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# **ASSESSMENT OF ECONOMIC RISKS AND OPPORTUNITIES OF CLIMATE RESILIENT INVESTMENT IN THE WESTERN CAPE**

**Project Report 3:**

**Summary Report on the Modelling of  
Climate Change Economic Risks,  
Impacts and Opportunities**

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# 1 KEY MESSAGES



## HOW INVESTMENT IN CLIMATE RESILIENCE WILL IMPACT THE WESTERN CAPE ECONOMY

### BETTER PROVINCIAL GDP

**33%**

By investing in improved climate resilience, provincial GDP could grow by more than 15% above the baseline by 2040. But failure to invest will result in contraction of the economy by more than 17%.

### INCREASED EMPLOYMENT

By 2040, provincial employment could have increased by over 12% above the baseline with investment in climate resilience in the Western Cape.

**12%**

### REDUCED PRICES

By becoming a national leader in climate resilience, the Western Cape can increase its competitive advantage and reduce its prices.



### INCREASED TRADE

**6.4%**

Increased climate resilience could boost regional exports from the Western Cape by up to 6.4% by 2040.



### LOWER COST OF LIVING

A more climate resilient province will result in lower cost of living and better quality of life for the Western Cape's people.



### MORE GLOBALLY COMPETITIVE



Investment in climate resilience will secure the Western Cape's place in an increasingly carbon-constrained global economy.

### GROWING GREEN ECONOMY

The introduction of local or global carbon pricing will drive demand for renewable energy, a sector that the Western Cape leads in nationally.



## TO ACHIEVE THE BENEFITS & MINIMISE THE RISKS

THE WESTERN CAPE GOVERNMENT NEEDS TO

### BE A NATIONAL LEADER



By leading in adapting to climate change, the Western Cape economy and society will benefit significantly, particularly if other provinces also adapt.

### EQUIP THE WORKFORCE

Anticipating and meeting new skills and training needs in an expanding climate resilient economy in the Western Cape will be critical.



A more inclusive climate resilient economy will be achieved through equipping the provincial workforce with the right skills to participate in it.

### CHOOSE WISELY

The choice of which sectors to prioritise for climate resilient investment will affect the industries that emerge as climate change winners and losers.

The agriculture, water, electricity, transport and real estate sectors affect household expenditure significantly, and should be prioritised for climate resilient investment.

### PLAN FOR CARBON PRICING

Energy and carbon intensive industries in the Western Cape are highly exposed to local and global carbon pricing impacts. The Western Cape Government needs to plan for this in its economic development strategies and sectoral investment choices.



### BUILD ON ADVANTAGES

Increased demand for renewable energy will result from energy price changes and the implementation of local and global carbon pricing, presenting opportunities for the Western Cape, which is already a national leader in this sector.



## CLIMATE CHANGE AND THE ECONOMY – STRATEGIC MESSAGES

**Climate change is real, and its impacts are unavoidable. While a sub-national government cannot entirely control the impact that climate change will have, it does have the power to choose how to respond. These choices will define the future growth or contraction of the Western Cape economy, which sectors of the economy will benefit / suffer the most, and the level of well-being of the Western Cape's people.**

- Climate change will reconfigure economic competitiveness regionally and globally. Effective investment in climate adaptation could serve as a critical catalyst for increased economic competitiveness of the Western Cape.
- Where climate change serves as a catalyst for proactive investment in climate adaptation, the net economic impact of climate change could be positive in the province.
- Climate change and climate adaptation investment will not affect all sectors equally. Policy makers must decide whether to protect the most exposed sectors or invest in the sectors that stand to benefit from climate change.

## CHANGES IN PROVINCIAL GDP

**By investing in improved climate resilience, the Western Cape economy could be 33% better-off in 2040 than if the province does not adapt to the impacts of climate change.**

- The effectiveness of the Western Cape Government's climate adaptation policies, along with the reactions of other provinces, could significantly affect the extent of Provincial GDP growth or contraction by 2040.
- Failure to invest adequately in adapting to climate change could result in the Western Cape's GDP contracting by more than 17% by 2040, particularly if other provinces are less affected by climate change, or if they adapt more effectively.
- Effective investment in enhancing climate resilience could boost the province's GDP by more than 15% above the baseline by 2040, particularly where the Western Cape is a national climate adaptation leader.
- The greater the investment in climate resilience, the greater the benefits to the Western Cape economy.

## CHANGES IN EMPLOYMENT

**Employment levels in the Western Cape could increase by as much as 12.4% by 2040, if the province leads in adapting to climate change.**

- Conversely, a failure to invest adequately in climate adaptation may result in employment levels declining by over 10% by 2040.
- Anticipating and meeting new skills and training needs in an expanding climate resilient economy in the Western Cape will be critical.

- 
- A more inclusive climate resilient economy will be achieved through equipping the provincial workforce with the right skills to participate in it.

## PRICE CHANGES

**By becoming a national leader in climate resilience, the Western Cape can increase its competitive advantage and so limit price increases.**

- Climate resilient investment in different sectors will result in price changes, affecting cost of living, economic competitiveness, and social equality.

## CHANGES IN TRADE

**Regional exports from the Western Cape could increase by 6.4% by 2040 with enhanced climate resilience.**

- The Western Cape needs other provinces also to adapt to climate change for there to be strong intra-regional and international trade in the medium and long-term.

## IMPACT ON HOUSEHOLDS

**A more climate resilient province will result in a lower cost of living and better quality of life for the Western Cape's people.**

- A lower cost of living is potentially a major driver of GDP growth in the province.
- Conversely, failure to invest adequately in adapting to climate change could lead to increased household cost of living in the Western Cape, with declining quality of life and a contracting GDP.
- The agriculture, water, electricity, transport and estate services sectors affect household expenditure significantly, and should be prioritised for climate resilient investment.

## CARBON PRICING IMPLICATIONS

**Investment in climate resilience will secure the Western Cape's place in an increasingly carbon-constrained global economy.**

- The Western Cape economy could be negatively affected by national or global carbon pricing, with the most exposed sectors being petroleum refineries, and all high electricity consuming industries such as iron and steel manufacturing.
- The Western Cape economy could benefit from increased demand for renewable energy stimulated by local or global carbon pricing, given the WCG's proactive stance in promoting the development of this sector.
- Proactive investment in the sectors that will benefit from a carbon tax would serve the strategic interests of the provincial economy.

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## 2 FOCUS OF THE STUDY

The Earth's average air temperature is warming at 0.1°C - 0.25°C per decade<sup>1</sup>. This rise in temperatures has been described as “unequivocal” and “unprecedented”<sup>2</sup>. In the scientific community, it is no longer contested that this warming is caused by the accumulation of greenhouse gases (GHGs) in the atmosphere.

Global warming is not uniform. Many regions in South Africa, including some locations in the Western Cape, have experienced levels of warming above the global mean. South Africa's 2016 National Communication to the Intergovernmental Panel on Climate Change indicates that the Western Cape will approach a 1.5°C average air temperature increase between 2040-2060, which is slightly ahead of the global mean.

There have been many economic assessments of the potential global cost of climate change. The United Nations has estimated that in 2010 climate change lowered global GDP by 1.6%, equivalent to a loss of \$1.2 trillion; and with the growing rate of climate change impacts, average global economic losses could rise to 3.2% annually by 2030 and up to 10% per annum by 2100<sup>3</sup>.

In response to this threat, signatories to the UNFCCC's Paris Agreement in 2015 committed to curtailing global warming to “well below 2°C”, and to “explore efforts to limit warming to 1.5°C”. To achieve this, an estimated \$16.5 trillion will have to be invested or reallocated towards renewable energy, sustainable cities, public transport, and adaptation and resilience building by 2030. This reallocation of global capital will generate new economic opportunities, some of which developing countries will be well-placed to benefit from. This could go a long way towards assisting these countries implement the United Nations Sustainable Development Goals<sup>4</sup> (SDGs).

The Western Cape Government has recognised the risks posed by climate change to its economy, population, ecosystems and infrastructure. These risks are already being experienced as escalating costs to the public and private sector for remediation and repair of damage resulting from more frequent and intense storms, floods, droughts and wildfires. Critically for the Western Cape, climate change is predicted to compound these pressures not only on environmental systems, but also on social and economic systems, escalating social inequality due to the disproportionately high impacts on the poor.

The need to address vulnerability and build resilience in response to climate change risks offers an unprecedented opportunity to direct investment in a manner that accelerates the process of transitioning the Western Cape economy, cities and society towards a more just, equitable and sustainable future. However, it is difficult to know where to begin and how to prioritise climate adaptation action across the diverse range of impacts, vulnerabilities and risks that are predicted for the province. The Western Cape cabinet has endorsed the

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<sup>1</sup> See Kirtman *et al.* 2013; Haustein *et al.* 2016.

<sup>2</sup> See IPCC, 2014.

<sup>3</sup> UNDP, 2016.

<sup>4</sup> <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

'Western Cape Climate Change Response Strategy (WCCCRS) 2014', which aims to guide the implementation of innovative projects and the search for opportunities that combine a low carbon development trajectory with increased climate resilience, enhancement of ecosystems and the services they provide, and economic stability and growth. However, understanding of the economic costs and opportunities are required in order to infuse more rapid and fast-tracked responses across all sector departments.

This report presents the outcomes of an economic modelling process undertaken to evaluate the economic costs of climate change in the Western Cape, and the potential economic benefits of investing in climate change adaptation in the province.

### 3 ECONOMIC MODELLING METHOD

The University of Pretoria's Computable General Equilibrium (CGE) Model was used for the economic modelling process. The model contains 27 economic sectors / industry clusters, the data for which is sourced from Statistics South Africa and disaggregated per province.

The CGE model starts with a baseline year (2016) in which all markets are assumed to be in equilibrium. The impact of climate change and climate adaptation investment on the Western Cape economy was then modelled to 2040, by adjusting the amount of capital and recurrent expenditure that would be expected to occur by 2040 with climate change and climate adaptation investment. The model produced margins of change in key economic variables, such as Gross Domestic Product (GDP), Consumer Price Index, trade and employment, over the 24-year modelling timeframe.

The CGE modelling process involved the following steps:

#### 1. Selecting Economic Sectors to Shock in the Model

The agriculture, energy, water, transport and construction sectors were chosen as priority sectors for the modelling, based on their special relevance to climate resilience or economic growth in the Western Cape. The expected changes in investment that would take place in these sectors with climate change and climate adaptation investment was used as a proxy for investment changes in the whole Western Cape economy with climate change.

#### 2. Defining the Scale of future Climatic Changes

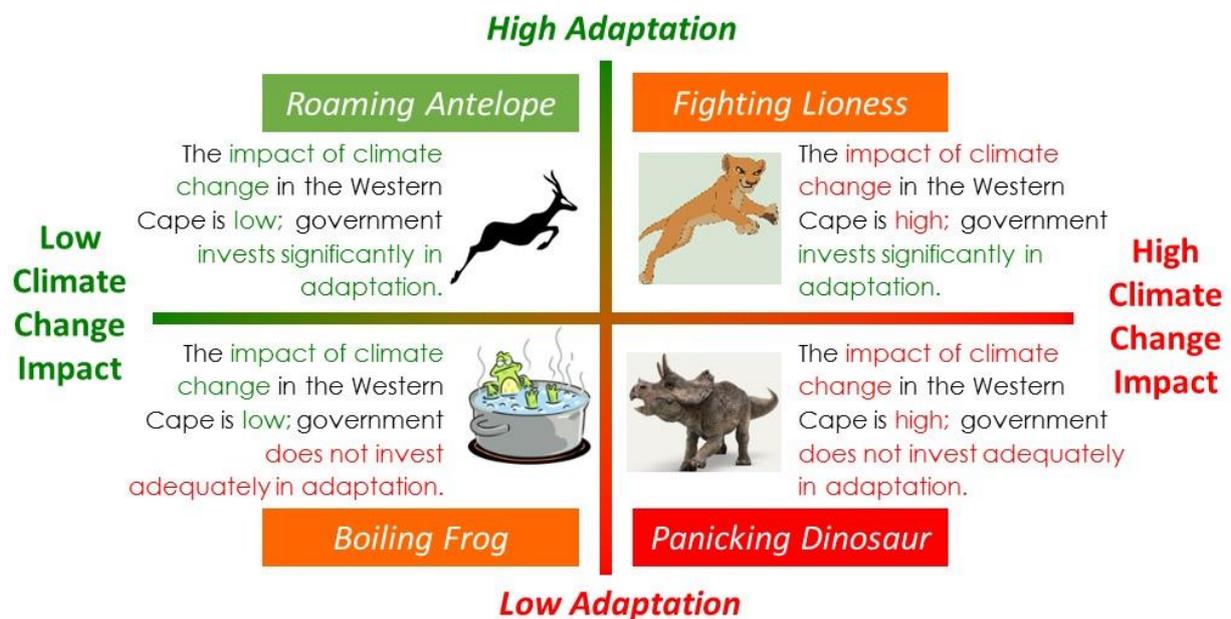
A scale of future "high" and "low" levels of climatic changes expected in the Western Cape by 2040 were identified using downscaled climate modelling and expert opinion. This was used to inform how climate change may impact on the 5 priority sectors, and the level of investment needed to adapt to these impacts.

+1.5 °C	Δ Mean Temperature	+2.5 °C
Same	Δ Rainfall	-20%, longer dry spells
-10%	Δ Run-off	-30%, longer dry spells
Same	Δ Flood severity	Small increase
Same	Δ Southeast wind	Increase (Summer)
+0.25m	Eustatic sea-level rise	+0.75m
+3.0m	Storm surge	+3.5m



### 3. Future Scenarios

Four future scenarios for the Western Cape were identified based on combinations of high / low levels of climate change impact, and high / low levels of climate change adaptation response by government.



The expected changes in investment in the five priority economic sectors (i.e. agriculture, water, energy, transport and construction) were identified for each of the future scenarios to the year 2040 using available data and expert opinion.

### 4. Assumptions used in the CGE Model

The expected changes in investment in each of the 5 priority sectors was modelled for the four scenarios. The CGE model was run three times over, with each respective run evaluating the impact that climate change and climate adaptation investment in the Western Cape would have on the provincial economy:

- (i) In the absence of any economic changes in other provinces (i.e. singling out the Western Cape economic impacts from regional economic change);
- (ii) Where other provincial economies decline due to inadequate adaptation to climate change (i.e. highlighting the role of other provincial economies in the health of the Western Cape economy);
- (i) Where all provinces respond to climate change within their anticipated capacity to do so (i.e. highlighting how a national-scale response to climate change would impact the Western Cape economy).

### 5. Analysing the Results

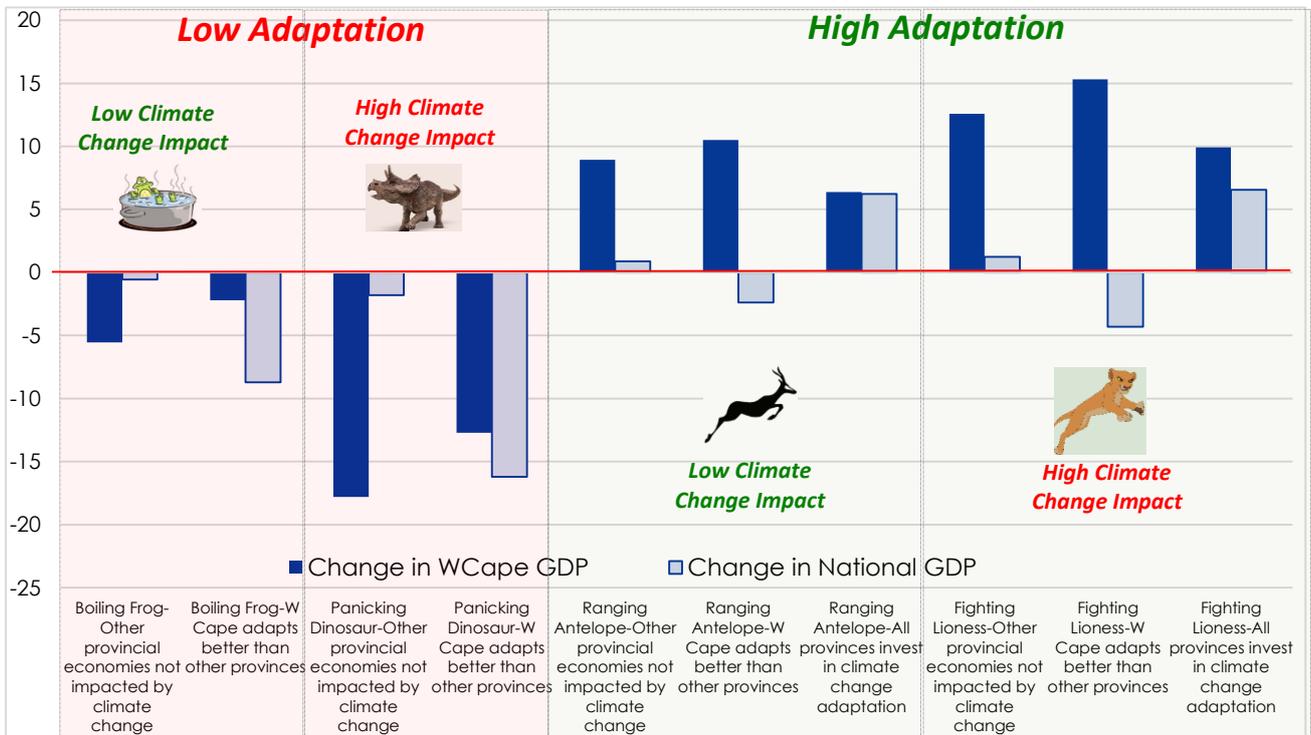
The CGE modelling produced ten different simulations of what the Western Cape economy could look like by 2040 with different levels of climate change impact, different levels of climate adaptation response by the Western Cape Government, and with different levels of climate adaptation response in other provinces.

## 4 RESULTS

### 4.1 Impacts on GDP and Employment



Figure 1: Impacts on GDP



#### Possible alternative figure 1

Between 2016 and 2040, the Western Cape's Provincial GDP may either contract by as much as -17.8%, or increase by as much as +15.3%. The worst-case situation is when the Western Cape does less than other provinces to adapt to climate change. The best-case situation is one in which the Western Cape is a national leader in climate adaptation.

By investing in improved climate resilience, the Western Cape economy could be 33% better-off in 2040 than if the province does not adapt effectively to the impacts of climate change.

This reflects the significant scale of economic risk and opportunity that the province is exposed to with climate change.

Proactive investment in climate adaptation would lead to positive GDP growth in the Western Cape, which could exceed National GDP growth. However, insufficient adaptation would cause contraction in both Provincial and National GDP, with the Western Cape GDP contracting more than National GDP when the province adapts less well than others.

The effectiveness of the Western Cape Government's climate adaptation policies, along with the reactions of other provinces, could significantly affect the extent of Provincial GDP growth or contraction by 2040.

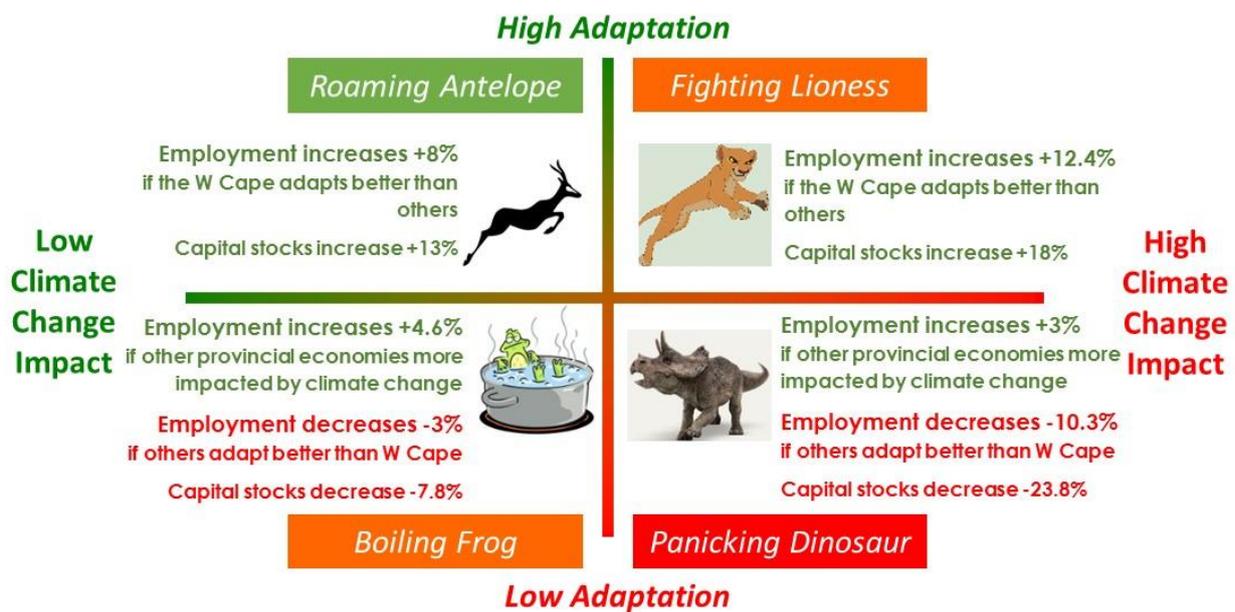


Figure 2: Change in employment levels and capital stocks

It is not only important to be able to mobilise an investment response to climate change, but the size of the investment response matters. GDP grows more with a higher level of investment in climate adaptation. If the Western Cape adapts better than other provinces, increases in capital stocks are likely to have a greater positive impact on Western Cape GDP and employment levels.

In the best-case situation, investment in climate adaptation increases capital stocks in the Western Cape by +18%. Climate change could therefore be a catalyst for accelerated economic growth in the Western Cape, with GDP growth of +10% to +15% above baseline levels possible by 2040. With this level of economic growth, employment levels may increase by +12.4% above baseline by 2040. However, if all provinces adapt effectively to climate change, or if other provinces adapt better than the Western Cape, then GDP and employment growth in the Western Cape are more muted.

In the worst-case situation, the Western Cape does not invest adequately in climate change adaptation and other provinces do, causing capital stocks in the Western Cape to contract by as much as 23.9% by 2040. Employment levels could drop by 10.4%, as workers migrate to other provinces where the economy is more buoyant.

*Employment levels in the Western Cape could increase by as much as 12.4% by 2040, if the province leads in adapting to climate change.*

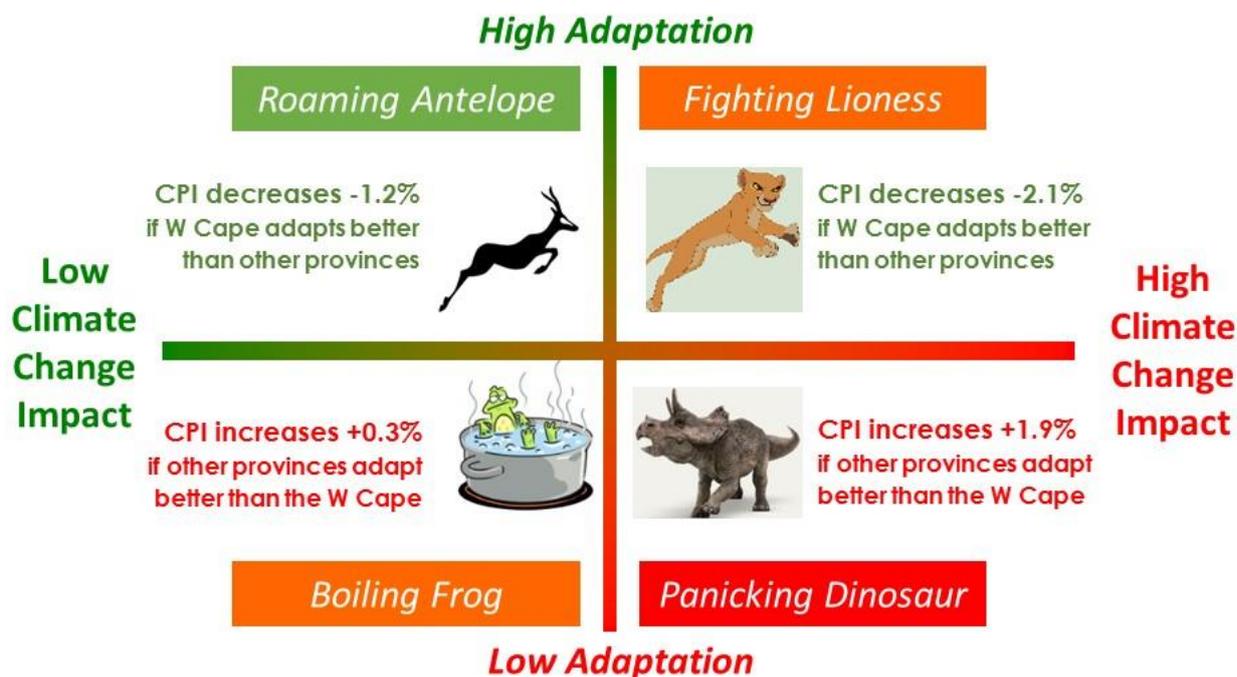
*However, employment levels in the Western Cape could decline by as much as 10.3% by 2040, if the province fails to invest adequately in adapting to climate change.*

If the Western Cape economy is less negatively impacted by climate change than elsewhere, in-migration could depress wages and lead to increased employment levels in the Western Cape, with employment in other provinces declining. While raising possible concerns about how this population growth would be accommodated in terms of housing and service delivery, this could also be associated with potential economic benefits for the host region, as economically active people lend their contributions to the host economy.

*Anticipating and meeting new skills and training needs in an expanding climate resilient economy in the Western Cape will be critical.*

*A more inclusive climate resilient economy will be achieved through equipping the provincial workforce with the right skills to participate in it.*

## 4.2 Price Changes



**Figure 3: Change in Western Cape CPI**

Prices directly influence household consumption levels. Household consumption has emerged as the most significant variable determining economic growth or contraction in

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the modelling. In South Africa, where more than half of all people live in poverty, the climate change response policies adopted by government must therefore take careful consideration of the associated price impacts on households.

*Climate resilient investment in different sectors will result in price changes, affecting cost of living, economic competitiveness, and social equality.*

The best-case situation is where the Western Cape is a national leader in adapting to climate change, thereby increasing its competitive advantage and reducing its prices. Conversely, the worst-case situation is one in which the Western Cape adapts less effectively than other provinces, and so erodes its capital stocks, loses its competitive advantage and so experiences increasing prices.

*By becoming a national leader in climate resilience, the Western Cape can increase its competitive advantage and reduce its prices.*

### **4.3 Household Expenditure on Consumer Goods**

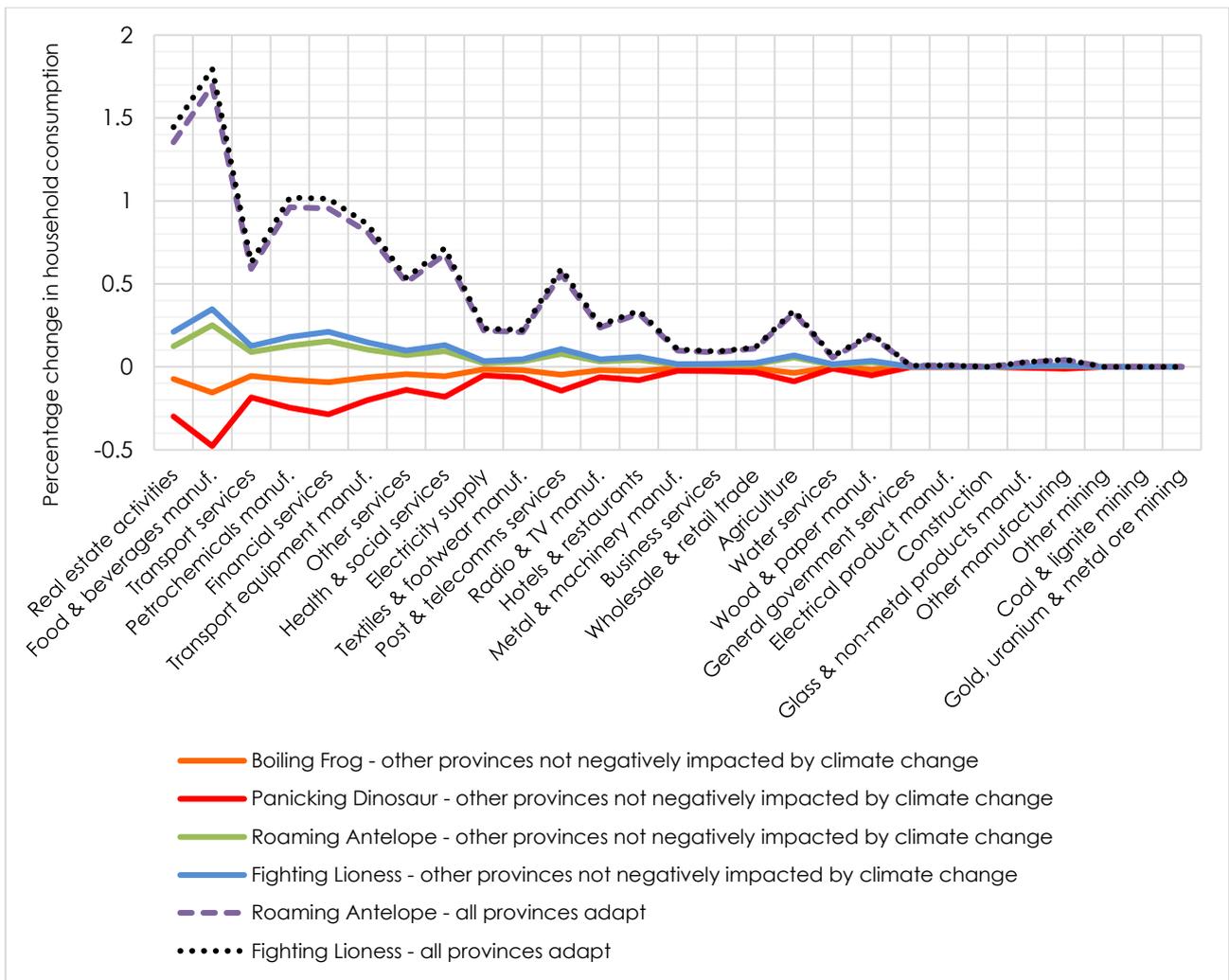
In addition to affecting export volumes, domestic consumer prices have a direct impact on levels of household consumption. In the ten model simulations, household consumption played the key role in determining the extent of GDP change at a provincial level. Other contributors included changes in provincial imports and exports, government expenditure, investment expenditure and stocks.

*Proactive investment in climate adaptation in the Western Cape could benefit households by making the cost of living lower. This is potentially a major driver of GDP growth and increased quality of life in the province.*

*Conversely, failure to invest adequately in adapting to climate change could lead to increased household cost of living in the Western Cape, with declining quality of life and a contracting GDP.*

Government's choice of which sectors to prioritise for climate adaptation investment is crucially important for households.

*The agriculture, water, electricity, transport and real estate services sectors affect household expenditure significantly, and should be prioritised for climate resilient investment.*

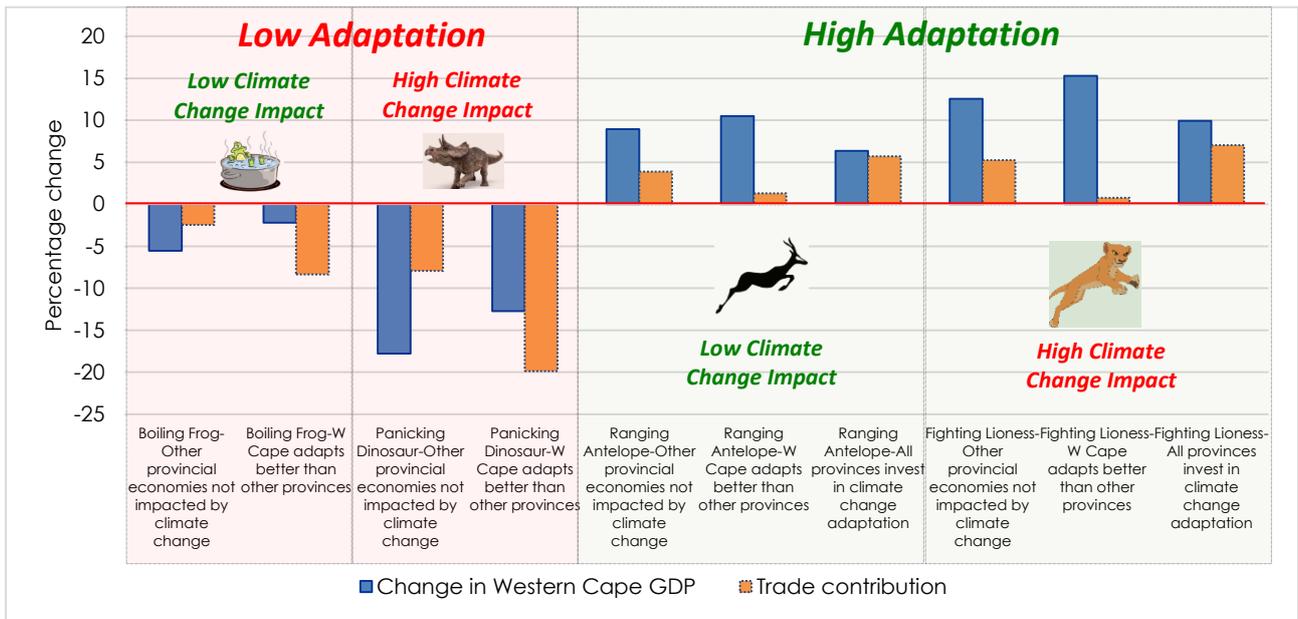


**Figure 4: Percentage change in household consumption per industry sector in Runs 1 and 3 of the scenarios**

#### 4.4 Local and International Trade

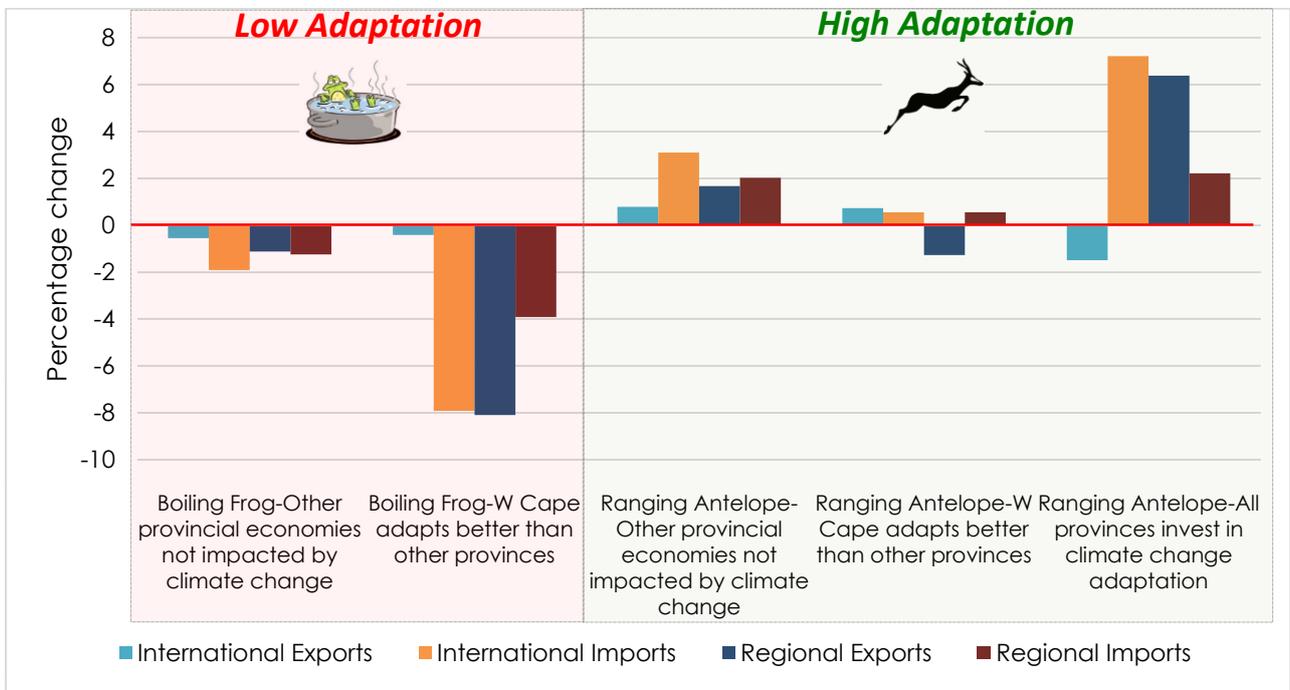
Imports and exports play a key role in South Africa's national economy, forming an integral part of national GDP. All provinces are highly dependent on trade with other provinces (i.e. intra-regional trade), as well as with the rest of the world. GDP and trade – whether intra-regional or international – are strongly linked, with both imports and exports tending to increase when the GDP is strong. This is because strong GDP implies high-levels of productivity, resulting in increased import demand for the goods and services required as inputs for production, and high levels of output which support increased levels of exports.

Because they are associated with increased GDP, the two high adaptation scenarios (i.e. Ranging Antelope and Fighting Lioness) are associated with increased trade; whereas the low adaptation scenarios are associated with contracting GDP and reduced trade.



**Figure 5: Relationship between Western Cape GDP and total trade**

However, the responses of other provinces to climate change affect the Western Cape's ability to engage in intra-regional trade. Even if the WCG invests effectively in climate change adaptation, but other provinces fail to adapt, reduced intra-regional and international trade will result.



**Figure 6: Change in regional and international trade in two scenarios**

If other provinces maintain or increase their GDPs through climate adaptation investment, the Western Cape can increase its regional exports and imports through also investing in climate adaptation.

*Regional exports from the Western Cape could increase by 6.4% by 2040 with enhanced climate resilience.*

*The Western Cape needs other provinces also to adapt to climate change for there to be strong intra-regional and international trade in the medium to long term.*

International exports could increase marginally if Western Cape becomes increasingly competitive by leading in adaptation nationally. However, if other provinces adapt well to climate change, the Western Cape's international exports may decline as other provinces compete for international trade opportunities.

If the WCG does not invest in adapting to the impacts of climate change, intra-regional international imports and exports could decline significantly. If other provinces also don't adapt, these declines can be expected to be much greater.

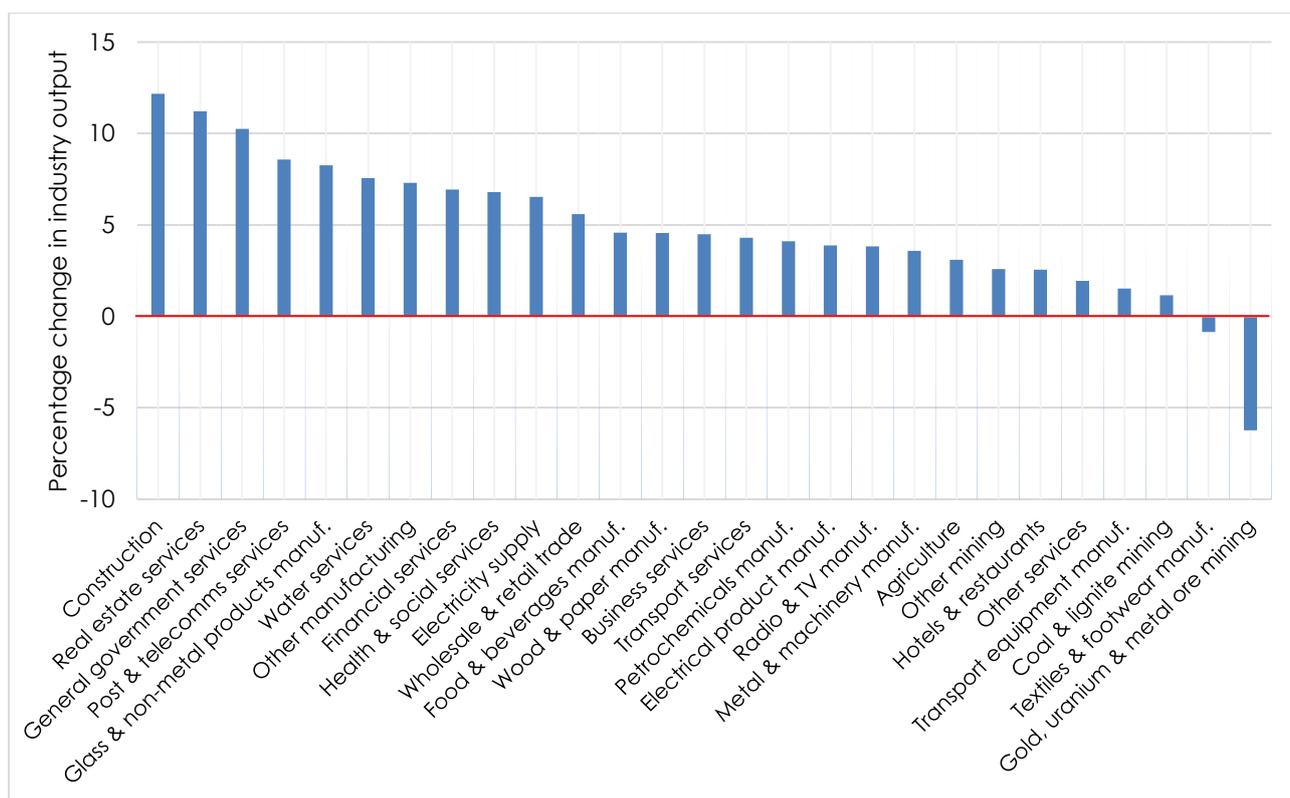
## **4.5 Industry Winners and Losers**

Within the overall economic impact of climate change and climate adaptation investment, different sectors / industries may be impacted quite differently. Three factors appear to influence which sectors are most and least affected:

- The capital to labour ratio in each sector, and how investment in climate adaptation affects demand for capital in each sector.
- The impact of shifts in demand created by climate change. Where export demand increases, the export oriented sectors benefit.
- Changes in price, driven by supply and demand changes, and the influence of price changes on a sector's competitiveness.

Climate change will generate sectoral winners and losers. The results suggest that important Western Cape sectors such as construction and real estate services might benefit significantly from investment in climate adaptation, whilst the most adversely affected mining sectors are not found in the Western Cape. At the same time, the restaurant and hotel industry, and the textile industry, both of which are important to the Western Cape economy, appear to suffer due to higher prices caused by climate change and resulting loss of competitiveness. Sectoral impacts are notoriously difficult to predict, but policy makers need to understand such differential impacts before crafting climate change policy responses.

*Climate change and climate resilient investment will not affect all sectors equally. Policy makers must decide whether to protect the most exposed sectors or invest in the sectors that stand to benefit from climate change.*



**Figure 7: Percentage change in industry output under Run 3 of the Fighting Lioness scenario**

## 4.6 Global and Local Carbon Pricing Implications

### 4.6.1 Carbon Pricing Instruments and Context

Carbon pricing aims to charge greenhouse gas emitters for the climate change damage they cause. This alters the relative price of goods and services based on their carbon intensity and sends the economy a signal that is intended to shift investment and consumption behaviour in favour of less carbon-intensive economic activity. Carbon pricing options include domestic taxes on emissions or input resources, border tax adjustments on imports or exports, or issuing emissions quotas to domestic industries. The South African National Government is currently considering the implementation of a carbon tax<sup>5</sup>.

### 4.6.2 Implications for the Western Cape Economy

The study has revealed that trade from the Western Cape is exposed to climate change impacts. These impacts include regulatory changes such as carbon pricing. A carbon price, whether applied globally or by South Africa (through a carbon tax), or *via* border tax adjustments, would have differential effects, altering the comparative advantage of countries and regions, and the competitive advantage of sectors and firms. This, in turn, would affect global terms of trade and import and export patterns.

<sup>5</sup> National Treasury, 2015.

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*The WCG needs to anticipate and plan to secure the province's place in an increasingly carbon-constrained global economy.*

Modelling undertaken for South Africa's National Treasury<sup>6</sup> shows that the proposed South African carbon tax, with no concomitant changes in relative prices abroad, would affect South Africa's trade balance negatively. The same effects would ensue from an internationally levied carbon tax. The underlying reason involves the relative high carbon intensity of the South African economy.

*The Western Cape economy could be negatively affected by national or global carbon pricing, with the most exposed sectors being petroleum refineries, and all high electricity consuming industries such as iron and steel manufacturing.*

*However, the Western Cape province could benefit from increased demand for renewable energy stimulated by local or global carbon pricing, given the WCG's proactive stance in promoting the development of this sector.*

*Proactive investment in the sectors that will benefit from a carbon tax would serve the strategic interests of the provincial economy.*

The Western Cape's trade exposure to local and global carbon pricing will hinge on several factors:

- The absolute carbon intensity of its export sectors;
- The carbon intensity of its export sectors relative to its competitors in South Africa and globally;
- The capacity to reduce the carbon intensity of specific sectors at reasonable cost;
- The impact of climate change on local productivity relative to productivity in competitor regions.

## 5 CONCLUSIONS

The CGE modelling has produced ten simulations of the potential future state of the Western Cape economy by 2040, each using a unique set of assumptions regarding the level of climate change impact experienced in the Western Cape, the level of adaptation response of the WCG, and the level of adaptation response in the other provinces. The model findings reveal that there are significant economic and social risks associated with climate change in the Western Cape, and that there are significant economic and social advantages associated with investing in climate adaptation. Furthermore, it is evident that the climate adaptation responses of the other provinces will have a considerable influence on the economic future of the Western Cape, primarily from changes in intra-regional and international trade, and worker migrations between provinces.

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<sup>6</sup> See Van Heerden *et al.* 2016.

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To a certain extent, the benefits to the Western Cape that could emerge from climate change are a function of how much better than other provinces the Western Cape's adaptation response is. Effective adaptation can secure investment, an effective workforce, and impart new economic competitiveness.

A critical aspect that emerged was the impact that climate adaptation investment will have on households, confirming the link between social well-being and economic growth and / or stability in the province. A declining economy because of climate change impacts and a failure of the WCG to respond appropriately could have major impacts on consumer prices and the cost of living. The real estate services, agriculture, water, energy and transport sectors have emerged as critical for climate resilient investment that protects social well-being by stabilising prices of major household consumption items.

Early, adequate, and well-directed investment in climate change adaptation can therefore be defined as a pro-poor approach. Such an approach would aim to ensure that the most vulnerable households are protected not only from increasing climate-related risks and resource scarcities, but also from escalating cost of living and economic decline that would result from a failure to invest adequately in climate change adaptation.

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## ANNEXURE A – MODEL INPUTS

Model Run 1 used the average weighted change in capital stocks for each sector and each scenario in the Western Cape, based on available literature and expert opinion. For all other provinces, the change in capital stocks were assumed to be zero.

**Table 1: Assumptions used for Model Run 1**

% change in capital stock				
% change over 23 years	Ranging antelope	Fighting lioness	Boiling frog	Panicking dinosaur
	Assumptions	Assumptions	Assumptions	Assumptions
<b>Western Cape*</b>	15,0%; 8,2%; 18,3%; 25,7%; 7,1%; 13,6%	15,0%; 13,4%; 25,4%; 48,4%; 12,9%; 18,7%	-10%; -15,3%; -10,9%; -5,2%; -4,2%; -8,1%	-15,0%; -21,4%; -38,1%; -20,9%; -18,4%; -24,2%
<b>Eastern Cape**</b>	0%	0%	0%	0%
<b>Free State**</b>	0%	0%	0%	0%
<b>Gauteng**</b>	0%	0%	0%	0%
<b>KwaZulu-Natal**</b>	0%	0%	0%	0%
<b>Limpopo**</b>	0%	0%	0%	0%
<b>Mpumalanga**</b>	0%	0%	0%	0%
<b>Northwest**</b>	0%	0%	0%	0%
<b>Northern Cape**</b>	0%	0%	0%	0%

\* Sequence of numbers: Agriculture, Energy, Transport, Water, Construction, and the rest of the Western Cape economy

\*\* All economic sectors in the province

Model Run 2 used the average weighted change in capital stocks for each sector and each scenario in the Western Cape, based on available literature and expert opinion. In the other provinces, for the agricultural sector, Blignaut *et al.* (2009) and Midgley *et al.* (2011) estimates of the impacts of high levels of climate change (10<sup>th</sup> percentile) and medium levels of climate change (50<sup>th</sup> percentile) on production were used. For the non-agricultural sectors, Abidoyea and Odusolab's (2015) estimate that a 1°C increase in temperature will reduce South Africa's GDP by 0.5% per annum (73% probability) was used. This value was adjusted by assuming that low climate change impacts would imply a 1.5°C increase and high climate change impacts 2.5°C. The values were adjusted for province-specific adaptive capacities using Turpie and Visser's (2014) adaptive capacity index.

**Table 2: Assumptions used for Model Run 2**

% change in capital stock				
% change over 23 years	Ranging antelope	Fighting lioness	Boiling frog	Panicking dinosaur
	Assumptions	Assumptions	Assumptions	Assumptions
<b>Western Cape*</b>	15,0%; 8,2%; 18,3%; 25,7%; 7,1%; 13,6%	15,0%; 13,4%; 25,4%; 48,4%; 12,9%; 18,7%	-10%; -15,3%; -10,9%; -5,2%; -4,2%; -8,1%	-15,0%; -21,4%; -38,1%; -20,9%; -18,4%; -24,2%
<b>Eastern Cape**</b>	-15,1%; -12,1%	-23,8%; -20,1%	-21,6%; -17,3%	-33,9%; -28,8%
<b>Free State**</b>	-9,3%; -8,6%	-18,5%; -14,4%	-18,5%; -17,3%	-37,1%; -28,8%
<b>Gauteng**</b>	-1,3%; -0,9%	-2,4%; -1,4%	-26,6%; -17,3%	-47,7%; -28,8%
<b>KwaZulu-Natal**</b>	-9,4%; -12,1%	-14,0%; -20,1%	-13,5%; -17,3%	-20,0%; -28,8%
<b>Limpopo**</b>	-2,9%; -12,1%	-17,6%; -20,1%	-4,1%; -17,3%	-25,2%; -28,8%
<b>Mpumalanga**</b>	-6,6%; -6,9%	-11,1%; -11,5%	-16,4%; -17,3%	-27,8%; -28,8%
<b>Northwest**</b>	-26,8%; -12,9%	-42,3%; -21,6%	-35,8%; -17,3%	-56,4%; -28,8%
<b>Northern Cape**</b>	-6,7%; -8,6%	-9,6%; -14,4%	-13,4%; -17,3%	-19,2%; -28,8%

\* Sequence of numbers: Agriculture, Energy, Transport, Water, Construction, and the rest of the Western Cape economy

\*\* Sequence of numbers: Agriculture, all other sectors

Model Run 3 used the average weighted change in capital stocks for each sector and each scenario in the Western Cape, based on available literature and expert opinion. For all other provinces patterns of investment change in accordance with their relative capacity to adapt to climate change, based on Turpie and Visser (2014).

**Table 3: Assumptions used for Model Run 3**

% change in capital stock		
% change over 23 years	Ranging antelope	Fighting lioness
	Assumptions	Assumptions
<b>Western Cape* (used in model)</b>	15,0%; 8,2%; 18,3%; 25,7%; 7,1%; 13,6%	15,0%; 13,4%; 25,4%; 48,4%; 12,9%; 18,7%
<b>Eastern Cape**</b>	5,3%; 6,6%	5,3%; 6,6%
<b>Free State**</b>	8,8%; 11%	8,8%; 11%
<b>Gauteng**</b>	16,8%; 20,9%	16,8%; 20,9%
<b>KwaZulu-Natal**</b>	5,3%; 6,6%	5,3%; 6,6%
<b>Limpopo**</b>	5,3%; 6,6%	5,3%; 6,6%
<b>Mpumalanga**</b>	10,6%; 13,2%	10,6%; 13,2%
<b>Northwest**</b>	4,4%; 5,5%	4,4%; 5,5%
<b>Northern Cape**</b>	8,8%; 11%	8,8%; 11%

\* Sequence of numbers: Agriculture, Energy, Transport, Water, Construction, and the rest of the Western Cape economy

\*\* Sequence of numbers: Agriculture, all other sectors

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