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Germany's Transition to Renewable Energy

– A Model for South Africa?

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1. INTRODUCTION

Germany and South Africa are both industrial powerhouses on their respective continents. Both have a history of low energy prices, and a fossil fuel intensive energy mix. Germany has recently committed to an 'Energiewende' or 'Energy Transition' to a clean energy future for the country, based predominantly on renewable energy with nuclear being phased out by 2022. South Africa is facing an electricity supply crisis, and is planning to meet its future energy supply needs through new coal fired power generation, some renewable energy, and perhaps most significantly through the procurement of a nuclear fleet.

At this critical energy juncture for South Africa, this paper considers what the German energy transition can offer in terms of inspiration and lessons, and how these could be applied in the South African context.

2. SETTING THE SCENE

Germany

The German 'Energiewende' or 'Energy Transition' is a policy direction which sets the country on a path to transform the way it generates and uses energy. Currently Germany generates electricity in relatively equal measure from lignite (23%), hard coal (19%), nuclear (22%) and renewables (20%) and to a lesser extent natural gas (Bosman, 2012; The Economist, 2012). The overarching aim of the Energiewende is to transition to generating 80% of electricity from renewable sources by 2050. Nuclear is to be entirely phased out by 2022.

Planning for the transition began in the 1980s, was translated into policy in 2000, and announced as the 'Energiewende' in 2010. After the Fukushima nuclear accident in Japan in 2011, commitment to the nuclear phase out component of the Energiewende was strengthened and accelerated (The Economist, 2012). The Energiewende covers all aspects of energy production and use, including interim (2020) and final (2050) targets for decreasing energy demand and consumption, increasing energy productivity, a greenhouse gas reduction target (40% in 2020 and 95% in 2050) from 1990 levels, and renewable energy targets as a percentage of gross final energy consumption (18% in 2020 and 60% in 2050) and as a percentage of electricity generation (35% in 2020 and 80% in 2050) (Hockenos, 2012).

The Energiewende will entail substantial changes to Germany's energy landscape, many of which are not yet fully understood from a technological perspective. It is clear that electricity generation will need to be largely decentralised, and the grid significantly expanded. Changes to the regulatory environment are already advanced, including feed-in-tariffs for renewable

energy since 1990, renewable energy price guarantees over long time periods (typically 20 years), subsidies for consumers who feed electricity back onto the grid, exemption of energy intensive industry and consumer price premiums, but further innovation will be needed. Four new laws introduced since 2011 address the ongoing needs of energy sector adaptation including those of the energy market, energy efficiency measures in the built environment, financing for the transition, and indeed the very way that society organises itself around energy production and consumption.

Germany has travelled a long road to arrive at the point where commitment to the Energiewende is possible. The primary enabler of the commitment appears to have been increasing citizen engagement in environmental and energy issues, including support for renewable energy and a strengthening anti-nuclear stance. There is great interest by the federal states in the jobs created by the transition, and also avoiding environmental risks and accessing the benefits of renewable energy production; over 50% of renewable energy capacity was in the hands of individuals or farmers in 2010 (The Economist, 2012). This presents a significant source of revenue for the rural areas. After years of lobbying by the Green movement, including the Green Party, the Energiewende is now supported across the political spectrum, ensuring its sustainability over political cycles. 'Within German society and politics, consensus exists on the general direction of the 'Energiewende' and things are being set in motion to accelerate it.' (Bosman, 2012:15). Strong political leadership and vision for the transition has been secured.

Germany has managed to merge environmental and economic drivers to the Energiewende, which is both another enabler of the policy direction, and likely to play a strong role in sustaining its implementation. The Departments of Environment and Economy have a joint mandate for its success. Through just over a decade of generous renewables subsidies, a sizeable renewable energy manufacturing sector has developed, despite the country not having the most advantageous renewable energy resources. Germany is now host to a third of global installed capacity in solar energy (Palmen, 2012). In turn, this sector can represent a strong lobbying force for hastening and deepening the Energiewende. Conversely, Germany's domestic coal production has been in decline since re-unification in the 1990s, and this has removed this sector as a strong anti-transition lobby.

From the perspective of energy resources, Germany has access to natural gas which is anticipated to act as an important interim fuel as the transition is made to biogas. The European Power Pool also offers flexibility in meeting energy demand, and realising the value of excess, at any particular time.

Securing the Energiewende has not been without its challenges. Whilst the lack of a domestic coal sector removed that potential source of opposition, Germany's four largest utilities have resisted change, particularly that of the renewable energy feed-in-tariffs. Full political acceptance was only secured after the Fukushima accident in 2011, and getting all incumbents on board for the transition is an ongoing challenge. Upgrading the transmission lines to enable a largely renewable energy grid is a sizeable task, especially given geographically distant generation hubs and many communities resist the installation of transmission lines and towers in their vicinity. From a regional perspective, there are concerns around the impact of the Energiewende on regional grid stability. Storage for renewable energy remains a technical challenge, and the risk of blackouts during the transition are potentially very damaging, given Germany's industrial prowess. Investment costs in renewable energy and its infrastructure are high, and financing is an issue despite Germany being one of the world's wealthiest nations. Technologically, it is not yet clear what will ultimately be required to fulfil the Energiewende targets.

Despite its early achievements, the Energiewende remains a vision and policy direction, a statement of political will. "Where we want to be is in black and white. The problem is how to get there", says a German energy expert (in Hockenos, 2012). There are many technical, regulatory, institutional and financial challenges which remain to be overcome.

South Africa

South Africa is a developing country, with poverty alleviation a primary policy objective (NPC, 2011). There is growing frustration amongst its citizen's because of continuing high levels of poverty, increasing inequality and lack of service delivery despite almost two decades of democracy. Mainstream energy policy discussions centre on the issues of ensuring adequate energy supply for economic growth, and electrification for all citizens. This is seen to underpin the country's ability to meet its poverty alleviation objective (NPC, 2012). The more nuanced debates around the supply-demand interface, energy service delivery (as opposed to electrification), appropriate energy technologies and delivery modes for the bottom-of-the-pyramid energy users, and serious consideration of an economic transition away from energy intensive industry remain on the fringe, and largely the remit of civil society. The influential minerals and energy complex (Fine and Rustomjee, 1996) continues to exert substantial influence on the framing of energy policy issues. In this context, the concept of a clean energy sector remains framed as an environmental consideration and therefore not one which the majority prioritises.

The South African energy sector has been historically dominated by an abundance of coal resources, which the utility Eskom has transformed into cheap electricity through favourable

financing structures and by situating power stations at the coal mine heads. Having one of the lowest electricity prices in the world led the country to establish an economy based on the exploitation of its significant mineral resources, and the establishment of energy intensive industry. A regulatory environment, institutions and powerful interest lobbies emerged to sustain this development direction.

Just after the dawn of democracy for the country in 1994, a progressive White Paper on Energy Policy (1998) demonstrated a desire to move on from the supply side policy paradigm which had dominated the sector for decades. The policy document focused on both the demand for, and use of energy, the importance of energy planning, renewable energy and energy efficiency, and outlined the gradual liberalisation of the electricity sector. A policy paradigm progression to one which gives greater consideration to the demand side and to how society organises itself around its energy needs lays a better foundation for a transition to a cleaner and more inclusive energy sector (Marquard, 2006). However, in the subsequent decade there was little concerted action to implement the White Paper's policy direction. There was no comprehensive energy sector planning to guide the sector going forward, only weak attempts at liberalisation, and low renewable energy and energy efficiency targets which were not implemented. The status quo of a plentiful, cheap, coal based energy supply was maintained.

Simultaneously, economic development and a massive electrification drive at the turn of the century saw the electricity sector fast advancing towards exceeding its capacity. Unfortunately, no clear decisions were made on how to deal with this, precipitating the 2008 electricity crisis, where brownouts brought the economy, and particularly the minerals sector to a standstill. This provided the trigger to belatedly implement some of the White Paper's policy initiatives, notably the development of an Integrated Resource Plan (IRP). However, this was done under a crisis mentality, rather than with the aim of implementing the policy direction of the White Paper, and therefore the role of the energy sector in the economy and society was not interrogated beyond that defined by an energy-supply policy paradigm.

The first IRP is known as 'IRP 2010'. It has a planning horizon to 2030, and provides a significantly improved outlook for renewables; 21500MW of new renewables capacity are envisioned by 2030 (NPC, 2012). However, coal continues to dominate the electricity landscape for the foreseeable future. Two new coal-fired power stations, Medupi and Kusile are currently being built, with provision for additional power stations to replace the existing fleet towards the end of the 2020s. The IRP also plans for a fleet of new nuclear reactors, 9600 MW by 2030. South Africa does not currently have a significant proven supply of natural gas, and therefore this is not a major feature of the IRP. However, the recent shale gas discoveries and other emerging natural gas sources may change this in future. The IRP anticipates a doubling in

electricity demand over the planning period largely driven by energy intensive industry (Trollip and Tyler, 2011). The electricity price is rising significantly at least until 2017 to finance the new capacity. A process is currently underway to develop the second iteration of the IRP (IRP 2012).

Whilst the decision to expand South Africa's nuclear capacity (it currently has one nuclear power station at Koeberg near Cape Town) is committed in the IRP, the specially established National Nuclear Executive Coordination Committee is still considering its viability, and the National Planning Commission calls for a thorough investigation of this option (NPC, 2012). Such a substantial investment programme would present significant risk of corruption, to which the country is currently particularly vulnerable. However a new nuclear fleet appears to have strong political support as the only non-coal option to provide baseload capacity to the South African grid by 2023 (Peters, 2012).

Given that little had been done to exploit South Africa's abundant renewable resources by 2010, there is a negligible level of installed renewable energy capacity in the country, and the renewable energy enabling environment remains immature. Whilst still arguably modest, the IRP has provided a step-change in the amount of renewable energy planned for the country (from 0% of total energy share in 2010 to 9% in 2030), far beyond the targets contained in the 2003 Renewable Energy White Paper. This has provided an impetus for developing the regulatory environment to accommodate this new capacity. Whilst initially a feed-in tariff was planned to subsidise renewables, this was abandoned in favour of the current auction system (REBID) under the Renewable Energy Independent Power Producer Programme (REIPPP), enabling renewable projects access to the grid. REBID includes a ceiling price for bids, and socio-economic requirements for the projects. 3725MW capacity was initially to be procured under REBID in four international bidding windows by 2016. However, given the high portion of the allocation which was absorbed in the first two bidding rounds, a further 3200MW has been made available for allocation in future rounds (Creamer, 2012).

Although there were concerns from civil society that the public participation aspect of the IRP was poorly managed and that there was a lack of transparency in the process as a whole (IDASA, 2010; South African civil society groups, 2010), submissions from civil society resulted in additional modelling being undertaken and the final IRP including a higher renewables contribution, from the envisaged 7,5% of total energy share by 2030 in the initial draft of the IRP to 9% after consultation (Project 90 by 2030, 2011).

The South African Renewables Initiative (SARi), which has a higher level of ambition for renewables than that contained in the IRP, has secured recognition as one of the Department of Trade and Industry's Industrial Policy Action Plan's key projects, related to the development

of a renewable energy manufacturing sector in the country. However, it is not yet clear how competitive such a sector could be. South Africa has a skills shortage, a pressing unemployment problem, and relatively expensive labour. It cannot compete with China on the manufacture of low-end technologies, but its economy may be too small and poor to compete with the likes of Germany on the more sophisticated end of the spectrum (the South African invention of thin-film solar electricity panels was commercialised in Germany). Much work is still required to integrate SARi with the IRP outcomes and regulatory enablers, and it is unclear how its level of ambition could be aligned with the IRP process.

South Africa's recent Climate Change Response White Paper (2011) describes a Peak, Plateau and Decline emissions trajectory to 2050, implying roughly 19GT of emissions space available for the country's continued growth and development (Marquard and Winkler, 2012). Modelling done to date is not clear on how the country will achieve this but what is clear is that a radically transformed energy sector will be required (LTMS, 2007). The White Paper cites the use of a carbon budget approach, carbon taxes and flagship mitigation projects and programmes to achieve this. At this point there seems to be fundamental misalignment between IRP 2010 and the Peak, Plateau and Decline trajectory, particularly the 'decline' portion post 2035 (Trollip and Tyler, 2011).

Across government policy documents there is a commitment to a cleaner, lower carbon future. However, the government is at very early stages of understanding how this could be achieved, with many relevant policies misaligned to this direction in their detail. A lot of the policy direction therefore remains rhetorical (Trollip and Tyler, 2011), with much work required to develop a clear, cohesive and plausible plan as to how this will be achieved. At the heart of the challenge lie the country's priorities to develop economically and to reduce poverty, together with its starting point of a minerals and energy intensive economic structure (NPC, 2012).

3. SIMILARITIES AND DIFFERENCES BETWEEN THE TWO COUNTRIES

Germany and South Africa are both economically dominant and energy intensive industrial powerhouses in their respective continents. Low historical energy prices have contributed to this in both countries. Germany's energy sector used to be dominated by fossil fuels (coal and lignite), and nuclear. South Africa's is still dominated by coal, and it is looking likely that nuclear could play a significant part in the country's future.

Nonetheless, apart from these energy and economic position similarities, Germany and South Africa are strikingly different. Germany is a wealthy developed country scoring 8th on the United

Nation's Human Development Standard (UN HDS, 2011), whilst South Africa is a medium income developing country, with high levels of poverty and inequality and low levels of human development (123rd on the HDS). Environment and energy issues are voting issues in Germany, a well-established democracy. The clean energy lobby has found platforms to engage with the government consistently over the past few decades, growing ever stronger until support is now found across the political spectrum. In South Africa democracy is still emerging, citizens are learning of their rights and responsibilities, and how to both use and strengthen democratic processes to engage with government. Issues of poverty and inequality trump environmental issues at this level, and there is no widespread understanding of the synergies between the two.

South Africa still has a largely opaque approach to energy issues, dictated largely by the incumbents in the energy, minerals and energy intensive industry sectors. This is changing, demonstrated by the influence of the over 5000 submissions in favour of a greater renewables component in the IRP process (Project 90 by 2030). However the lack of transparency around the nuclear fleet decision shows that there is still a long way to go before the majority of South African citizens are truly empowered to engage with government on energy issues.

The countries also differ with respect to their energy demand profiles into the future. Germany as a developed country, and with a global trend of declining energy intensity, would be expected to have a stable or declining level of energy demand going forward. South Africa however is a developing country, targeting a 5% growth rate (NPC, 2012) and a doubling in energy demand by 2030.

Despite having far lower renewable resources than South Africa (particularly with regard to solar), Germany is at least two decades more advanced in developing the regulatory, subsidy, manufacturing and technical environment to support renewables. Hence, Germany has a far higher installed renewable energy capacity at 20% than South Africa whose is currently negligible. Germany also has utilised its highly skilled workforce and manufacturing base to develop a competitive niche in areas of renewable technology. South Africa lacks a clear case for a similar niche. From a resources perspective, the South African government, with a BBB+ credit rating and many competing development policy objectives is less able to invest in an enabling environment for renewable energy than the AAA rated Germany (Fitch, 2012).

4. COULD SOUTH AFRICA COMMIT TO TRANSITION TO A CLEAN ENERGY FUTURE?

The discussion in the paper thus far suggests that South Africa currently experiences two main barriers to committing to energy transition such as Germany's:

Firstly, energy transition is not yet a priority for the majority of South African citizens: The German transition was largely adopted as a result of the country's citizens increasingly demanding it over a long time period. In South Africa clean energy is a lower priority than access to energy services per se, and the possibility that these could occur concurrently is not seriously considered in the mainstream. Civil society has achieved success in influencing the level of renewable energy considered in the IRP, but has not yet been able to make inroads into the dominant energy-supply policy paradigm. Without a change at this level, it is highly unlikely that the majority of South Africans will articulate the need to transition to clean energy until basic poverty alleviation needs are met.

Secondly, there is no challenge to the existing energy sector incumbents: It is in the interests of the energy sector incumbents to maintain an energy-supply policy paradigm, which constrains the countries ability to advance to a cleaner energy sector (Marquard, 2006). The majority of South African citizens are unlikely to challenge this given the primacy of development and poverty alleviation priorities, notwithstanding the opportunities to achieve both objectives concurrently. Whilst the renewables sector itself has the potential to present a challenge, it is in its infancy and has little current policy influence. Even given the significant window of opportunity presented during the first decade of this century to build the foundations for an energy transition (a supportive White Paper, the need to plan for new capacity and the optimism of a new democracy), the dominant policy and institutional paradigm proved too powerful to overcome. Whilst the IRP 2010 does represent a step-change in renewable energy support, it has made no inroads to sustainable energy efficiency, consideration of the demand-side or of new ways of conceptualising the way South African society uses and produces energy.

In the absence of broad-based citizen support enabling the government to make a bold, ambitious (and risky) commitment to an energy transition on political grounds, the government would have to act from a conviction that this is both the most appropriate economic and development course for the country. Currently, a number of factors work against this course of action. South Africa still has significant coal resources, which the coal industry maintains it can extract at relatively low cost, and the power utility has decades of expertise in coal-fired power generation. The upfront investment required for renewables to replace coal (including the investment in infrastructure, storage and innovation to overcome the base load issue) is substantial, thought in some circles to be prohibitively so for a developing country, and there is no existing institutional framework or infrastructure to facilitate a major renewables expansion. A compelling case for developing a competitive renewable technology manufacturing sector is also currently lacking.

However, there are a number of bases upon which the argument that a clean energy transition could represent the most appropriate economic and development path for the country could be built. For example it could be argued that South Africa is highly vulnerable in a low carbon global economic future given its high grid emissions factor, and therefore cannot economically afford not to undertake an energy transition. Also, a renewable energy transition could attract significant foreign investment, whilst this is less clear for nuclear (which could arguably cost as much if not more). If the world adopts a carbon price, invests heavily in clean energy technology and infrastructure this may bring the costs and risks down to an acceptable level for a developing country. Establishing a lead in an area such as Concentrated Solar Thermal technologies where South Africa has ideal locational advantages, or to leverage its dominant position in Africa to manufacture and export renewable technologies adapted for the African context (potentially off-grid, lower cost installations aimed at lower income consumers) could provide sufficient cause.

From a developmental perspective, there is perhaps even greater opportunity. Poverty alleviation, employment creation and a reduction in inequality are South Africa's most pressing policy priorities. Are these best met through a conventional, centralised energy sector, or could the alternative cleaner option equal or better this? The country's high levels of unemployment are concentrated in the unskilled labour force. Exploiting its significant coal resources would contribute towards employment for this labourforce, and energy intensive minerals extraction and beneficiation has clear export revenue. But it is less clear how this path could contribute towards a reduction in inequality (an issue which has been painfully highlighted by the recent Marikana Massacre). Perhaps the developmental risk of corruption of the nuclear route outweighs the increased upfront cost of renewables? Perhaps decentralised solutions provide greater economic stimulation of rural areas? Or would the additional investment cost of renewables and renewable energy infrastructure result in a reduction of welfare expenditure, exacerbating poverty?

There are few international precedents to provide insights in to the questions above, and each developing country's unique circumstances will dictate its most appropriate path. What is clear is that the current model for growth and development is patently not working to reduce poverty and inequality in South Africa. However it does not appear that the government is yet convinced that an energy transition would contribute towards a solution rather than exacerbating the problem (IRP, 2010; NPC, 2012; DTI, 2011).

If a convincing case for choosing a clean energy path is developed, and accepted by government, then an energy transition such as Germany's may well be possible for South Africa. The driving force behind this would be very different to Germany's, arising out of a developmental agenda

and a conviction on behalf of government and its stakeholders that this is the most appropriate development path, as opposed to the political and environmental reasons motivating Germany.

It's worth noting, however, that the planned building of a nuclear fleet in South Africa in the next decade (together with additional coal post 2025 as envisioned in the current IRP) is a critical moment for the country. If this happens it will lock South Africa into a highly centralised energy sector pathway for many decades, crowding out the development of a thriving renewable energy sector and greatly reducing the chances for building a convincing economic case for a clean energy transition. It would take a world with an extremely high carbon price, and available and affordable renewable solutions to justify stranding a nuclear and coal fleet before the end of their economic lives.

5. HOW DO LESSONS FROM THE GERMAN EXPERIENCE TRANSLATE TO THE SOUTH AFRICAN CONTEXT AND OPTIONS?

The primary enabler of Germany's Energiewende has been argued in this paper to be a broad-based and growing citizen support of a clean energy transition. Given the infancy of South Africa's democracy, it is unlikely that this will play as strong a role. However, the actions of civil society still represent a key ingredient. To mobilise broad-based support in South Africa would require linking the issue of clean energy to development and service delivery. Whilst civil society has made good inroads into the renewable energy supply, this link has been given less attention, both on the ground and in influencing policy, than it potentially warrants.

The second relevant ingredient in the Energiewende was a fairly plausible economic case for its implementation. Germany is a wealthy country, and is able to provide resources to invest in the transition to a certain extent. The country has an advanced manufacturing base, capable of responding to a major stimulus for rapid renewable energy technology innovation and diffusion, thereby creating jobs and dominating this growing sector internationally. Germany needs to economically re-energise the rural areas, which could also be delivered through the transition to the de-centralisation characteristic of a pre-dominantly renewable energy based energy system. Although different, South Africa would therefore need to establish its own economic case. This is something that has been attempted by focusing on certain issues, but has not yet been found persuasive from a systemic perspective at a national policy level.

Thirdly, Germany had two decades worth of experience in renewable energy, with 20% of its electricity currently generated by renewable sources when it committed to a transition. This is something South Africa would need to develop, building on its recent progress. The better-

than-expected absorption of the available capacity for the first two bidding windows of the REIPPP hint at a renewables sector in South Africa which is perhaps more viable than is acknowledged by the dominant policy position. However, this window of opportunity will close with a lock-in decision to a new nuclear fleet, as any potential for additional renewables would be crowded out.

Finally, and perhaps most importantly, the German experience demonstrates a successful country committing to an alternative, unknown, contested and risky path to attain a better future for its citizens. This statement of political will can act as a powerful motivator, especially given the argument that a fossil-fuel or nuclear based energy future has its own sets of (potentially greater) risks and costs. South Africa has already made its mark as a leader on climate issues in the international fora and could take Germany's energy and commitment as encouragement to also lead on a domestic policy level, working out a clean energy path in a developing country context.

6. CONCLUSION

This paper argues that South Africa is currently unlikely to embark on a clean energy transition similar to that of Germany. The reasons for this centre on the country's development challenges, the influence of energy sector incumbents, and its young democracy where, contrary to Germany's experience, there is no similar broad-based citizen's challenge to South Africa's energy status quo.

In the short term the potential for a clean energy commitment lies with government. Poverty alleviation and the reduction of inequality are cited as South Africa's policy priorities. The government could only commit to an energy transition if it is convinced that it can better deliver on its poverty and inequality policy objectives through an alternative energy route. Whilst conceptually possible, the development and economic case for this has yet to be convincingly made at a national policy level.

The German experience challenges a country like South Africa to focus on the benefits, rather than the risks of taking an unconventional energy path. Whilst the challenges appear daunting, perhaps they are just more immediate and evident than the challenges and long-term risks of remaining on the current path, and not necessarily greater overall.

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