“Biting the hand that feeds you: green growth and electricity revenues in South African metropolitans”

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Biting the hand that feeds you: green growth and electricity revenues in South African metropolitans

Abstract

Local governments are central in green growth (green economy) transition. They set framework conditions for investments, draw up incentives and finance, inform private behavior and drive local innovation and scaling up. Consequently, South African metropolitan municipalities have been engaging with the green growth transition agenda as informed by the need to mitigate negative impacts of climate change through green growth transition strategies. Green growth transition is, however, associated with both risks and opportunities for local governments, especially when one considers electricity revenues. Through a case study of the impact of mitigating the demand for coal generated electricity demands in the Johannesburg, Tshwane and Cape Town metropolitan municipalities, this research sought to identify risks associated with such transition so that these are minimized whilst opportunities are enhanced. Among the key measures aimed at mitigating demand for this 'dirty' electricity, the retrofitting of energy efficient technologies in municipal and private facilities and the use of renewable energy sources (dominated by the use of solar technologies) are the most prominent. This paper, however, finds that the use of these technologies poses the risk of 'biting the hand that feed the metropolitans'. This is so given that significant revenue is generated from rates charged on usage of this dirty electricity. The conclusion from this work is that whilst there is pressure for metropolitan municipalities in South Africa and globally to embrace the green growth agenda, due diligence must be undertaken to minimize the risks associated with this transition.

Key words: South Africa, metropolitans, green growth, risks, opportunities, climate change
JEL Classification: Q56

Introduction

Climate change is perhaps the twenty first century's most enduring problem. Its impacts are real, demanding urgent and decisive action to address. The relevant actions must be directed at minimizing its adverse impacts and where possible, ensure that drivers to further changes in climate are minimized and/or eliminated altogether. Where damage has been done, the challenge is to learn to live with such consequences.

The adverse impacts of climate change are especially acute in developing economies. Here, urban areas (cities and towns) with their rapidly growing populations, the majority of whom are poor are the most vulnerable to climate-related disruptions (United Nations Human Settlements Programme, 2011; Balk et al., 2007). Concerns about the adverse impacts of climate change are forcing local government bureaucrats and elected officials to devise ways that can presently and in the future, effectively and simultaneously deal with their triple mandates of (1) delivering affordable, reliable and adequate services satisfy the needs of both the rich and poor; (2) attracting investment that ensures economic growth; and (3) ensuring development that address environmental concerns, in other words meet the first two mandates in a context of practices that ensure "green cities". These objectives in principle appear to be in irreconcilable opposition because the inherent nature of cities as net consumers of commodities and emitters of waste some of which has deleterious effects on the climate. However, this seemingly irreconcilable opposition is not a licence for a *laissez-faire* approach to addressing the respective challenges. Instead, it has been and continues to be the center of efforts to address, if not minimize the conflicting mandates of local authorities.

South Africa is a country that has and continues to undergo transformation aimed at addressing the legacies previous discriminatory infrastructure delivery practices. One of these transformations involves the supplying electricity to previously excluded populations. This is taking place in a country with a predominantly urbanized population comprising 63% urban population (Republic of South Africa, 2013). Projections are that urbanization is likely to reach 70% by the year 2030 (Ibid). Statistics show that between the years 1996 and 2010 the proportion of households with access to electricity increased from 58% to 83% (Investec, 2012). Increases in urbanization explicitly imply an increase in electricity demand for both domestic and for industry/commerce uses. Estimates indicate that 93.5% of the country's electricity is fossil fuel (mainly coal) generated (Haw and Hughes, 2007). Nuclear generated power accounts for 5.5% and hydro-power accounts for the balance (Organization for Economic Cooperation and Development, 2008). Although some local governments such as the municipalities of Johannesburg and Tshwane have the electricity generating plants, the state-owned power utility firm ESKOM is a dominant player in the sector in both generation and high-voltage distribution. ESKOM,

owns and operates 20 power stations which generate approximately 98% of South Africa's electricity. The company also owns and operates the national transmission system (Mbendi Information Services, 2014).

Following this introduction, this paper begins with a brief outline of the research methodology that guided this research. Thereafter, it briefly discusses climate change mitigation and adaptation theories. The next section locates local governments within the South African government structure. This section also outlines the importance of local government in climate change mitigation and adaptation works. It also outlines current and planned mitigation and adaptation practices in the three metropolitan cases. This is followed by a section that presents and discusses the research findings and a final section that draws conclusions.

1. Research methodology

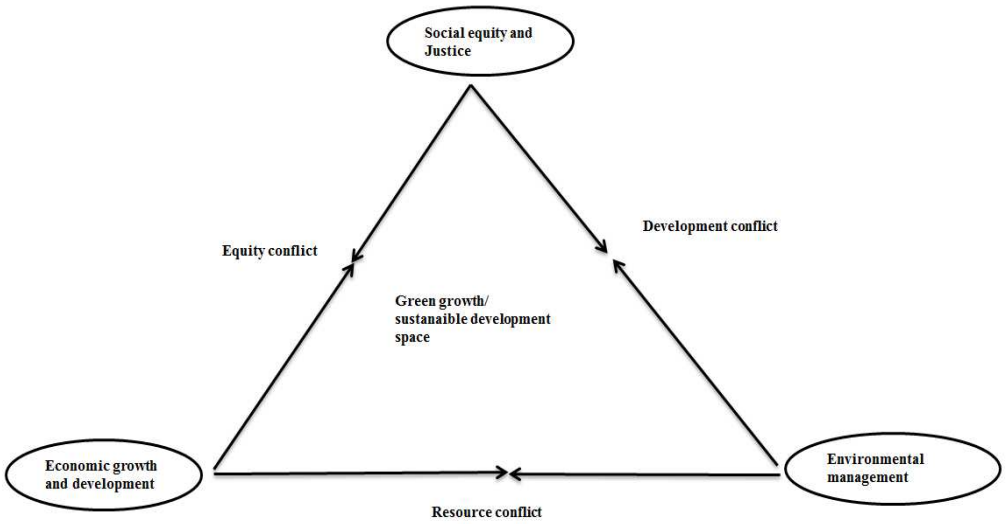
In this paper, we examine the challenges that local authorities face in meeting their seemingly conflicting mandate. We examine this through a narrowly focused lens of the seemingly contradictory mandate of climate change mitigation through the adoption energy efficient technologies against revenues accruing to local government for the electricity supply services via the 'dirty' traditional national electricity grid of South Africa. We adopt a case study approach, focusing on three South African metropolitan municipalities of Johannesburg (the commercial capital), Tshwane (the center of government administrative bureaucracy) and Cape Town (the home of the national parliament of South Africa and a prime tourism destination). We specifically address two research questions: (1) What are the trends in electricity consumption and revenues generated in selected metropolitan municipality? (2) What risks does green growth transition (and climate change mitigation) related initiatives like energy efficiency and renewable energy have on the metropolitan municipalities revenue?

Noting the challenges associated with accessing the relevant data from South Africa's eight metropolitan studies, we adopted a case study approach (see Yin, 2009), focusing on three South Africa metropolitan municipalities as outlined before. We adopt an instrumental case study frame based on the belief that the lessons and conclusions drawn from this study offer general learning points that may apply to other metropolitans, cities and towns in South Africa and even beyond.

Furthermore, the research is situated within the policy analysis realm. This is a field that locked us in document analysis. Document analysis (also called document review) is a research method that involves the gathering and analysis of documents such asacts of parliament, government policy documents, private documents that include letters, diaries and artistic expressions that contain information detailing the phenomenon under study (Payne and Payne, 2004; Bailey, 1994). This paper accessed and analyzed data from publicly available policy documents dealing with climate change, green growth (green economy), general environmental and sustainable development. The metropolitans' financial reports were specifically targeted with a special interest on the relationship between the adoption of 'green' practices in the energy sector and trends in electricity consumptions and municipal revenue from charges related electricity supply services.

Data analysis and discussion was based on the 'triangle of conflicting goals' framework. Campbell (1996) used this framework in an analysis of contradictions, of sustainable development and urban planning (Figure 1). The author equates the three corners of this triangle to three perceptions of a city. One corner represents the need for economic development driven by the consumption of resources, including natural resources to create public and private goods. Cities compete to provide these goods in a quest to attract investment. The second corner represents the environment. In this corner the city is viewed as a consumer of resource and producer of waste. In this context the city can be viewed as being in perpetual conflict with nature as it expands clearing land for settlements and business enterprise and in the process producing even more waste and consuming energy (Ibid). The third corner represents the social justice that ensures equity in the system that is fair and just to both the affluent and the less affluent.

Campbell (1996) states that the three corners are joined by three axes that are characterized by conflicts along each of the threes axes. He further adds that the area bounded by the three axes represents the balance of three goals of achieving equitable development with minimal negative impact on the environment, in other words sustainable development. Sustainable development has remained the over-arching framework in which green growth transition is viewed as one of the many tools for achieving it (Nhamo, 2013). In this paper, we adopt this framework, paying particular interest in the provision of electricity as the unit of analysis.



Source: Modified after Campbell (1996)

Fig. 1: Triangle of goals

Part of the work confronting local governments in South Africa is the need to address historical discriminatory practices by connecting previously disregarded populations to the supply grid and simultaneously ensuring that there is adequate electricity to drive commerce and industry and mitigating climate change. A key realization is that balancing these three conflicting objectives (the center of the triangle) is in principle and practice possible, at least to an extent. The compromize is the green growth transition space; a discourse born directly from the sustainable development discourse. Its main argument is that not only are economic growth and development compatible with environmental protection but in fact, protecting the environment can actually yield better growth (Jacobs, 2013). This discourse confronts the challenge of compatibility of growth and environmental protection head-on. The response to the challenge general falls into two broad theories and practices: climate change mitigation and climate change adaptation.

2. Understanding climate change

When examined from the original United Nations Framework Convention on Climate Change (UNFCCC) view point, climate change and mitigation practices are fundamentally dissimilar in practice and approach but also complimentary to an extent.

Mitigation refers to anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases, GHGs (International Panel on Climate Change [IPCC], 2001). In practice, mitigation comprises all human activities aimed at reducing the emissions or enhancing the sinks of greenhouse gases GHGs such as carbon dioxide, methane and nitrous oxide (Klein et al., 2005; Goklany, 2005). Energy generation, especially coal fired power plants, adds to the emission of GHGs. Hence, any measure to mitigate climate change should ideally focus first on reducing fossil fuel generated electricity consumption.

Adaptation on the other hand, refers to all adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities arising from climate change (IPCC, 2001). The aim of these adjustments is to moderate the adverse effects of climate change and/or to exploit any arising opportunities. Laukkonen et al. (2009) state that the difference between the two approaches is that whereas mitigation aims to avoid the unmanageable, adaptation instead aims to manage the unavoidable. This dichotomy of actions is the source of differences between mitigation and adaptation practices, policies and action levels. Klein et al., (2005) identify three fundamental differences between the two approaches. These differences relate to: (1) the spatial and temporal scale of their effectiveness and practice, (2) the cost and benefits of each approach; and (3) the actors and type of policies around the two approaches.

With regards to spatial and temporal scale, mitigation measures are implemented in varied spaces that include the local, regional and international levels. In principle and practice mitigation has global benefits, that is, reduced GHG benefits the global climate and not only the local climate (Klein et al., 2007). Generally, effective mitigation practices require

action from a large number of actors (Klein et al., 2007). This is because the climate impact of GHG emissions is not localized but is instead global. Given the central role of municipalities, such may not be seen to be doing nothing. As a result, McKibbin and Wilcoxen (2004) argue that mitigation is best suited for international and national level emphasis. Adaptation on the other hand relates to a local system which at best extends to a regional level (Klein et al., 2007). This is because adaptation practices have to suit specific local (and regional) realities relating to varied geographic, institutional, infrastructural and resources issues among others (Ibid).

Climate change mitigation and adaptation further differ with regard to the cost and benefits of their implementation. Generally, mitigation involves technology and infrastructure related investments all focused on using renewable energy source and/or improving energy efficiencies. This means that the monetary cost of implementing mitigation strategies can be determined and evaluated and where possible compared with alternative routes. Adaptation presents difficulties in costing because adaptation costs relate to avoided losses to human, cultural and natural values in addition to monetary loses. Human, cultural and natural value losses are very difficult assign pecuniary value. Further differences relate to the typical benefits of adaptation measures and practices that are immediately effective as is witnessed by reducing vulnerability to the adverse impacts of climate change in comparison to mitigation benefits which are realized after longer periods (Klein et al., 2007). For example the impact of reduction in GHGs emissions on the climate (mitigation) are not likely to be as immediate as adaptation measures like the impact of a dam built to mediate the impact of climate change-induced seasonal dry spells.

The players, policy types and levels active in climate change mitigation and adaptation work also differ. Typically, mitigation relates to the energy, transportation and to an extent the forestry and agriculture sectors of developed and developing countries (Klein, Schipper and Dessai, 2005). This limits the number of players in the mitigation implementation. These players are often organized and linked to national planning and policy making. In contrast, adaptation work involves a wider range of players that are in both the private and public sectors. In addition the players are in diverse sectors that include: agriculture, natural resource management, urban planning and coastal management among others (Ibid). A distinguishing characteristic of adaptation practice players is that whilst they are affected by climate change, they are not the typical and primary decision makers on the adoption of adaptation measures. Often these players have other primary concerns outside climate change. For example, in countries with food shortages players in the agricultural sector may be solely concerned with producing adequate food (Klein, Schipper and Dessai, 2005).

Klein et al. (2007) argue that despite the differences, mitigation and adaptation do not only work in tandem but are in fact synergistic. They argue that the perceived differences arise because stakeholders in the climate change space often emphasise different aspects of mitigation and adaptation in their work. They define four types of interrelationship between the two as follows:

1. *Adaptation actions that have consequences for mitigation*. These actions have energy use implications which pose serious challenges where energy supplies are fossil fuel based. An example of this relationship is in the case of adapting to heat-waves. A typical response to this would be the installation of air conditioners, a practice common in hot regions like East Africa, West Africa and the Middle East. Where electricity is generated by burning fossil fuel, the need to increase electricity demands to power the air conditioners without increasing GHG emissions offers the opportunity for alternative energy sources that produce less or no GHGs (Klein et. al., 2007).
2. *Mitigation actions that have consequences for adaptation*. An example of this association is the case of the use of water from a dam. In a move to manage GHG emissions, hydro-power is a sensible option where water is available. However, this raises a potential area of conflict when irrigating food crops become necessary to mitigate the impacts of climate change on precipitation patterns.
3. *Trade-offs or synergies between adaptation and mitigation*. McKibbin and Wilcoxen (2004) state that ideally it would be beneficial to simultaneously adopt and implement both climate change mitigation and adaptation practices. However, finite resources often limit the ability to adopt and implement both practices. An example of a trade-off is a scenario where long term GHG emissions paths and magnitude are managed in a manner that does not impose excessive mitigation costs on various stakeholders. For example,the absence of carbon taxes to mitigate GHG emissions.
4. *Processes that have consequences for both mitigation and adaptation*. At times it is inevitable to simultaneously consider both mitigation and adaptation. For example, where there is a need to mitigate GHG emissions through a dam

with hydro-power generating equipment, the dam may also be a source of water for irrigation to adapt to climate change induced precipitation patterns (Klein et al., 2007). In this case the water management plan may not explicitly state either mitigation or adaptation as its main mandate.

The complex and dynamic relationship between mitigation and adaptation forms the arena in which local governments have to navigate their unending quest of meeting their triple mandate of delivering affordable, reliable and adequate services, attracting investment and managing the environment.

3. South African local government and climate change

The United Nations Environment Programme (UNEP) (2010) maintains that local governments are formal institutions that are mandated to deliver a variety of public goods and services at a local level. Local governments are therefore based on the principle of subsidiarity. This principle acknowledges that some government functions are best suited to the lowest level of government that is capable (in principle) of undertaking certain functions at a lower level. However, one needs to note that local governments vary in terms of: population size, mandate and functions, available resources (human, financial or natural), location (such as rural versus urban) and linkages with other institutions among others (UNEP, 2010).

In South Africa, local governments comprise the third tier of South Africa's three-tier government structure (Reitzes, 2009). Local government comprises municipalities whose main functions are to provide services that promote social and economic development of local communities. This is done through developing and supplying appropriate and adequate infrastructure and services (Ibid). Local governments in South Africa comprise 278 municipalities made up of eight metropolitans, 44 district municipalities and 226 local municipalities (RSA, 2012). Local governments are superseded by the national and provincial governments. The national government is concerned with setting the broader institutional and policy framework that is aimed at providing a stable and predictable macroeconomic framework. Provincial governments serve to administer laws and implement policies defined at the national and/or provincial level. Provincial legislation is bound by and is subordinate to national legislation where it is deemed to be undermining national security, economic unity, national standards or the interests of another province (Rietze, 2009).

Within this administrative arrangement, climate change mitigation and adaptation straddle the three government tiers. The national government sets the broad policy framework that defines the desired standards, which the provincial and local government need to meet on specific aspects of economic and social issues such as health, education and environmental management. The provincial and local governments in turn set their own specific frameworks within the broad national frameworks as defined by the national government. The country's broad response to the challenges of climate changes are specified in the Constitution of South Africa Act 108 of 1996 (RSA, 1996). The Act specifies the need for a developmental trajectory that uses natural resources in an ecologically sustainable, but also promote justifiable economic and social development. One of the direct products of this constitutional requirement is the White Paper Promotion on Renewable Energy and Clean Energy Development (2002). The paper articulates the need for South Africa to shift its energy portfolio away from its reliance on coal to renewable sources of energy.

UNEP (2010, p.12), thus, argues that in a tiered government structure, local governments are best suited for responding to climate change challenges. This is so because climate change is "often a highly localised affair". The argument is that climate change impacts can affect areas of close proximity differently. As such responses to these effects often require location – specific actions, at specific times. Local governments are therefore best suited first respondents due to their familiarity with the local environment than central government. Local governments as formal institutions that are mandated to deliver a variety of public goods and services (Ibid) are thus at the forefront of coordinating efforts that deal with climate change challenges as well as local economic and social equity challenges. Consequently, a number of metropolitans in South Africa have formulated strategies to deal with the climate change phenomenon and energy efficiency.

As per the National Climate Change Response White Paper (DEA, 2011), local government was identified as playing a critical role in guiding climate compatible development through planning both rural and urban development. Some of the key functions are in providing infrastructure, water, energy demand management, and local disaster risk reduction. To this end the White Paper stipulates that climate change considerations will be an integral component of Integrated Development Planning (IDP).

The White Paper, however, notes certain challenges. For example, the mandate and funding for local government on environmental responsibility (and climate change) are "not always clear" (DEA, 2011, p. 38). To this end, DEA (2011) suggests that a

comprehensive review of legislation relating to local government functions and powers in addressing climate change be instituted by the Department of Cooperative Governance and Traditional Affairs. This activity will be supported through National Treasury's re-examining of existing fiscal measures and appropriate incentives for promoting the adaptation and mitigation agenda at local government level. The lack of institutional and individual capacity is acknowledged and the White Paper says developing such capacity should be prioritized. The White Paper further makes reference to a climate change toolkit that was developed for local government's use in mainstreaming climate change into operations.

4. Key findings and reflection

The key findings come in two major sections. We first deliberate on strategies addressing general green growth transition. Secondly, we focus strictly on trends in electricity consumption and revenue generation and how this addresses the main topic "Biting the hand that feeds you".

4.1 General findings: Green growth transition. Located in the Gauteng Province, the Johannesburg Metropolitan is the commercial capital of South Africa. It hosts a number of key manufacturing, banking, insurances and other service industry sites and headquarters. As host to all these industries and owing to its high population density, the metropolitan contributes significantly to Gauteng's reputation as one of South Africa's highest GHG emitters. To its credit, the metropolitan realized this and in an attempt to mitigate and adapt to the challenges has designated a climate change programme (Liphoto, 2007). The programme aims to achieve three specific objectives, namely: (1) to develop mitigation and adaptation strategies: (2) undertake vulnerability assessments: and (3) establish the city's carbon footprint (Ibid). Since the initiation of the climate change programme, much work has been done.

The City of Johannesburg (2012) reports on a number of mitigation practices that are in places. These include the implementation of the public transport system named the Rea Vaya Bus Rapid system. As a result of fewer vehicles on the road and some of Rea Vaya Buses using greener fuels, it has been projected that the system will lead to savings of about 382,940 tonnes of carbon dioxide equivalent (CO_2e) in emissions by the year 2013 (Liphoto, 2007). Other programmes include tree planting and greening of parts of the city. Of relevance to this paper is the retrofitting of municipal facilities with energy efficient technologies and generating electricity from methane gas from dump sites. A significant and visible practice with regard to clean energy is the Solar Water Geyser Programme (SWGP). The SWGP has been extended to various parts of the city mainly targeting low income formal settlements (Ibid). On the other hand, adaptation practices and plans include the design of Vulnerability Assessment and Risk Management Plan and flood modelling for flood prone areas and disaster response plans (Ibid). Furthermore, the city's 2013/16 Integrated Development Plan (2013) articulates a need to shift the local economy towards a green path that support green production, manufacturing and services.

The Tshwane Metropolitan is the largest municipality in South Africa by land area covering 6,260 square kilometers (City of Tshwane, 2012). The city's economic activity is service-based led by government and financial services sectors (City of Tshwane, undated). The city hosts a number of manufacturing firms led by the automotive industry that include manufacturers such as Ford, Volvo, BMW and Nissan. These activities contribute to the city's high GHG emission levels.

Like other metropolitans in South Africa, the City of Tshwane has a number of initiatives aimed at mitigating and adapting to climate change. Mitigation practices in the metropolitan include the retrofitting of buildings with energy efficient lighting and the establishing a rapid bus transit system aimed at encouraging the use of public transport instead of private vehicles. Speaking at the Tshwane University of Technology Public Officials Energy and Environment Workshop in 2013, the Tshwane Executive Mayor outlined the following as the City's main mitigation and adaptation strategies in addition to strategies under implementation: (1) developing a municipal hydro-power initiative using the city's water supply system: (2) establishing efficient systems and processes for the operation and long-term sustainability of the two City of Tshwane coal-power stations (Pretoria West and Rooiwal): (3) developing a solar park to generate 20MW of electricity using photovoltaic (PV) panels: (4) plans to generate renewable energy fuels such as biogas and landfill electricity using gas from sewage and wastes at municipal treatment facilities, and (5) to support and promote the use of low-carbon renewable transport fuels such as electric-powered vehicles and the displacement of petrol and diesel with biofuels and Concentrated Natural Gas (Ramokgopa, 2013).

The City of Cape Town hosts the national parliament of the Republic of South Africa. Unlike Johannesburg and Tshwane, the city hosts less manufacturing industry and is dominated by service industries. The City's energy supply is dominated by electricity supplied from the national grid. The elec-

tricity is largely fossil fuel generated and coal-fired electricity contributes up to 85% of the city's electricity (City of Cape Town, 2011). The balance is provided by burning of other fossil fuels and nuclear generated electricity from the Koeberg nuclear power station.

As a coastal city, parts of Cape Town face the risk of flooding as a result of climate change induced a rise in sea levels. To that and other ends, the city has taken a number of measures to mitigate and adapt to climate change. The city was the first metropolitan to adopt to an integrated Metropolitan Environmental Plan (IMEP) in 2001 (Mokwena, 2009). A key objective of the IMEP is its recognition of the need to balance the various aspects of environmental vulnerabilities and concerns with variable and varied human vulnerabilities and concerns. Although the IMEP forms the basis of the city's response change to climate change, it has been supported by a number of other initiatives that include the City's Energy and Climate Change Strategy (2005) and the Framework for Adaptation to Climate Change in the City of Cape Town (2006).

Measures on the mitigation front include the retrofitting of energy efficient bulbs and systems in the municipal buildings (City of Cape Town, 2013a). The city is also a beneficiary of the central government programme called the Municipal Energy Efficient Demand Side Management (EEDSM) Programme (City of Cape Town, 2013b). Through this programme the city has worked on its street lighting, traffic lighting and municipal buildings making them energy efficient. In addition to this work the City has embarked on a programme targeted at replacing 400,000 electric water geysers with combined electric-solar water heaters in middle and high income residential areas aimed at realizing 6% electricity saving for the city and significant financial savings for the concerned households (City of Cape Town, 2011). Furthermore, in 2011 the city embarked on a programme to install solar water heaters in low-income households. Adaptation work on the other hand has been driven by city-supported research activities that provide the basis for adaptation work in Cape Town. Work on this front includes risk assessment studies that were conducted to shed light on the threats of rising sea levels. The studies have informed the City of Cape Town's work and proposals on land-use management in coastal areas and the citywide spatial plans (Mokwena, 2009).

A common thread of the three cities is that mitigation strategies are all aimed at minimizing electricity consumption, which indirectly means a reduction in GHG emissions. Solar water geysers and the use of low energy lighting are leading practices in the three metropolises. In theory, these practices should have led to the reduction of energy consumption and perhaps the cost of grid-sourced electricity for consumers that have adopted these energy efficient technologies and solar energy a renewable (and alternative) energy source for some functions. Table 1 presents a summary of green growth transition in the case study metropolitans as viewed from the policy landscape.

Table 1. Green growth transition through the policy landscape

City of Cape Town	City of Johannesburg	City of Tshwane
2012: Information and Guideline Document on the Implementation of Green Procurement in the City of Cape Town. 2011: Environmental Awareness, Education and Training for City Staff and Councilors 2011: Public Environmental Awareness, Education and Training Strategy 2010: Report on Energy and Climate Change – what the City is doing 2010: Energy and Climate Change Action Plan 2009: Local biodiversity Strategy and Action Plan 2009: city of cape Town environmental Agenda (2009-2014) 2008: Framework for a Strategy and Action Plan for the Management of Invasive Alien Species 2007: Energy and Climate Change Strategy 2003: Coastal Zone Management Strategy 2001: Integrated Metropolitan Environmental Policy	2013: City of Johannesburg Integrated Development Plan 2011: City of Johannesburg Integrated Waste Management Plan 2011: Johannesburg 2040 Growth and Development Strategy 2009: City of Johannesburg Biodiversity Strategy and Action Plan 2009: Climate Change Adaptation Plan 2008: City of Johannesburg State of Energy Report 2008: City of Johannesburg Economic Development Policy and Strategy Framework 2006: Climate Change programme 2003: State of the Environment Report	2014: City of Tshwane Green Economy Strategy (Under preparation) 2013: City of Tshwane Integrated Development Plan 2010: Green Buildings By-Law 2009: Green Buildings Development Policy 2007: The Tshwane Integrated Environmental Policy (TIEP) Implementation Plan 2006: City of Tshwane: State of Energy Report 2006: State of the Environment Report for the City of Tshwane 2005: Air Quality Management Plan for the City of Tshwane Metropolitan Municipality 2005: Sustainable Energy and Climate Change Strategy 2005: Environmental Noise Management Policy 2005: Tshwane Environmental Education Awareness Strategy

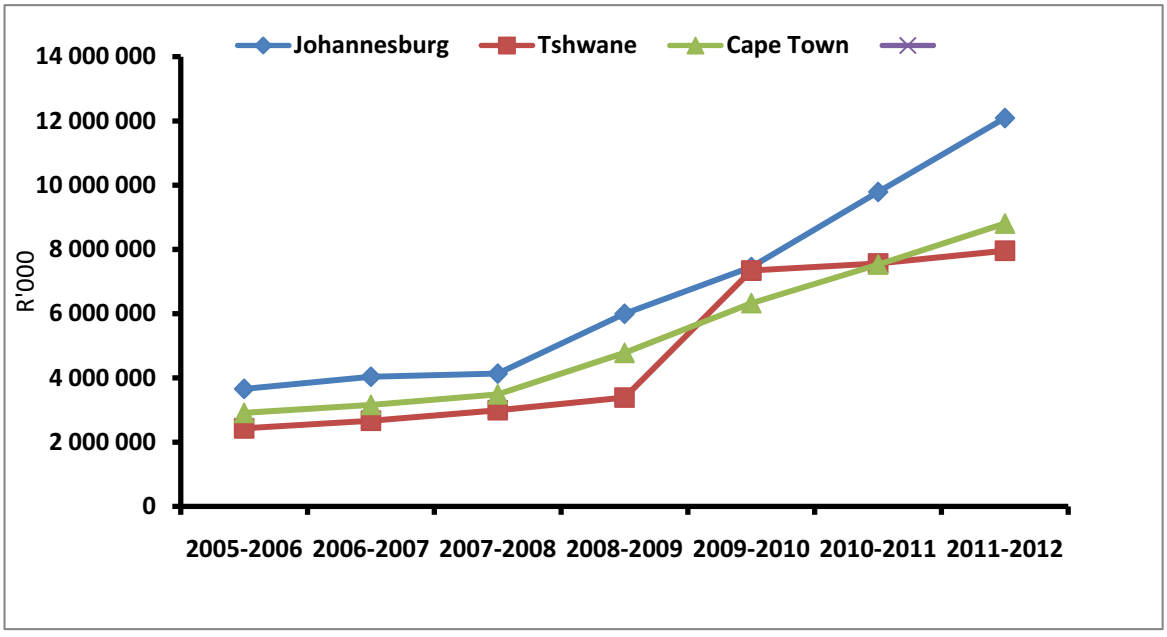
Source: Authors (based on www.capetown.gove.za, www.joburg.gov.za and www.tshwane.gov.za, accessed January 10, 2014).

Green procurement issues will no doubt be a permanent feature on the green growth transition agenda globally and in South Africa. The guideline document for implementing green procurement in the City of Cape Town is part of the Supply Chain Management Policy (City of Cape Town, 2012, p. 2). In the document, green procurement is defined as "a public procurement system with intent to maximize its benefits and minimizing its disadvantages to the natural environment and associated resources, thereby promoting environmental sustainability by applying the procurement processes". Key to the

guideline document is the issue of climate change that is indicated as cutting across global spatial boundaries and the need to influence green living. Green procurement is viewed as promoting six principles namely: wise use of resources, polluter pays, duty of care, full life cycle responsibility, cradle to grave (and we will add to cradle), and precautionary principle. The tender evaluation committee of the City of Cape Town is encouraged to take into consideration generic selection criteria that promote green procurement (City of Cape Town, 2012, p. 6), among them:

- Reduction of virgin material requirements of products.
- Ensuring highest recycle material content of products.
- Minimising waste in manufacture.
- Minimizing energy consumption during manufacture and operations.
- Minimising carbon emissions during manufacture, delivery, operation and disposal.
- Minimising the use of hazardous material.
- Encouraging use of environmentally certified suppliers.
- Promoting low maintenance.

4.2. Specific findings on electricity consumption and revenues. Typically, local governments in South Africa purchase bulk electricity from ESKOM for distribution within their jurisdictions. To recover the cost of purchasing bulk power from ESKOM as well as fund the operational distribution costs (and in some cases the running of own power generation plants), local government charge consumers a fee for electricity supplies. The general practice is that municipality electricity tariffs track ESKOM charges. This makes electricity and related-services supply a major source of revenue for local governments in South Africa. Statistics from the 2005/2006 to 2011/12 financial years show that revenue collected from charges for electricity and related services collected by the three metropolitans have been rising (Figure 2). The figures include erevenues from both domestic and commercial consumption of electricity. The pattern of increases mirrors the ESKOM charges. The early years of democracy saw an ESKOM that had a generation, excess reserve because of massive generation capacity investment in the 1970s and 1980s (Newberry and Eberhard, 2008; Eberhard, 2004).



Source: Authors (based on various available sources).

Fig. 2: Electricity supply revenue in Johannesburg, Tshwane and Cape Town (2005-2012)

In these early democracy years ESKOM engaged in a massive electrification programme that was meant to address historical discriminatory electrification programmes. The excess capacity of this era was used to maintain low wholesale electricity prices (Newberry and Eberhard, 2008). However, in the last half of the first decade of the 2000s supply began to be constrained. The effect of these constraints and reforms in the energy industry were sharp increases in electricity prices from 2008/2009 onwards as indicated in Figure 2. These increase further mirror the metropolitans' growth in size, population and economic activity. For example, in 2011 the City of Tshwane grew in size and population by incorporating three municipalities: Metsweding, Nokengtsa Taemane and Kunguwini (City of

Tshwane, 2012). With a less dramatic growth in the size of land under its jurisdiction, Johannesburg's population is, however, reported to be growing faster than that of its host province, Gauteng (City of Johannesburg, 2012) and of cities such as Cape Town. This growth is attributed to Johannesburg's lure as the commercial capital of South Africa hosting a range of manufacturing and services industry (Ibid).

In principle the growth in the area, the size of the economy and population and increases in electricity tariffs should account for the increases in the collected revenues. This is true because in theory, such increases should lead to increased electricity demand, which translates to burning more coal to ensure an adequate and reliable supply of electricity. Such a scenario would and does present a seemingly irreconcilable conflicting objective for the local government bureaucrats and elected officials. The triangular conflict arises from the need to manage environmental concern in one corner against the need for economic development in the second corner and the need for social justice that ensures equity in the system in the third corner. However, the increases in the revenue collected from the supply of electricity coincide with the period of increased awareness and adoption of climate change mitigation practices in the three metropolises. In theory, mitigation interventions should have slowed the growth of revenue by decreasing grid-electricity consumption. Therefore, at face-value a growth in revenue collected for electricity supplies presents a contradiction. This, possibly due to the incubation and uptake of energy efficiency programmes being promoted under the green growth agenda.

A green growth tide might be finding its way into the affairs of the metropolitans. An examination of electricity consumption trends appears to support this view. For example, electricity consumption trends in the City of Johannesburg show a decrease between the period 2009 and 2012 (Table 2). Surely, reduced electricity consumption results in reduced revenues.

Table 2. City Power (Johannesburg) electricity sales and purchases (2009-2012)

Measure	Unit	2011/2012	2011/2010	2009/2010
Bulk purchases	Megawatt hour	13,064,152	13,116,388	13,117,250
Direct costs of bulk purchases	c/kWh	56.7	47.7	36.5
Electricity sales	Megawatt hour	10,129,266	11,72,961	11,633,380
Growth in sales	%	-10.2	3.1	3.7
% reduction in electricity consumption	%	3.7	4.7	3.7
Number of customers	Number	422, 367	407,906	345,523

Source: City Power (2013).

Table 2 presents figures from the City of Johannesburg-owned power generation and distribution firm City Power. The figures show that a growth in customer base does not necessarily translate into growth in electricity (volume sales). The table shows two interesting issues: (1) an increase in the unit cost of electricity (c/kWh) marked by 35% difference between the bulk unit cost of bulk electricity in the period 2009/2010 and 2011/2012. This increase in unit cost is perhaps the largest contributor to annual increases in revenues realized from electricity sales; and (2) more interestingly, the table shows a decline in electricity consumption. While figures from Tshwane and Cape Town were not available, we posit that a similar process may be occurring particularly given that these cities are also actively mitigating climate change like the City of Johannesburg. This observation raises interesting points.

Assuming that the decreases in consumption is not due to a switch from municipal supplies to direct supply from ESKOM in industry and commerce and from business closures, the trends suggest the efficacy of mitigation measures. Solar power has been projected as the most accessible alternative and cleaner energy source. Households and businesses have been advised to consider cleaner energy sources and technologies for both lighting and water heating purposes. As a result, there are instances where solar power is already in use in domestic premises, public spaces and even in commercial enterprises. Proponents of this technology explicitly refer to the environmental benefits and the pecuniary benefits of the technology. However, there is a paucity of studies focused on the impact of these technologies on the revenue streams of service providers whose services "environmentally friendly" technologies seeks to replace if not supply differently.

The fact that annual increases in the unit cost of electricity are largely responsible for growth in revenue from electricity sales even when there is a de-

cline in consumption presents two very pertinent issues for local governments that distribute electricity. The first and perhaps obvious issue is that for as long as South Africa witnesses annual increases in electricity tariffs, local authorities as the dominant bulk buyers and distributors of electricity in urban settlements are likely to see a growth in electricity revenues even if consumption was to decrease. Given that the National Electricity Regulator of South Africa (NERSA) has announced that the price bulk electricity will increase by eight percent each year for the five years spanning 2013 to 2017 (Ramayia, 2013), this *ceteris paribus*, implies guaranteed growth revenue streams for local governments in South Africa. Although the approved increases are less than the 16% that had been requested by ESKOM, the increases are still above the projected 5.5% consumer inflation level over the same period (Ibid). This implies an electricity price increase in both nominal and real terms.

The second issue is that the above inflation price increases present an unsustainable cost to both domestic and commercial electricity consumers. In the case of domestic consumers, low-income communities are inevitably the most vulnerable. Sluggish global economic growth also presents a financial challenge to the middle-income group. The price sensitivity within these groups has the potential to lead to payment defaults, which in turn may adversely affect cash flows in the municipalities. Furthermore, increased and increasing electricity tariffs are likely to render cities uncompetitive. In a globalized world, capital and labor can easily move to competitive locations, meaning that 'uncompetitive' cities risk the loss of investment the vehicle for ensuring that local governments achieve their objective ofensuring economic development and growth. The need to remain competitive renders the continuous increase in electricity tariffs unsustainable. More importantly though, is that electricity consumers investing in mitigation measure that encompass energy efficient technologies expect to realize two results: reduced electricity costs and the mitigation of climate change. 'Paying more for using less' defeats the use of energy efficient technologies and renewable energy sources. We posit that consumers will eventually come to a point where they demand pecuniary benefits of adopting energy efficient technologies. When this point is reached, revenue realized by local government for electricity supply services will either stagnate or decline. When this happens local governments are likely to suffer noticeable cash flow challenges, which are most likely to be exacerbated if the use of energy efficient technologies becomes widespread within their jurisdictions.

Conclusion

The climate change phenomenon continues to trigger many responses. The wider impact of these responses is not fully understood. In this paper, we have presented an argument that while climate change mitigation through the adoption of energy efficient technologies can mitigate GHG emissions and subsequently climate change is desirable, the practice has the potential to adversely impact local government revenue streams. This realization raises the question: How does a local government that adopts climate change mitigation interventions that replace 'dirty' but revenue generating service delivery practices protect its revenue streams? The evidence presented here indicates that some current mitigation practices are synonymous with 'biting the hand that feeds you.' However, we argue that this contradiction is not a licence to continue with the 'dirty' and environmentally damaging practices of burning fossil fuel to meet energy requirements. Instead, we challenge researchers and governance practitioners to help local governments innovate their revenue sources in a manner that can enable (if not accelerate) the realization of local governments' triple mandates.

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