ul style="list-style-type: none"> ■ Theme 2 presentation: information on costs and potential benefits from the adaptation measures ■ Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures ■ Economics of Climate Adaptation reports: case studies proxy of cost-benefit

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 145

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2.3.1 Evaluation phase – Cost-Benefit analysis

The conversion of arable land into salt marsh may contribute to the protection of coastal areas – the cost-benefit analysis shows that the measure is worthwhile

4 Conversion of arable land into salt marsh Cost-benefit

Description	A salt marsh is an environment between land and salty or brackish water, dominated by dense stands of halophytic (salt-tolerant) plants such as herbs, grasses, or low shrubs
Potential Benefits	This adaptation measure should contribute to protect the coastal area – private investors can invest in a measure like this in order to protect their investments near the coast, preventing damage to properties, breakdown of equipments and energy cuts
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Considered "Conversion of arable farmland into salt marsh" as a coastal zoning mechanism ■ Case studies indicate a range of cost-benefit ratio between 0,05:1 (in several Caribbean countries¹) and 0,75:1 (in Dominica) ■ The coastal protection measures (including the conversion of arable land into salt marsh) were based on the Bermuda case study <ul style="list-style-type: none"> – This case study reveals a cost-benefit ratio similar to Mozambique's reality on coastal protection measures (related to sea level rise) that were considered in EACC (e.g. sea walls and dikes)
Main sources	<ul style="list-style-type: none"> ■ Theme 2 presentation: information on costs and potential benefits from the adaptation measures ■ Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures ■ Economics of Climate Adaptation reports: case studies proxy of cost-benefit

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 146

¹ Anguilla, Antigua and Barbuda, Barbados, Bermuda, Jamaica and Sta Lucia

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2.3.1 Evaluation phase – Cost-Benefit analysis

An ecotourism resort contributes to the development of local communities – the cost-benefit analysis shows that the measure is worthwhile

5 Development of an Ecotourism resort Cost-benefit

Description	Ecotourism resort provides for conservation measures, includes meaningful community participation and is profitable and can sustain itself.
Potential Benefits	With its own self-sustainable infrastructures, the resort will be better prepared to resist to natural hazards, protect biodiversity and boost development of the villages nearby
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Private investor documentation with information regarding the potential demand of the project Benchmarking of average revenues per night Estimation of operating costs considering similar examples from ADL experience (an example of the construction of a hotel of a tourism player)
Main sources	<ul style="list-style-type: none"> Technoserve – Tourism Development Plan for Ilha de Mocambique Hotels websites

INGC Cost/Benefit ratio: 147

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2.3.1 Evaluation phase – Cost-Benefit analysis

The development of agro forestry may contribute for the reduction of soil erosion – the cost-benefit analysis shows that the measure is highly worthwhile

6 Development of agro forestry Cost-benefit

Description	The development of agro forestry consists in the integration of trees with crops
Potential Benefits	The integration of trees with crops contributes to the reduction of soil erosion and consequently increases in revenues (both through the increase of crops yield or alternative revenue sources) and in food security. This measure can represent at the same time a mitigation option since it depends on reforestation
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Benchmarking of experiences and business cases described in FAO reports <ul style="list-style-type: none"> The main benefits are considered to be increasing crops yield, avoiding losses of productivity (it is implied above that agro-forestry would replace present systems that are lower-yielding but stable in output) and alternative revenues in the form of poles, firewood and fruit The main costs are related with the cost of planting and maintaining the new trees and initial decrease of crops yield (it is assumed that land is diverted to trees)
Main sources	<ul style="list-style-type: none"> FAO – Food and Agriculture Organization: benefits and costs associated to this measure

INGC Cost/Benefit ratio: 148

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2.3.1 Evaluation phase – Cost-Benefit analysis

The development of a microcredit line for adaptation will help poor individuals and families to adapt to climate change - this measure is highly worthwhile and will be detailed in Phase III

7 Development of microcredit solutions for adaptation Cost-benefit

Description	The main goal of this project is to develop a microcredit line focused only on adaptation projects supported by the government and run by private companies or NGO's
Potential Benefits	Microfinance has the potential to help the poorest and most vulnerable segments of the populations adapt to climate change by providing individuals & small companies with a means of accumulating and managing the assets and capabilities needed to become less susceptible to the impact of natural hazards
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> The cost benefit of such a program is always very positive, but will only be fully validated in Phase III. According to Blue Orchard: "The high cost of capital in the developing world (20-100% APR), the high demand for credit, and the low cost of labor, make transaction-intensive microfinance quite profitable if done right"
Main sources	<ul style="list-style-type: none"> Aga Khan, Blue Orchard, Monitor Institute

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 149

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2.3.1 Evaluation phase – Cost-Benefit analysis

Reforestation may contribute to the protection of coastal areas and / or soils – the cost-benefit analysis shows that the measure is worthwhile

8 Reforestation Cost-benefit

Description	Reforestation consists in restocking of existing forests which have been depleted
Potential Benefits	This adaptation measure should contribute to improve soil conditions, help control floods and reduce cyclone impacts. It can also have a very positive impact on investments near the coast.
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Benchmarking of reforestation of mangroves in other developing countries – We have seen that cost-benefit ratio is high in the great majority of the benchmark cases identified Case studies indicate a range of cost-benefit ratio between 0,1:1 (in several Caribbean countries¹) and 1:1 (the maximum, in Dominica) The coastal protection measures (reforestation of mangroves) were based on the Bermuda case study – This case study reveals a cost-benefit ratio similar to Mozambique's reality on coastal protection measures that were considered in EACC (e.g. sea walls and dikes)
Main sources	<ul style="list-style-type: none"> Theme 2 presentation: information on costs and potential benefits from the adaptation measures Economics of Adaptation to Climate Change reports: world bank information on total adaptation costs and total damage costs due to sea level rise with and without adaptation measures Economics of Climate Adaptation reports: case studies proxy of cost-benefit

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 150

¹ Anguilla, Antigua and Barbuda, Barbados, Bermuda, Jamaica and Sta Lucia

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2.3.1 Evaluation phase – Cost-Benefit analysis

This project contributes to increase revenues and food security – the cost-benefit analysis shows that the measure is highly worthwhile

9 Increase crops yield through the reduction of ground-level ozone Cost-benefit

Description	This adaptation measure is based on the hypothesis that ground-level ozone is one essential factor that determines the final crop yield. The project seeks to determine if average Crop yield in Mozambique can be increased by 20% or more as the result of minimizing the effects of ground level ozone
Potential Benefits	The introduction of different techniques might increase crop yields without using high technology. This contributes to revenues increase for private investors and to the increase of food security in the region
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Meetings with Theme 6 to understand the potential costs and benefits of the adaptation measure: <ul style="list-style-type: none"> Without high investment it is possible, just by controlling the current operating costs (e.g. in fertilizers), to increase crops yield and revenues associated by 20% Meeting with potential private investor interested in the measure to understand how much 20% could represent in additional revenues
Main sources	<ul style="list-style-type: none"> Theme 6: project's budget and success cases benefits

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 151

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2.3.1 Evaluation phase – Cost-Benefit analysis

The construction of small scale solar plants will reduce energy dependence – the cost-benefit analysis shows that the measure is worthwhile

10 Small scale solar plant Cost-benefit

Description	The development of small scale solar plants are planned for Mozambique to explore the country abundant resources to produce clean energy in a decentralized fashion
Potential Benefits	This adaptation measure should reduce energy dependence of private investors or bring electricity to rural communities that otherwise would not have access A private investor has done an extensive cost-benefit analysis comparing the production of solar energy with the production of energy based on fuel and concluded that the production of solar energy is always more cost-efficient. Moreover, if a feed in tariff is introduced this project has a positive NPV even when not considering fuel-based electricity generation
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Meetings with private investor Private investor documentation with a detailed business case on the implementation of solar photovoltaic energy
Main sources	<ul style="list-style-type: none"> Private investor documentation: potential benefits and costs of the implementation of solar pv mini-generation plants in Maputo, Beira and Pemba

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 152

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2.3.1 Evaluation phase – Cost-Benefit analysis

The introduction of water filter techniques contributes to the desalinization of the water – the cost-benefit analysis shows that the measure has a negative cost-benefit

11 Introduce water filters **Cost-benefit**

Description	Introduction of water filters for the agricultural application of desalinized water.
Potential Benefits	Water desalinization technologies will give access to clean water for the investors. This investment will contribute to boost agriculture
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Benchmarking of levels of investment and operating costs <ul style="list-style-type: none"> – Investment per hectare – Operating costs per hectare – Energy consumption per hectare ■ Meetings with private investor to estimate the potential loss averted of a measure like this
Main sources	<ul style="list-style-type: none"> ■ Theme 2: high operating costs (e.g. high costs related to energy consumption, very expensive techniques and huge amount of water needed for agricultural purposes) ■ Texas Water Development Board

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 153

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2.3.1 Evaluation phase – Cost-Benefit analysis

The introduction of different crops for the production of bio fuel may contribute to energy independence – the cost-benefit analysis shows that the measure is worthwhile

12 Introduce different crops for bio fuel production **Cost-benefit**

Description	Introduction of a different variety of crops in the production of bio fuel by expanding an existing sugar cane and sweet sorghum test plantation in Cabo Delgado
Potential Benefits	This adaptation measure should not only enable income generating activities for local communities, direct and indirect jobs, but also reduce the dependence on oil which contributes to the country's energy security and reduction in greenhouse gas emissions
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Private investor documentation with a detailed business case on the implementation of biofuel production <ul style="list-style-type: none"> – Main private sector benefit: investment return superior to 10% of capital employed and capital gains superior to €4.000.000 – Main community benefits: Income generating activities for local communities and direct and indirect jobs increase – Main region benefits: Less dependence on oil which contributes to country's energy security and reduction in greenhouse gas emissions
Main sources	<ul style="list-style-type: none"> ■ Theme 4: Ecoenergia

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 154

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2.3.1 Evaluation phase – Cost-Benefit analysis

The introduction of rainwater harvesting techniques contributes to improve water management – the cost-benefit analysis shows that the measure is worthwhile

13 Introduction of rainwater harvesting techniques Cost-benefit

Description	Rainwater harvesting is the storing of rainwater for reuse. It has been used for example to provide drinking water, water for livestock and water for irrigation
Potential Benefits	This adaptation measure should improve water management conditions and contribute for the improvement of agriculture and living conditions of the population (there is a significant number of droughts reported in the North of the country for example). Rainwater harvesting is convenient in the sense that it provides water at the point of consumption, reducing operation and maintenance problems. Running costs, also, are almost negligible
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Benchmark of costs/m³ of storage water in The Global Development Research Center reports ■ Benchmark of how much land can be irrigated, with a flow of how many liters and for how long – in order to calculate the average number of liters needed to irrigate 1 hectare (Agriinfo.in) ■ Used as proxy revenues per hectare of a private investor to compare with the costs per hectare (derived from the two points above)
Main sources	<ul style="list-style-type: none"> ■ The Global Development Research Center: costs of storage water infrastructures ■ Agriinfo.in - My Agriculture Information Bank: land irrigation details

INGC ¹ Anguilla, Antigua and Barbuda, Barbados, Bermuda, Jamaica and Sta Lucia

Cost/Benefit ratio: 155

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2.3.1 Evaluation phase – Cost-Benefit analysis

The production of solar energy may contribute to decrease energy dependence – the cost-benefit analysis shows that the measure is worthwhile

14 Production of solar energy at tourist facilities Cost-benefit

Description	The introduction of solar photovoltaics provides energy independence to the facility
Potential Benefits	This adaptation measure should reduce energy dependence of the tourist facility. A private investor has carried out an extensive cost-benefit analysis comparing the production of solar energy with the production of energy based on fuel and concluded that the production of solar energy is always more cost-efficient
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Meetings with private investor ■ Private investor documentation with a detailed business case on the implementation of solar photovoltaic energy
Main sources	<ul style="list-style-type: none"> ■ Private investor documentation: potential benefits and costs of the implementation of solar photovoltaics

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Cost/Benefit ratio: 156

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2.3.1 Evaluation phase – Cost-Benefit analysis

The production of electricity based on Biomass needs to be performed in large scale to be cost effective – the cost-benefit analysis shows a negative cost-benefit for Quirimbas

15 Production of Energy based on Biomass in Quirimbas Cost-benefit

Description	The development of this adaptation project would be the construction of a biomass plant to produce energy to lodges and communities in Quirimba National Park
Potential Benefits	Biomass produce less emissions than fossil fuel, contains less sulfur than coal (producing less SO ₂). Moreover, a project like this in Quirimbas would bring electricity for the lodges and communities nearby that still do not have access to the grid. Finally, biomass utilization could prevent the effects of forest fires on the atmosphere
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Benchmarking of levels of investment and operating costs and relative size of the plants
Main sources	<ul style="list-style-type: none"> Gekgasifier., FAO

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 157

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2.3.1 Evaluation phase – Cost-Benefit analysis

Solar panels will generate energy to pump water for irrigation reducing fuel dependency - the cost-benefit analysis shows that the measure is worthwhile

16 Solar panels for irrigation in Cabo Delgado Cost-benefit

Description	Installation of solar panels to generate energy to pump water from the river and distribute it through the irrigation system
Potential Benefits	Solar irrigation can be the answer to watering needs of this region. The alternative source of energy is fuel and according to a private investor extensive cost-benefit analysis comparing the production of solar energy with the production of energy based on fuel and concluded that the production of solar energy is always more cost-efficient
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Meetings with private investor to understand the potential costs and benefits of the adaptation measure Private investor documentation with a detailed business case on the implementation of solar photovoltaic energy
Main sources	<ul style="list-style-type: none"> UNDP project for the province of Gaza Use of solar panels for irrigation in Brazil Private investor

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1 0,75 to 1 0,1 to 0,5 158

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2.3.1 Evaluation phase – Cost-Benefit analysis

Upgrading main routes can improve distribution channels and minimize loss averted – the cost-benefit analysis shows that the measure is worthwhile

17 Small infrastructures development Cost-benefit

Description	Improving routes used in the distribution of the crops. It was considered the construction of a bridge in the Buzi area
Potential Benefits	Upgrading main routes contributes to the improvement of distribution channels, which contributes to minimize loss averted. For example, in Buzi area the only way to cross the river is through a boat named "batelão". For at least 3 weeks every year the "batelão" cannot work due to river flooding that, with climate change is likely to increase impacting the area even more.
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Benchmark of bridges construction costs ■ Meetings with private investor to understand the potential costs and benefits of the adaptation measure
Main sources	<ul style="list-style-type: none"> ■ Private investor working group member ■ California Department of Transportation: Construction costs of bridges

INGC Cost/Benefit ratio: 159

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2.3.1 Evaluation phase – Cost-Benefit analysis

A drainage system could have a significant impact in drainage and salinization issues – the cost-benefit analysis shows that the measure is highly worthwhile

18 Introduction of Drainage Systems Cost-benefit

Description	A drainage system is a system that controls the surface water to avoid for example the loss of crops in agriculture land
Potential Benefits	Will improve water management and agriculture helping in floods control. With climate change, the regions in the south for example, are likely to have more floods, meaning that not only private sector investments in the region may be highly affected but also food security in the villages nearby can decrease
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> ■ Meetings with private investor to evaluate the potential benefit of the measure ■ Benchmarking of the introduction of Drainage Systems in other developing countries – We have seen that cost-benefit ratio can be approximately 0 because, despite the initial investment, it is assumed that this adaptation measure implies operating cost savings by reducing labour and other costs related to manual drainage. Nevertheless, it also contributes to high loss averted
Main sources	<ul style="list-style-type: none"> ■ Private investor working group member: estimations of losses due to drainage issues ■ Economics of Climate Adaptation reports: : case studies proxys of cost-benefit

INGC Cost/Benefit ratio: 160

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2.3.1 Evaluation phase – Cost-Benefit analysis

Development of fertilizers by composting of organic waste will improve waste management and produce organic fertilizer - the cost-benefit analysis shows that the measure is worthwhile

19 **Development of fertilizers by composting of organic waste** **Cost-benefit**

Description	Composting is a process in which organic wastes are degraded by microorganisms at elevated temperatures under both aerobic and anaerobic conditions.
Potential Benefits	Composting of the organic fraction of city waste will avoid methane emissions from anaerobic decay, increase the lifetime of the existing landfill massively and produce high quality compost for use as natural fertilizer.
Process – Cost-benefit estimation –	<ul style="list-style-type: none"> Meeting with private investors to understand costs and potential benefits of the project Use of information provided by a private investor that is starting a pilot project in Beira. Financial returns are expected to come mainly through CDM certificates and the selling of organic fertilizers and need to be further studied in Phase III of the project
Main sources	<ul style="list-style-type: none"> Aga Khan, Terra Nova

INGC Cost/Benefit ratio: >1 0,5 to 0,75 0 to 0,1
0,75 to 1 0,1 to 0,5 161

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2.3.2 Evaluation phase – Feasibility analysis

For the feasibility analysis, we approached private investors as well as public and private financial institutions to help us evaluate the feasibility of each adaptation project

Feasibility analysis							Comments / Objectives
	%	Classification					
		0	0,25	0,5	0,75	1	
Familiarity - Is the private investor familiar with Mozambique business context?	15%	No familiarity	Low	Medium	High	Very high	The main goal is to evaluate private investor's knowledge regarding business barriers that a project development faces in Mozambique. A private investor operating in Mozambique for several years will have the highest valuation. An investor that is thinking about entering will have the lowest valuation.
Interest - Is the private investor committed to invest in this adaptation project?	70%	Low	-	Medium	-	High	The main goal is to evaluate which adaptation options garner most interest among private investors and therefore are more likely to be supported in the future.
Financing priority - Is the project a high priority for the financing institutions?	15%	No	-	yes (indirect)	-	yes (direct)	The main goal is to evaluate which adaptation projects are more likely to get financing considering the priority sectors of reference financing entities.

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2.3.2 Evaluation phase – Feasibility analysis - Familiarity

First, private investors linked to potential adaptation projects were evaluated according to their business knowledge of Mozambique

Selected examples

Business knowledge of Mozambique

- green RESOURCES**: The company is developing a project in Mozambique
- VALE**: The company is developing a project in Mozambique having significant interaction with the government
- MazFoods Mozambique**: The company is established in Mozambique being in operation for at least 5 years in several areas of Mozambique
- MIPS**: The company is established and with strong interactions with the government
- AVIAM Lda**: The company is developing a project in Mozambique
- Búzi Açúcar**: The company is developing a project and the board has extensive experience in developing businesses in Mozambique
- RANI Resorts**: The company is established in Mozambique being in operation for at least 5 years in several areas of Mozambique

● Very High ● High ● Medium ● Low

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2.3.2 Evaluation phase – Feasibility analysis - Expressed Interest

Then, the adaptation projects were evaluated according to private investors' willingness to invest in the development of a particular project

Project	Company	Expressed Interest
Construction of mini dam	Búzi Açúcar	Medium Interest
Improvement of climate forecast infrastructure	AVIAM Lda	High Interest
Introduction of drainage systems	Mozfoods	High Interest
Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges)	Búzi Açúcar	High Interest

Top projects	
Nº	High Interest Projects
1	Reforestation with agricultural activities
2	Introduction of drainage systems
3	Increase crops yield through the reduction of ground-level ozone
4	Solar panels for irrigation
5	Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges)
6	Construction of Mini Dams
7	Introduction of a different variety of crops in the production of bio fuel
8	Construction of Mini Dams
9	Develop of fertilizers by composting of organic waste
10	Construction of Macuti houses in Mozambique island
11	Resettlement to the Coastal Land in Mozambique island
12	Develop ecotourism resort
13	"Stone and Clay" city resilience in Mozambique island
14	Introduction of Resilient crops for the production of Biofuel
15	Introduction of rainwater harvesting techniques

High Interest Medium Interest

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2.3.2 Evaluation phase – Feasibility analysis - Financing priorities

Finally, we assessed the financing priorities of international sources of development financing considering the interactions we had with three reference players

Entity	Priority sectors	Financing	Examples of projects
IFC International Finance Corporation World Bank Group	<ul style="list-style-type: none"> Ports Tourism Forestry Urban drainage systems 	<ul style="list-style-type: none"> Directly to the private investor 	<ul style="list-style-type: none"> Reforestation with product diversity (softwood / hardwood and / or short / long rotation) Develop ecotourism resort with energy and communications independence Construction of near shore breakwaters
	<ul style="list-style-type: none"> Agriculture Water 	<ul style="list-style-type: none"> Through the government 	<ul style="list-style-type: none"> Introduction of rainwater harvesting techniques Increase crops yield through the reduction of ground-level ozone Introduction of drainage systems
THE WORLD BANK Working for a World Free of Poverty	<ul style="list-style-type: none"> Infrastructure 	<ul style="list-style-type: none"> Through the government 	<ul style="list-style-type: none"> Upgrade main routes ahead of predicted occurrences of floods (e.g.: Bridges) Improvement of climate forecast infrastructure

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2.3.3 Evaluation phase – Short List identification

We evaluated the 33 potential adaptation projects feasibility and cost benefit and selected the options with a grade of at least 0,7 (1/3)

Adaptation Measures	Area	Region	Company	Familiarity	Feasibility		Cost benefit analysis	Total
					Expressed Interest	Financing priority		
Reforestation with agricultural activities	Buzi and Dondo	Center	Buzi Açucar	0,75	1	1	1	0,98
Introduction of drainage systems	Gaza	South	Mozfoods	0,75	1	0,5	1	0,93
Increase crops yield through the reduction of ground-level ozone	Cabo Delgado	North	Ouro Verde	0,75	1	0,5	1	0,93
Solar panels for irrigation	Cabo Delgado	North	Ouro Verde	0,75	1	1	0,5	0,78
Small scale solar plant	Maputo city	South	Selfenergy	0,75	1	1	0,5	0,78
Upgrade main routes ahead of predicted occurrences of floods	Buzi and Dondo	Center	Buzi Açucar	0,75	1	0,5	0,5	0,73
Construction of Mini Dams	Buzi and Dondo	Center	Buzi Açucar	0,75	1	0,5	0,5	0,73
Introduction of a different variety of crops in the production of bio fuel	Cabo Delgado	North	Ouro Verde	0,75	1	0,5	0,5	0,73
Introduction of Resilient crops for the production of Biofuel	Nacala	North	Aviam	0,25	1	1	0,5	0,73
Development of agro forestry	Cabo Delgado	North	Pemba Sun	0,25	0,5	1	1	0,72

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2.3.3 Evaluation phase – Short List identification

We evaluated the 33 potential adaptation projects feasibility and cost benefit and selected the options with a grade of at least 0,7 (2/3)

Adaptation Measures	Area	Region	Company	Feasibility			Cost benefit analysis	Total
				Familiarity	Expressed Interest	Financing priority		
Development of agro forestry	Nampula	North	Green Resources	0,25	0,5	1	1	0,72
Develop of fertilizers by composting of organic waste	Cabo Delgado	North	Aga Khan	1	1	1	0,5	0,71
Construction of Macuti houses in Mozambique island	Nacala	North	Technoserve	1	1	0	0,5	0,71
Develop ecotourism resort	Maputo	South	Technoserve	1	1	0	0,5	0,71
"Stone and Clay" city resilience in Mozambique island	Nacala	North	Technoserve	1	1	0	0,5	0,71
Introduction of rainwater harvesting techniques	Nacala	North	Aviam	0,25	1	0,5	0,5	0,69
Produce solar energy at tourist facilities to decrease energy dependence (Quirimbas)	Cabo Delgado	North	Rani Resorts	0,75	0,5	1	0,5	0,57
Development of microcredit solutions for adaptation	Nationwide	Nationwide	Aga Khan	0,75	0,5	1	0,5	0,57
Conversion of arable farmland into salt marsh and grassland	Vilanculos	South	Grupo Pestana	0,75	0	1	1	0,56
Reforestation of mangroves	Vilanculos	South	Rani resorts	0,75	0	1	1	0,56
Construction of Mini Dams	Cabo Delgado	North	Ouro Verde	0,75	0,5	0,5	0,5	0,52

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2.3.3 Evaluation phase – Short List identification

We evaluated the 33 potential adaptation projects feasibility and cost benefit and selected the options with a grade of at least 0,7 (3/3)

Adaptation Measures	Area	Region	Company	Feasibility			Cost benefit analysis	Total
				Familiarity	Expressed Interest	Financing priority		
Resettlement to the Coastal Land in Mozambique island	Nacala	North	Technoserve	1	1	0	0	0,51
Increase crops yield through the reduction of ground-level ozone	Buzi and Dondo	Center	Buzi Açucar	0,75	0	0,5	1	0,51
Develop ecotourism resort	Vilanculos	South	Rani Resorts	0,75	0,5	0	0,5	0,48
Produce solar energy at tourist facilities	Vilanculos	South	Rani Resorts	0,75	0	1	0,5	0,36
Produce solar energy at tourist facilities	Beira	Center	Grupo Pestana	0,75	0	1	0,5	0,36
Introduce water filters techniques	Buzi and Dondo	Center	Buzi Açucar	0,75	0,5	0	0	0,28
Construction of Mini Dams	Nampula	North	Green Resources	0,25	0	0,5	0,5	0,27
Construction of Coastal protections	Maputo city	South	Maputo Port	1	0	1	0	0,18
Construction of Coastal protections	Beira	Center	Beira Port	1	0	1	0	0,18
Construction of Coastal protections	Nacala	North	Nacala Port	1	0	1	0	0,18
Production of Energy based on Biomass	Quirimba National Park	North	Guludo Beach Lodge	0,5	0	1	0	0,14

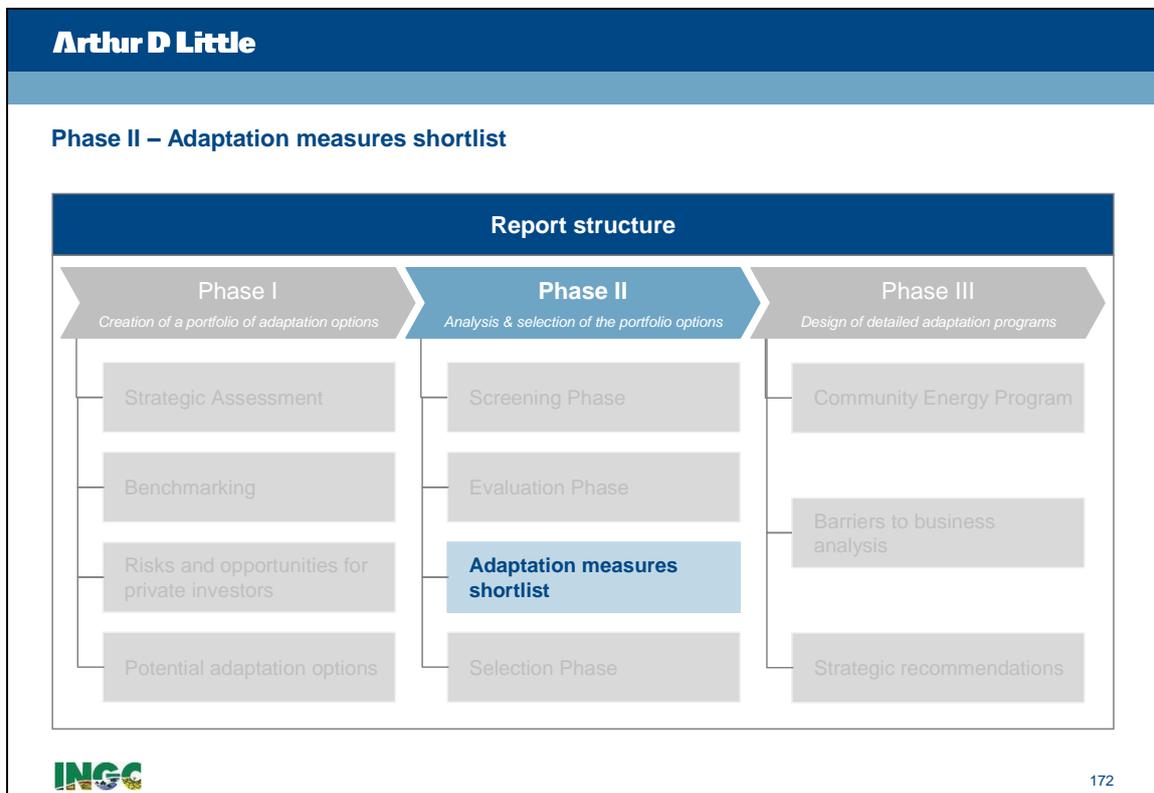
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2.1 Executive Summary

We are now in the end of the evaluation phase, having performed site visits to 10 of the 12 short-listed projects and having had meetings with the investors associated with all projects

A Water Security through mini dam construction

- Region: Búzi (Beira)
- Investor: Búzi Açúcar
- Focus: water security, irrigation



B Access during Floods through bridge construction

- Region: Búzi (Beira)
- Investor: Búzi Açúcar
- Focus: access during floods



C Reforestation with agricultural activities

- Region: Búzi (Beira)
- Investor: Búzi Açúcar
- Focus: income diversification, food security, carbon reduction



D Income diversification through waste composting

- Region: Pemba
- Investor: Aga Khan
- Focus: food security, income diversification, soil recovery



E Alternative food and energy Production

- Region: Ocuia (Chiure)
- Investor: Ecoenergia
- Focus: adaptation to climate variability, food security, income diversification, clean energy



F Irrigation with solar panels

- Region: Ocuia (Chiure)
- Investor: Ecoenergia
- Focus: water security, irrigation, food security, clean energy



Source: Arthur D. Little analysis

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2.1 Executive Summary

We are now at the end of the evaluation phase, having performed site visits to 10 of the 12 short-listed projects and having had meetings with the investors associated with all projects

G Alternative energy supply through small-scale solar plant

- Region: Maputo district
- Investor: Selfenergy
- Focus: energy supply, carbon emissions reduction



H Agro forestry in Cabo Delgado

- Region: Cabo Delgado
- Investor: Pemba Sun / Technoserve
- Focus: income diversification, food security, carbon reduction



I Income diversification through micro credit for adaptation

- Region: Nation wide
- Investor: Aga Kan
- Focus: Finance adaptation at a micro level



J Resilient crops

- Region: Nacala
- Investor: Aviam
- Focus: drought resistant crops



K Increased crop yields

- Region: Ocuia
- Investor: Ouro verde
- Focus: Food security, yield increase through ozone reduction



L Agro forestry in Nampula

- Region: Nampula
- Investor: Green resources / Technoserve
- Focus: income diversification, food security, carbon reduction



Source: Arthur D. Little analysis

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2.4 Adaptation measures Short List - Adaptation project - Construction of a mini dam in Búzi river

The construction of a mini dam will significantly improve water management - both in the periods of drought and flood

A Construction of a mini dam in Búzi river

Main objectives and benefits	Potential costs
<ul style="list-style-type: none"> ■ Búzi Açúcar project has an associated investment of about \$ 120M and is expected to create over 3,500 jobs. ■ The aim is to produce sugar cane in an area of 15,000 ha, to feed the New Búzi Sugar Factory, with a projected annual production capacity of 150,000 tons of sugar ■ The Búzi area is fairly flat and there are many crop losses due to floods ■ With climate change, it is predicted that floods and droughts will be more intense leading to a higher rate of crop losses ■ The construction of a mini-dam will allow for better management of river flow in both drought and flood periods benefiting the company and the surrounding communities ■ It will become possible to manage the flow of the river - store water between November and March for re-use for irrigation in the months July to September ■ With a mini dam it will be possible to mitigate between 10-20% of the crop losses due to floods 	<ul style="list-style-type: none"> ■ ~ 4,5 M€ (<i>indicative</i>)¹ ■ Technical studies are needed to detail project construction and operating costs
	Barriers to implementation
	<ul style="list-style-type: none"> ■ Agreement with the Sofala Government, MICOA and MOP ■ Viability of the infrastructure investment in the required area
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ■ World Bank, DFID and ADB ■ Búzi Açúcar, Sofala Government, Ministry of Obras Públicas and Self energy

Source: Búzi Açúcar, Self Energy

INGC ¹ Used as a proxy for a more detailed study of the construction of a mini dam with little power energy in the province of Manica

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2.4 Adaptation measures Short List - Adaptation project - Construction of a mini dam in Búzi river

Improving the main lines of transport and communication will allow better access to distribution channels for goods and people in the event of extreme weather

B Construction of a bridge over the Búzi river

Main objectives and benefits of the project	Potential costs
<ul style="list-style-type: none"> ■ In the area of Búzi, the only way to cross the river is through a "batelão" - which transports people, cars and trucks with raw materials such as sugar cane and wood ■ At least 10% of the year (6 weeks) the "batelão" can not work due to river flooding or drought – both situations will become more accentuated with climate change ■ The road that links the two sides of the river is one of the main choices to shorten the trip between Beira and Maputo (between the Centre and South) which translates into increased traffic that allows the development of local economy ■ Many of the shipments of sugar cane must be transported by "batelão" (average trip lasts about 30 minutes) ■ With climate change, it is predicted that floods and droughts are intensifying in the area and, hence, this transportation of people and goods will be interrupted for several weeks a year ■ The road (EN214), which contains the passage via barge, is one of the roads defined as a priority by the government and a tender was launched for consultation at the central level of the feasibility project for the construction of the bridge 	<ul style="list-style-type: none"> ■ 2,5 M€, according to <i>benchmarks</i>¹ ■ Technical studies are needed to detail project construction and operating costs
	Barriers to implementation
	<ul style="list-style-type: none"> ■ Agreement with the Government of Sofala and the Central Government on the responsibilities of management and investment ■ Technical studies are required (tender ongoing)
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ■ World Bank, DFID and ADB ■ Búzi Açúcar, Sofala Government and Central Government

Source: Búzi Açúcar, ANE

INGC ¹ Used as a proxy for a more detailed study on construction of bridges http://www.dot.ca.gov/hq/esc/estimates/Construction_Stats_2009.pdf

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2.4 Adaptation measures Short List – Adaptation project - Reforestation with agricultural activities in Búzi area

The planting of native trees decreases the effect of deforestation – and where integrated with agro-forestry techniques allows greater community involvement

C Reforestation with agricultural activities in Búzi area

Main objectives and benefits	Potential costs
<ul style="list-style-type: none"> Búzi Açúcar has a concession of 15.000 ha to produce sugar cane. In addition to that area the company received also an area of 45,000 ha of forest area that is supposed to recover and keep This forest has been depleted over the years and is now very sparse and weakened There are plans for reforestation with indigenous species, but currently "frozen" for lack of funding It is necessary to involve the community so that there is a greater likelihood of success in reforestation - an example might be the use of agro forestry in partnership with an NGO so that no customary burning for the subsequent planting of the fields or cutting trees occurs Using the mechanisms of carbon credits, taking into account the average CO2 sequestration to plant trees and price per ton of CO2 an investor can hope a return of almost \$ 10M in 25 years of planting¹ 	<ul style="list-style-type: none"> 4 M\$¹
	Barriers to implementation
	<ul style="list-style-type: none"> Carbon credit enabling legislation Technical studies needed
	Potential financing institutions and partners
	<ul style="list-style-type: none"> IFC, DFID, Green Belt Búzi Açúcar, Sofala Government, CTA, Small farmers, Technoserve

Source: Búzi Açúcar

 ¹ Used as a proxy for a more detailed study of reforestation in Haiti - the costs include the planting and maintenance over 10 years to an area of 7000 ha and the returns are calculated as the sum of annual returns in 25 years

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2.4 Adaptation measures Short List – Adaptation project - Production of raw sugar and bio-ethanol

The use of sweet sorghum will act as encouragement for the surrounding communities and will enable a dramatic reduction in water used

E Production of unrefined organic sugar and bio-ethanol in Ocuca

Main objectives and benefits	Potential costs
<ul style="list-style-type: none"> The Ouro Verde project is a project that aims to produce commercially unrefined organic sugar and ethanol in a region where there has never been a sugar plantation The project is associated with an investment of about \$ 12.4 M By the end of 2011 the project aims to plant 100ha of sugar cane and start building the production plant In the second phase, the plantation will extend to 490 ha and the factory will produce unrefined organic sugar and bio-ethanol. As sub-products there will be the production of energy through bagasse The main benefits of the project will be: <ul style="list-style-type: none"> Maximizing the productivity and resilience (through tests on various varieties of sugarcane and sorghum) Minimize use of water Food production (crop rotation for soil improvement) Improved resilience of local populations 	<ul style="list-style-type: none"> ~ \$12,5M Having already two investors (Ecoenergia and Agricane) the project still needs about \$ 1M
	Barriers to implementation
	<ul style="list-style-type: none"> Tests with sweet sorghum hybrids do not give the expected crop yield results and hence the commercial viability of producing sugarcane in this region of the country may not be validated
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ADB, IFC and High Net Worth Individuals Cabo Delgado Government, ICRISAT and Crops Advance

Source: Ecoenergia



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2.4 Adaptation measures Short List – Adaptation project - Introduction of solar panels for irrigation

The use of solar panels will ensure energy independence of the project and transfer energy to the surrounding communities

F Introduction of solar panels for irrigation

Main objectives and benefits	Potential costs
<ul style="list-style-type: none"> ■ The Ouro Verde project is a project that aims to produce commercially unrefined organic sugar and ethanol in Ocuva. ■ The project is located at the "end of line" of the electricity transmission network of the Cahora Bassa dam, so energy is delivered irregularly (there are many losses/interruptions along the transmission line). Energy independence for the local communities is therefore critical. ■ A major goal of the company is energy independence from the transmission grid for the operation of the irrigation system. ■ There are already some examples of the use of solar panels for water extraction from water holes for local communities. The use of solar panels is an option that may be feasible considering the energy needs and levels of sunlight in the region ■ An additional objective of the project is to bring energy into the surrounding communities 	<ul style="list-style-type: none"> ■ ~ \$30k / ha (indicative)
	Barriers to implementation
	<ul style="list-style-type: none"> ■ High initial investment
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ■ High Net Worth Individuals, Commercial Banks, PNUD ■ Cabo Delgado Government, Selfenergy

Source: Ecoenergia, Self Energy

 1 Used as a proxy study of use of solar panels for irrigation in Brazil and a UNDP project for the province of Gaza

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2.4 Adaptation measures Short List – Adaptation project – Organic waste by composting

The objective is to improve the urban environment, reduce health risks through the recycling of most of the municipality's solid organic waste and increase agricultural productivity

D Organic waste by composting

Key objectives and benefits	Potential Costs
<ul style="list-style-type: none"> ■ Composting is a process in which organic wastes are degraded by microorganisms at elevated temperatures under both aerobic and anaerobic conditions. ■ Due to city development, Mozambique is starting to face a major problem related with waste management across the country. In the formerly pristine environment, waste is disposed indiscriminately in rivers, canals and roadside. ■ The goal of this project is to develop a pilot between the Pemba Municipality and a private investor where the city's organic waste will be used to produce natural fertilizer ■ The product will improve agricultural productivity and allow the regeneration of soils that have been damaged by rapid erosion ■ By decreasing the amount of waste entering the municipal rubbish dump, the project will reduce emissions of methane – this fact will allow the investor to sell certified carbon credits 	<ul style="list-style-type: none"> ■ 900 k\$
	Implementation Barriers
	<ul style="list-style-type: none"> ■ Agreement of Pemba Municipalities and municipal operation (regarding waste management)
	Potential financing entities
	<ul style="list-style-type: none"> ■ World Bank, DFID, African Development Bank ■ Aga Khan, Terra Nova, MICOA

Source: Terra Nova



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2.4 Adaptation measures Short List – Adaptation project – Small Scale Solar Plant

The development of small scale solar plants will allow the harnessing of the country abundant resources to produce clean energy in a decentralized way

G Small Scale Solar Plant

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> ■ The development of small scale solar plants are thought for Mozambique to explore the country abundant resources to produce clean energy in a decentralized fashion ■ The main goals are the production of clean energy, reducing the dependence on external sources of energy like fuel. ■ The development of this project will also minimize losses of energy and implies less investment in infrastructure ■ This adaptation measure should reduce energy dependence of private investors or bring electricity to rural communities that otherwise would not have access ■ The project as a positive NPV if a feed in tariff is in place. When compared with the use of fuel, solar energy is more cost effective 	<ul style="list-style-type: none"> ■ Capex – 3,6ME/MW
	Implementation Barriers
	<ul style="list-style-type: none"> ■ Renewable Energy Strategy has been issued but a FIT law is still to be materialized
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ■ IRENA – International Renewable Energy Agency ■ Private Stakeholders as Selfenergy in a ESCO model

Source: Selfenergy

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2.4 Adaptation measures Short List – Adaptation project – Agro forestry in Cabo Delgado

Agro forestry – integration of trees with crops – contributes to the reduction of soil erosion and to the increase in food security for local communities

H Agro forestry in Cabo Delgado

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> ■ Pemba sun is a Forestry & Sawmilling business operating in Cabo Delgado Province. ■ The core focus of the company is low-volume, high-value local processing of hardwoods and to export Mozambican hardwood lumber. ■ Long-term sustainability of forestry resources is a key business driver and Pemba Sun is willing to develop community projects that involve communities in the preservation of the forest ■ A partnership between Pemba Sun and Technoserve aims to improve the soil's conservation, biodiversity and food security for the people in the region – The Agro-Forestry Village Program - has as the ultimate beneficiary the rural farmer that has to be part of the development process and has to reap socio-economic benefits (jobs, improved farming practices, markets, socio facilities and services) 	<ul style="list-style-type: none"> ■ ~ 140 k\$ per ha / year <p><i>Similar projects are calculated for a 10 years period</i></p>
	Implementation Barriers
	<ul style="list-style-type: none"> ■ There is the need of high involvement of the local communities
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ■ High Net Worth Individuals ■ IFC, DFID, ADB

Source: Technoserve, Portucel, Food and Agriculture Organization of the United Nations

 ¹ FAO study on Agro forestry projects - <http://www.fao.org/docrep/u2246e/u2246e06.htm#a>. benefits and costs to the farmer 182

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2.4 Adaptation measures Short List – Adaptation project – Micro Credit for Adaptation

Development of Micro-credit financing lines for investments in climate change resilience projects by farmers, small and medium-sized companies and local communities

I Micro Credit for Climate Change Adaptation Initiatives

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> ■ The Aga Khan Foundation opened a microcredit bank in Mozambique and is now studying the best way of entering the market with this type of loans. ■ The main issues faced by the Foundation are a) loans valuation, b) client training and c) follow up measures ■ The Aga Khan Foundation indicated that it would be interested in analyzing the development of a Micro credit line for investments in climate change resilience. ■ Examples of interventions could be: <ul style="list-style-type: none"> – development of irrigation projects that utilize drip irrigation or rainwater harvesting – provision of water to domestic and agricultural users from ground water resource – Construction of Macuti houses for tourism – ... 	<ul style="list-style-type: none"> ■ To be determined in depth if the project goes forward to Phase III.
	Implementation Barriers
	<ul style="list-style-type: none"> ■ Microbank is based in Pemba and mechanisms must be set to reach high impact areas ■ Awareness in the private sector
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ■ IFC, Standard Bank, Barclays (ABSA) ■ Aga Kan

Source: Aga Khan

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2.4 Adaptation measures Short List – Adaptation project – Introduction of Resilient crops for Biofuels

The project's main goal is to produce clean energy using a highly resilient crop that grows in marginal lands and needs no irrigation

J Introduction of resilient crops for the production of Bio-fuel

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> ■ Aviam is developing a project of cultivation and development of Jatropha Curcas and production of vegetable oil in the Nacala region ■ The project's main goal is to use a resilient crop to produce clean energy and to boost environmental, economic and social development in the region. ■ Nacala is the northern province most affected by droughts and with climate change, the severity of drought is likely to increase since rainfall is expected to increase in intensity but decrease in frequency ■ Jatropha Curcas grows in arid and marginal lands and its products are not edible. Moreover, no irrigation is required. ■ At present, Aviam is preparing nurseries and cultivating 10.000 hectares of land as a pilot project ■ In the future, the company plans to extend the plantations and set up a system of outgrowing which will give local workers the opportunity to cultivate Jatropha Curcas independently 	<ul style="list-style-type: none"> ■ ~ 21M USD
	Implementation Barriers
	<ul style="list-style-type: none"> ■ Project viability – needs to be analyzed carefully given the dependence on the yields from Jatropha Curcas plantations
	Potential financing institutions and partners
	<ul style="list-style-type: none"> ■ DFID, ADB, IFC, Commercial Banks ■ CTA, Vale, Plant research international, International entities investigating the use of Jatropha Curcas

Source: AVIAM

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2.4 Adaptation measures Short List – Adaptation project – Increase crops yield

This pilot project seeks to determine if average crop yields can be increased by 20% or more using Ouro Verde’s test site

K Increase agricultural crop yields

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> This pilot project seeks to determine if average crop yield in Mozambique can be increased by 20% or more, as a result of minimizing the effects of ground level ozone The pilot project consists of three components: <ol style="list-style-type: none"> Research and compilation of available data, New data generation at test sites, Reference data generation by ground-level ozone monitoring sites. The pilot will follow a similar successful experience in Brazil (yield was doubled) and will use Ouroverde’s land as a test site The potential implications of the above findings are highly relevant to Mozambique’s goal to increase crop yields in the coming decade. 	<ul style="list-style-type: none"> ~350KUSD for the pilot project
	Implementation Barriers
	<ul style="list-style-type: none"> New concept under peer review in the scientific community
	Potential financing institutions and partners
	<ul style="list-style-type: none"> IFC, WB and ADB Cropsadvance, Ecoenergia

Source: Cropsadvance

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2.4 Adaptation measures Short List – Adaptation project – Agro forestry in Nampula

Agro forestry (the integration of trees with crops) contributes to the reduction of soil erosion and to increasing food security for local communities

L Agro forestry in Nampula

Main objectives and benefits	Potential Costs
<ul style="list-style-type: none"> Green Resources is a plantation, carbon offset, forest products and renewable energy company Green Resources has obtained permission to develop 126,000 hectares of forest plantation for carbon sequestration, as well as for producing wood for building materials, energy and pulp in Nampula province (inside the Nacala development corridor) In addition, Green Resources will assist in the establishment of 54,000 ha of forests by local smallholders and companies. A partnership between Green Resources and Technoserve aims to improve soil conservation, biodiversity and food security for the people in the region. The Agro-Forestry Village Program has as the ultimate beneficiary the rural farmer that has to be part of the development process and has to reap socio-economic benefits (e.g. employment, improved farming practices, market access, social facilities and services) 	<ul style="list-style-type: none"> ~ 140 k\$ per ha / year <i>Similar projects are calculated for a 10 years period</i>
	Implementation Barriers
	<ul style="list-style-type: none"> There is the need for high involvement of the local communities
	Potential financing institutions and partners
	<ul style="list-style-type: none"> High Net Worth Individuals, IFC, DFID and ADB Technoserve, Nampula Provincial Government

Source: Technoserve, Green Resources, Food and Agriculture Organization of the United Nations

 ¹ FAO study on Agro forestry projects - <http://www.fao.org/docrep/u2246e/u2246e06.htm#a>. benefits and costs to the farmer 186

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2.4 Adaptation measures Short List – Country-wide significance

From the top 12 list, 3 projects have major significance for the country, whereas the remaining projects are regionally important but lack significant country-wide impact

Project	Potential Impact	Comments
Microcredit for adaptation	Nationwide	<ul style="list-style-type: none"> Only three projects have a nationwide impact <i>per se</i>: 1. The projects by themselves are replicable all over the country and can reach a significant number of small businesses (e.g. microcredit and composting projects) 2. The projects are a flagship in a sector that needs to be considered as key for climate change adaptation (e.g. Infrastructure and financing mechanisms)
Develop of fertilizers by composting of organic waste		
Construction of a Bridge		
Introduction of drainage systems	Gaza	
Bioetanol Production	Cabo Delgado	
Increase crops yield	Cabo Delgado	
Reforestation with agricultural activities	Buzi and Dondo	
Development of agro forestry	Cabo Delgado	
Development of agro forestry	Nampula	
Solar panels for irrigation	Cabo Delgado	
Introduction of Resilient crops for the production of Biofuel	Nacala	
Construction of Mini Dams	Buzi and Dondo	
Small Scale Solar Plants	Maputo	

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2.1 Executive Summary

To design initiatives with a country-wide impact, the projects were aggregated into themes to address some of Mozambique's most strategic challenges: energy, water, forestry, tourism

Project aggregation by strategic area

Projects	Areas	Energy	Water	Tourism	Forestry/ Agriculture
Alternative food and (renewable) energy production, CD		X	X		X
Increase crop yields, nationwide					X
Reforestation with agricultural activities, Buzi					X
Development of agro forestry, CD, Nampula					X
Income diversification with waste composting, nationwide		X			X
Irrigation with solar panels, Gaza, CD		X	X		
Resilient crops, Nacala, Gaza			X		
Water security and energy with Mini Dams in Búzi River		X	X	X	
Small Scale Solar Plant, Maputo		X		X	
Access during floods through bridge construction, Buzi			X		
Income diversification through microcredit for adaptation, nationwide		X		X	
Identification of new programs e.g. insurance, company early warning systems, other		X	X	X	X

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3.1 Executive Summary

An overarching theme of Community Energy Program was selected as top priority in the reduction of vulnerability whilst having real relevance for the private sector

Phase II

Community Energy Program				
Clean Energy	Micro & Small Scale Lending	Composting	Insurance	New Programs
<ul style="list-style-type: none"> ■ Target projects of this program will be focused on creating energy independence for agriculture, tourism and other sectors, as well as for rural communities, via the promotion of sustainable electricity generation 	<ul style="list-style-type: none"> ■ The target segment of the population is mainly micro and small companies and communities working as companies in sectors like tourism, agriculture, industry or energy 	<ul style="list-style-type: none"> ■ The program will be nationwide and cover all the major cities of the country and will be developed through several concurrent pilot projects ■ The main products are organic fertilizer and methane emissions reduction 	<ul style="list-style-type: none"> ■ No major insurance player has a real presence in Mozambique and similarly to the investment sector, many comment on the need for a stable regulatory framework and strong governance if a more penetration of products is to develop. 	<ul style="list-style-type: none"> ■ After these initial Programs, the next Programs scouted should obey to a list of selective criteria: sustainability impact, interest for Mozambique and the investors and capacity to build resilience to climate change

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3.1 Executive Summary

The Clean Energy Program will address on one hand the insufficient electricity supply in Mozambique, and on the other hand take advantage of the tremendous natural resources

Phase III

Clean Energy Program	
Project Summary	
<ul style="list-style-type: none"> ■ Mozambique has tremendous untapped natural resources for the development of renewable energy (wind, solar, hydro,...) ■ With this Program, the Mozambican Government aims to boost a sector that is crucial for building resilience to climate change, one that has not been widely addressed so far ■ The Program will allow investment in micro (1-10 kW)/mini scale (10-100 kW) and distributed utilities (100-1.000 kW) projects. These installations are crucial for the development of some social services (hospitals, schools) and the flourishing of commerce, industry, agriculture and fishing 	
Forecasted Investment	175-200 M€
Major Investors	Specialized funds, Private Equity, National & Multilateral Development Finance, Industry players
Pilot Project	Construction of a 1MW on-grid PV plant in Maputo

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3.1 Executive Summary

The two main goals of the Composting Program are the improvement of the waste management procedures and the increase in fertilizer usage in agriculture

Phase III

Composting	
Project Summary	
<ul style="list-style-type: none"> ■ Low agricultural yields and waste management are two significant problems in Mozambique ■ To address both, the Mozambican Government will launch this Program which addresses solid organic waste treatment and builds resilience to climate change by incentivizing the wider usage of fertilizers in agriculture, increasing yields and economic returns ■ The composting sites will use waste from households, communities, commerce and industry, in order to produce fertilizers that will then be sold to farmers and cooperatives 	
Forecasted Investment	15-30 M€
Major Investors	Environmental Funds, Private Impact, Grants & Foundations, National & Multilateral Development Finance
Pilot Project	Pilot project in Pemba, in partnership with the Aga Khan Foundation

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3.1 Executive Summary

The Micro and Small Scale Lending Program will help financing, with bearable interest rates, projects that help building resilience to climate change in Mozambique

Phase III

Micro & Small Scale Lending	
Project Summary	
<ul style="list-style-type: none"> Mozambique is one of the world's countries with lowest access to financing, which hinders the birth and growth of entrepreneurs/SMEs, the backbone of any country's economy The Program aims to help fund projects that foster resilience to climate change and at the same time fortify Mozambique's economy By creating pre-negotiated packs with suppliers of irrigation, energy, transport and other equipment, we plan to be able to offer attractive loan conditions for stimulating micro and small-scale financing of resilience building initiatives and projects nationwide 	
Forecasted Investment	25-50 M€
Major Investors	Regional and international wholesale banks, National & Multilateral Development Finance Institutions, Micro-Finance Funds
Pilot Project	Partnership to be established with two of the biggest banks in Mozambique (Socremo or Novobanco)

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3.1 Executive Summary

Appropriate insurance products could have a significant impact on the likelihood of the successful implementation of the selected projects

Phase III

Summary of activities
A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed

Interviewed parties
AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk

	Data mapping	Governance and regulation	Pricing and value	Products versus events	Distribution and collection
Insurance	Availability of reliable, historic data remain a critical factor in determining risk and understanding where product risks end and insurance can take over	As with other financial products, a stable, enforceable regulatory framework remains a requisite for scalable corporate transactions.	Lack of data, cluster risks and a challenging operating environment make pricing risk extremely difficult for climate related risks	Involvement of the insurance sector varies across the pilot projects. Factors that are product-related e.g. for the renewables or composting programs are easier to insure than weather or climate related factors e.g. agroforestry	For programs with higher volume collection and product distribution e.g. microfinance and agro-forestry local partnership with trusted players with an understanding of the operating environment will be key

Pilot project approach
A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of "investment"

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3.1 Executive Summary

However, to bring these Programs to light it's necessary to overcome a series of investment barriers that have been detrimental to the external investment in Mozambique

Phase III

Framework of analysis	Key issues
	<p>Access to electricity and a decrease in foreign investment due to the current global crisis are two of the most pressing barriers. Another big deterrents of private investment, specially foreign investment, are the levels of corruption.</p>
	<p>From a list of issues that should be overcome in the near future the most pressing are the establishment of feed-in tariffs and of an adequate legislative framework</p>
	<p>In the Composting Program the most important barriers are also on the economic/financial and legislative side, with initial investment and lack of legislation playing an important role</p>
	<p>Logistic barriers and inadequate mindset are the most pressing barriers concerning the Micro & Small Scale Lending Program</p>

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3.1 Executive Summary

A key aspect for the success of these Programs is the creation of a sound support structure, to ensure efficient communication and a swift decision making process

Phase III

Strategic Recommendations

- A **dedicated team** will work exclusively on the set-up of each of these Programs
- A **Unique Point of Contact (UPC)** will be established to support international investment in to these and other climate change adaptation and resilience building programs, ensuring a clear and effective channel for investment.
- This UPC is supported by a team of experts that will manage the economic, technical and legal aspects of the projects in each Program and the relationship between international investors and local promoters, authorities and communities.
- In addition to building climate change resilience, another important target of these Programs is **to build the required skills and capabilities** in Mozambique to ensure the execution and continuity of these Programs, as well as to develop future initiatives. With this in mind, a Capability-Building project is to be launched where local resources will receive appropriate training, side-by-side learning with external experts and necessary technical assistance
- However, without a portion of **public funding** to start these initial four Programs and without ensuring **proactive Government support**, the private sector will not be interested to make the investments on their side as the costs/barriers will be too great

```

graph TD
    PM[Prime Minister] <--> UPC[Unique Point of Contact (UPC)]
    UPC <--> TT[Transversal Team]
    TT --> MSTL[Micro & Small Scale Lending]
    TT --> Comp[Composting]
    TT --> Ins[Insurance]
    TT --> CE[Clean Energy]
    MSTL --- ST1[Specific Team]
    Comp --- ST2[Specific Team]
    Ins --- ST3[Specific Team]
    CE --- ST4[Specific Team]
    
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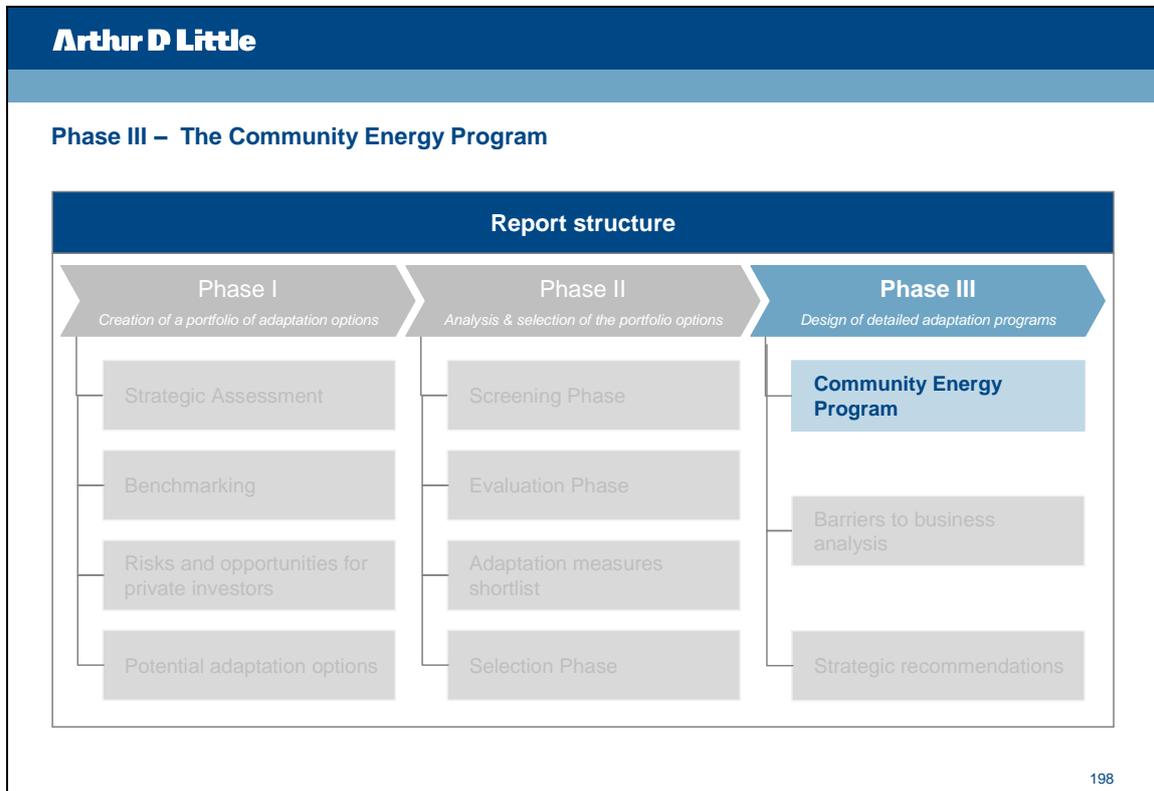
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3.2 Community Energy Program – Programs' overall structure

The major goal of the Community Energy Program is the implementation in Mozambique of a set of projects to reduce vulnerability and increase resilience to climate change

Program overview	
Objective	Key components
Implementation of a set of projects that will reduce vulnerability and increase Mozambique's resilience to climate change	■ Capacity building
	■ Creation of unique point of contact for investors
	■ Provisioning of on going technical support
	■ Drive legal framework alignment for the promotion of investment
	■ Monitoring of the program implementation and operation

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3.2 Community Energy Program – Addressing Rio+20 critical issues

The Community Energy Program address all the critical issues defined by the Rio+20 agenda

Addressing Rio+20 critical issues	
Jobs	All the Programs have direct job creation, however they also allow for indirect job creation. For instance bringing electricity to population fosters the development of new businesses in commerce, agriculture, fishing and services
Energy	The Clean Energy Program addresses this issue directly, by bringing renewable energy to the populations under a distributed energy concept
Cities	From the targets of the Community Energy program, Micro & Small Scale Loans and Composting are probably those that contribute more for a sustainable city development, by improving significantly the quality of life of their citizens
Food	The Community Energy Program addresses this issue, by contributing for a sustainable agricultural production, with the parallel benefit of reforestation
Water	Access to clean water is a side benefit of the Clean Energy program (by providing use to water pumps) and the Micro & Small Scale Loans (by providing the financial means to access to clean water)
Oceans	Fishing is one of the main activities in Mozambique. Access to electricity allows the conservation of fisheries and an increase in quality of life
Disasters	The Community Energy Program has the common and primary goal of increasing resilience to climate change, and thus to natural disasters

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3.2 Community Energy Program – Programs' overall structure

Each of the program's is divided in three stages: an initial set up phase, the pilot project set up and implementation and finally the creation of a comprehensive pipeline of projects

Program's structure

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3.2 Community Energy Program – The three steps

In the Program set up phase the ground work will be set for all the logistic/ legal/ financial/ personnel aspects of the Program, that will be further explored in the two subsequent phases

A Program set up

- Identify all the core competences needed for each Program and start a Human Resources work thread by identifying suitable candidates and giving them the proper training
- Define the articulations of each Program with the Governmental institutions to maximize the existing structures, optimize the relationships and avoid any clashes
- Identify all the suitable partners and investors and start building-up & formalizing the relationship with them
- Secure the necessary funding for the capacity building phase
- Finalize the identification of the pilot projects, identify all the investments necessary and define the timings for their implementation

B Pilot Projects' set up and implementation

- Start gathering the teams for each pilot project (composed of external experts and local resources)
- Put each pilot project in place, and build necessary relationships with end-users and consumers
- Build institutional support at the national, regional and local levels
- Create awareness for the pilot projects – and their climate adaptation benefits - at both the national and international level
- Secure funding for the pilot projects and organize roadmap and road shows for funding the building of the pipeline of projects to make up the Program portfolio

C Pipeline of projects

- Intensify the road show presentations and fund raising activities to maximize the number of projects in the portfolio of each Program
- Populate each Program portfolio with new projects
- Market these projects/Programs to the international community
- Increase the involvement of the local teams and resources to start the "capabilities transition process"
- Invite researchers and investigators to participate in the Programs and support them in publishing the results of their observations
- Implement the monitoring systems for measuring climate adaptation benefits and sustainability of the projects

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3.2 Community Energy Program – Program set up

The Program set up will require very specific competences for each of the Programs and also a unique type of financing, less focused on returns and more on building competences

Program set up	Summary of activities Make all the necessary arrangements to have everything that is needed for each Program (personnel, structures, authorizations, hierarchies, etc...) ready to launch the pilot projects and the overall Program management as soon as possible		
	Clean Energy	Composting	Micro & Small Scale Lending
	<p>Capacity building Personnel with deep knowledge of renewable energy (solar, wind, hydro), CDM and other financing mechanisms for developing countries and of the Mozambican reality</p> <p>Types of funders National and Multinational Development Agencies, Grants & Foundations</p> <p>Duration Approximately 3-6 months</p> <p>Major challenges No defined feed-in tariff system, lack of financial capacity, very disperse locations, bureaucratic licensing process, difficulties in negotiating with EDM</p>	<p>Capacity building Personnel with knowledge of composting best practices and with ground knowledge of where to get the waste and whom to sell the fertilizer</p> <p>Types of funders National and Multinational Development Agencies, Grants & Foundations</p> <p>Duration Approximately 3-6 months</p> <p>Major challenges Educating populations for correct waste separation and the benefits of using compost in agriculture. Creating effective network of waste collectors and fertilizer distributors</p>	<p>Capacity building Personnel with deep financial and accounting knowledge and capacity to manage a financial institution</p> <p>Types of funders National and Multilateral Development Agencies, Grants & Foundations</p> <p>Duration Approximately 3-6 months</p> <p>Major challenges Educate populations for this type of lending. Evaluate project impact in building resilience for climate change. Network reach that covers all target populations</p>
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3.2 Community Energy Program – Pilot Project

Pilot Project's set up and implementation	Community Energy Program – Summary of Activities Implement pilot projects and gather new investors for the Programs' roll-out to a portfolio of projects. Portfolio building, monitoring pilots and feedback cycle to ensure lessons learned are incorporated into following projects.		
	Clean Energy	Composting	Micro & Small Scale Lending
	<p>Micro (1-10 kW), Mini (10-100 kW), Distributed Utilities (100-1000 kW) projects Pilot: 1 MW PV plant in Maputo</p> <p>Capacity building Personnel with capacity to understand the specificities of the project and negotiate with the Government and funders. Personnel with fund raising capacities. Personnel with deep knowledge of renewable energy (solar, wind, hydro), CDM and other financing mechanisms and of the Mozambican reality</p> <p>Types of funders Specialized funds, Private Equity, National & Multilateral Development Finance, Industry</p> <p>Duration /Cost Pilot: 12 months/ \$ 375,000 (total private investment \$4.5 million)</p> <p>Forecasted private sector investment, 5 years: approx.USD 250 million for 33 MW</p> <p>Benefits: 575,000 people and hundreds of businesses with electricity access. Improved productivity, improved living conditions, improved health facilities, reduced pollution, easier access to early warning through improved connectivity</p> <p>Major challenges Negotiating with FUNAE, EDM or other Government institutions. All the installation operational issues. No defined feed-in tariff system, lack of financial capacity, very disperse locations, bureaucratic licensing process,</p>	<p>Solid organic waste treatment for agricultural fertilizer production Pilot: Pemba</p> <p>Capacity building Personnel with capacity to understand the specificities of the project and negotiate with the suppliers, funders and end consumers. Personnel with fund raising capacities</p> <p>Types of funders Environmental Funds, Private Impact, Grants & Foundations, National & Multilateral Development Finance</p> <p>Duration/Cost Pilot: 12 months/\$180,000 (total private investment \$400,000)</p> <p>Forecasted private sector investment, 5 years: approx.USD 20 million</p> <p>Benefits: Pilot: aprx 100,000 people, reduction in contamination of soil, groundwater, air (CH4, CO2), 95 tons of fertilizer for yield increase from the pilot (Year 1), income generation</p> <p>Major challenges Optimize the waste collection and the fertilizer production with the consumption/sales. Guarantee buyers for the fertilizer. Seasonality and variance in conditions. Relatively high operating / maintenance costs. Lack of incentives for composting. Requires presence of basic utilities. Educating populations on correct waste separation and the benefits of compost in agriculture. Creating effective network of waste collectors and fertilizer distributors</p>	<p>Class A loans (\$100-5000), Class B loans (\$10,000-\$100,000). Access to water, irrigation, mangroves, house refurbishment Pilot: Maputo and surrounding area</p> <p>Capacity building Personnel with experience in setting up a financial institution, financial and accounting knowledge, and capacity to negotiate with the funders and MFIs. Personnel with fund raising capacities</p> <p>Types of funders Regional and international wholesale banks, National & Multilateral Development Finance Institutions, Micro-Finance Funds</p> <p>Duration/Cost Pilot: 12 months/ \$ 365000 (total private investment \$2.5 million)</p> <p>Forecasted private sector (bank) investment, 5 years: approx.USD 25 million</p> <p>Benefits: Financial inclusion. Pilot: Aprx. 190 projects, 1 year. Improved resilience to climate change shocks (agriculture, water, housing)</p> <p>Major challenges Negotiating with the partners and investors. Quality of governance. Track record of counterpart. Transmit confidence to borrowers. Ensure an adequate balance of interests, management costs and borrowers capacity to pay. Educate populations for this type of lending. Evaluate project impact in building resilience for climate change. Network reach that covers all target populations</p>
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3.2 Community Energy Program - Building a pipeline of projects

Building a healthy, sustainable and nation-wide pipeline of projects is the natural step after the implementation of the pilot projects and the ultimate goal of these four Programs

Pipeline of Projects

Summary of activities
Maintain the road show and fundraising activities and populate the Programs with new projects. Intensify the awareness campaigns and prepare a mid Program result's meeting

Clean Energy **Composting** **Micro & Small Scale Lending**

Capacity building
Project manager with capacity to manage the Program from one end to the other. Team of fund raisers to contact external investors. Team of marketing people to advertise and increase Program's awareness.

Types of funders
Regional and international wholesale banks, National & Multilateral Development Finance Institutions, Micro-Finance Funds, Specialized funds, Private Equity, National & Multilateral Development Finance, Industry players

Duration
4 years (at least)

Major challenges
Fund raising and building independence/autonomy in the Program's management. Select an adequate pipeline of project's given the existing constraints (very disperse locations, lack of FIT, difficulties in financing the projects, costly projects)

Major challenges
Fund raising and building independence/autonomy in the Program's management. Ensure a continuous flow of waste to the composting sites, and the existence of clients for the fertilizer

Major challenges
Fund raising and building independence/autonomy in the Program's management. Minimize the default risk in the projects. Attract people to this type of financing

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3.2 Community Energy Program– Program set up phase costs (1/2)

In the Program Set up phase, the majority of costs for the specific teams will be related with human resources (hiring & training), technical material and support & back office...

Program Set up (6 months) – Specific teams¹

Category	Sub-category	Cost (€)
Clean Energy	Human Resources	
	International experts	180.000
	Local resources	14.400
	Training	20.000
	Technical	
	Solar, wind and hydro mapping	30.000
	Modeling	30.000
	Support	
	Offices	
	Support material (computers, mobiles,...)	6.400
Back office personnel	2.400	
Total		285.000
Composting	Human Resources	
	International expert	90.000
	Local resources	10.800
	Training	9.000
	Technical	
	Nutrient requirements, new techniques,...	10.000
	Modeling	15.000
	Support	
	Offices	1.800
	Support material (computers, mobiles,...)	4.100
Back office personnel	2.400	
Total		143.100
Micro and Small Scale Lending	Human Resources	
	International expert	
	Local resources	180.000
	Training	18.000
		24.000
	Technical	
	Financial analysis tools, subscriptions	
	Modeling	25.000
	Support	
	Offices	20.000
Support material (computers, mobiles,...)	1.800	
Back office personnel	6.400	
	2.400	
Total		277.600

¹See Chapter 5 for more details on the Transversal Team and Unique Point of Contact. All values in euros (€)

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3.2 Community Energy Program – Program set up phase costs (2/2)

... while the costs associated with setting up the transversal team and unique point of contact are exclusively from personnel

Program Set up (6 months) – Transversal Team & Unique Point of Contact¹

Category	Role	Cost (€)
Transversal Team ² (6 months)	Coordinator	6.000
	Clean Energy Program Point of Contact	4.800
	Composting Point of Contact	4.800
	Micro & Small Scale Lending Point of Contact	4.800
	Total	20.400
Unique Point of contact ² (6 months)	Coordinator	6.000
	Personal Assistant	3.600
	Total	9.600

¹All values in euros (€); ²See Chapter 5 for more details on the Transversal Team and Unique Point of Contact

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3.2 Community Energy Program – Pilot Project set up and implementation phase costs

The overall cost of the pilot projects is some 6,25 M€, with the majority being allocated to the Clean Energy Program

Pilot Project's set up and implementation

Category	Cost
Clean Energy	3,4 M€
Composting	350 k€
Micro and Small Lending	2,5 M€

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View slide 302 for more details

View slide 320 for more details

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3.2 Community Energy Program – Pipeline of projects phase costs

Creating an healthy and interesting pipeline of projects is a crucial step in the overall Program structure, and where the majority of the investment will be made

Pipeline of Projects

Clean Energy		Composting	
Fund raise Program target	175 - 200 M€	Fund raise Program target	15 - 30 M€
Set-up the Program	(- 300 k€)	Set-up the Program	(- 150 k€)
Pilot Project	(- 3,4 M€)	Pilot Project	(- 350 k€)
Project Pipeline	~ 171 – 196 M€	Project Pipeline	~ 15 – 30 M€

Micro and Small Lending	
Fund raise Program target	25 - 50 M€
Set-up the Program	(- 300 k€)
Pilot Project	(- 2,5 M€)
Project Pipeline	~ 22 – 47 M€

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3.2 Community Energy Program – Overall view on costs

The total investment in the Community Energy Program, is around 265 – 380 M€ and will be raised from a mix of philanthropists and specialized funds, with debt for project roll out

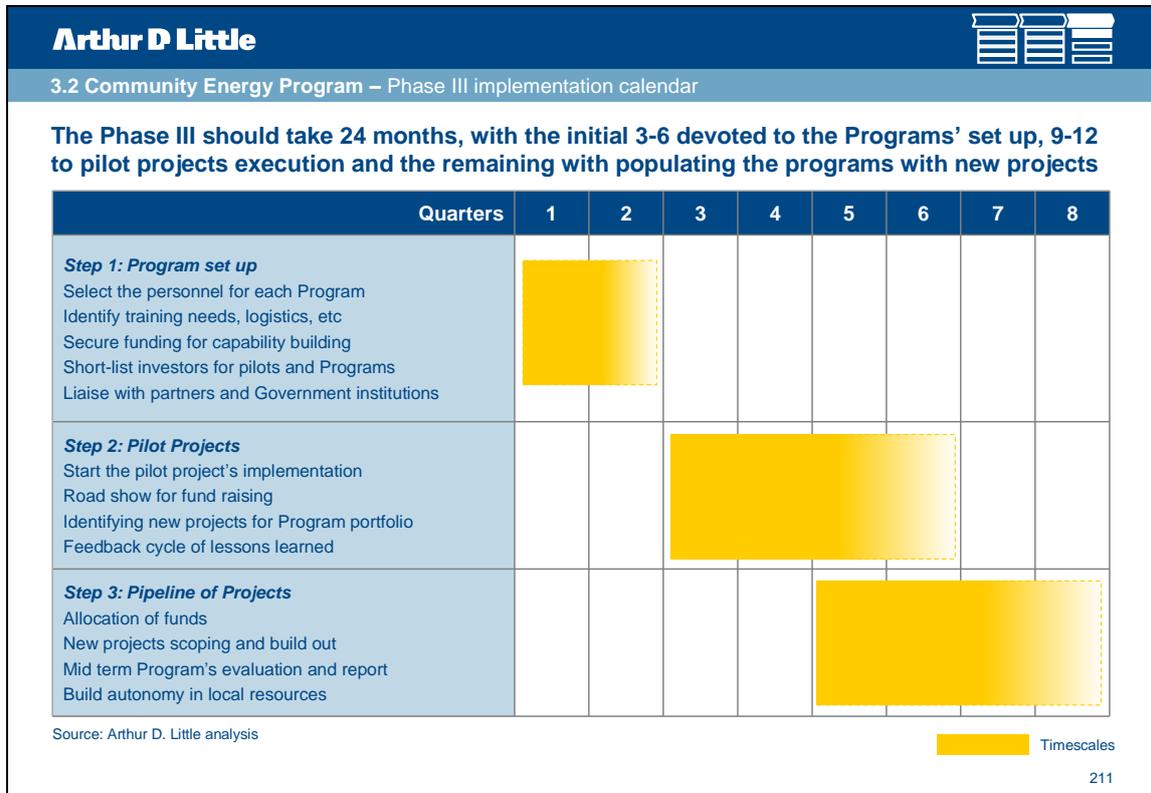
Overall costs

Stage	Value		
	6 months	6-18 months	12 months-onwards
Program Set up	735.700 €		
■ Unique Point of Contact	9.600 €		
■ Transversal Team	20.400 €		
■ Specific Teams	705.700 €		
Pilot Project Set up and implementation		9.250.000 €	
Pipeline of projects			255 – 370 M€
Total			265 – 380 M€

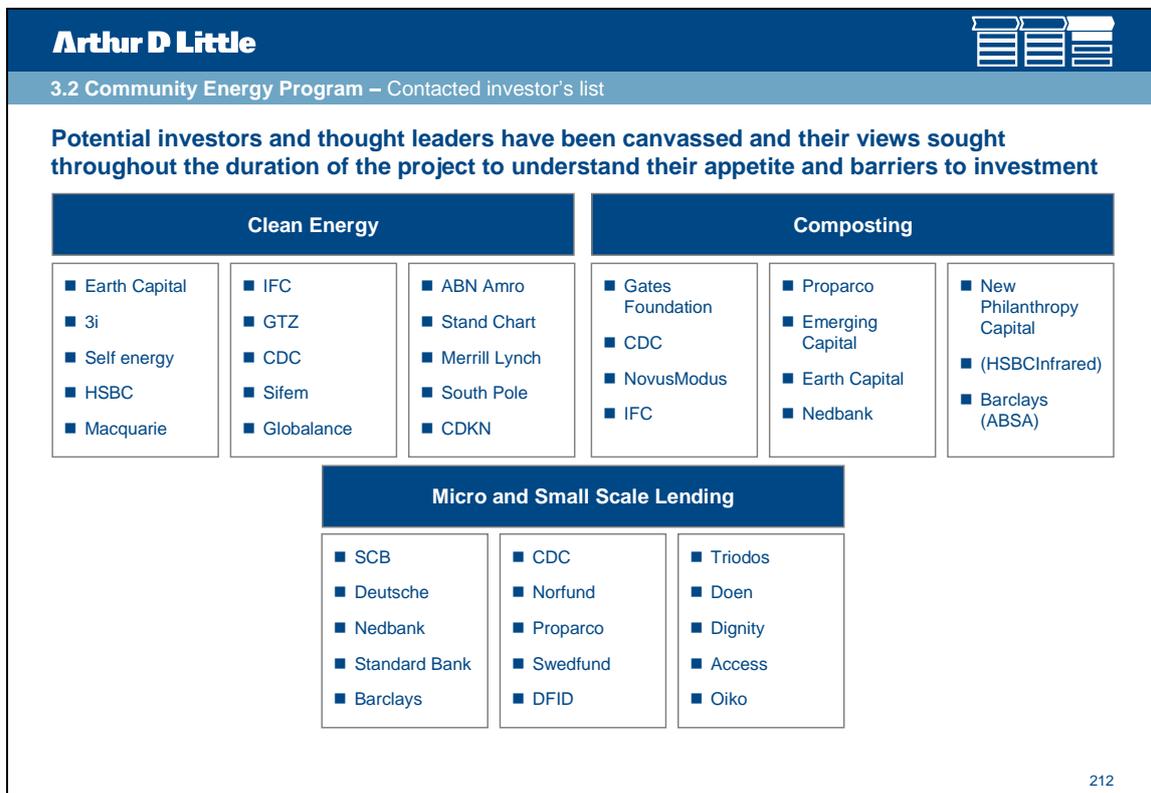
Without a portion of **public funding** to pump-prime these projects and proactive **Government support**, the private sector will not be interested to make the investments on their side as the costs/barriers will be too great

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3.2.1 Introduction – Electric production capacity

Mozambique produces electricity mainly from hydro with the majority of this production being exported to South Africa given the inexistence of distribution grid to bring electricity south

Mozambique's electricity production capacity

Split of total capacity by source, MW

Source	Capacity (MW)	Percentage
Total production	2,300	100%
Hydroelectric	2,185	97%
Fossil	145	3%

- 97% of the electricity production in Mozambique comes from hydro sources
- The 2,075 MW Cahora Bassa dam is responsible for 95% of the hydroelectric production in the country
- However, around **80% of the electricity produced in Cahora Bassa is exported** mainly to South Africa under the SAPP Agreement
- Mozambique imports power for use in the southern part of the country, namely Maputo

Cahora Bassa dam, Mozambique



Source: FUNAE; * solar and wind; **South African Power Pool Energy Supply

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3.2.1 Introduction – Use of renewable energy sources

Nevertheless, the use of renewable energy sources, other than hydro, has been limited so far

Use of renewable energy sources in Mozambique

Hydro 	Solar 	Wind 
<ul style="list-style-type: none"> Over 2.185MW of installed capacity The 2 GW Cahora Bassa dam is responsible for 97% of the country production There are 12 medium/size and large dams in Mozambique Considered the cheapest electricity source 	<ul style="list-style-type: none"> On grid projects are inexistent and there is no foreseen legal framework to promote investment Off grid projects have been critical to provide electricity to remote communities not connected to the grid These are typically small scale initiatives targeting schools, hospitals, public and also houses of families, typical funded by the government and donors. 	<ul style="list-style-type: none"> The use of wind energy is very limited, despite the favorable wind conditions Most common use is to support small scale pumping systems It is acknowledge by the government the potential of wind energy

Source: FUNAE; * solar and wind; **South African Power Pool Energy Supply

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3.2.1 Introduction – Current legislative framework and future perspectives

The Mozambican Government has considered the investment in renewable energy to address the country's power access limitations - however adequate legal framework is still lagging

Policy and regulation of renewable energy investments

	Situation	Mozambican Government objectives
On-grid	<ul style="list-style-type: none"> No established legislative framework for investments in solar and wind on-grid projects <i>Feed-in-tariffs</i> (FIT) assumed to be key mechanisms to promote investment in renewable energies - government officials state that a FIT framework will be put in place in the short-term 	<ul style="list-style-type: none"> Conclude mapping of national wind conditions Create legal framework to incentivize private investment in wind projects Install 100MW of wind energy capacity Install 125MW of hydroelectric capacity
Off-grid	<ul style="list-style-type: none"> Considered crucial to provide power to distant communities All public off-grid initiatives are centralized in one entity – FUNAE It is assumed that the definition of a sustainable tariff scheme is essential to incentive investment 	<ul style="list-style-type: none"> Install 50.000 solar and wind systems for households Install 5.000 solar pumping systems Install 5.000 solar and wind systems for small business Install 10.000 of micro/mini wind generators

Source: National plan for the Renewable Energy Sector

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3.2.1 Introduction – Off-grid projects

Off-grid projects have been essential to serve distant rural communities and have been promoted mostly by FUNAE - the governmental institution that centralizes of off-grid initiatives

Off-grid projects in Mozambique - Examples



- FUNAE was set-up by the government in 1998 to centralize off-grid projects initiatives
- Raises funds from donors, to invest in the projects with no expected return
- It is responsible for the identification and selection of projects, procurement of equipment and bidding process

Electrification of the Chicualacuala district

- Electrification of the district using photovoltaic systems
- Included homes, businesses, healthcare facilities and water pumping systems
- Beneficiated directly around 175 families



Construction of Mini hydroelectric plant in Rotanda

- Electrification the using a 650kw hydroelectric plant
- Will be the main source of energy in that point of the country
- Will beneficiate a population of around 13 thousand people



Source: FUNAE

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3.2.1 Program Description – Program overview

This Program aims to implement a series of renewable energy projects aimed to increase Mozambique's resilience to climate change

Limited electricity access	Distributed utilities	Lower CO₂ emissions
Address the limited access to electricity that Mozambican populations currently observe	Implement a distributed utilities approach to address the lack of a nation wide distribution grid	Promote the use of renewable energy in detriment of fuel based alternatives
International Investment	Sustainable Development	High natural resources
Open up the door to external investors to invest in Mozambique	Promote the sustainable development of commerce, agriculture and fishery	Harvest and profit from one of Mozambique's richest resources and create a reliable source of revenues

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3.2.1 Program Description – Program model

The Program will provide the opportunity to invest in a portfolio of projects with different return characteristics and profiles

Program operationalization

<p>Investment Community</p> <ul style="list-style-type: none"> ■ The funding of the program will include entities with different profiles, from non-profit organizations to institutional investors such as funds ■ The funds/ investments can be directed to financing of overall program, specific components (e.g. technical studies) or specific projects 	<p>Clean Energy Program</p> <p>The program organization will be responsible for:</p> <ul style="list-style-type: none"> ■ Analysis and selection and of the projects ■ Fund raising & investors relations ■ Capability building ■ Monitoring the projects ■ Provide technical assistance 	<p>Projects</p> <ul style="list-style-type: none"> ■ The projects will be selected following pre-defined sustainability and finance criterion ■ The portfolio will include projects of different scale and technology ■ There will be projects that will not generate return to investor that will be suitable for donors
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3.2.1 Program Description – Projects' profile

The portfolio will include projects with different sizes and technologies directed to meet needs of different segments of the population

Profile of the projects to be considered in the program

<p>Micro-scale <i>Off-grid</i></p> <ul style="list-style-type: none"> ■ Solar and wind systems with capacity between 1kW and 10kW (e.g.: electrification of small houses and water pumping systems) ■ Demand includes small families and house based business 	<p>Mini-scale <i>Off-grid</i></p> <ul style="list-style-type: none"> ■ Solar PV systems with production capacity of 10kW-100kW (e.g.: electrification of small villages, including public streets, schools, and health care facilities) ■ Demand includes local governments institutions and businesses 	<p>Distributed utility <i>Off-grid and on-grid</i></p> <ul style="list-style-type: none"> ■ Solar PV and hydroelectric plants with capacity of 100kW- 1.000kW ■ Off-grid projects can provide power to specific cities or a defined group of businesses through decentralized grids ■ Demand includes local governments and group of medium-size companies
<p><i>Wind pumping</i>  <i>Solar Powered house</i> </p>	<p><i>Solar Irrigation</i>  <i>Solar Power School</i> </p>	<p><i>Mini Dam</i>  <i>Solar Plant</i> </p>

Source: Arthur Little; FUNAE

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3.2.1 Program Description – Installed capacity

The programs aims to install around 33 MW over a 5 year period, following a gradual implementation roll-out

Target installed capacity

Year	Annual addition (MW)	Cumulative installed capacity (MW)
Y1	1	1
Y2	5	6
Y3	7	13
Y4	10	23
Y5	10	33

- The project aims to install a total of 33 MW over the program's lifetime
- The roll-out of the projects will be gradual in order to assure the sound implementation of the program's components -such as capacity building- and a effective leverage of the learning curve
- The program will start with the implementation of a pilot project in the first year

Source: Arthur Little;

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3.2.1 Program Description – CapEx

The CapEx associated with each type of project varies significantly, raging from €3,4 million to 15 million per MW

CapEx per type of project

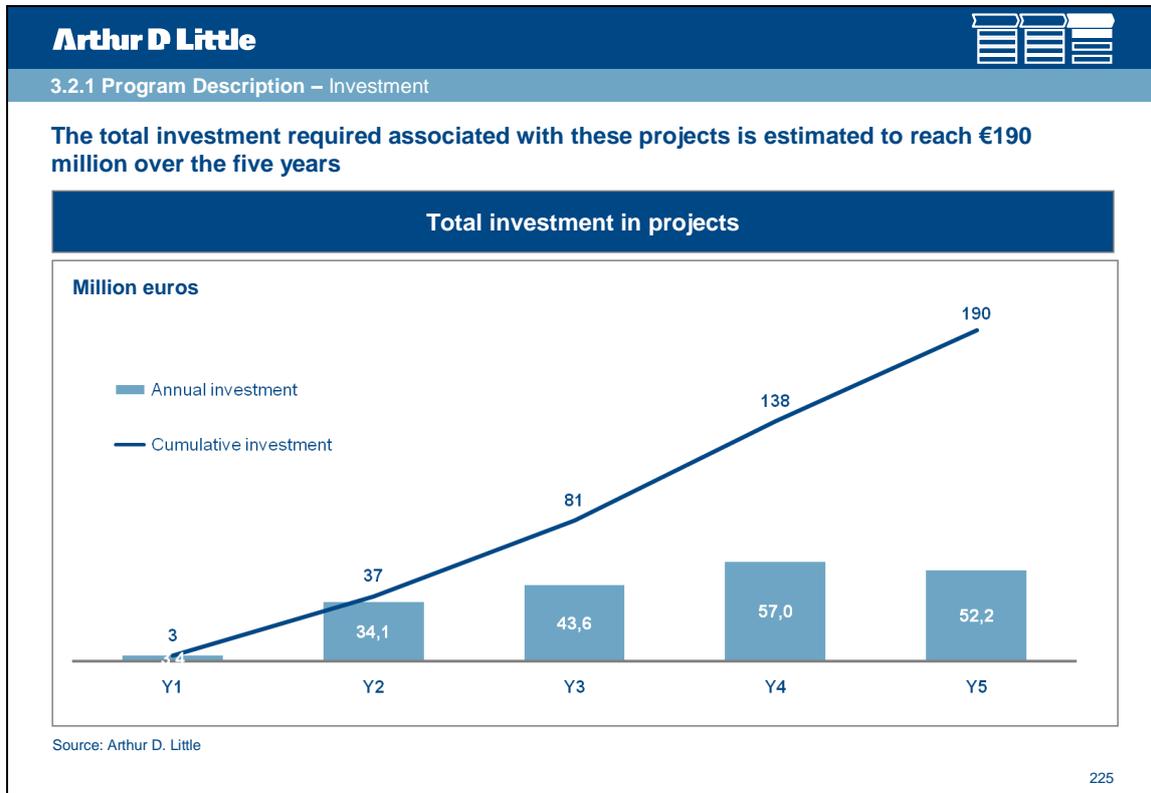
Project Type	CapEx per MW (€ Million / MW)
Micro / Mini scale projects	15
Distributed utility projects	3.4

- CapEx can vary significantly in function of the project size. Based on projects being developed in Mozambique:
 - Micro and Mini scale projects can reach around €15 million per MW. High cost are mainly due to the small size per project, additional equipment (e.g. batteries) and challenging logistic circumstances such as dispersed remote locations with poor road accesses
 - The Capex for on-grid distributed utility projects are significantly lower, estimated at €3,2 million per MW
- CapEx per MW is expected to decrease around 10% per year due to falling price of key components (e.g. panels) and increase efficiency in the installation of the projects and economies of scale

Based on Selfenergy Mozambique projects

Source: Arthur D. Little; Selfenergy

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3.2.1 Program Description – Sources of funding

The program will count with different sources of funding depending on the typology of the project

Sources of funding	Micro-scale	Mini-scale	Distributed utilities		Technical studies
			Off-grid	On-grid	
Donors Include private and pure government donors	✓	✓	✓		✓
Impact investors Include development finance institutions and private impact investors				✓	
Micro-finance institutions Provide loans to individuals or small business	✓	✓			
Investment funds Includes infrastructure and private equity funds				✓	
Local businesses Group of business with significant power needs to operate			✓		

Business owners have demonstrated willingness and resources to fund jointly with other owners, projects that solve their power needs

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3.2.1 Program Description – High level selection methodology

Each project within the Clean Energy Program will be subject to a three phases analysis, to guarantee that fully fulfills all the selection criteria

Phase I Sustainability assessment	Phase II Operational criteria	Phase III Cost-benefit analysis
<ul style="list-style-type: none"> Respect for basic human rights Impact on ecosystem: the project should comply with national environmental regulation and policies. The impacts on the ecosystem are to be clearly identified and evaluated. A plan to address the environmental impacts has to be developed with concrete initiatives, milestones and monitoring systems. Climate-resilience contribution: the project has to have the potential to generate a clear contribution to the country's resilience to climate change and is located in a region identified as a priority. Benefits for the local community: the project has to have the potential to generate benefits for the local community 	<ul style="list-style-type: none"> Time to implementation: verify if the project's timeframe aligned with the program's. Attractiveness to investors: assess the existence of potential private investors with interest in the project 	<ul style="list-style-type: none"> Investment: investment associated with the implementation of the project Operating costs: expected operating and maintenance costs of the project Revenues: expected delta in revenues deriving from the adaptation measure Loss averted: costs that are expected no longer exist due to the implementation of the project

Source: Arthur D. Little analysis

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3.2.1 Program Description – Capacity building

Another key aspect of this Program, is the development of “in house” competences, to foster in a near future, total local autonomy in the management of the Program

Human Resources	Training	Learning by Doing	Technical Assistance	Assets
<ul style="list-style-type: none"> Training and recruiting of personnel with capacity to deal directly with the international investors and project promoters Recruiting of personnel with “ground knowledge”, i.e., deep knowledge of the Mozambican reality and geographies, to identify the best opportunities 	<ul style="list-style-type: none"> Development of core capabilities, including technical, financial and legal Development of workshops, seminars and study tours to the successful pilot projects for the key officials and stakeholders, as well project developers and potential investors 	<ul style="list-style-type: none"> Create “mixed” teams, incorporating local personnel and external consultants, to foster the knowledge transfer and create a pool of internal resources fully capable of implementing the entire process Involvement of local communities during implementation of the projects to ensure the sustainability and local ownership of the project 	<ul style="list-style-type: none"> Provide single window technical advisory services, including technical feasibility study and technical trouble shooting services to potential developers 	<ul style="list-style-type: none"> Development of support infrastructure, including IT tools, monitoring instruments

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3.2.1 Program Description – Impact of the program

It is estimated that the program will provide access to electricity to approximately 575.000 Mozambicans

Impact of the program

Population estimated to gain access to electricity due to the program*

Year	Yearly Increase	Cumulative
Y1	0	0
Y2	25.000	25.000
Y3	125.000	150.000
Y4	175.000	325.000
Y5	250.000	575.000

- It is estimated that the 31 MW to be installed will serve around 575.000 people, which represents around 5% of the population that currently has no access to electricity
- In addition it is estimated that several hundreds of businesses will benefit from electricity access

Source: Arthur D. Little; FUNAE; *it is estimated that in Mozambique 1MW of electricity serves approximately 25.000 persons

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3.2.1 Program Description – Impact of the program

The increase share of the population with access to electricity will generate benefits at several levels

Impact of the program

Health conditions increase	<ul style="list-style-type: none"> Inherent improvement in the healthcare facilities with the installation of electricity Improvement in air quality in households due to reduction in the use of polluting fuels for cooking and lighting; and better nutrition due to refrigerated storage
Increase in the level of education	<ul style="list-style-type: none"> Electrification of classrooms allowing for night schooling for adults Possibility to study at home
Increase in public structures quality	<ul style="list-style-type: none"> Increase in public safety due to public lighting
Increase in business productivity	<ul style="list-style-type: none"> The introduction of lightning and electric tools will increase productivity and diverse activities
Pollution reduction	<ul style="list-style-type: none"> Displacement of existing nonrenewable energy sources, mostly kerosene
Poverty reduction	<ul style="list-style-type: none"> Possibility of new business creation (small shops, agriculture and fishing yields increase, etc...) and better nutritional conditions
Increased connectivity	<ul style="list-style-type: none"> Awareness programs are easier to reach and early warning and response in the event of a disaster is more effective

Source: The World Bank: The Welfare Impact of Rural Electrification:

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3.2.1 Program Description – Sustainability monitoring

On a yearly basis this Program will be evaluated using a dedicated questionnaire, that evaluates the impact of the program in the promoters, investors, and overall community

Sustainability Monitoring

- The sustainability monitoring is to be performed at least on a yearly basis
- A significant sample of the population should be selected to allow for representativeness
- A yearly comparison should be performed to assess the existence of improvements

The full questionnaire is given as an Appendix to this Report

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3.2.1 Pilot Project – Description of Pilot Project I

A pilot project underway is the construction of a 1 MW of grid PV plan in the city of Maputo, with a total investment around 3,4 million euros

Pilot project 1: Construction of 1 MW on-grid PV plant

Description	<ul style="list-style-type: none"> The project consists of the construction of a 1 MW on-grid PV plant in Maputo The government has demonstrated strong willingness to introduce feed-in tariffs (FIT) for on-grid PV projects in the short-term The FIT is expected to be around €300/ MW The project has been designed by Selfenergy 	<p>Financial inputs</p> <p>Investment: €3,4 million (considers equipment and construction)</p> <p>Higher than current on-grid PV projects in developed countries due to logistics issues and limited economies of scale</p> <p>Operational costs: 16% of revenues</p> <table border="1"> <tr> <td>O&M</td> <td>8%</td> <td>of Revenues</td> </tr> <tr> <td>Rent</td> <td>3%</td> <td>of Revenues</td> </tr> <tr> <td>Insurance</td> <td>5%</td> <td>of Revenues</td> </tr> </table> <p>Estimated equivalent hours: 1.553 /year</p> <p>FIT: €250 €275 €300 / MW</p> <p>The returns were simulated for these FIT possibilities</p>	O&M	8%	of Revenues	Rent	3%	of Revenues	Insurance	5%	of Revenues
	O&M		8%	of Revenues							
Rent	3%	of Revenues									
Insurance	5%	of Revenues									
Promoter	<ul style="list-style-type: none"> Selfenergy has been involved for several years in the construction off grid projects in Mozambique Has extensive experience in the construction of PV plants on and off grid in Portugal, Spain and Mozambique 										

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3.2.1 Pilot Project – High level financial analysis

Considering a 20 years timeframe and a FIT of €275/ MW, the returns for this project (in the absence of any financial leveraging) are some 8%

High level financial analysis

FIT (€ / MW)	pIRR
250	6,8%
275	8,0%
300	9,1%

Payback time
~ 11 years

Source: Arthur D. Little analysis

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3.2.1 Pilot Project – Timings

The first 5 months of the project will be used to set the grounds for the overall structure, that will be put in practice until the end of the year

Months (2012)	1	2	3	4	5	6	7	8	9	10	11	12	2013
Negotiation of feed-in-tariff	█	█	█										
Negotiation of other licenses (land, insurance, ...)			█	█	█								
Infrastructure construction				█	█	█							
Project launch & operation						█	█	█	█	█	█	█	█
Mid term pilot project evaluation									█				
Sustainability monitoring and evaluation of Pilot project results												█	
Fund raise for new projects & implementation of new projects						█	█	█	█	█	█	█	█

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3.2.1 Pilot Project – Description of Pilot Project II

Another pilot project underway is the investment on the electrification of a small rural community through off-grid PV systems

Pilot project II: Electrification of small village

Description	Financials
<ul style="list-style-type: none"> The country has been conducting efforts to provide electricity to rural communities through off-grid systems The pilot project consists in the electrification of a small village in Maputo through off-grid PV system The project is to be developed by Selfenergy which has been closely involved in the initiatives developed by FUNAE Over the last three years Selfenergy implemented relevant off-grid projects in Mozambique such as: <ul style="list-style-type: none"> The electrification of 50 schools, 50 healthcare centres and 2 hospitals Implementation of 200 PV solar panels in Maputo 	<ul style="list-style-type: none"> The project considers PV off-grid systems with a total capacity of 200 Kw Investment: €3 million (€15M/MW) Significantly higher than on-grid projects mainly due to small scale and additional equipment, such as batteries Returns: <ul style="list-style-type: none"> Typically investors in these projects do not expect financial returns However, institutions such as micro finance institutions can provide financing to individuals or small businesses

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3.2.1 Investors' contacts – Main messages

Distributed renewable energy has many "followers" but a combination of strong governance, the right regulatory framework and being clear who you are dealing with is critical

Main messages

"The length of payback in distributed renewable energy is such that as an investor I need to know that the regulatory environment is stable enough to protect my investment"

Earth Capital Partners - Partner

"There are many projects to put money into which makes making a decision to invest in a country like Mozambique all the more difficult" -

Venture Capitalist

"Getting a real understanding of operational and maintenance costs/supply in a country like Mozambique is vital"

Self Energy – Head of Business Development

"As with all investment in countries like Mozambique, you need to choose right partner and know who you are dealing with"

Emerging Capital Private Equity – ESG Head

"We like the idea of a program to set up multiple distributed energy projects. We really need to get a strong understanding of investment profiles on the projects"

CDC – Investment Partner

Source: Contacted investors

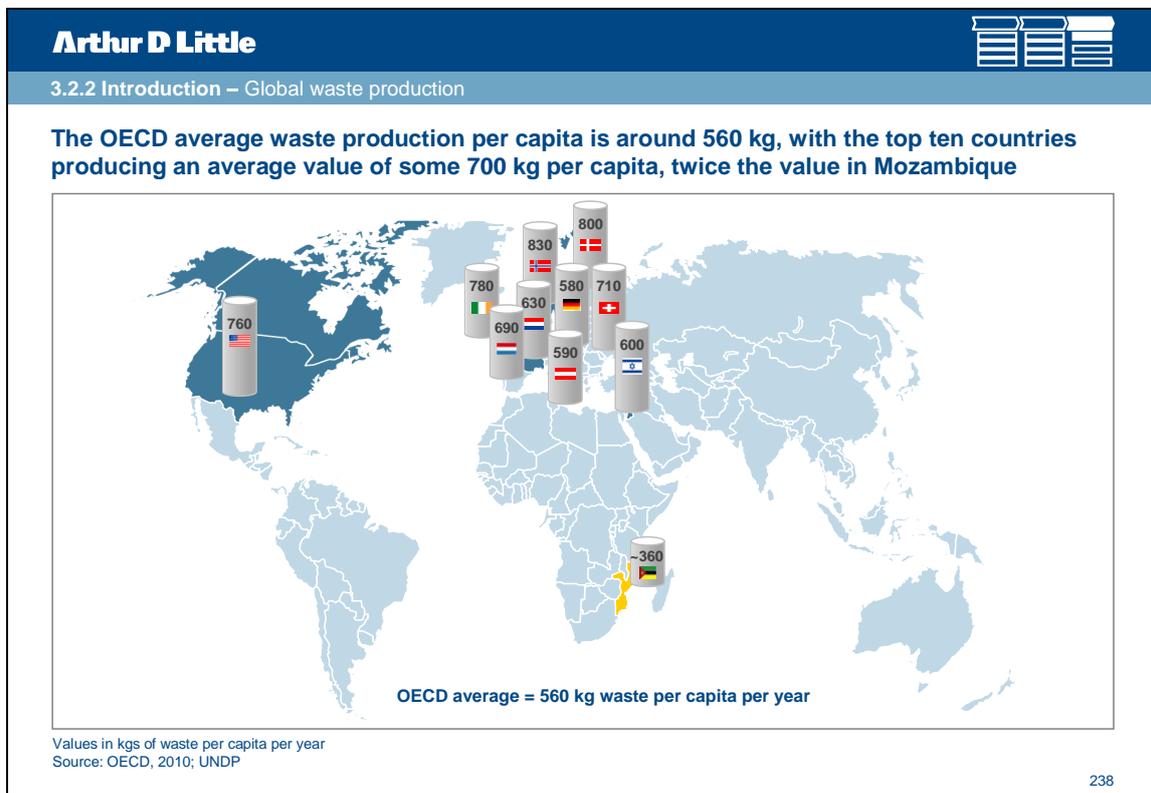
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3.2.2 Introduction – Waste production evolution

Despite the significant difference in waste production, the trend in the last 20 years evidences a growing pattern for Mozambique, with a CAGR higher than the World and USA values

Waste production evolution in the world and in Mozambique

Year	USA (metric tons of oil equivalent)	Mozambique (metric tons of oil equivalent)	World (metric tons of oil equivalent)
1990	~55,000	~5,000	~80,000
1992	~70,000	~5,000	~85,000
1994	~65,000	~5,000	~90,000
1996	~70,000	~5,000	~95,000
1998	~70,000	~5,000	~100,000
2000	~70,000	~5,000	~105,000
2002	~65,000	~5,000	~110,000
2004	~70,000	~5,000	~115,000
2006	~75,000	~5,000	~120,000
2008	~80,000	~5,000	~125,000

- Calculating the global amount of waste produced presents a problem. There are a number of issues, including lack of reporting by many countries and inconsistencies in the way countries report
- Nevertheless, the general pattern points towards a visible increase in waste production in the last 20 years
- Mozambican levels of waste production are far below the typical for developed countries, nevertheless their yearly increase is at levels above the ones for USA

CAGR – Compound Annual Growth Rate
Source: World bank (WDI & GDF)

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3.2.2 Introduction – Waste production in Mozambique

If we look closer at the Mozambican reality, we realize that the waste production pattern is quite asymmetric, with provinces like Maputo and Nampula assuming a clear leading position

Waste production in the major Mozambican cities

City	Waste Production ('000 Tons/year)
Maputo	1135
Nampula	192
Matola	110
Beira	62
Inhambane	52
Nacala	33
Xai-Xai	17
Mozambique Island	7
Montepuez	7
Pemba	6
Quelimane	5
Mocimboa da Praia	2
Mocuba	0,75

Environmental costs
Waste attract rodents and insects which harbor gastrointestinal parasites, yellow fever, worms, the plague and other conditions for humans. It can contaminate surface water, groundwater, soil, and air which causes more problems for humans, other species, and ecosystems. Waste treatment and disposal produces significant green house gas (GHG) emissions, notably methane, which are contributing significantly to global climate change.

Social costs
Many of the environmental burdens are more often borne by marginalized groups. However, the need for expansion and siting of waste treatment and disposal facilities is increasing worldwide. There is now a growing market in the trans boundary movement of waste, and although most waste that flows between countries goes between developed nations, a significant amount of waste is moved from developed to developing nations

Economic costs
Money can often be saved with more efficiently designed collection routes, modifying vehicles and public education. Environmental policies such as pay as you throw can reduce the cost of management and reduce waste quantities. Waste recovery (that is, recycling, reuse) can curbe economic costs because it avoids extracting raw materials and often cuts transportation costs.

Source: Mozambican National Institute of Statistics, EPA, OECD

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3.2.2 Introduction – Waste classification

Waste can be classified according to it's toxicity, origin, composition or management. This Program will be focused on the management and valuation aspects of waste

Different approaches to waste

Source: UNEP/GRID

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3.2.2 Introduction – Major problems associated with waste

Waste production is not only an aesthetics problem. On the one hand it carries significant risks with the formation of leachates and groundwater, soil and air contamination...

Dangers of waste contamination

<p>Groundwater Contamination</p> <p>Contaminated groundwater can adversely affect animals, plants and humans if it is removed from the ground by manmade or natural processes. Depending on the geology of the area, groundwater may rise to the surface through springs or seeps, flow laterally into nearby rivers, streams, or ponds, or sink deeper into the earth. In many parts of the world, groundwater is pumped out of the ground to be used for drinking, bathing, other household uses, agriculture, and industry.</p>	<p>Soil Contamination</p> <p>Contaminants in the soil can harm plants when they take up the contamination through their roots. Ingesting, inhaling, or touching contaminated soil, as well as eating plants or animals that have accumulated soil contaminants can adversely impact the health of humans and animals.</p>
<p>Air Contamination</p> <p>Air pollution can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs into other parts of the body. Certain air contaminants can also harm animals and humans when they contact the skin. Plants rely on respiration for their growth and can also be affected by exposure to contaminants transported in the air</p>	<p>Leachate</p> <p>Leachate is the liquid that forms as water trickles through contaminated areas leaching out the chemicals. For example, the leaching of landfill can result in a leachate containing a cocktail of chemicals. In agricultural areas leaching may concentrate pesticides or fertilizers and in feedlots bacteria may be leached from the soil. The movement of contaminated leachate may result in hazardous substances entering surface water, groundwater or soil.</p>

Source: UNEP/GRID

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3.2.2 Introduction – Carbon emissions from waste

... while on the other hand it is a significant greenhouse gases emitter, mainly due to the methane release for the atmosphere

Life Cycle of Waste

Source: EPA

If a product is not recycled at the end of its useful life, it goes through one of three waste management options: composting, combustion, and landfilling.

- **Composting:** an option for organic materials, releases some non-biogenic carbon dioxide associated with transporting and turning the compost. However, some of the carbon contained in organic materials is returned and stored in the soil and therefore not released into the atmosphere.
- **Combustion:** releases both carbon dioxide and nitrous oxide (a GHG that is 310 times more potent than carbon dioxide). However, some of the energy released during combustion can be harnessed and used to power other processes, which results in offset GHG emissions from avoided fossil fuel use.
- **Landfilling:** the most common waste management practice, results in the release of methane, that is 21 times more potent as GHG than carbon dioxide.

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3.2.2 Introduction – Landfill disposal

Landfill waste originates severe atmospheric pollution, due to CH₄ and CO₂ emissions, which helps explaining the increase in waste handling projects approved by the CDM

Dealing with Waste – Landfill disposal

Landfill gas typical composition

■ Methane ■ Carbon Dioxide ■ Nitrogen ■ Oxygen ■ Ammonia ■ Sulfides ■ Others

The major components of the landfill gas are methane (with a GHG potential 21 times bigger than CO₂) and CO₂. If not adequately treated or burnt, these gases will be emitted to the atmosphere

Waste handling and disposal projects in the CDM

589 results

There are several options to deal with these gases, and there are currently 20 different methodologies resulting in 589 waste handling and disposal projects registered at CDM, representing 14,4% of the total projects registered.

Source: Integrated Solid Waste Management, Engineering Principles and Management Issues; CDM

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3.2.2 Introduction – Composting

Composting not only avoids methane emissions, but also allows for carbon storage in the soil, and at the same time produces fertilizers that improve agricultural yields

Dealing with Waste - Composting

- Compost is organic matter that has been decomposed and recycled as a fertilizer and soil amendment. It is rich in nutrients and it's widely used in gardens, landscaping, horticulture, and agriculture. The compost itself is beneficial for the land in many ways, including as a soil conditioner, a fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil
- Bokashi is a method of intensive composting. It can use an aerobic or anaerobic inoculation to produce the compost. Once a starter culture is made, it can be used to extend the culture indefinitely, in a way similar to yogurt culture
- Industrial composting systems are increasingly being installed as a waste management alternative to landfills

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3.2.2 Introduction – Fertilizers usage around the world

However, if worldwide the use of fertilizers is increasing, in Africa it has been decreasing for the last 10 years, despite some efforts to push up their utilization

Evolution of the usage of fertilizers

Year	Sub Saharan Africa	Mozambique	World
2002	~12	~6	~16
2003	~11.5	~8	~17
2004	~11	~2	~17.5
2005	~10.5	~2	~18
2006	~11	~5	~18.5
2007	~10.5	~3	~19

- While the global tendency is for the increase in fertilizers' usage, sub Saharan countries are decreasing their consumption
- The Africa Fertilizer Summit (AFS) recommended that the African Heads of State and Government should support countries to increase the fertilizer use in Africa from the average of about 8 kg per hectare to new average of at least 50 kg per hectare by 2015.
- An extreme example is Mozambique, with an average decrease of 10% per year since 2002: the provinces with the highest potential for agricultural production practically do not use fertilizer; Nampula has 3% of households using it and Zambezia just 2%.

Source: World bank (WDI & GDF)

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3.2.2 Program Description – Creating resilience to climate change

Therefore, the implementation of a Composting Program appears inevitable within the “building resilience to climate change” challenge

Composting Program contribution for building resilience to climate change

Improvement in the local environment	<ul style="list-style-type: none"> The compost plant allows avoiding methane emissions from the organic fraction of city wastes that would have otherwise been left to decay anaerobically in a solid waste disposal site
Increase the lifetime of the existing landfill and soil degradation	<ul style="list-style-type: none"> The program allows increasing lifetime of the existing landfill massively and producing high quality compost to use as natural fertilizer. The program offers alternative techniques to slash-and-burn practices to fertilize soils. The fertilizer combats soil degradation and helps to keep soil humidity
Improvement of the local life conditions and local economy	<ul style="list-style-type: none"> The construction and operation and maintenance of the composting site will provide employment and proper wages

Source: Arthur D. Little analysis

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3.2.2 Program Description – Program strategy

This Program will be focused in developing local competences and establishing a strong network of contacts and advisors to maximize it’s probability of success

Program Strategy

<p>Technical advisory services</p> <p>Provide technical advisory services, including technical feasibility studies and technical troubleshooting services</p>	<p>Involve local communities</p> <p>Involve local communities during implementation to ensure the sustainability and local ownership of the project.</p>	<p>Training</p> <p>Implement workshops and seminars to demonstrate the projects for the key officials and stakeholders of target regions, as well project developers and potential investors.</p>
<p>Advisory services</p> <p>Provide advisory services to conduct financial feasibility services and arrange project-financing package to potential investors.</p>	<p>Networking</p> <p>Facilitate a strong relationship between the financial sector and project development sector</p>	<p>Facilitation</p> <p>Facilitate the enactment of policies, rules and procedures to attract investments on composting technologies</p>

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3.2.2 Program Description – Barriers to implementation

Despite the inherent benefits, there are several barriers, mainly at the policy, institutional and financial levels, that need to be overcome, in order to bring this Program to light

Policy and Institutional Barriers	Financial Barriers
<ul style="list-style-type: none"> ■ Effective coordination between institutions: Waste management is a complex and multi-sector activity with several governmental institutions operating in this area. An effective coordination between these institutions is lacking and effective mechanisms are required for a proper coordination. ■ Absence of specific incentives for composting: There are no direct or indirect incentives for composting projects in Mozambique. Also the municipalities in Mozambique are in poor financial health and lack resources. ■ Absence of institutional experience in dealing with composting projects: Only very few initiatives in composting were taken in Mozambique so the institutions do not have experience in dealing with this type of projects. ■ Bureaucratic project implementation: Working with municipalities may increase the bureaucratic burden of the project. 	<ul style="list-style-type: none"> ■ Absence of dedicated financing mechanisms within the national financial institutions to support composting projects in Mozambique ■ Farmers cannot afford to buy fertilizers at the current price: The commercial banks interest rates available to fertilizer industry are between 20 and 25 percent due to risk associated in the agricultural sector and credit institutions are practically non-existent in the country so farmer's access to credit is practically null. ■ High operation and maintenance cost, specially given the the uncertainty in market prices and demand of compost in a sector that is not used to use fertilizers. ■ High capital investments: If not complemented with some support initiatives (like CDM) composting is unlikely to interest private investors, given the high CapEx when compared with the uncertainty in the returns
Technical Barriers	Awareness Barriers
<ul style="list-style-type: none"> ■ Main utilities are not available in all provinces: The composting plant installation could be more difficult and costly due to unavailability of some basic utilities like electricity or water. ■ Limited technical capacity to design, install, operate, manage and maintain a composting plant due to lack of skills and expertise 	<ul style="list-style-type: none"> ■ Fertilizer from waste could be considered as "dirty": The concept of soil conditioner is still not widely known amongst farmers (the buyers) and can be considered as "dirty" since used waste.

Source: Arthur D. Little analysis

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3.2.2 Program Description – High level selection methodology

Each project within the Composting Program will be subject to a three phases analysis, to guarantee that fully fulfills all the selection criteria

Phase I Sustainability assessment	Phase II Operational criteria	Phase III Cost-benefit analysis
<ul style="list-style-type: none"> ■ Respect for basic human rights ■ Impact on ecosystem: the project should comply with national environmental regulation and policies. The impacts on the ecosystem are to be clearly identified and evaluated. A plan to address the environmental impacts has to be developed with concrete initiatives, milestones and monitoring systems. ■ Climate-resilience contribution: the project has to have the potential to generate a clear contribution to the country's resilience to climate change and is located in a region identified as a priority. ■ Benefits for the local community: the project has to have the potential to generate benefits for the local community 	<ul style="list-style-type: none"> ■ Time to implementation: verify if the project's timeframe aligned with the program's. ■ Attractiveness to investors: assess the existence of potential private investors with interest in the project 	<ul style="list-style-type: none"> ■ Investment: investment associated with the implementation of the project ■ Operating costs: expected operating and maintenance costs of the project ■ Revenues: expected delta in revenues deriving from the adaptation measure ■ Loss averted: costs that are expected no longer exist due to the implementation of the project

Source: Arthur D. Little analysis

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3.2.2 Program Description – Program operationalization

The compost will be produced in dedicated installations, using as raw material waste collected from nearby installations and households, and will be then sold directly or to intermediaries

Program Operationalization

```

    graph TD
        subgraph Waste_Producers [Waste Producers]
            H[Households]
            I[Industries]
            C[Commerce]
            O[Other]
        end
        subgraph Waste_Processing [Waste Processing]
            W[Waste]
            D[Dumps]
            Co[Composting]
        end
        subgraph Logistics [Logistics]
            TF[Transportation + Fuel]
            Ws[Workers]
            Wh[Warehouse]
            Wk[Workers]
        end
        subgraph Investment [Investment]
            Inv[Investors]
        end
        subgraph Returns [Returns]
            DS[Direct Sell]
            Int[Intermediates]
        end

        Waste_Producers -- Produce --> W
        W -- Deposit --> D
        W -- Deposit --> Co
        TF --> W
        Ws --> W
        Wh --> Co
        Wk --> Co
        Inv -- Investment --> TF
        Inv -- Investment --> Ws
        Inv -- Investment --> Wh
        Inv -- Investment --> Wk
        Co -- Sell --> DS
        Co -- Sell --> Int
        DS -.-> Returns
        Int -.-> Returns
        Returns -.-> Inv
    
```

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3.2.2 Program Description – Program phasing

The INGC has identified five climate change priority areas, that will be the Tier 1 regions in the implementation of this program

Program phasing

Region	Waste Production (ton/year)
1 Pemba	6.300
2 Nacala	33.127
3 Quelimane	4.500
4 Beira	62.065
5 Inhambane	52.370
6 Maputo	1.135.000

- The composting program in Mozambique is intended to be nationwide and cover all the major cities of the country and will be developed through several concurrent pilot projects to improve the probability of success
- The program has a multi-year timeframe during which the projects portfolio are developed mainly in the cities included in INGC climate change priority areas like Pemba, Nacala, Quelimane, Beira, Inhambane with a total population affected of some **1,12 million persons** in the first Phase
- In a second Phase, Maputo (given its dimension, it should benefit from the key learning's of Phase I) and Tier 2 cities will be addressed
- Pilot projects running simultaneously will enable the private investors and the municipalities to:
 - Compare alternative technologies in a small scale
 - Gain hands-on experience (learning by doing the best ways to develop the fertilizer)
 - Determine which permits are required and establish confidence with the regulating agencies
 - Establish a design basis for a full scale compost facility
 - Develop a reasonable cost model to look at capital investment, operating costs, profit and loss projects, and return on investment

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3.2.2 Program Description – Total Investment

In a 5 years timeframe we estimate a total investment of some 15 M€, allowing for the waste management of the Tier 1 cities and the expansion to some of the Tier 2 in the latter years

Total amount to be invested

Year	Investment (M€)	Average tons of (additional) fertilizer produced per year
Y1	0,4	96
Y2	1,6	384
Y3	2,8	672
Y4	4	960
Y5	6	1440

- In the first three years, the investment will be channeled for the Tier 1 priority cities
- This will imply an investment of some 4,8 M€ and an annual production of fertilizer of some 1.170 tons
- Maputo will be addressed in Phase II to benefit from the knowledge and key learning's from Phase I
- The Tier 2 cities will be scouted during the first three years of the Program, and should combine big waste productions and fertilizer needs

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3.2.2 Program Description – Capacity Building

A key aspect of this Program, is the development of “in house” competences, to foster in a near future, total local autonomy in the management of the Program

Human Resources	Training	Learning by Doing	Technical Assistance	Assets
<ul style="list-style-type: none"> Training and recruiting of personnel with capacity to deal directly with the international investors and funders Recruiting of personnel with “ground knowledge”, i.e., deep knowledge of the Mozambican reality and geographies, to identify the best opportunities 	<ul style="list-style-type: none"> Development of know how on the composting process and commercial techniques for the sale of the fertilizer 	<ul style="list-style-type: none"> Create “mixed” teams, incorporating local personnel and external consultants, to foster the knowledge transfer and create, in the near future a pool of internal resources fully capable of implementing the entire process 	<ul style="list-style-type: none"> Partnership with Aga Khan to assist in the technical aspects of the composting process and pass the knowledge to the local personnel 	<ul style="list-style-type: none"> Trucks, small vans, composting infrastructures, terrain rental contracts, intellectual property over developments performed

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3.2.2 Program Description – Risks & Mitigation Strategies

There are several risks that should be addressed, however, they all have adequate mitigation strategies envisaged

Risks	Solution
Farmer's lack of interest in using the fertilizer (lack of awareness for the benefits, lack of habit, cost, etc...)	<ul style="list-style-type: none"> A marketing and awareness campaign will be held ahead of launching the program to increase awareness and teach how to use and the benefits of using the fertilizer
Not enough buyers for the fertilizer	<ul style="list-style-type: none"> Apart from the individual farmers, small farms and communities will be addressed, to build some economies of scale. A diversified portfolio of clients is envisaged to hedge the risk
Lack of financial capacity from farmers to buy the fertilizer	<ul style="list-style-type: none"> A protocol will be performed with the Micro and Small Scale Lending Program to help financing the fertilizer acquisition
Not enough nitrogen for the composting process	<ul style="list-style-type: none"> Gather more livestock waste suppliers and find an alternative (organic) source of nitrogen

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3.2.2 Program Description – Sustainability monitoring

On a yearly basis the Program will be evaluated using a dedicated questionnaire, that evaluates the Program impact in the waste suppliers, fertilizer users and project workers

Sustainability Monitoring

- The sustainability monitoring is to be performed at least on a yearly basis
- A significant sample of the population should be selected to allow for representativeness
- A yearly comparison should be performed to assess the existence of improvements

The full questionnaire is given as an Appendix to this Report

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3.2.2 Pilot Project – Overview

The pilot project will be developed in Pemba, in partnership with the Aga Khan Foundation, with an estimated budget of 350 k€ and should break ground in 2013

Pilot Project			
Partner	<ul style="list-style-type: none"> The Aga Khan Foundation is launching the Pemba Composting project as the first in a pipeline, and are looking for partners 	Target Geography	<ul style="list-style-type: none"> The initial project will be in Pemba, but Aga Khan's goal is to have a network of composting sites in the major Mozambican cities, to help solve the waste problem and at the same time produce fertilizer and increase agricultural yields
Amount	<ul style="list-style-type: none"> The set up of the Pemba project should cost some 350 k€, distributed by the Bokashi infrastructure, a truck/tractor to transport the waste to the Bokashi site, fuel and salaries for four full time workers 	Timings	<ul style="list-style-type: none"> The pilot project is expected to start in 2013

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3.2.2 Pilot Project – Location and main characteristics

This project will help solving the increasing waste problem in the Pemba region and at the same time address the fertilizer requirements of the region

The Pemba Bokashi Project



Source: Aga Khan Foundation

Waste collection

In order to help solving the growing waste management problem in Pemba, the Aga Khan Foundation is launching a composting project, that uses the waste from industry, households and livestock for the production of fertilizer using a technique named Bokashi

Bokashi composting

Bokashi is a type of organic fertilizer that increases and activates the microorganisms in the soil. Regarding the traditional composting techniques, the Bokashi is faster (it takes approximately 2 weeks when compared with the 90 days in the traditional methods)

Selling the fertilizer

The result is an organic fertilizer, that highly increases the yields in the agricultural fields surrounding Pemba. The final goal is thus selling this fertilizer to the surrounding farmers

In the last two months this technique has already been implemented in five small associations and two households in the Pemba region, with excellent results

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3.2.2 Pilot Project – Location and main characteristics

The composting center will be located in the outskirts of Pemba, and should be able to produce 95 tons of fertilizer per year...

Pemba Bokashi project future location

Bokashi production site, using waste from the production of cassava in Costa Rica

Potential location for the Pemba Bokashi site
This is the chosen location for the new Pemba landfill. The Municipality has granted part of this terrain to the Bokashi project

Bokashi specificities

- Bokashi production should be performed on an open site to promote aeration, with cement floor, but with a ceiling to avoid the rain
- The waste residues (household, industry and livestock waste) should be dry mixed, adding water until having a humidity level of some 30-40%. It's important to avoid higher levels of humidity, to prevent rotting
- The fermentation process takes approximately two weeks, producing on a weekly basis 2 tons of fertilizer
- The yearly production is some 96 tons of fertilizer

Source: Aga Khan Foundation

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3.2.2 Pilot Project – Regional demand

... a quantity perfectly aligned with the current agricultural requirements of this region

Fertilizer demand in the region

The major Bokashi consumers will be the saffron and ginger producers from Metuge:

- Mieze
- Nangua
- Namuapala
- Nacuta
- Unidade
- Tratara

Village	Culture area (ha)	Fertilizer usage* (tons/y)
Mieze	13,8	55
Nangua	2	8
Namuapala	2	8
Nacuta	2	8
Unidade	2	8
Tratara	2	8
Total	23,8	95 tons of fertilized needed

Source: Aga Khan Foundation
*Considering a metric of 4 ton/y, according to Leblanc et al, 2000

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3.2.2 Pilot Project – CapEx & OpEx

With a CapEx of some 350 k€, an Opex of 16 k€/year, and considering a selling price of 700-800 €/ton, the payback time is around 7-10 years

CapEx		OpEx	
Building	270 k€	Workforce (4 full time workers)	10.000 €/year
Truck + small vehicle	75 k€	Fuel & Others (considering a 15 km distance)	6.000 €
Total	345 k€	Total (year)	~ 16.000€

Revenues

95 tons/year x 700-800 €/ton = ~77.000 €/y

Payback time: ~ 7-10 years

Source: Aga Khan Foundation, Arthur D. Little analysis

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3.2.2 Pilot Project – Financial Analysis

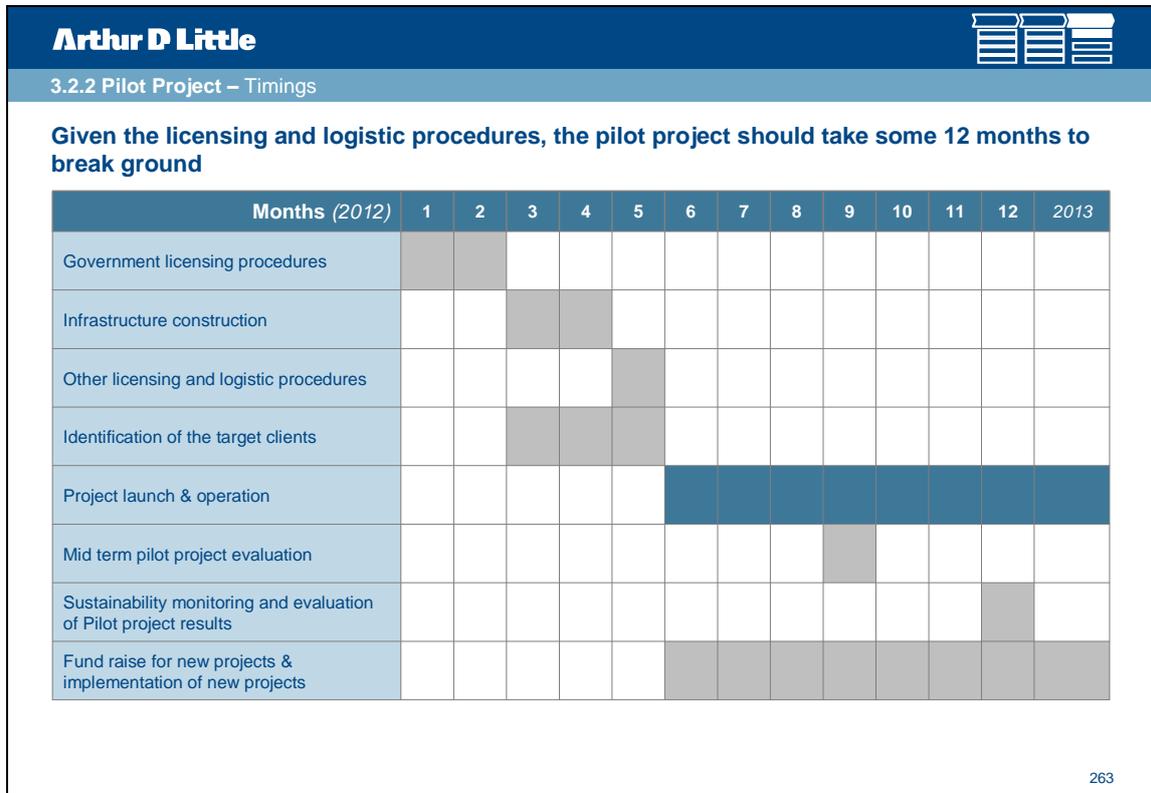
Considering a 15 years timeframe, the returns for this project (in the absence of any financial leveraging) are some 13%

High level financial analysis

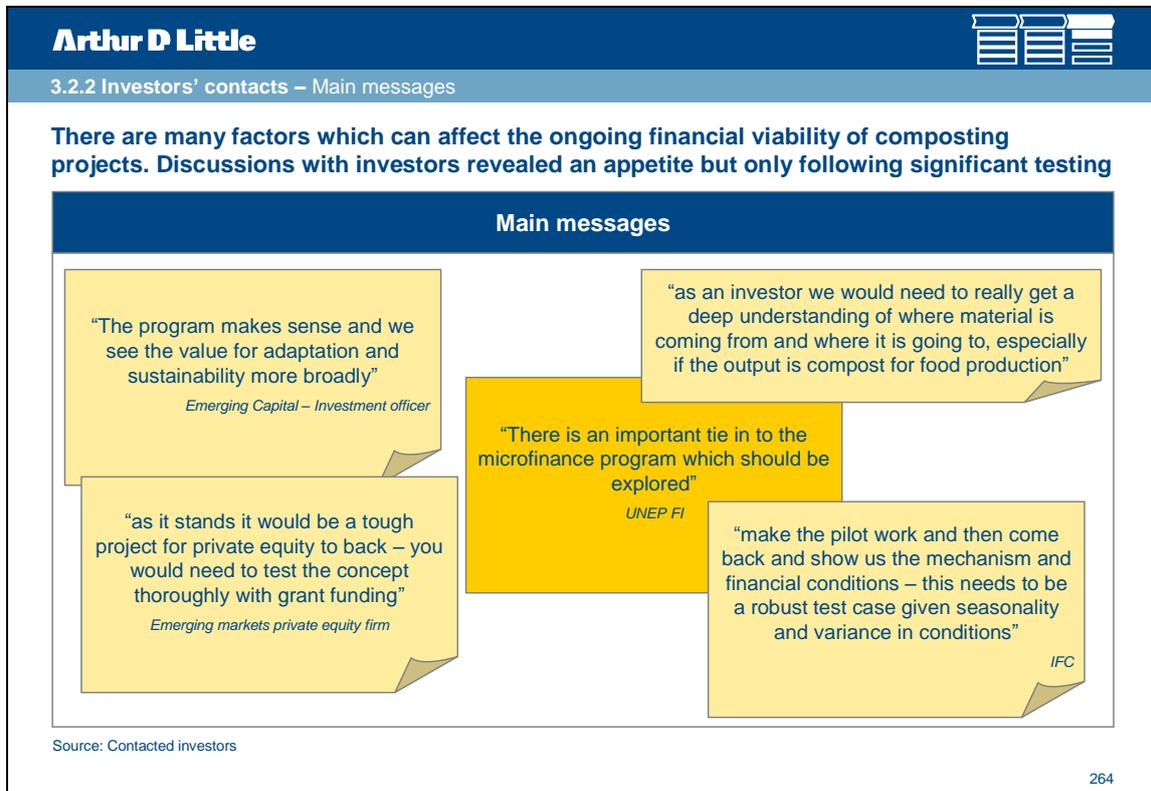
Source: Arthur D. Little analysis

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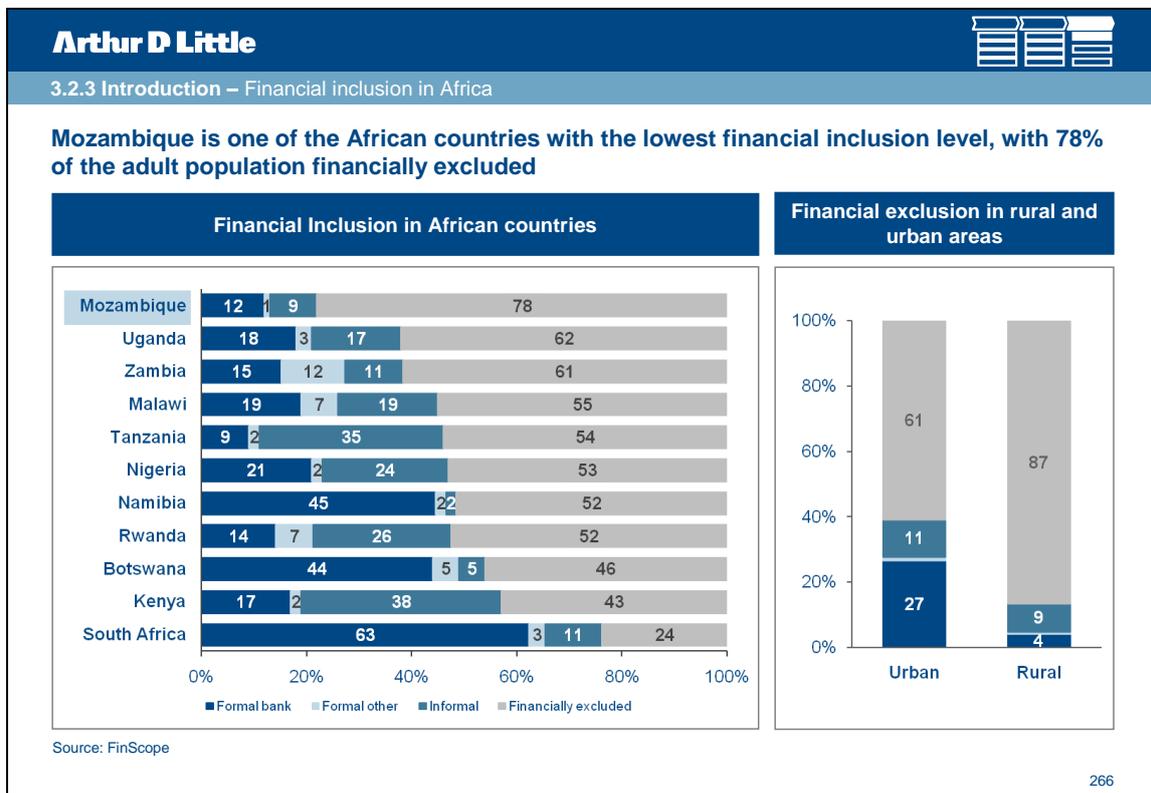


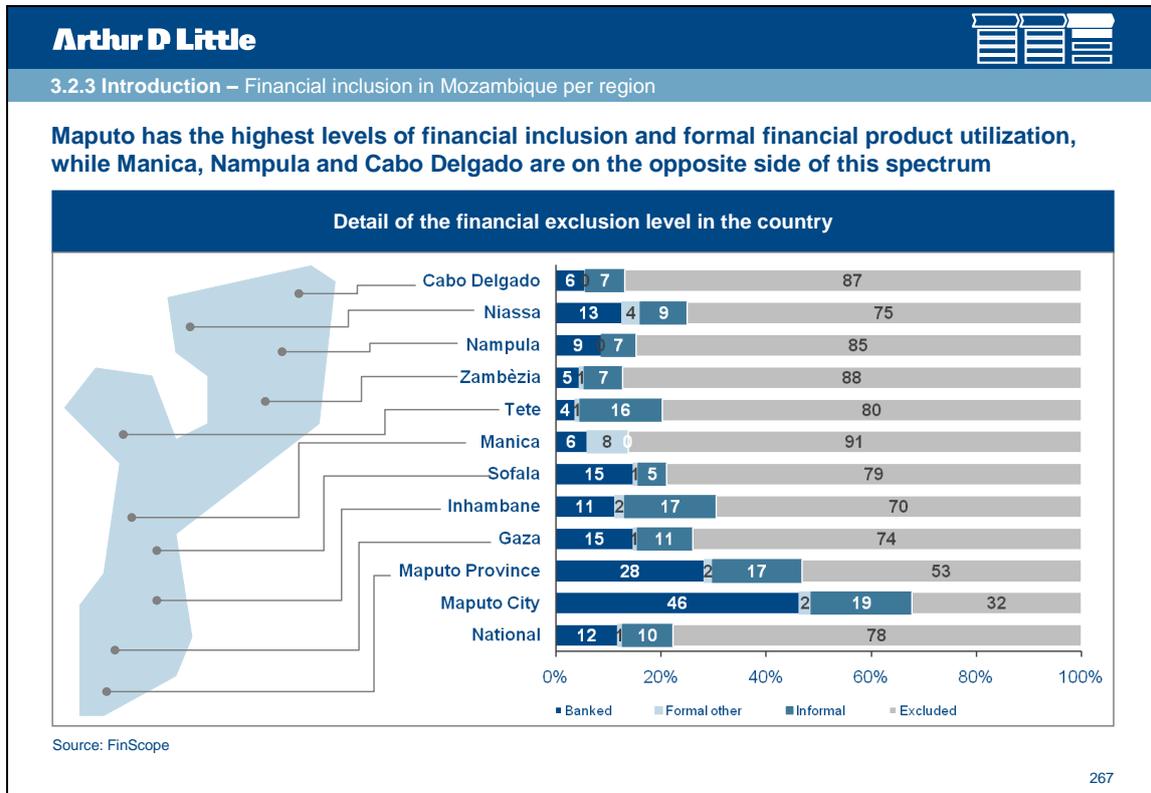
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3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

In order to address and overcome this problem, several institutions are providing microcredit to the needed populations

AfricaWorks

Mission
To develop and implement scalable, self-sustaining business models in agribusiness and trade finance for holistic transformation of farmers, small traders and SMEs in communities.

Gross loan portfolio 1,1 million (USD 2010)	Number of active borrowers 4.307
Average loan per borrower 249,7 (USD 2010)	Deposits 437.053 (USD 2010)
Total assets 1,5 million (USD 2010)	Number of depositors 4.742

BOM

Banco Oportunidade de Moçambique

Mission
BOM is on schedule to start opening bank branches and operate as a microfinance bank in four cities: Maputo, Chimoió, Beira and Quelimane. Is currently offering access to small loans to over 2,000 Mozambicans and aims to offer access to microfinance services to many more

Gross loan portfolio 3,1 million (USD 2010)	Number of active borrowers 9.243
Average loan per borrower 336,3 (USD 2010)	Deposits 2,3 million (USD 2010)
Total assets 6,6 million (USD 2010)	Number of depositors --

Source: Mixmarket, institutions' websites

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3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

With some exceptions, the typical average loan per borrower is around 200-500 USD, and the money is commonly used for agricultural and commercial entrepreneurial projects



FDM
Fundo de Desenvolvimento da Mulher

Mission
Motivate the positive and lasting change of the Mozambican micro entrepreneurs life's prioritizing families lead by women.

Gross loan portfolio 644.982 (USD 2010)	Number of active borrowers 2.977
Average loan per borrower 216,7 (USD 2010)	Deposits 178.324 (USD 2010)
Total assets 1 million (USD 2010)	Number of depositors 4.977



Hluvuku

Mission
To improve the socio economic conditions of the population in the Maputo province, providing high-quality sustainable services to low income people, with competence, professionalism and zeal and considering the viability of the initiatives.

Gross loan portfolio 2 million (USD 2010)	Number of active borrowers 4.425
Average loan per borrower 456,3 (USD 2010)	Deposits 28.339 (USD 2010)
Total assets 2,4 million (USD 2010)	Number of depositors 4.425

Source: Mixmarket, institutions' websites

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3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

One of the most challenging problems that these institutions face is the difficulty in addressing all the needed populations, mainly due to geographical and logistic constraints



Banco ProCredit
Mozambique

Mission
Provide financial services to low-income segments of the Mozambican population. Position itself as a leader in the market.

Gross loan portfolio 32,7 million (USD 2010)	Number of active borrowers 15.916
Average loan per borrower 2.057 (USD 2010)	Deposits 35.8 million (USD 2010)
Total assets 49,8 million (USD 2010)	Number of depositors 123.570



Socremo

Mission
To provide - in a transparent, professional and sustainable way - financial services to low and middle income groups, with special focus on micro and small entrepreneurs.

Gross loan portfolio 27,1 million (USD 2010)	Number of active borrowers 20.092
Average loan per borrower 1.347 (USD 2010)	Deposits 31 million (USD 2010)
Total assets 26,7 (USD 2009)	Number of depositors 133.053

Source: Mixmarket, institutions' websites

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3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

The Aga Khan Foundation offers a good anecdote: the project they set up in 2004 in Cabo Delgado found so many difficulties, that had to be postponed

 <p>Tchuma Mozambique</p> <p>Mission</p> <p>Tchuma's mission is to provide credit and savings services to the emerging entrepreneurs of Mozambique, particularly women.</p> <table border="1"> <tr> <td>Gross loan portfolio 32,7 million (USD 2010)</td> <td>Number of active borrowers 15.916</td> </tr> <tr> <td>Average loan per borrower 2.057 (USD 2010)</td> <td>Deposits 35.8 million (USD 2010)</td> </tr> <tr> <td>Total assets 49,8 million (USD 2010)</td> <td>Number of depositors 123.570</td> </tr> </table>	Gross loan portfolio 32,7 million (USD 2010)	Number of active borrowers 15.916	Average loan per borrower 2.057 (USD 2010)	Deposits 35.8 million (USD 2010)	Total assets 49,8 million (USD 2010)	Number of depositors 123.570	 <p>Aga Khan</p> <p>Mission</p> <p>The Aga Khan Foundation is part of the Aga Khan Development Network, a group of private, international, non-denominational agencies founded by His Highness the Aga Khan. The Network's organizations have individual mandates that range from the fields of health and education to culture, rural development and the promotion of private-sector enterprise. It is dedicated to improving living conditions and opportunities for the poor, without regard to faith, origin or gender.</p> <p>Aga Khan initiated its microfinance project in Mozambique in 2004, in Cabo Delgado. However the rash economic conditions in this region made it very difficult to implement the project and Aga Khan is now repositioning to other more developed areas (Nampula, Maputo) that can be used as leverages to further projects in the poorer regions of the north.</p>
Gross loan portfolio 32,7 million (USD 2010)	Number of active borrowers 15.916						
Average loan per borrower 2.057 (USD 2010)	Deposits 35.8 million (USD 2010)						
Total assets 49,8 million (USD 2010)	Number of depositors 123.570						

Source: Mixmarket, institutions' websites

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3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

The majority of the Micro Finance Institutions (MFI) in Mozambique are backed up and funded by world known institutions...

MFI	Funders
Socremo	 <p>Established in 2006 by an international group of private and public investors, will build up a network of microfinance banks worldwide. Investments are taken to success through a combination of growth capital, holding services and technical assistance. Access Holding has divested from Socremo recently.</p>
	 <p>The DF aims to increase the number of poor households with access to credit, savings and other financial services by providing debt financing to microfinance institutions. The DF believes that this funding will enable microfinance institutions that are seeking capital for growth to reach more poor clients, allowing them to lift out of poverty with dignity.</p>
	 <p>Triodos Investment Management has been one of the leading investors in the microfinance sector since making its first investments in the industry in 1994. Our aim is to build long term relationships, based on transparency and fairness, and a shared commitment to relieving poverty and caring for the planet.</p>
Novobanco	 <p>The Doen Foundation's ambition is to help build a sustainable world in which everyone can participate, by promoting sustainable, cultural and social pioneers. DOEN promotes people and enterprises that take the lead in the field of sustainable, cultural and social innovation. DOEN seeks out these innovators, supports and inspires them.</p>
	 <p>IFC provides advisory services and direct and indirect investment services to the microfinance sector. It's focus is on creating and supporting commercially viable microfinance institutions that can attract the private capital needed to scale up and respond to unmet demand.</p>

Source: Mixmarket, institutions' websites

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3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

... that use these MFIs as preferential and trusted channels to help financing the needed populations...

MFI	Funders
Tchuma	 An international financial consortium with Headquarters in Padua, Italy, and three regional offices in Sri Lanka, Argentina and Senegal. It collects savings in Europe and invests in developing and emerging countries financing microfinance institutions, producers cooperatives linked to Fair trade markets and social enterprises.
	 Fundació Un Sol Món was created by Caixa Catalunya, a Spanish Bank, in 2000. The fund has four priority activities: development of employment for groups at risk from social exclusion; microcredits for self-employment; international cooperation; generating awareness of poverty issues.
	 The unique guarantor model of MicroCredit Enterprises utilizes the financial capital and good credit of high net worth individuals and institutions to guarantee micro loans that lead to sustainable communities and social good.
BOM	 Oikocredit invests around 80% of its development finance portfolio in microfinance and 20% directly in other sectors, including agriculture, manufacturing and education
	 The United Nations Capital Development Fund (UNCDF) offers a unique combination of investment capital, capacity building and technical advisory services to promote microfinance and local development in the Least Developed Countries

Source: Mixmarket, institutions' websites

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3.2.3 Introduction – Existing Micro Finance Institutions (MFI)

... and at the same time strengthen the financial tissue in Mozambique

MFI	Funders
Hluvuku	 Triple Jump's mission is to contribute to the sustainable development of emerging market economies by facilitating investment in micro and small enterprises. Triple Jump seeks to support the expansion of viable microfinance institutions in all three stages of their development (emerging, expanding and mature) by providing capital and advisory services
FDM	 The United Nations Capital Development Fund (UNCDF) offers a unique combination of investment capital, capacity building and technical advisory services to promote microfinance and local development in the Least Developed Countries

Source: Mixmarket, institutions' websites

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3.2.3 Program Description – Operationalization

The idea underlying this Program is empowering the needed populations and SMEs in the creation of resilience to climate change, by giving them credit to invest in sustainable projects

Program operationalization

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    graph LR
      A[Impact Investment Community] --> B[Micro Finance Institutions (MFI)]
      B --> C[Borrowers]
      D[Monitoring] -.-> C
  
```

Investors
A pool of international investors lends the money directly to the MFIs in the terrain, as long as their expectations in terms of returns and social impact are met.
The money lent should be channeled to loans directly related with resilience to climate change

MFIs
The MFIs in the terrain are the direct liaison between the borrowers and the investors. They analyze and select the borrowers that meet the criteria set by the Investors for this specific Program. They are also responsible for ensuring that all the sustainability criteria are met

Borrowers
This Program is specifically designed to support investments that increase the resilience to climate change

Monitoring
Every year, an evaluation should be performed to assess the results and verify if all the criteria set for the Program are being met

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3.2.3 Program Description – Product offer

The combination of investors with different return profiles and pre-negotiated packages will result in more affordable loan conditions

Product offer

Interests & Payment Conditions
The combination of philanthropists and impact investors as funders will allow for the establishments of more affordable loan conditions for the borrowers (higher duration and lower interests)

Pre-negotiated Packs
The technical team responsible for this project will negotiate with specific suppliers bulk conditions, in order to gain economies of scale in some types of projects (renewable energy, reforestation, etc...), and thus decrease their cost. These conditions will be available as packages for the borrowers

	Loan Duration	Average Loan
Class A Loans (Micro Lending)	10 months for borrowers without credit history that can go up to 24 months once credit history is established	100 – 5.000 €
Class B Loans (Small Loans)	12 months for borrowers without credit history that can go up to 36 months once credit history is established	10.000 – 100.000 €

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3.2.3 Program Description – Project's portfolio

Depending on the type of projects, the amounts involved and the background of the borrower, the loan can fall in one of two categories

Examples of projects	
Class A Loan	Class B Loan
Individuals and small communities	SMEs, cooperatives and medium to bigger communities
<ul style="list-style-type: none"> ■ Use of fertilizers in agriculture, to increase yields and land utilization ■ Enhance freshwater availability and access ■ Houses refurbishment ■ Solar/wind power for irrigation pumps ■ Plantation of mangroves or similar species to protect the coastal line ■ Other investments as long as it's proven their value in terms of building resilience to climate change 	<ul style="list-style-type: none"> ■ Renewable energy for small communities electrification ■ Biomass, bioethanol and biogas projects ■ Waste management projects (composting) ■ Building roads and accessibilities (small scale: connecting small properties) ■ Small reforestation projects ■ Acquisition of mini vans and motorcycles for transportations ■ Other investments as long as it's proven their value in terms of building resilience to climate change

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3.2.3 Program Description – Total Investment

We forecast a total of 25 M€ raised over 5 years, which, considering a typical average loan of 12.800¹ €/year, should benefit some 2.000 borrowers over this period of time

Total amount to be invested

Year	Average number of new borrowers
Y1	190
Y2	390
Y3	390
Y4	390
Y5	590

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- To lend money, the MFIs generally require some credit history
- Usually the first loans granted are smaller loans with shorter duration
- Once the borrower has a credit history established (some three or four loans) the amounts may be increased and the duration extended

¹Considering a mix of 40% Class A Loans with an average value of 2.000€ and 60% Class B Loans with an average investment of 20.000€;
²Additional investment per year

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3.2.3 Program Description – Investment routine

These 25 M€ are to be distributed in yearly tranches, with the interests optimized to allow for the investors' targets accomplishment and the MFIs management costs

Investment routine

i – interest paid by the borrowers on the capital
mc – management costs

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3.2.3 Program Description – Program phasing

To maximize the success of the Program, the initial investments will be made in the more developed areas of the south, and gradually start going north, to the more needed populations

Program phasing

Phase C
... that typically are excluded from these programs, like Cabo Delgado.

Phase B
Gradually, it will start “going north” and develop structures able to support some of the poorest regions in the country...

Phase A
Initially the Program will support mainly institutions in the south (most developed) region of the country, to minimize the risk of not having enough borrowers and maximize the chances of success.

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3.2.3 Program Description – Capacity Building

Another key aspect of this Program, is the development of “in house” competences, to foster in a near future, total local autonomy in the management of the Program

Human Resources	Training	Learning by Doing	Technical Assistance	Assets
<ul style="list-style-type: none"> Training and recruiting of personnel with capacity to deal directly with the international investors, funders and the MFIs Recruiting of personnel with “ground knowledge”, i.e., deep knowledge of the Mozambican reality and geographies, to identify the best opportunities 	<ul style="list-style-type: none"> Development of financial and legal competences: the personnel should be comfortable in establishing the conditions and calculating the returns of every investment and feel at ease with the legal and contractual aspects 	<ul style="list-style-type: none"> Create “mixed” teams, incorporating local personnel and external consultants, to foster the knowledge transfer and create, in the near future a pool of internal resources fully capable of implementing the entire process 	<ul style="list-style-type: none"> Development of innovative and dedicated financial solutions for the local populations 	<ul style="list-style-type: none"> Network of MFIs

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3.2.3 Program Description – Risks & Mitigation Strategies

There are several risks that should be addressed, however, all of them have adequate mitigation strategies

Risks	Mitigation
Lack of awareness and knowledge from the populations to microfinance and lending in general	<ul style="list-style-type: none"> Investment in educating the population Illustrate the concept with success cases Use the endorsement of local and well known celebrities
Logistics and accessibility: Mozambique is a web of small and very disperse populations, which makes it harder the access to all the needed populations	<ul style="list-style-type: none"> Initiate the program in the richest regions of South and Center, to build momentum Make partnerships with local authorities and NGOs to facilitate the penetration in less accessible locations
Lack of people with knowledge and competences to support in setting up the process and dealing with the clients	<ul style="list-style-type: none"> Invest in education and training of the collaborators Initially the program will operate on a “hand by hand” approach, with the support of experts
Default	<ul style="list-style-type: none"> The risk of default is typically very small for microfinance and small lending, as there is a big exposure of the individuals and they are “ashamed” to default Specific insurances will be put in place and collateral guarantees will be requested
Difficulty in accessing the eligibility of some projects	<ul style="list-style-type: none"> An extensive list with all the eligibility criteria will be elaborated, however there is flexibility to include other projects, as long as it’s proved that they meet all the criteria. A committee will be formed to analyze these situations

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3.2.3 Program Description – Sustainability monitoring

On a yearly basis the Program will be evaluated using a dedicated questionnaire, that evaluates the impact of the program in the borrowers, investors, MFIs and overall community

Sustainability Monitoring

- The sustainability monitoring is to be performed at least on a yearly basis
- A significant sample of the population should be selected to allow for representativeness
- A yearly comparison should be performed to assess the existence of improvements

The full questionnaire is given as an Appendix to this Report

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3.2.3 Pilot Project – Main characteristics

The first step of this Program is setting the grounds for the pilot project, that should be done in partnership with one of the most reputable institutions in Mozambique

Pilot Project

Partner (MFI)	<ul style="list-style-type: none"> The institution chosen should be a solid player in this market, with a widespread network of branches and a solid client's list The goal should be to create critical mass in the southern regions, that facilitates their posterior entrance in the northern regions 	Target Geography	<ul style="list-style-type: none"> The goal of the program is to reach the whole country, however, initially the focus will be in the southern parts, typically more prone to microfinance, and then gradually address the poorer regions of the north The initial target area should be Maputo and surrounding areas
Amount	<ul style="list-style-type: none"> The amount for the pilot project is around 2,5 M€ As most of the borrowers should not have a credit history, initially the loans should be around 250-500 € maximum, with a maturity of 6 months 	Timings	<ul style="list-style-type: none"> The pilot project should start in 2013 and the full 2,5 M€ should be allocated within a year.

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3.2.3 Pilot Project – Partner selection criteria

We have evaluated the top six microfinance institutions operating in Mozambique according to the following criteria:

- Client Base**: Number of clients currently in the bank's database. The higher the number, the more reliable and widespread the institution should be
- Loan conditions**: Interests, duration and major requirements. Very strict requirements or extremely high interests may be a deterrent for new clients
- Partners' reliability**: Quality of the current partners of the institution: well known and solid institutions give credit to the bank and help raising money
- Widespread network**: Number of branches. Having a widespread network is extremely important and one of the crucial aspects of selection
- Openness to alliances**: Number of alliances/partnerships established and potential openness to new ones

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3.2.3 Pilot Project – Partner selection

The analysis of the results evidenced that given their current positioning, Socremo and Novobanco are the most adequate candidates for this partnership

	Client base	Loan conditions	Partners' reliability	Widespread network	Openness to alliances	TOTAL
Socremo						
Novobanco						
BOM						
Tchuma						
Hluvuku						
FDM						

Source: Arthur D. Little analysis, MixMarket; Financing Mozambique

Top ranked strong weak

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3.2.3 Pilot Project – Timings

The first six months of the project will be used to set the grounds for the overall structure, that will be put in practice until the end of the year

Months (2012)	1	2	3	4	5	6	7	8	9	10	11	12	2013
Partner selection	█												
Identification of the criteria for the credit line (resilience to climate change)	█												
Identification of the target clients' profile (target geographies, gender mix, etc.)		█											
Fund raise			█	█	█								
Promotion and Commercialization						█	█	█	█	█	█	█	█
Mid term pilot project evaluation									█				
Sustainability monitoring and evaluation of Pilot project results												█	
Fund raise for new projects & implementation of new projects						█	█	█	█	█	█	█	█

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3.2.3 Investors' contacts – Main messages

The messages coming possible investment partners have been very consistent

Main messages

- "The **track record** of the counterparty is absolutely critical. We won't work with a new start up. They must show a good few years of operating effectively before we would consider investing"
Standard Chartered – Sustainable Development
- "There are only a handful of players. You need to think clearly about whether you are **targeting** rural populations or the cities"
Oiko – Head of Country - Mozambique
- "A **strong working knowledge** of operating on the ground in Mozambique. Recipients of funding must have a strong understanding of the way that business is done"
Ned Bank – Head of Institutional Investment
- "You will need great people to work with who you can **trust**"
Doen – Investment Officer
- "The **quality of governance** of the organization must meet our expectations. What we consider to be obvious in terms of basic requirements is often not seen that way"
Doen – Investment Officer
- "The size of pilot you are looking at is about the right size but need to think about which section of the population you are targeting"
Oiko - Head of Country - Mozambique

Source: Contacted investors

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3.2.4 Involvement of the Insurance Sector – Key Findings (1/2)

Penetration of insurance products into developing markets is extremely low but a growing number of players are trying to understand what the future could hold

Insurance Sector Workshop	Summary of activities				
	A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed				
	Interviewed parties				
	AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk				
	Insurance is not a silver bullet	Governance and regulation	Pricing and value	Products versus events	Data mapping
Insurance products come at the end of the process, they transfer risk that is uneconomic to mitigate through other measures. As such a robust loss/damage methodology should be followed in the pilot projects to assess and address project risk	As with other financial products, a stable, enforceable legal regulatory framework remains a requisite for scalable corporate transactions	Lack of data, cluster risks and a challenging operating environment make pricing risk extremely difficult for climate related risks but easier for more traditional product related insurance	Involvement of the insurance sector varies across the pilot projects. Factors that are product-related e.g. for the renewables or composting programs are easier to insure than weather or climate related factors e.g. agroforestry	Availability of reliable, historic data remain a critical factor in determining risk and understanding where product risks end and insurance can take over. Projects should be evaluated using a loss damage work program methodology	
Pilot project approach					
A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of "investment"					

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3.2.4 Involvement of the Insurance Sector – Key Findings (2/2)

Penetration of insurance products into developing markets is extremely low but a growing number of players are trying to understand what the future could hold

Insurance Sector Workshop

Summary of activities
A significant number of major global insurance and re-insurance companies have been interviewed and their views sought on the potential deeper involvement in the programs into 2012 and beyond. A number of regional players were also interviewed

Interviewed parties
AXA, Allianz, Swiss Re, Micro-ensure, Zurich, Willis Group, The Hartford, Fin-mark, CDC, Bankable Frontiers, Nedbank, Guy Carpenter, Climate Wise, Micro-risk

Quality of infrastructure	Stakeholder awareness	Index Linked /Parametric Insurance	Convening the right players	Distribution and collection
Build quality of infrastructure and buildings has a significant impact on evaluation of risk from an insurance perspective	A major stakeholder awareness and education program needs to happen to build trust in the role of insurance in building resilience into the private sector	For climate and weather event related insurance a far more appropriate product might be parametric or index linked insurance. Unlike traditional indemnity insurance this product pays out upon a trigger event e.g. wind speed over 100kmph or Weather Warning	Relevant parts of the value chain will need to collaborate closely in the pilot projects to identify ways which each others mutual actions can support more climate resilient development	In respect of higher volume products likely in "agroforestry, small scale lending and the distribution part of composting" consideration needs to be given to collection and distribution

Pilot project approach
A number of players agreed that a pilot project approach with tangible and investable projects could be interesting. It is important however that the projects are of sufficient scale to enable appropriate levels of "investment"

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3.2.4 Involvement of the insurance sector – Insurance is not a silver bullet

Insurance products come at the end of the risk management process. Projects that are not managed effectively cannot be made into good projects through insurance products

Each project should be subject to a robust loss/damage methodology

Assess Risks	Address Risks	Manage, Mitigate or Transfer Risk
<ul style="list-style-type: none"> Types of Hazards Frequency of occurrence Value at risk Physical risk Stakeholder engagement 	<ul style="list-style-type: none"> Identify options Evaluate options (physical, infrastructure) Price tag of risk Cost benefit analysis 	<ul style="list-style-type: none"> Risk transfer development plan Which insurance products can transfer risk that is uneconomic to manage but economic to insure

Insurance is not a silver bullet to climate change, but understanding the way insurance products are priced encourages prudent risk management. It also will result in more "insurable" risks at the end of the day

David Bresch – Swiss Re

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3.2.4 Involvement of the insurance sector – Insurance is not a silver bullet

Addressing project level risk in a prudent, methodological way is a vital step in creating an environment onto which appropriately priced insurance products can be delivered

A number of areas should be focused on when addressing risks

Identify adaptation options

- Societal issues
- Education and awareness
- Infrastructure (e.g. quality of buildings and regulations)

Physical Preparedness

- Emergency services
- Evacuation
- Fire protection

Economic analysis

- Cost benefit of adaptation options – is it cheaper to address the risk than insure it
- Loss/damage evaluations

Example

Adaptation cost curve for drought risk in the state of Maharashtra, India*

For this case, almost 50% of the loss under a high climate change scenario can be cost-effectively averted by prevention and intervention measures.

"A well structure risk management program for your projects will result in it being far more likely that insurance products can be delivered to transfer risk" **Head of Product Innovation** – Development Finance Institution

*Report of the Economics of Climate Adaptation Working Group 2009

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3.2.4 Involvement of the insurance sector – Governance and regulation

No major insurance player has a real presence in Mozambique and similarly to the investment sector, many comment on the need for a stable regulatory framework and strong governance

Governance & Regulation

- The size of the opportunity in Mozambique for insurance companies when compared with the lack of understanding and uncertainty makes working in the country a very difficult proposition
- Interviewees also talked about the need for a stable and enforceable legal framework
- An interesting practice, that has been adopted in some countries is mandating insurance products alongside lending products
- Pilot programs should be used to demonstrate how close collaboration of a "basket" of players in a transaction can lower political, country and regulatory risk

Building and infrastructure quality

- Insurance companies place a good deal of emphasis on construction quality since this greatly affects likely value at risk
- Working closely with building industry and introducing relevant and reliable building/planning standards could have a significant impact in lower indemnity insurance premiums

"Why would my Board sanction spending significant time and effort on product R&D in such a challenging environment when the margins are likely to be so low and country, security and regulatory risks are so high"

Anonymous – Head of Climate Risk – Global Insurance/re-insurance firm

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3.2.4 Involvement of the insurance sector – Pricing and value

The insurance sector is heavily governed and scrutinized in terms of how it calculates risk and prices it accordingly – the sector is inherently “risk averse”

Cluster Risks & Actuarial Value

Cluster Risks

- A major issue that will need to be addressed when insuring climate and weather related issues through indemnity type insurance is overcoming significant “cluster” risks. Flooding, sea level rise, or drought will cause a large concentration of insured parties to claim
- Interviewed parties saw this as particularly relevant to the microfinance programs

Actuarial Value

- Insurance firms rely on data to have confidence that premiums charged are in line with the level of risk
- Interviewed parties noted that the presence of a specific work stream on data mapping would be vital to creating greater confidence in value at risk in the pilot programs
- Insurance/risk transfer products actually incentivises prevention initiatives by putting a real price tag on the risk with a premium

“We have a pilot program in India. The town flooded and all insured parties claimed – programs that are entirely focused at mitigating disaster and weather related risks will be highly subject to cluster risks and will be challenging to price correctly “

Allianz - Group Head of Sustainability

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3.2.4 Involvement of the insurance sector – Products versus events

It is much easier for the insurance sector to become involved when insuring, products, components and equipment than weather, events or climate conditions

Products versus events

- Each interviewee was asked to determine which areas of the project they felt were easier to become involved with
- Feedback was consistent across the board that product and equipment related insurance must be clearly differentiated from event, weather or climate related insurance
- **Parametric insurance** could provide a more appropriate method of tackling weather and event related risks given the far lower actuarial burden on the insurance firm
- Elements of both exist in all four programs

“You need to distinguish risks that are product-related from those that are weather, climate or event related. If you are constructing infrastructure or installing equipment, it’s vital that construction takes into account extreme conditions. Re-insurance can then attempt to cover disaster scenarios”

Swiss Re – Climate Risk

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3.2.4 Involvement of the insurance sector – Data mapping

The insurance sector has always relied on strong, historical data on which to determine risk. This is critically important when addressing environmental issues/disaster risk

Data mapping

- Availability of reliable, historic data remain a critical factor in determining risk for insurers on indemnity insurance
- The sector will typically look at trends over a 30-40 period particularly when addressing environmental/weather/disaster risks
- High volume/lower premium insurers (e.g. micro-ensure, micro-risk) are able to take a more pragmatic view on available data
- High resolution data is less relevant when insuring product related risks or on index linked or parametric insurance (see products versus events)
- Better availability of data is not necessarily a cost intensive effort but more about understanding and evaluating existing knowledge and identifying gaps
- Micro-ensure are also operating on the ground in Mozambique. They are highly regarded in the industry and could be an extremely interesting partner for small-scale lending program

"I am of the view that insurance firms need to take a very different approach to data when it comes to working in developing markets. The challenge though is that not having strong enough understanding of historical data will mean that investment by the larger players in the sector will remain on a very small scale"

Micro-ensure – President and CEO

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3.2.4 Involvement of the insurance sector – Quality of infrastructure

The build quality of infrastructure and buildings has a significant impact on evaluation of risk from an insurance perspective

Quality of infrastructure

Building Quality

- Minimum standards of build quality governed by appropriate governance processes could make a material impact on reducing risk profiles and hence pricing in indemnity insurance extended to physical infrastructure
- Appropriate planning processes which take into account identified climate adaptation risks can also have an impact

Intervention mechanisms

- Whilst recognising the current public services infrastructure in Mozambique the availability and accessibility of emergency services and disaster intervention can play a part in mitigating project risk
- This could include accessibility of the infrastructure/building and likely response from emergency services e.g. fire service that could reduce value at risk

"The importance of building quality and planning processes is vitally important in assessing value at risk"

Head of Sustainability – Willis Group

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3.2.4 Involvement of the insurance sector – Stakeholder awareness

A major stakeholder awareness and education program needs to happen to build trust in the role of insurance in building climate resilience into the private sector

Stakeholder Awareness

- There is a real lack of understanding of insurance products in the developing world
- By using the pilot project we can increase awareness that appropriate climate risk management requires a balanced portfolio of prevention, intervention and insurance measures
- Interviewees felt that the fact that the project is endorsed and driven by INGC/Government of Mozambique will have a strong element of drawing together relevant parties
- Equally a pilot project approach that is action oriented and that has already attracted “financing” interest increases the likelihood of results in the next phase

“why would I pay for something that I might never see the benefit of...”

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3.2.4 Involvement of the insurance sector – Index Linked/Parametric Insurance

For climate and weather event related events a more appropriate product might be parametric insurance which is an event or reference-point based insurance

A more appropriate way of insuring residual climate risks

- Unlike traditional indemnity insurance this product pays out upon a trigger event or reference point happening (e.g. a wind speed of 100 km/h being reached or a severe weather warning happening)
- The product pays out equal amounts to all those insured under the policy regardless of whether damage was caused by the trigger event
- This has an interesting effect of encouraging more resilient development since the payout is not linked to damage caused by the event
- This type of product also requires a far lower actuarial burden on the insurer
- There will be winners and losers in this type of insurance

“This type of product needs vision but could be a far more relevant and effective way of insuring against weather and climate related damage that traditional indemnity products”

Swiss Re

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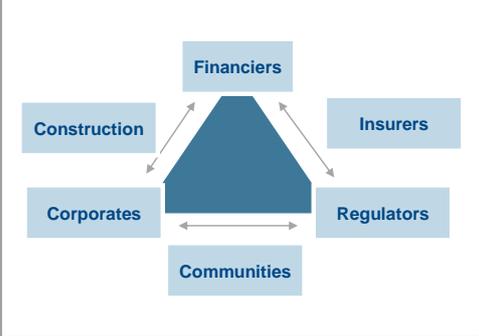
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3.2.4 Involvement of the insurance sector – Convening the right players

Relevant parts of the value chain will need to collaborate closely in the pilot projects to identify ways which each others mutual actions can support climate resilient development

Aggregation

- There is a real lack of understanding of insurance products in the developing world
- Interviewees felt that by “aggregating” relevant agencies or parties together in the roll-out of the pilot programs will have a very helpful effect of understanding relevant roles and impact that each might have
- E.g. construction companies gaining a greater understanding how build quality and governance will significantly affect indemnity insurance against damage from natural weather events



“the pilot programs provide an interesting opportunity to work in a collaborative way on activity which is supported by government and by other bodies” (referring to INGC)

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3.2.4 Involvement of the insurance sector – Distribution & collection

In respect of higher volume products likely in “small scale lending and the distribution part of composting” consideration needs to be given to collection and distribution

Distribution & Collection

- Insurance products in respect of the distribution part of the composting program and small scale lending and microfinance are likely to higher volume and lower premium
- These types of products will require distribution and collection infrastructure
- Insured parties also need to trust they will get paid
- As such from interviews it is highly unlikely that international insurance companies will have appetite for significant involvement in the these types of products
- A local insurance market is certainly required with a supporting legal framework
- The next phase of the work should look at identifying potential local trusted partners with a track record to work with e.g. Micro-ensure, Microrisk
- There has been some activity in the developing world but this appears limited to CSR type activity
- Progressive parts of the international re-insurance sector are more likely to have appetite for involvement if scale is large enough

“We have no infrastructure, presence in or knowledge of Mozambique. Whilst we understand how critical insurance products can be in promoting climate resilient development it would simply be not in our strategy to offer local on the ground insurance”

AXA – Head of Sustainability

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3.2.4 Involvement of the insurance sector – Next steps

Whilst penetration of insurance products in extremely limited in Mozambique, research has uncovered an appetite to work with us in the next Phase of the work

Summary of required next steps

Data Mapping	<ul style="list-style-type: none"> Engage with data mapping team/key industry thinkers to determine the level of resolution of data to enable informed weather/event related insurance products Swiss re have just completed cyclone and hurricane mapping in Mozambique)
Pricing and value	<ul style="list-style-type: none"> Work with identified partners and using the pilot program approach to refine pricing and risk evaluation of insurance products (link to data mapping)
Thorough risk-based economic analysis	<ul style="list-style-type: none"> Performing a thorough risk assessment, identifying risk prevention, intervention and insurance measures Insurance products are highly relevant across the four pilot programs. Identified partners and thoughts leaders should be worked with closely to map where relevant insurance products might be introduced to create more resilient projects/development. These partners should be a cross section of international insurance/reinsurance and Mozambique based insurance/micro-insurance players
Distribution and collection	<ul style="list-style-type: none"> Analysis of possible local partners to undertake distribution/collection for higher volume activity Strong synergies exist with the micro-finance/small scale lending program

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3.2.4 Involvement of the insurance sector – Next steps (continued)

Whilst penetration of insurance products in extremely limited in Mozambique, research has uncovered an appetite to work with us in the next Phase of the work

Summary of possible next steps

Engaging people	<ul style="list-style-type: none"> A major component in the ongoing work should be around engaging people around management and mitigation of climate risks and on the role of insurance in managing these risks The project needs to catalyze major understanding of climate related risks and their potential impact on economic development The role of insurance products are fundamental in this education program
Governance and Regulation	<ul style="list-style-type: none"> Identify critical government and regulatory mechanisms/interventions required to introduce a more likely insurance business in the Mozambique context This would include building regulation and standards of work /planning standards and permitting Work should also be done to examine what sort of underpinning legal framework required to more broadly develop a relevant local insurance market
Products versus events	<ul style="list-style-type: none"> Insurance products are highly relevant across the four pilot programs. Identified partners and thoughts leaders should be worked with closely to map where relevant insurance products might be introduced to create more resilient projects/development. Investigate how index/parametric based insurance can be extended on programs These partners should be a cross section of international insurance/reinsurance and Mozambique based insurance/micro-insurance players
Convening the right organizations	<ul style="list-style-type: none"> The right agencies need to be involved as the pilot programs are developed This would include local insurance firms, international insurers/reinsurers/regulatory bodies /development finance and donors

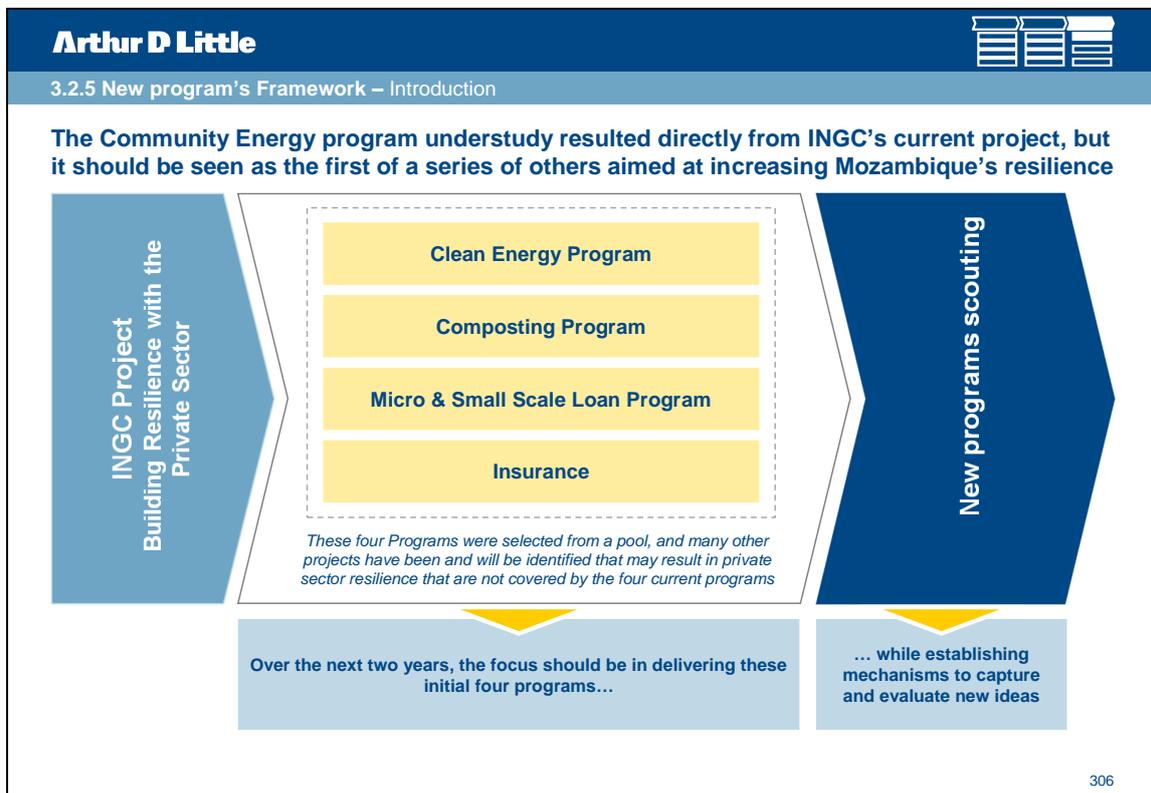
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3.2.5 New program's Framework – Introduction

This work stream should guarantee the implementation of the four defined Programs and also comprise a radar for new trends & topics and an evaluation procedure for new opportunities

Ensuring the successful implementation	Radar for new trends & topics	Evaluate new Program opportunities
<ul style="list-style-type: none"> A critical point is ensuring the successful implementation of the initial four Programs, in order to use them as flagship Programs to illustrate the soundness of the Program concept and the capacity that Mozambique has to implement them 	<ul style="list-style-type: none"> Promote contacts with impact investors and donors to evaluate which additional projects/programs within the overall portfolio of projects should be supported by private sector initiatives or a mix of private and public donor support. Promote a "market-driven" orientation to Mozambique for the growing areas of interest, in order to allow Mozambique to adapt the way it formulates and "packages" new projects/Programs to trends in the global impact investment market. 	<ul style="list-style-type: none"> Evaluate all the new ideas/trends that are identified through a four dimensions process: sustainability criteria, impact for Mozambique, impact to investors and capacity to build resilience to Mozambique

Unique Point of Contact & Transversal Teams

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3.2.5 New program's Framework – Evaluation framework of analysis

The new Programs scouted should obey to a list of selective criteria: sustainability impact, interest for Mozambique and the investors and capacity to build resilience to climate change

Framework of analysis	Key issues
	<p>The Sustainability criteria should be composed of strict guidelines that evaluate each of the new Programs and exclude those that do not meet the minimum criteria defined</p>
	<p>The scouted Programs should have a direct and positive impact in the development of Mozambique, at the social, economical and environmental level</p>
	<p>The selected Programs must be of interest to private investors, addressing their major concerns and providing interesting returns</p>
	<p>The Programs must contribute effectively for building resilience o climate change in Mozambique, addressing some of the most pressing issues</p>

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3.2.5 New program's Framework – Sustainability Criteria

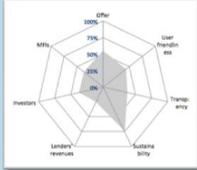
The Sustainability criteria should be composed of strict guidelines that evaluate each of the new Programs and exclude those that do not meet the minimum criteria defined



- Respect for basic human rights (namely gender equality)
- Respect for transparency and anti corruption practices
- Positive impact on the populations' quality of life
- Positive impact on the ecosystems and biodiversity
- Positive benefits for the local community
- Build climate change resilience
- Fight the poverty
- Foster economic growth and bring sustained income
- Contribute for a peaceful coexistence, without fomenting wars or disagreements

Examples

- Elaborate a specific spider diagram to evaluate the fulfillment of all these criteria and establish a minimum score, below which the Program is excluded



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3.2.5 New program's Framework – Interest for Mozambique

Another axis of analysis should be the impact for Mozambique and the capacity to address the most relevant sectors of activity



- The scouted Programs should have a direct and positive impact in the development of Mozambique, at the social, economical and environmental level
- The most prominent sectors of activity in Mozambique are agriculture, trading, manufacture, transports and tourism. From these, the latter are two of the most sensitive sectors to climate change
- Programs addressing these sectors of activity should be prioritized. On the other hand, programs addressing specific concerns of the population (water availability, logistics, accessibilities) should also be given very high priority

Examples

- Programs' that address the key sectors at risk in each region (Phase I report, Chapter 5) should be prioritized



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3.2.5 New program's Framework – Interest for the Private Sector

On the other hand, all the selected Programs must be of interest to private investors, addressing their major concerns and providing interesting returns



- In a developing country it's very difficult to address these type of projects without the support of the private sector, whether local or foreign
- The investors' community that we've contacted evidenced as critical factors in the investment decision that should undoubtedly be present in the scouted Programs:
 - Existence of a solid track record
 - High returns to compensate the risk
 - Existence of trust and trustable persons
 - Strong working knowledge
 - Quality of Governance

Examples

- The Programs should have a mix of interesting returns and social impact, in order to attract not only the venture capital investors, but also philanthropists and impact investors, that enable some investments that despite highly necessary, might not be financially attractive



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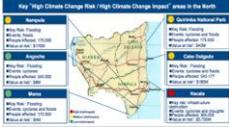
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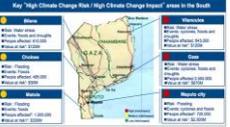
3.2.5 New program's Framework – Building Resilience to Climate Change

Finally, all the Programs must contribute effectively for building resilience o climate change in Mozambique, addressing some of the most pressing issues



- On top of the interest to Mozambique and to the private investors, each new Program should bring an obvious and impactful resilience to climate change
- The top priorities should be the causes identified as most critical in terms of private investment for each location (for a detailed description, please refer to Phase I report, Chapter 5)

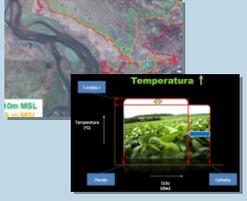




Phase I report, slide 12 Phase I report, slide 12 Phase I report, slide 12

Examples

- The other themes in this project offer a valuable source of inputs for new programs, like mangrove protection, coastal line protection, crops adaptation measure, malaria protection, among so many others



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3.2.5 New program's Framework – Methodology

Arthur D. Little designed a 3 steps approach to the development of blueprint process to help the identification of a portfolio of adaptation options

High-level project approach				
	Phase 0 Setup project	Phase I Creation of portfolio of adaptation options	Phase II Analysis & selection of portfolio options	Phase III Design of detailed adaptation program
Process	<ul style="list-style-type: none"> Desk research Benchmarking 	<ul style="list-style-type: none"> Identification of key business risks from main climate change risks Develop long-list of adaptation options Benchmarking from countries and agencies 	<ul style="list-style-type: none"> Perform cost-benefit and feasibility analysis of adaptation options Analyze financing options and barriers to investment Meeting with stakeholders to select final options 	<ul style="list-style-type: none"> Perform detailed cost-benefit and feasibility analysis for the options Identify changes to national policy and strategy to facilitate private investment Presentation to decision-makers
Output	<ul style="list-style-type: none"> Research findings Detailed scope and plan definitions for Phase I 	<ul style="list-style-type: none"> Key business risks prioritized by region Portfolio of adaptation options 	<ul style="list-style-type: none"> Portfolio evaluated and prioritized Short-list of options with financing options 	<ul style="list-style-type: none"> Describe the adaptation options «ready to implement» Guidelines for national policy and strategy

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3.2.5 New program's Framework – Methodology

Phase I aims at the creation of a portfolio of adaptation options and identification of the key business risks...

High-level project approach				
	Phase 0 Setup project	Phase I Creation of portfolio of adaptation options	Phase II Analysis & selection of portfolio options	Phase III Design of detailed adaptation program
Process	<ul style="list-style-type: none"> Desk research Benchmarking 	<ul style="list-style-type: none"> Identification of key business risks from main climate change risks Develop long-list of adaptation options Benchmarking from countries and agencies 	<ul style="list-style-type: none"> Perform cost-benefit and feasibility analysis of adaptation options Analyze financing options and barriers to investment Meeting with stakeholders to select final options 	<ul style="list-style-type: none"> Perform detailed cost-benefit and feasibility analysis for the options Identify changes to national policy and strategy to facilitate private investment Presentation to decision-makers
Output	<ul style="list-style-type: none"> Research findings Detailed scope and plan definitions for Phase I 	<ul style="list-style-type: none"> Key business risks prioritized by region Portfolio of adaptation options 	<ul style="list-style-type: none"> Portfolio evaluated and prioritized Short-list of options with financing options 	<ul style="list-style-type: none"> Describe the adaptation options «ready to implement» Guidelines for national policy and strategy

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3.2.5 New program's Framework – Methodology

... Phase II aims at the identification of a short-list of adaptation measures...

High-level project approach				
	Phase 0 Setup project	Phase I Creation of portfolio of adaptation options	Phase II Analysis & selection of portfolio options	Phase III Design of detailed adaptation program
Process	<ul style="list-style-type: none"> ■ Desk research ■ Benchmarking 	<ul style="list-style-type: none"> ■ Identification of key business risks from main climate change risks ■ Develop long-list of adaptation options ■ Benchmarking from countries and agencies 	<ul style="list-style-type: none"> ■ Perform cost-benefit and feasibility analysis of adaptation options ■ Analyze financing options and barriers to investment ■ Meeting with stakeholders to select final options 	<ul style="list-style-type: none"> ■ Perform detailed cost-benefit and feasibility analysis for the options ■ Identify changes to national policy and strategy to facilitate private investment ■ Presentation to decision-makers
Output	<ul style="list-style-type: none"> ■ Research findings ■ Detailed scope and plan definitions for Phase I 	<ul style="list-style-type: none"> ■ Key business risks prioritized by region ■ Portfolio of adaptation options 	<ul style="list-style-type: none"> ■ Portfolio evaluated and prioritized ■ Short-list of options with financing options 	<ul style="list-style-type: none"> ■ Describe the adaptation options «ready to implement» ■ Guidelines for national policy and strategy

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3.2.5 New program's Framework – Methodology

... and finally, in Phase three a detailed description of the four selected programs should be performed

High-level project approach				
	Phase 0 Setup project	Phase I Creation of portfolio of adaptation options	Phase II Analysis & selection of portfolio options	Phase III Design of detailed adaptation program
Process	<ul style="list-style-type: none"> ■ Desk research ■ Benchmarking 	<ul style="list-style-type: none"> ■ Identification of key business risks from main climate change risks ■ Develop long-list of adaptation options ■ Benchmarking from countries and agencies 	<ul style="list-style-type: none"> ■ Perform cost-benefit and feasibility analysis of adaptation options ■ Analyze financing options and barriers to investment ■ Meeting with stakeholders to select final options 	<ul style="list-style-type: none"> ■ Perform detailed cost-benefit and feasibility analysis for the options ■ Identify changes to national policy and strategy to facilitate private investment ■ Presentation to decision-makers
Output	<ul style="list-style-type: none"> ■ Research findings ■ Detailed scope and plan definitions for Phase I 	<ul style="list-style-type: none"> ■ Key business risks prioritized by region ■ Portfolio of adaptation options 	<ul style="list-style-type: none"> ■ Portfolio evaluated and prioritized ■ Short-list of options with financing options 	<ul style="list-style-type: none"> ■ Describe the adaptation options «ready to implement» ■ Guidelines for national policy and strategy

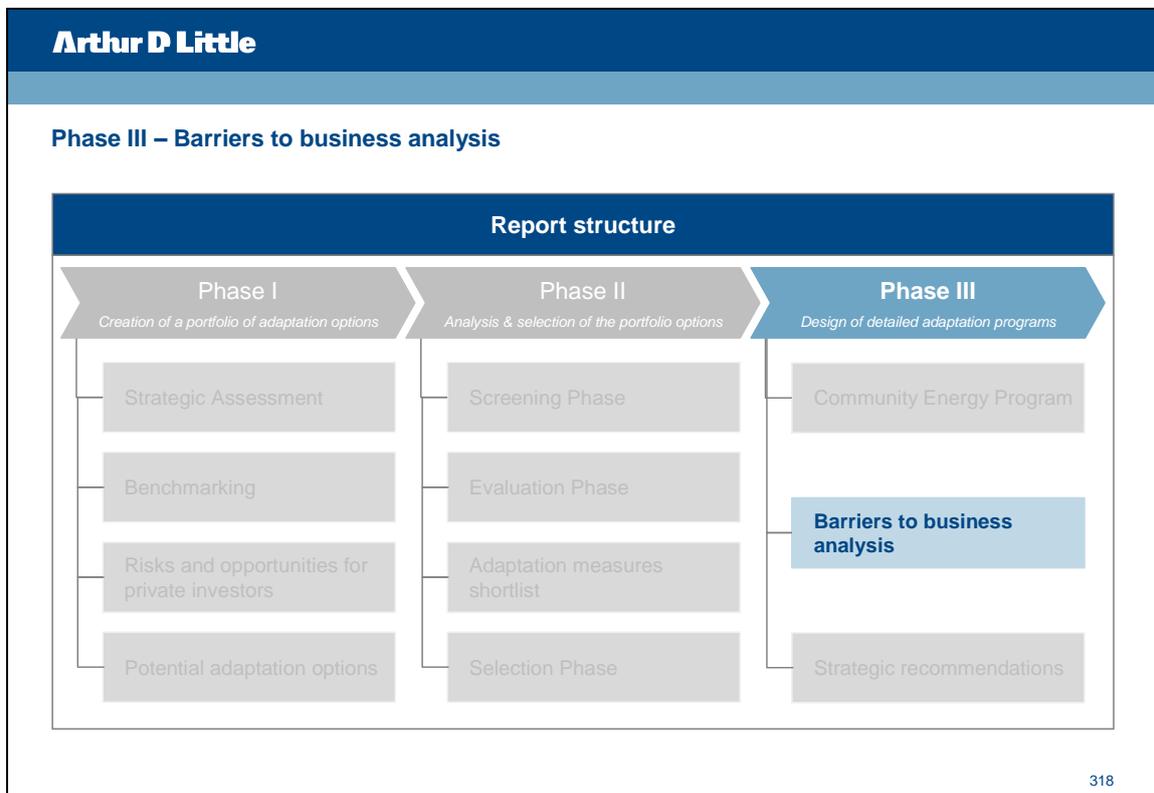
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3.3 Barriers to Investment – Doing business in Mozambique

Out of 183 countries present in the World Bank’s Doing Business ranking, Mozambique is poorly positioned in #139, a decay from the 132 position obtained in 2011

Doing Business Ranking	
Parameter	Ranking
Ease of doing business	139*
Starting a business	70
Dealing with construction permits	126
Getting electricity	172
Registering property	156
Getting credit	150
Protecting investors	46
Paying taxes	107
Trading across borders	136
Enforcing contracts	131
Resolving insolvency	143

Some notes

- The Doing Business ranking is a tool from the World Bank to assess the transparency in the business arena in the different countries
- Mozambique was ranked in #132 in 2011, one of its best classifications ever in this ranking, however, a change in the electricity acquisition permits lead to a severe decrease to the 139 position

Mozambique made getting electricity more difficult by requiring authorization of a connection project by the Ministry of Energy and by adding an inspection of the completed external works
in Doing Business, 2012

- This poor classification can be a detractor to foreign investment in the country, so it’s vital that aspects like construction permits, property registration, credit access, and on top of all, getting electricity, be swiftly and efficiently addressed

Source: Doing Business 2012, World Bank; *Out of a total of 183 countries

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3.3 Barriers to Investment – Corruption Perception Index

In the Corruption Perception Index, Mozambique achieved a very poor classification of 2,7, which is seen by investors as a severe problem that decreases their confidence in investing

Corruption Perception Index

- The Corruption Perception Index is a tool from Transparency International, that measures the level of corruption perception in the public sector through surveys to the private sector and independent consultants
- The index goes from highly corrupt (0-0,9) to very clean (9-10)
- It is estimated that a 1 point increase in this index leads to a 4% improvement in the average income
- Out of 178 countries, Mozambique was classified in 116, ex aequo with Ethiopia, Mali and Mongolia
- A rank below 3 is seen by investors as a vicious problem in the country, and leads to very low levels of confidence in terms of investment

Mozambican Classification

#1 – Denmark (9,3)

#116 – Mozambique, Ethiopia, Guyana, Mali, Mongolia, Tanzania, Vietnam (2,7)

#178 – Somalia (1,1)

Source: Transparency International

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3.3 Barriers to Investment – Governance Indicators

It is visible a growing trend in the majority of the dimensions analyzed by the Governance Indicators, however there is still a long road ahead to escape from the bottom of the table

Governance Indicators (WGI)

- The Worldwide Governance Indicators (WGI) project aggregates indicators from 213 economies since 1996, for six dimensions of governance:
 - Voice and accountability (freedom of speech, to chose government, free press)
 - Political stability and absence of violence (violence or terrorism)
 - Government Effectiveness (quality of public services)
 - Regulatory quality (stable and efficient regulatory framework)
 - Rule of Law (trust in the law enforcement)
 - Control of Corruption

Results for Mozambique

Despite the growing tendency for the majority of the indicators, Mozambique still presents very low values in the majority of the dimensions

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3.3 Barriers to Investment – Framework of analysis

The Community Energy Program was selected to foster sustainable development and investment in Mozambique, however there are still a series of barriers that must be overcome

Framework of analysis	Key issues
<div style="display: flex; align-items: center;"> <div style="background-color: #0056b3; color: white; padding: 10px; writing-mode: vertical-rl; transform: rotate(180deg);">Transversal Barriers to Investment</div> <div style="margin-left: 20px;"> <div style="background-color: #d9e1f2; padding: 5px; margin-bottom: 5px;">Clean Energy Program Barriers to Investment</div> <div style="background-color: #d9e1f2; padding: 5px; margin-bottom: 5px;">Composting Program Barriers to Investment</div> <div style="background-color: #d9e1f2; padding: 5px;">Micro and Small Scale Lending Program Barriers to Investment</div> </div> </div>	<p>Access to electricity and a decrease in foreign investment due to the current global crisis are two of the most pressing barriers. Another big deterrents of private investment, specially foreign investment, are the levels of corruption.</p>
	<p>From a list of issues that should be overcome in the near future the most pressing are the establishment of feed-in tariffs and of an adequate legislative framework</p>
	<p>In the Composting Program the most important barriers are also on the economic/financial and legislative side, with initial investment and lack of legislation playing an important role</p>
	<p>Logistic barriers and inadequate mindset are the most pressing barriers concerning the Micro & Small Scale Lending Program</p>

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3.3 Barriers to Investment – Transversal barriers

Access to electricity and a decrease in foreign investment due to the current global crisis are two of the most pressing issues in terms of economic & financial barriers

Transversal barriers to Investment

Economic & Financial	Energetic dependence of South Africa and lack of adequate infrastructures (only 13% of the population has access to electricity). The recently approved legislation makes it even harder to install electrical installations	●	Invest in electrical infrastructures and in the distributed electricity concept: small electrical installations, that supply electricity to small villages and population agglomerates. Enforce adequate legislation and install a feed in tariff for renewable electricity
	The ongoing global economic crisis may pose severe challenges to the investors willing to invest in Mozambique	●	Approve legislation that gives attractive conditions to foreign investors (tax benefits, Government guarantees, etc)
	Exchange rate and Price Stability	●	Eliminate excessive liquidity (emitting treasury bills, buying national currency) to prevent an increase in inflation
Logistic	Communication infrastructures (mobiles, accessibilities, etc.)	●	Invest in improving or creating from scratch good accessibilities: the lack of roads and good accesses is detrimental for the majority of investments

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3.3 Barriers to Investment – Transversal barriers

One of the biggest deterrents of private investment, specially foreign investment, are the levels of corruption in Mozambique, that must be severely fought

Transversal barriers to Investment

Legislative & Administrative	Getting permits and registering property: two of the worse classified items in the World Bank's Doing Business ranking	●	Speed up the bureaucratic mechanisms needed to get permits and register properties. Invest in new technologies that help smoothing these processes
	Corruption	●	Enforce very strict anti corruption legislation, impose adequate fines and create efficient inspection mechanisms.
	Insufficient regulatory framework (lack of legislation that promotes stability and encourages the private investment)	●	Promote a forum with representatives of the private sector (including foreign representatives) to discuss the top measures that should be enforced to increase private investment in Mozambique
Human Resources	Low levels of literacy and education	●	Increase the number of schools and the professor/student ratio. Promote adult education. Establish scholarships for the most needed

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3.3 Barriers to Investment – Clean Energy Program

From a list of issues that should be overcome in the near future the most pressing are the establishment of feed-in tariffs and of an adequate legislative framework for renewables

Clean Energy Program		
Economic/Financial	Lack of feed-in tariff or similar mechanisms (PPA, tax benefits, etc.) to incentivize the implementation of renewable energy projects	Lobby with the Government for the implementation of such mechanisms
Logistic	Bad/insufficient accessibilities and dispersed locations highly increase the construction and transport costs of these projects	Negotiate a bulk contract with the transport company. Prioritize nearby locations
Human Resources	Lack of personnel with adequate qualifications to install the devices and perform adaptations to the Mozambican reality	Invest in training local personnel, and put them in direct contact with the foreign teams doing the initial installations
Legislative	Lack of an adequate legislative framework that defines the grounds for the Government support to clean energy (feed-in tariffs duration, scope of support, etc.)	Lobby with the Government to clearly define and implement adequate legislation
Cultural	The inexistence of renewable energy projects in Mozambique doesn't create the necessary pull mechanism from the population	Create advertising campaigns to bring awareness to the populations of the benefits/possibility of having renewable energy

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3.3 Barriers to Investment – Composting Program

In the Composting Program the most important barriers are also on the economic/financial and legislative side, with initial investment and lack of legislation playing an important role

Composting Program		
Economic/Financial	It is necessary a high initial investment to brake ground, which, given Mozambique's lending conditions it's not easy to obtain	Create specific credit lines for composting programs, with lower interest rates and adequate maturities
Logistic	Typically the population does not comply with the appropriate places to dispose the garbage, so it's necessary to invest in sometimes expensive collecting routines	Create awareness programs to illustrate the dangers of non regulated waste disposal and implement a fines system
Human Resources	The techniques are simple enough, to be easily understood by the personnel, after an initial training, however it's important to implement quality control procedures	Implement rigorous quality control procedures, to ensure that the fertilizer produced is of the highest quality
Legislative	The legislation to enforce for the adequate disposal of garbage and waste is not strict enough and doesn't compel the individuals/companies to comply	Lobby with the Government to clearly define and implement adequate legislation and a fine system
Cultural	Individuals and companies are used to throw away the garbage everywhere without much concern on safety. On the other hand, the use of fertilizers is not much widespread in agriculture	Bring awareness to the benefits of using fertilizers in agriculture and on the health issues coming from wrongful waste disposal

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3.3 Barriers to Investment – Micro & Small Scale Lending Program

Logistic barriers and inadequate mindset are the most pressing barriers concerning the Micro & Small Scale Lending Program

Micro & Small Scale Lending Program		
Economic/Financial	The high interest rates in the country difficult the creation of an entrepreneurial mindset based on banks financing	 Negotiate with partners looking for lower returns, that emphasize other metrics like impact in the population well being
Logistic	The distance between the cities makes it difficult to promote synergies. Also there's a big disparity between the south of the country and the north, poorer and with lower access to finance	 Select partners with a widespread network of branches
Human Resources	Lack of personnel with specific financial knowledge to work in micro finance institutions and to be able to clarify the questions and doubts of the clients	 Invest in training local personnel, and put them in direct contact with experts from the sector. Promote mixed teams
Legislative	Lack of supporting legislation, promoting entrepreneurial activities and allowing for some benefits ((e.g. tax benefits, dedicated credit lines, etc.)	 Lobby with the Government to clearly define and implement adequate legislation
Cultural	Mozambique is one of the countries with lower borrowing rates, specially because individuals are still afraid of asking for money to banks, as they feel ignorant of the trading practices	 Increase awareness and promote educational campaigns to show the benefits of micro and small scale lending

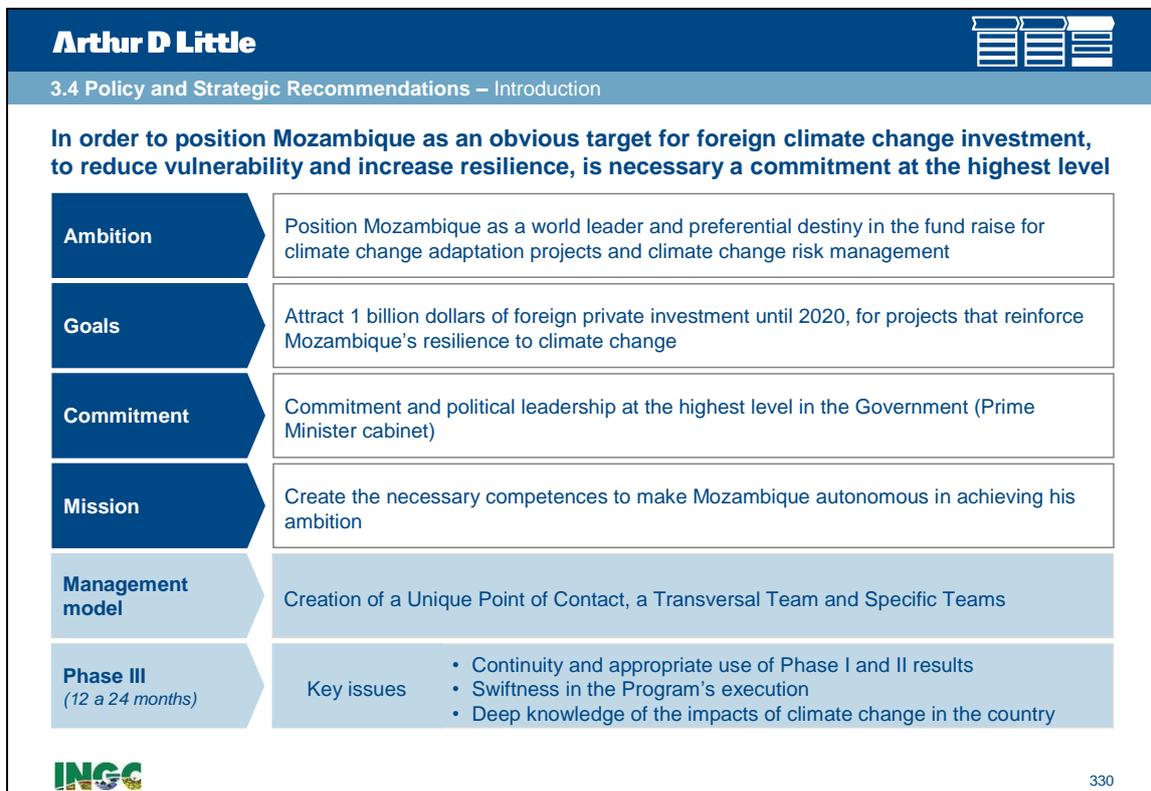
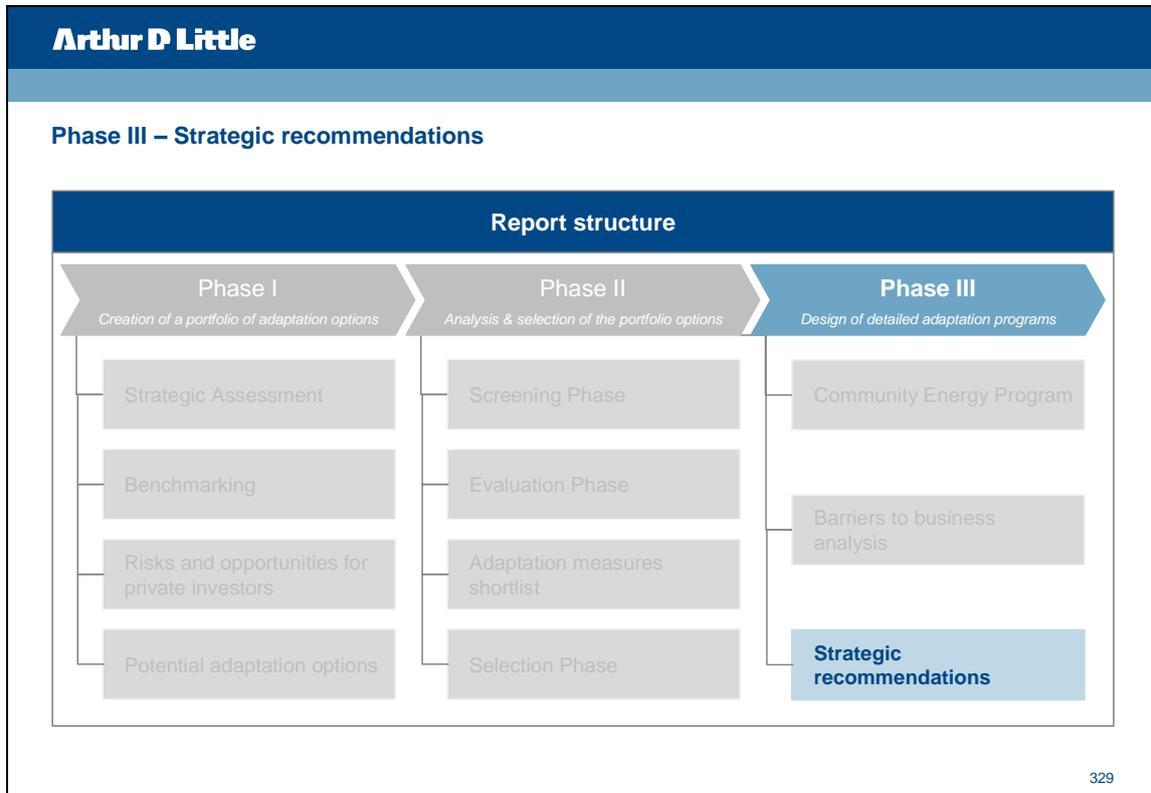
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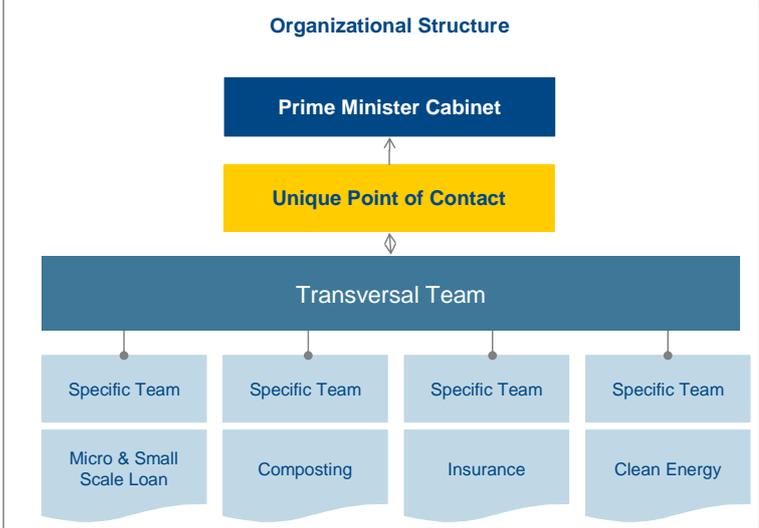
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3.4 Policy and Strategic Recommendations – Proposed organizational structure

The organizational structure should be characterized by the highest level of political leadership and a clear and swift strategy approval process



The diagram illustrates the proposed organizational structure. At the top is the Prime Minister Cabinet. Below it is the Unique Point of Contact. A diamond symbol connects the Unique Point of Contact to the Transversal Team. The Transversal Team is supported by four Specific Teams: Micro & Small Scale Loan, Composting, Insurance, and Clean Energy.

Unique Point of Contact
Team with specific competences in negotiating with financial investors and capacity to articulate with the entire network of related Governmental entities

Transversal Team
Team able to articulate with the different governmental entities and in coordination with the Specific Teams and Unique Point of Contact

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3.4 Policy and Strategic Recommendations – Competences & Responsibilities

The profile of the international investors' community requires teams with highly specific competences

Unique Point of Contact	Transversal Team	Specific Teams
<ul style="list-style-type: none"> Capacity to deal directly with international investors (<i>Impact Investment Funds</i>, banks and others) Deep knowledge of the Mozambican reality and government structures at the national, regional and local level Coordinating role, between the international investors and all the entities involved in the approving, licensing and monitoring of the Programs Scouting of new projects/Programs 	<ul style="list-style-type: none"> Definition of the global strategy for the Programs, operational model, conceptualization of the roadmap and capacity building (in the early phases) and projects' PMO* Competences in corporate finance, project valuation, portfolio management, contracting process with investors, etc. Fund raise and project's sustainability monitoring Evaluation of new projects/Programs 	<ul style="list-style-type: none"> Teams with specific competences for each Program (technical legal, legal, administrative, logistic) Responsible for the direct operationalization of the projects within each Program (project identification, technical valuation, etc.) Responsible for delivering the necessary training to foster autonomy in the national resources

INGC will be the catalyst in the establishment of the Unique Point of Contact, Transversal Team and should maintain the responsibility over the Specific Teams during the cruise velocity phase

*PMO – Project Management Office

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3.4 Policy and Strategic Recommendations – Capacity Building

The capacity building to render Mozambique autonomous in the management of these Programs is a priority mission

Human Resources	Identification, profile selection and hiring of specialized personnel.
Training	Capacity building at the technical, financial and legal levels (among others) and knowledge transfer
Learning by doing	Polishing of the personnel capacities, by creating mixed teams, formed by national personnel, supported by an interim team of external consultants
Technical Assistance	Perform technical and scientific studies, project conceptualization, detail engineering studies, etc.
Assets	Development of informatic models, measurement instruments and monitoring systems

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3.4 Policy and Strategic Recommendations – Main messages (1/2)

To bring these Programs to light and make them a flagship for future opportunities it is crucial to secure funding and an adequate investment environment...

Main messages

- Raising the funding**

Securing the funding for the Programs will require a **concerted effort** in working with investors, Unique Point of Contact, Transversal Team, Specific Teams and the network of authorities, Government, local partners/businesses and communities required to set up the plans, governance models, vehicles, etc. to channel the funding to the Programs and projects.
Essentially here is to execute whatever needs to be done to unlock the finance from whatever part of the funding community it should come from.
- Creating the investment channels/environment for FDI**

There is a strong sentiment among the international investors, that **doing business in Mozambique is difficult and cumbersome** and that this perception/reality will be one of the key barriers to be overcome if the gates to significant private sector funding for climate change adaptation measures are to be fully opened up.
The work here should **build on the recommendations that come out of the "barriers to investment"** and **take this in to concrete recommendations** and support to building the Unique Point of Contact to coordinate/facilitate/accelerate the necessary authorization, licenses, logistics etc. to help international investors gain traction in the Programs quickly and smoothly.
- Program Management Office**

Ensure **that all the organizational structures that facilitate the full project execution are in place** and that all the different aspects of the execution are coordinated among themselves, in order to deliver a final and coherent result.

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3.4 Policy and Strategic Recommendations – Main messages (2/2)

... that allows for a successful deployment with a tangible impact in the populations quality of life

Main messages	
4 Seed capital/early stage funding to pilot projects and capability building	Providing early stage support to specific pilot projects to get them "off the drawing board", i.e. through technical assistance or studies, or in funding capability-building for the development of the necessary local skilled workers/professionals and project managers that will be required to support/oversee the implementation of the Programs.
5 Public funding is crucial	Without a portion of public funding to start these initial four Programs and without ensuring proactive Government support , the private sector will not be interested to make the investments on their side as the costs/barriers will be too great
6 Engagement of local population and other stakeholders	Creating the right mind set in the populations and "educate" them on sustainability issues and opportunities, so that they understand that more than a threat or "another project", this may be a real opportunity to improve their quality of life. This will not only have a positive impact in the population literacy, but should also help to create momentum for these projects development.
7 Promote the creation of insurance platforms	Developing micro-insurance/other insurance products that build resilience into the private sector/support the programmes.

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4.1 Methodologies

«ECA – Shaping climate-resilient development: a report of the economics of climate adaptation» group was used as a methodology for strategic assessment and benchmarking phases

Interpretation of ECA's approach

```

    graph LR
      A[Design a systematic approach to climate adaptation] --> B[Find solutions from test cases]
      B --> C[Steps to implement a comprehensive strategy for climate-resilient development]
  
```

Used in strategic assessment in order to evaluate "Exposure", "Vulnerability" and "Climate Risk"

Used in our benchmark approach in order to look for adaptation measures that could be adopted in Mozambique and build scenarios to guide decision-making

Used in the assessment of risks and opportunities for private investors in order to prioritize hazards and locations, and in the identification of funding mechanisms from the international community

Source: ECA - Climate Adaptation Working Group

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4.1 Methodologies

«EACC – Economics of Adaptation to Climate Change» was used as a methodology in climate change analysis, benchmarking and potential adaptation measures identification phases

Interpretation of EACC's approach

```

    graph LR
      A[Definition of climate change impacts] --> B[Evaluation of impacts in climate change with different scenarios]
      B --> C[Definition of adaptation strategies]
      C --> D[Identification of a set of adaptation options]
  
```

Used in climate change analysis in strategic assessment in order to evaluate "Exposure", "Vulnerability" and "Climate Risk"

Used in benchmarking and potential adaptation measures identifications

Source: EACC - Economics of Adaptation to Climate Change

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4.1 Methodologies

SEA an adaptation to climate change from OECD was used as methodology in strategic assessment, risks and opportunities for private sector and potential adaptation options

Interpretation of «OECD – SEA and adaptation to climate change» approach

```

    graph LR
      A[Establishing the Context] --> B[Implementing the SEA]
      B --> C[Informing and Influencing Decision Makers]
      C --> D[Monitoring and Evaluation]
  
```

Used in strategic assessment in order to evaluate business context

Used in strategic assessment in order to evaluate “Vulnerability” and “Climate Risk”. Moreover, used in “Risks and opportunities for private investors” and in “Potential adaptation options”

Will be used in next phases to recommend and communicate policy changes

Source: OECD – SEA and adaptation to climate change

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4.1 Methodologies

«Adaptation - An issue brief for business» was used as methodology for the definition of risks and opportunities for private investors

Interpretation of «Adaptation - An issue brief for business» approach

```

    graph LR
      A[Definition of business risks and opportunities] --> B[Division of risks and opportunities according to the spheres of activity or influence]
      B --> C[Division of risks and opportunities per business sector]
  
```

Used in “Risks and opportunities for private investors” mainly in the definition of key business risks and opportunities in high climate impact areas

Used in “Risks and opportunities for private investors” mainly in the definition of key business risks per sector

Used in “Risks and opportunities for private investors” mainly in the definition of key sectors at risk

Source: Adaptation - An issue brief for business –World Business Council for Sustainable Development

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4.1 List of sources

List of key sources (1/5)

	Sources
1 Introduction	<ul style="list-style-type: none"> ■ INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; ■ Theme 2 “Coastal protection”, theme 4 “Ecoenergia” and theme 6 “ Food- meeting demands” ■ Construindo Resiliência com o Sector Privado – Technical proposal adenda
2 Strategic Objectives	<ul style="list-style-type: none"> ■ INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique ■ Construindo Resiliência com o Sector Privado – Technical proposal adenda

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4.1 List of sources

List of key sources (2/5)

	Sources
3 Strategic assessment	<ul style="list-style-type: none"> ■ EACC - Economics of Adaptation to Climate Change ■ ECA – Shaping climate-resilient development: a report of the economics of climate adaptation group ■ Strategic environmental assessment and adaptation to climate change© OECD 2008, ■ Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário ■ INE Mozambique ■ Banco Central da República de Moçambique ■ Portal do Governo de Moçambique ■ Human development index 2010 from UNDP ■ Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets ■ EM-DAT -The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain - Brussels - Belgium ■ INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique: Main report; ■ Desconsultar database ■ 100 maiores empresas de Moçambique – document KPMG ■ Nacala XXI, Nacala, Beira and Maputo development corridors ■ Mozambique investment forum 2010 ■ Investment Opportunities in the Industrial Sector ■ Investing in Mozambique 2010

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4.1 List of sources

List of key sources (3/5)

	Sources
<p>4</p> <p>Benchmark</p>	<ul style="list-style-type: none"> ■ Meetings with private investors ■ Other themes' input ■ ECA - Climate Adaptation Working Group ■ OECD – SEA and adaptation to climate change ■ Working Group II Contribution for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change ■ Australia - climate change adaption actions for local government ■ UNFCCC - United Nations Framework Convention on Climate Change ■ FAO - Food and Agriculture Organization ■ International Cooperation Bureau Yangtze (Changjing) Water Resources Commission, MWR, China ■ The World Bank ■ http://www.rainwaterharvesting.org/ ■ UNESCO ■ Environmental protecting agency USA

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4.1 List of sources

List of key sources (4/5)

	Sources
<p>5</p> <p>Risks and Opportunities for private investors</p>	<ul style="list-style-type: none"> ■ Adaptation - An issue brief for business –World Business Council for Sustainable Development ■ SEA - Strategic Environmental Assessment – Good Practices Guide ■ EACC - Economics of Adaptation to Climate Change ■ OECD – SEA and adaptation to climate change ■ ECA - Climate Adaptation Working Group ■ Strategic environmental assessment and adaptation to climate change © OECD 2008 ■ Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; ■ Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets ■ EM-DAT – The OFDA/CRED International Disaster Database ■ INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique ■ Desconsultar database. ■ CPI, approved projects from 2005 till November 2010 ■ World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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4.1 List of sources

List of key sources (5/5)

5 Risks and Opportunities for private investors	Sources
	<ul style="list-style-type: none"> ■ Adaptation - An issue brief for business –World Business Council for Sustainable Development ■ EACC - Economics of Adaptation to Climate Change ■ OECD – SEA and adaptation to climate change ■ ECA - Climate Adaptation Working Group ■ Strategic environmental assessment and adaptation to climate change© OECD 2008 ■ Strategic Environmental Assessment Good Practices Guide - Maria do Rosário Partidário; ■ Prevention Consortium - The quality and accuracy of disaster data – a comparative analysis of three global data-sets ■ EM-DAT - The OFDA/CRED International Disaster Database ■ INGC – Study on the Impact of Climate Change on Disaster Risk in Mozambique ■ Desconsultar database. ■ CPI, approved projects from 2005 till November 2010 ■ World Business Council for Sustainable Development – Business risks and opportunities resulting from climate change impacts

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