RESEARCH PAPER

Implementation case study

Energy and thermal efficiency in government-subsidised housing in South Africa

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Developing countries exploring pathways to climate compatibility

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ENERGY AND THERMAL EFFICIENCY IN GOVERNMENT-SUBSIDISED HOUSING IN SOUTH AFRICA

Framing question: how do we move from mitigation plans to actions?

This research aims to isolate the factors that lead to implementation (or lack thereof) of interventions that may have an impact on reducing greenhouse gas (GHG) emissions in developing countries. This case study is part of a series looking to collectively consider research on GHG mitigation action implementation by applying existing theoretical frameworks to examples of projects ultimately addressing climate change. These case studies inform a comparative synthesis paper which will aim to collate insights and lessons on how to consider the implementability of GHG mitigation projects. This research builds on two previous papers and a journal article published by the MAPS programme. The previous papers considered an overview of South Africa's GHG mitigation activities (Tyler et al. 2011; 2013) and the implications of lessons learnt from these activities for public policy implementation (Boyd & Coetzee 2013). For this particular case study we examine the GHG mitigation action involving the provision of improved energy and thermal efficiency in government-subsidised housing in South Africa. The case study will focus on three initiatives within the broader efforts to implement energy and thermal efficiency programmes in government-subsidised housing in South Africa, namely:

1. the establishment of a South African National Standard for energy usage in buildings (SANS 10400 XA),
2. the Sustainable Settlements Facility and
3. the implementation of energy and thermal efficiency in the Joe Slovo housing scheme in Cape Town.

Public policy implementation theory

A broad overview of the public policy implementation is useful to frame the discussion regarding implementation of GHG mitigation actions. With this in mind, the concept of implementability and how public policy is executed is couched within the school of public policy administration theory. Parsons (1995, p.461) writes that, "a study of implementation is a study of how change occurs, possibly how it may be induced." As such, implementation is theoretically recognised as a distinct stage in the policy process typified by the transformation of a policy idea or expectation into an action aimed at remedying a social problem or sub-set of social problems (Lester & Goggin 1998). Further, the transformation of a policy idea or exception usually involves the engagement of a number of stakeholders in a chain of actions requiring execution in order to complete the set task(s). The chain of actions is aptly described by Najam (1995, p. 34) noting that implementation is marked by, "a dynamic process of negotiation between multiple actors, operating at multiple levels, within and between multiple organisations." Further, Najam outlines three generations which summarise the thrust of the body of implementation research within the school of public policy administration theory to date:

- **Classical generation:** This first school of thought assumed that implementation would happen automatically once the appropriate policies had been authoritatively proclaimed.
- **Empirical generation:** The second wave of research challenged this assumption by using case studies of implementation failure to demonstrate that implementation, much like policy formulation, was a complex political process rather than a mechanical administrative one.

- **Analytical generation:** The third generation, by contrast, has been less concerned with specific failures rather looking to understand how implementation works in general and how its prospects might be improved.

However, it is widely noted by implementation theorists that the distillation of key success factors for implementation is not without its complexities. Najam (1995) notes that the field is characterised by little cumulative, theoretical understanding of how policy implementation works in reality and recognises that complexity is endemic to policy processes throughout and not merely limited to the implementation phase(s). The chain of actions leading to the execution of a desired policy goal or directive usually reflects this complex system with it being described as an evolutionary process that, in reality, is seldom linear in progression (Capano 2009). The complexity is marked by policy development processes at times showing a seemingly illogical sequencing of steps with few causal links between the stages of progression (Capano 2009). Furthermore, implementation typically involves the coordinating of action across multiple organisational actors and implementers making the allocation of accountability fragmented and causality difficult to track (O'Toole,2000).

A number of theoretical models have been used to assist with the analysis of implementation. Najam (1995) notes two distinctive theoretical approaches to these models, namely top-down and bottom-up analyses. A top-down approach, "begins with the central decision-maker and the authoritative policy statement, and proceeds downwards through the hierarchical administrative structure to examine the extent to which the policy's legally-mandated objectives were achieved and procedures followed." Meanwhile, "a bottom-up approach starts with an analysis of the many actors who interact at the local level and works backwards to map the outcomes and impacts of the policy in terms of the strategies adopted by the relevant actors in response to the particular policy choice." However, Najam notes that the choice of top-down or bottom-up is usually a reflection of the context of a system in which a policy is being implemented and the actors within that system. Extrapolating on the choice of theoretical models he outlines the need for five inter-linked variables articulating the complexities of a implementation challenge, namely:

1. **Content:** What the policy sets out to do (goals), how the policy problematises the issue (causal theory) and how the policy aims to solve the perceived problem (methods).
2. **Context:** Institutional context with relevance to the corridor through which policy must travel, and by whose boundaries it is limited, in the process of implementation.
3. **Commitment:** The commitment to the goals of those entrusted with carrying out implementation at various levels, causal theory and methods of the policy. Najam also outlines the role of the "street-level bureaucrats" who essentially make up the implementers whom citizens encounter.
4. **Capacity:** The administrative capacity of implementers to carry out the changes desired of them.
5. **Clients and coalitions:** The support of clients and coalitions whose interests are enhanced or threatened by the policy and the strategies they employ in strengthening or deflecting its implementation.

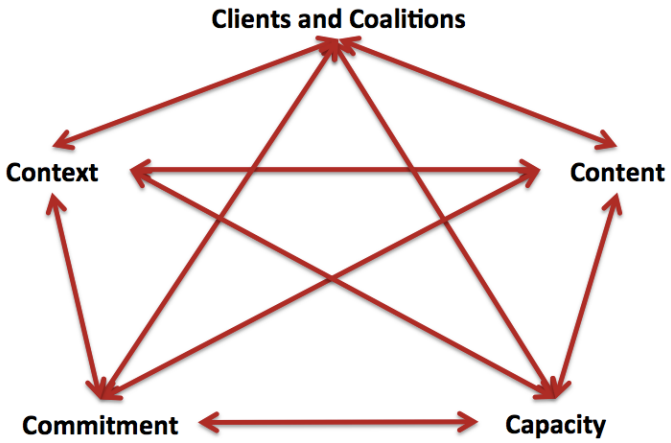

Image reference: Najam, A. (1995). Learning from the Literature on Policy Implementation: A Synthesis Perspective. Working paper: International Institute for Applied Systems Analysis.

Further, in defining policy implementation it is useful to make the conceptual distinction between the policy implementation process (the activities) and policy outcomes (the outputs), even though these are interrelated in reality (O'Toole 2000). The process involves action on the behalf of the policy whereas policy outcomes refer to the ultimate effect on the policy problem (DeGroff & Cargo 2009). By understanding implementation as a complex political process rather than a mechanical or administrative one the study of implementation becomes an attempt to unravel the complexity. For example, Boyd and Coetzee (2013) attempted to unravel the variables (financial, technical capacity, vested interests and social acceptance of policies) requiring sequenced management along the various stages of policy making (i.e. identification, promulgation, planning, financing, operationalisation) in order to see successful implementation of GHG mitigation actions.

South Africa's energy demand and its contribution to GHG emissions

According to the Second Communication to the UNFCCC (Department of Environmental Affairs 2011) South Africa's total GHG emissions in 2000 were estimated to be 461 178.5 Gg CO_2e. The majority of these emissions (83%) were associated with energy supply and consumption, and transport (13%), followed by the residential sector (2%), agriculture (1%) and commerce/services (1%) (Department of Environmental Affairs 2011, p. 29). As noted by Winkler and Marquard (2007, p. 4) coal-fired power plants form the primary means of energy production in South Africa with approximately 93.5% of electricity produced from coal. Furthermore, the country's economy is traditionally structured around mineral extraction and energy-intensive processing. With regards to economic growth, South Africa has experienced an average growth rate of approximately 5% in real terms between 2004 and 2007 (Stats SA). However, growth between the periods 2008 to 2015 contracted recording an average growth just above two per cent. South Africa's real gross domestic product (GDP) grew by 1.5% in 2014, down from 2,2% in 2013 (Stats SA).

With specific reference to energy demand from the residential housing sector a number of factors require consideration. A historical under-supply of adequate housing for the majority of the country's citizens coupled with rising population has seen an increased demand for access to subsidised government housing schemes in South Africa (Tissington 2011). With this increased demand for housing increases in GHG emissions are to be expected in the construction sector (for example cement manufacturing, brick making etc) and in the demand for energy in the operation of the new homes (heating, cooling, etc.) According to the National Energy Efficiency

Strategy (NEES) the residential sector in 2009 accounted for 18% of final energy demand in South Africa. This makes the residential sector a large energy consuming sector alongside industry, mining and the transport sector. In relation to the exact amount of GHG emissions from residential buildings the South African Second Communication (Department of Environmental Affairs 2011) notes that it is difficult to disaggregate the CO_2e emissions of buildings and specifically those for residential use. However, the DEA reports that the residential sector was responsible for 5 928.40 Gg CO_2e or approximately 1.33% of South Africa's total CO_2e emissions in 2000 (Department of Environmental Affairs 2011).

An overview of the energy-efficiency policy landscape in South Africa

A brief overview of the South African recent energy-efficiency policy landscape is helpful to contextualise the interventions outlined later in this case study. The concept of energy efficiency (EE) enters the South African policy landscape in the 1998 White Paper on energy policy (Fawkes 2005). Following this White Paper the Department of Energy (DoE) formulated the NEES in 2005, outlining the DoE's first attempt to consolidate a demand-side management intervention (DME 2005). The DoE holds the mandate for formulating, implementing and monitoring the country's NEES (Roux 2012) which committed government to play a central role in EE with regards to setting norms and standards, consumer education and awareness, and the provision of compensation for market failures. The NEES also set a policy target of reducing overall energy demand for all uses by 12% by 2015 off a business as usual baseline with a target of 10% energy reduction in residential sector in the same timeframe. The NEES outlined a number of measures for the residential sector to achieve this which included mandatory building standards, appliance labelling, efficient lighting coupled with an excise duty (and proposed future ban) on incandescent lamps, as well as subsidies for solar and heat-pump water heating.

It would appear, however, that EE was not prioritised by the DoE until South Africa's electricity net reserve margin dropped to below five per cent in 2008 precipitating a national energy crisis that saw a wave of scheduled blackouts, costing the country an estimated ZAR 50 billion (Mail and Guardian 2008). In 2009, the DoE's first review of NEES noted that, "significant progress remains to be documented … It is a sore fact that with all the good intentions and political support behind the national strategy then [sic] implementation in some sectors are [sic] hardly visible and the monitoring of the achievements is outstanding" (DoE 2009, p. 9). A number of reasons for the lack of progress are outlined, but most notable is the lack of human and financial capacity in the face of a seeming lack of financial support to resource those tasked to execute. Roux (2012) notes that the DoE's ability to support the country's EE strategy and initiatives was reliant on donor support programmes that left much of the capacity to implement outside of public sector execution structures. Whilst a lack of external donor support could be listed as an implementation inhibitor, there were a number of critical donor-supported programmes that aimed to support the DoE in carrying the strategy forward (for example the Capacity Building Project in Energy Efficiency and Renewable Energy 2001–2005). Both the 1998 White Paper and the 2005 NEES acknowledge that there were capacity gaps experienced by the DoE whilst attempting to implement EE measures and a recommendation was made to establish a dedicated agency (namely the National Energy Efficiency Agency) should be established (NEEA 2010).

In 2006 NEEA was established by ministerial directive with a funding allocation flowing from electricity tariffs charged by the national public utility, Eskom. This raised a potential conflict of interest with regards to financing as Eskom's revenues are generated through the selling of electricity, giving it little incentive to spend money

convincing or enabling consumers to consume less electricity (Roux 2012). The surrounding financing structure left little motivation for the DoE or Eskom to take EE seriously until the supply crisis of 2008. Between 2006 and 2010 NEEA did not receive the funds required to operationalise the organisation or its work plan from Eskom (NEEA 2010). In 2008 the National Energy Act established an independent agency, the South African National Energy Development Institute (SANEDI). The Act combined SANERI and NEEA's mandates and gave it the legal backing it needed to function as an independent entity. SANEDI was operationalised on 1 April 2010 and was financed through a fiscal allocation directly from the National Treasury until a sustainable funding structure could be established.

Looking back it can be seen that the NEES was initially framed as a wish list of initiatives with little political support within the macro-energy planning processes and tools. It was not fully absorbed into the state's energy planning; for example, it is not mentioned in the Integrated Resource Plan for Electricity 2010–2030 which is the master plan for estimating South African's long-term energy demand and the implications for supply expansion. The IRP 2010 (and its subsequent scheduled update in 2013) only considered the government-owned energy utility's (Eskom) DSM programmes (for example residential mass rollout of solar water heating and heat pumps). Public interest organisations noted the lack of mention of NEES and the resulting contradictions between the two policy positions (NEES vs. IRP 2010) (Trollip, Nakhooda & Pienaar 2010). The IRP 2010 noted that, "unacceptable planning uncertainty and economic growth risk," were the reasons for not considering the full scope of NEES within the modelling exercise (DoE 2011, p. 16). Additionally, commentators have suggested that supply-side stakeholders were influencing the IRP 2010's scope and that the DoE's own EE Directorate was sidelined in the planning processes (Roux 2012). Noting that stakeholder engagement within energy policy arena in South Africa has a complex political economy attached to energy regulation (Trollip et al. 2014). For example, much of the key data is held by vested-interest holders such as Eskom whilst lobby groups such as the Energy Intensive Users Group (industry and mining stakeholders) can secure privileged access to decision-makers (Misuka Green Development & the Climate Finance 2012, p. 26). In October 2012 Cabinet approved the release of the second review NEES document for public consultation. During the review process an EE policy mapping study was conducted through the South African Energy Programme (SAGEN) in collaboration with SANEDI and GIZ. The outputs of the study provided a comprehensive policy and legislative context for the development of the National Energy Efficiency Action Plan (NEEAP). The DoE is commencing with the preparations for the NEES post-2015 which is the point at which its targets are aimed (Modise 2013).

Further developments have emanated from South Africa's need to reduce GHG emissions by reducing demand for energy usage. From the EE and GHG mitigation perspective the Department of Environmental Affairs (DEA) is responsible for providing enabling structures for the implementation of the South African National Climate Change Response White Paper (2011). The DEA has identified a number of, "near-term priority flagships programmes," to be given preference for implementation aligned to a number of key planning initiatives by the DEA (including the desired emissions reduction outcomes, the carbon budgets amongst others). One of these is the Energy Efficiency and Energy Demand Management flagship programme that would include an EE programme in industry, a residential EE programme and an EE programme for public buildings. The DEA has identified two implementation coordination groups to take responsibility for development and oversight of frameworks for each of the near-term priority flagship programmes, namely the Inter-Ministerial Climate Change Committee (IMCCC) and a sub-committee of the Inter-Governmental Climate Change Committee (IGCCC). However, a number of the flagship projects are made complex due to the transversal nature of their execution - they cross a number of government departments mandates

and require a number of partners to coordinate actions (Molotsoane, pers. comm., January 2015). The current structure of the flagship programmes looks to facilitate both horizontally and vertically decentralised decision-making. Horizontal decentralisation spreads responsibility across the implementing national departments while vertical decentralised decision-making processes empower sub-national governmental authorities. So far this has delivered varied success with some working well whilst others have not achieved traction (Molotsoane, pers. comm., January 2015). Each flagship programme consists of a stack of coherent initiatives that, though not directly interconnected, are complementary in nature. The programmatic approach is aimed to coordinate various regulatory instruments, projects and initiatives which all contribute towards the goal of a lower-carbon and climate-resilient development. However, achieving coordination between the coherent initiatives is a complex process when institutional mandates and delivery systems are deeply entrenched and difficult to influence change within (Molotsoane, pers. comm., January 2015). This makes achieving cooperation amongst the individual flagship programmes difficult in reality. For flagship programmes to realise their objectives and full potential it is essential that there is institutional ownership and political commitment from the implementing focal department with support from others whose mandates will be crossed.

South Africa's government-subsidised housing policy

South Africa built approximately 3.8 million government-subsidised housing units in the 20 years since the advent of democracy in the country (Government of South Africa 2014). The mandate for the government to provide adequate housing for all citizens emanates from section 26 of the Constitution of the Republic of South Africa:

- "Everyone has the right to have access to adequate housing."
- "The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of this right."

The first democratically elected government inherited a housing sector that clearly demonstrated racial inequality and a skewed distribution of wealth as a result of the apartheid system and government. Contextually, South Africa has one of the world's highest economic inequality levels, evidenced by a Gini co-efficient of 0.65 coupled with high rates of unemployment (24.9% as of the fourth quarter of 2014) and 45.5% of the population living below the upper-bound poverty line in 2011[1] (World Bank 2011 & Stats SA 2014). The Housing White Paper of 1994 outlined a supply-side approach to redress the housing backlog whereby the government would subsidise houses for qualifying households in the low-income (defined as households earning less than ZAR 3500 (±USD 289) per month) and middle-income (greater than ZAR 3500 and less than ZAR 7500 (±USD 619) per month) brackets. Table 1 below indicates that, although in the past 20 years more than 3.8 million subsidised housing units have been constructed, there has been a continuously increasing housing backlog.

Table 1: Housing backlog 1996 – 2011[2]

[1] The upper-bound poverty line (UBPL) equals R620 / ± USD 51 per capita per month in 2011 prices which translates into roughly 23 million people living below the UBPL in South Africa in 2011.

[2]Source: Department of Housing, 1994 and Department of Human Settlements, 2011.

Year	Estimated number of units within the housing pipeline
1996	1.5 million
2001	1.8 million
2011	2.1 million

With regards to the policy landscape there are a number of policies and laws that govern the delivery of government-subsidised housing to South African citizens. The policy, legislative and regulative frameworks are complex and interwoven. Tissington (2011, p. 3) provides a comprehensive overview of the policy documents, primary legislation and relevant secondary legislation guiding the provision of housing in South Africa. In summary there are three tiers of government (national ministries, provincial governments and municipal authorities) that hold different roles and mandates within the process of delivering various subsidised housing typologies. These government institutions interact with private sector contractors during the construction/execution phases of new government subsidised housing developments. There are three types of housing schemes that receive government subsidies namely:

- **Fully subsidised housing** (dubbed either RDP housing or BNG housing depending on the policy era during which it was erected) built on behalf of government for low-income households, delivering standardised 40m^2, mostly freestanding, freehold houses targeted at those earning less than ZAR 3 500 (±USD 280) per month (Tissington 2011, p. 36).
- **Subsidised rental housing** (dubbed social housing) provided to citizens through designated social housing agencies and/or through the Community Residential Upgrade Programmes and/or the institutional subsidy mechanisms, aimed at those earning between ZAR 3 500 and ZAR 7 500 (±USD 605) per month (Tissington 2011, p. 38).
- **Subsidised mortgage housing** (dubbed gap housing) comprising of entry-level housing units provided by private sector developers with subsidised mortgage for lower-income households through a government mortgage insurance facility (the Housing Guarantee Fund) and the Finance-Linked Individual Subsidy programme. Typically the subsidised mortgage looks to assist those households who fall short of being eligible for a bond from a private banking institution in South Africa yet are above the threshold for fully subsidised housing. While the gap market is defined as the ZAR 3 500 to ZAR 7 000 (±USD 560) per month income bracket in the National Housing Code, the national Department of Human Settlements operationally defines the gap market as being as those earning between ZAR R3 500 and ZAR 12 500 (±USD 1005 per month) (Tissington 2011, p. 40).

With regards to the spatial spread of population, South Africa is 62% urbanised and 13% of urban residents live in slum dwellings typically situated on the periphery of major towns or cities. Urban areas generate about 85% of economic activity and act as a magnet for citizens from rural areas. Although the rate of urbanisation in South Africa differs per city, it is estimated that another 7.8 million people will be living in South African cities by 2030 and a further 6 million by 2050, putting additional pressure on city municipalities (local government authorities) to deliver services. In many ways South African cities are still being formed and the manner in which these communities are integrated into cities will have (and has already had) major social, economic and environmental implications. Meanwhile South Africa's economy is continuing to register positive growth rates, albeit at a slower rate than before, in line with global economic conditions (Nene 2015). The resulting economic

climate has resulted in a constrained national fiscus and the need to consolidate the country's public finances (Nene 2015). In general local municipal authorities are struggling to keep up with service delivery in the face of rapid urbanisation and will come under increasing pressure as the government attempts to rein in public spending. City planning approaches focusing on achieving densification, mixed income settlements near amenities, public transport nodes and economic opportunities with mechanisms to collect a sustainable revenue stream are two of the many challenges facing policy makers in South Africa.

Policy makers within the housing sector have aimed to address this through the Breaking New Ground (BNG) initiative (Breaking New Ground: A Comprehensive Plan for the Development of Sustainable Human Settlements 2004) which began to shift the focus from the quantity of houses built towards a greater emphasis on the quality and sustainability of housing being provided by the government. The 2004 BNG policy outlined the DHS plan to shift its focus from merely providing housing for citizens towards facilitating, "the creation of sustainable human settlements and improved quality of household life" (Breaking New Ground Housing 2004). The revised housing codes, published in 2009, marked a further, "conceptual shift away from the mandate of providing shelter, to supporting the residential property market." The BNG policy and the corresponding housing codes aimed to allow for increased access to housing and services for low-income families whilst ensuring a greater choice in quality, location and ownership mechanisms. It also marked a change in strategy in the provision of housing with the realisation that there was growing evidence that the state could not deliver on the growing demand through the continual provision of free housing (Engineering News 2010).

In terms of recent delivery schedules the DHS has been allocated an additional ZAR 2.9 billion (±USD 342 million) in 2013/14 and 2014/15 for informal settlements upgrading through a local government conditional grant, and ZAR 1.1 billion (±USD 130 million) for 2013/14 and 2014/15 for informal settlements upgrading through a provincial government conditional grant. In addition ZAR 111.2 million (±USD 13.1 million) is provided over the medium-term expenditure framework period for project level technical assistance to upgrade informal settlements for provinces and municipalities. An amount of ZAR 620 million (±USD 72.9 million) over the medium-term is allocated for social housing.

Table 2: Department of Human Settlements' mid-term delivery targets

Indicator	Past			Current	Projections		
	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Number of residential units completed per year	160 409	161 854	121 879	88 441	127 200	134 832	142 922
Number of additional sites serviced per year	68 469	64 362	63 546	33 361	72 876	77 248	81 883
Number of additional households upgraded in well located informal settlements with access to secure tenure and basic services per year	-	-	52 383	66 639	67 124	62 752	66 517
Number of additional loans granted in affordable housing segment per year	-	-	47 616	69 576	69 970	74 470	78 938

Up until 1 April 2014 the government-subsidised housing programme in South Africa was delivered with little concern for thermal and/or energy efficiency (Department of Human Settlements 2013). One of the drivers of this has been the need to deliver on political and constitutional mandates in the face of a limited departmental budget drawn from a limited national fiscus. As a result subsidised houses have been built to minimum specifications to maintain a level of standardised quality and at minimum cost to ensure that the maximum number of new dwellings can be provided within the limited budget available (Department of Human Settlements 2013). However, the original minimal specification design can create uncomfortable indoor living conditions in both summer and winter with the winter cold in particular resulting in residents using a relatively large amount of energy in order to keep their homes warm. Whilst homeowners incur additional energy costs,they are often prone to poor indoor air quality and fire hazards in dense urban communities when heating methods such as paraffin stoves are typically used. Additionally, water for bathing is usually boiled in kettles and/or pots on stoves tops which is inconvenient for the resident and energy-inefficient. These factors, coupled with other socio-economic ones, result in residents of subsidised housing typically experiencing relatively higher costs for energy whilst being faced with the health implications of living with physical discomfort and poor indoor air-quality (Cousins & Mahote 2003).

However, with regards to GHG emissions, the residential electricity consumption in South Africa is projected to be a relatively small share of total demand for electricity, accounting for approximately 15% of forecast demand by 2020. The share of poor households of this total is minor, accounting for only 0.4% of total electricity demand (Winkler & Tait 2012). Winkler and Tait (2012) estimate that with the South African government's efforts to ensure that all residential buildings have access to energy by 2020 the new stock of low-income households connected will only constitute a small addition to total electricity demand amounting to an increase in electricity consumption by 0.11% by 2020. They further estimate that the impact of emissions from newly

connected households would have a negligible impact on the country's emissions profile increases in households' access to electricity for poor contributing only 0.09% to South Africa's total emissions in 2020.

The issue of implementing government-subsidised housing with greater consideration for thermal and energy efficiency measures was attractive to the South African climate change community because it matched a development imperative (i.e. housing for all citizens with a backlog to be delivered through a public procurement process), addressed concerns regarding energy poverty for the country's poorest residents, engaged private sector service provides (for example providers of solar water heaters and thermal insulation technology) and reduced GHG emissions. Thus, a number of inventions have been attempted in order to change the way in which government-subsidised housing has been implemented. The focus of this case study will be three of these interventions, namely:

1. South African National Standard (SANS 10400 XA): Energy Usage in Buildings,
2. the Sustainable Settlements Facility and
3. energy and thermal efficiency in the Joe Slovo (Cape Town) housing scheme.

South African National Standard (SANS 10400 XA): Energy Usage in Buildings

New building regulations promulgated in 2011 require the inclusion of energy efficiency interventions in all new buildings in South Africa under the South African National Standard (SANS) 10400XA – Energy Usage in Buildings (South African National Standards 10400XA 2011). This signalled the introduction of mandatory energy efficiency and thermal insulation measures in all new buildings in South Africa. The regulations require (amongst other technical stipulations) new buildings to include insulated ceilings and walls, roof overhangs, adjusted window sizes and that at least 50% of the water heating should be from an energy-efficient source. However, it was not until 1 April 2014 that the Department of Human Settlements allowed for the housing subsidy quantum to be increased in order to execute the norms and standards set out by the SANS 10400XA (and the revised National Building Regulations) in government housing programmes. Until then government-subsidised houses had not included energy efficiency interventions except in the Southern Cape Coastal Belt region where insulated ceilings and plastered walls were being provided to reduce damp levels and the associated threat of illness.[3]

The mention of this exception is important to the chain of events that led to the adoption of SANS 10400 XA. In 2003 the DHS was receiving complaints regarding the levels of dampness within their standard specification housing units and was facing the potential of legal action against it for the health implications to residents due to the condensation issues (Reynolds, pers. comm., January 2015). The DHS approached the South African Council for Scientific and Industrial Research (CSIR) and the Thermal Insulation Association of Southern Africa (TIASA) to do a study on what could be done to remedy condensation issues within homes in the Southern Cape Coastal Belt. Amongst the recommendations to reduce the condensation was the inclusion of additional ceiling insulation over and above what was provided as standard specification (Reynolds, pers. comm., January 2015). The report and recommendations were accepted in 2005. At a similar time, Australia had published energy efficiency regulations that were of interest to the CSIR/TIASA team which highlighted the potential for energy

[3] The Southern Cape Condensation Problem Area (SCCPA) is the area stretching from Malmesbury and Ceres in the West and following South of the coastal mountain ranges and escarpment though the Western Cape Province into the Eastern Cape Province and up to and including Port Alfred in the East. This area is prone to prolonged periods of cold and rainy weather, mould growth occurs on damp surfaces respiratory health problems such as tuberculosis, have been reported and connected to such mould growth.

efficiency in typically warmer climatic zones similar to those of South Africa (Reynolds, pers. comm., January 2015). Additionally, the CSIR/TIASA's report to the DHS also coincided with the DoE's publication of the NEES.

In 2006 a number of the members of the CSIR/TIASA team approached the DoE with the recommendation to write a South African EE standard for buildings in order to assist with meeting the NEES target. In order to do this two organisations were mobilised: the South African Bureau of Standards (SABS) and the National Regulator for Compulsory Standards (NRCS) which both operate under the auspices of the Department of Trade and Industry (DTI). With the knowledge of the DoE the DTI was approached and a committee was established within SABS for the drafting of what would later become South Africa's voluntary energy efficiency standard (SANS 204). The committee working under SABS drew on elements used under the Australian standard as the starting point for the drafting process of the SANS 204. The committee was made up of a variety of interested parties volunteering their time (including representatives from DTI, DHS, DoE; industry players including those from the air conditioning industry, glass industry, concrete industry, steel frames industry, lighting industry; and representatives from academia including experts from the CSIR). Part of the committee's considerations included factors such as the technical efficiency of technologies, the burden of implementation of the proposed standard, ensuring that standard did not destroy any markets and that interventions were not inflationary in the long-run. In 2008 the three sections of voluntary SANS 204 standard were published. A number of industry players are critical of a number of aspects of the standard but they were generally accepted by role players as the standard was voluntary in nature (Reynolds, pers. comm., January 2015).

In 2009 the Green Building Council of South Africa adopted SANS 204 as their requirement for green building accreditation and, in doing so, gave the new voluntary standard a level of industry support (Reynolds, pers. comm., January 2015). Meanwhile, SANS 204's drafting committee decided that the next step would be to start a process to incorporate the voluntary standard into the National Building Norms and Standards in order for them to become mandatory over a period of time. The National Regulator for Compulsory Standards (NRCS) under the DTI is responsible for issuing and updated mandatory building codes within South Africa. A working group was established and the process to start writing a new addendum national building standard (SANS 10400XA) whilst writing the new energy efficiency regulations in parallel. The working group agreed to embed the standard in building regulations so as to take advantage of the system of enforcement inherit in building control officers within municipalities who were responsible for the approvals processes for building permits (Reynolds, pers. comm., January 2015). The process of writing any national standard and/or regulations includes an extensive consultation process involving a number of rounds of draft commenting amongst committee members followed by an extensive public commenting process. The consultation process is time-intensive with the iterative process of internal and external comments requiring repeated rounds of consultation until consensus on material technical issues has been reached. During the drafting of the SANS 10400XA there were calls to adopt the complete voluntary SANS 204, however there were concerns regarding the destructive effect this would have for certain sectors (for example concrete brick production). Therefore, it was decided that parts of the SANS 204 would be incorporated into a new amendment to the SANS 10400 XA that included energy and thermal efficiency in buildings.

Whilst SANS 10400XA was being written a number of external events pushed the South African government (specifically the DTI) to move the working group's efforts along. The 2010 FIFA World Cup hosted in South Africa required a number of new infrastructure projects to be approved and to meet international construction standards. This re-articulated the need for the drafting of a national energy efficiency standard to be prioritised.

Additionally, South Africa's hosting of the UNFCCC 17th meeting of the Conference of the Parties in Durban precipitated a final burst of action from the DTI to ensure that new regulations were complete in time for the COP in December 2011. These regulations were announced in the government Gazette in September 2011 and promulgated by November 2011.[4]

Following the promulgation of the regulations, the DHS began considering its response to the SANS 10400XA and the implications on the government-subsidised housing programme. Initially the DHS elected to ignore SAN 10400XA on the grounds that the low-income housing sector was exempt from the regulations because the additional costs were prohibitive to enable their full application. The National Regulator for Compulsory Standards (NRCS) argued that the DHS would have to comply with the new regulations and the only way the department could be exempt would be through a memorandum of understanding between the DTI and DHS. Engagements between the two departments took place during the course of 2012 and 2013. Eventually such a memorandum of understanding was determined to be politically unfeasible (Reynolds, pers. comm., January 2015). Subsequently, in December 2013, the Director General of the DHS authorised an increase in the housing subsidy quantum to achieve the norms and standards set out by the 2011 revised National Building Regulations to be effective by 1 April 2014 (Department of Human Settlements 2014).

The determination that low-income housing projects delivered on behalf of the government were not exempt from SANS 10400XA has significant financial implications on the DHS' budget for delivery. However, to date, no budget re-prioritisation has been undertaken by the DHS or a request for additional funding been made to the National Treasury in order to cover the quantum increase from ZAR 78 000 (±USD 6 441) to ZAR 110 947 (±USD 9 161) per standard 40m^2 government-subsidised house (Van der Walt, pers. comm., January 2015). The increased quantum allocation per residential build implies that the DHS is required to allocate additional budget per housing unit and the DHS will be unable to meet its delivery targets with lesser budget being allocated to low-income housing delivery year-on-year (Van der Walt, pers. comm., January 2015). Furthermore, there is consideration of the medium-to-long-term impact of SANS 10400XA on the DHS delivery mandate as the DHS moves towards a policy of providing land tenure and bulk infrastructure (i.e. a policy of providing site and service) as opposed to the provision of full, turn-key houses as has been the case in the previous years (Van der Walt, pers. comm., January 2015). This would be in line with the BNG initiative which, amongst other things, started to shift the focus from the number of houses built to the quality and sustainability of housing provided (Van der Walt, pers. comm., January 2015).

The implication of this is that the burden of responsibility for meeting the mandatory energy efficiency standard would be shifted towards low-income homeowners who would be erecting their own top-structures (Van der Walt, pers. comm., January 2015). Rental and gap-housing developers are particularly affected by the water-heating component as these units are typically furnished with electric geysers that would now require either new energy efficiency or renewable energy to be installed. DHS are also unlikely to receive an increased budget allocation over the next financial year from government and will have to find a sustainable way to raise the additional capital required to implement the interventions (Van der Walt, pers. comm., January 2015). The rental and gap housing markets are typically bound very tightly by construction costs in an effort to keep prices

[4] During the initial stages of drafting the SANS 10400XA, DTI had the view it would like the mandatory standard to achieve the level of SANS 204 over time and that a revision would be considered five years after XA was promulgated (i.e. 2016). Water and waste efficiency regulations are also being considered as part of a suite of considerations with regards to the impact of the built infrastructure on the environment.

of houses as affordable as possible. It is estimated that the additional cost of a solar water heater and extra insulation for a gap house can increase its cost by ZAR 10 000 (±USD 826) – ZAR 20 000 (±USD 1 651) depending on insulation type and SWH size.

Looking ahead, additional finance for the implementation of the mandatory interventions would be required in order to supplement the DHS's overall budget if the target number of houses is to be delivered. This requirement for additional financing comes at a time when national government is looking for alternative solutions for housing delivery in South Africa in line with the BNG policy where more economical housing designs are being considered alongside the options of providing just land tenure with bulk infrastructure (i.e. site and service). The two case studies below outline two attempts in this regard: the Sustainable Settlements Facility (with regards to finding additional financing) and the Joe Slovo housing development (innovative design including specified energy and thermal efficiency measures). When considering the process by which SANS 10400XA was adopted there are a number of lessons relevant for the discussion regarding the implementation of mitigation measures within the developing country context:

- Large events (for example the 2010 FIFA World Cup) or conferences (for example the UNFCCC COP17) can be political drivers catalysing the prioritisation of public policy interventions. However, the political push to complete public policy documents can lead to those responsible for execution being out of step – the example here being the DHS seeking an exemption because of the budgetary implications of the SANS 10400XA on the delivery of the government-subsidised housing programme.
- The background research for the initial intervention in the Southern Cape Coastal Belt was undertaken at the request of the key national departments and undertaken by the big parastatal research organisations (for example CSIR) which are both technically proficient and politically accepted as experts.
- The development of a clear voluntary standard first is likely to have softened the blow with the stated intention to become mandatory over time. It appears that it reduced resistance by private sector and other players.

The Sustainable Settlements Facility

The Sustainable Settlements Facility (SSF) has been a concept in development since 2001 and has yet to be executed at scale. The SSF aimed to provide an operational and financial vehicle for the installation of thermal and energy efficiency measures in fully subsidised housing, subsidised rental housing and/or units provided through government-subsidised mortgages. Whilst being explicitly mentioned in the National Climate Change Response White Paper (Department of Environmental Affairs 2011), as a component of the Energy Efficiency and Energy Demand Management near-term flagship programme, as a mechanism that would determine EE standards for low-income housing, it has had little, if any, influence over the history of the development of SANS 10400XA as described above.[5] However, subsequent to the adoption of SANS 10400XA, the SSF has been positioned as a potential enabling financing mechanism that could allow the South African government raise the resources to be in compliance with the new standard whilst meeting its delivery targets for new housing (Sustainable Settlements Facility NAMA Drafting Group 2013).

[5] The National Climate Change Response White Paper (page 32) states that "a residential energy efficiency programme [will include] the development of appropriate initiatives, incentives and regulations will be finalised by the DoE and the DTI. Furthermore, the development of energy specifications for low-income housing will be determined through the National Sustainable Settlements Facility under the Department of Human Settlements"

The basis of the SSF was the theoretical emissions modelling undertaken between 2001 and 2005 to assess the potential to measure, report and verify GHG emission reductions using a suppressed demand methodology under Clean Development Mechanism (CDM) rules. Essentially the methodology looked to measures to avoid emissions in low-income housing by calculating a reduced emissions profile off a future business-as-usual baseline. A South African based non-governmental organisation (SouthSouthNorth) undertook this modelling that was funded by a number of local and international development agencies.[6] The theoretical modelling was aimed to build a case for the use of carbon credits (in the form of certified emission reductions from the CDM) as an innovative funding mechanism for the inclusion of energy and thermal efficiency measures in low-income houses in South Africa. In addition to the theoretical emissions modelling, Cousins and Mahote (2003) conducted a social study to analyse how the installation of solar water heater geysers, ceiling insulation and energy efficient light bulbs would be received by the residents of government-subsidised houses in the Kuyasa township in Khayelitsha, Cape Town. The result of these efforts was the conceptualisation and registration of the Kuyasa CDM Pilot Project between 1999 and 2005. The CDM project looked to retrofit low-cost houses in Kuyasa with solar water heaters to provide hot water on demand, insulated ceilings to improve the thermal efficiency of the households and energy-efficient lighting in the form of compact fluorescent lamps (Technical Assistance Unit and Western Cape Government 2013). It was approved in 2005, commencing with ten pilot houses being retrofitted in order to supply baseline data to measure and evaluate the benefits of the efficiency measures installed.

During 2006 SouthSouthNorth took the modelling forward in the form of a Renewable Energy and Energy Efficiency Partnership Southern Africa (REEEP)-funded project to investigate how to scale-up the theoretical CDM methodology work. A drafting group was established, consisting of key public stakeholders in the South African energy and housing sectors including the then Department of Housing (now the Department of Human Settlements), the then Department of Minerals and Energy (now the Department of Energy), the Development Bank of Southern Africa, the National Housing Finance Corporation, the National Energy Efficiency Agency, Eskom, SouthSouthNorth, the regional REEEP secretariat, the National Home Builders Regulatory Council, the Central Energy Fund, the South African Designated National Authority of the CDM, major metropolitan areas and an representative of the Energy Saving Companies (ESCOs) constituency. The National Energy Research Institute (SANERI) chaired the drafting group. The primary output of the drafting group was a Sustainable Settlements Facility business plan and institutional architecture published in 2008 (National Sustainable Settlements Facility Drafting Group 2008).

Following positive results of the 2006 study, the ten-house pilot study was extended in a wider rollout of the Kuyasa CDM Pilot Project starting in August 2008 with completion in October 2010. The funding for the initiative was provided through a number of channels including the Dutch government, City of Cape Town, the provincial government of the Western Cape and the South African Export Development Fund, and the Department of Environmental Affairs and Tourism. In total the Kuyasa CDM Pilot Project retrofitted 2 309 subsidised RDP houses with solar water heating systems, insulated ceilings and energy-efficient lighting that resulted in a saving of approximately 6

[6] The author works for SouthSouthNorth, a partner to the MAPS Programme.

580 tons of carbon equivalent (tCO_2e) per year. At the time, it was proposed that the Kuyasa CDM Pilot Project could provide one practical example of how the SSF could function by creating a sustainable finance stream for maintenance of the installed EE interventions through the recycling revenue generated through the sale of CER credits. The CDM project was registered for the installed interventions to be in operation for a period of 21 years and for CERs to accrue over this period (Technical Assistance Unit and Western Cape Government 2013).

Following the completion of the retrofit in Kuyasa, SouthSouthNorth and the Development Bank of Southern Africa looked into the possibility of developing a CDM Programme of Activities (PoA) to bundle together multiple interventions like those executed in the Kuyasa CDM Pilot Project into one carbon-accounting instrument (a PoA). A single PoA would allow for the efficient monetisation of CERs for the maintenance of similar energy efficiency measures in multiple low-income housing areas provided they utilised similar methodologies and had similar baselines. Under a CDM PoA it is possible to register the coordinated implementation of a policy, measure or goal that leads to emission reduction. Once a PoA is registered an unlimited number of component project activities can be added without undergoing the complete CDM project cycle (UNFCCC 2014). In the intervening years, however, the carbon market experienced a significant drop in price of CERs due to uncertainty surrounding the ongoing commitment of countries to the international agreement that underpinned the CDM (i.e. the Kyoto Protocol) and the 2008 financial crisis. The ability of the project to monetise the carbon credits has been delayed, leading to growing frustrations with local residents who now require maintenance to be undertaken on their units.[7] Furthermore, the high transaction costs involved in getting the CERs registered, verified and subsequently issued has been higher than expected making it very difficult to make the gains required for maintenance on installations from the carbon credits.

Furthermore, the scaling-up of the innovative financing using carbon credits into a CDM PoA proved to be difficult. The SSF met a number of limitations in scaling the Kuyasa CDM Project into the PoA, including: scale limitations of the approved methodologies used to measure and verify GHG emission reduction, a lack of consensus of where the most appropriate institution for the PoA's coordinating and managing entity (CME) should be placed, the establishment of the necessary operational synergies required with the DHS and a designated CME, and difficultly in establishing multi-departmental support for an innovative financial mechanism within strict governance within public-financing legislation. Additionally, two PoAs pertaining to solar water heaters were subsequently registered in South Africa (Standard Bank Low Pressure Solar Water Heaters for South Africa and SASSA Low Pressure Solar Water Heater Programme) adding to coordination complexity with private sector entities registering PoAs in their own capacities. It was unclear at the time whether these respective PoAs covered government-subsidised housing, although there was evidence to show that at least one of them did overlap (Misuka Green Development & the Climate Finance 2012). Furthermore, the coordination of multiple national government mandates proved to be difficult – the DoE had the mandate as the CDM Designated National Authority, the DHS had the mandate for housing delivery whilst the DEA held the mandate for mitigation policy, monitoring and evaluation.

[7] Notwithstanding the failure of the Kuyasa CDM Pilot Project sustainable financing mechanism to deliver in time for routine maintenance to proceed, the experience in Kuyasa holds a wider lesson for other South African SWH installations in communities where constrained financial resources would see residents unable to privately finance maintenance.

In 2013 the SouthSouthNorth and Development Bank of Southern Africa team decided that a more appropriate mechanism for the SSF would be a Nationally Appropriate Mitigation Action (NAMA) as defined under the United Nations Framework Convention for Climate Change. The concept of submitting the SSF as a NAMA was first raised in 2008 but was not pursued at the time given the uncertainty as to the definition of the concept within the international negotiations. However, definition of a NAMA became arguably clearer over time and with the decline in the carbon credit prices coupled with the complexities registering a PoA it was decided that a NAMA would be an appropriate vehicle through which to pursue the SSF. As such, a NAMA Working Group was established by the Development Bank of Southern Africa and SouthSouthNorth that included representatives from key departments including the DHS, DEA and the National Treasury. The NAMA was aimed at assisting in the financing of delivery of new government-subsidised housing and the retrofitting of existing government-subsidised housing with the following interventions: installation of insulated ceilings, insulated walls (i.e. plastering internal walls and rendering on external walls) and the provision of energy-efficient water heaters (i.e. solar water heaters or heat pumps). However, to date there has been limited support for the SSF as a NAMA and the project concept remains stalled, resulting in limited success of the SSF to date (Sustainable Settlements Facility NAMA Drafting Group 2013).

When considering the process by which the SSF has attempted to move from concept into implementation, there are a number of lessons relevant for the discussion regarding the implementation of mitigation measures within the developing country context:

- Whilst broad participation and consensus building was useful to generate interest, the SSF appears to never have found a national political champion in the form of the DHS, National Treasury, DoE and/or the DEA. The resulting efforts to scale-up a pilot project that demonstrated a version of how the SSF would function was therefore difficult at a national scale. The SSF seems not to have found a "street-level bureaucrat" as outlined by Najam (1995, p. 47).
- Dependence on a volatile finance source proved a problem, revenue generated off the back of carbon credit sales, as shown by the fall in price for the carbon credits and the long lead times to monetise the CERs. Additionally, residents typically do not have disposal income to contribute to the maintenance of the technology provided, bringing the ongoing sustainability of the intervention into question.
- Managing a new and innovative programme between the various government departments, at various tiers (national, provincial and local) across three government-housing typologies, requires an immense amount of coordination. The potential for complexity grows exponentially and it could be argued that keeping the intervention focused on a single technology or house typology may have been helpful. Simplicity is the ultimate sophistication.

Energy and thermal efficiency in the Joe Slovo (Cape Town) housing scheme

In 2005 the DHS and the Kingdom of Denmark (via the Danish International Development Assistance Agency) agreed on a ZAR 17.5 million (±USD 1 427 000) grant programme to support the South African government with the inclusion of energy efficiency measures in the low-income housing sector (Sustainable Energy Africa 2014). The grant included an anticipated result that lessons learnt through the pilot projects implemented would be used to inform local regulatory frameworks and policies for including energy efficiency in low-income housing. One of the pilot projects identified

was the houses being constructed at Joe Slovo 3A (Sustainable Energy Africa 2014). Joe Slovo Phase 3 is a national flagship housing project of the DHS used to showcase new approaches to sustainable housing delivery in the country under the government's Breaking New Ground initiative. This settlement is in the suburb of Langa in Cape Town and is visible on the main highway from Cape Town CBD to the airport. Whilst it aimed to address the spatial challenges faced by the country (i.e. the spatial exclusion of low-income families from the main socio-economic facilities of cities) the development also aimed to address issues of energy and thermal efficiency in government-subsidised housing (Sustainable Energy Africa 2014). The Joe Slovo 3 settlement design needed to take the BNG principles further if it was to create a sustainable settlement and accommodate all of the residents of the pre-existing informal settlement.

It was envisioned that there was a greater impact achievable through the integration of energy efficiency into the design of the DHS's housing designs as apposed to those impacts attainable through comprehensive retrofitting ex post (Sustainable Energy Africa 2014). Therefore, the implementation of energy and thermal efficiency interventions in Joe Slovo 3 happened thanks to the inclusion of innovative designs of architects and the sustainable energy advisors appointed to work on this project. The assignment of creative terms of reference for these consulting architects and advisors was a result of the project's national flagship status and the grant allocated by the Kingdom of Demark and top-up funds being provided by the Western Cape Provincial government (Sustainable Energy Africa 2014).

A number of creative and simple interventions were incorporated in the housing design, including being equipped with energy-efficient water heating via gravity-fed solar water heaters whilst energy-efficient CFL lights were provided in the new houses. Further thermal efficiency measures included double-storey houses with shared walls that have been plastered and painted on the outside, roof overhangs to shade windows in summer but allow solar gain in winter and orientation was north-facing as far as is possible in a complex development, and all houses being equipped with insulated ceilings (Sustainable Energy Africa 2014).

Additionally, policy alignment between different government departments and across spheres of government made this development possible. The DHS worked with the Western Cape provincial government as well as the City of Cape Town on this development. It cost more (ZAR 86 100 / ±USD 7110) to build a double-storey house than a typical BNG house (ZAR 68 612 / ±USD 5170) because of additional construction costs as a result of putting in a more substantial foundation slab, stairway and other construction items. However, innovative design led to a reduction in service infrastructure material use and costs (water, storm water drains, sewage and electricity) per household due to densification. Because of the density each metre of road or sewer or water pipe services more people. Being a double-storey development, savings were realised on the roof costs due to a smaller roof area per dwelling compared to other typical RDP or BNG houses. Costs were also reduced in the delivery of the infrastructure by paving the alleyways and courtyards instead of using bitumen. Infrastructure cost savings outweighed the increased housing construction costs (Sustainable Energy Africa 2014).

The implementation of energy and thermal efficiency interventions in low-income government-subsidised housing will require creative thinking around how to integrate these interventions within the available (government subsidy) budgets. It has been noted that there are a number of limitations

to integrating new, innovative delivery solutions into government building specifications and designs (Sustainable Energy Africa 2014). These limitations are not unique to the issue of housing delivery and they transverse a number of well-articulated institutional and process barriers to mainstream climate change-related investments in the South Africa public sector (Technical Assistance Unit & Western Cape Government 2013). Furthermore, South Africa's public sector financial management legislation (i.e. the Preferential Procurement Policy Framework Act, the Public Finance Management Act and the Municipal Finance Management Act) instils caution amongst public sector bureaucrats that is often seen by those tasked with execution as being, "excessively rigid, at times confusing, costly and time-consuming" (Technical Assistance Unit and Western Cape Government 2013). This legislation (ensuring transparent and prudent public financial management) has been seen to stifle innovation in the delivery of public sector services and investments (Technical Assistance Unit & Western Cape Government 2013). The resulting culture promotes an excessive risk-averse attitude identified by a number of officials involved in public procurement as having a negative impact on new technologies and innovations addressing climate change challenges (Technical Assistance Unit & Western Cape Government 2013).

When considering the process by which the Joe Slovo Phase 3 project was implemented, the following may be relevant for the discussion regarding the implementation of mitigation measures within a developing country context:

- The high national profile (i.e. DHS flagship status) facilitated cooperation between different spheres of government, enabling innovative attention to design and helped attract donor support.
- Donor support was essential for innovative additional design features that were beyond the usual standard government specification. Now that usefulness has been demonstrated there is an increased likelihood of interventions to be adopted in future approaches. However, well-intentioned public-finance legislation can often stifle innovation initiated by officials looking to deliver services in new and innovative ways.
- Most features of the project were completely replicable (except additional funds from donor for the provision of solar water heaters) so could be easily extrapolated into general practice.
- Pre- and post-implementation community surveys clarified how the community experienced interventions and financial savings which was important positive reinforcement for DHS to consider scaling-up the interventions to other projects.

Conclusion

Observation based on the above case studies and lessons identified suggests that there are two key aspects to the consideration of how implementation takes place in relation to interventions that reduce GHG emissions. Firstly, there is the process by which implementation occurs and, secondly, there is the impact of an implemented action. The first aspect allows for researchers to draw on the body of knowledge focusing on how public policy implementation happens, specifically the interactions between policy actors, constituencies of decision-makers and the flow of decision-making steps that lead towards an implementation goal being identified. A helpful framework here is that which is proposed earlier in the 5C model (Najam 1995) outlining the importance of content, context, commitment, capacity, clients and coalitions when analysing the process by which public policy implementation occurs (i.e. the introduction of a national standard for mandatory EE measures for new residential buildings in South Africa). Meanwhile, the second aspect describes the execution

of activities that lead to the achievement of a public policy goal (i.e. a reduction of GHG through a reduction in energy usage through a change made to a residential building).

These two aspects describe what authors have described as the evolutionary process by which implementation occurs (Majone & Wildavskey 1978, Najam 1995). Najam (1995, p. 34) frames implementation as, "a dynamic process of negotiation between multiple actors, operating at multiple levels, within and between multiple organisations." In the context of the case studies above the adoption of SANS 10400XA regulations could be viewed as implementation (in the first aspect, adopting a process by which implementation will happen) whatever the result of these regulations on the delivery of low-income housing in South Africa now that the DHS (as of 1 April 2014) recognises the standard. Notably the experiences of the SSF (including the Kusaya CDM Pilot Project) and the Joe Slovo Phase 3 housing may provide useful guidance on the practical execution of these regulations (touching on the second aspect, the execution of a policy goal) but are not systematic examples of large-scale execution of policy. As such, implementation could be seen as being as much about policy objectives as it is about understanding the dynamic and iterative engagements amongst various actors executed at various scales over time.

Whilst seeking useful lessons for practitioners in the field, a contradiction is faced: to understand why implementation does or does not happen one needs to look at the detail. Higher-level assessments and distillations of key elements, such as those by Kay (2009) and Najam (1995) are useful but are not detailed enough for those practitioners grappling with execution of public policy directives (in this case, the directive to reduce GHG emissions). On the other hand, when one looks at the details of specific implementation examples, it is noted that generalisations are often less helpful and factors such as a mind-set of systematic opportunism amongst those responsible for execution becomes an important factor within the idiosyncrasies of political and bureaucratic systems. One practitioner interviewed for this particular case studied lamented: "Often policy makers go about designing policies with no idea of how the implementation will look. Designing policies in a 'blue sky' scenario is one thing, layering that with the messiness of implementation is another, a very important consideration that is often missed."

Notwithstanding, in the case of energy and thermal efficiency in government-subsidised housing in South Africa, there are some general lessons that have either hindered or supported implementation that could be drawn from the analysis above to assist practitioners working on GHG mitigation actions. However, the specifics of implementation of one technology or project are not necessarily as transferable as one would hope. Granting the limitation of how transferable these lessons may be, three observations could be made that may assist practitioners:

1. Using "the stick" approach to drive implementation forward can be valid and effective.
2. The importance of consensus forming should not be undervalued.
3. Dexterity is required to be exercised by executing agents, given the non-linear and complex process of implementation.

The use of "the stick" to drive implementation forward can be valid and effective

When considering the question of what has been the key lever for change for energy and thermal efficiency considerations in the delivery of government-subsidised housing in South Africa, it could be argued the DHS was compelled by SANS 10400XA to rollout basic thermal and energy efficiency at scale. It is probable that the DHS would have continued to deliver standard low-income houses if there was no external factor forcing it to adopt

new EE specifications. Whilst the two other profiled case studies (i.e. the SSF and Joe Slovo Phase 3) may have provided pilot projects that could have informed the way future housing would have been delivered, it appears that promulgation of the SANS 10400XA regulations resulted in a step-wise change in the way the DHS procures new low-income housing developments. Whilst a number of initiatives were working diligently to find innovative incentive mechanisms for the problem, the public procurement systems were only modified substantially following arrival of the national norms and standards that took into account the directives of SANS 10400XA.

Policy implementation is as much about policy objectives as it is about understanding the iterative engagements amongst policies' various actors. In the case of the SANS 10400XA regulations it is noteworthy that an action that ultimately impacted on energy efficiency and housing was not spearheaded out of neither the DOE or the DHS but rather the DTI. The bodies setting the implementation goal are not directly those that are and will be responsible for execution of the new standards. It would seem that in this particular context "the stick" approach of using a compliance mechanism compelled the DHS to incorporate basic energy and thermal efficiency measures across its new-build programme.

The art of consensus forming should not be undervalued

Najam (1995) noted that the support of clients and coalitions whose interests are enhanced or threatened by the policy, and the strategies they employ in strengthening or deflecting its implementation, are critical considerations for implementation. For example, the Thermal Insulation Association of Southern Africa had strong interests in building a coalition to write SANS 204 in order to ensure that the initial research concluded with the CSIR was taken up into regulation, thereby expanding its members' market base. The three case studies in the paper showed that a number of parallel consensus building processes took place to support the implementation of a policy target of EE in buildings. The most effective of these highlighted that there was either a single or a group of "policy entrepreneurs" within key government departments or ministries who took a psychological responsibility to see it through to execution (Roberts & Kind 1991). For example "policy entrepreneurs" were critical in the success of the adoption of SANS 10400XA and the EE measures included in Joe Slovo Phase 3A. Critically, the SSF seems to not have attracted either a "street-level bureaucrat" or a "policy entrepreneur" within key government departments to its cause, limiting its ability to capture a coalition of supporters to drive forward implementation. The identification of key actors and coalitions being impacted by the implementation is important for consensus building from the inception of an implementation plan.

Dexterity is required to be exercised by executing agents given the non-linear and complex process of implementation

It would appear that reasons for implementation success or otherwise are often complex and political, and it is seldom a linear process. What works or doesn't often seems irrational and chaotic. Furthermore, it is often linked to specific timing around political and bureaucratic trends or events. However, within this non-linear process there are some considerations:

- **Operating on multiple fronts may be of help:** Working on several fronts at the same time is important because of the unpredictability and lack of rationality of the environment. Considering the multi-dimensional nature implementing climate change policy, it is seldom that a single point of intervention will be able to autonomously implement a GHG mitigation action. However, the coordination of mandates and managing the relationships between different implementing agencies can frustrate a multi-foci approach to policy execution.

- **Systematic opportunism**: An implementer's ability to be opportunistic is important. Key political moments are important considerations for policy implementers as they galvanise senior leadership to commit towards moving forward on a particular agenda. The ability to identify and capture these political moments is an important skill for "street-level bureaucrats" or "policy entrepreneurs". For example energy efficiency policy within the DoE and Eskom appeared to receive traction as a result of the energy supply crisis of 2008, while the SANS 10400XA received high-level political support in the wake of the infrastructure build for the 2010 FIFA World Cup and ahead of hosting the UNFCCC COP17.
- **People animate systems:** Implementation is a complex, dynamic political process as much as it is a mechanical, administratively bureaucratic process. The concept of having at least one person acting as a champion or within a group of champions within the system or process appears important. By nature this makes progress unpredictable at times. An example would be the DoE's apparent lack of capacity to carry out and execute much of plans identified in their own EE strategy. Following the strategy's preparation (with external capacity support by donor funds), the process of strategy compilation seems to not have built sufficient capability to execute tasks without new resources being allocated internally to the DoE (Roux 2012). Is important to understand the capacity of the human resources tasked with policy implementation at various levels when considering how effective execution takes place.
- **Temporal considerations (i.e. how long actors expect policy changes, and the associated implementation processes, to take):** It should be recognised that some change takes time to filter through systems especially when there are multiple policy imperatives being considered by those responsible for implementation. For example the introduction of new thermal and energy efficiency in buildings only applies to new buildings and renovations. It will take generations for the majority of South Africa's buildings to meet the mandated energy and thermal emission standards. Another example would be the lessons learnt from Joe Slovo Phase 3 and the influence that these lessons will have on the DHS in the delivery of future housing and/or the retrofit of housing already delivered.

In closing, what will trigger further implementation in South Africa with regards to thermal and energy efficiency in government-subsidised housing in South Africa? The planned revisions of SANS 10400XA during 2016 will potentially trigger an increase in the levels of thermal and energy efficiency in such housing. Additionally, it would appear that there is a need to determine a sustainable financing mechanism for the adjusted housing quantum to meet the SANS 10400XA and maintain any of the interventions installed. With a constrained fiscus the public funds available to the DHS are not enough alone to balance delivery and cost with an increased quantum. Whilst the DHS move from providing free houses to site-and-service (where public funds are responsible to secure tenure and bulk infrastructure and municipal services) will alleviate some of this burden, there will still need to additional funds raised or innovative re-prioritisation of resources to meet housing demands in South Africa. This raises the point that if the savings from EE interventions are found in the full delivery (including infrastructure) then this value may be hard to capture under a move to site-and-service. Furthermore, the DEA's role as the coordinator of the near-term priority flagships under the NCCRWP should be aware of the importance of translating each of the initiatives objectives on a tactical and operational level where they are supported by clear institutional arrangements, systems and processes that aid execution.

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