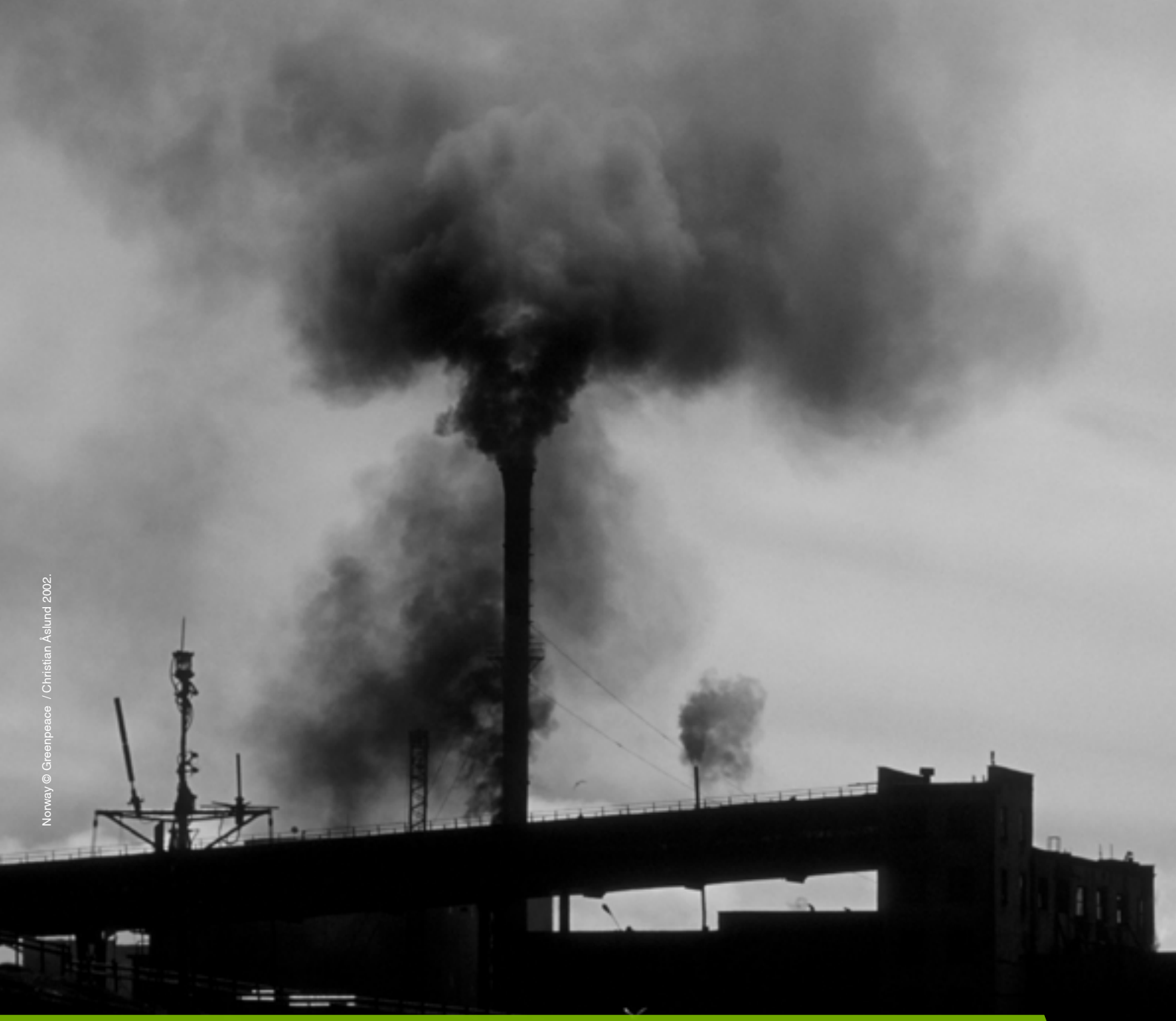

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01 Executive summary

South Africa has a coal addiction. More than 90% of the country's electricity comes from coal[1] and the government does not seem to want to change this trend anytime soon. Instead, in the face of catastrophic climate change, Eskom is betting on massive coal-fired power stations, arguing that without them, the country will face rolling blackouts. Supported by the South African government, the utility has embarked on a process to build more coal-fired power stations.[2] Medupi and Kusile, two of the largest coal-fired power stations in the world, together with major power lines, are being built to meet rising electricity demand in South Africa. Eskom's 'new build' budget is approximately R385 billion up to 2013, and is expected to grow to more than a trillion rand by 2026.[3] These power plants have a projected lifespan of 50 years, locking the country's next two generations into a dirty energy future.

This report outlines the True Cost of Coal in South Africa, assessing the external costs and impacts of the entire coal chain, with special focus on Kusile.

Coal in South Africa

Kusile (which means 'good morning' in Ndebele), a 4 800 MW power station, will sit in the middle of an already heavily polluted area. It will use an estimated 17 million tonnes of coal per year[4], and its first unit is scheduled to be operational by 2014.[5] Kusile will generate an estimated 37 million tonnes of carbon dioxide (CO_2) equivalent emissions annually, increasing the country's total contribution to climate change by an immense 10%.[6]

Coal is the most polluting energy source on the planet, and the main cause of the world's CO_2 emissions.[7] South Africa is the world's fifth largest producer of coal, and is already the sixth largest consumer.[8] Industrial consumption of electricity and coal is subsidised directly from the state budget as well as through cross-subsidies, which has resulted in very inefficient patterns of energy use. For example, twice as much energy is consumed to make a ton of steel in South Africa, compared to some of the most efficient countries.[9] As a result, the country is among the highest emitters of CO_2 in the world.[10]

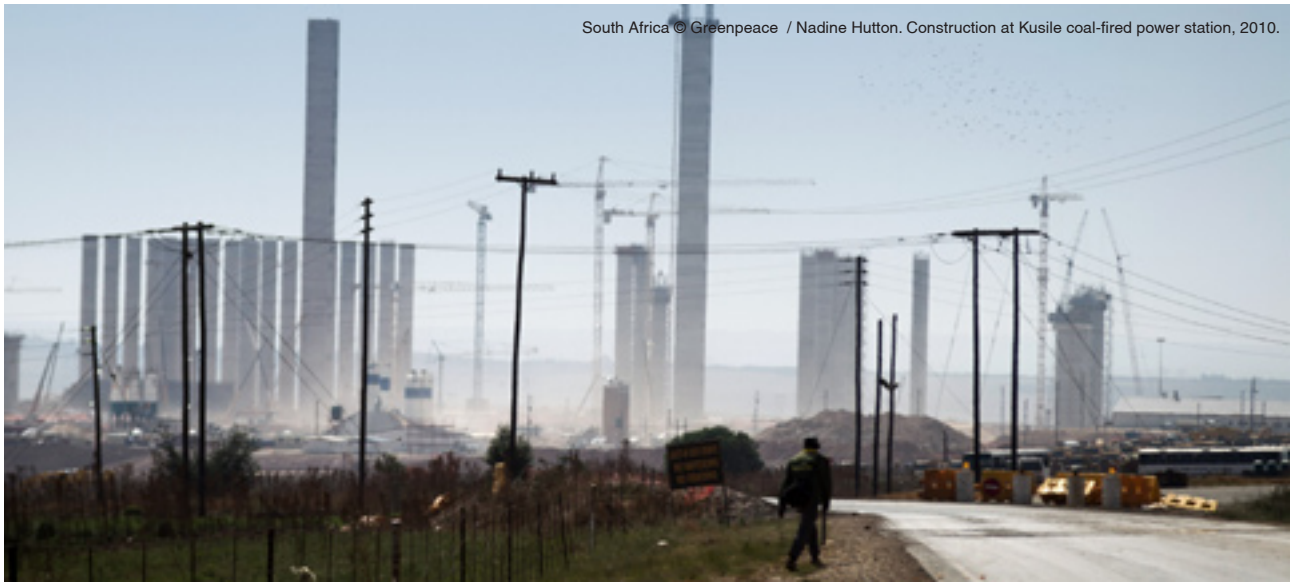
Burning coal is one of the most destructive practices on the planet. The True Cost of Coal is environmental destruction at every step, using massive amounts of scarce water and destroying people's health and wellbeing. It is the people of South Africa who are paying this price, rather than decision makers or Eskom. In fact, the utility has made frequent reference to its industrial tariffs as the cheapest in the world[11], but residential consumers (most of whom can ill-afford it) pay significantly more.[12]

Of Eskom's 237 000 GWh total power generation, the electricity output from wind is only 2 GWh.[13] The utility's capacity expansion program includes a negligible amount of renewable energy.[i] Funding the investments has required major electricity tariff hikes, the injection of taxpayers' money into the company's balance sheet, and substantial borrowing from foreign banks and investors. Investments made by 2013 amount to R8 000 per person living in South Africa. On top of that, as this study shows, the dramatic external costs of coal use will be borne by South African society. The massive coal projects of Medupi and Kusile clearly also crowd out investments in renewable energy.

A case study: The external cost of coal-fired power generation in South Africa

To determine what 'The True Cost of Coal' is in South Africa, Greenpeace commissioned an independent study from Business Enterprises at the University of Pretoria (Pty) Ltd (BE at UP) to assess the external cost of coal-fired power generation in South Africa, focusing specifically on the case of Kusile. Coal-fired power stations contribute to widespread indirect costs, which are referred to as externalities, and these are not included in the traded price of coal or of products relying on coal. Putting a price on these externalities was the objective of the study.

An **externality** is a cost or benefit of economic activity that is not borne by the actors responsible for the activity and therefore not reflected in market prices. If there are externalities, the markets do not deliver an efficient outcome: too many resources are spent on activities with (net) negative externalities and too little on activities with positive externalities. Examples include polluting power production (negative externality) and the beneficial impacts of education on society at large (positive externality).



South Africa © Greenpeace / Nadine Hutton. Construction at Kusile coal-fired power station, 2010.

[i] Medupi and Kusile are 4 800 MW each, while only 100 MW of wind and 100 MW of solar are planned. In addition, the 100 MW Sere wind farm has been delayed, and pumped storage cannot be considered renewable, as the scheme in effect stores coal-generated power.

The analysis considers the following key externalities:

- Kusile and its health impacts due to air pollution
- The global damage cost due to Kusile's contribution to climate change (estimating the anticipated CO_2 emissions)
- The scarcity value (opportunity cost) of water, and
- A quantification of the external costs of mining and transporting coal to Kusile

Key Findings

The case study provides cautious estimates of the externality cost of coal-fired power generation, as some impacts had to be excluded due to lack of data.[ii] Even with those conservative estimates, the analysis shows that **the full externality costs of Kusile could be as massive as R60.6 billion a year.** Another key finding is that because these costs are significant and they are caused by coal:

"the results of the analysis provide strong evidence of the need for Eskom to invest in alternative (renewable) energy sources, and for government to support those investment initiatives" (BE at UP, 2001: p.6).

Table 1, based on the analysis, shows that **the estimated social damage cost (or externality cost) of Kusile is economically very significant, ranging from R31.2 billion to R60.6 billion a year.** Expressed in unitary terms, the externality cost ranges from R0.97 to R1.88/kWh.[iii] By way of comparison, electricity prices for non-industrial consumers in South Africa are set to rise from R0.52/kWh in 2011/2012 to R0.65/kWh in 2012/13. The water impacts dominate these externality costs – approximately 70% of the external costs are water-related. Given that the nationwide average electricity tariff was R0.41/kWh in 2010[14], an externality inclusive tariff could, potentially, range between R1.38/kWh and R2.29/kWh. In percentage terms, making consumers pay for the true cost of coal-fired electricity generation would add between 237% and 459% to the 2010 tariff (BE at UP: p. 17).

Table 1: Estimated annual externality cost of Kusile (BE at UP: p. 18)

	Net output	Externality cost			
	GWh	Low (R million)	R/kWh (Low)	High (R million)	R/kWh (High)
Health	32 301	182.8	0.006	213.3	0.007
Climate change	32 301	3 148	0.097	5 334	0.165
Water	32 301	21 305	0.660	42 357	1.311
Mining	32 301	6 538	0.202	12 690	0.393
Total		**31 174**	**0.97**	**60 594**	**1.88**
Total excluding water for generation purposes*		**9 869**	**0.31**	**18 237**	**0.56**

* For illustrative purposes only

[ii] These include: the impact of Kusile's power generation on water quality, noise pollution, damages to roads, the impact of ash lagoons on water resources, issues of occupational health and safety, the impacts of radionuclides and heavy metals in causing cancer, and the health cost related specifically to ash dumps.

[iii] The table provides comparative information with respect to the relative externality costs of water. For illustrative purposes the values excluding water costs were also calculated.

Renewable energy investments

The study then assessed what quantity of renewables could be purchased if it were possible to shift the external costs of investing in Kusile to renewables instead. Using the capital costs associated with various renewable options, as listed in the Integrated Resource Plan 2010-2030 (IRP)[iv15], the amount of renewable power generation that could be purchased was calculated. At its worst:

"it would be possible to develop no less than 500% of Kusile's proposed power generation capacity, assuming that renewable electricity generation capacity was funded from only 30% of Kusile's external costs" (BE at UP: p. 19).

The analysis also looks at the length of time that it would take to equal Kusile's output using renewables with the money from the calculated true (damage) cost of the plant. Two estimates of the impacts of the opportunity cost of Kusile were calculated, a full estimate, based on the full external costs (see Table 2) and an extremely conservative estimate, based on 30% of external costs.

If investments were shifted to renewable energy, they would likely be recouped from the damage cost of Kusile within three and a half years, but at worst within 10 years if costs from water impacts were excluded.

"In other words, over its lifespan, the opportunity cost of Kusile is, at its most conservative, an installed capacity of 24 000 MW (4 800 x 5[v]), but could be as high as 68 600 MW (4 800 x 14.28[vi])" (BE at UP: p. 20).

Recalling that the additional costs are associated with coal-fired power generation, and not electricity generation *per se*, the results of the analysis provide strong evidence of the need for Eskom to invest in alternative (renewable) energy sources, and for Government to support those investment initiatives.

Table 2: Opportunity cost of Kusile[1, 2, 3, 4] (BE at UP: p. 19)

	MW capacity and MWh generated that would equal a total annual cost of:		Time it would take to equal Kusile's output	MW capacity and MWh generated that would equal a total annual cost of:		Time it would take to equal Kusile's output
	R31 174 million			R60 594 million		
	MW	MWh	Number of years	MW	MWh	Number of years
Wind	9 881	25 100 975	1.3	19 206	48 790 295	0.7
Concentrated photovoltaic (PV)	3 923	9 209 235	3.5	7 625	17 900 550	1.8
PV (crystalline silicon)	7 135	12 125 835	2.7	13 869	23 569 724	1.4
Forest residue biomass	3 967	29 540 823	1.1	7 712	57 420 298	0.6
Municipal solid waste	1 919	14 290 024	2.3	3 730	27 776 390	1.2
Concentrated solar power, parabolic trough with nine hours storage	2 882	11 032 313	2.9	5 602	21 444 178	1.5

Notes:
1 Assuming that the capital costs are repaid in five years and that there are no resource and/or technological constraints.
2 While it is unlikely that, in reality, the focus will be exclusively on one technology, this is done here (as opposed to a bundle of technologies) for demonstration purposes.
3 Given the ongoing R&D in renewable energy technologies, the unit costs are likely to come down, reducing the time it will take to reach the capacity of Kusile.
4 While it might be argued that it is currently unlikely that there are sufficient resources to invest in these technologies to the extent indicated, with R&D and improvements in efficiencies, this might become plausible soon. Also, in reality, a bundled approach using a suite of technologies is arguably the best way going forward.

[iv] The costs as listed in the IRP are not uncontested, with Greenpeace arguing (based on the Energy [R]evolution scenario) that these costs are inflated, and in reality the costs are lower. The implication of this is that lower costs (and the capital costs of these technologies will decline over time anyway as developments in the renewable electricity generation sector advance) would mean that significantly more renewable energy could be purchased.
[v] Estimated as Kusile's lifespan of 50 years, divided by a conservative estimate of the time it would take to replace Kusile's capacity of 10 years.
[vi] Estimated as Kusile's lifespan of 50 years, divided by the plausible time it would take to replace Kusile's capacity of three and a half years under the "with water" scenario.

The case for an Energy [R]evolution

Greenpeace's report *'The Advanced Energy [R]evolution: A sustainable energy outlook for South Africa'*[16] is a detailed, practical blueprint for cutting carbon emissions – replacing coal and nuclear fuels with renewable energy (such as sun and wind) and energy efficiency. If South Africa commits to this option, the country can phase out coal in a just transition. This will mean that Eskom does not need to build Kusile, and half of South Africa's electricity could come from renewable energy by 2030.

Coal versus renewables: the case of job creation

South Africa suffers from a myriad of socio-economic challenges including an extreme and persistent unemployment problem. This makes job creation a key priority for the country. The energy sector is an important employer, providing a total of 250 000 jobs in South Africa. Coal mining alone employed 57 700 people in 2006.[17]

Less than 1% of South Africa's electricity currently comes from renewables – with huge growth potential in the renewables sector, if a just transition towards an Energy [R]evolution is implemented. The Advanced Energy [R]evolution scenario would create more jobs than the implementation of the government's IRP.[18]

The job creation potential for the government's plan is 111 000 by 2030, which pales in comparison to the Advanced Energy [R]evolution scenario, with 149 000 jobs being created by 2030. Furthermore, renewable energy sectors tend to employ proportionally more low-skilled workers than both the coal and nuclear sectors.[19]

Large-scale development of renewable technologies, combined with ambitious energy efficiency measures has significant job creation potential; a view which is also echoed by Eric Gcilitshana in this report. He is the National Secretary for Health and Safety of the National Union of Mineworkers (NUM) and argues:

"Looking toward the future we are very pro renewable energy. We see solar, hydro and wind energy not only as viable energy sources from an ecological perspective, but as strong avenues for job creation within the South African economy."

However, the transition away from coal and towards renewables will fundamentally transform the employment sector in South Africa, and must be just and carefully managed. Importantly, job transformation programmes must be developed and implemented, and active and progressive government policies will be required to support developing industries, and to train a local workforce.

South Africa © Greenpeace / Oswald Chikosi 2011.

Coal versus renewables: the case of energy access and energy security

Development and poverty alleviation are primary objectives for South Africa, and so are the pressing social needs related to energy use and access. Coal-fired electricity generation has failed to deliver electricity to all South Africans. There are an estimated 10 million people without access to electricity in the country, and service delivery to these people has massive implications for the country. Expanding the current centralised infrastructure to provide energy access is inefficient, and will make people reliant on dirty energy with rapidly escalating costs.

Decentralised energy systems, where power and heat are produced close to the point of final use, can reach those in need in weeks rather than years. Building up clusters of renewable micro grids, especially for people living in remote areas, must be a central tool in providing sustainable electricity to all South Africans. To provide for the electricity needs of large cities, investments in 'climate infrastructure' such as smart interactive grids, as well as super grids, to transport large quantities of offshore wind and concentrating solar power are essential.[20]

Existing renewable technologies can harness energy effectively and efficiently. A variety of renewable energy sources will provide greater energy security through diversification between different types of flexible renewable sources.

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Coal versus renewables: the case of climate change

The increased concentration of greenhouse gases (including CO_2) in the earth's atmosphere, due to human activities like burning coal, causes dangerous climate change. South Africa's coal addiction makes it the highest CO_2 emitter on the African continent[21], with emissions on a sharp upward trajectory due to the building of Medupi and Kusile. As shown in the study by the University of Pretoria, the economic impacts of coal on climate change are real and significant. In contrast, there are a range of renewable energy sources that offer increasingly attractive options (wind, sustainable biomass, photovoltaics, solar thermal and geothermal power). They produce little or no greenhouse gases and are fuelled by virtually inexhaustible elements.

Climate change is possibly the greatest threat the planet faces, but it is also a fantastic opportunity for sustainable development. Choosing renewable energy instead of coal would make a huge contribution to averting catastrophic climate change. And it would also create a strong, sustainable, low-risk economy based on green jobs.

Removing the barriers to renewable energy

To start phasing out coal in a just transition, South Africa needs to significantly scale up renewable energy. However, the country's renewable energy industry is young and fragile, and significant barriers need to be removed for it to be able to develop to its full potential. Globally, the renewable energy industry has been experiencing explosive growth since the 1990s. And after lagging behind for the past decade, renewable energy development finally took off in Africa in 2010, with multi-billion dollar investments in renewables.[22] South Africa must take advantage of having the most advanced infrastructure in Sub-Saharan Africa to kick-start a real energy revolution on the continent. Otherwise, the country risks being left in the dust.

For large-scale renewables to become a reality, renewable technologies need to be able to compete on a level playing field and should be given priority access to the grid. All financial assistance directed towards supporting coal and nuclear power production should be phased out. Instead, international financial institutions, export credit agencies and development agencies should provide the required finance and infrastructure to facilitate the implementation of an Energy [R]evolution in South Africa.

It is also vital that specific funding mechanisms are developed under the international climate negotiations that can assist the transfer of financial support to climate change mitigation, including technology transfer.[23]

The country should be aiming to get 50% of its electricity from renewables by 2030, which would send a clear signal to the market about the prioritisation of renewable energy. The abandonment of REFIT in favour of a competitive bidding process known as 'REBID' has created instability, thereby seriously undermining the renewable investment climate in South Africa. Moving forward, it is crucial that improved incentives, institutional structures and a stable regulatory framework are developed, which will allow the renewable energy market to boom.

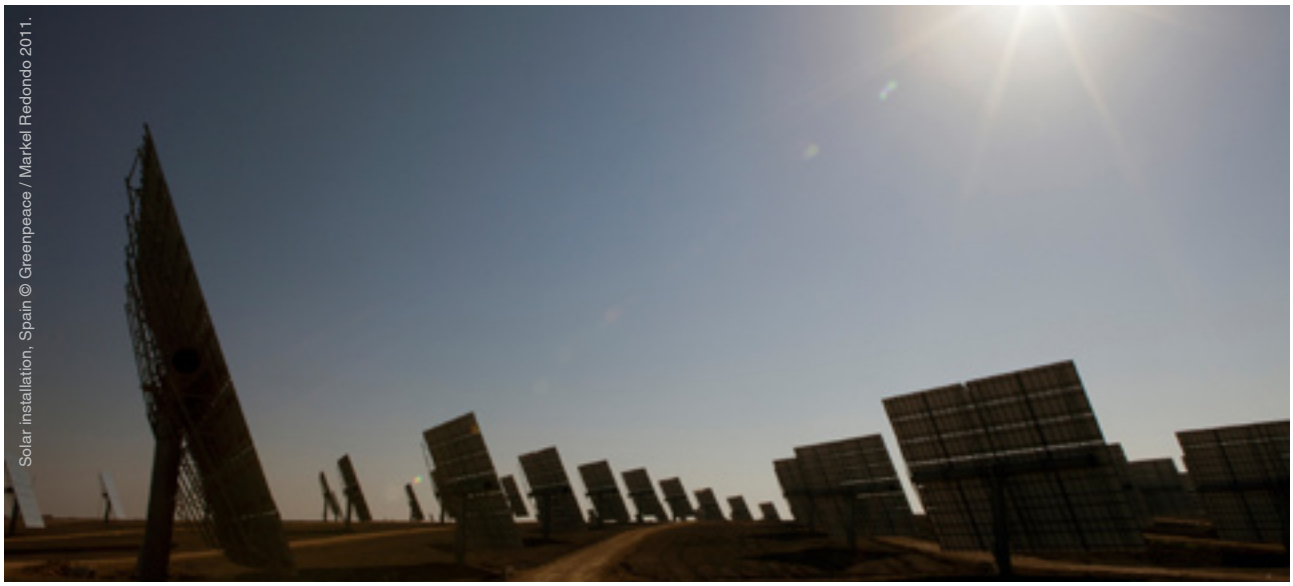
South Africa © Greenpeace / Oswald Chikosi 2011.

Conclusion

The True Costs of Coal are colossal, with repercussions already being felt by the people of this country. The choices that South Africa makes now will determine the country's energy future. They will affect standards of living, levels of job creation, energy access and security, the environment, and South Africa's economic future. Eskom consistently refers to so-called 'clean coal'[24], but the assessments made by BE at UP clearly show that 'clean coal' simply does not exist. Instead, the True Cost of Coal is destruction at every step, and investing in coal and Kusile could be costing the country up to R60.6 billion a year.

However, a future without coal is within reach. The case *against* investing in coal and *for* investing in renewable energy is clear. Importantly, compared with an energy future reliant on coal, the investments in renewable energy and energy efficiency made in the Greenpeace Energy [R]evolution scenarios will result in a more stable and lower long-term electricity cost, specifically for residential consumers, with protection from fossil fuel price escalation and volatility. This would also make a major contribution to South Africa's economic competitiveness. Investing in decentralised renewable energy and smart/micro grids would also mean that all South Africans would be able to access sustainable, low-risk electricity.

The construction of the coal-fired Kusile power plant must be stopped to prevent its massive environmental, economic, and social impacts. Eskom needs to stop building new coal-fired power stations, and instead invest in large-scale renewable energy projects – securing the country's electricity supply, creating jobs, ensuring energy access for the poor, and helping to prevent catastrophic climate change. The government should support this shift. South Africans simply cannot afford to pay for the True Cost of Coal.



Solar installation, Spain © Greenpeace / Markel Redondo 2011.

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02 Coal versus renewables: The case of job creation

South Africa suffers from a myriad of socio-economic problems, including extreme, rising and persistent unemployment and underemployment levels. This makes job creation a key priority for the country – as highlighted by the government's '5 million jobs' target.[1] The energy sector is an important employer, providing a total of 250 000 jobs in South Africa. Coal mining alone employed 57 700 people in 2006.[2]

Employment potential: coal

More than 90% of South Africa's electricity comes from coal[3], and if the construction of Kusile continues, this will only further increase the country's addiction to coal, once it is operational.

Globally, there is a trend for decreasing employment in coal mining and coal power while producing the same output, which means that the coal sector is actually losing jobs.[4] Employment per ton in coal mining has fallen sharply over the last twenty years in South Africa, with an average decline of 5% per year. This pattern is repeated worldwide, and is expected to continue during the next two decades, regardless of which energy path is followed.[5] In addition, world demand for coal over the next decades will be determined by international agreements on climate change. If these result in action proportionate with that required by science to stop catastrophic climate change, world demand for coal can be expected to decline significantly.[6] This means that jobs in the coal sector in South Africa are far from secure.

Employment potential: renewables

In comparison, less than 1% of South Africa's electricity currently comes from renewables – with huge growth potential in the renewables sector, if an Energy [R]evolution[7] is implemented. In the recently published briefing '*More jobs and progress for South Africa: The Advanced Energy [R]evolution scenario and its impact*'[8] Greenpeace Africa found that the implementation of the Advanced Energy [R]evolution scenario would create more jobs than the government's Integrated Resource Plan 2010-2030 (IRP).[9] Furthermore, renewable energy sectors tend to employ proportionally more low-skilled workers than both the coal and nuclear sectors.[10]

Even more importantly, compared with an energy future heavily dependent on coal, the investments in renewable energy and energy efficiency made in the Energy [R]evolution scenarios will result in a more stable and lower long-term electricity cost for the economy, with protection from fossil fuel price escalation and volatility. This would make a major contribution to the predictability of electricity prices, and South Africa's competitiveness.

Table 1 illustrates the job creation potential of the government's IRP compared to the Advanced Energy [R]evolution. The IRP pathway will result in 111 000 jobs by 2030, compared to the Advanced Energy [R]evolution scenario, which will result in 149 000 jobs. Hence, the transition to clean energy will provide more jobs by 2030 in the electricity sector than a continuation of South Africa's current carbon-intensive path.

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South Africa © Greenpeace / Oswald Chikosi 2011.

Health impacts of coal

Eric Gcilitshana, National Secretary for Health and Safety of the National Union of Mineworkers (NUM) explains: "Coal workers' pneumoconiosis (CWP) is the major disease associated with coal mining and is ultimately fatal."

Although specialised dust suppression equipment is already being used in many of South Africa's coal mines, it is not always to a sufficient extent.

"The cost of this precaution impacts the bottom-line of these mines, so some try to minimise capital investment in this equipment," says Gcilitshana. "We see this as very short-sighted. Besides the good business sense this makes, the wellbeing of the workers must come first."

"Looking towards the future we are very pro renewable energy. We see solar, hydro and wind energy not only as viable energy sources from an ecological perspective, but as strong avenues for job creation within the South African economy."

Table 1: Electricity sector jobs in the IRP versus the Advanced Energy [R]evolution (thousands)[11]

South Africa		IRP Policy Adjusted Scenario			Advanced Energy [R]evolution Scenario		
Thousand jobs	**2010**	**2015**	**2020**	**2030**	**2015**	**2020**	**2030**
Coal	68	75	67	70	53	43	29
Gas, oil & diesel	2	2	4	6	3	3	3
Nuclear	1	16	32	10	1	1	0
Renewables	5	23	30	25	127	91	111
Energy Efficiency	-	-	-	-	5	2	5
Total jobs	**76**	**116**	**133**	**111**	**188**	**140**	**149**

A just transition

For a just transition away from coal, job transformation programmes must be developed and implemented, not only from coal to renewables, but also to other economic sectors like sustainable tourism, health, social enterprises etc. In addition, if South Africa becomes Africa's renewable energy manufacturing hub, the job creation potential is massive, providing clean technology across the continent.

South Africa has huge renewable energy resources. The transition away from coal and towards renewables will fundamentally transform the employment sector in South Africa, and must be just and carefully managed. Active and progressive government policies will be required to support developing industries, and to train a local workforce both in installation, and the technical skills required for manufacturing.[12]

Job creation and security in the energy sector depends heavily on energy policy choices. Decisions taken today will determine to what extent the country takes advantage of the new jobs and economic opportunities from the global shift to clean energy sources. Large-scale development of renewable technologies, combined with ambitious energy efficiency has significant job creation potential and would reduce South African emissions, while making the country's economy much more resilient in the face of declining demand for coal worldwide.[13]

Coal is an integral part of South Africa's past, but renewable energy can, and should be, a central part of South Africa's energy future. Now is the time to start implementing a just transition, which will transform the jobs of today and develop the sustainable, green jobs of tomorrow – for the benefit of all South Africans.

A just transition is a framework for a fair and sustainable shift to a low carbon economy, proposed by trade unions. This type of transition requires broad consultation, the creation of green and decent jobs, and the investment in new green skills to equip working people with the skills for a low carbon, resource efficient economy.

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03 Coal versus renewables: The case of energy access and security

There are an estimated 2.5 million households (mainly poor rural households) without access to electricity in South Africa, and the question of delivery to these households is urgent.[1] There is an increasing push to deliver electricity to rural, marginalised areas in the country to enable socio-economic development. Accordingly, in an emerging economy like South Africa's, development and poverty alleviation remain the primary objectives, and will be for the foreseeable future.

South Africa needs to decouple economic growth from the consumption of coal so as to be able to create the necessary shift towards a clean future. An Energy [R]evolution[2] based on decentralised energy and smart grids has the real potential to deliver safe, sustainable electricity access and security to all of the people of South Africa, in a way that centralised, massive coal-fired power stations have failed to do in the past.

An estimated 40% of South Africa's 48 million people are poor.[3] As such, sustainable energy access and security of energy supply is of paramount importance. The pressing social needs relating to energy use and energy access must be addressed, urgently. The overwhelming lack of access to modern energy affects both health and development, and the government is intent on addressing unemployment and increasing GDP growth in the coming years.

Indeed, the Department of Energy has a vision of creating a "transformed and sustainable energy sector with universal access to modern energy carriers for all by 2014".[4] This has many implications for South Africa's future power generation and distribution system. The country has an old, centralised electricity grid structure, based almost entirely on coal-use.

Currently, industry and mining are the sectors benefitting from this structure. They consume over 60% of the electricity produced in the country, and the inclusion of commerce takes this figure to almost 75%.[5] Residential users only account for between 16-18%.[6] Indeed, an estimated 45% of electricity used in South Africa is consumed by just 36 companies represented in the Energy Intensive Users Group of Southern Africa (EIUG).[7]

Expanding the centralised infrastructure and generation capacity to cater for all the people that currently lack energy access is inefficient, and would make the poor even more reliant on dirty energy, with escalating costs for the forseeable future. Energy poverty continues in South Africa, despite massive electrification attempts. Simply expanding centralised electricity capacity (as Eskom is proposing through the building of Medupi and Eskom) is not a solution to creating sustainable energy access for all in the country.[8]

Decentralised renewable energy

In comparison, decentralised renewable energy is fuel-free or relies on local fuels, which are not subject to the escalation and volatility of fossil fuel prices. Decentralised energy systems, where power and heat are produced close to the point of final use, can reach those in need in weeks rather than years. Building up clusters of renewable micro grids, especially for people living in remote areas, will be a central tool in providing sustainable electricity to the estimated 2.5 million households for whom access to electricity is presently denied. Decentralised

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Water security

According to WITS University Professor of Geoscience, Terence McCarthy, "Water security is a very real issue in South Africa. Through various mining activities we are currently poisoning our main drinking water supply, namely the Upper-Vaal River catchment. If this continues we are going to have to rely on Lesotho Highlands water to dilute our own water supply and remedy the high toxicity levels to a point where it is once again fit for human consumption. If we continue on this trajectory we will render our fresh water completely undrinkable within the next few decades."

energy production is ideal for the rural communities in South Africa that are not located near to the grid. To provide for electricity needs in large cities, investments in 'climate infrastructure' such as smart interactive grids, as well as super grids to transport large quantities of offshore wind and concentrating solar power, are essential.[9]

Presently, South Africa is almost entirely dependent on coal for its electricity supply, which is clearly risky. If coal supply fails due to heavy rains or strikes, the country risks rolling blackouts. In contrast, a variety of renewable energy sources will provide greater energy security through diversification between different types of flexible renewable sources. Existing technologies can harness energy effectively and efficiently.

Renewable energy and energy efficiency measures are ready, viable and increasingly competitive. And in addition, sustainable energy produces less carbon emissions, is cheaper, and will make the country less dependent on imported fuel. Decentralised renewable energy will create more jobs[10] and has the potential to empower local communities. These systems are more secure, and more efficient, and will be highly beneficial to South Africa's economy.[11] If we are to secure a better future for all, the time for a just transition away from coal and towards renewable energy has clearly come.

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04 Coal versus renewables: The case of climate change

The findings of the Intergovernmental Panel on Climate Change (IPCC) are clear: human activities are significantly changing the global climate. Climate scientists warn that if the atmosphere warms by 2ºC or more from pre-industrial levels, processes will be triggered resulting in even more emissions being released, taking climate change beyond our control, and creating so-called "catastrophic climate change". The planet has already warmed by 0.74ºC – a major alteration of the natural climate system aggravated by human activities such as the burning of coal.[1]

A variety of human activities – most notably, the burning of fossil fuels – produce greenhouse gases, like carbon dioxide (CO_2), nitrous oxide (N_20), hydrofluorocarbons (CFCs, HCFCs, and HFCs) and methane (CH_4). These emissions trap the sun's heat and warm the planet, adding to the earth's natural greenhouse effect. CO_2 is by far the worst greenhouse gas produced through human activity. Since pre-industrial times, the concentration of atmospheric CO_2 has increased by 30%, from 280 parts per million to more than 360 parts per million. Measurements taken since 1959 show more than a 12% increase in only 35 years. CO_2 concentrations will double by the end of the next century if emissions trends continue unabated.[2]

Some of the likely impacts of catastrophic climate change include sea level rise, a greater risk of extreme weather events (heatwaves, droughts and floods), increased risk of species extinction and biodiversity loss, increased spread of disease, changes in agricultural yields and the displacement of people forced to compete for increasingly scarce resources. It is the poorest countries of the world that will be most vulnerable to these impacts, and the African continent is on the frontline of climate change.[3]

Kusile's contribution to climate change

Due to South Africa's addiction to coal, the country is among the highest emitters of CO_2 in the world, and is the highest emitter on the African continent[4], meaning that the country contributes disproportionately to climate change. Currently, South Africa's greenhouse gas emissions are still on a sharp upward trajectory, with more than 90% of the country's electricity coming from coal[5], and two of the biggest coal-fired power stations in the world (Medupi and Kusile) under construction.[6] Kusile will burn 17 million tonnes of coal per year[7], with estimated annual greenhouse gas (GHG) emissions of 37 million tonnes CO_2eq, increasing the country's total contribution to climate change by an immense 10%.[8]

As illustrated in the study examining the true costs of Kusile by the University of Pretoria[9], the economic impacts of climate change are real and significant. The damage caused by Eskom's CO_2 emissions will cost us up to twice the value of the electricity generated by the utility. If electricity generators like Eskom were actually held responsible for damages caused by their contribution to climate change, coal-fired power plants would be out of business overnight.

Climate change and renewable energy

Renewable energy technologies vary in their technical and economic maturity, and a range of sources offer increasingly attractive options. These include wind, sustainable biomass, photovoltaics, solar thermal, geothermal, ocean and

The water impacts of coal mining

One South African who does not take fresh drinking water for granted anymore, is Winston Nhlapo. Aged 42, Winston is a casual farm labourer in the Brakfontein area on the Mpumalanga Highveld and has lived near the rural settlement of Moganyaka on the banks of the Olifants River for the past two decades. The river was once his family's primary water source. But now it has been heavily polluted by coal mining, threatening their very well-being.

"We are too scared to drink this water any more, we can only use it for washing of clothes and to bathe," says Nhlapo. "In the past my children have had serious stomach problems so now my wife walks several kilometres each day to buy borehole water from a nearby farm for drinking and cooking purposes. I am afraid to think that my three children may not have any fresh water to drink when they reach my age."

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Winston Nhlapo's family still uses water from the Olifants River to irrigate their subsistence crops but as a result, has noticed a definite decline in yield and quality. "We've always grown mealies and sweet potatoes, and in the past even had excess to sell. Nowadays we barely grow enough for our own use, and the quality is much poorer than before," complains Nhlapo. "My dream has always been to have my own farm which I could one day pass-on to my children. But with conditions like this, it seems impossible."

small-scale hydroelectric power. They produce little or no greenhouse gases, and are fuelled by virtually inexhaustible natural elements. Some of these clean technologies are already financially competitive with other energy sources – even more so when the True Cost of Coal is taken into account. The wind power industry, for example, continued its explosive growth in the face of a global recession and a financial crisis and is a testament to the inherent benefits of renewable technology.[10]

The government's Integrated Resource Plan 2010-2030[11] envisages an increase in South Africa's CO_2 emissions – increasing 29% by 2050 (compared to 1990 levels). Under the Advanced Energy [R]evolution scenario published by Greenpeace[12], CO_2 emissions will decrease by 85% by 2050, based on 1990 levels (i.e. from 349 million tonnes in 2008 to 44 million tonnes in 2050). In spite of the phase-out of nuclear power and growing electricity demand, CO_2 emissions will decrease enormously in the electricity sector from 221 million tonnes CO_2 per year now, to only 8 million tonnes of CO_2 in 2050[13], when choosing the sustainable Energy [R]evolution pathway.

Climate change is possibly the greatest threat the planet faces, but it is also an incredible opportunity for sustainable development. If South Africa utilises its massive renewable energy resources, the country would not only make a huge contribution to averting runaway climate change by reducing emissions, but would also create a strong, sustainable economy based on green jobs. And it is the people of South Africa who stand to benefit most from this shift towards a sustainable development pathway. While renewable energy markets continue to grow exponentially, South Africa risks being left in the dust unless there is a major shift away from coal and towards renewables.

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05 Removing the barriers to renewable energy in South Africa

To start phasing out coal in a just transition, South Africa needs to significantly scale up renewable energy. Less than 1% of South Africa's electricity comes from renewables, which means that there is huge potential for development. The renewable energy industry in South Africa is still young and fragile, and therefore significant barriers need to be removed for it to be able to develop to its full potential.

Globally, the renewable energy industry has been experiencing explosive growth since the 1990s. Between 2005 and 2010 the installed capacity of wind grew by 333% globally[1], while solar photovoltaics grew by over 700%.[2] After lagging behind for the past decade, renewable energy development finally took off in Africa in 2010, with multi-billion dollar investments in renewables.[3] South Africa must take advantage of having the most advanced infrastructure in Sub-Saharan Africa to kick-start a real energy revolution on the continent. It is more than possible for South Africa to develop into a renewable manufacturing hub, exporting renewable technologies to the rest of the African continent.

For large-scale renewables to become a reality, renewable technologies need to be able to compete on a level playing field (particularly after coal and nuclear have received subsidies and other state support for decades), and should be given priority access to the grid. All financial assistance directed towards supporting coal and nuclear power production should be phased out in the next two to five years. Instead, international financial institutions, export credit agencies, and development agencies should provide the required finance and infrastructure to support the implementation of an Energy [R]evolution.[4]

The role of the international climate negotiations

South Africa has a responsibility to take a progressive role in the international climate negotiations, and it is crucial that emerging economies begin to take responsibility for their domestic emissions, which will in turn stimulate investments in renewable energy. It is vital that specific funding mechanisms are developed under the international climate negotiations that can assist the transfer of financial support to climate change mitigation, including technology transfer.[5]

The importance of policy stability and incentives

The country should be aiming to get 50% of its electricity from renewables by 2030[6], which would send a clear signal to the market about the prioritisation of renewable energy. South Africa can only reap the benefits of a renewable energy boom if the government introduces stable and ambitious new policies that support renewable energy production.

The publication of the Integrated Resource Plan 2010-2030 (IRP)[7] outlined a target of 23% of South Africa's electricity coming from renewables by 2030, and this is a first step in creating a shift towards renewable energy. However, it is not nearly enough. Just as the IRP was published, it was announced that the Renewable

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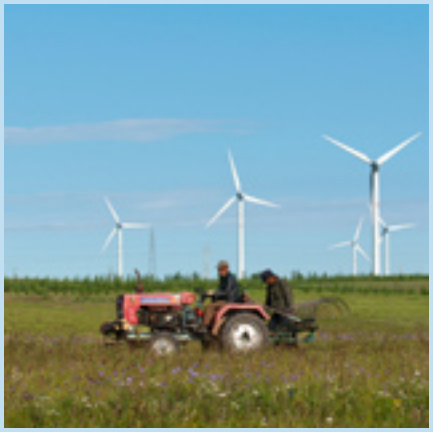

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The opportunity costs of coal

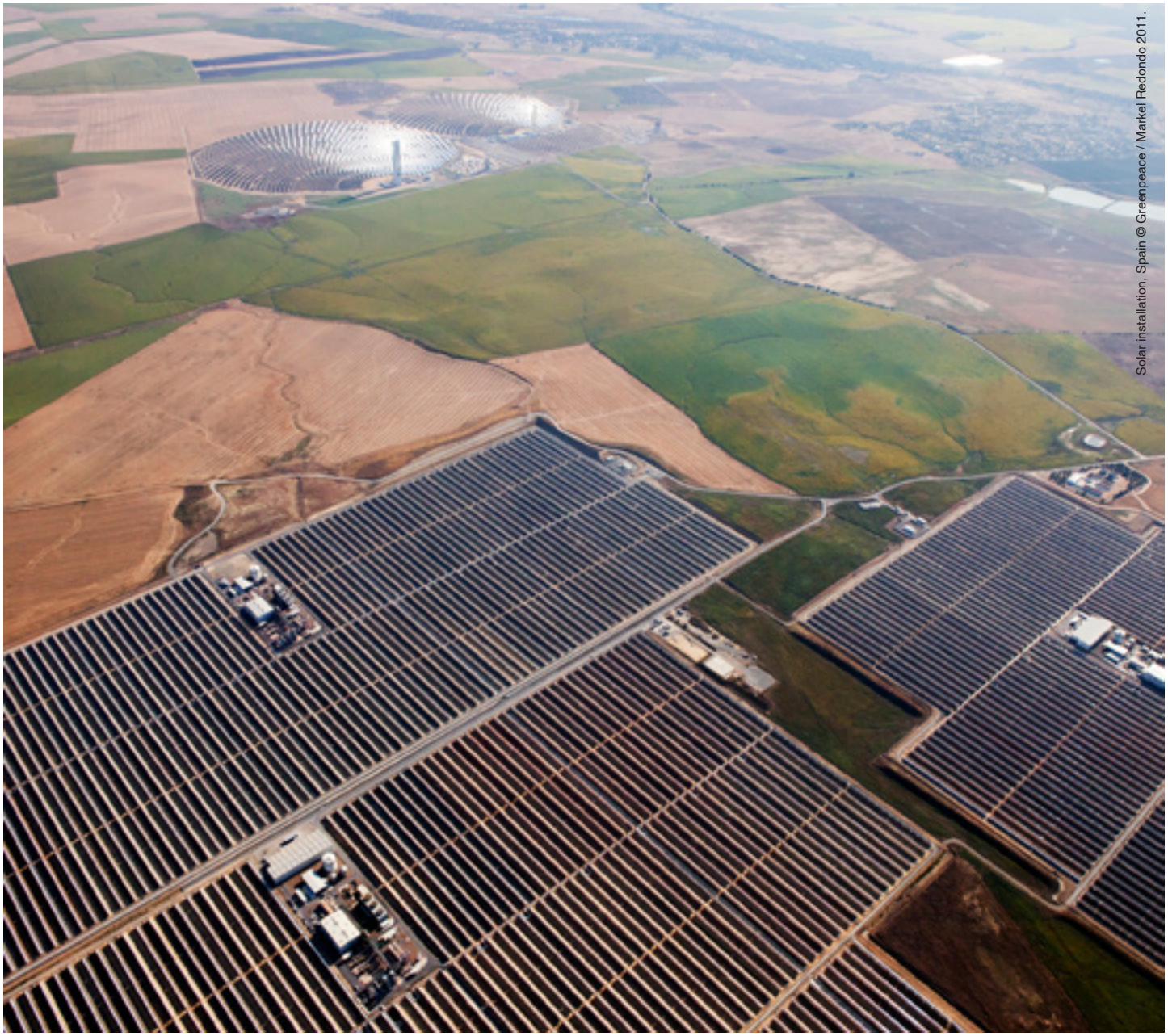
Koos Pretorius, a farmer from Belfast in Mpumalanga, is the co-founder of the Federation for a Sustainable Environment – a non-profit organisation which promotes the ecological sustainability of development and the wise use of natural resources in South Africa.

According to Pretorius there is very little point in even comparing the economic cost of different energy solutions when neglecting to take into account the indirect costs of such things as long-term water pollution and the destruction of arable land and crops.

"For as long as people continue to believe that renewable energy is too expensive - and we continue to disregard the true cost of the externalities of coal power - the longer we lie to ourselves and do ourselves an injustice as a country."

Energy Feed In Tariff (REFIT) would be withdrawn (after National Treasury indicated that REFIT contradicted competition laws). The abandonment of REFIT – in favour of a competitive bidding process known as 'REBID' – has created major levels of instability, thereby seriously undermining the renewable investment climate in South Africa. The policy mechanism that has now been chosen is risky for a country with virtually no installed modern renewable energy capacity. Successful implementation of the first renewable energy projects is the key to ensuring the rapid and successful rollout of safe and clean energy, and bidding schemes involve the risk of forcing prices so low that the projects cannot be realised. It is now up to the Department of Energy to ensure that the tariffs granted to projects are adequate to ensure the projects go ahead.

A major shift towards renewable energy is vital in ensuring that the people of South Africa benefit from sustainable, secure energy access and the potential for job creation. Removing the barriers to renewable energy is needed to create a thriving renewable energy industry in the country. Renewable energy is not a 'nice to have'; it is a necessity. It could form the cornerstone of South Africa's economy, but only if it is approached with enough ambition. Improved incentives, institutional structures and a stable regulatory framework need to be developed, allowing the renewable energy market to boom. South Africans cannot afford to continue paying the price for coal, and should instead be reaping the benefits of a clean, low-risk future, based on renewable energy.



Solar installation, Spain © Greenpeace / Markel Redondo 2011.

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