Energising Urban South Africa: poverty, sustainability and future cities

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Abstract

While the economy has grown and energy consumption has increased accordingly, South Africa is one of the few countries in the world where this has resulted in no human development benefits as measured by the Human Development Index (HDI). The paper will be rooted in practical experience gained from 15 years of work with South African cities around sustainable transformation and welfare promotion. The paper focuses on the energy dimension of urban sustainable development, looking 20 years into the future to illustrate the urgent need for radical changes in current practices, policies and resource allocations. It will explore this through three key themes which are central to socially acceptable, resource-efficient future cities: 1) The spatial form of cities – current land markets and political pressures prevent release of well-located land to low-income households; 2) Transport provision – cities need a far more rapid shift to public transport, both to enable mobility of the poor and in response to the low carbon imperative and 3) Electricity provision to informal settlements – while some impressive forays are being made for provision of electricity to these areas, complex barriers relating to integration of informality within the city obstruct energetic tackling of the issue.

1. Introduction

South African policy development since democracy in 1994 has focussed on the huge challenge of redressing the injustices of the apartheid regime. The country's development objectives were encapsulated in the Reconstruction and Development Programme (RDP) White Paper (RDP[1]) of 1994 which promoted development through the expansion of infrastructure in poor communities with a central focus on the delivery of basic services (Office of the Presidency, 1994). This led to an impressive national electrification programme, the building of 2 to 3 million homes to address the massive housing backlog, job creation and land redistribution amongst others. However, to a large extent the macroeconomic policies which have emerged since then have put pressure on the socio-economic developmental agenda in that they have promoted competitive growth beginning with the GEAR policy of 1996 - growth, employment and redistribution. The idea being that economic growth within a market driven environment would result in job creation and the kind of transformation needed to overcome the legacy of apartheid. In many respects these policies have not challenged the status quo, the systemic social and economic exclusion, established under apartheid.

South Africa's economy for the past 100 plus years has been built around a mineral-energy complex that continues to dwarf all other areas of economic activity (Fine & Rustomjee, 1997). South Africa abounds in cheap coal and a range of minerals, which are the foundation

[1] Reconstruction and Development Programme, ANC socio-economic policy framework 1994

of the country's economic advantage. The power sector[2], reliant on mining of coal, has, in turn, been developed to support further mining of minerals, notably gold and platinum and associated smelting production. Much of the country's manufacture and service activity is horizontally linked to the mining sector, so that the contribution of these sectors to GDP can often not be divorced (decoupled) from the primary economic activity of mining.

While it is broadly recognised that the South African economy has grown since 1994 at an annual growth rate averaging 5.4% per annum between 1999 and 2008, with a drop following the global financial crisis of 2009 and recovering slightly by 2010 (DEA, 2011a; Camco & TIPS, 2010; Hanival & Maia, 2008), the country continues to face a particular set of fundamental development challenges (NPC, 2011). Growth has not produced the degree of change and social development hoped for.

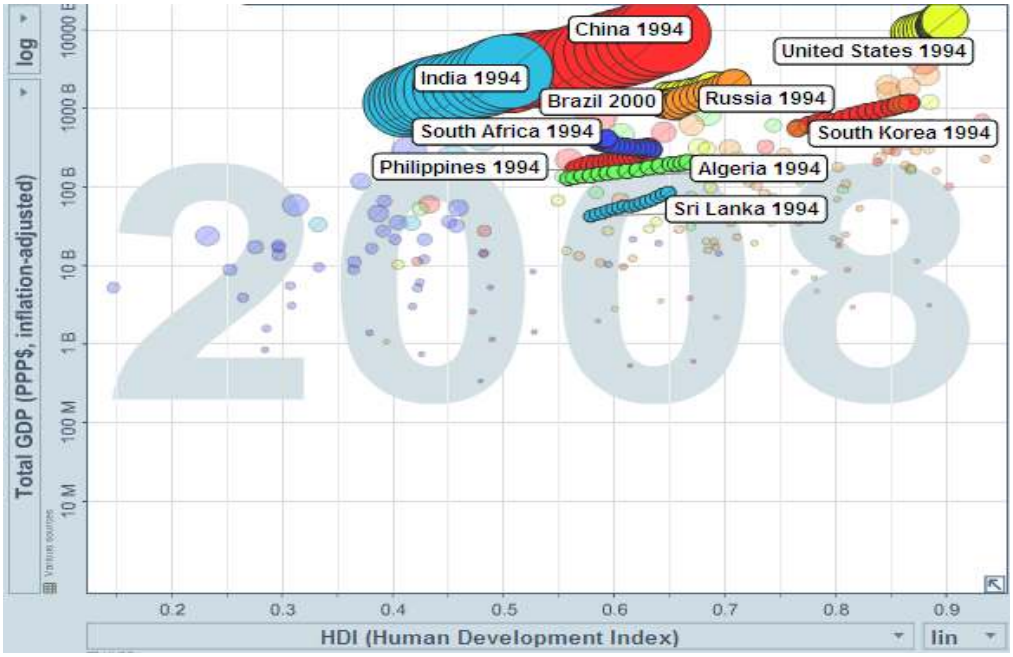

Figure 1: *Graph illustrating HDI versus GDP of BRIC and other countries from 1994 -2008*
(Source: data sourced from World Bank, WHO, Medical Research Council: South Africa and UNDP and graph generated by www.gapminder.org)

Thus 18 years on and despite government's firm commitment to poverty alleviation and building development, the problems remain deeply rooted whereby, apartheid spatial form and poverty persist and inequality has deepened (Turok, 2011; FFC, 2001; Ewing & Mammon, 2010; Biermann & Van Ryneveld 2007; Adelzadeh, 2006; Hoogeveen & Ozler, 2004). Figure 1 above shows a comparison of South Africa to BRIC (Brazil, Russia India and China) and other countries from 1994 to 2008. It is apparent from this graph that the actual HDI levels for South Africa have progressively declined over this period unlike those of the other countries shown. This is largely because the commitment to poverty alleviation is fundamentally hampered by the systems and macroeconomic policies in place, which in

[2] Coal accounts for 70% of primary energy consumption, 93% of electricity generation and 30% of petroleum liquid fuels (Eberhard, 2011)

reality are not aligned with the developmental agenda and to this end simply perpetuate an unequal system despite all good intentions. In fact these policies have continued to fuel a system that maintains the inequality constructed under apartheid – largely supporting an extractive industry, private property and formal municipal service delivery, locking us into the poverty cycle.

It is generally accepted that energy is central to meeting basic human needs and improving living standards. Within a developmental context it is a useful way of tracking policy intention and outcome. South Africa's economy is extremely energy intensive (energy used per unit of economic production) even by global standards, which is generally associated with growth, employment and high human development indices. The economic trends in developed countries have seen a move from being primary extractive or industrial to manufacturing and service driven leading to an increase in the wealth of the society in relation to energy inputs. In South Africa we have remained trapped in a primary extractive economy, where wealth remains concentrated amongst a very few. Economic growth has not been accompanied by increasing wealth across the country.

In looking at the South African picture, final energy consumption per sector in 2000 shows 45% consumed by industry, 20% by transport and 10% by residential sector of which most is urban and falls in the mid to high income group (Winkler, 2008). South Africa is ranked among the world's top 15 largest carbon dioxide (CO_2) emitter[3], largely due to our heavy dependence on coal which supplies 92% of our electricity (DME, 2005; Eberhard, 2011; CDIAC, 2012). This plentiful cheap coal is what led to our developing an energy-intensive industry sector which includes producing liquid fuels from coal. Furthermore our cities demonstrate high carbon emissions per capita (on par with those cities of industrialised countries such as Europe and elsewhere - London, Berlin and Tokyo) relative to our level of development (SEA, 2011). The rate of urbanisation is growing with currently 64% of the population living in urban centres, and estimated to rise to 70% by 2030[4] with most of that growth occurring in the informal and low income sectors. Between 30-40% of national energy consumption takes place in our largest cities, those forming the economic backbone of our country (SEA, 2006; SEA, 2011).

Thus despite democracy and a spate of pro-poor policies, despite high levels of energy intensity and economic growth our country remains characterised by the following:

- Our human development indices remain low,[5] South Africa is ranked 110 out of 169 (UNDP, 2010) and our Gini coefficient of 0.7 remains high by international standards (Leibbrandt et. al, 2010);

- Unemployment is a substantial concern - 25.4% of the total population were unemployed in 2010[6] and only 41% of adults in South Africa were in employment - this is low for a developing country where trends in other countries report an average of 60% of adults working;

[3] 14th biggest carbon dioxide emitter in the world as a result of energy-sector emissions
[4] NPC Diagnostic Overview, 2011
[5] Human Development Indices considers health, education and living standards
[6] According to Labour Force Survey, NPC Diagnostic Overview 2011

- Although the national electrification programme has been impressive with 82% of population electrified in 2011 compared to 36% in 1994 and the bulk of this taking place in urban centres[7], predominantly within formal housing sector and does not include a growing informal and backyard dweller sector;

- The RDP housing programme did result in the building of many new houses for the poor, however they were poorly built structures with no ceilings or other forms of insulation. Moreover, these low income homes are largely located on the outskirts of cities resulting in a perpetuation of the apartheid spatial form, meaning that poor people continue to be far from economic and job opportunities and faced with high transport costs to access these opportunities, further entrenching the poverty cycle.

Closer examination of the outcomes of our impressive growth records, begs the question of who benefitted from this growth and what other methods are available to address the developmental agenda facing the country. As Fine (2012) states:

"The National Development Plan (NDP) proposes that GDP per capita should more than double between now and 2030. However, the proportion of income earned by the lowest 40% is only projected to rise by 4%[8], and the gini-coefficient is only to drop from 0.7 to 0.6, while requiring GDP annual growth of 5.4%. So, the question is who is this growth for?

This affirms that new and current planning for the country still points to growth as the marker for development. Unless government makes strong interventions in the market so that structural inequalities are addressed, the status quo will be maintained. The State needs to recognise that there are certain developmental elements the market will not address.

Looking ahead to 2030

Urban growth, the increasing price of electricity, volatility in liquid fuel prices, and growing obligations regarding global warming emissions make it imperative that South Africa takes cognisance of the potential dangers within a business as usual approach to development. Sustainable Energy Africa has pioneered energy data collection at the local level and undertaken research and scenario modelling that has considered what the situation would look like if no significant change of course takes place and current growth trends continue. The scenarios have then considered what is required to reach the National Long Term Mitigation Scenarios (LTMS)[9] for a required by science approach to curb catastrophic climate change carbon emissions trajectory and an 'Optimal Energy Future'[10] in looking 20 years ahead.

[7] President Jacob Zuma – South African State of the Nation address, 2011

[8] National Development Plan (2012) -page 28

[9] LTMS refers to the National scenario development and modelling exercise completed in 2007 to model the carbon future for the country and to define the carbon trajectory required by science to stabilise climate change and align with international climate change targets. Implementation of options in this scenario include amongst others new nuclear supply, new renewable energy supply and energy efficiency interventions required to meet the nationally endorsed carbon reduction profile.

[10] Optimum Energy Future Scenario: the proposed optimum mix of energy efficiency interventions and low carbon supply options in order for a city to achieve a robust energy future and low carbon profile.

The exercise highlights the unacceptable (from a social, economic and environmental perspective, situation) that will exist unless radical changes in current practices and resource allocations are effected. If we are to reach the intended levels of transformation by 2030, then we urgently need to consider a new picture and new ways of understanding and approaching development and macroeconomic policy. It is not the intention of this paper to deal with the macro structural and systemic changes that are essential, but rather to focus on the potential for change at the local level. As the seat of delivery of basic services (land, water, energy, sanitation and solid waste), the platform for redistribution and the sphere closest to the communities it serves, local government is an important site for enormous opportunity to develop pioneering, 'learn by doing' and transformative solutions.

What follows is a more detailed picture of the three areas we have selected: spatial form, transport and energy access for informal settlements. Sustainable Energy Africa has worked closely with cities for the past 15 years and through this depth of experience we have seen the blockages, the changes that have been made and the potential for extraordinary transformation if the intention is well articulated in the system and support is provided.

2. Spatial Form

The spatial form and structure of cities play a crucial role in the productivity of urban economies and the long-term financial soundness of city governments. It also has a significant influence on the welfare of urban residents, patterns of human interaction, social inclusion and efficient use of resources in a city, particularly energy for mobility and distribution of services

South African cities have historically developed along sprawling, low density suburban lines. This was rooted in Apartheid's inequitable and segregated spatial-land distribution policies, but also a consequence of modernist planning, which emphasised suburban development, separation of urban activities of work and leisure as well as the prioritisation of technical efficiency over social and environmental imperatives (Biermann & Van Rhyneveld, 2007; Ewing & Mammon, 2010; FFC, 2011; SACN, 2011).

Our cities are consequently hugely resource inefficient in comparison to similar size international cities (FFC, 2011). The average South Africa metro has a carbon footprint of 6.5 tonnes of carbon dioxide equivalent (CO_2e), equivalent to cities such as Paris and Berlin, with larger populations and higher levels of development (see Figure 2).

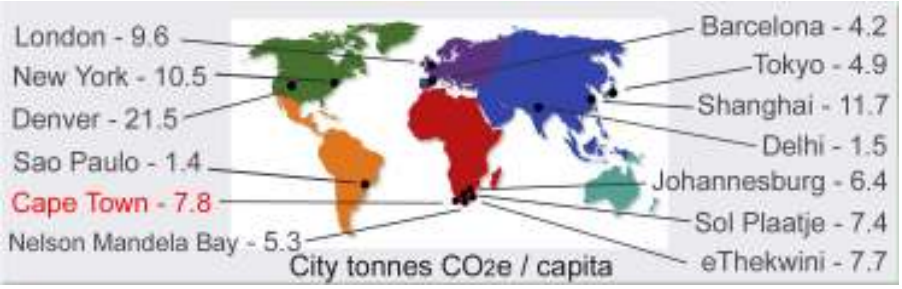

Figure 2: Per capita carbon emissions for some of the global cities
(Source : "*Greenhouse Gas Emission Baselines for Global Cities and Metropolitan Regions*" by Kennedy et al, 2009 AND "*GHG data collection and emissions inventory report 2005/2006*" prepared for eThekwini Municipality by ECOSERV (Pty) Ltd)

Half of the energy used in South African cities is consumed by the transport sector (SEA, 2006; SEA, 2011). SEA modelling of energy consumption data in the City of Cape Town indicates that on a business as usual path transport fuel consumption will increase from 70 GJ (gigajoules) in 2012 to 140 million GJ by 2030 – an increase of 100% (CCT, 2008); this would result in an equivalent increase in global carbon emissions, as illustrated in Figure 3 below.

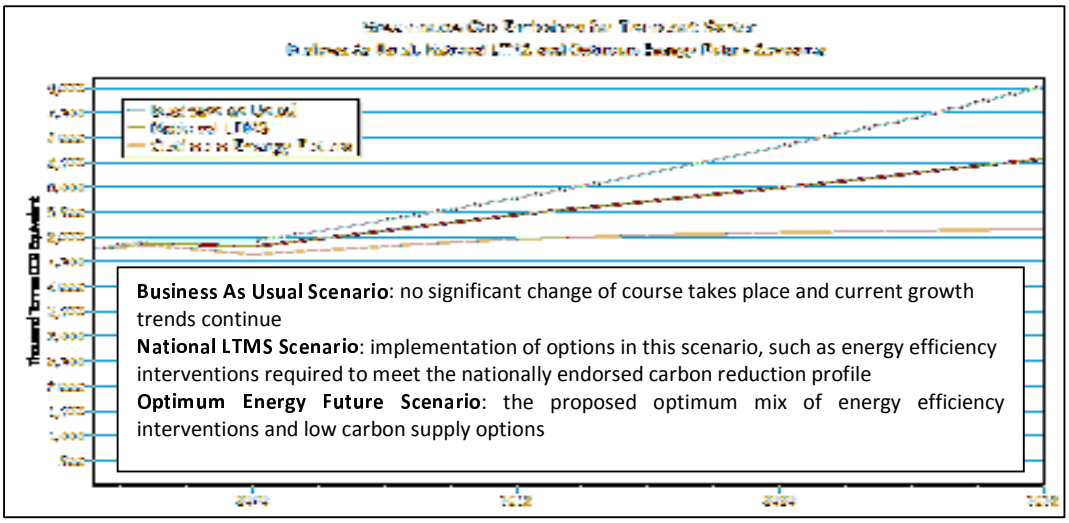

***Figure 3**: Greenhouse gas emissions for transport sector in Business As Usual, National LTMS and Optimum Energy Future scenarios (Source: City of Cape Town's Optimal Energy Futures Study, 2011a)*

These cities are also socially exclusive with the poor living on the distant margins, with persistently inadequate levels of service delivery and unable to access the opportunities of social resources and employment cities have to offer. This urban settlement pattern may have been laid down by Apartheid planners, but it has remained entrenched. Figure 4 below demonstrates starkly how spatial planning frameworks have failed to address the issue: the old 'white' suburbs have remained low density, with unsustainably high densities emerging in the old 'black' areas.

Modelling of household growth for the City of Cape Town shows an increase from 1100 thousand households in 2012 to 1800 households by 2030. This is a near doubling in urban household growth, with Figure 5 below indicating that the majority of this growth will be amongst the urban poor. If present trends continue, this group will be housed on the urban fringe, in informal dwellings, with little services and contributing, in turn, little to city revenue.

While marginal locations provide an important point of access (relatively cheap and easy) in gaining a foothold in the city, the 'locking' in of the poor into these locations, and continuing low density suburban development of the rich, is socially, economically and environmentally unsustainable. By 2030 such persistent, unaddressed spatial polarization with regard to access to resources and employment opportunities, will present enormous and severe challenges in the political stability functioning and management of cities. Thus contrary to government's intention to alleviate poverty, the problems remain entrenched.

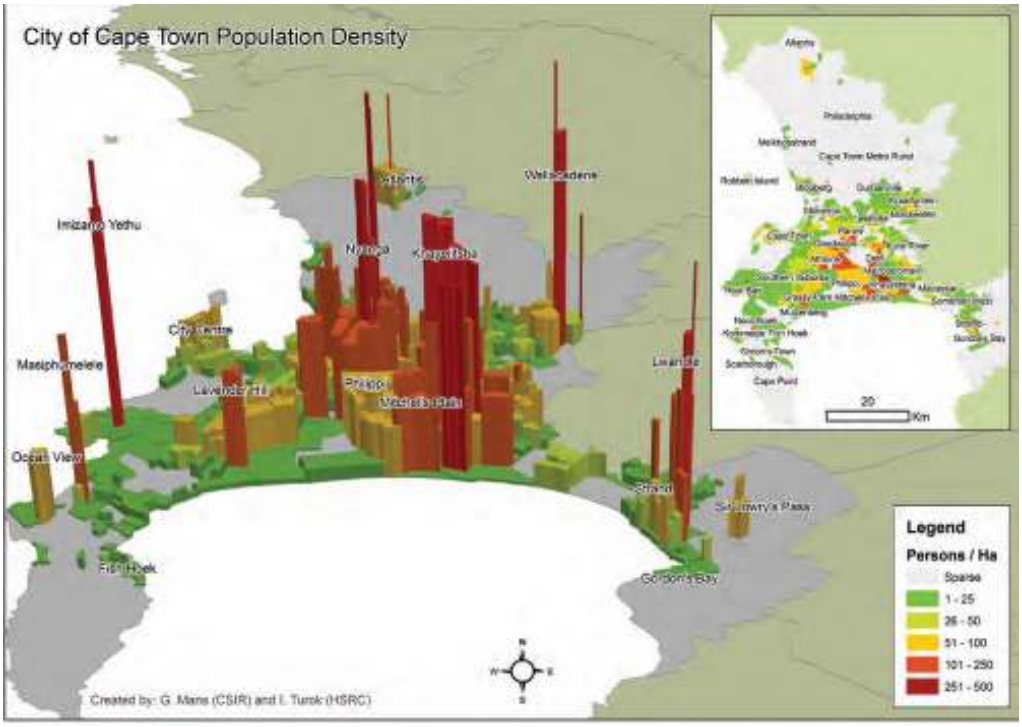

***Figure 4**: Population density of the City of Cape Town depicting the population distribution patterns typical of South African cities as a result of the persistence of historic Apartheid planning (Source: SACN, 2011).*

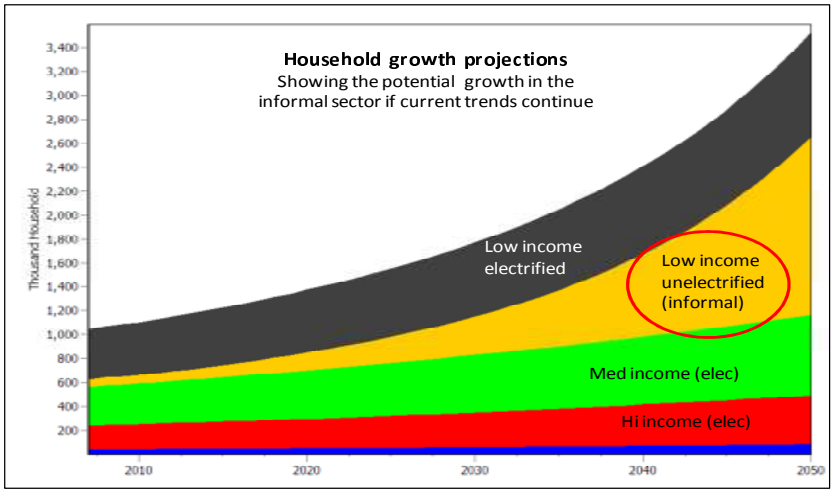

***Figure 5**: Household growth projections - showing the potential growth in the informal sector if current trends continue (Source: CCT, 2011a)*

Marginal locations present service challenges to cities: they are often costly as service distribution infrastructure must run long distances, maintenance is more difficult due to distance and local needs for materials result in stripping of infrastructure. Transport routes are unsustainably far. Continued spatial inequality (with densities in black townships increasing

beyond an already untenable 5 times higher than in the old suburban areas) would result in enormous political unrest, as currently witnessed in the increasing spate of community protests nationally relating to inefficient service delivery within cities.

Low density cites also involve expensive service provision, with low volumes of rate paying households to support city revenue required to cover service level. In a low density city, the cost per capita of providing other services and infrastructure relating to water, electricity connections, sewage and solid waste removal and roads, is higher, placing financial strain on already cash-strapped cities, and compromising the ability to service residents. A spatial form that has not transformed by 2030 will be prohibitively costly in terms of service delivery, placing severe financial strain on already cash-strapped cities. In turn, this urban growth, unlike commercial/industrial or mid to high income residential growth, will contribute little to the city revenue base, so that cities will be required to deliver more and more costly services, with relatively less and less budget to do so.

Such low density and dispersed urban form makes for less efficient use of natural resources, with higher bulk infrastructure costs, and greater energy consumption and carbon emissions. Cities will be hugely vulnerable to any carbon pricing arising out of international climate negotiations. They will also be vulnerable to disruptions to oil supplies, whether through political sanction/disruption or relating to peak oil.

Studies have indicated that mobility is a critical factor in developing a service economy (Altman, 2009). If our cities fail to address spatial form such that it facilitates greater mobility, this will particularly increase the severity of poverty through increased transport costs eating into small household budgets, or inhibiting mobility altogether and with that blocking critical access to jobs, education and social amenities.

Densification (typically refers to higher residential densities in existing built areas) takes decades, so it is important that it is clearly held right at the outset of strategic city planning, even if the imperatives are not of an immediate high priority to all stakeholders. Densification and Urban Edge (refers to a demarcation boundary and interrelated policy which serves to manage, direct and control the outer margins of urban expansion of a city or town), work together (relaxed urban edge works against densification). Densification also prevents expansion into natural zones with resulting biodiversity loss and, importantly, potential agricultural land loss – important for future food security as localisation (and resulting reduced dependence on transport) becomes increasingly important.

Addressing the effects of the Apartheid spatial plan was of course a major concern of the post Apartheid government. The Development Facilitation Act of 1995, which specifically encourages a more compact and sustainable urban form, was designed to facilitate this. Following from this, cities were provided with excellent planning tools such as the Spatial Development Framework[11] (SDFs are key templates for cities, with the intention of guiding

[11] A SDF is mandatory legal requirement for a municipal area as per the Municipal Systems Act (No 32 of 2000). It is a planning document with the highest legal status applicable to a municipal area. It involves an overall plan guiding the physical structuring (includes green space, movement, urban public spaces and places, social facilities etc) and development of an entire municipal area – providing the basis for all other levels of spatial planning in a municipal area

future growth and change in an optimal manner), Integrated Zoning Schemes[12] (which has an impact on land use and development for years in fact several decades to come), Densification Strategies, Urban Edge policies and Housing policies.

In line with this, City departments are looking to new approaches to urban development and now acknowledge that urban planning is a key driver in moving to a sustainable city and cognizant that this takes time to effect. The vision is one of cities developed along the line of mixed use urban forms, that utilize land efficiently and protect the natural environment, biodiversity and food producing areas and where public transport, walking and cycling become key elements of the city and large freeway and road infrastructure investments are de-emphasised (Kenworthy, 2006). Densification policies are in place in some cities.

Yet cities are still struggling to undo the distorted urban form and implementation of the necessary measures to transform cities is slow. Densification remains a challenge, as there are conflicting interests between short-term gains of property developers, city rates collection and resistance to integration, and the long-term benefits of densification. In practice policy is shaped by organized, wealthy lobby groups (SEA, 2011). Some 90% of responses in the public participation phase of Cape Town's recent Spatial Development Framework came from wealthy residents, particularly Rates and Property Owners Associations (CCT, 2011b). These are powerful, well resourced lobby groups. In contrast the poor have a minimal and weak voice: only one or two comments/inputs were received from groups (NGOs) representing the interests of the poor. The form of city engagement with residents may well preclude the participation of poorer residents: the SDF document is lengthy and complex, requiring specialist 'interpretation' to engage with the technical components; these documents are located at civic centers, often far from where the poor are living.

Government is under enormous political pressure to deliver housing and services. The social housing programme of government is measured in numbers (quantity) and has been driven by private companies whose central rationale is to make a profit. Low income housing therefore continues to be located on the urban margins where land is cheaply available and an integrated approach to poverty reduction, looking at access to urban resources and mobility, is missing in this cornerstone redress policy.

Political pressure to deliver housing spills over into City governments' struggle to hold the Urban Edge. This again weakens any stated intentions of local government to meet the longer term densification requirement. City officials across the country all know of processes in which development approval/exemptions from SDF along the urban fringe will take place where developers offer to include a percentage low income houses in the development. Few cities are in a position, politically, to turn down such development plans. It is difficult for cities therfore to hold such long-term objectives strongly in the face of constant short-term pressure from the private sector and politicians representing narrow constituency interests.

There are also governance factors that constrain transformation of urban form. Although housing has now been devolved to the metro level, it began as a Provincial undertaking and

[12] A Zoning Scheme is a regulatory instrument that identifies development rights and obligations and together with other legislation is used to manage land use and development in a city. Legally it determines use rights and controls use rights and utilization of the land.

remains such for smaller municipalities. Province may deliver housing with little interaction with questions of urban form and longer term sustainability, which are concerns of local government. Public land located more centrally in the city would provide a good option for affordable land for low income housing development. These tracts of land often fall under national departments such as Public Works and South African National Defence Force (SANDF) and the experience of cities is that it is difficult to access this land. A further common experience working with city planning departments is that communication between the planners and other key departments within a city, such as transport and infrastructure, is extremely weak. Policies and plans will also remain 'paper tigers' until they are truly bedded down in all layers of the city 'beast', but in particular ensuring it is tightly held through giving it a legal status.

The City of Johannesburg (CoJ) has pushed furthest with their comprehensive Policy for the Promotion of Energy Efficiency in Land Use Development. This policy development involved boring down into the 'substrata' of urban planning processes in order to understand the drivers of urban form and where to effect change. A key realisation was the need to work with all three spheres of urban management: the political; the legislative; and the managerial. The political involved ensuring political buy-in and understanding and unpacking the Integrated Development Plan, as the highest political document, in order to see how it directs capital spending and what impact this will have on sustainability and urban form (e.g. on densification of public transport routes). The new planning policy in COJ, promoting sustainable and compact city development, was thus consciously worked into the city's IDP.
The legislative sphere is associated with the land use planning schemes. Johannesburg is introducing its new policy commitments into the new Town Planning and Zoning Schemes, through a clause stating that all development applications will be assessed in terms of the City's criteria relating to climate change and resource efficiency. This is possibly the most important means to ensure that urban transformation is strongly held as it compliance with the policy mandatory.
The policy has been officially approved by the City, and forms part of their overall approach to reduce greenhouse gas emissions. The next step will be to build and develop the capacity and commitment of officials to implement and manage the new approach. The managerial dimension speaks to this and the area of building management control – those who implement and engage with developers on a daily basis. According to longstanding ex- City of Johannesburg planner, who drove this work, new policy approaches require a degree of dynamism, discretion and innovation from officials (rather than just ticking off development approval boxes) and this is challenging (R. Holden, pers. comm., July 2010)

Planning and investment decisions taken today will shape our communities and the economy well into the next 20-50-100 years. Densification is critical to a sustainable, carbon-resilient, peak-oil-resilient city. To transform a city in this way, takes decades of applying firm and consistent policies and strategies. Given the short term political imperatives, the best way to hold this tightly seems to be through making sure it has legal power, through bringing it into the Zoning Scheme. The possibility of granting stronger powers to local government to expropriate land 'in the public good' should also be evaluated and considered.

Long-term economic and financial costing of our current patterns and the opportunity costs of not developing more efficient and equitable cities would provide a powerful stimulus and motivation for this. Such costing would also need to take into account 'external' costs

associated with social instability and exclusion arising from factors such as immobility and stifled entrepreneurial activity should our cities continue on a business as usual spatial trajectory.

It is important to note that South African cities, given the anticipated near-doubling of urban population and associated resource consumption, are effectively half formed. While this poses a daunting challenge, it also presents an enormous opportunity to ensure that new urban development is resource efficient, offering greater opportunities to the majority of city residents, from the start. Enormous opportunities also lie in South Africa seeking to invest in infrastructure through its recently introduced massive 20 year infrastructure investment programme (NT, 2012). At a time of huge opportunity and considerable scope to turn our urban development around, it is crucial we act decisively to ensure the infrastructure doesn't create 'lock in'. This is far cheaper and easier than the process of retrofitting the existing urban infrastructure.

3. Transport

Our cities are not only characterized by the Apartheid spatial form which successfully segregated populations, placing the poor on the peripheries of our cities, far from work opportunities and access to services such as hospitals and schools. But they have also been designed largely for private vehicles following the North American city development model of the past century as current research indicates (L.Kane, pers.comm., 2012). Our cities today are typically sprawling, have inadequate public transport systems, and the poor are often located far from economic opportunities (SACN, 2011; FFC, 2011; Ewing & Mammon, 2010). Poor planning, weak administrative controls, lack of capacity and infrastructure build are among the key reasons hindering good public transport development and the persistence of our inequitable and inefficient spatial form, 18 years after democracy. The figure below illustrates that the majority of South Africa's poor residents are much more dependent on public transport/walking than wealthier households. In fact only 26% of South African's own a car, yet public funding continues to prioritise road transport and is not proportionally supportive of public transport modes (FFC, 2011; DBSA, 2008). A study in Tshwane revealed significant findings, it was found that the average trip length for car users to be twice that of cities such as Moscow, London, Tokyo and Singapore and about three times as high for public transport users. Low density of the city and 'displaced urbanisation' as a result of apartheid spatial planning are attributed to these surprising findings (Van Ryneveld, 2010 cited in SACN, 2011).

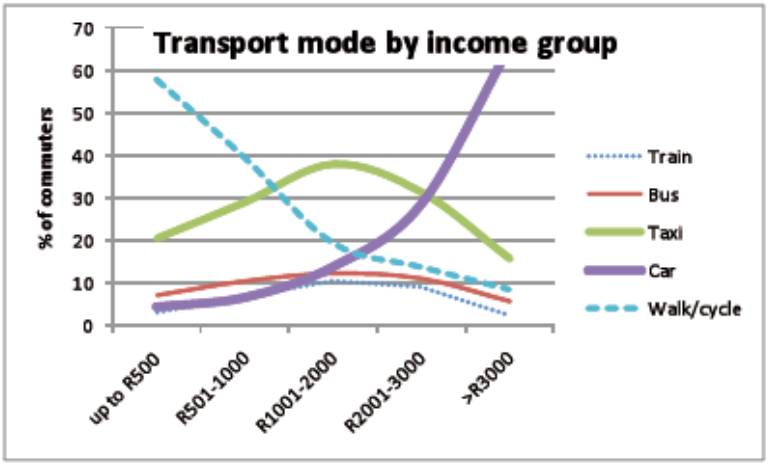

***Figure 6**: Transport mode by income group in South Africa (Source; National Household Travel Survey 2003)*

South African transport systems are generally expensive and inefficient, do not enable the mobility of the poor adequately, and have high energy use per capita with associated high greenhouse gas emissions (SEA, 2007, SEA, 2011). In 2004 energy consumption related to transport in our metro cities was 56% and associated GHG emissions were as high as 30% for the same year.[13] These figures indicate the gravity of the challenges associated with mobility within South Africa's prevailing low density, sprawling cities.

Looking to the future, the inefficient and ineffective public transport system appears to result in an increased reliance on private car transport (already visible in the rapidly increasing car ownership displayed in Figures 7&8). Poor integration between different modes of public transport as well as issues of safety on public transport reinforces the trend of private car usage. Indicative long-term energy forecasting modelling undertaken by Sustainable Energy Africa for South Africa's metros has clearly shown that, without intervention, energy consumption**,** associated greenhouse gas emissions**,** and end-user energy expenditure relating to transport use in our cities is likely to close double over the next 20 years as illustrated in the series of graphs below (Figures 7,8,9).

A business as usual trajectory is entirely unsustainable. By 2030 South African cities will be significantly vulnerable to the possibility of diminishing global oil reserves, and resultant increase and instability in fuel prices. A fossil fuel driven transport sector will also be vulnerable to carbon taxes arising from climate change mitigation action, nationally and internationally.

Increased energy, carbon and related transport costs will have huge financial implications for city economies and general sustainable development of cities. Congestion will be substantially higher, reducing quality of life with longer travel times and increasing local air pollution. Increased transport emission levels will compromise the health of cities' residents, in turn negatively affecting the sustainable development of cities.

[13] Sarah Ward, The New Energy Book, 2008

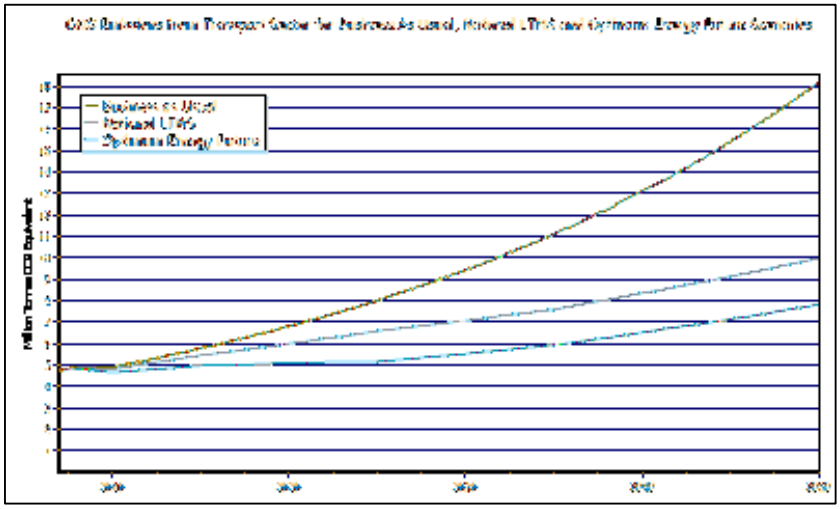

Figure 7: *Greenhouse gas emissions for transport sector in Business As Usual, National LTMS and Optimum Energy Future scenarios (CCT, 2011a).*

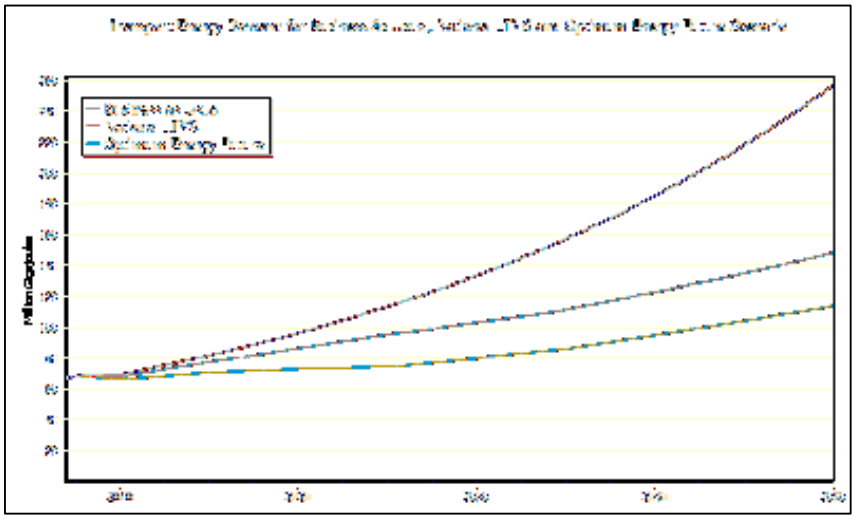

Figure 8*: Energy demand for transport sector only in Business As Usual, National LTMS and Optimum Energy Future (CCT, 2011a)*

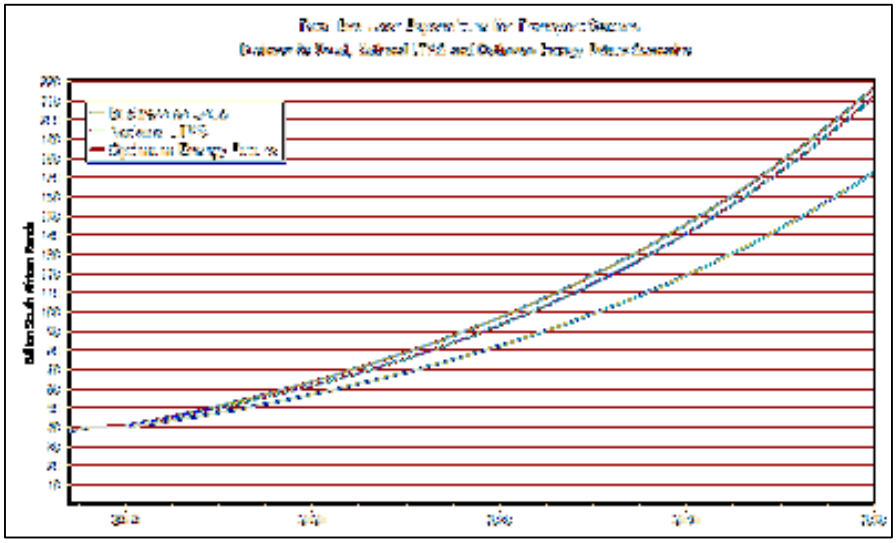

Figure 9: *Total end user expenditure for transport sector in Business As Usual, National LTMS and Optimum Energy Future scenarios.*

The poor, who make up the majority of residents in our cities and are dependent on public transport to commute over large distances to places of employment and services, will be the most vulnerable to fuel price increases and polluted cities.

The carbon profile of our cities, shown by the energy demand (Figure 8 above) and greenhouse gas emissions trajectory (Figure 7 above) in a business as usual scenario versus the National LTMS scenario reveals an untenable rise in carbon emissions – a large deviation from what is 'required by science' (a challenge of 80% emissions reduction) for climate stability by 2050.

To improve access and mobility in South African cities there is a need to transform and restructure the current transport system, and improve public transport. An effective and affordable public transport system is key to reducing the dependence of the city on fossil fuels and lowering the carbon footprint, in addition to having important social benefits. The cost of an upgraded public transport system is however high. Cities may struggle to find this money, yet significantly improved public transport facilities are essential to a sustainable city.

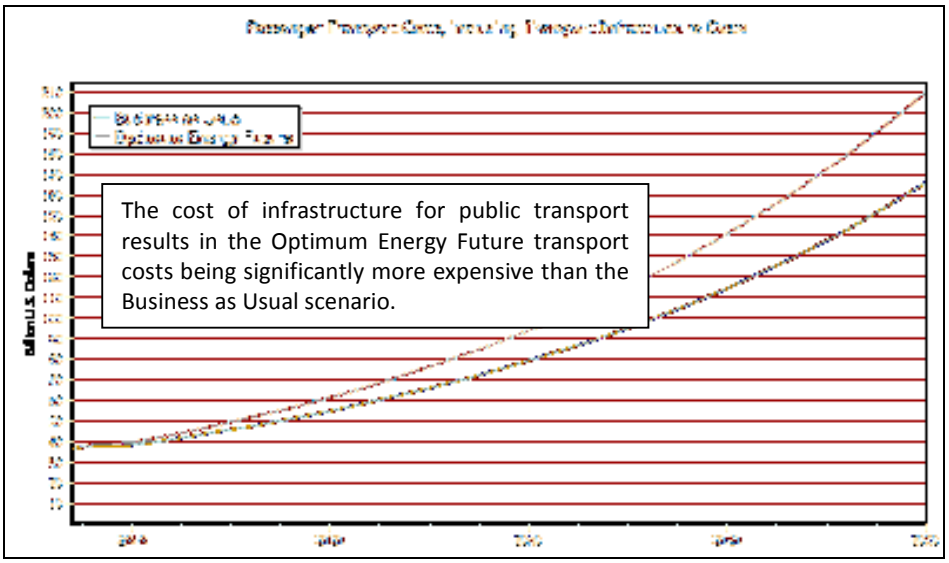

***Figure 10**: Passenger transport costs for business as usual and optimum energy future (including transport infrastructure costs for public transport)*

The figure above shows the cost impact of the provision of a reasonably comprehensive (new Integrated Rapid Transit bus and rail system) public transport system, taking into consideration costs associated with the construction of the infrastructure, such as the dedicated lanes and new rail services, as well as the operations and maintenance costs. These costs are based on an average occupancy of 30%[14] on the public transport services. The implication of a higher occupancy through improved densification, are explored below.

Currently the funds required to upgrade public transport systems in our cities have come from a number of sources, including National Government, International Funders and local government. Clarification over who is responsible for the necessary expansion of public transport initiatives, their maintenance and operating cost is not there and presents a real obstacle to taking this important component of sustainable, equitable urban development forward. The National Climate Change Response White Paper (2011b) identifies transport as one of its flagship programmes and recommends the development of public transport programmes in five metros and ten smaller cities as well as the creation of an efficient vehicles programme.

The infrastructure and operating costs of public transport services has been shown to be particularly financially unviable in low-density cities (SEA, 20011; SACN, 2011; Newman & Kenworthy, 1999).
Experience in South American cities indicates that the costs of public transport are double per passenger-km in sprawling cities compared with dense cities, shown in Figure 11 below. If cities are to pursue the development of a 'mobile population' and a 'required by science' carbon profile, a shift in public transport occupancy levels from 30% in 2007 to 60% in 2035 is required. Modelling illustrates that the creation of a denser city reduces the cost of this shift

[14] International studies, give average public transport occupancy for low density cities (such as Cape Town) as 30%. This occupancy figure was used as the baseline for representing the low density currently experienced in Cape Town.

per passenger-km and brings down to manageable levels the capital requirements for an effective public transport system (CCT, 2011a).

City	pers/ha
Cape Town	14
Johannesburg	24
Tshwane	11
Ekurhuleni	14
eThekwini	15
Nelson Mandela	20
Saldanha	0
Sedibeng	2
Buffalo City	3
Mbombela	2
Msunduzi	10
Polokwane	1
Sol Plaatje	1

***Table 1**: City densities*

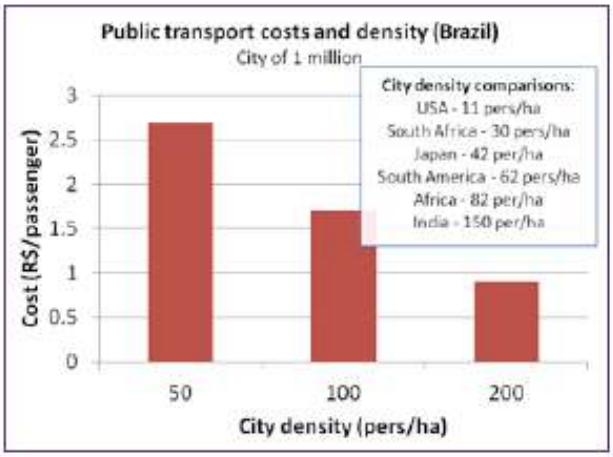

***Figure 11**: An illustration of declining public transport costs with increasing density in Brazil (Source: Vasconcellos, E)*

The figure below shows that in a Densification Scenario costs are significantly less than the Optimum Energy Future Scenario, with no densification, for the same level of service to city inhabitants. In 2030, it equates to a saving of R10 billion, while in 2050, R40 billion would be saved. Given the daunting costs of public transport provision, strong support for densification is important for a sustainable city. Indicative modeling has shown that viability of investment in public transport requires a doubling of current density figures (CCT, 2011a).

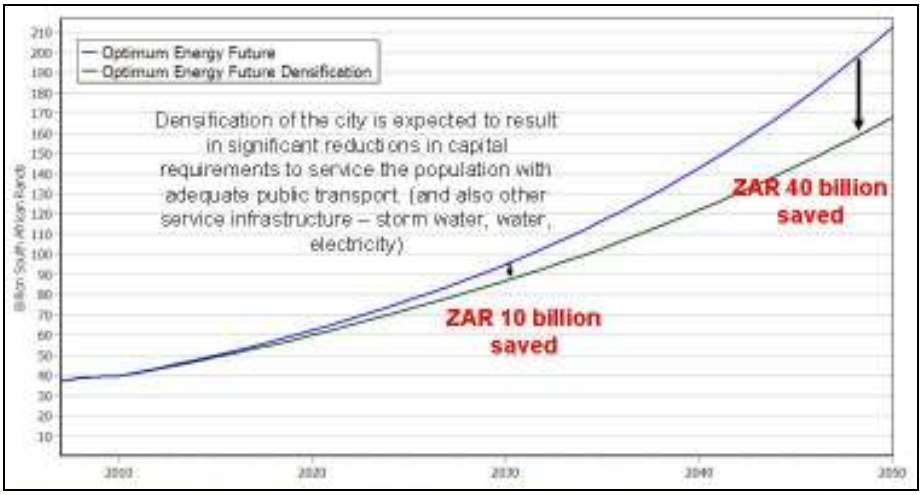

***Figure 12:** Cost for Optimum Energy Future compared to a higher densification scenario*

Another significant challenge to more sustainable transport systems is the fragmented responsibilities and poor coordination between the spheres of government involved in transport provision. Different modes of transport are mandates of different spheres of government – national government allocates the budget for trains, provinces for most buses, while most roads remain the mandate of local government. There is now a move to devolve all city transport mode mandates to local government, which is expected to enable more

integrated and effective city transport systems. Decisive action to clarify this issue, or at the very least ensure cooperation and communication between the spheres on matters relating to urban transport, is required.

City departments are beginning to acknowledge that urban planning is crucial in moving to a sustainable city, and a greater emphasis on public over private transport systems is beginning to emerge in plans and budgets. Many cities have undertaken programmes towards improved public transport systems (accelerated by hosting the 2010 World Cup) such as the Bus Rapid Transit Systems in Johannesburg (Rea Vaya) and Cape Town (MyCiti), and the Gautrain.

While the majority of the country's residents are dependent on public transport, most city and national budgets tend to be prioritised for the improvement of road systems further facilitating the expansion of car ownership (FFC, 2011; DBSA, 2008). This is partly due to the fact that investment in public transport infrastructure development is enormously expensive. Our energy modeling research in this area (Figure 10 above) has shown that the overall cost to the City's inhabitants of a low carbon future is slightly higher than the Business As Usual Scenario due mainly to the costs associated with substantial public transport infrastructure, but the efficiency gains and economic benefits resulting from the interventions far outweigh the extra costs (CCT, 2011a).

When exploring public transport options, passenger rail is the most efficient, but has historically been the mandate of national government and out of the preserve of local government. This and other capital-intensive public transport measures would need to form part of longer-term planning, budget allocation, inter-governmental coordination and implementation.

More medium-term and less expensive measures include allocation of road space to public transport (taxis and buses), improving safety and reliability of current public transport, promoting scholar buses, and having measures that target middle-income commuters who are most likely to shift from private vehicles (high income commuters are generally more inflexible).

The provision of an efficient public transport system alone does not typically give rise to the necessary substantial modal shift from private vehicles - typically only around 10% shift occurs as a result of public transport development (Kane, 2010). In order to achieve an effective shift it is necessary to use pricing levers such as taxing fuels, vehicle purchase tax or congestion charges on private vehicle use (although not all of these measures fall in the mandate of local government). These levers cumulatively can bring about a modal shift of around 20%.

It is clear that in looking at the achievements made during the World Cup 2010 and with the changes proposed in this section, cities can in fact make shifts in building public transport systems.

4. Energy Access for Informal Settlements

Households require energy for essential services in order to satisfy basic human needs and a lack of choice in accessing adequate, reliable, safe and environmentally benign energy

services is the way in which energy poverty manifests itself (UNDP, 2000). Energy poverty is particularly prevalent in informal settlements[15] and includes those households living in backyard shacks of formal properties (serviced plots) in overcrowded conditions. At least 10% of South Africa's population (4.7 million people), reside in approximately 2700 urban informal settlements comprising more than 1.2 million households (Misselhorn, 2010; SACN, 2011).

The majority of informal settlements are situated on the periphery of cities and do not have formal access to Eskom or Municipal distributed electricity. Those that are electrified are generally receiving electricity through illegal connections and figures show that non-technical losses from electricity provision as a percentage of total revenue in municipalities ranged from 2%-9% in 2004[16]. Research has also pointed to the problem that even where poor households are electrified they continue to use a mix of energy sources to meet their energy needs due to cost, ability to purchase electricity and affordability of electrical appliances. Poor households spend up to 20% or more of their household budget (a ratio used to express the energy burden of a household) on energy compared with 2% or 3% for wealthier households (SEA, 2006).

To continue on a business as usual trajectory will result in a deepening of the problems associated with energy poverty contrary to government's intention to tackle our developmental challenges. The trends indicate that the informal housing sector is growing at a faster rate than the formal housing sector. The actual extent of this growth is uncertain but recent research indicates a growth rate of 3.5% relative to a formal rate of 2.5% (SANERI, 2008). According to Turok and Parnell[17] South Africa's six metros are "growing at nearly twice the national average, putting considerable strain on their services and poorer communities, as these cities now accounted for almost half of all informal housing in the country". Thus many poor households will remain inadequately serviced and without formal housing in the long-term particularly in the urban context. Misselhorn (2010) has shown that the cost of providing housing and basic services including electricity to all poor households is prohibitive to the state. Further, the lack of insulation and the absence of ceilings in the low income dwellings together with persistent use of paraffin for heating and cooking purposes, lead to a high incidence of respiratory and other health related problems in the country. Shack fires and deaths or severe burns are a regular occurrence from candle accidents in informal households. In densely populated areas one fire leads to a domino effect with many shacks (contrasted from highly flammable materials such as cardboard, bits of wood) razed to the ground. Additional health problem associated with energy use by this sector is the high prevalence of accidental ingestion of paraffin amongst children (Panday et al, 2007).

Many of the policies that have been developed over the years whilst they have been progressive and some have been successful in their own right such as the electrification programme, they have not succeeded in eradicating overall poverty and inequality.

For instance in recognition of the problems associated with energy poverty, government introduced the Free Basic Electricity (FBE) policy (DME 2003) which makes provision for 50 units (kilowatt hours) of free electricity to people consuming below 450kWh per month

[15] Informal settlements are situated on land unauthorised or not zoned for residential development and poor and overcrowded

[16] State of Energy in South African Cities 2006, Sustainable Energy Africa

[17] I Turok, S Parnell, Reshaping Cities, Rebuilding Nations: The Role of National Urban Policies, 2009

(although the amount varies from municipality to municipality). Whether 50kWh of electricity per month is sufficient to meet basic needs such as lighting, media access, limited water heating and basic cooking is debatable. The FBE allocation is intended to benefit the poor. However, because the allocation is based on electricity consumption this is not always the case. Some middle to high income households qualify for FBE due to low electricity consumption, whereas backyard dwellers, where more than one household feeds off a single meter, do not qualify. The move to remedy this problem through indigence registries appears to run the risk of the very poor falling through the cracks again, due to failure to register.

In response to informality and recognizing that many of the poorest residents were falling outside of the major energy poverty subsidy, the FBE grant, government introduced Free Basic Alternative Energy (FBAE) policy in 2007; a subsidy intended to provide poor households with alternative energy where electricity is not available. The objective of this policy is to provide indigent households with the equivalent of R76 per month of free basic alternative fuels/technology in the form of paraffin and liquefied petroleum gas (LPG), among a list of other energy forms deemed appropriate by the municipality. However, implementation of this has been problematic and most municipalities have failed to provide FBAE largely due to the fact it is hard to finance, control and administer, unlike FBE, which can be distributed at source and was largely intended for rural communities.

Funding and financing is another critical area that unless addressed will continue to entrench a business as usual path. In general many municipalities are struggling financially and do not have sufficient funds to deliver on some of their developmental mandates. In addition offering free basic services means a loss of income for municipalities as well as a large expenditure outlay. In addition cities do not have the capacity to administer and implement all the good intentions held in the various policies.

Regulations prevent municipalities from electrifying informal settlements on private land or on encumbered land such as wetlands. There is limited money for connections and the grant received from national government is a one off so if a municipality electrifies an informal settlement that is temporary then that money is lost if the settlement were to later move. All of this is hugely challenging for municipalities and research indicates that informal settlements are far from temporary, many have been in existence for some years with little prospect of moving. Therefore how are municipalities to deal with these challenges?

Research undertaken by SEA over the past three years, clearly indicate that informal dwellers countrywide desire access to electricity rather than alternative energy, such as liquefied petroleum gas (LPG). This is largely because of the convenience and the particularly good and safe service that electricity offers in terms of lighting and media. Many respondents spoke about the difficulties their children experienced in doing homework by candle light, problems of safety at night and the ability, with electrification, to refrigerate perishables and engage in small scale home-based enterprises, to name but a few.

Informality represents the largest residential growth within cities in the next 20 years. The current inability of the formal system to electrify this sector means that a substantial portion of South Africa's poorest residents in 2030 will not be able to access the energy poverty subsidy – one of the mainstay's of government's poverty programme. To shift this picture in 2030 there is a need for 'out of the box' thinking relating to informal electrification.

The City of Cape Town has been successful in implementing an 'out of the box' response to the challenges of informality and energy poverty by electrifying 90% of households in their jurisdiction. They have achieved this through the work of a champion who pioneered new ways of approaching the problem. They included and closely engaged with the communities in question resulting in their cooperation with the electrification programme.

Cape Town was able to work around the formal electrification regulations and introduced an innovative technical solution (maypole with a connector box) to the challenge of informal layout and the inability to lay electricity lines as one would in formal areas. Whilst the City acknowledged that the subsidy from national government is a once off, they were able to recognize that the status of informality is not transient, and that most informal communities will persist for many years to come.

Sustainable Energy Africa is currently engaged in a pilot informal electrification project in eThekwini Metro Municipality. The municipality loses on average R120 million in electricity theft per year (equivalent to 2% of their electricity revenue). They have 70 dedicated full time staff to minimise illegal connections. The municipality is faced with 320 000 shacks in informal settlements and 80 000 back yard dwellers. Although the problems facing eThekwini are different to Cape Town in that there are physical challenges including lack of access roads to bring in 1 tonne transformers needed, the city is also faced with some institutional tensions: on the one hand there is a political will to electrify, on the other there are valid concerns about technical and regulatory issues. This includes personal liability concerns should a weakening of the technical regulations result in accident or death; some of the technical difficulties include electrifying on floodplains, steep and unstable slopes, and overcrowded settlements where homes are less than a meter apart from each other etc.

If the country is to see 100% electrification by 2030 then regulatory frameworks need to be adjusted to provide electrification to informal settlements, given that the land is not suitable for permanent electricity infrastructure. Regulations should be flexible across the varied conditions within our cities and built environments. They need to recognise and acknowledge the plight of the backyard dweller. In this case two households are being serviced by one meter which means that between them they are generally consuming more than 450kWh of electricity per month resulting in them not receiving FBE and being charged higher tariffs as they are deemed high end users. Cities need to develop a system of duel metering which the City of Cape Town has begun to do. This of course adds a cost to the municipality. Resources to support implementation and delivery must be made available if municipalities are going to be able to act on new policy directions. Cities that have a clear policy around the electrification of informal areas (even on unproclaimed land) seem to be moving ahead, such as Cape Town.

In line with this National government must provide leadership and support, as well as devolve more authority to cities to act locally. A shift has taken place in that more recently the National Electrification Programme has just acknowledged the challenges of informality. The challenges and solutions need to be integrated into local and national policy, and aligned between these two spheres of government. Turok and Parnell (2009) argue for the need for a national urban development framework to support cities in coping with urban migration and a growing informal sector. If national government supports city planning then cities will be able to realize their potential for transformation.

5. Conclusion

In 2001, South Africa established a bold vision for metropolitan government (of integrating divided communities, promoting fair distribution of municipal resources to ensure viable and sustainable service delivery and creating economically vibrant communities) recognising that cities are central to solving some of our biggest challenges. Although the country has made remarkable progress in some areas, we seem to have ground to a halt when it comes to transforming our cities so they reduce and preferably eradicate inequality and poverty. Despite many laudable and comprehensive pro-poor policies since democracy in 1994 and despite consistent economic growth, the country has not been able to turn around poverty, unemployment and many of the other post-Apartheid challenges. It is clear that if we want to see a different kind of landscape for the country then we need to do things in a radically different way.

In exploring spatial form, transport provision and electricity service provision to informal settlements from a local government perspective, this paper has attempted to illustrate how working from a position of practice at the local level can highlight some of the blockages hampering transformation of our cities and can indicate new practices that take us closer to equitable, resource efficient and sustainable urban landscapes. Transformation needs to be driven from the perspective of practice – from within local government at the micro level. The local level of government as the seat of delivery of the country's developmental agenda is perfectly poised to implement a new paradigm and a new way of doing that does transform us and break us from the legacy of Apartheid – where historically our energy systems underpinning the macro-economic policies were specifically designed to serve the minerals industry and 'white' towns - and set us on a new path of development. It is possible for municipalities to begin to shift the patterns that have locked us into the poverty cycle, locked us into a spatial form where the majority of the urban poor population are housed on the urban edge without access to basic services, far from economic possibilities and with poor transport options. But alone this will not achieve the level of change urgently required. It is imperative that the macro- level or overarching framework which includes points of articulation between the spheres of government, financing, service delivery models and the institutional form align and change in parallel to the local level to ensure access to services including sustained accessibility and affordability of services to meet the demands of the city citizens in the face of high unemployment, vulnerability and irregular household incomes. Whilst we know that since 1994 low cost housing developments for the poor have been built on the periphery of cities because the cost of the land was significantly low. This ultimately is a false saving. In the long term the cost of maintaining inefficient cities to the economy is high "travel patterns, infrastructure and energy use, social and environmental costs, congestion costs and the cost of sprawl"[18] as well as electricity thefts all have significant financial implications for cities and the economy in general.

It is important to acknowledge that government cannot singlehandedly work towards this transformation but the enormous wealth of experience and technical expertise of players such

[18] Financial Fiscal commission

as non-governmental organisations and academic institutions are vital to this process. In addition the communities themselves are key to transformation and to harnessing a new way of operating.

This paper has highlighted the vital practices and policies and major shifts that are needed and that are possible from all players to pave the way for the creation of equitable and resource efficient cities into the future.

References

1. Adelzadeh, A, 2006. Overcoming unemployment. Strategies for giving the effect to the right to work. District Six Museum. Alternate Information Development Centre. 12 -15 June.
2. Altman, M, 2009. Working in the cities. Paper presented to the SACN 3rd Urban Conference on the State of Cities, Nelson Mandela Bay, 24-25 November 2009. South Africa.
3. Biermann, S & Van Ryneveld, M, 2007. Improving the location of low-income housing delivery in South African urban areas. 10th International Conference on Computers in Urban Planning and Urban Management (CUPUM).11-13 July 2007. Iguassu Falls, Parana, Brazil.
4. CAMCO and TIPS (Trade and Industrial Policy Strategies), 2010. Climate change: risks and opportunities for the South African economy – an assessment of mitigation response measures.
5. CDIAC (United States Department of Energy's Carbon Dioxide Information Analysis Centre), 2012. List of countries by 2010 emission estimates. Available at - http://cdiac.ornl.gov/trends/emis/perlim_2009_2010_estimates.html
6. CCT (City of Cape Town), 2011a. Technical report for energy scenarios for Cape Town – exploring the implications of different energy futures for the City of Cape Town up to 2050. Developed by Sustainable Africa and the Energy Research Centre, University of Cape Town, South Africa.
7. CCT (City of Cape Town), 2011b. Public comments on City of Cape Town's Spatial Development Framework. Cape Town, South Africa.
8. Constitution of the Republic of South Africa 1996 Act 108 of 1996. South Africa.
9. DEA (Department of Environmental Affairs), 2011a. South Africa's Second National
10. Communication under the United Nations Framework Convention on Climate Change.
11. DEA (Department of Environmental Affairs), 2011b. The National Climate Change Response White Paper. Pretoria, South Africa.
12. Development Bank of Southern Africa (DBSA), 2008. Infrastructure Barometer. South Africa
13. DME (Department of Minerals and Energy), 2007. Free Basic Alternative Energy Policy (Households Energy Support Programme). Department of Minerals and Energy. South Africa.
14. DME (Department of Minerals and Energy), 2005. Energy efficiency strategy of the Republic of South Africa. Pretoria, South Africa.
15. DME (Department of Minerals and Energy), 2003. Free Basic Electricity Policy. Department of Minerals and Energy. South Africa.
16. DME (Department of Minerals and Energy), 1998. White Paper on the Energy Policy of the Republic of South Africa. DME, Pretoria.
17. DT (Department of National Treasury), 2012. Budget Speech 2012 by Minister of Finance, Pravin Gordhan. Pretoria, South Africa. Available at http://www.treasury.gov.za
18. Eberhard, A, 2011. The future of South African coal: market, investment and policy challenges. Working Paper #100. Program of Energy and Sustainable Development. Freeman Spogli Institute for International Studies, Stanford University, USA.

19. eThekwini Municipality, 2007. GHG data collection and emissions inventory report 2005/2006. Prepared for eThekwini Municipality, Environmental Management Department by ECOSERV (Pty) Ltd. Durban, South Africa.
20. Ewing, K & Mammon, N, 2010. Cape Town Den[city]: towards sustainable urban form. In Swilling (M.) Ed 2010. Sustaining Cape Town, imagining a livable city. Stellenbosch, Cape Town. South Africa.
21. FFC (Financial and Fiscal Commission), 2011. The Economic and Fiscal Costs of Inefficient Land Use Patterns in South Africa. Report developed by Palmer Development Group, African Centre of Cities and Stephen Berrisford Consulting. South Africa.
22. Fine, B, 2012. Chronicle of a developmental transformation foretold: South Africa's National Development Plan in hindsight. *Transformation 78.*
23. Fine, B & Rustomjee, Z, 1997. South Africa's political economy: from minerals-energy complex to industrialisation. Wits University Press, Johannesburg, South Africa.
24. Hanival, S & Maia, J, 2008. An overview of the performance of the South African economy since 1994. Paper commissioned by the Presidency as input to the 15 year South African review process. South Africa.
25. Holden, J, 2011. Per s comm. July 2011.
26. Hoogeveen, JG & Ozler, B, 2004. Not Separate, Not Equal. Poverty and Inequality in Post-Apartheid South Africa. World Bank, Washington, DC, USA.
27. Panday, S & Mafu, S, 2007. Limited choices: an exploratory study of paraffin use in Kwa-Zulu Natal. Report prepared by Human Science Research Council for the Paraffin Safety Association of Southern Africa.
28. Kane, L, pers.comm., 2012. Doctoral Candidate, University of Cape Town.
29. Kane, L, 2010. Sustainable transport indicators for Cape Town, South Africa: advocacy, negotiation and partnership in transport planning practice. *Natural Resources Forum*, 2010. 34:289-302.
30. Kennedy, CA, Ramaswami, A, Carney, S & Dhakal, S, 2009. Greenhouse gas emission baselines for global cities and metropolitan regions. World Bank. Available at: http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1256566800920/6505269-1268260567624/KennedyComm.pdf
31. Kenworthy JR, 2006. The eco-city: ten key transport and planning dimensions for sustainable city development. *Environment &Urbanization*, 18(1), April 2006: 67-85.
32. Leibbrandt, M, Woolard, I, Finn, A & Argent, J, 2010. Trends in South African income distribution and poverty since the fall of Apartheid. OECD Social Employment and Migration Working Papers, No 101, OECD Publishing.
33. Marx, C, 2007. Do informal urban land markets work for poor people? - An assessment of the three metropolitan cities in South Africa. A synthesis report produced for Urban Landmark by Isandla Institute and Stephen Berrisford Consulting with Progressus Research and Development. South Africa.
34. Misselhorn, M, 2010. A new response to informal settlements. *Transformer,* December/January 2010.
35. Newman, P. & Kenworthy, J, 1999. Sustainability and cities: overcoming automobile dependence, New York: Island Press.
36. NPC (National Planning Commission - The Presidency Republic of South Africa), 2011. Diagnostic Overview. Pretoria, South Africa.
37. NPC (National Planning Commission - The Presidency Republic of South Africa), 2012. National Development Plan – Vision for 2030. Pretoria, South Africa.
38. DoT (Department of Transport), 2003. The first national household travel survey. Pretoria, South Africa.
39. PDC (Palmer Development Cooperation) & SCE (Science Consultancy Enterprises) 2003. Review of the effectiveness of energy subsidies and related taxation policies in South Africa. Report completed for National Treasury and Department of Minerals and Energy.

40. SACN (South African Cities Network), 2011. Towards resilient cities: a reflection on the first decade of a democratic and transformed local government in South Africa 2001-2011. South African Cities Network, Johannesburg, South Africa.
41. SANERI (South African National Energy Research Institute), 2008. Improving energy welfare in unelectrified urban informal households. Report prepared by Sustainable Energy Africa for SANERI. Report available from Sustainable Energy Africa, Cape Town.
42. SEA (Sustainable Energy Africa), 2006. Sate of energy in South African cities 2006 – setting a baseline. SEA, Cape Town, South Africa.
43. SEA (Sustainable Energy Africa), 2011. Sate of energy in South African cities 2011. SEA, Cape Town, South Africa.
44. SACN (South African Cities Network, 2009). "Sustainable Public Transport – Overview Report. Johannesburg: South African Cities Network. South Africa.
45. SACN (South African Cities Network), 2006. State of Cities Report. Johannesburg: South African Cities Network. South Africa.
46. The Presidency of South Africa, 1994. White Paper on the Reconstruction Development. South Africa.
47. The Presidency of South Africa, 2011. State of the Nation Address -2011. Office of the Presidency, Pretoria, South Africa.
48. Todes, et al 2010. Contemporary South African Urbanisation Dynamics. *Urban Forum*, Vol. 21, 331-348
49. Turok, I, 2011. Deconstructing density: strategic dilemmas confronting the post apartheid city. *In the process of being published in 'Cities'.* South Africa.
50. Turok, I & Parnell, S. 2009. Reshaping cities, building nations: the role of national urban policies. *Urban Forum*. Vol. 20, No.2:157–174.
51. UNDP (United Nations Development Program), 2000. Overview. In Goldemberg, J (Ed.) World Energy Assessment: Energy and the Challenge of Sustainability. UNDP Programme, New York.
52. UNDP (United Nations Development Program), 2010. Human Development Report 2010. UNDP, New York.
53. Van Ryneveld, P, 2010. Assessment of public transport in South African cities. Institute for Transport and Development Policy. New York, USA.
54. Vasconcellos, E. 2008. Mobility, Equity and the Environment. Presentation to the City of Cape Town, South Africa.
55. Ward, S, 2008. The New Energy Book – for urban development in South Africa. Sustainable Energy Africa, Cape Town, South Africa.
56. Winkler, H, 2008. Cleaner energy, cooler climate – developing sustainable energy options for South Africa. HSRC Press, South Africa.