

# ONE MILLION CLIMATE JOBS

MOVING SOUTH  
AFRICA FORWARD  
ON A LOW-CARBON,  
WAGE-LED, AND  
SUSTAINABLE PATH



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## TABLE OF CONTENTS

<b>One:</b> Introduction	1
<b>Two:</b> The South African Economy and Global Climate Change	8
<b>Three:</b> Farming and Rural People	15
<b>Four:</b> The Jobs	21
<b>Five:</b> Financing climate jobs	46
<b>Six:</b> Conclusion	52



# ONE MILLION CLIMATE JOBS

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## PREFACE:

The One Million Climate Jobs Campaign is an alliance of labour, social movements and popular organisations in South Africa that is campaigning for the creation of a million climate jobs as part of a collective approach to the crisis of unemployment and climate change. The Campaign was launched in 2011 and since then has been mobilising thousands of South Africans around real solutions to slowing down climate change, protecting the natural environment, improving the quality of life for all and moving towards a sustainable development path. Climate change will exacerbate inequality and poverty because it reduces access to food, water, energy and housing. Thus it is vital that social justice struggles around these issues incorporate struggles around climate change.

This booklet is a follow-up, six years later, to the first booklet that was produced in 2011. It is based on well-researched solutions for how South Africa can immediately begin a just transition, away from the Minerals-Energy Complex that continues to dominate the South African capitalist economy, to a low carbon economy in which the basic needs of communities are met in an equitable, sustainable and affordable way.

It recognizes that in these six years there have been many developments – for instance, renewable energy is now firmly established as part of the energy mix (although still a minor part); retrofitting buildings, and the development of environmentally friendly construction methods, is being developed, and the Rapid Bus Transit system is being slowly implemented in some municipalities.

But most of these solutions are being pursued within the logic of the market. It is not possible, we would argue, within these market parameters, to respond adequately to the enormous challenges facing us – what is needed is a publicly-driven solution for the shift to a sustainable, low-carbon future. The research that this booklet is based on begins to set out what such a transition could look like. We hope that it will be an important contribution to the ongoing work of building a political movement to struggle around these issues.



## CHAPTER ONE: INTRODUCTION

We have been living through a global economic crisis for several years now. A global crisis of climate change is beginning. We need solutions to both crises. This booklet has two starting points. We need jobs, now. And we need to halt climate change, now.

Luckily, South Africa is blessed with almost limitless resources of sunshine and wind to make renewable energy. But the economic crisis is not only global. It is here, now, in South Africa. We have one of the highest unemployment levels in the world. Unemployment is so severe that it underpins a more generalized crisis of extreme poverty, hunger, crime, substance abuse, and domestic violence. Unemployment is also part of a crisis of service delivery in health, education and every other area. Women and children pay the heaviest price for all of this. South Africa also faces a crisis in industrial jobs, mining jobs and electricity production jobs.

Climate change is here too, now, in South Africa. As we write this, we are in the third year of a drought partly caused by climate change. We hope that by the time you read this, that drought may have lifted. But that relief will only be for a time. Unless something major is done on a global scale, in the next twenty years we will face more droughts, more heat waves, more crop failures, more water shortages, and more cattle dying. So we need to help people cope with the devastation of climate change, now.

### WHAT ARE CLIMATE JOBS?

In this report we lay out a proposal for approximately a million new climate jobs. What do we mean by climate jobs? Are they the same as green jobs?

No. Climate jobs are jobs which stop the world heating up from climate change. Green jobs can mean almost anything, from a ranger in a national park to a worker in waste water. These are important jobs. But they do not stop climate change.

Climate change is complicated. But at the core, there is one simple process. The air is getting hotter because humanity is burning so much coal, oil and natural gas. To stop that we have to use renewable energy instead – especially wind power and solar power. That change will require many new jobs over a generation.

Most of these climate jobs in South Africa will be in renewable energy, public transport, electric vehicle manufacture, construction and agriculture. There will be some professional jobs for graduate engineers and technicians, and some jobs in rural areas and agriculture, but also large numbers of factory workers, electricians, construction workers, drivers and labourers.

This booklet explains why we need to act, and what we can do. This is a call to action by working people, unemployed people and small farmers to organise and force government and big business to act. However, it is only the state, acting in the public interest, that has the legitimacy, power and authority to take the action. Science demands action must be taken against climate change. This means taking action that seriously curtails capital's right to invest in (virtually) anything calculated to maximise profit. Governments worldwide have singularly failed to do this so far. A South African government committed to prioritising the minimisation of greenhouse gas emissions while simultaneously maximising job creation will, most likely, also be a government that has succeeded in transforming the efficiency and effectiveness of the public sector, including the municipalities and Eskom.

This will not be easy. But the problems we face are not simple, and they are not small. This booklet presents a vision. It will require an immense political movement to make this vision reality.

## THE EFFECTS OF CLIMATE CHANGE

A warming climate will affect everything. Six changes will affect humanity most. The first is that heat and drought will kill the crops in many places. In the economic and social system that we live in now, that will produce famines.

Second, the heat will produce rising sea levels and stronger storms. Much of the world's population lives in cities on the coast. Much of those cities, the homes, jobs and businesses, will be lost to the storms. That will mean economic devastation.

Third, climate change will mean economic suffering. The governments who have done nothing for so long will come to us and say that now we must all sacrifice together to save the Earth. There will be budget cuts. Companies will be forced to cut costs and jobs will go. We will sacrifice our incomes, our jobs, and our children's health. The rich and the politicians will sacrifice nothing. And they will use guns, tanks and the police to force us to sacrifice.

Fourth, climate change will mean hundreds of millions of refugees globally. They will flee droughts, famines, floods and the wars. They will drown in the seas, or walk to borders patrolled by men and women with machine guns. Many millions of these refugees will be coming to South Africa from other parts of Africa.

Fifth, climate change will mean an orgy of racism and xenophobia. Where the hungry and homeless mass on one side of the border, on the other side racisms will rise to justify not letting them in. And everywhere, amid chaos and want, governments and the rich will look for scapegoats to blame – for anybody to blame but themselves. Because they will be acutely aware that we will be blaming them.

Sixth, climate change will lead to wars. The process is not simple, and there will never be a simple climate war. Great power politics and local conflicts will always be involved. But if you



want an example of what forty years of how climate change, drought, famine, refugees and war can come together, look at Darfur in Sudan. There are many causes to the wars in Darfur and neighbouring Chad, but at the core, on the ground, are poor farmers and poor hunters killing each other for disappearing grass.<sup>1</sup>

How bad will it be? We don't know, and we can't know. Nothing like this has ever happened before. We can say that hundreds of millions will die. But how many hundreds of millions? And what will the deaths, the famines and the wars do to the survivors?

We can only guess.

This will not be the end of the world. Many species of animals will be lost – perhaps more than half of species. We don't know. But this will not be the final apocalypse. Eventually people will find a way of coping. After untold suffering.

None of these catastrophes will be simply climate disasters. Always there will be the effects of the capitalist market. Always super powers and small powers will be meddling.

At every step of the way there will be alternatives. When there are famines, governments can feed the hungry. When there is economic devastation, people can share equally and rebuild anew. People can welcome refugees to new homes in new countries, with new jobs and schools for their children. Where war threatens, people can build mass movements for peace.

All this is possible. The great majority of the devastation will happen not simply because of climate change, but because climate change will happen in a greedy, cruel, market driven social and economic system. We do not have to live that way. Every step of the way, we can campaign for sharing and kindness.

Climate jobs are a solution that shares work and shares money so we can take care of each other. They are a step in building a different society.

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1 See Jonathan Neale, *Stop Global Warming*, Bookmarks, London, 2008, and Nancy Lindisfarne and Jonathan Neale, 'Oil, Heat and Climate Jobs in the NENA Region', Paper presented at the SOAS conference on Environment in the Middle East, October 2016. There is now a considerable literature on war and climate change. Of these works, Christian Parenti, *Tropic of Chaos: Climate Change and the New Geography of Violence*, Nation, New York, 2011, is uneven but consistently interesting. The great strength of Parenti's work is that it is not Malthusian, and that he deals with mediated complexity. For an astringent view of what is wrong with the growing, and frankly silly, literature that tries to make statistical associations between climate and conflict, see Tim Forsyth and Mareike Schomerus, *Climate Change and Conflict: A Systematic Evidence Review*, Justice and Security Research Programme, London School of Economics, 2013.

## AN AMBITIOUS PLAN

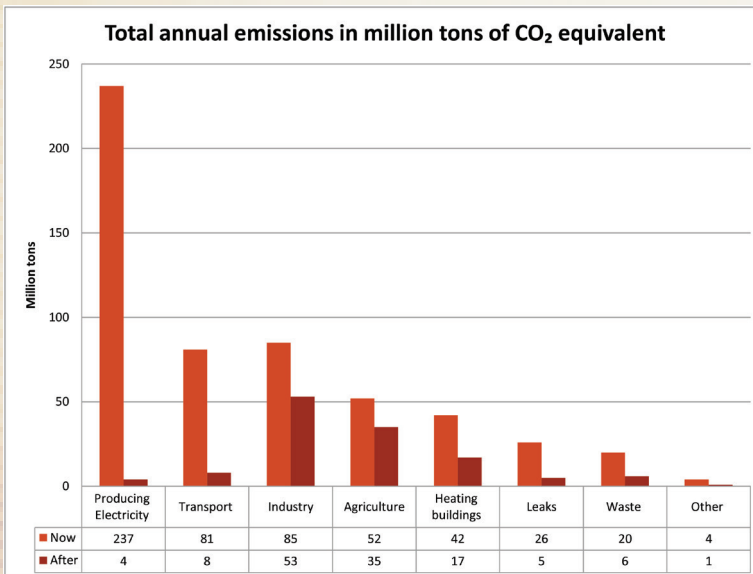
This booklet presents an ambitious plan. We are arguing for at least 1,000,000 new jobs, and we expect those jobs to last for twenty years, and in many cases for much longer.

**Table: Job Estimates**

Electricity & Renewable Energy	250,000 jobs
Transport	390,000
Construction & Repairs	150,000 to 200,000
Agriculture	100,000 to 500,000
Waste, Industry and Education	110,000
<b>TOTAL</b>	<b>1,000,000 jobs</b>

With those jobs we can cut emissions of the gases that cause climate change by more than three-quarters. Here are our estimates of how that will work. The first column shows actual emissions now in megatons of 'CO<sub>2</sub> equivalent'. (CO<sub>2</sub> equivalent includes emissions of CO<sub>2</sub> and emissions of methane and nitrous oxide converted to a number that expresses their warming effect equivalent to CO<sub>2</sub>.)

The second column shows our estimate of how much the emissions will be after twenty years of climate jobs. The numbers in the first column are from 2010, the last year for which we have reliable figures.





That is a 76% cut in total emissions.

These cuts would not mean sacrificing our standard of living. These cuts in emissions would still allow enormous room for much more electricity use, transport use and affordable housing. This is a programme of conversion to a low carbon economy that is a programme for more jobs and more services for ordinary people.

## TIMETABLE

What would be the timetable for these jobs? How would the different projects fit together?

The expansions in public transport could happen very quickly on the buses and trains. A country-wide full scale Bus Rapid Transit system with special stations would take longer, but not that long, and some of that is already in place in municipalities like Johannesburg and Cape Town. Extensions to the rail system would take years in all. So some workers would be required in rail construction at first, and then other workers later running the new railways. These public transport jobs would be permanent.

Plants to manufacture wind turbines and solar PV cells could be built and up and running in a year. Already there are some factories in South Africa involved in this manufacturing. With more factories added, the work in manufacturing and installing wind power would proceed steadily, adding to the renewable energy that already exists. After twenty years, the wind turbine and PV cells would be wearing out and a new generation would have to be built.

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2 These figures are calculated as percentages from those given in the official government report for the UN, Jongikhaya Witi and Luanne Stevens, *GHG National Inventory South Africa 2000-2010* (Department of Environmental Affairs, November 2104), 76 and 275. We have used the figures not including land use. Using the figures including land use would reduce the total from 547 million tons to 521 million tons. This is because there is a net reduction in emissions due to the fact that agriculture has been declining in South Africa, which means that some farming land has changed into grazing, forestry, or simply unused land, and some grazing land has changed into forestry or unused land. There is no particular reason to assume that this trend will continue – indeed, some of the proposals we make for supporting small farmers would probably lead to an increase in land under cultivation and used as pasture.

We have included the manufacture of liquid fuel, mainly by SASOL, and the small emissions from refineries in transport. We have also included aviation fuel in transport. These figures are for 2010, the last year for which there are detailed numbers. Our total is 3 million tons higher than the official total without land use, because we have included the 3 million tons from international aviation bunkers in transport, and in the official records they are recorded only as a note, not as part of the total.

The local construction workforce could have reasonably steady numbers, but would have to be flexible. Already there is work being done on insulating and converting buildings and building new infrastructure. This needs to be stepped up. As more and more PV solar power and wind turbines were installed over twenty years, these workers would increasingly move to maintenance and repair work.

All this means that most, and probably almost all, the necessary workers would be hired in the first two years. And the teachers and trainers would have to be employed first. That means we would need a large number of trainers and teachers right at the beginning of the process, and fewer in later years.

However, there will be a shortage of people with the necessary skills in South Africa, as there would be in any other country. We will also be adapting technologies already in use in other countries like India, China, Denmark, Germany and Japan. It will make sense to employ trainers and teachers from abroad just at the start at local salaries, with the main focus on transferring skills. There will be no shortage of idealistic skilled volunteers, and we will be creating enthusiasts for climate jobs around the world.

## **WHAT ABOUT THE PEOPLE WHO LOSE THEIR JOBS?**

For forty years now 'neoliberal economics' has dominated the world. Neoliberal economics says that only the market can solve problems. It says governments must cut public spending to the bone.

Massive government spending on climate jobs will stand those ideas on their head. Once government does that for the atmosphere, everyone will say: *Why can't they do that for the hospitals? Why can't they do that for the schools? Why can't they make sure everyone has a job?*

The people who run the world don't want that. The people who do the work of the world would love that. So how do we organise for that confrontation?

Basically, we have to make sure ordinary people are united. But what will happen to the people who lose jobs in mining and manufacturing? And what will happen to the people who lose their jobs if we switch to renewable energy? What about coal miners? What about oil workers?

We need a simple promise from government. Anyone who loses their job because we stop burning oil, coal or gas will be guaranteed re-employment or a grant ensuring that they are no worse off than before. But many workers will not need to take up that promise. It will take twenty years to make the changes. Half of workers in those industries will retire in those twenty years at any rate.

## THE REST OF THIS REPORT

The rest of this report sets out our project in detail. Chapter Two is about what is happening to jobs in South Africa now and how climate change works. Chapter Three is about agriculture. Chapter Four, the longest, lays out how climate jobs would work in electricity production, transport, construction, industry, waste and education. Chapter Five explores different publicly-funded options for financing the the jobs. A final short chapter looks at the future.

## CHAPTER TWO: THE SOUTH AFRICAN ECONOMY AND GLOBAL CLIMATE CHANGE

In this chapter we look at some of the reasons why we have such a major problem with unemployment, and the state of the South African economy<sup>3</sup>

The South African economy was built up in the days of the apartheid regime. It rested then, and it rests now, on two pillars. One is cheap coal and cheap energy. The other is cheap workers.

Cheap energy and cheap workers have allowed great multinational corporations to extract minerals cheaply. Cheap labour has always meant that most South Africans have little money to spend. This 'minerals energy complex' has always been directed at export abroad. Cheap labour and massive profits have made South Africa one of the most unequal countries on Earth.

Now the old model of cheap energy and cheap minerals is unravelling, and there is nothing to fill its place. That's one reason we must have climate jobs. We need work.

The official figures say that South Africa's rate of unemployment is about 27%, one of the highest in the world. But the official statistics grossly underestimate the actual numbers of the unemployed.

The official statistics count anyone who has earned income of any kind during the past two weeks as fully employed. They do not count the people who have given up looking for work as unemployed. The people who are pursuing subsistence activities with a few animals or a little land, but not a full livelihood, are not counted as unemployed. And two and a half million 'homemakers' are not counted among the unemployed. Most of these are women, and most of them would take a job if they could get one.

If we include all these people, the real figure for unemployment is closer to 40%. Even if we take the official figures, there are still more than five million people who need jobs.

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<sup>3</sup> This section relies particularly on Brian Ashley, 'Climate Jobs at Two Minutes to Midnight' forthcoming in Vishwas Satgar & Jacklyn Cock *The Climate Crisis and Just Transitions- Democratic Eco-Socialist Alternatives in South Africa and Beyond*, Wits, forthcoming; and also on David McDonald, ed., *Electric Capitalism: Recolonising Africa on the Power Grid*, Routledge, London, 2015; David Hallows, *South Africa in the Crises of Energy, Environment and Capital*, University of KwaZulu Natal Press, Durban, 2011; and Lucy Baker, Jesse Burton, Catrina Godinho and Hilton Trollip, *The political economy of decarbonisation: Exploring the dynamics of South Africa's electricity sector*, Energy Research Centre, University of Cape Town, 2015.

Climate jobs cannot give all those people a job. But climate jobs can give a million people work, and another half a million people jobs in the supply chain. We know that already people have got work that could count as climate jobs – jobs in renewable energy, insulation, retrofitting and so on. It is a start. But it could be much much more. It needs to lead to an even larger job program of reclaiming water, building affordable housing, and building new industries. And the jobs that are created in this process need to be decent jobs that are publicly driven.

Under the weight of South Africa's unemployment crisis, the social fabric of society is collapsing. This is giving rise to a pandemic of crime, gangsterism and substance abuse. It also wears away relentlessly at the bonds of love between family members who have so little to share with each other.

The miracle in South African society is that so many are so willing to share with their relatives and take care of them. That is an overwhelming piece of evidence for the deep decency and bedrock values of most South Africans. But people should not be forced to depend on the decency of their kin. They should have the dignity of their own jobs.

South Africa's unemployment crisis is rooted in the structure of the South African economy. We are a semi-industrial country, dependent on the export of cheap raw materials and the import of high value manufactured goods. The national oppression of black people under colonialism and apartheid created extraordinary levels of inequality. We all know this, and we all see it, every day.

That extraordinary inequality meant that most South Africans were, and are, too poor to buy many of the goods that factories make. So the country has been unable to build strong local industries.

The dispossession of land and the creation of the cheap migrant labour system have also meant that fewer people in South Africa now live off the land. Not many are involved in farming either to satisfy their own food needs or to produce for the local market. And many, many of the people who were moved off the land have not been able to find jobs in the industrial and service sectors of the economy.

On top of this, in the last twenty years the South African economy has opened up to neoliberal globalization. This has led to the domination of the economy by banks, to deindustrialisation and to even more unemployment.

In 2008 the global financial crisis exposed the vulnerability of South Africa to the world economy. Between October 2008 and March 2010 more than 1.2 million workers lost their jobs. Mining jobs and manufacturing jobs were particularly hard hit.

The government's current strategy for economic growth is based on two things. First, intensified exploitation of our natural resource wealth. And second, loaning people money so they can buy more things and slide deeper into debt. It's a strategy that offers no hope of dealing with South Africa's unemployment crisis.

We need a new development path and industrial strategy. Climate jobs can be part of that new path.

Crises are not just about threats. They can also be the source of new opportunities. That's the meaning of the saying "never let a good crisis go to waste". Things that previously seemed impossible suddenly appear feasible, even realistic. And South Africa's industrial heartland is now facing an existential crisis. It is not just the mining sector. The entire minerals, minerals-beneficiation and related manufacturing appear to be in terminal decline.

Climate jobs will be mostly factory, construction and transport jobs. They are jobs the people losing their jobs can do.

Electricity supply is also in crisis. Together with cheap labour, cheap electricity has been central to South Africa's industrial expansion throughout our history. Mining, the ferrochrome and related industries were built on cheap electricity, with cheap coal as the primary energy source. Even in 2015, more than 90% of electricity comes from coal. And over 85% of coal mining is in the hands of Anglo-America, Exxaro, BHP-Billiton, Glencore and SASOL.<sup>4</sup>

The electricity crisis is also a result of the Growth Employment and Redistribution (GEAR) program adopted in 1996. GEAR cut state investment and promoted liberalisation and privatisation. The consequences for ESKOM, the public electricity corporation, were severe.

ESKOM was targeted for privatisation. So the government stopped investing in new capacity to generate electricity. Old plants grew older and less efficient. Back in 1985 South Africa could generate more electricity than it needed. Thirty years later the economy is now twice the size, and manufacturing is about 70% larger. But total electricity generating capacity has remained the same.<sup>5</sup>

The result is that since 2006 South Africa has had regular power outages. In 2015 alone we had more than 100 days of load shedding. And in addition to that load shedding, supplies were cut to large customers like mines and mineral processing plants.

Ever since ESKOM was corporatized its finance has gone pear-shaped. In March 2015, its investment status was downgraded to 'junk' – which means ESKOM now has to pay much more to raise or borrow money.

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4 Stephen Greenberg, 'Market Liberalisation and Continental Expansion: The Repositioning of ESKOM in post-Apartheid South Africa', in David McDonald, ed., *Electric Capitalism: Recolonising Africa on the Power Grid*, Routledge, London, 2015

5 Mark Allix, 'Load Shedding Squeezing the Life out of SA's Factories', *Business Day*, 15 July 2015.



We all know there are many causes to the crisis of ESKOM.<sup>6</sup> Many municipalities are in arrears on payments, the rates for businesses are too low, there are inflated management salaries, costly bonuses and perks for nothing, corruption, high maintenance costs and other inefficiencies. Anyone who has ever been near ESKOM can tell you stories. But the fundamental difficulty is that the government has not spent the money on repairs and new plants, machinery and equipment. Everyone is now paying the price.

## MINING IN CRISIS

It is not just ESKOM. The mining industry is in trouble too. The Anglo American Corporation once controlled 60% of the Johannesburg stock market. Now it is deeply in debt. In February 2016, Anglo American announced that it would cease most of its holdings, including coal mines. When it completes these changes, Anglo-American will employ only 50,000 workers globally, concentrated in platinum, diamonds and copper.

Glencore has similar difficulties. Glencore is a global commodities trader, heavily involved in the South African coal industry. As for 2014, BHP Billiton announced that it would sell most of its South African assets.

Mining coal and minerals was at the heart of the South African economy. In 1990 there were 780,000 mine workers. In 2016 there were 438,000.<sup>7</sup>

Part of that decline is because the technology is improving all the time, and fewer workers can produce the same amount. This is a global trend in mining.

Part of the problem is changes in the global economy. The most important change is that the Chinese economy has stopped growing. This means that Chinese companies are buying much less coal and platinum from South Africa.

Another part of the problem is that South African mines now need more and more electricity and water. But the problems with electricity supply make this harder. And part of the problem is that some of the biggest global corporations are taking their capital out of South Africa. South Africa will need jobs to replace the mining jobs that disappear.

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<sup>6</sup> See *The ESKOM factor: Power politics and the electricity sector in South Africa*, Greenpeace, 2012.

<sup>7</sup> Johannes Feddereke and Farah Pirouz, *The Role of Mining in the South African Economy, Policy Paper, Economic Research South Africa*, 2000, 16; and *Quarterly Labour Force Survey, Quarter 3*, Statistics South Africa, 2016, 2.

## HOW CLIMATE CHANGE WORKS

The last section explained one reason we need climate jobs – what’s happening to the South African economy. This section explains the other reason – what’s happening to the global climate.

Climate change is happening because several gases in the atmosphere are warming up the surface of the earth. The most important gas is carbon dioxide, also called CO<sub>2</sub>. That CO<sub>2</sub> lets the energy and heat from the sun pass through the air down to the surface of the earth. But when heat rises from the surface of the earth, the CO<sub>2</sub> in the air stops some of it from rising any further. The more heat is trapped by CO<sub>2</sub>, the warmer the air gets. And the more CO<sub>2</sub> there is in air, the faster the air warms up.

Most of the carbon dioxide in the air now comes from burning coal, oil and natural gas. Coal is almost all carbon. Oil and gas are about half carbon. When coal, oil and gas burn, the carbon mixes with oxygen in the air to make carbon dioxide (CO<sub>2</sub>). That CO<sub>2</sub> stays in the air.

We burn coal, oil and gas to make electricity, to heat buildings, to run transport, and to heat materials in factories. About half of the CO<sub>2</sub> we put into the air each year stays in the atmosphere for about 100 years. So year by year the level of CO<sub>2</sub> in the atmosphere grows.

For hundreds of thousands of years, the world has gone back and forth between cold ice ages and warm periods. We are in a warm period now. During the ice ages, carbon dioxide levels were about 180 parts per million in the atmosphere. (Don’t worry about what parts per million means. Just remember the number.) During the warm periods, there were about 280 parts per million. There are now just over 400 million parts per million.

**Table: CO<sub>2</sub> in the atmosphere**

	CO <sub>2</sub> parts per million
Ice Age	180
1800	280
1965	320
1996	362
2016	404 <sup>8</sup>

The change from the ice age to the warm periods was 100 ppm. The change from the warm period in 1800 to 2016 has been 124 ppm.

<sup>8</sup> See the data link at [www.co2.earth](http://www.co2.earth) to IAC Switzerland Global CO<sub>2</sub> yearly data (Institute for Atmospheric and Climate Science, Zurich) and the data from the observatory at Moana Loa, Hawaii, since 1958 at the National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Global Monitoring Division, at [www.esrl.noaa.gov/gmd](http://www.esrl.noaa.gov/gmd).

The change from the ice age was caused by small, slow changes in the orbit of the earth around the sun. The change since 1800 has been caused by humans burning coal, oil and gas.

The pace is speeding up. One third of the change in the last two centuries happened between 1800 and 1965. The next third of change happened between 1965 and 1996. The last third of the change happened in the last twenty years. The pace in the next twenty years will be even faster. We are entering unknown territory.

Climate change has already warmed the atmosphere by an average of about one degree centigrade. That does not sound like much. But it has produced serious droughts in much of Iran, Iraq, Syria, much of North Africa, Australia, the southwestern United States, northern Mexico, northern Kenya, Ethiopia, Somalia, Sudan, Chad, northern Ghana, northern Nigeria, Mali, Mauretania, much of southern Africa, and now South Africa.

One degree has produced the biggest cyclones in the history of Philippines, Burma, Bangladesh and Thailand. Floods have made tens of millions homeless in Pakistan, Nigeria and many other countries.<sup>9</sup>

But we are on course for increases of three or four degrees in the lifetime of the majority of the people reading this. That will not mean things will be only three or four times worse than now. They will be much worse than that. We have already outlined the worst consequences in the introduction. So what can we do?

## STOPPING CLIMATE CHANGE

We can't undo all the warming that has already happened. But to halt global warming, we need to stop almost all burning of coal, oil and gas. We cannot stop global warming by cutting back on what we consume, or what we buy, or how much fuel we burn. We cannot do it by cutting back on economic development in South Africa, or anywhere else.

Here is why cutting back on consumption won't work.

If we only needed to cut emissions by 30%, we could cut what we consume by 30%. Or we could cut the fuel we burn by 30%. Or we could stop economic growth and then cut the size of the economy by 30%. We could do that. We would have to cut jobs by about 15% and cut wages as well. It would be hard. It would hurt. But we could do it.

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<sup>9</sup> The best way to get a sense of what is happening is to read the Special Supplements to the *Bulletin of the American Meteorological Society* that have been published each year since 2012. The most recent is Stephanie C. Herring et al, *Explaining Extreme Events of 2015 from a Climate Perspective*, BAMS (12), December 2016. In that edition 26 peer reviewed articles by 116 scientists cover extreme events on five continents. Taken together, the supplements are conservative, careful, balanced, nuanced, and will make your hair stand on end.

But we don't need to cut emissions by 20% or 30%. We need to cut emissions by about 90% as soon as possible. We can't cut our spending and consumption by 90%. Think what most South Africans would have if they cut their spending by 90% - not enough to eat, and nothing else. It's not going to happen, not in South Africa or anywhere else. People in China, India, Africa, Latin America, Europe and North America will not put up with cuts on that scale. Luckily, there is an alternative. Instead of cutting back how much we do, we can change what we do.

We can stop burning coal and gas to make electricity. Instead, we can make almost all our electricity from renewable sources like wind power and solar power. We can run cars, buses and trains on renewable electricity, not oil. We can heat homes and buildings with renewable electricity. And we can use renewable electricity to heat materials in factories. That will mean more jobs, not cutting jobs. But the only way to do that will be massive action by governments.

The market could probably do it instead of governments if we only needed cuts of 20% or 30%. But we need cuts of 90%. That means so much work, so much investment, that only government action can make it happen.

This means changing the whole world economy. But we can do it, we can do it quickly, and if we do it there will be lots more jobs.

After all, climate change is happening because of the work of millions of men and women with their hands and brains. It will take the work of millions of people globally to stop climate change.

Technically, it would be easy to do. Politically, it will be enormously hard to make governments and corporations do what needs doing. Making a reasonable argument to government will not be enough. Environmentalists have made enough reasonable arguments. Governments have at least pretended to listen, but they have not acted.

## WHY NOT?

Think what a change to a low carbon dioxide world will mean. It will mean more jobs, certainly. But it will also mean an end to the oil and gas companies, the coal companies, and the power companies. The banks who have loaned billions to old power stations will lose out. It will mean the old car companies will lose out to new electric car companies.

Those corporations have an enormous amount of global power. Those corporations have been fighting tooth and nail for more than twenty years to prevent any action on climate change. Even in the face of growing climate threats, they will not stop now.

Getting climate jobs will mean taking on Trump and Putin, Exxon Mobil and Shell, and all the people like them.

## CHAPTER THREE: FARMING AND RURAL PEOPLE<sup>10</sup>

If you read material produced by our sister climate jobs campaigns in the global North, in Britain, Norway, Canada or France, you will see that they start with renewable energy, transportation and building conversions.<sup>11</sup> In South Africa, we are going to start with farming and people in rural areas. At the most fundamental level, climate change is going to affect farming, and the growth of enough food to meet the needs of all, the most. There are many initiatives already underway which are focused on growing food in a different way – a way that takes account of the broader environment including land, water and air, and the need to use these sustainably; recognizes the need to preserve traditional seeds for the future; and respects the rights of those who live and work in rural areas. There are many points along the food chain, such as fertiliser use, feedlots, transport in long supply chains and on-farm production systems, where emissions can be reduced, and jobs created.

In this chapter we are focusing less on jobs that will help reduce emissions, although this is important, and more on jobs and incomes that will help people cope with climate change now—we need to do this with radical land and agrarian transformation, as well as by developing an alternative model of food production based on agro-ecological methods. But this is going to take a long time. As part of the process of working towards an alternative model, we also need to think about jobs that can be immediately created, subsidies that need to be paid out, and more sustainable and effective farming methods that can be introduced now.

So many rural South Africans are going to be affected by climate change. Communities that are already struggling to survive off the land – either through subsistence farming, or through paid labour, are going to feel the impact of climate change very starkly. This is particularly true for rural women, who are a vital part of building rural livelihoods as well as working as paid labourers, and who often bear the brunt of difficult situations like drought, floods and poor working conditions.

We want rural people to organise to fight against climate change. This is because we cannot make governments act on climate change without a conscious, organised and determined mass movement from below.

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<sup>10</sup> This chapter focuses on the growing of crops and argues that we need to shift towards an agro-ecological approach to farming. While the chapter focuses particularly on growing food, we need to remember that sustainable farming, or agro-ecology, includes many elements, including how we use water, how we pollute the air and so on. In this chapter we do not look at fishing and forestry, although these are important areas, and areas we will need to focus on in subsequent publications.

<sup>11</sup> Detailed materials can be downloaded at the Global Climate Jobs website, [www.globalclimatejobs.wordpress.com](http://www.globalclimatejobs.wordpress.com).



There are two ways of looking at how many jobs can be created in the short term. One way is to say that subsidies and all the other kinds of support will mean that perhaps half a million small subsistence farmers, as well as decentralised markets and small-scale agro-processing plants will be able to continue making a living from the land when they would otherwise have to give up. And perhaps even more than half a million. There will be more jobs in other businesses and services because small subsistence farmers will have some money to spend. And many communities that would otherwise die will live.

There is also a narrow way of counting climate jobs in agriculture. This to count the jobs working directly on food production, on commercial farms, for government and public corporations in experimental farms, a public seed company, agricultural extension, veterinary services, and other kinds of support. In this narrow sense, we estimate that 50,000 to 100,000 jobs will be needed.

## DROUGHT

Many rural people across Africa are on the global frontlines of climate change. There are a lot of these people in South Africa, and there will be many more. The drought that has affected many neighbouring countries has spread to South Africa in the last few years. Animals and crops are dying because of drought.

The media blame the drought on 'El Niño'. El Niño is something that happens off the coast of Peru, in South America, every few years. The water in the ocean near Peru gets much warmer, and that alters the weather in many countries.

However, it is not just El Niño. The most careful study of the causes of the drought in Southern Africa is by Chris Funk and seven colleagues at the US Geological Survey, the University of California Santa Barbara, the USAID Famine Early Warning Network, and the NOAA Earth System Research Laboratory in Boulder.

Funk and his colleagues ran computer simulations and found that part of the drought was due to local temperature increases as a result of climate change, and part was due to a much stronger than usual El Niño effect. But that hot El Niño, in turn, was also partly due to climate change. And Funk and his colleagues suggest it is entirely possible that when this El Niño passes, Southern Africa will become even drier.<sup>12</sup>

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<sup>12</sup> Chris Funk et al, 'Assessing the Contributions of local and East Pacific Warming to the 2015 Droughts in Ethiopia and Southern Africa', in Stephanie Herring et al, eds., *Explaining Extreme Weather Events of 2015 from a Climate Perspective*, Special Supplement to the *Bulletin of the American Meteorological Society*, 97 (12), December 2012, S75-S80.



And it is not just drought that is affecting farming. Temperature increases, all by themselves, are reducing crop yields and pasture. And all of the temperature increase is due to climate change.

We cannot know the exact shape of the future. Maybe the rains will return in South Africa for a time, and the temperatures will not rise much in the next few years. Or it may be that the bad times have already arrived.

But we do know the direction of the future. Over time, temperatures will rise, drought will increase, crop yields will fall, and livestock will die.

This is not just happening in South Africa. Climate change is having serious effects on many different kinds of farmers, in many different countries. This is true in the rich countries too. In places like Australia and the United States, they do not simply say people will be resilient and adapt. They declare a state of emergency.

This is climate change. Some people do not want to say this to farmers. They worry that farmers will be very angry, or that they will despair. But farmers and poor people deserve the truth.

And farmers should be very angry. Everyone should be angry about climate change. But we do not have to despair. We can act instead. And small farmers and rural people have to start acting now to force government to give them the help they need.

It is not enough simply to say that rural people need advice on 'adaptation', and that we must increase 'resilience'. Climate change will destroy farms all over the world. In many parts of Africa and the world people are fleeing from land afflicted by climate change. Certainly, many people will need more help farming. But they will need new livelihoods too – jobs and money. And they deserve to have those jobs and that money in the communities where they live now – not to have to flee.

We think farmers and rural people need four things now:

One) Rural people who lose their livelihoods because of climate change need climate subsidies.

Two) Small farmers need an enormous amount of help to cope with the new climate.

Three) Small farmers, semi-subsistence farmers and farm workers will need much more good land to cope. That means land reform, which includes access to water.

Four) Rural areas and rural people will need many of the new climate jobs in energy.

Now we look at each of these four things.

## SUBSIDIES

Government will be able to help many small farmers and subsistence farmers keep going in spite of climate change. But there will also be many farmers who cannot keep going. They should have climate subsidies, like the grants that retired and disabled people get now. It is only fair. Those farmers did not heat the world.

Who will pay for those subsidies? Government could do it. But we think that the people who profited from heating the world should pay for it. This means mainly the rich people, and the oil, gas and coal corporations in the rich countries. It means also some rich people, and rich corporations, in South Africa.

We also think that a campaign for subsidies for farmers who have been ruined by climate change would have enormous support from ordinary people in North America and Europe. And South Africa could set an example for farmers cursed by climate change throughout Africa.

It is a radical idea. Winning subsidies would require a national campaign, national demonstrations, political work and an international campaign. But it is better to fight for justice than to stand on your land and cry.

## LAND AND LAND REFORM

There is enormous pent up demand for land among poor rural people now. This demand is there not just among the landless, but also among small semi-subsistence farmers, among many town dwellers, and among agricultural labourers. Surveys show that what people say they want is one hectare, or maybe two, to graze animals and grow food, some for themselves and some to sell. They do not feel they need to own the land, but they want a secure right to use it.<sup>13</sup>

Until now, government land reform policy, such as it is, has focused upon only taking over white commercial farms when the owners are willing to sell. The aim has been to create a class of large scale commercial or cooperative farms that work in much the same way, and on the same scale, as the old white farms. One consequence has been the demand for people who want land to produce long written, itemised business plans drawn up with the aid of consultants. Nothing could be further from what most people say they need.

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13 For some of the background to farming and land reform, see Ruth Hall, ed., *Another Countryside: Policy Options for Land and Agrarian Reform in South Africa*, Institute for Poverty, Land and Agrarian Studies, University of Western Cape, 2010; Ruth Hall, 'A Political Economy of Land Reform in South Africa', *Review of African Political Economy*, 2004, 100: 23-37; Michael Aliber and Ruth Hall, *Development of Evidence-Based Policy around Small-Scale Farmers*, Programme Support for Pro-Poor Development Policy, Pretoria, 2010; and Reza C. Daniels, Andrew Partridge, Dinoo Kekana and Sibongile Musundwa, *Rural Livelihoods in South Africa*, Southern Africa Labour and Development Research Unit, UCT, 2013.

As climate change bites, it makes even more sense to give dispossessed people what they say they want – enough land to help them survive. This will not necessarily increase production – either for providing for the families' needs, or selling on the market. Smallholders everywhere use a lot of their land to make sure that they and their relatives eat properly. This cuts into the amount of food and cash crops going to market.

There are very large numbers of people who make some, or all, of their living from the land. There is dispute about the numbers, but a reasonable estimate would be:

2,000,000 small scale farmers

600,000 farm workers

200,000 medium-sized black commercial farmers

35,000 large ('white') commercial farmers<sup>14</sup>

The large commercial farmers and agribusiness currently have most of the best land. For everyone else to survive in dignity, they will have to share that land. As it is, the numbers of white farmers are declining very rapidly. This is because of consolidation into ever larger farms and buy-outs by agribusiness.

## **JOBS FOR RURAL AREAS**

Subsidies on their own are not enough. People need jobs too. And not just farmers – all people in rural areas need jobs.

This means that many of the climate jobs in transport, buildings and renewable energy must go to rural areas. Some of this can happen easily. Many of the jobs driving electric buses and trains to and from the rural areas should start in the rural areas. Many of the jobs building new sustainable housing should happen in the rural areas.

There will be many jobs installing and maintaining renewable energy and a new electrical grid in rural areas. Most of these should go to rural people. It will take time for the number of these jobs to grow, as more and more solar power and wind power is installed and will need maintaining. But we must never again have the situation where very highly paid Danish workers are brought in to install wind turbines in a region where people with very low incomes need jobs desperately.

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<sup>14</sup> See Hall, 2010; Frikkie Liebenberg and Johann Kirstop, *Statistics on Farm Labour in South Africa*, University of Pretoria, 2013; and Census 2011: *Agricultural Households*, Statistics South Africa. There is disagreement about the number of small scale 'semi-subsistence' farmers. The census of agricultural households gives 2.9 million as the number of households who get at least some of their income or food from farming. Liebenberg and Kirstop treat this as 2.9 million individuals, while in many cases Hall regards two people in a household as both small farmers. This is a familiar problem in many parts of the world. Some censuses count both men and women on family farms as economically active, and some count only the head of household.

## JOBS HELPING FARMERS

Some subsistence farmers, small farmers and agricultural workers will be so badly hit that they cannot go on. But many will be able to cope – if they get help. That help will mean public sector jobs for other rural people.

For example, at the moment two multinational companies sell almost all the seed in South Africa, and thus control the future pathways of agriculture. The government could set up a public seed company that would allow farmers far more choice, and could involve farmers in the work of breeding, seed production and so on.

Small and subsistence farmers will need many more extension workers who do not just help big commercial farms. They will also need help with the loan of machinery for short periods, help with veterinary services, and with dipping and vaccinations. All these kinds of help require more public sector jobs.

We would also propose a new kind of small scale experimental research projects. This is where agroecology comes in. Extension work and plant science all over the world is focussed on medium and large scale commercial farming, not small-scale and subsistence farming. Agroecology is at its best in helping people raise yields in small scale, labour intensive farming.<sup>15</sup>

But simply transporting ideas from elsewhere will not work. African small farmers have centuries of experience and skill. Relying on all the old ways will not work either, because climate will be changing each region.

We have a suggestion – small experimental farms, with five to ten people working together, trying out new ways of farming crops and raising livestock. The workers in each experimental farm would include local people with long experience in subsistence farming, people with expertise in agroecology and conservation agriculture, people with expertise in other forms of scientific agriculture, and young local people willing to learn. If those people work together, they can try out different methods and see which work in this region. Local farmers will be able to see the results, and know the people who did the work.

That way we can prove to small farmers what works in agroecology, and what does not, right in their area. That means they will adapt the methods that work.

These experimental farms would have to work in conversation with, and with education from, universities and decentralised agroecology centres.

It is difficult to be precise, but we estimate there could be 50,000 to 100,000 direct jobs supporting farmers and working in experimental farms. But land reform would also enable a much larger number of people to pursue a steady livelihood.

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<sup>15</sup> See Stephen Greenberg, *Agroecology and Climate Change in South Africa*, AIDC/One Million Climate Jobs, Cape Town, 2013.

## CHAPTER FOUR: THE JOBS

Now we turn to the jobs that will cut emissions in different sectors. In each case, we will lay out what we could do *with the technology we already have*.

We will start with electricity. Remember, 44% of South Africa's greenhouse gas emissions come from manufacturing electricity. Almost all of these come from burning coal in power stations to make electricity.

Our plan is to build enough wind power and solar power over twenty years so that we can produce all South Africa's electricity from these kinds of 'renewable energies'. They are called renewable energy because the world will never run out of wind and sun. The value of renewable energy is that the fuels - wind and sunlight - produce no carbon dioxide emissions.<sup>16</sup>

### WIND POWER

Wind power uses very large wind turbines. The blades on these turbines turn in the wind, and that turns a turbine that creates electricity. Turbines work best if they are large, placed high off the ground, and in very windy places. This is why they are usually built in 'wind farms' of many turbines, spaced out so they do not interfere with the wind supply. Wind turbines also work best in rural areas where no buildings block their wind. So what makes sense is large wind farms in rural areas, and then power cables take the electricity to cities and wherever else it is needed.

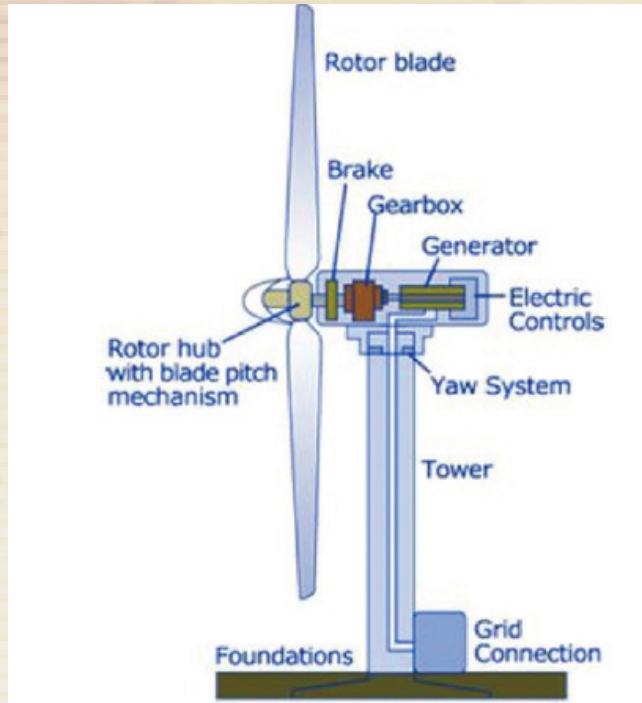
Compared to most other countries, South Africa has great reserves of strong, steady wind. There are good winds in every region of the country. Less than one percent of the land area will provide all the wind power we could possibly need. Moreover, livestock can graze on the land beneath the turbines.

People often think that most of the jobs in wind power are in putting up and maintaining the giant turbines. This is not the case. The majority of the jobs are in manufacturing plants that make the various parts of the turbines. These are factory jobs. They can be anywhere in the world. The wind turbines on site need some maintenance, but not much.

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<sup>16</sup> This section on renewable energy relies particularly on Richard Worthington, *Challenging the State: Renewable Energy opportunities and electricity in South Africa 2015, AIDC 2016*. For wind and solar resources in South Africa see Tobias Bischof-Niemz and Crescent Mushwana, *Solar PV resource for higher penetration through a combined spatial aggregation with wind*, CSIR Research Space, 2016; and Kaspar Knorr, Britt Zimmerman, Stefan Bofinger, Ann-Katrin Gerlach, Tobias Bischof-Niemz and Crescent Mushwana, *Wind and Solar Power PV Resource Aggregation Study for South Africa: Final Report*, CSIR, March 2016. Two other important studies are McKinsey and Company, *Socio-Economic Deep Dive*, Draft Final Report to Department of Energy, August 2014; and Liziwe McDaid, *Renewable energy: Where are the jobs? A critique of the government's socio-economic programme*, AIDC, Cape Town, 2016.





This explains something that has happened with many wind power programmes in South Africa and other countries. Local people are told there will be many jobs with wind power. But then they find out that all the parts of the turbine are imported from other regions.

In South Africa, for example, recently many turbines were imported from Denmark and assembled on site by Danish workers at European wages. Local people felt they had been lied to, because they had been lied to.

So we need to be clear. Most wind farms will be in rural areas. But for at least the first ten years, most wind jobs will be in factories. If we are up to getting climate jobs from wind power, those factories have to be in South Africa.



## SOLAR POWER

The second main source of clear energy will be solar power. The cheapest, and the most common, kind of solar power is called 'Photovoltaic' power, or PV. The sun passes through a film (the 'photo' and in the process creates electric power (the 'volt'). Many small rectangles of PV are put side by side in a sheet, or 'array', that is turned toward the sun.

PV needs a steady supply of sunlight to work well. As with wind, South Africa is also blessed with sunlight compared to most other countries. And as with wind, there are steady supplies of sunlight in all regions of the country.<sup>17</sup>

Wind in cities is unreliable and choppy. But the sun shines in cities as it does in the countryside. This means that it is easy to build arrays of solar PV in the same places where people live. It's simple enough to put the PV on the roof of many houses. But it is even more efficient to put larger arrays on the roofs of schools, hospitals, public buildings, large stores and factories.

It is cheaper to build PV tiles into new roofs. Then instead of nailing the PV tiles on top of the old roof, the tiles can be the new roof. It is lighter, cheaper and easier to do.

Cheapest and most efficient of all, though, is 'industrial' PV. This means large fields full of tens of thousands of PV arrays. Moveable parts can tilt the arrays as the angle and direction of the sun changes through the day.

Again, as with wind, in the early years most of the jobs are in the manufacture of the PV cells and the arrays. Right now, the cells are manufactured most cheaply in China. This means that almost all current contracts for PV import the cells. The result is, as with wind, that the jobs are somewhere else in the world, and people feel cheated.

So we have to manufacture the cells and the arrays in South Africa, or we will not have the climate jobs. Both wind power and solar power local manufacture can be done at first in partnership with companies from China, India or Europe, which could license their technology for a reasonable royalty.

Then there is Concentrated Solar Power (CSP). This uses a large array of directional mirrors to concentrate the rays of the sun on one particular point, heating a material such as molten salt to a very high temperature. That material then drives a turbine that turns the heat into electricity. At the end of 2016 there were already three CSP plants working in the Northern Cape, and several more under construction. CSP is currently much more expensive than solar PV, but can store heat to provide electricity into the night. And it will become cheaper.

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<sup>17</sup> See Knorr et al, 2016; and Bischof-Niemz and Mushwana, 2016.

## MIXING TOGETHER RENEWABLE ENERGIES



People often say that the advantage of solar power is that is local. You can make the electricity where people use it, on the roof of the home. And because solar electricity is local, and direct, it is more democratic.

This sounds good, but reality is more complicated. Renewable electricity will only work if you mix together different sources of electricity.

The reason is obvious if you think about it. People and businesses need different amounts of electricity at different times of the day. The sun shines only in the daytime. Wind blows night and day. But the stronger the wind, the more electricity the wind turbine makes. And the wind tends to go down around sundown and sunup. There is often a lot of wind power at two o'clock in the morning, when people don't need that much electricity. Solar PV works when the sky is cloudy, but it makes more electricity when the sky is clear and the sun is strong.

All this means that we have to mix electricity from different areas. If one end of the country is cloudy, the other is likely to be clear. If the wind is low in one place, it is likely to be strong 1,000 km away.

We also need to mix different kinds of electricity. Then wind makes up the balance at night when the sun does not shine. And the sun makes up the balance on still days. CSP plants can store energy from the sun into the late evening.

None of these ways of mixing renewable energy are important as long as most electricity still comes from coal and gas. But they become absolutely necessary when all, or almost all, electricity comes from wind and sun.

All this mixing means we have to extend the national grid. The grid is a whole system of wires

and cables that connect the places making electricity to the places using electricity. In some cases, it will make more sense for isolated rural areas to have their own smaller grid, but many rural sources of renewable electricity will have to be connected to urban areas. This will mean many jobs connecting different producers and users.

We will also need what's now called a 'smart grid'. Engineers and technicians now monitor the grid from minute to minute, making sure that the supply continuously fits the demand. Demand is complicated, and keeps varying. Supply of electricity is simpler now, because there are a small number of power stations delivering electricity.

But in a new grid with small solar power installations on roofs all over the country, the supply will be even more complicated than the demand.

And where people have solar PV on their roofs, through much of the day they are not using that electricity. It can be wasted. Or it can be fed back into the grid through the same wires that bring electricity to the building.

That's where the 'smart grid' comes in. The smart here basically means computers. A computerised grid constantly monitors demand and supply, matching them up. At moments when there is too much electricity, the grid disconnects or turns off some turbines. In addition, low prices late at night encourage people and businesses to use electricity produced by wind turbines that spin all night.

All this is necessary because it is hard to store electricity. You can store coal and gas. But electricity that is not used is lost.

It is hard to store electricity. But it is possible. Batteries are a help. They have long been too big and expensive, but recent advances in California suggest it now makes sense to use them on a large scale. Concentrated solar power, using directional mirrors to produce giant heat engines, is still expensive, but it provides the possibility of storing solar energy for several hours into the evening. Electricity companies can also pump water uphill into reservoirs when there is a lot of electricity. When there is more demand, that water can run back down through a turbine that makes electricity.

All these demands mean that there will be many jobs in building a new smart grid and in operating that grid once it is up and running.

## **TRIPLE THE ELECTRICITY SUPPLY**

Moreover, we are going to need an enormous increase in the supply of electricity. This has nothing to do with economic growth. It is because renewable electricity can replace coal, oil and gas in many parts of the economy.

Cars, buses, trucks and trains now burn oil and SASOL gas from coal. We can change that, so they all run on electricity from sun and wind. (We will explain how in a later section.) Then we can run transport with almost no CO<sub>2</sub> emissions.

Large amounts of coal, gas and oil are now burned to melt materials at great heat in industry. Most of the emissions here come from the steel, ferro-alloys and aluminium industries. We will it, can be done by using electricity from sun and wind to heat minerals and materials. (We will explain how in a later section.) Then we can run industry with much lower emissions. We can also use renewable electricity to heat houses, to heat buildings, and to cook.

Put all that together, and we will need close to triple the electricity we have now.

## REIPPPP

Of course, South Africa is already expanding renewable energy rapidly. The government's widely praised public/private partnership in renewable energy (REIPPPP) has already agreed contracts with private firms for 6.3 GW of capacity in wind and solar power. And the government has announced an intention to commission another 6.3 GW of capacity. And as the project has gone on, prices have come down substantially. This is a lot of capacity, compared to the past and to many other countries.<sup>18</sup>

But it is nowhere near enough. If all of the commissioned energy is actually up and running, and if ESKOM connects all of it to the grid, REIPPPP will supply enough energy to replace 12% of current electricity. That will still leave 88% of electricity coming from fossil fuels.

Moreover, the stated intention in REIPPPP is that 45% of value will be provided by work done in South Africa. Another way of saying the same thing is 55% of the value created, and almost half the jobs, will be located outside South Africa. By contrast, a climate jobs program to triple electricity production and keep most of the jobs in county would provide about thirty-five times as many jobs as REIPPPP.<sup>19</sup>

REIPPPP has been an important beginning. It has demonstrated that renewable energy makes sense in South Africa, and it has begun the process of training a generation of engineers, technicians and craft workers.

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<sup>18</sup> Green Cape, 2016, *Utility Scale Renewable Energy Sector – 2016 Market Intelligence Report*, 16 and 19.

<sup>19</sup> For 45% of value created, see Green Cape, 23. These will mostly be jobs in the global north, on average better paid than in South Africa, and jobs in China. So we assume that about half of the jobs will be abroad, whereas roughly 90% of the jobs in a climate jobs program will be national. We are proposing to build 300 GW of capacity as opposed to 12.6 GW. 12.6/300 times 0.9 is 37.8. We round to 35.

## HOW MANY JOBS IN RENEWABLE ENERGY?

To triple electricity production, and get it all from renewable energy, we would have to build 6 Gigawatts of capacity of wind energy a year for twenty years. We would have to build 9 Gigawatts of capacity of solar PV. We would have to build and operate a new grid. And we would have to maintain all the wind turbines and PV.<sup>20</sup>

Here are our estimates of how many jobs would be required. These estimates are based on the number of jobs that are currently required around the world to build wind and solar capacity. We have also taken account of the marked recent fall in the number of workers required to manufacture solar PV cells.

**TABLE : Average New Energy Jobs each year**

Building and installing wind power	66,000
Building and installing solar power	122,000
Building and operating a smart grid	62,000 Maintenance and repairs 0 to 88,000 <sup>21</sup>

<sup>20</sup> How much do we need to install? The key table is on page 4 of Bischof-Niemz and Mushwana, 2016. That table says that for 250 TW hours a year from wind we would need about 75 Giga watts of onshore wind capacity installed. They also say that for 200 TW hours of solar installed we would need about 104 Giga watt hours of solar PV installed. And in all their work they suggest that the best balance of wind/solar in SA is a bit more wind than solar. That suggests that 750 Tw total could come from 400 TWh from wind, which is 120 GW of wind capacity, and 350 TWh from solar PV, which is 182 GW of solar capacity. If you think of a programme to build capacity over twenty years, that means building 6 GW of onshore wind a year and 9 GW of solar PV a year.

<sup>21</sup> In a first draft of this report we relied on the methods of calculating renewable energy jobs set out in detail in Jonathan Neale, ed., *Online Companion to One Million Climate Jobs, Campaign against Climate Change*, 2014, 41-57. However, for the South African case, we will use the estimates of jobs in the McKinsey and Company study for the Department of Energy in *Socio-Economic Deep Dive*, Draft Final Report, August 2014. The advantages to these estimates is that they are based on contemporary interviews with experts in the industry and on the ground. The study is in part funded by Shell, which may well have led to some constraints on the conclusions, but probably did not affect the calculations which matter to us. The estimates in this report are, in general, about 25% higher than we came up with an earlier draft of this report that used the methods in Neale, 2014, but allowed for adjustments because of the recent falls in the price of solar PV.

Our plan would be to install 9GW of PV and 6GW of wind each year. At the end of twenty years, this would produce 400 TWh from wind and 350 TWh from PV. We use the estimates of jobs from McKinsey, p. 65. We combine their estimates for 'direct' and 'supplier' into our estimate for direct jobs, and use their estimate for 'indirect jobs' as our estimate for indirect jobs.



That is 250,000 jobs at the beginning of the process. Those are permanent jobs. More than half of these will be industrial jobs. But there will also be a lot of construction jobs building the grid and installing wind power and solar power. There will also be a lot of jobs for electricians, technicians and engineers.

Then each year the number of jobs in maintenance and repairs will increase by about 4,400 jobs, until at the end of twenty years there will be an additional 88,000 jobs. Much, or all, of this work could be done by local municipality construction workforces – we suggest how later in this chapter.

And if we do that, at the end of twenty years, the emissions of greenhouse gases will be almost nothing. Because nothing is ever perfect in this world, we estimate that emissions will fall from 237 million tons a year to 4 million tons.

## TECHNOLOGICAL PROGRESS

What about the future? Many things will change. Up until now, we have been writing as if the technology will stay the same. We have done that because we want to show that it is possible to cut emissions and create jobs on a massive scale with the technology we have now.

We have done this because it is easy to write that solar power will become immensely cheaper, all the problems of storage will be solved, and space cars will float in the air. It is easy enough to solve environmental problems with predictions, some of which will in fact come true. But that does not convince most ordinary people, who have learned to be wary of promises. We want to convince people that this can be done, now.

Still, there will be important changes in technology. Some things will become much more efficient, so that few workers can produce more energy. Some unexpected breakthroughs will happen, and some expected breakthroughs will meet stubborn resistance from material reality. But the general direction of travel will be that fewer workers produce more energy.

However, there will also be economic growth over twenty years. That economic growth will increase the demand for transportation, housing, electricity and industrial goods. South Africa has a young and growing population as well, and that too will increase economic growth. We have made some provision for this growth in our estimates, but not much. This growth may balance out much of the increase in efficiency.

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We round their estimates to avoid specious precision. This gives us estimates of 13,500 direct jobs per GW of PV installed and 11,000 direct jobs per GW of onshore wind installed. For 9 GW of PV and 6GW of wind a year, that would be 187,500 jobs. We round to 188,000 jobs each year in manufacture and installation.

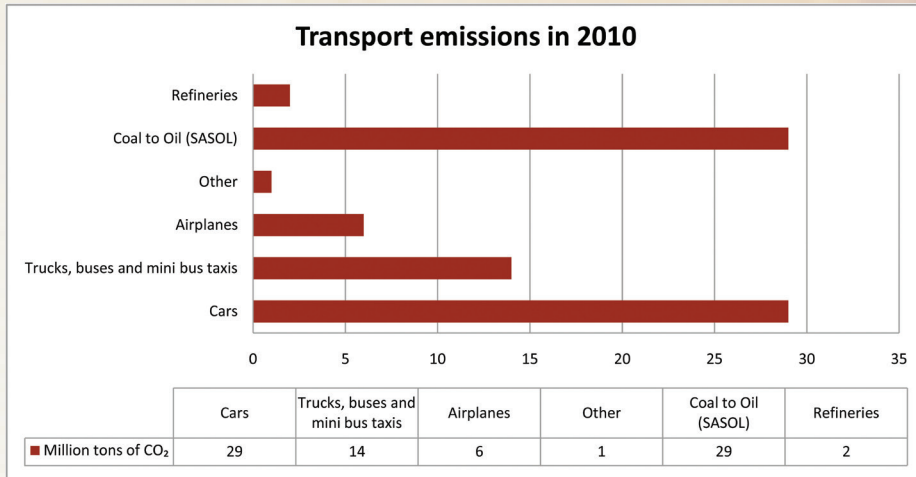
For jobs in operations and maintenance, we use their estimates of direct jobs as our direct jobs, and their estimates of supplier and indirect as our indirect jobs. This procedure is different from that with manufacture and installation, because the technical nature of the jobs is different. This gives us 107 direct jobs for each TWh of solar PV and 127 direct jobs for each TWh of onshore wind. This would be a total of 88,250 jobs at the end of twenty years, but no jobs at the beginning of the process. We round the total to 88,000 jobs.



But there are likely to be significant increases in efficiency in electricity production. These will not make that much difference – these are only a quarter or less of the total climate jobs. But if there are considerable savings here, it will be possible to do far more work developing what are not very expensive forms of renewable energy – wind power, wave power, and concentrated solar power.

## TRANSPORT

Transport is responsible for about 16% of total South African emissions. Here are the numbers:



With climate jobs and government regulations, we can cut these emissions by about 90%. That will mean 390,000 new direct jobs.

To make those cuts and create those jobs we need to do two main things. The first is to persuade people to switch from cars to buses. The second is to make sure all vehicles are eventually electric – electric cars, electric buses, and electric trucks. Here is how it would work.

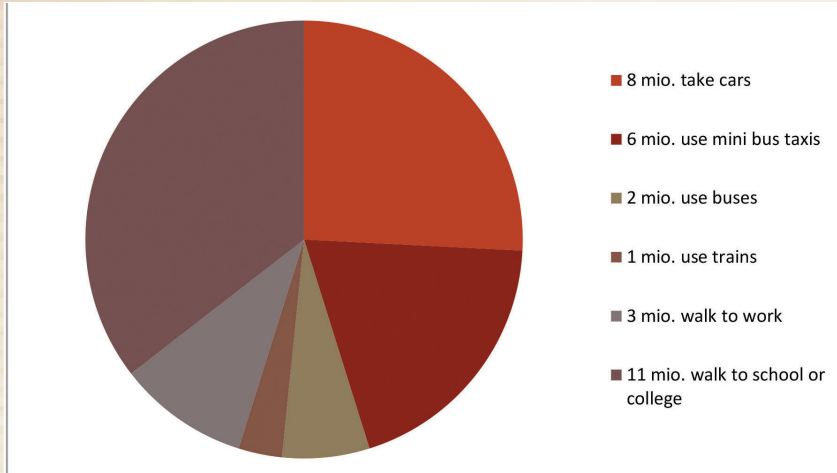
## FROM CARS TO PUBLIC TRANSPORT

Cars have much bigger emissions per passenger than buses, trains and mini bus taxi. The main reason is that cars carry so few people compared to the weight of the vehicle. So we need to get people out of cars.

<sup>22</sup> The statistics are from *South African Greenhouse Gas Inventory, 2013*. The numbers are for 2010. We have added the total for international aviation bunker to the total for civil aviation.

Here are the numbers for how people travel to work and education each day now:

**TABLE: Daily Commuters to Work and School**



Those 8 million people in cars have more money and their journeys are more pleasant. Those workers and school children in cars produce almost all the emissions from road travel. We need to persuade those people to take public transport. That will require clean comfortable buses that come often. It will require decent toilets and sheltered waiting rooms at the start of bus and mini bus taxi routes. Passengers will want more branch train lines and mini bus services taking people to train stations. And we need cheap services, with free travel for school children, like in many other countries. And it is important for people to be able to find a toilet and get a cup of tea at the start of the journey.



23 Source: *National Household Travel Survey 2013*, Statistics South Africa, 2014, 22 and 40. We have rounded figures to the nearest million. These are numbers for commutes to work, school or college.

We need more buses, so the service is not so crowded. And we need dedicated bus lanes, in both directions, divided off from the rest of the road by barriers. This is technically called Bus Rapid Transit, and is already being built in South Africa.

And in many places we will need complete roads reserved only for buses during rush hours. In some places we only need special reserved lanes in rush hours.

With these changes, bus traffic will move much faster in rush hour, and people will get to work faster. Car traffic will move much slower. Buses and trains will be more comfortable. Then people will want to take public transport – if we make sure there are enough buses. But we also need to ensure that people will feel safe and secure. Little public transport runs at night now, because people are afraid of assault and rape. There is general concern about overcrowding, and about the rates of accident and death on the roads. This means passengers will want effective, enforced controls on speed and driving. But it also means conductors on buses, trains and mini bus taxis whose main task is to look after people.

We want to encourage half of car commuters to switch – 4 million people. But if an expanded public transport system works, we would have a lot more than just those 4 million new passengers. There would be a million more climate jobs workers, and at least half a million working in support industries. Moreover, many people who walk to work or school now would choose a cheap, fast, comfortable public transport service.

So we propose providing enough buses, trains and mini bus taxis for 8 million new passengers:

**Table: New Jobs in Public Transport**

	New Passengers	New Direct Jobs
Buses	6 million	250,000
Trains	1 million	30,000
Mini bus taxis	1 million	70,000 <sup>24</sup>

Plus we would need at least 30,000 new jobs for the first ten years building a bigger rail network and all train lines. And we would need about 30,000 jobs for three years building new bus rapid transit lines and stations – about 30,000 jobs for three years.<sup>25</sup>

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<sup>24</sup> These estimates are based on statistics in Kyle Mason-Jones, *Employment in the South African Transport Sector*, WWF South Africa; and Jane Barrett, *Transport and Climate Jobs*, SATAWU and One Million Climate Jobs, 2011. When in doubt, we have gone with Jane Barrett's estimates rather than official figures. We have allowed for an increase of 25% on staffing levels in new buses, trains and mini bus taxis to provide for additional conductors and support staff to ensure safety.

<sup>25</sup> These are rough estimates.

That is an average of 370,000 jobs each year for the next twenty years. Most of those would be bus drivers, mini bus taxi drivers, conductors, railway workers and construction workers.

It would take some years to build new rail lines. But we can do all the other changes within three years.

These changes would make transport easier, faster and cheaper for the large majority of people in South Africa. But there is another reason for making the switch from cars now. We have to think about the future. Right now most South Africans are poor. The UK has about the same population as South Africa. But people in the UK buy five times as many cars as South Africans. If South Africans get a decent standard of living, they will buy five times as many cars too. And then the emissions that cause climate change will go through the roof.

That is why we need a transport system now that everyone knows is better than driving cars – faster, cheaper, cleaner. It is why it is so important that public transport is not too crowded. And why it is important to have public transport that runs at night. If we do not make public transport appealing now, we will end up with unspeakable congestion, pollution and gridlock.

And yet, despite the enormous challenges that a transport policy must deal with, the government's policy has little sense of urgency about it. While the policy on transport is often progressive, and ahead of its time, the problem is the practice.

Rather than implementing the rapid roll-out of a public transport system, the Department of Transport has a 2025 deadline for finalization of the planned public transport systems. The main focus of government policy is to see public transport as a business opportunity – involving multiple forms of the privatised provision of integrated public transport. In addition, vast amounts of money have been spent on consultants over the years – to do the work that government employees should have been doing, using money that should have been used to build the transport system.

Writing in 2014, Professor Jackie Walters noted:

*For many years the South African government has put forward policies and strategies to improve and promote public transport. Despite this, very little has changed over the last 30 years<sup>26</sup>*

## ELECTRIC TRANSPORT

Once we have improved and increased public transport, we need to make all cars, buses, trucks and trains run on electricity. And we need that electricity produced by sun power and wind power. Then we will have almost no emissions.

Why not simply let everyone have cars and run them on electricity? It would take a great deal of electricity, to say nothing about space. An electric bus or an electric mini bus needs far less electricity per passenger.

But government needs to move fast, and seize the moment to build a world leading electric vehicle industry. South Africa has the scientists, the engineers, the technicians and the car workers to do this. But time is of the essence.

The world is moving towards electric vehicles. The price of batteries for electric cars is coming down, and the strength of the batteries is increasing. At some point in the next 15 years, electric cars will be cheaper than normal petrol driven cars. At that point, the current auto industry will start to go bust, fast.<sup>27</sup>

When that happens, we want South Africa in on the ground floor, with one of the leading electric car, bus and truck industries in the world.

Two things will make that happen. First, a law stating that in five years time all new cars and trucks sold will have to be electric. After that, older vehicles will still be on the road until they wear out. So it will take about fifteen or twenty years before all vehicles are electric.

A law like this would concentrate the minds of the car companies. South Africa is a medium sized market for them now. Suddenly, it would be one of the two biggest markets in the world for electric cars. Only one thing can make an industry a world leader – the experience and innovation you get from mass production.

Secondly, we need jobs to kick start that South African industry. Some of these will be jobs in lab research. But the main way that companies develop new technologies is by learning through mass production. That means the lab has to link to at least one factory producing electric vehicles.

In the long run, this is the only way to safeguard the automotive production industry, a key part of the South African economy.

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<sup>26</sup> Jackie Walters (2014) Public transport policy implementation in South Africa: Quo vadis? *Journal of Transport and Supply Chain Management*; Vol 8, No 1

<sup>27</sup> For the growing literature on this see Chris Goodall, *The Switch, Profile*, London, 2016; Steve Levine, *Powerhouse: America, China and the Great Battery War*, Viking, New York, 2015; and Tony Seba, *Clean Disruption of Energy and Transportation*, Beta, 2014. Care is needed with all of these books, and even more care with media reports on solar power and batteries, as there is a strong element of boosterism. Levine, however, is useful in setting out the difficulties. And the general argument seems convincing.



Moreover, right now the sector where electric engines work best of all is buses. This is, because electric cars are currently designed and built to have fast acceleration, so that they can compete with petrol cars. But this makes electric cars expensive. Buses don't need that acceleration. And everything a manufacturer learns from making an electric bus can be used to build better electric cars.

So a law that says, right now, that all new buses and mini bus taxis have to be electric would be the way to kick start a whole new electric vehicle industry.

We estimate we will need 20,000 new direct jobs in pioneering an electric vehicle industry, and we will save many more jobs that would otherwise disappear. We assume that the established vehicle manufacture industry would either be nationalised, or would work in partnership with the new climate jobs programmes.

All these electric vehicles are part of the reason why we will need much more electricity than we have now. Right now, even burning coal in power stations, the electricity for vehicles causes no more emissions than come from a petrol engine.

But once we have all our electricity coming from solar power and wind power, the CO<sub>2</sub> emissions because of buses, bakkies, trains and cars will go down to almost nothing.

## AVIATION

Airplane flights are only 1% of current South African emissions. The great majority of South Africans cannot afford to fly. So right now we do not have to worry about aviation emissions. But South Africa, we hope, will grow richer, and then there will be many more flights.

It is easy to cut emissions from buses and cars – you just use renewable electricity. But you can't run an airplane on electricity.

Unless researchers can develop other fuels that will work in airplanes without CO<sub>2</sub> emissions, the only way to hold down aviation emissions is a cap on the number of flights. But we can build fast, comfortable train lines with sleeper cars that connect all South African cities. Then we can stop all flights within the country, but allow some more international flights. We also need fast rail lines, with connecting fast buses, to carry people originally from rural areas and neighbouring countries home to visit relatives and attend funerals.

There will be some climate jobs here in building high speed rail lines. No jobs need be lost in aviation.

## LIQUID FUEL AND RAIL FREIGHT

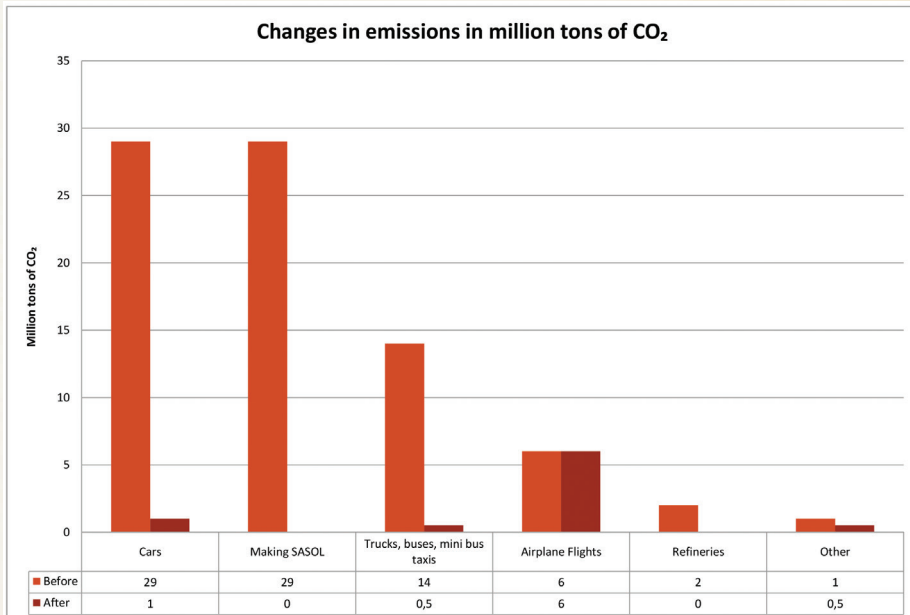
Once we have changed to electric cars, buses and trucks, we can stop using oil. That means SASOL can also stop producing oil from coal, which takes enormous emissions. But the people who do that work will need new secure livelihoods. Right now 20,000 people work in fuel, oil and refineries, and we will have to guarantee them new, secure climate jobs.

Rail freight produces a lot less emissions than using trucks. And moving freight by rail makes special sense for South Africa, with a few long lines between major cities. Government already has plans for reviving rail freight, and we support those.

On the face of it, more rail freight will mean fewer jobs for truck and van drivers. But we will need trucks and vans to switch to run on renewable electricity too. Those electric trucks will be, on average, slower and smaller. That will mean more jobs for truck drivers. And there will be many delivery jobs for van drivers between the rail depots and the final destinations. The number of jobs should balance out.

## TOTAL CHANGES IN TRANSPORT

Here are the total changes in emissions we can get with a switch to public transport and electrification. As before, we count the emissions in million tons of CO<sub>2</sub>:



28 Few things are perfect in this world, so we estimate that emissions from cars will fall only to 1 million tons, not to nothing. The estimate for 'Other' makes allowance for the fact that shipping will probably increase.

That is a cut of 90% in transport emissions over twenty years. And most South Africans will have cleaner, faster, and cheaper travel.

These are the new climate jobs. These are the additional jobs, above and beyond the jobs people already have on buses, trains and mini bus taxis.

**Table: Direct Public Sector Climate Jobs**

Buses	250,000 jobs
Mini bus taxis	70,000
Trains	30,000
Construction	20,000
Vehicle manufacture	20,000
TOTAL	390,000 jobs

That is a total of 390,000 jobs a year for twenty years and a 90% cut in transport emissions.

## OUR BUILT ENVIRONMENT

This section is about jobs working on the built environment. This includes roads, homes, buildings, water treatment plants, hospitals and schools. We need to convert old buildings so they use less energy, and build new ones that use even less. And we need to do work so our built environment can cope with the growing consequences of climate change.

5% of emissions currently come from heating buildings. This is not that much now. One reason is that some parts of South Africa are warm much of the year. But the main reason is that most South Africans are very poor and have such limited housing that they make small demands on fuel for heating buildings or electricity for air conditioning. And because of the growing costs of electricity, many households are forced to cut themselves off from electricity use and as a result expose themselves to illness and disease. We fervently hope that in future South Africans will have far better housing. That will mean very large emissions unless we start building better housing that uses less energy now. So this section is about reducing emissions now, but it's more about holding emissions down in the future.

## GETTING DATA AND MAKING PLANS

We will need every municipality to map communities, informal settlements and other infrastructure that is at risk from flooding and other impacts of climate change. This will include getting an accurate picture of the communities whose lack of access to water, electricity and housing will be made worse by climate change.

Government, and particularly the government statistical service, StatsSA, needs to be more consciously tracking mitigation and adaptation measures so that local, provincial and national government can make better decisions about what still needs to be done.

For example, how many low-income houses have no ceilings? How many have solar water heaters? How many have solar panels? How much electricity do those panels generate? How many households have water tanks? How many have a food garden?

Some of this information is already available, but much is not. Some of this work is number crunching and planning by white collar workers and professionals in offices. Some of it is interviewing people in their homes all over the country. All of it is necessary.

## **CONSTRUCTION JOBS WORKING FOR MUNICIPALITIES**

We will need many jobs in construction to respond to climate change. Many of these kinds of jobs are currently low-paid, insecure, short term and unsafe. We want them decently paid, permanent and safe. Among other things, that will produce far more careful and responsible work. The best way to ensure this is to make them public jobs.

Municipalities are the obvious people to employ many more workers to carry out climate construction jobs at the local level. This municipal construction force could carry out climate-related work across the different municipal departments. This would ensure workers could be employed in permanent posts rather than in contract work.

It would also make sense for these municipal construction workforces to take on most of the work of maintenance and repair of solar PV and wind turbines. There are two good reasons for this. One is that the amount of repair and maintenance work will grow steadily over twenty years – enough for 88,000 workers by the end of twenty years. Municipal workers could do most of the necessary conversion and construction work on the built environment early in the twenty years. Then they would be available as a local, skilled workforce to do the repair work. That would give municipal construction workers permanent, secure jobs.

Many of these jobs will be skilled and semi-skilled construction workers. We will also need engineers, technologists, technicians, and other highly educated staff. At the moment municipalities do not have that staff. Indeed, since 2005 the number of municipalities that don't have civil engineers on their staff has increased from 126 to 202.<sup>29</sup>

## **THE WORK TO BE DONE**

There will be a lot of work for those local climate construction workers to do. Retrofitting existing buildings helps to reduce CO<sub>2</sub> emissions. The reason is that with retrofitting and better insulation, buildings need less heat to stay warm. Retrofitting is also important for the adaptability of communities to the impacts of climate change. Buildings we need to retrofit range from homes to government buildings such as schools and hospitals, and private businesses and industry.

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<sup>29</sup> Lawless, Allyson (2015) "Numbers and needs in local government - update 2015", in IMESA 10th Conference proceedings.

An obvious place for municipal construction forces to start is public sector buildings and low-income residential homes. They would install ceilings in houses which currently have none. (These are mainly low cost RDP houses.) They would also change to energy-efficient light bulbs, install solar water heaters on the roof, install rainwater harvesting tanks, help create food gardens, and make more accessible and pleasant parks and other public spaces.

All these measures will reduce energy loss and make living conditions for thousands of residents more bearable.

For example, a Ceiling Insulation Project was allocated R30 million to retrofit ceilings for 230 government subsidy houses in Mamre, Western Cape. This project created 18 local jobs for unemployed people, who also learned new skills.<sup>30</sup> On a national level, there are now 2.3 million households in RDP or state-subsidised homes. If the Mamre project was expanded across the country, it would create thousands of new jobs.

Then there are solar water heaters on the roof. By the time the project was ended in 2012, ESKOM had installed 400,000 solar water heaters in low-income households. This was far from the target of one million heaters announced in 2008. There were numerous problems with the programme. The local content was low. Installation was often of a low quality. And the systems were not adequately maintained, so many residents simply went back to electrical geysers.

Future implementation of the programme is now in the hands of the Department of Energy. Government have said they aim to ensure the installation of 1.75million solar water heaters by 2019, and 5 million by 2030. Local municipal construction workers would be the obvious people to do this work.

Two things would be crucial to creating jobs and making water heater installation work. One would be that municipal construction workforces have steady responsibility for doing repairs promptly. The other is that a climate jobs programme manufactures the heaters and components in South Africa, to create as many jobs as possible.

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30 GreenCape (2015) *Greening the Construction Sector: 2015 Market Intelligence Report*. If such a project was expanded into communities and municipalities country wide it would create thousands of new jobs. 14%, or roughly 2.321 million of the 16.122 million households in South Africa are RDP or state-subsidised houses. (StatsSA (2016) *General Household Survey 2015*). While it is difficult to say how many of these houses need ceilings fitted, and how many have already had ceilings retro-fitted, if we presume about 80% of them still need to be retrofitted, that would create approximately 145 000 job years. Further retrofitting work in the same houses would increase this to something on the order to 300,000 to 400,000 job years.



## NEW BUILD

There is a huge backlog of houses in South Africa, as well as ongoing demand for new public buildings such as schools, hospitals, clinics, and so on.

We already have important regulations designed to ensure that all new buildings are energy efficient. But monitoring the implementation of these regulations is going to be an important task. This is going to require thousands more building inspectors. And we will need even stronger, and more stringent, energy regulations.

The process of building new houses could be much more energy efficient too. More labour intensive methods of building rather than high-tech machinery would make a difference. So will making sure every new house has a ceiling and a solar water heater. It also means more demand for thermal insulation products of different types.

This would mean more jobs in installation and maintenance. But even more important, it would mean an increase in jobs in the manufacturing sector.

With the introduction of various regulations that call for greater energy efficiency, there has already been demand for “alternative building technologies”. These designs and technologies are different from conventional brick and mortar or reinforced concrete. They include both traditional technologies and new innovations. Technologies such as structural insulated panels, radiant wall systems and modular timber frames are currently imported into the country and then assembled here. Apart from being energy efficient, these technologies result in less waste, and faster building times.

Already the government has committed to using Alternative Building Technologies for 60% of its social infrastructure plans - which includes subsidised houses, schools, universities, student accommodation and healthcare facilities.<sup>31</sup> That would encourage much wider use of alternative materials in private construction. But again, the crucial thing is to have manufacturing in South Africa making the materials.

Lightweight steel frame buildings are also increasingly used in the private and public sectors. This is important because it increases demand for local steel, as well as products such as cladding, bulk insulation and other materials. In addition, it would help preserve jobs in the steel sector which has been hit hard by the worldwide drop in steel production.

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31 GreenCape (2015) *Greening the Construction Sector: 2015 Market Intelligence Report*.

## EMBEDDED GENERATION



'Embedded generation' is the installation of photovoltaic panels on the roofs of residential, commercial and industrial buildings. This already saw a 300% growth in 2015. The regulations in the area of embedded generation of less than 1 MW are still vague, with local and national government still developing the necessary rules and regulations.

As the regulations and tariffs relating to small scale embedded generation are developed and firmed up, and as more and more municipalities follow the route of allowing embedded generation to feed electricity back onto the grid, and the demand for rooftop PV increases, there will be greater incentive for PV companies to invest in the South African market, thus creating jobs. In the Western Cape alone, it is estimated that about 1000 job opportunities will be created in manufacturing, installation and maintenance of small scale embedded generation. This could be replicated in other provinces.<sup>32</sup>

## OTHER AREAS

Then there are many more areas local construction forces can deal with. These include:

- \* Constructing new roads and adapting existing roads to withstand climate changes such as increased temperature and flooding.
- \* Changing stormwater pipes across municipalities to have a bigger diameter to deal with the increase in rain intensity.
- \* Make street lights and traffic lights more energy efficient.

<sup>32</sup> GreenCape (2016) *Energy Services: Energy efficiency and embedded generation - 2016 Market Intelligence Report*.

\* Increasing the role of disaster and emergency workers, and making them better prepared to identify climate related hazards early, deal with climate related emergencies, and educate communities/prepare communities for the impacts of climate change.

\* Planting trees in public places

Local municipal construction teams would also be the obvious people to build dedicated cycle lanes in urban areas.

But the most important work they could do would be constructing millions of new RDP houses. There is still enormous pent-up demand for decent, affordable housing among South Africans. A generation of very low energy, high quality RDP houses built by local workforces would also have an important effect on greenhouse gas emissions.

This is because new RDP houses could be built, as a standard, with ceilings, excellent insulation, embedded PV arrays as part of the roof, solar water heaters, and rainwater collection. The equivalent of the “passive houses” now built for some affluent Germans could become the birth right of working class South Africans.

How many jobs would all of this require? It depends on the range of work local construction teams do, and above all on whether they build large numbers of passive houses. A minimum would be 88,000 workers, to make sure all renewable energy maintenance and operations were covered at the end of twenty years. But with 200,000 workers, it would be possible to do substantial work building new RDP houses as well. We suggest a range of 150,000 to 200,000 jobs, depending on how many jobs are needed in to support farmers.

## AGRICULTURE

In the previous chapter we talked about jobs and grants that can help farmers deal with the effects of climate change. Here we turn to ways to reduce emissions from farming.

Unfortunately, climate jobs cannot help cut farming emissions by much. This may be surprising. After all, many people say that a third or more of global greenhouse gas emissions come from agriculture.

This is not true. The United Nations statistics say that about 10% of climate change emissions come from farming and livestock raising. Another 10% come from cutting down forests. That is only 20% in all.

In South Africa it's much less. Government provides honest, detailed statistics on South African emissions. They say that only 9% of total South African greenhouse gas emissions come from agriculture. And on balance, South Africa is not cutting down forests or turning pasture into crop land.

Let's look at the details, and see what can be done about these emissions.

5% of South African emissions come from the digestive systems of cattle, sheep and goats. As they chew the cud, they take a long time to digest their food. That digestion creates methane, a powerful greenhouse gas, which comes out in their burps and farts.

Chickens, pigs and ostriches make much less methane. So a switch from eating beef to eating chicken and pork could reduce emissions. This switch is already happening. That helps reduce global warming a bit.

3% of total national emissions come from using animal manure and animal urine on the fields to help grow crops. No one wants to reduce this – the result would only be to replace these emissions with similar emissions from manufactured fertilisers.

1% of total national emissions come from using commercial manufactured fertilisers. This is a very low proportion compared to other countries.

What all these statistics mean is that we cannot cut emissions from farming by much. There are technical things farmers can do, like using new breeds of cattle and sheep, feeding livestock with different techniques, and using manure and fertiliser more carefully. But even with all these, we will be lucky to cut emissions from farming by a third over twenty years.

Finally, in many countries there are a lot of emissions from cutting down forests for grazing land and farming. That releases a lot of carbon from the forest trees and soil into the air as CO<sub>2</sub>. But in South Africa it is the other way round. People are already leaving agricultural land, and the amount of forest and savannah is growing. This reduces South African emissions by about 4% a year. We can continue doing this, but not by much more, because we still need a lot of farming and grazing land.

## WASTE & BIOGAS DIGESTERS

4% of South African emissions come from the waste industry. About nine tenths of these emissions come from solid waste, the other 10% come from waste water.

Some solid waste is burned in incinerators. This does not only produce CO<sub>2</sub>, but also other harmful emissions that damage the health of people in neighbouring communities. A vast amount of solid waste is buried in landfills, where it decays and produces methane, a powerful greenhouse gas that seeps into the air. Waste water, mainly sewage, is rich in organic material. Any organic substances in the waste water produce methane as they break down.

To tackle the emissions of the waste industry we have to reduce the amount of waste in the first place. This starts with strict controls on packaging – especially on plastics. But it also means careful recycling after use. Tin cans, glass bottles, paper, metals, building materials and many other materials can be used over and over or turned into the material for new manufacture.<sup>33</sup> Also, recycling materials means less energy consumption to produce new ones.

We cannot completely cut down the emissions from the waste industry, but we can limit their negative impact. Most importantly, solid waste incineration has to stop in order to avoid health hazards.

Furthermore, we can make use of the methane produced in landfills or waste water treatment. Modern landfills should be fitted with channels that carry the methane to vents at the surface, where, in the absence of oxygen, the material breaks down into a sludge of organic material and methane. This methane is collected and used for heating or power production. When the methane is burned, it is turned into carbon dioxide, which is a far weaker greenhouse gas.

In practice, both, recycling and sustainable management of waste will be needed, and both will produce jobs. Compared to waste incineration, recycling needs much more workers. Other workers have to monitor the landfills.

Lastly building and operating biogas digesters have the potential to create jobs within communities. Biogas digesters can be built in almost any size, from a small single-household model to a plant that uses the organic waste of a whole neighbourhood. Rural people could especially benefit from the livestock that produce large amounts of organic waste that is ideal feedstock for digesters. The construction, which need not be sophisticate, can be done in a labour intensive way, which creates a large number of jobs for skilled and semi-skilled builders.

In Nepal, a country with roughly half the population of South Africa, there were 260,000 household digesters at the end of October 2009.<sup>33</sup> Yet, there were only around 700 digesters in the whole of South Africa, in 2015.<sup>34</sup>

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33 *Tirtha Raj Aryal*, Biogas In Nepal, Brief Introduction, n/d

<http://www.saarcenergy.org/wp-content/uploads/2016/07/Nepal%20Presentation.pdf>

34 Mark Tiepelt, Biogas In South Africa. <http://www.sairec.org.za/wp-content/uploads/2015/10/M-Tiepelt-SAIREC-Conference.pdf>



## INDUSTRY

16% of South Africa emissions come from industry. This does not include the emissions that are made in producing electricity for industry. We have already counted those in the section about electricity, and we can get those emissions down to almost zero. Here we are talking about emissions that come from industrial processes themselves.

Industry, like agriculture, is a stubborn problem for reducing emissions. There is huge potential for reducing industrial emissions. But, in the short term, this doesn't come cheap and industry is driven to maximise profits.

This does not mean we cannot regulate industry to reduce emissions. We can. Governments already prescribe health, safety and environmental standards, and industry conforms, despite the cost. But it does mean that the process should ideally be multilateral, with South Africa giving a practical lead, if need be.

In many cases, it is possible to substitute electricity for burning coal or gas in the process. The most important example is the use of electric arc technology in steel manufacture. This is often expensive, because it requires a great deal of electricity. It also requires a large amount of new capital investment in new plants. And it does not work for all processes.

The other source is emissions that happen as result of the industrial process itself. These emissions do not come from burning coal. They come from chemical reactions in the materials that are being heated and mixed. In South Africa most of these emissions come from the steel industry and from cement manufacture.

There are technical ways to reduce these emissions too, but it is not as simple as substituting electricity for coal.

The climate jobs here would be of two kinds. One would be in research to work out new ways of reducing emissions. The other would be in specialist teams of advisers that can go into large and small businesses and offer tailored advice on ways to reduce emissions and increase energy efficiency.

Given all these considerations, our estimate is that in twenty years it should be possible to reduce industrial emissions by almost half, from 16% of the current total to 10% of the current total. Perhaps, with international cooperation, it will be possible to do better than that.

## LEAKS

About 5% of greenhouse gas emissions currently come from 'fugitive emissions', which means leaks. Some of this comes from oil refineries. Much of it comes from gas leaks in landfills, coal mines, and pipelines to heat buildings and to heat materials in industry. Repair work,

particularly on pipelines, can reduce these leaks. But in the long term simply reducing the use of oil, coal and especially gas will automatically reduce these emissions. We estimate a cut of four-fifths is possible in twenty years.

## **EDUCATION, TRAINING AND RESEARCH**

Finally, there will be climate jobs in education and training. The climate jobs will require a wide new variety of skills. Some of these will be engineering and design skills taught in universities. Some will be on the job training, as usually happens in wind turbine manufacture globally. Many of the new jobs will require apprenticeships, with a mix of on the job learning and formal training in colleges or special centres.

There will also be of retraining. Some of this will happen as people change their work, for example from installing ceilings and installation in RDP houses to doing repairs and maintenance on PV solar power. Some of it will happen when people lose a high carbon job – for example, when a miner retrain to become an electrician or a wind turbine blade technician.

We will also need many research jobs. Many of these will be in factories and plants, as part of the production process. Nothing drives engineering forward like the experience of mass production. But much of the thinking to be done involves new technology and young industries, and there will be room for a great deal of basic research in universities.

## **TOTAL JOBS**

We have been able to make reasonably accurate estimates of jobs in electricity, transport and construction. For waste, industry and education our estimates are more tentative. Our estimate, and it is only that, is that there would be 110,000 climate jobs in waste, industry and education.

## CHAPTER FIVE: FINDING THE MONEY

Climate jobs are necessary. To ask if we can afford climate jobs is a strange question. To say that we cannot afford them is to say it is too expensive to go on living. All governments claim that climate change is real. This alone means that addressing climate change cannot be left to being a nice optional extra dependent on whether or not it can be afforded.

Our current path of corroding away our planet is already extremely costly. The costs imposed on our society by unemployment are immense. And if we do not act, the cost of coping with full scale climate change will be unfathomable. The longer we wait, the worse the problems become, the greater the suffering, and the higher the cost of coping.

There are many ways to finance these climate jobs. Any one of these options will make tens of billions of rand available. Whether governments can afford something is always a matter of choice. In 2007, ESKOM and the government started the building of the two giant coal power stations Medupi and Kusile. They were supposed to be completed by 2011. They are now supposed to be completed in 2019 at a cost of R306 billion. This is more than double the planned cost when the two projects started.<sup>34</sup>

A closer look at the estimated cost for ESKOM's 'Capacity Expansion Program' for 2005-2011 showed the cost at R140 billion, with a projected cost of R450-500 billion until 2017. This has been overrun by a huge margin.<sup>35</sup>

In 2016, the Unemployment Insurance Fund (UIF) had built up a surplus of R90.3 billion. The reason is that much of the money deducted from worker wages has not been paid out to the unemployed. In the 2014 financial year alone, the UIF added another R20 billion to its surplus. This fund should be used for climate jobs.<sup>36</sup>

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34 City Press cites a researcher that the cost will be close to R420bn. <http://city-press.news24.com/Business/economy-faces-eskom-shock-20160710>

35 A careful investigation in the cost over-run for Kusile and Medupi was published in Daily Maverick 7 July 2016. The estimated cost for these two power stations now hovers around R420bn. URL: <https://www.dailymaverick.co.za/article/2016-07-07-medupi-kusile-and-the-massive-costtime-overrun/#.WIDFeFV97IU>

36 National Treasury, *2014 Budget Review*. The 2015 and 2016 tells the same story about UIF surpluses. Accumulated surplus in UIF has been growing every year at an increased rate.

Instead, much of this money is being used for more coal power. R2.3 billion of UIF money stored in the Public Investment Corporation (PIC) will be invested in the R11 billion Thamabetsi coal power station, planned at Waterberg, Limpopo. The rest will be funded by loans from SA's four biggest banks. The planned Thabamesti and Khanyisa coal power stations together will absorb another R40 billion in loans and investments.<sup>37</sup>

Affordability is a matter of choice. From an economic perspective, it is never "expensive" to a nation to organise, educate and train previously unemployed people in work that creates public assets and productive wealth, like wind and solar power stations, or public transport facilities.

This excludes eight nuclear reactors at an official cost of about R500 billion and a real cost of much more. That creates few jobs, and vast amounts of nuclear waste will remain poisonous for tens of thousands of years. Experience from all other big projects in South Africa suggests, that a nuclear adventure would finally cost in between R1 and R2 trillion in today's prices.<sup>38</sup>

Governments show us time and time again that if there is political will, money can be found for any project or emergency. After the 2008 financial crisis, rich nations came up with trillions of dollars to bail out bankers.

In South Africa, government has so far spent R70 billion on the corruption-ridden arms deal. And they spent R40.3 billion directly on the 2010 Soccer World Cup.<sup>39</sup>

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37 GroundUp Website reports that UIF will hold 21% of the equity or R2.3 billion. R2.3bn is 21% of R11bn. 'Equity' means shares in a business. In addition, a big project also take huge loans to get started: <http://www.groundwork.org.za/archives/2016/news%2020161207%20-%20Why%20are%20SAs%20big%20four%20banks%20financing%20a%20new%20coal%20power%20plant%20that%20risks%20becoming%20a%20stranded%20asset.php>. Estimates in media of the cost for the two projects: URL: <https://www.bloomberg.com/news/articles/2016-10-10/khanyisa-thabametsi-set-to-build-power-plants-in-south-africa>.

38 <https://mybroadband.co.za/news/energy/126814-south-africa-to-build-6-new-nuclear-power-plants.html>. Today, the government speaks of 8 nuclear reactors. The cost for 6 reactors, not 8, would be R400mn – R1bn according to a report from Reuters (2015). The margin of error in the Reuters report is R600 billion.

39 The national government spent about R30 billion. The provincial governments spent another R10bn (Grand Thornton cited in Mail and Guardian). URL: <http://mg.co.za/article/2015-06-11-was-world-cup-2010-worth-it>

## HOW MUCH WILL IT COST?

We cannot be exact about how much a program of climate jobs will cost. But we can make rough estimates. Our estimates will be an answer to the question: How much of our social resources should be reallocated. Especially, how much of our human resources that now lie unemployed can be organised and put to work.

Let's say the government will provide enough funding for a million workers to be directly employed each year, and for all the materials and services in the supply chain. That would mean the equivalent of 1.7 million jobs.

Another way of thinking about that is to say that the climate jobs programme would be about 11% of the size of the current South African economy. However, our programme is likely to be somewhat smaller than that. One reason is that almost half of costs in typical South African industry go to profits, rents, interest and other non-wage costs. In a government climate jobs program, any surplus in one project can be reallocated to another project, and not disappear as income to private shareholders. We also take for granted that the government will not have 'management fees' paid to tax havens abroad, like a big corporation. A government program would also be able to borrow money at much lower interest. So we estimate the total cost would be closer to 8% of the total economy now, or about 346 billion rand each year.

That sounds like a very large amount of money. But in a growing economy where the population grows and people previously unemployed are employed, we grow the economy that does not burn coal, the non-fossil production, and shrink the economy of coal and oil burning. And in the short term, the government would be able to recover and recirculate about two thirds of this money into the next year. Here's how:

Some of the money spent is going towards producing renewable electricity. Companies and people will pay for that electricity. We estimate those payments on electricity bills will cover just over half of that spending.



Some of it is going towards public transport. Many people will pay for tickets to travel. We assume that public transport will be subsidised for poor people. But if we keep subsidies at current levels, we can recover about half of spending on public transport. And some of the money is going towards building new houses. People will pay rent. Some is going towards building electric vehicles. People will buy them. Overall, we estimate the government can recover about R167 billion each year through electricity bills, tickets, rent, sales and the like.<sup>40</sup>

Next, more than a million people who did not have a job will now be making money. (Some will be directly employed, some working in the supply chain.) They will spend much more money, and some of that money will go toward paying VAT. The better paid will also be paying income tax to the government. And companies in the supply chain will also be paying corporation tax. We estimate that altogether the government can get back at least R85 billion in taxes.<sup>41</sup>

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40 We assume that spending is roughly proportional to the number of jobs. We assume an average of 188,000 jobs a year in manufacture and installation of renewable energy, 44,000 jobs a year in operations, and 20,000 jobs a year in running the grid, but do not include any jobs in building a national grid. This assumes higher charges than currently for large commercial users of electricity, which is a political decision, but such rates have been comparatively low. That is a total of 252,000 jobs.

Of course, income from tariffs year by year will not be high until most of the new renewable energy has been built. In calculating the return on investment, we are assuming that money can be borrowed against the long term returns from electricity sales, as any electricity venture, private or public, would do, and that the tariff structure would reflect the cost of paying off the loans.

We also assume 390,000 jobs in transport. But 110,000 of these would be in privately operated mini bus taxis, rail construction and electric vehicles. We assume that ticket sales would cover half of the cost of remaining 280,000 jobs, and subsidies the other half. In 2012/13 government subsidy covered 60% of the cost of train and bus travel. But the subsidy for rapid bus transit was a good deal lower than the average, so with a heavy emphasis on BRT the cost of subsidies could easily come down to 50%. (See National Treasury, Performance and Expenditure Review: Public Transit.) Of course, this is a political decision, and could be varied. But on these assumptions we would be raising enough money to cover 140,000 jobs.

There would also be some income, though not a great deal, from construction work on insulating new houses and the sale of electric vehicles. In all, ticket sales, electricity bills and other income would be pro rata to approximately 400,000 jobs. This would produce an average annual return of R149 billion rand on expenditure of R346 billion.

41 SARS, *2016 Tax Statistics*, page 18, gives total tax income for 2015-2016 as R389 billion for personal income tax, R281 billion for value added tax, and R193 billion for corporate income tax. We are proposing 1,000,000 direct jobs and 700,000 indirect jobs. Let's assume that wages as a whole are roughly the same as wages in the national economy.

**Table: Annual Costs and Income**

Upfront costs	R346 billion
Minus sales, tickets, bills	R149 billion
Minus tax and VAT income	R85 billion
Net costs to government	R112 billion

This leaves 112 billion rand the government still has to find each year. That is only 32% of the upfront costs, but it's still a substantial sum.

There are several ways that the government could raise money for the shift to a low-carbon economy.

**Increased taxation of companies.** In March, 2016 non-financial private companies in South Africa were hoarding R725 billions in bank accounts. A compulsory 10% tax could raise R70 billion.

**Tax high incomes.** The top rate of tax for the rich now is only 41%. If we just roll back a third of the cuts in the personal income tax since 2000, we could raise R60 billion a year. We could raise more if we wanted to raise taxes further on incomes of over R5 million a year.<sup>42</sup>

**Tax Bond Sales.** There is already a tax of one quarter of one percent on sales in the stock market. If we extend that small tax to bond sales, we should raise some R20 billion a year.<sup>43</sup>

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Then we could assume that these workers would pay R44 billion in income tax and spend money which would lead to R32 billion in value added tax. This is a total of R76 billion. We could also assume that return on corporate income tax for companies employing people indirectly would be equal to 0.7/15 million jobs. That would produce an increase in corporate income tax of R9 billion. That makes a total of 85 billion.

We should also make allowance for the extra income generated for government by induced jobs as a result of this spending. But for reasons explained in Chapter Six, we are assuming that the number of induced jobs will be roughly balanced by the number of jobs lost over the long term in high carbon jobs, so the net gain to the number of jobs in the economy will be approximately the direct jobs plus the indirect jobs, but not including the induced jobs.

42 Even more important than the cut in the tax rates 2000-2001 have been exaggerated 'adjustments of tax bracket for inflation every year since 2000. Source: Dick Forslund, *Personal Income Taxation and the struggle against inequality in a time of crisis*, AIDC, 2016, Cape Town.

43 This assumes that the number of bond sales remains steady. Of course, the sales may go down if they are taxed.

**Close Tax Haven Loopholes.** During the last decade, illegal capital flows from South Africa, and shifting profits to tax havens, have been very large. It is not possible to be precise about how much money we could raise, because these transactions are hidden, and only some of this money could be recovered in taxes. But these profits would be liable for the 28% tax on corporate profits.<sup>44</sup>

**Use the Underspend of the money paid by workers to the Unemployment Insurance Fund.** The fund presently underspends R20 billion a year and it has been growing every year for ten years.<sup>45</sup>

**Pension Funds and Prescribed Assets.** Government could declare that 10% of the PIC R1.8 trillion funds and 5% of the private retirement fund industry to be prescribed as assets for fighting climate change. This fund is growing every year, both because of people saving more for their pension than what is paid to pensioners, and because of returns on invested funds. Today, this would raise over R220 billion in loans at prescribed interest rates, still leaving more than enough to safeguard pensions.<sup>46</sup>

If government did all those measures, they could raise R195 billion a year and another R220 billion in loans to kick-start the process. That is far more than the R112 billion a year they would need to find.

Almost all these measures rely on taxing corporations and the rich. It is fair to make the rich and the corporations pay to help solve a problem they have created.

The numbers we have quoted in this section are all estimates.

We cannot be more precise, partly because we are talking about hidden incomes, and partly because we are talking about the future. Our estimates in some cases will be out by quite a bit. But the general pattern we have sketched will hold up. Government can “choose to afford” to pay for climate jobs. Let us remember that the government today is hell-bent on a hugely expensive expansion of nuclear power. This is an investment of R1000 billions or more, which will create a minimum of jobs and leaving future generations with an unsolvable problem of taking care of poisonous waste. The government can choose a low-carbon trajectory for the economy, only if they are ready to challenge the power of the rich and the corporations.

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44 See the Annual Reports from Global Financial Integrity.

45 SA National Treasury *2016 Budget Review*.

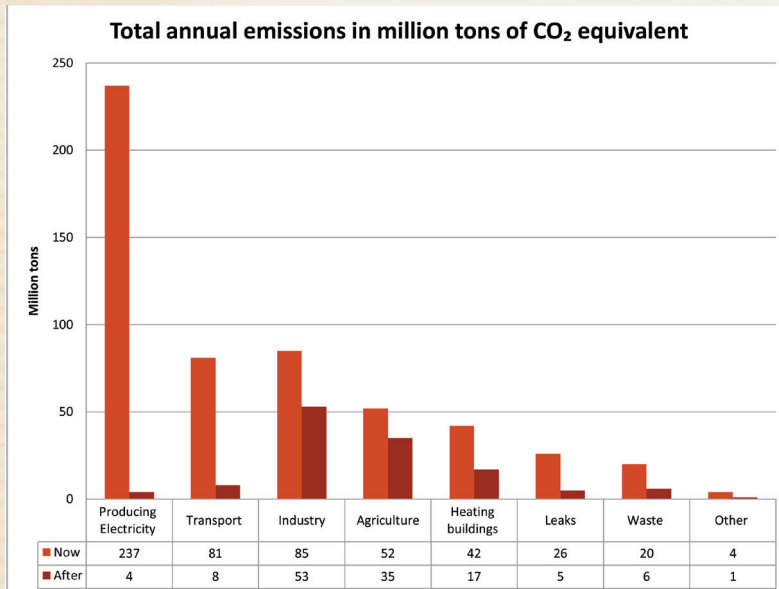
46 <http://mg.co.za/article/2016-05-13-00-finance-minister-debacle-cost-pic-more-than-r99bn>

## CHAPTER SIX: CONCLUSION

We will now repeat the tables we presented in Chapter One. Here are our estimates for the total number of directly employed workers each year for twenty years, and the resulting cuts in emissions.

**Table: Job Estimates**

Electricity Manufacture/Install	250,000
Transport	390,000
Construction/Electric repairs	150,000 to 200,000
Agriculture	50,000 to 100,000
Waste, Industry and Education	110,000
<b>TOTAL</b>	<b>1,000,000 jobs</b>



47 These figures are calculated as percentages from the given in the official government report for the UN, Jongikhaya Witi and Luanne Stevens, *GHG National Inventory South Africa 2000-2010* (Department of Environmental Affairs, November 2104), 76 and 275. We have used the figures not including land use, which would reduce the total for emissions. We have included the manufacture of liquid fuel, mainly by SASOL, in transport. We have also included aviation fuel in transport. These figures are for 2010, the last year for which there are detailed numbers.

That is a 76% cut in total emissions. One quarter of total emissions come from industry and agriculture, which are the two most difficult sectors to cut, for reasons we have explained. The other three quarters of emissions come from electricity, transport, heating buildings, leaks, waste and other. In these sectors, taken together, the cuts in emissions would be 90%.

After twenty years, it should prove possible to cut emissions still further. With further work, it will be technically possible to cut emissions from heating buildings and from burning materials in industry to almost nothing by switching further to electricity. Further reductions in industrial process emissions will be possible with technical change, and with international cooperation so industry does not become uncompetitive. Agricultural emissions will be harder to reduce, but will come down if and when South Africans are comfortable with a long term shift to eating more chicken and pork and less beef and sheep.

We estimate, therefore, that within thirty years, and with international cooperation in industry and some technological change, it will be possible to reduce all emissions from 547 million tons a year to 54 million tons – a cut of 90%.<sup>48</sup>

## ADDITIONAL JOBS

However, these figures understate the true impact on jobs. This is because the numbers above only count workers directly employed in transport, construction, renewable energy, and so on. There will be many more workers in the industries that supply the parts, goods and services the directly employed workers need. A reasonable estimate for all the sectors across the board will be that the number of these 'indirect workers' in the supply chain will be about half the number of directly employed workers.

This gives the following totals:

**Table: Direct and Indirect Workers**

Directly employed workers	1,000,000
Indirectly employed	700,000
TOTAL NEW JOBS	1,700,000

<sup>48</sup> This assumes a long term fall in emissions to 10 million tons from industry, 26 m. tons from agriculture, 0 from heating buildings, 0 from leaks, and 3 m. tons from waste, mainly waste water, and a steady 4 m. tons from electricity and 8 m. tons from transport, for a total of 54 m. tons.



There will also be a need for a much larger number of disaster management jobs to help with recovery from the effects of climate change. These disaster management jobs need to be recognized although they can't yet be quantified. In many parts of the world there will be increasingly strong storms, with 'hurricane surge' waves which could devastate surrounding communities like those on the Cape Flats, or cause fires, explosions, and flooding with toxic materials, if these waves flood major industries like the refineries and chemical plants of Durban. In either case, recovery and resettlement would be a major task.

There are three other adjustments we should make to these estimates of the total number of jobs. One is because all these extra new workers will have money in their pockets they can spend on everything from sandwiches and shoes to entertainment and housing. Meeting that demand will create still more jobs in the economy.

The second adjustment pulls in the opposite direction. Some of the new climate jobs will be replacing old jobs, particularly in coal mines, power stations and SASOL. All those workers will be able to retire, or to find new climate jobs. But still, we have to deduct those jobs from the total number of new jobs in the economy. We assume that the two ways of adjusting the job numbers will roughly balance out.

Our third adjustment is that we will have to make some allowance for the jobs that will be lost. We estimate that over twenty years these will include a total of about 115,000 direct jobs (in SASOL, in producing coal for the domestic market, and in electricity generation). And there would be another 80,000 indirect jobs in the supply chain. The impact on actual workers will not be great. About half of them will retire or leave the industry anyway over those twenty years, and we would provide the remaining workers with guaranteed retraining transfers or a grant. But the jobs, as such, would still disappear. On the other hand, we can expect a roughly equal number of 'induced jobs' – jobs that arise because the new workers have money in their pockets to spend, and new jobs are created to supply the goods and services they are buying.<sup>49</sup>

So our final estimate is that there will be 1,700,000 new extra jobs in the economy. These jobs will affect a much larger number of people among the families and relatives of these workers.

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<sup>49</sup> The usual formula for induced jobs in a developed economy is 15%. This would suggest an extra 191,250 to 236,250 induced jobs. McKinsey and Company, 2014, give much larger estimates for induced jobs in renewable energy. We have decided not to use their estimates, as it is all too easy to get carried away in calculating induced jobs.

The main sectors where jobs are likely to disappear over twenty years are SASOL, where there are 30,000 jobs now; Coal, where roughly 60,000 jobs now produce coal for the domestic market; and Eskom, where there are about 42,000, of which at most 25,000 are working in electricity generation. This would be a total of 115,000 jobs lost over twenty years. On these numbers, the jobs lost in high carbon work would be much less than the induced jobs created, so if we assume the two balance each other out, we are being conservative about the total number of jobs created in the economy.

## SOME THINGS TO THINK ABOUT

Before we finish this report, we should note that there are important controversies that we have said almost nothing about. For example, we have largely avoided the questions of nuclear power, biofuels, and 'clean coal'.

This is not because we do not have opinions on these matters. We do. But space is limited in this report. More important, this report is not a final blueprint for government action. Our figures are estimates informed by wide reading and detailed professional knowledge. But they are still only estimates.

Our intention in this report has been to show the reader that a climate jobs programme could work, that government could find the finance for it, that it would lead to very large cuts in emissions, and that it would create more than a million new jobs in the economy. We trust we have showed that much.

We are aware that this report was written by a small network of specialists. We have built, however, on a great deal of work and thinking by many trade unionists, environmentalists and intellectuals in the years since the One Million Climate Jobs campaign was launched in 2011. Our hope is that in future a much larger movement of trade unionists, rural people, the unemployed, students and environmentalists can turn these preliminary arguments into a detailed programme.

There are, however, three points we should make. One is about equal opportunities. Most of the kinds of jobs we have mentioned have been traditionally done by men. We would want a balance of men and women doing the work, and a balance of young men and young women taken on as apprenticeships. The only way we can see that happening is if most of the jobs are in the public sector.

Which brings us to another point we want the movements to think about and discuss. The funding for a climate jobs programme would have to come from government. But we have also written this report as if almost all the jobs would be in the public sector, in one way or another. There are many advantages to such an approach. It would mean more secure employment, and it would be possible to promise coal miners and SASOL workers new jobs, or a grant. It also means that less spending would be diverted to profits and loan interest. And it would make it far easier to ensure that most of the jobs are in South Africa, not in richer countries.

We are also aware, however, that many people feel strongly that private companies or local cooperatives would make more sense in many situations. We do not want to foreclose those arguments, and we would like the broader movement to debate these matters, in all their detail and complexity.

## SOUTH AFRICA AND THE WORLD

One question remains. Why should South Africa do all this work of climate jobs on its own?

One answer is that it would provide many desperately needed jobs. Another is that unions and activists are trying to develop climate jobs campaigns in many countries. We are working together.

But a third answer is that there are two possible climate futures for South Africa. In one at least a million people leave the countryside for the cities, and food production falls to levels where the country has trouble feeding itself. A crisis in minerals production and export will mean that there are fewer jobs in the cities. Very much larger numbers of people come south from the climate devastation effecting the more rural countries to the North. Some of these climate and economic refugees will be stopped at the border, shot or deported. There will be much worse competition for jobs than there is now. (Think about that.) Racism against fellow Africans is already common enough – it will grow much stronger. War and famine will become common in the countries to the North.

There is another possible future. In that future subsistence farmers in South Africa win grants to replace the crops and livestock they lose to climate change. That example spreads across Africa, and several hundred thousand rural people are able to stay alive, and at home. The threat of local wars for land or grazing will be lifted. Experimental farms and agricultural research in South Africa will develop new crops, and new techniques, that can be used in many other countries.

But the South African example will go further than that. South Africa is a large, industrialised country. When South Africans took on the apartheid system and won, the whole world saw. If South Africans win a million climate jobs, workers and ordinary people all over the world will notice. They will see us on their televisions, and come to visit and learn. They will understand that there is a way of dealing with climate change, and there is a way of dealing with austerity.

We hope this report has showed you that a solution to the climate crisis will be easy and straightforward - technically. Politically, it will be hard to win. That is clear. But there is much at stake – the future of South Africans, and the future of humanity.

**NOTES:**



**NOTES:**





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