



State of Energy in South African Cities 2006



Setting a Baseline

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Compiled by Sustainable Energy Africa
in partnership with cities and city stakeholders

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This data review has been developed through the participation of a wide range of stakeholders, however Sustainable Energy Africa are responsible for the views expressed and any errors made in this final report.

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Foreword



Executive Mayor Duma Nkosi

This review examines the state of energy in our cities and explores the transition of cities towards more resilient, sustainable energy approaches. Such information is increasingly important if cities are to take their place as major players in the national energy picture.

This review indicates that nearly half of the country's energy is consumed within the 15 cities included within the study, in spite of only occupying less than 3% of the land area. Cities are therefore extremely energy intensive nodes in the national fabric.

Historically, energy issues were considered to be the business of national government, and very little energy capacity existed in cities, outside of the electricity departments. Yet we have realized that cities have a major influence over energy use within their areas of jurisdiction. They influence building efficiency, urban layout and expansion - which determine the potential for transport efficiency – public transport effectiveness, and price signals sent to users by electricity and other tariffs, amongst many others.

As well as being consumers of energy, cities are also potential energy producers. For example, much of the electrical energy used for water heating, currently produced in power stations far distant from the cities, could easily be sourced directly from the sun, using solar water heaters on rooftops. This would increase employment, decrease negative environmental impacts and increase sustainability.

As cities worldwide have discovered, national government cannot always provide solutions to all problems and when it doesn't it is often at the city level that the problems present themselves most forcefully. Cities face the problem of providing services to low-income households that cannot afford to pay for the services and cities face the problem of developing local economies to provide both the work needed by the large number of unemployed in the Second Economy and the goods and services needed by city economies.

Adequate and appropriate energy and access to the resources of the well-developed national energy sector are prerequisites for providing services and for growing the productive components of the economy.

It is therefore entirely appropriate, and in fact necessary, that cities take a leading role in steering the energy situation in their boundaries. It is also becoming clear that cities are important components of any national government strategy towards meeting their Energy Efficiency and Renewable Energy targets. In the same way that cities need national government support, so national government needs city support.

Amongst other challenges, we increasingly need to factor global warming and climate change into our plans. However, we should not make the mistake of thinking that sustainable energy options are important mainly for environmental reasons. We know that there are many, many immediate



opportunities to apply energy efficient and renewable energy measures that save cities money, develop the economy, and improve the quality of lives of the poorest of the poor.

This review is the product of a working partnership of local and national government, NGOs, national organizations and research institutions. This represents the first time that such a group of cities and city stakeholders have come together in this way, sharing experience and building capacity around understanding the energy issues of cities. It has laid an important foundation for city energy partnerships and learning networks.

The development of city level energy planning and management capacity represents the beginnings of a new chapter in the energy history of South Africa. This report provides a basis for discussion and debate around city energy issues and a starting point for further urban energy work. We believe that all involved in city development will benefit greatly from careful reading and examination of this document.

Yours in Governance!

Duma Nkosi

Executive Mayor

Ekurhuleni Metropolitan Municipality



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Executive Summary

Review aims and method

This report on the state of energy in South African cities aims to develop a baseline picture of energy (supply and consumption) in our cities. The report has been developed through a growing network of city officials and related stakeholders and builds on the city energy work that has taken root in South African cities over the past seven years. Fifteen cities and towns were involved in the study, including the six big metros, industrial towns, inland, coastal and more rural towns. These cities include thirteen of the seventeen cities that form the ‘backbone’ of the South African economy.

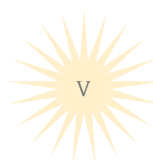
This review has been structured according to the City Development framework quadrants: Inclusive City, Productive City, Sustainable City and Well-governed City. This review has included a fifth area, that of Mobile and Accessible Cities. This speaks specifically to transport and was felt to warrant separate attention as it is of substantial importance within city energy consumption and has attributes peculiar to it that may be lost within a broad energy approach.

Issues were identified, and related measures developed, in a participatory manner through a series of network meetings with city officials and stakeholders. The measures also refer substantially to the internationally-recognised IAEA/UNDP Energy Indicators for Sustainable Development. City officials were centrally involved in data collection, which was also gathered from national agencies, such as StatsSA, NERSA and SAPIA. The report also speaks to notable data gaps, with the aim that city energy data processes can be improved as an outcome of the report. The process – bringing together city players in the development of measures, collection and analysis of data – provided a notable ‘bottom-up’, decentralised thinking process for energy policy making.

Cities and energy

Developmental local government places the responsibility of meeting basic needs and promoting just and equitable social and economic development on the shoulders of local government. South Africa’s larger cities, representing the centre of the nation’s wealth, but also containing its most abject poverty, are especially critical players in the government’s bid to tackle poverty and development. Energy is central to meeting basic socio-economic rights and the provision of electricity to households is a core task of local government in South Africa.

Energy is also a key and substantial factor in economic production. Local government provides a platform for economic development, a central component of which must be reliable energy service provision, planning and regulation. This is particularly important in light of the global trends around the supply and use of fossil fuels, especially related to climate change and greenhouse gas (GHG) emissions and world trade and globalization.



The Constitution of South Africa not only sets out basic socio-economic rights, but establishes the right to a clean and safe environment for all South Africans. Fossil fuel dependency means that energy, critical for life and development, is also highly destructive in terms of air quality, health, disasters and global greenhouse gas (GHG) emissions related to climate change. Cities have to manage the consequences of ill health (direct health costs, but also substantial indirect costs in loss of economic production) and local disasters. Again, it is the poor who are the most vulnerable and unmanaged risk works to counter poverty alleviation strategies.

South Africa is a signatory to a number of international summits and agreements, such as the Kyoto Protocol, the Millennium Development Goals and the Johannesburg Plan of Implementation, that relate, directly or indirectly, to energy management. Although national government has not devolved specific responsibilities relating to these commitments to the city level, much of what the state can do is city-based and coordinated by local government, if not directly delivered by them.

At a national level energy is governed through the White Paper on Energy (1998), which outlines an integrated resource planning approach to energy in pursuit of economic development, access to electricity, management of health and environmental impacts of energy generation and vigilance around paraffin poisoning and transport health impacts. South Africa has set specific energy efficiency and renewable energy targets in recent years. The Renewable Energy White Paper (2002) sets a target of establishing 10 000 GWh of renewable source energy by the year 2013. The draft national Energy Efficiency Strategy of 2004 provides specific targets for reduction in energy demand within given demand sectors, with an overall target of 12% reduction in consumption by 2014.

Understanding the particular conditions of poverty in our cities, and the existence of a ‘Mineral-Energy’ complex, largely de-linked from these social and economic problems, at the heart of the South African economy, is useful for understanding the potential for various trajectories in future energy development in our cities. South African cities are characterised by what is often referred to as a ‘dual’ economy: a small minority live in conditions similar to those of the developed economies, while the majority live on the margins of cities, in the townships, squatter camps and peri-urban areas, in conditions similar to those of the developing economies of Africa. An important implication of the existence of a dual economy for city energy planning is that statistical aggregations that include both economies may have limited validity, or could be misleading, if not interpreted with great caution.

City Energy Planning, being undertaken by leading South Africa’s cities, aims to integrate and entrench sustainable energy approaches and practices at the local level, within a framework that has a clear vision and direction. It can improve service delivery and quality of life, save money and reduce greenhouse gas emissions. Energy is the backbone of the city, and a crucial driver in all areas of city development. Energy management and city energy planning locates itself within the broad city strategic approaches contained within overarching Integrated Development Planning and City Development Strategies.

The emerging city energy picture

Social development lies at the heart of the **inclusive city**. Energy is critical to meeting basic social needs such as cooking food, warming and lighting homes, providing health services and community facilities and powering domestic appliances and communication and entertainment devices. In aggregate across the study cities, 16% of city households do not have access to a clean, safe, affordable and reliable



energy service. Within poor, rural towns, such as King Sabata this is as high as 58%. The National Electrification Programme has been effective in providing access to substantial numbers of city dwellers; however this programme may struggle to keep pace with rapid urbanisation.

Electrification levels within Tshwane clearly illustrate the persistence of urban-rural and racial divisions in electricity access. Winterveld (Ward 24), a black rural area, has no grid connection; Pretoria (Ward 1), the urban centre with over 90% of households being white, has 100% access to electricity.

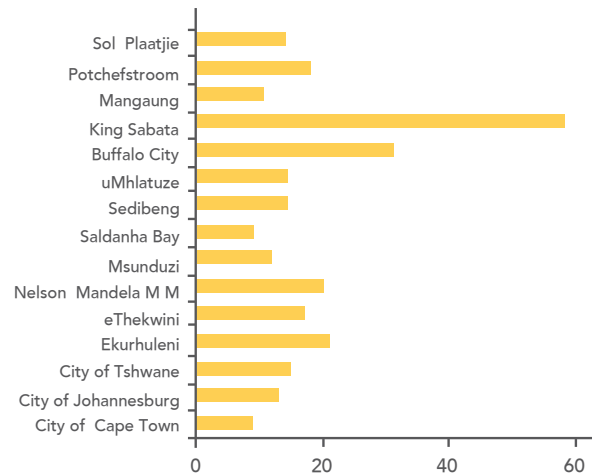
Affordability of energy services remains a key concern and a quarter of South African city dwellers may be considered to be living in ‘energy poverty’. On the other side, a small minority of wealthy households consume substantial amounts of energy, contributing to local and global pollution. Despite electrification, city households continue to make use of a variety of household fuels.

Fuel use in poor households poses dangers in the form of fires, burns and poisonings. Poverty makes households extremely vulnerable in the face of energy-related disaster events.

Energy in relation to **productive** cities explores the energy consumption of cities in relation to economic productivity; and how the energy sector can contribute directly to local resource utilization, including employment creation. The data points to cities being notable energy consumers, with the 15 study cities contributing nearly 40% to energy consumption in South Africa.

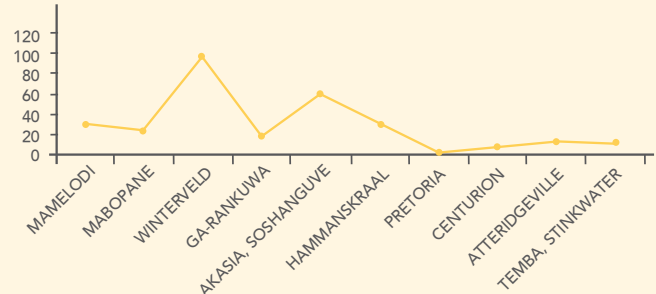
Although energy per unit of economic production must be interpreted with caution at the city level due to forward and backward economic linkages, South African cities reflect the national picture of high energy intensity – high levels of energy are consumed for economic value generated. Just about all city energy is derived from fossil fuels. Little data exists on how well cities are responding to and

Share of South African city households not using electricity for lighting, 2001



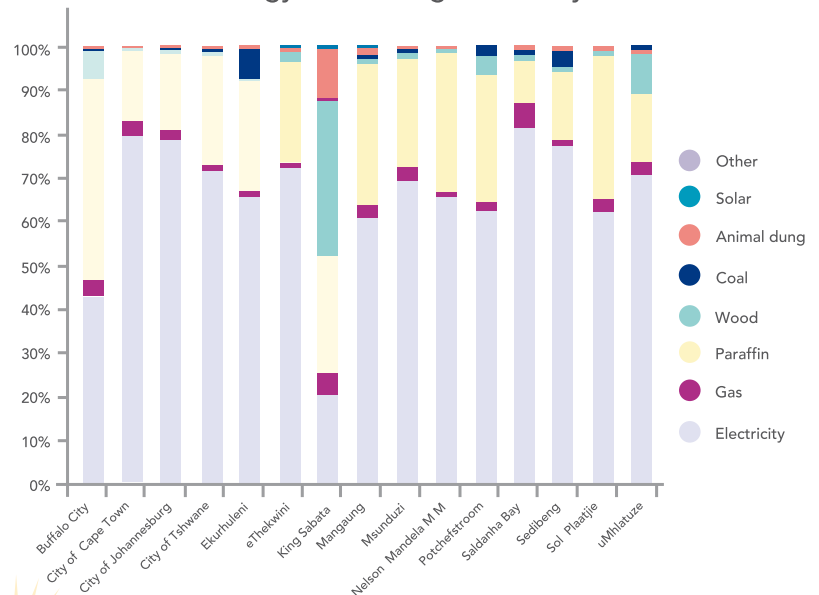
Source: Stats SA Census 2001

Percentage Tshwane households without electricity, 2002



Source: Tshwane IDP, 2002

Main source of energy for cooking across city households, 2001

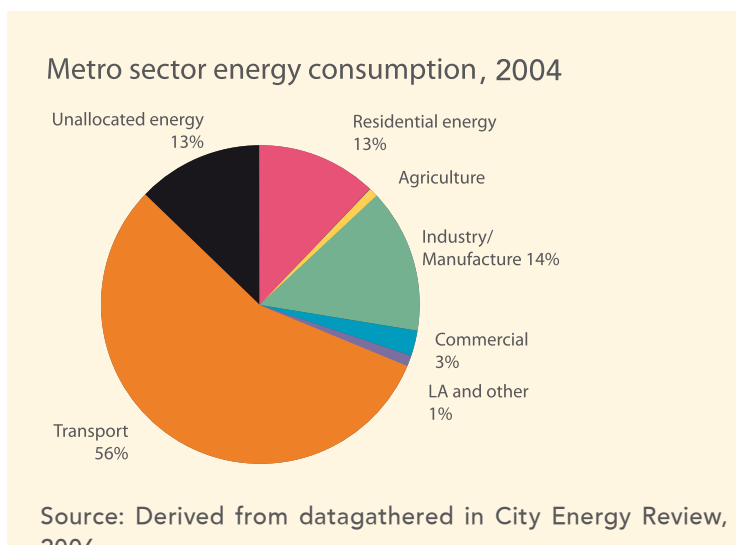


Source: Stats SA Census 2001

Population, GGP, energy consumption and electricity consumption of South African cities and towns, 2004

	Population % SA	GGP		Energy consumption		Electricity consumption	
		Per capita [2004 ZAR]	% SA	Per capita [GJ]	% SA	Per capita [KWh]	% SA
Metros	33	45,688	54	44	25	3,821	26
Industrial towns	4	24,583	4	153	11	16,150	13
Non-industrial towns	5	22,786	4	25	2	1,888	2

Source: Derived from data gathered in City Energy Review, 2006



Average study city transport mode to work and school, 2001

Non-motorised commuters as % total transport – (i.e. on foot)	39.1
Public transport commuters as % total	30.7
Private transport commuters as % total	30.3

Source: Census 2001

supplying energy to support the development needs of the ‘second’ or more marginalised township economy. Further work needs to be done on exploring the extent to which cities are proactively taking decisions around longer-term energy management

as a foundation for economic development strategies. However, the evidence is that efforts by South African cities to ensure their economically productive bases through diversifying energy usage and energy sources are in their infancy.

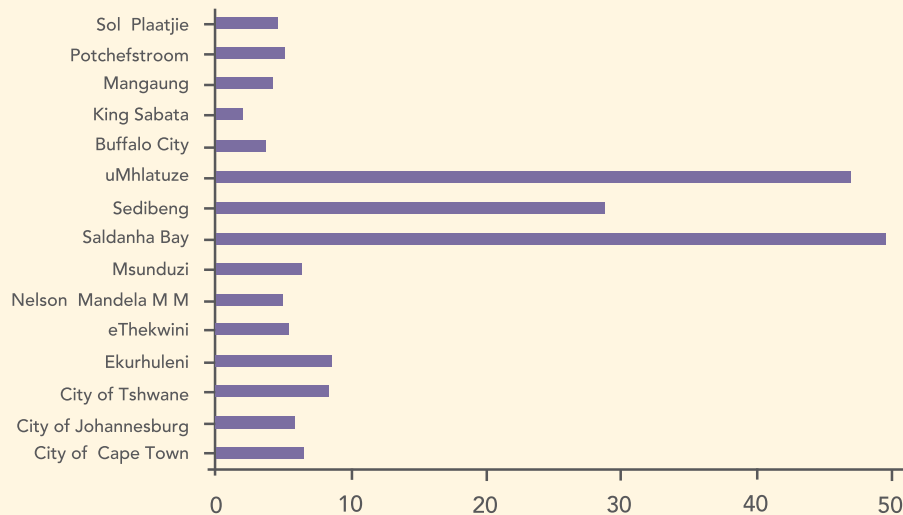
Being able to participate in the benefits of city living – employment, education, social and cultural ties – lies at the heart of the notion of **mobile and accessible** cities. Within South Africa’s six metros, transport accounts for 56% of total energy consumed.

Nearly 40% of people within the study cities commute to work and school on foot. This is not because of healthy lifestyles, or environments conducive to walking, but a factor of poverty – mode of transport is strongly linked to income in South African cities. These walkers are also hugely at risk and are twice as likely to die through a motor vehicle accident as the driver of the vehicles themselves.

Amongst those using motorised transport, there is a 50:50 private: public transport split. There is a strong correlation between income and mode of transport, with a move from non-motorised to public and finally private vehicle transport as income increases. Public transport is a critical area requiring attention if South African cities are to become efficient, competitive and sustainable.

The **sustainable** city issues highlighted within this report look specifically to areas of energy management that have direct impact on the local

Carbon emissions per capita, 2004



Source: Derived from data gathered in City Energy Review, 2006

and global natural resource base, predominantly through the “waste” products of city energy consumption: notably global greenhouse gas (GHG) emissions, local air pollution and radioactive waste. South Africa’s six big metros have an average carbon emissions level of 6.5 tonnes per person a year – higher than the global average, but below the European and North American averages. This per capita footprint is substantially higher within industrial cities and substantially lower amongst the non-industrial towns, with an average carbon footprint of 8.1 tons CO₂ per capita across the study cities.

In the aggregate, the South African economy exhibits a comparatively high level of CO₂ emissions related to energy consumption per unit of economic value created. Although using relatively more diesel and petrol, electricity contributes substantially to the global carbon emissions of the study cities. This is largely due to the heavy carbon footprint of our, coal-fired electricity.

Local air quality has recently become an important area of environmental management for cities. Cities

Carbon emissions in study cities by end-use* fuel type, 2004

Fuel	CO ₂ tonnes/yr	%
Electricity	102,536,369	66
Petrol	16,611,724	11
Diesel	10,592,249	7
Paraffin	1,140,868	1
LPGas	514,243	0
Jet fuel	5,219,851	3
Heavy furnace oil	1,217,702	1
Coal	15,979,685	10
Natural gas	2,199,180	1
RE	0	0
Total	155,912,874	100

Source: Derived from data gathered in City Energy Review, 2006

*Note that this does not include the consideration of manufacture of a significant proportion of SA liquid fuels from coal and natural gas. This would increase CO₂ emissions attributable to liquid fuels by a factor of between 2 and 3 for those fuels manufactured from these sources.

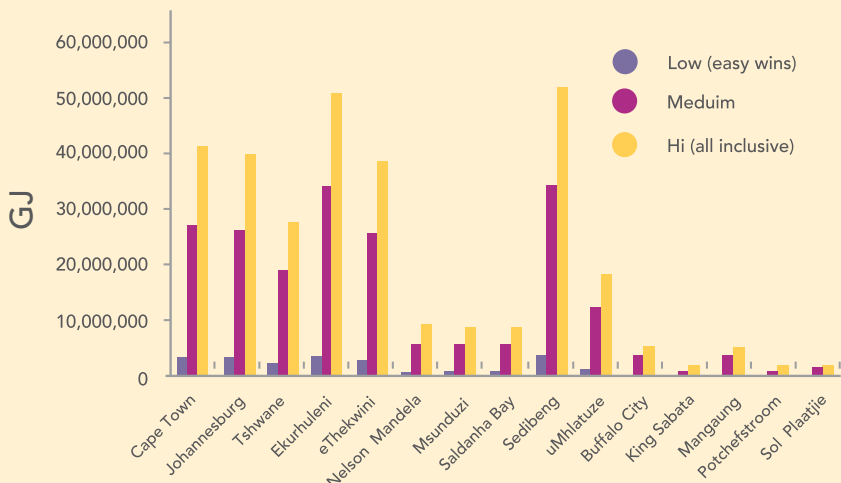
exhibit a wide variation in levels of air quality monitoring, and there is currently little consistency amongst city reporting measures, making data collection and comparison difficult. The City of Cape Town is currently the only city that has high level radioactive waste awaiting disposal within the city region.

The **well-governed** city explores the efficiency of local government in utilising resources and effectiveness of local government in addressing the identified development priorities of residents. Local authorities consume, on average, 1% of all energy used in a city. Some opportunities for energy (and financial) savings through efficiency in service delivery have been taken up within cities, but systematic implementation of routine energy management through all departments has yet to be achieved. In addition, monitoring of energy use does not readily link to the level of service outputs achieved. It is vital that efficiencies do not take place at the expense of service delivery levels and standards. Some cities, such as City of Cape Town and Nelson Mandela Municipal Metro, are beginning to explore their power as consumers of electricity to influence the generation sector towards 'greener' electricity production.

Electricity distribution management was identified as an important area for measure, but limited data was accessed in the course of this study. Broad energy management (as opposed to electricity delivery management) is taking root within the big metros in South Africa, and in some of the smaller cities – notably those who participated within the ICLEI Cities for Climate Protection campaign.

Energy strategies are frequently linked to air pollution and climate change management issues and often located within Environmental Management departments. Although strategies speak to social and economic issues, getting energy management considerations into city departments tackling social and economic issues is still something of a hurdle. Those cities furthest ahead with institutionalising of city energy management have established important networks with NGOs and research institutions, as well as national government and related institutions. This is an important foundation for the involvement of civil society in policy development, which needs to be built on.

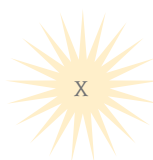
Potential savings from Energy Efficient measures and solar water heaters (reduction in annual energy consumption in 20 years)



Source: Derived from data gathered in City Energy Review, 2006

Future scenarios

A brief look at a range of generic renewable and energy efficiency options that are applicable to cities was conducted as a first step towards assessing the potential impact of these options in terms of energy consumption and CO₂ emissions. The estimated impacts are indicative only, but show that significant savings can be realized, and clear shifts to a more sustainable energy profile can take place. Major impacts can result from transport modal shifts from private vehicles to public transport, and industrial energy efficiency. From the perspective of changing the total city energy profile, the importance of



thinking big, and implementing mass rollout of solar water heaters, ceilings and efficient lighting programmes, for example, is illustrated (e.g. a 10% SWH penetration target will not shift the overall city energy profile significantly). However, from an economic and social point of view, these interventions are clearly beneficial, at whatever scale they are implemented.

The value of implementing on several different fronts, in all sectors, is apparent if cities are to shift to significantly more sustainable profiles. It is important to note that many of these options make good financial sense and require little or no up-front capital outlay, and therefore can and should be pursued without delay. Solar water heaters, efficient lighting, industrial energy efficiency, and HVAC efficiency improvements are amongst these. Where capital outlay for interventions, such as SWHs and ceilings are prohibitive, particularly for low-income households, there is a need for carefully designed financing and possible subsidies.

Huge carbon dioxide savings can be realized from sustainable energy interventions in South African cities – between 119 million and 864 million tons in the next 20 years. CO₂ reduction targets of between 15 and 20% over 20 years appear to be manageable for cities through efficiency and renewables interventions.

The way forward

In light of the significant role played by cities in the national energy profile, and because cities strongly influence energy characteristics within their boundaries, they are a critical part of any national sustainable energy strategy, and will be key players in meeting the energy efficiency and renewable energy targets set by national government. This report is a ‘first cut’ exploration of city energy data and points to the need for an ongoing urban energy research agenda to be developed. Appropriate institutional support to local government in their pursuit of local energy management for development requires urgent national attention.

Government’s electrification programme remains critical in providing access to energy for all South Africans and should be actively pursued. This programme could be enhanced by a more flexible energy services approach that includes a range of energy carriers (different fuels have different costs and efficiencies per application) and non-fuel services, such as energy interventions in houses (ceilings, insulation, plastering, use of natural lighting and passive solar insulation through house orientation, solar water heating). This would assist in best meeting household energy needs at the lowest cost for the cleanest, safest and most efficient services. Affordability of energy services requires continued attention.

Given the change in the global environment resulting from climate change, South Africa will soon be challenged in terms of its competitive advantage through cheap, dirty coal-based energy. In this regard cities need to play a more active role in determining their economic development and related energy paths. Persistent unemployment requires that cities vigorously tackle local economic development and begin to work with the marginalized areas of poverty in their sprawling townships. Key to this is providing energy services to make an economic base in these areas viable. A move towards a more distributed energy system, looking to energy efficiency and renewable resource utilisation at the local level, is increasingly being seen as a route through which to manage global shifts away from fossil fuel dependency, the risks associated with dependence on a centralised system and generating local economic opportunities.

Achieving sustainable city development in South Africa is going to require that our city transport issues are tackled. The critical transport modal shift from private vehicles to public transport is relatively demanding, often requiring substantial investment in public transport facilities. However most cities have identified this as a priority area of attention, and are formulating clear strategies to achieve such a shift.

Greater efficiency within industry (and choices about what kind of businesses cities wish to attract) and amongst high-income, high-energy consuming households needs to be realised. Industrial efficiency programmes are being tackled through government's Energy Efficiency Strategy. Local government need to address commercial building and high income household efficiency – and related emissions – through mechanisms such as stepped electricity tariffs, information and awareness, solar water heating and energy-efficiency building regulations and by-laws.

An integrated approach to energy planning, through the development of city energy strategies, provides cities with a mechanism through which to approach many of the issues raised within this report. In order for these to be effective, however, political support is critical – both locally and at a national level.

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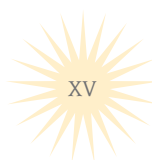


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Glossary of Terms and Abbreviations

AMEU.....	Association of Municipal Electricity Undertakings	GVA.....	Gross Value Added
ASGISA.....	Accelerated Shared Growth Initiative of South Africa	GW	Gigawatt (10 ⁹ watts)
BEE	Black Economic Empowerment	GWh	Gigawatt hour – a measure of energy (1GWh is equivalent to 3.6x10 ¹² joules and is equal to 10 ⁹ watt-hours)
BESST.....	Basic Electricity Support Service Tariff	HDI.....	Human Development Index
CBO	Community Based Organization	HFO.....	Heavy Furnace Oil
CCP.....	Cities for Climate Protection	HSRC	Human Sciences Research Council
CDM	Clean Development Mechanism	IAEA.....	International Atomic Energy Agency
CER.....	Certified Emissions Reductions	ICLEI.....	ICLEI Local Government for Sustainability
CEF.....	Central Energy Fund	IDP.....	Integrated Development Plan
CFL.....	Compact Fluorescent Light Bulb	IEA	International Energy Agency
CH ₄	Methane	IEP.....	Integrated Energy Plan
CMIP	Consolidated Municipal Infrastructure Programme	IPCC	Intergovernmental Panel on Climate Change
CO.....	Carbon monoxide	IPP.....	Independent Power Producer
CO ₂	Carbon dioxide	KPI	Key Performance Index
CPI	Consumer Price Index	KW	Kilowatt (10 ³ watts)
CSIR.....	Council for Scientific and Industrial Research	KWh.....	Kilowatt hour – measure of energy usually electricity (10 ³ watt-hours)
Danida	Danish International Development Agency Assistance	LA2I	Local Agenda 21
DBSA	Development Bank of Southern Africa	LED	Local Economic Development
DEAT	Department of Environmental Affairs and Tourism	LPG.....	Liquefied Petroleum Gas
DME	Department of Minerals and Energy	MA.....	Millennium Ecosystem Assessment
DoH.....	Department of Housing	MEC.....	Minerals-Energy Complex
DPLG.....	Department of Provincial and Local Government	Mt.....	Megaton
DSM	Demand-Side Management	MW.....	Megawatt – measure of power (10 ⁶ watts)
DST.....	Department of Science and Technology	MWh	Megawatt hours (10 ⁶ watt-hours)
EE	Energy Efficiency, the ratio of energy output to energy input of a system	NEEA.....	National Energy Efficiency Agency
EISD.....	Energy Indicators for Sustainable Development	NEMA.....	National Environmental Management Act
EU	European Union	NEP.....	National Electrification Programme
FBE.....	Free Basic Energy	NERSA.....	National Energy Regulator of South Africa
GDP	Gross Domestic Product	NGO	Non-governmental organization
GEAR.....	Growth Employment and Redistribution (policy)	NIRP.....	National Integrated Resource Plan
GGP	Gross Geographic Product	NMVO.....	Non-methane volatile organic compounds
GHG	Greenhouse Gas	NOx.....	Nitrogen oxides (or oxides of nitrogen)
GJ.....	Gigajoule (10 ⁹ joules)		



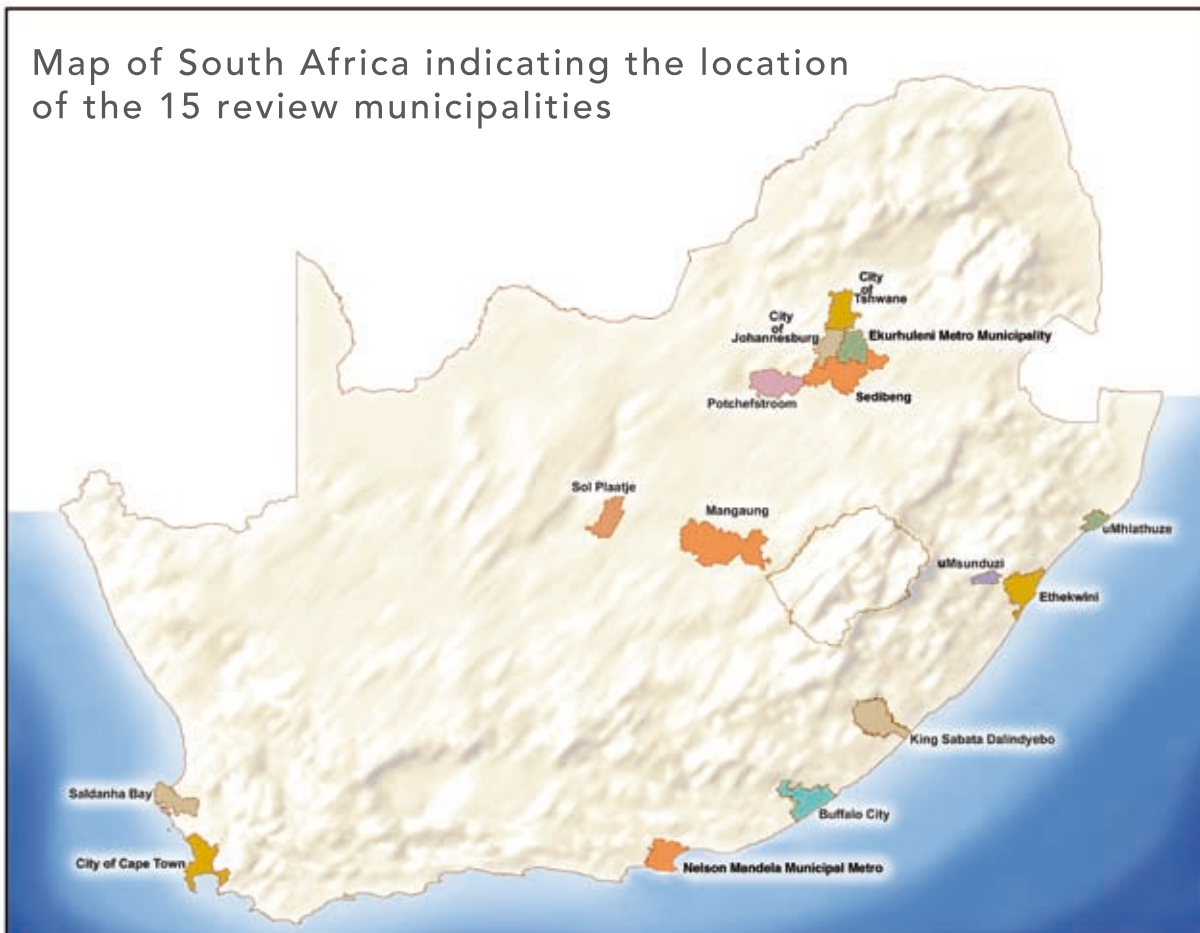
N₂O.....Nitrous oxide
PM10.....Particulate matter with a diameter less than 10 micrometres
PPA.....Power Purchasing Agreements
PV.....Photovoltaic
RDP.....Reconstruction and Development Plan
RERenewable Energy, energy used at a rate at which it can be naturally replenished
RED.....Regional Electricity Distributor
SACANSouth African Climate Action Network
SACN.....South African Cities Network
SALGA.....South African Local Government Association
SAPIASouth African Petroleum Industry Association
SEED.....Sustainable Energy for Environment and Development
SMME.....Small, micro and medium enterprise
SO₂.....Sulphur dioxide
Stats SA.....Statistics South Africa
SWH.....Solar Water Heater
TJ.....Terajoule (10¹² joules)
TRECTradeable Renewable Energy Certificate
TWh.....Terawatt-hour
UNFCCC.....United Nations Framework Convention on Climate Change
VOCsVolatile Organic Compounds
WSSD.....World Summit on Sustainable Development, Johannesburg 2002

Introduction

The City Energy Data Review has been developed through an emerging network of city officials and related stakeholders. It originated as an attempt to draw together the urban energy work taking root in South African cities and to start examining the role of city energy consumption within the national energy picture. The measures identified in the review aim to unpack the issues that lie at the heart of the local government mandate to deliver services to meet basic needs and promotion of sustainable development. The data collated is a key tool for energy planning, strategy and policy development at the local, provincial and national level. Careful and detailed analysis of the data will take place through ongoing urban energy work envisaged over the next few years.

Within a generation the majority of the world, and indeed South Africa, will live in urban areas. The scale of this urbanization is unprecedented and poses daunting challenges. However, the urban transition may also offer significant opportunities for countries to improve the quality of life for all citizens, reduce poverty and create more sustainable communities. Whether this potential is realized depends critically on the quality of urban management and on local and national policies affecting sustainable development issues.

Map of South Africa indicating the location of the 15 review municipalities



In South Africa a large and concentrated energy sector is responsible for producing and supplying energy. However, energy – as a key factor in economic production and a key input in meeting basic human needs – is a significant concern for cities. If city government does not also play an active and effective role in managing long-term trends in energy supply and use within their jurisdiction, city development is unlikely to succeed. There is compelling evidence that this argument has been accepted by the most successful cities worldwide, leading to those cities implementing programmes which have demonstrated the major benefits which this approach offers. This is particularly important in light of the global trends around the supply and use of fossil fuels, especially related to climate change and greenhouse gas (GHG) emissions and world trade and globalization.

This report builds on the city energy work that has taken root in South African cities over the past seven years, through the Sustainable Energy for Environment and Development (SEED) and ICLEI Cities for Climate Protection programmes, as well as the city development work established through the South African Cities Network (SACN). Africa's first ever City Energy Strategies Conference, held in Cape Town in November 2003, was an important milestone. Today a number of our cities have, or are in the process of developing, city energy strategies. The time is ripe to draw together information and data on energy in our cities, to track progress to date and highlight critical issues to take the work forward.

This review emphasizes again the key role that dense city nodes have to play in the development of our country. The review includes 13 of the 17 cities considered to be the “backbone” of the South African economy. It also includes cities that, by contrast, show the issues of poverty and economic marginalization confronting areas of South Africa. In total the study cities contribute some 60% of national GDP and account for nearly 40% of national energy consumption. The study shows that city energy should be a key area of any national energy strategy and that, within this, transport may be the key city energy issue.

The other key energy area that emerges within the study is where energy is not being used. Energy poverty is still a major concern in South African cities. Energy is also a key input in the development of city economies and ensuring energy for local economic development in marginalized city township areas requires urgent attention.

Cities manage many areas that substantially impact on the use of energy, such as land use planning, transport network development, the delivery of government subsidy housing and building regulation. In addition, cities are large energy users themselves – requiring substantial inputs of energy in water pumping, waste removal, municipal facilities and so on. While South Africa has a legacy of highly centralized power supply, the framework has been opened up for independent power producers and cities, bringing the substantial purchasing power of a city with them, are likely to be key drivers in enabling independent power producers to become economically viable.

City energy management is taking root in South African cities. We have particular challenges to face given our legacy of cheap and dirty energy production, huge levels of social and economic inequality and entrenched poverty. Establishing partnerships between local and national government is of key importance in addressing the urban energy challenges. Moving cities towards more sustainable energy paths is a huge task. City networks, already established within the SACN and within the SEED Programme, have shown themselves to be invaluable in the exchange and sharing of learning, experience and information. Such networks require ongoing support. This review hopes to add impetus to the urban energy networks begun. The data gathered is rich and calls for the development of an urban energy research agenda to take it a further step – shedding light on a complex and critical area of our country.

This review has been structured according to the City Development Strategy framework quadrants: Inclusive City, Productive City, Sustainable City and Well-governed City. These roughly align themselves to the social, economic and environment ‘pillars’ of sustainable development approaches. This review has included a fifth ‘column’, that of Mobile and Accessible Cities. This speaks specifically to transport and was felt to warrant separate attention as it is of substantial importance within city energy consumption and has attributes peculiar to it that may be lost within a broad energy approach. While the City Development quadrants provide a useful way of organising the information, energy is such a cross-cutting issue, that there results some degree of content repetition within quadrants.

Within each City quadrant chapter, data information is presented under an issue theme, and then reporting to a particular measure developed to highlight aspects of the issue. These measures were developed in a participatory manner, through a series of network meetings, by city officials and city stakeholders. The measures also refer substantially to the IAEA/UNDP Energy Indicators for Sustainable Development. An upfront methodology chapter details this process and examines the data, its availability and reliability. The process – bringing together city players in the development of measures and data discussion - provides a notable ‘bottom-up’, decentralised thinking for energy policy making. Indeed the true value of the review may lie in this.

An overview chapter upfront outlines the role of energy in tackling poverty, sustainability and development at the local level. The report includes a number of case studies. These aim to draw out qualitative issues that may be lost within the data, or not obtainable from existing data. The case studies also intend to emphasize that energy is a people issue – we don’t need energy for its own sake, but for the services energy provides: lighting, heating our food, warm homes, mobility. An approach that emphasizes and explores energy services and demand for energy is critical in energy management.

In conclusion the review takes a brief look at the future – what does the energy consumption and global emissions case look like if we carry on business as usual, or move towards a more renewable and energy efficient future. A full ‘statistical almanac’ from which the information within the report is derived, plus city data sheets and a summary of key global, national and local initiatives, policy and legislation relating to city energy development are provided within the annexures.

Methodology

This review was undertaken over 18 months, from April 2005 to September 2006. It began life as an activity within the Danida-funded Sustainable Energy for Development (SEED) programme Phase 2 and has been further supported by the Renewable Energy and Energy Efficiency Partnership (REEEP) and Wallace Global Fund. The drive behind the review was to establish the role of city energy in the national energy picture – and make the links between national and local policy and planning, to get a sense of how our cities are doing in terms of integrated energy planning and development and develop a data tool to assist with energy planning and decision making (locally and nationally) and provide a baseline against which to monitor development over time.

The time indeed seemed ripe to draw together some baseline information on energy in our cities: in 2005 the SEED city energy capacity building programme had been running for some six years, the Cape Town Energy Declaration, formulated at the City Energy Strategy Conference held in Cape Town, was two years old and the ICLEI Cities for Climate Protection (ICLEI-CCP) Programme, running in 11 cities in South Africa, was drawing to a close. In addition both the South African Cities Network (SACN) and Department of Environment and Tourism (DEAT) were looking for more detailed measures to be considered for energy monitoring within the city level sustainability and environmental monitoring programmes they were each building.

Defining the study area

Cities initially included within the study were those cities participating within an energy, or city network programme. This group was then expanded to ensure a better geographic, social and economic spread: coastal and inland towns, metro and smaller cities, industrial and more rural cities, metro, A and B municipalities and a District Municipality and an ex-“homeland” city. The cities within the study thus include the six big metros, City of Cape Town, City of Johannesburg, City of Tshwane Metropolitan Municipality, Ekurhuleni Metropolitan Municipality, eThekweni Metropolitan Municipality and Nelson Mandela Metropolitan Municipality, the industrial towns of uMsunduzi Municipality, Saldanha Bay Municipality, Sedibeng District Municipality and uMhlatuzi Municipality and the non-industrial cities or towns of Buffalo City Municipality, King Sabata Dalindyebo Municipality, Mangaung Municipality, Potchefstroom Municipality and Sol Plaatje Municipality.

Although the focus of the study is on urban energy consumption, municipal level data is used. This is due to the difficulty of disaggregating the energy data down to the city level. However, this does not coincide with SACN city monitoring, and may require consideration in a further study of this nature, or second round of monitoring.

A cadre of local energy strategists

At the heart of this review has been the work of city officials and city stakeholders who, despite the enormous time and capacity pressures they face on a daily basis, came together to discuss and develop



the energy issues to measure, went back to their city departments to dig out relevant data, and engaged with the emerging data review. The networking meetings held provided an opportunity for this group to begin to engage with South African city energy issues as a collective concept for the first time. Valuable conceptual lessons arose, to take forward, and experience was shared. Important points of contact were also formed – within cities, between NGOs and city government, between cities and between cities and national level organizations. In the main cities were represented through their environmental management departments, where issues of climate change are held, but energy and electricity officials were also represented.

Key energy issues were agreed upon through exploration of cities' energy and sustainable development mandate, using the tools of the City Development quadrants and direction from local and international energy and sustainability indicators. Measures were then developed within each issue theme. These were intended to be a set of local sustainable energy indicators, however, complex indicator development has not been achieved in this “first cut”. Distilling a coherent, measurable, defensible set of indicators from these will be an important part of taking the urban energy agenda forward. These are likely to line up with energy indicators from the standard Energy Indicators for Sustainable Development (EISD). It is believed that the measures in this report do still provide a useful, usable tool to promote effective city energy planning and decision-making.

A set of key city energy issues and measures

The aim of developing key energy issue measures has been to raise city energy issues on the local and national policy agenda through highlighting key issues and their implications, stimulating the generation of data to support policy decisions and providing a benchmark against which work in the field could be monitored – and indeed celebrated where achievements made. The measures align with many international measures, enabling South African cities to benchmark themselves against international developments. The review data thus targets all levels of government policy makers, but will hopefully also capture the imagination of research institutions and further support an urban energy research programme.

Broadly, the measures aim to:

- a. Generate baseline information on city energy consumption and related GHG emissions, both by sector and fuel type;
- b. Test for diversification – the resilience of the energy system to weather trade impacts, supply disruptions;
- c. Measure pollutants – the global and local impacts of energy consumption;

Developing City Energy Measures

In developing city energy measures for this review existing energy and sustainability indicators were consulted, notably the Sustainable Energy and Climate Change Partnership (SECCP) / Energy Development Research Centre (EDRC) Energy Sustainability Indicators for South Africa (Spalding-Fecher) and the Energy Indicators for Sustainable Development generated by the International Atomic Energy Agency (IAEA) in cooperation with the United Nations Department of Economic and Social Affairs (UNDESA), the International Energy Agency (IEA), Eurostat and the European Environment Agency (EEA). The City of Cape Town Sustainability Indicators provided insights as did the existing State of Energy Reports for a handful of South African cities: Cape Town (2003), Ekurhuleni (2004), Tshwane (2004) and Sol Plaatje (2005).

The EISD standard indicators that underpin our measures, were developed by statistical bodies that South Africa belongs to and in processes in which South Africa was involved.



- d. Look at equity and access to energy (in line with the Millennium Development Goals);
- e. Probe economic development issues related to energy, such as supporting local economic development, exploring the “energy intensity” of city economies, as well as the levels of investment in energy efficiency and renewable energy; and
- f. Benchmark energy management at the city level.

The measures are grouped in line with the SACN City Development Strategy Quadrants, namely Inclusive City, Productive City, Sustainable City and Well-Governed City. When emerging data indicated the relative importance of transport as a city energy issue, and because of a growing sense that transport forms a management focus on its own, this was then added to form a fifth group. Information was not readily available for all measures. In some instances a proxy has been used. In others, the lack of data is simply flagged for attention.

Data

The review was based as much as possible on existing data. This posed its own problems: rather than building from needs up, or level of services, the emphasis tends towards the more easily measurable “inputs”; the Second Economy is notoriously under-recorded.

The baseline year has been set at 2004, however the study was very reliant on information gathered in the 2001 census and thus a fair amount of data reflects this base year. Gigajoule (GJ) conversion factors are taken from the Energy Information Administration, USA (2001) and emissions coefficients used are from the Intergovernmental Panel on Climate Change (IPCC) Revised Guidelines for National Greenhouse Gas Inventories (1996). It needs to be noted that carbon emissions from liquid fuels within this study were calculated without factoring in that local liquefaction (coal to synthetic fuel) supplies about 35% of national petroleum fuel consumption. This process has a carbon emissions level associated with it that is not factored into the consumption emissions calculations.

Participating city officials undertook to complete a fairly lengthy and comprehensive questionnaire on energy consumption within their municipalities. This was an arduous task involving the follow up of many different departments, visits to coal yards and establishing what data was available. A SEA staff member visited three of the smaller local authorities (Mangaung, uMsunduzi and uMhlatuzi) to support officials and build capacity around identifying sources of data and methods of energy data collection.

City data was not always comprehensive. Filling in gaps and cross checking was done through accessing existing national databases. Liquid fuel data was received from the South African Petroleum Industry Association (SAPIA). This data is still collected along old magisterial boundaries, and thus required a degree of working to match data with municipal boundaries. Obviously better alignment with current judicial boundaries would assist the process, however, this data is comprehensive and readily accessible. Jet fuel always poses a problem. Technically only that consumed on landing and take off at city airports should be included; however this requires fairly complex calculations. The Cape Town State of Energy Report does not include jet fuel, whereas Ekurhuleni does. This report has included all jet fuel sold within a city as part of the city energy picture.

Electricity data for municipally distributed electricity was sourced from municipal electricity departments and NERSA. Data from the two different sources did not always line up exactly, but were reasonably aligned. In general NERSA data was used (both to ensure consistency over time, but also as this data is



also provided with a sectoral breakdown). However, where data was either not available for the baseline year, or where city data was clearly better developed, these figures were used.

Obtaining Eskom distributed electricity data at the municipal level was difficult. Eskom stated that they did not have distribution data available along municipal boundaries (though are beginning to do so). Eskom distribution was thus sourced via a combination of “expert” estimations by city electricity departments and data collected within state of energy reports. Eskom’s “Top 50” customers list was also used to ensure that the biggest consumers were included within the review data. Although Eskom cannot publish the consumption figures, reasonable estimations could be made from pegging those customers for which such information was available (municipalities or big multi-nationals which publish their electricity consumption figures, such as Billiton).

Coal has been deregulated, making data collection on coal consumption within municipal boundaries extremely difficult. Figures were sourced from the larger local merchants, state of energy reports, municipal officials visiting local coal yards. The iron and steel industry association was approached for assistance with industrial consumption figures, but were unable to help. Industrial estimates are therefore decidedly rough. A gap certainly still exists within this area of data.

Biofuel (wood and animal dung) is prevalent in all cities in South Africa, but apart from City of Cape Town which had calculations for biofuel use (wood), quantifying this was not possible within the review. Biofuel is provided within the mix of household fuels from census figures – but is presented as share of households using this fuel, rather than a figure for total fuel consumed.

Although a start has been made in the development of biodiesel and ethanol gel, this report was unable to trace city level consumption data relating to these fuels. Similarly, levels of solar water heating within cities are as yet un-quantified and good data, reportedly, hard to obtain.

In terms of internal city energy consumption few cities have a regular, systematic way of collating their own energy consumption and, critically, aligning this with the level of services achieved. Cities may also measure using slightly different categories, making cross comparison difficult. The privatization of areas of city service delivery further muddies the water – it is important that service delivery contracts in future should ensure that the contractor reports on energy consumption as part of the procurement requirements.

Data collection and comparisons over time need to factor in any municipal or district boundary changes, as well as changing definitions of “household” and of “income bands”.

Conclusion

This report is a “first cut” data review: in the process many issues around methodology and approach have arisen and there have been rich learnings. A session will be held, drawing all participants together to review the process and document learnings. In addition, Danida will be funding a SEED Phase 3 Programme which will run over the next two years and provide an opportunity to take the process begun in this review forward. This will include capacity building in cities to develop systematic energy data collection, in particular on the Second Economy and emphasising energy needs of people, rather than energy inputs, as the basis of measure. Further work that will build on the foundation of this review will also include the development of targeted policy briefs around key energy and development issues and taking an urban energy research agenda forward. The city energy capacity building of SEED Phase 3 will work intensively with 5 cities to take energy work forward, but will also ensure that this broader network continues to receive information, training opportunities and facilitate the exchange of experience over the next couple of years.



The developing urban energy mandate in post apartheid South Africa

Developmental local government

South Africa has 284 ‘wall-to-wall’ municipalities, consolidated through the Municipal Structures Act (Act 117 of 1998). A legacy of uneven economic development, concentrated around the growth of the mineral-energy complex (MEC) and related industrial activities, and the ports, has resulted in some 17 cities and towns amongst these municipalities forming the backbone of the South African economy¹. This handful of cities and towns contribute some 70% to national GDP, accommodating nearly half of national population, while occupying 3 – 4% of land area. Uneven development exists both between cities and smaller towns, but also within cities. These cities represent the centre of the nation’s wealth, but also contain its most concentrated, abject poverty². South Africa’s ‘core’ cities are thus crucial in meeting the challenges of poverty and (just, equitable and sustainable) development in South Africa.

These goals are enshrined in our Constitution which sets out basic socio-economic and environmental rights for all South Africans. Both the private right of individuals to basic services and the public right to a healthy and sustainable environment must be secured³. The allocation of powers across the spheres of government mean that some of the most important services for the poor, including access to electricity and environmental health, amongst other services to meet basic needs, fall in the jurisdiction of local government (detailed for municipalities in the White Paper on Local Government, 1998). The democratically elected government in South Africa further introduced a system of developmental local government⁴ for building more equal and just cities and towns.

Developmental local government aims to relieve poverty through making local government a platform for intra urban redistribution through local “indigent policies” that ensure the provision of basic grants and services to the poorest. It also involves local government proactively in economic development that looks to job creation and local economic growth directed at spreading the benefits amongst the majority.

This is an enormous challenge given the legacy of apartheid inequality in service delivery, infrastructure and spatial planning, current levels of poverty and unemployment in our cities. The challenge is deepened in the context of a dwindling fiscal base – both from national treasury and local service payments as many citizens reach the affordability limit. Simultaneously, globalisation is “pressuring municipalities to create internationally competitive locations for businesses and households, going beyond merely supplying basic services and infrastructure”⁵.

1 Luus, & Krugell, 2005, p11.

2 Parnell, S, 2004, *Constructing a developmental nation – the challenge of including the poor in the post apartheid city.*

3 Parnell, S, 2004, p16.

4 South Africa, 1998: *Local Government White Paper*, Department of Constitutional Development, Pretoria

5 Luus. & Krugell, *Economic Specialisation and Diversity of South Africa's Cities*, 2005, p9.



Energy as a key pillar within developmental local government

Cities in South Africa thus take their obligation and responsibility, effectively their mandate, to tackle a wide range of energy issues – notably access to clean, reliable, affordable and safe energy - from the South African Constitution, the White Paper on Local Government, Municipal Structures Act and legislation such as the National Environmental Management Act (NEMA) of 1988.

It is well established that access to clean, reliable, affordable and safe energy is a necessity in ensuring human well-being and development.⁶ South African city energy consumption patterns tend to be unsustainably high for a small minority and unsustainably low for the vast majority. Energy poverty as experienced by many South African urban-dwellers is a severe burden. Health is compromised through poorly heated homes, or indoor air pollution from burning of wood, coal or paraffin inside the house. These fuels are also dangerous, rendering poor households highly vulnerable to the setbacks of disasters such as fires and poisonings. When fuel runs out households may be forced to eat less nutritious meals. Borrowing to buy fuel places households in debt. There is a heavy burden in terms of time and safety, on household members, often women or children, who must go out in search of firewood or other fuel. The energy burden erodes households' ability to meet city service delivery costs.

Energy is a key and substantial factor in economic production: either directly, such as the coal used in minerals processing or electricity used in manufacturing industries, or indirectly, such as the liquid fuels used to power the vehicle fleet that transports freight and carries people to and from where they work. The types and quality of energy available enable various kinds of economic activities. Local government provide a platform for economic development, a central component of which is reliable energy service provision, planning and regulation. Although the energy supply industry in South Africa is a large and nationally concentrated sector, consisting largely of a small number of state-owned corporations and large private-sector owned companies, city government can play a key role in medium- to long-term trends in energy supply and use in the area of the city's jurisdiction. While effective national government policy and support and well-functioning energy industries are required to provide an enabling environment, proactive city energy management of long term trends in energy supply and use in the area of the city's jurisdiction is critical for economic success.

In South Africa broadly the energy sector contributes approximately 15% to total GDP and creates employment opportunities for approximately 250 000 people⁷. Currently this remains a highly centralised industry. The developmental local government mandate emphasises that cities must be proactive about opportunities and programmes that are locally owned and locally rewarding. Decentralised energy services, such as energy efficiency delivery, efficient housing products development, solar water heating, small-scale renewable electricity generation, may all offer such local development opportunities.

While energy is necessary for life and development, current dependence (in South African cities this is nearly 100%) on fossil fuels means that energy is also very destructive in terms of air quality, health, fires and greenhouse gas (GHG) emissions. Some of the case studies in this review explore how incidences of respiratory disease and cancers occur more frequently in areas where heavy, coal and coal-fired electricity reliant industrial activity and indoor coal burning to heat homes takes place; blood lead levels are higher in children walking to school along busy

6 Much work has been done on exploring the relationship between measures of human well-being and consumption of energy and electricity. In "Global Energy Futures and Human Development: A framework for analysis" Alan D Pasternak of the Lawrence Livermore National Laboratory, shows a correlation between the United Nations' Human Development Index (HDI) and annual per-capita electricity consumption for 60 populous countries comprising 90% of the world's population. In this correlation HDI reaches a maximum value when electricity consumption is about 4 000 kWh per person per year.

7 Eskom 2005/6



roads and have dropped since the introduction of ‘cleaner’ petrol and diesel; shack fires, usually paraffin or candle-related, destroy hundreds of homes in South Africa each year.

At the global level, climate change, and the need to get onto a significantly less carbon-intensive path, is a high priority. Of the increased levels of greenhouse gases in the atmosphere, 50-60% is said to be from carbon dioxide released when burning fossil fuels⁸. While climate change is considered a global issue, the impact will be increasingly felt at the local level. Shifting weather patterns will affect agricultural production. The severity of weather and related disaster events has already increased, as flooding events across South Africa and increased fires in the Western Cape have shown. The poor, with no security against risk, will bear the brunt of climate change impacts.

The challenges of reducing carbon emissions and ensuring security of supply are closely linked. Our own reserves of coal are predicted to decline within the next 150 – 200 years. Dependency on imported oil renders us reliant on supplies from regions far beyond our borders. Global energy demand is forecast to grow strongly. This will mean greater competition for supplies, within a market that has tightened, with a decline in spare production and refining capacity⁹.

Energy is often considered the ‘lifeblood’ of modern cities: energy powers homes, office blocks, transport systems, industry, infrastructure and commerce. City governments are important suppliers of goods and services that requires energy inputs and involve energy usage. City management is thus in a good position to play a leading role in demonstrating the implementation of energy policies, such as improving energy efficiency, decreasing negative environmental impacts involved with energy production, and boosting the use of renewable energy sources. City procurement policies can play a role in encouraging shifts in energy production, supply and usage. City planning can also play a major role in influencing energy use patterns.

Furthermore, energy costs also draw precious budgetary resources from other important municipal functions, such as public transport and health care. Energy is a variable cost that can be controlled by cutting down on wasteful energy consumption – greater energy efficiency means lower energy costs and improved competitiveness. Effective municipal energy management produces short-term cost savings and longer term viability and competitiveness of local government. Using less energy also means reduced local pollutants (with associated health savings) and carbon emissions¹⁰.

Rolling out of developmental local government in the context of international and national commitments on sustainable development

⁸ DEAT, *Learning about Climate Change, An Environmental Education Learning Resource for Educators*, Jacana, 2002, p 26.

⁹ United Kingdom Department of Trade and Industry, *The Energy Challenge*, 2006, p19.

¹⁰ Ward, *Energising African Cities*, p 1-2..

¹¹ Millennium Ecosystem Assessment, 2005, UNEP.

¹² Vital Signs 2003, p 17.

The threatened diversity of life on earth and climate change may be considered to be the most pressing political issues facing the world. The Millennium Ecosystem Assessment ¹¹ (MA) completed in 2005 tells us that over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre and fuel. The ability of the planet’s ecosystems to sustain future generations can no longer be taken for granted.

The environmental challenge is inextricably linked to inequality and poverty: while resource consumption has escalated, fuelling the sevenfold increase in the world economy since 1950¹², the majority have not had adequate access to resources to



meet basic needs and global poverty has deepened¹³. Resource-intensive growth has not led to worldwide prosperity. The disparity in per capital income between the world's 20 richest and 20 poorest nation has more than doubled between 1960 and 1995¹⁴. Inequality has also risen *within* countries.

Countries have responded to the crisis through a number of international summits and agreements in an attempt to move towards a sustainable development path. South Africa is signatory to a number of international protocols relating to sustainable development, including the Millennium Development Goals (MDGs), the Johannesburg Plan of Action and the Kyoto Protocol. Although national government has not devolved specific responsibilities relating to these commitments to the city level, much of what the state can do is city-based and coordinated by local government, if not directly delivered by them. These commitments thus have a bearing on local government mandates. They also often represent areas of international focus, and potential project funding opportunities for cash-strapped municipalities.

The Millennium Development Goals, agreed upon by world leaders in 2000, do not have specific energy targets, but recognise that lack of access to adequate, affordable, reliable, safe and environmentally benign energy services is a severe constraint on development. It has been made clear that without increased access to modern energy services the MDG target of halving the proportion of people subsisting on a dollar a day or less by the year 2015 will not be achieved. Alongside the recognition of the need for energy to alleviate poverty, the MDGs also look to track energy efficiency and carbon emissions of countries.

The issue of carbon emissions is more specifically addressed within the legally binding Kyoto Protocol. The Kyoto Protocol, as of February 2005, governs the international implementation of carbon reduction commitments by industrialised countries. One such mechanism to facilitate emissions reduction is the Clean Development Mechanism (CDM). Using this mechanism, countries are able to claim carbon reduction “credits” by supporting non-industrialised countries in reducing their CO₂ emissions.

As a non-Annex 1 country within the Protocol, South Africa is only committed to a general CO₂ reduction target. As a high global carbon emitter there is speculation that South Africa's non-Annex 1 status may change in the next round of negotiations (2001 – 2012). This would potentially bind South Africa to specific carbon reductions.

South Africa has also developed local renewable energy and energy efficiency targets. The Renewable Energy White Paper (2002) focuses on the Independent Power Producer framework, discussion of renewable energy targets, financing and legislative framework while promoting local manufacture of renewable technologies. The draft national Energy Efficiency Strategy of 2004 provides specific targets for reduction in energy demand by 2014 within given demand sectors, with an overall target of 12% reduction in consumption and specific demand sectors reduction targets by the year 2014.

World leaders have recognised that local government are the level of governance closest to the people, and therefore a major group that can implement a global planning process for sustainability through their own programs and initiatives.

It is also recognized that local and global problems, and the impacts of these, are inter-related. Sprawling urban slums without economic centres and inadequate public transport will result in a rise of inefficient private vehicles filling increasingly congested roads and emitting high levels of gas emissions – polluting air locally and further contributing to GHG build up and climate change. In turn, global environmental problems have negative local impacts. Global climate

¹³ *Vital Signs, 2003, The WorldWatch Institute in cooperation with UNEP.*

¹⁴ *Vital Signs 2003, p 18.*

South Africa's energy efficiency targets

DEMAND SECTOR	REDUCTION IN DEMAND BY 2014
Industry	15%
Commercial and Public Buildings	15%
Residential	10%
Transport	9%
Total	12%

Source: DME, 2004b

and development means thinking, planning and acting in the long-term, examining all the impacts of decisions made today with tomorrow in mind. Local governments make decisions affecting energy management, industrial development, air quality and climate change action, and public procurement. Local governments own and operate buildings, vehicles and facilities, such as street lighting and water supply and treatment that consume large quantities of fuel and electricity. Local governments also control land-use policies. They determine where buildings and developments should be located, the ensuing mobility needs and the mix of uses that are allowed, which in turn affect energy use. Local governments make or exert influence on decisions and investments regarding road, transportation and transit systems. Local governments often have regulatory influence over or responsibility for building codes, which determine the energy efficiency of building stock. Some local governments also own and operate power plants and potentially have the choice of energy sources in their hands.

In September 2006 at the Africities Summit, the United Cities & Local Government World Organization, recognizing the important role cities can play in achieving the MDGs, resolved to support African cities in the implementation of City Development Strategies based on the MDGs. The Summit also recognized the importance of city planning practices in order to adapt strategies in the regional context, city to city cooperation, and the promotion of sustainable and innovative practices in the execution of the Millennium Development Goals. A number of cities internationally and in South Africa have also developed energy and climate change policies to address these specific issues within the broad development context.

“Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and sub-national environmental policies. As the level of governance closest to the people, they play a vital role in educating, mobilising and responding to the public to promote sustainable development .”

Agenda 21: Chapter 28.1 United Nations Conference on Environment and Development, Rio de Janeiro, 1992

change results in extreme weather events and related disasters, placing homes and lives at risk; regional economic bases, such as agriculture and tourism, may crumble as the climate changes, resulting in heavy job losses, economic decline and potential further migration into the cities and towns. Cities need to manage these problems.

A sustainable approach to environment

City energy planning for sustainable development in the South African context

The national regulatory framework

City energy planning has developed in response to the challenges of developmental local government, particularly within the global development and environment context. City energy planning is also located within the national energy regulatory framework.

The Department of Minerals and Energy (DME) bears the primary responsibility for developing national energy policies in South Africa. The national Energy White Paper of 1998 outlines an integrated resource planning approach to energy in pursuit of economic development, access to electricity, management of health and environmental impacts of energy generation and vigilance around paraffin poisoning and transport health impacts. The latest National Energy Bill (2004) provides a comprehensive framework for national energy management in accord with the White Paper – including the establishment of a National Energy Advisory committee and national Energy Data Base and Information System. The Renewable Energy White Paper (2002) and Energy Efficiency Strategy (2004) detail national commitments to the development of independent power producers, renewable energy and energy efficiency targets.

The major tools for tackling access to electricity and poverty alleviation have been government's National Electrification Programme (NEP), begun in 1994, and the Electricity Basic Service Support Tariff (EBSST), provided for in 2003, to support poor households meet their basic energy needs. The EBSST is a free 50KWh per connected household and is funded by national government through transfers to local governments and through cross subsidies from high end users.¹⁵

Electricity reticulation is a municipal function in terms of the constitution, and for many municipalities, revenue earned from electricity sales provides a critical surplus used to cross-subsidise other, loss-making municipal services. Recently municipalities have had to grapple with restructuring of the electricity distribution industry when new national legislation in 2003 called for the establishment of wall-to-wall Regional Energy Distributors or REDs. REDs were mooted to deal with consolidating energy distribution in South Africa, including standardizing the variety of energy tariffs across the country, to allow for geographic cross subsidisation between urban and rural areas and delivering on equity issues raised in the Energy White Paper.

The National Energy Regulator of South Africa (NERSA) is mandated to regulate the supply, transmission and distribution of electricity and gas within the confines of the Electricity Act of 1987 and the Gas Act (2001) as amended and the Energy White Paper of 1998 and the National Energy Regulator Act of 2004. The National Energy Regulator also has an Energy Efficiency Policy¹⁶ that aims to protect electricity customers, stimulate the realisation of the benefits of energy efficiency and remove barriers inhibiting the implementation of energy efficiency.

The National Integrated Resource Plan¹⁷ of 2004 (NIRP) is prepared by the NERSA and is based on Eskom's Integrated Electricity Plan. The objective of the NIRP is: "to optimise the supply-side and demand-side mix to keep the price of electricity to the consumers as low as possible". Of significance is the core consideration of Demand Side Management (DSM) and potential for wind to be part of the "peak supply" mix. It also considers the need to diversify away from coal (partly for environmental reasons, partly security), and lists research & development options identified.

The combined strategies of national government and the NERSA on regulating energy efficiency and DSM activities imply that local electricity departments/REDs will have to become more directly involved in the efficient use of electricity in the near future. Municipalities have a significant role to play with respect to energy efficiency and demand-side management (DSM) in South Africa.

These few policy examples are indicative of the existence of constructive and socially concerned energy policy and national energy strategy in South Africa. Critical government policy decisions are often national. But almost

¹⁵ Winkler H (Ed), 2006.

¹⁶ NER, 2004, *Regulatory Policy on Energy Efficiency & Demand Side Management for South African Electricity Industry* not in refs

¹⁷ NERSA 2003/2004 *In refs says 2003/2004*



all energy use is “local”. Transportation, homes, buildings are all strongly influenced by local priorities, information, and resources. The missing element is sustained implementation and support to local government who are the seat of development and who have significant obligation in delivering services and providing basis for economic and social development. Within this, a particularly notable gap is the location of urban transport policy support. Transport emerges within the State of Energy in South African Cities Review, 2006, as **the** urban energy issue in South African cities. At a national level the Department of Transport has an **access** focus, rather than energy and environment focus. DME, on the other hand, has a focus on transport fuel, but not the energy aspects of transport planning. There is currently no institution or framework to take up this critical urban energy issue.

The challenge of the ‘dual economy’

18 Mbeki referred to the South Africa’s “Dual Economy” and the notion of a First and Second Economy within his 2003 State of the Nation address. Noted descriptions of South Africa, such as that by the UNDP, refer to the dual economy and this is also well described within publications such as *Understanding South Africa’s Financial Markets*, Cecilia van Zyl, Ziets Botba and Peter Skerritt, Van Scaik, 2006 and *South African New Economics Network (SANE)* vol.6 No. 14, April 2006.

19 The First Economy has well developed institutions, high levels of production and consumption and participants in and beneficiaries of the economy have access to and consume services at levels similar to rich countries of the North. They have high levels of education and skills, high material standards of living and good health status. They would typically be above the 0.9 HDI level of the UN Human Development Index (HDI).

The Second Economy has poorly developed institutions, low levels of production and consumption and participants in and beneficiaries of the economy have access to and consume services at levels similar to poor countries of the South. They have low levels of education and skills, low material standards of living and poor average health status. They would typically be well below the 0.9 HDI level of the UN HDI index.

20 Stats SA, 2005c. Discouraged workers are people that are unemployed (and most likely would like to be employed) but who have not sought employment in the past month.

21 Kingdon and Knight, 2005: formal sector real wages fell by 0.5% over the period 1997–2003; informal sector real wages fell by 7.8% per annum and self employment incomes by 11.4% per annum.

City energy planning in South Africa takes place in the challenging context of what has been described as a ‘dual’ economy¹⁸. This consists of a First Economy, which exhibits characteristics similar to those of the developed economies of North America and Europe and a Second Economy which exhibits characteristics similar to those of the developing economies of Africa¹⁹. It is called dual because the two economies have weak linkages. They are spatially separated and people in South Africa largely tend to participate in one or the other. Within cities the Second Economy occupies the black townships, squatter camps and peri-urban areas, i.e. the previous black areas of apartheid South Africa. The condition of the Second Economy in the cities reviewed, is described in the tables below presenting household income and unemployment figures.

The proportion of households across the review cities which can be considered Second Economy is very significant, probably at least between 40–70%. These are households living in areas where the economic base is not adequate to generate economic production (supply side) at a level to pay for basic needs and where these needs (demand side) of households are generally not met because households cannot afford them.

One of the most important implications of the existence of the dual economy is that statistical aggregations that include both economies have limited validity or could be misleading. So, for example, statements over recent years that “the economy is growing” do not describe what has been happening in the Second Economy. Although there has been growth in total South African GDP and in the GGP of the review cities over the past decade, this masks an ongoing socio-economic crisis, namely that unemployment in South Africa is extremely high and that it has been rising since 1993. The official national unemployment level is 27%, the unofficial level, which includes “discouraged workers” is 39%²⁰. Over the same time period real wage levels have been decreasing²¹.

Achieving developmental local government in this context is extremely challenging. One dimension of the challenge is the strain put on city resources

to provide basic services for unemployed citizens and zero-income households, because central government welfare grants are not sufficient to cover these costs, cities have to subsidise the costs. In the face of what appears to be long-term, structural unemployment, city governments will need to look at the other side of the policy equation, namely at policies to involve vast numbers of unemployed in the city's productive economy. Energy, as a key and substantial factor in economic production, will be a necessary driver in such endeavours.

Understanding the Mineral-Energy complex

The existence of a minerals-energy complex²² at the centre of South African economic development has been described as a foundation for understanding the development and role of the cluster of industries involved in mining, energy and heavy industry in South Africa. The electricity industry is a core component of this and coal lies at its heart. Familiarity with the MEC concept is very useful for understanding the potential for various trajectories in future development of energy and related industries and issues in South Africa. City governments need to bear this in mind when addressing issues that might impact on the MEC.

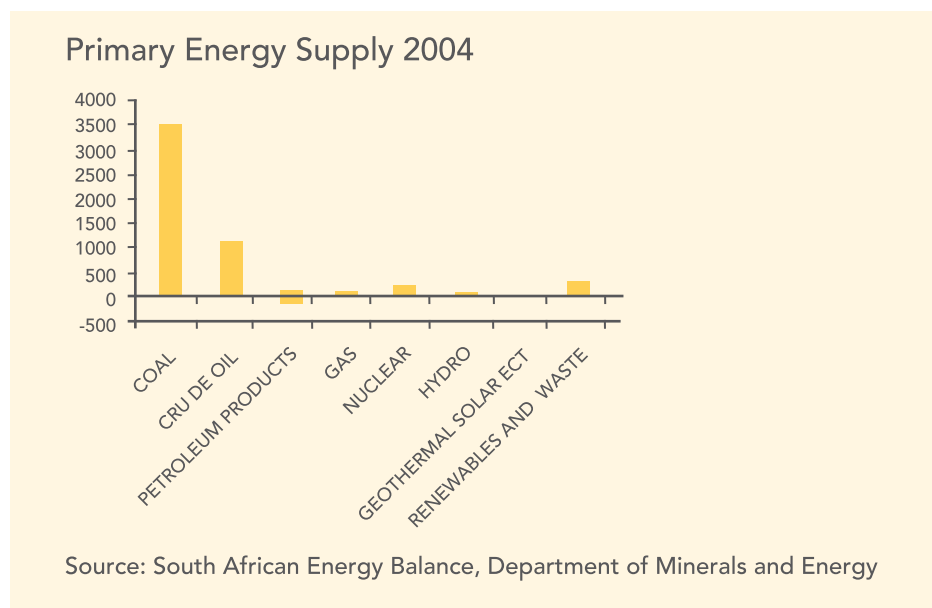
South Africa's primary energy is supplied by coal (68%), crude oil (23%) and renewables and waste (8%).²³

Given that the highly concentrated minerals sector²⁴ supplies the coal which accounts for 90% of the fuel

Household income and employment status, 2001

	HOUSEHOLDS INCOME R0 – R1 600/MONTH	UNEMPLOYMENT RATE
	%	%
Buffalo City	69	53
City of Cape Town	39	29
City of Johannesburg	51	37
City of Tshwane	47	32
Ekurhuleni	56	40
Ethekwini	57	43
King Sabata	80	57
Mangaung	67	40
Nelson Mandela	58	46
uMsunduzi	60	48
uMhlathuze	61	41
Potchefstroom	56	37
Saldanha Bay	39	21
Sedibeng D	62	44
Sol Plaatje	56	42

Source: Stats SA Census 2001



22 Fine & Rustomjee, 1996.

23 This is just about all fuelwood.



24 Usually, ownership and control of the sector can be narrowed down to a handful of players, although in this transitional period, complex re-arrangements, especially around Black Economic Empowerment, are in process.

inputs to the electricity generation system, and inputs for the production (through liquefaction – synthetic fuels manufacture) of 35% of local petroleum fuel consumption and given that linked industrial economic interests take most of the output of the system (industry accounts for half of South Africa’s total energy consumption and 76% of South Africa’s electricity consumption²⁵), it is understandable that this combination of sectors (the MEC) might view energy services requirements not directly connected with it as not being central to its interests or responsibilities. It could be sufficient unto itself: using capital-intensive high-technology and a minimal labour input that could be sourced anywhere, to exploit natural energy and mineral resources.

Integrating the industries involved in large scale resource extraction into national economies so that these industries can provide benefits to the wider economy has been an ongoing struggle in South Africa, and indeed, globally. Even though the state is the sole Eskom shareholder and Eskom core strategy state that its aim is to “maximise shareholder value in economic, social and environmental returns”, Eskom’s response to legislation introduced to corporatise it and make its profits taxable was to withdraw funding from the National Electrification Programme (NEP). It argued it could not compete on an equal footing if it had to fund electrification which would not show a positive return.

In government’s acceptance of this argument, the principle that surpluses in the First Economy components of the energy system should be retained in the First Economy energy system and not be used to subsidise components outside the system in the Second Economy, for example support to poor households or to assist areas of economic and social deprivation, has been asserted. Privately-owned, listed coal companies, tightly bound up in South Africa’s energy economy, are even less likely to promote goals (such as inclusion and environment) outside of their shareholders common financial “value”.

After the threats, dangers and disturbances experienced over the political transition during the 1990s, members of the MEC appear to be able to once again pursue their growth agenda largely de-linked from the social and economic problems experienced in the South African Second Economy. Demand for outputs from the MEC is very low in the Second Economy and stagnation in this sector of little concern in terms of the main MEC agenda.

The MEC is a major participant in the growth in total GDP that South Africa is experiencing. Total earnings in the coal mining sector were about R1.8 billion in 1993 and climbed steadily through the decade, with a slight levelling off around 2001/2001 to reach a level of just under R5.5 billion in 2003. From the perspective of earnings, the sector was doing very well²⁶. In 1993 this same mining sector had about 61 000 employees in service. This number stayed relatively constant until 1998 when it began a sudden and sharp decline and by 2003 there were about 47 000 employees in service. Over a period when sales and prices were improving, financial earnings were showing strong growth and there was an increase of the order of 29% in total physical production, the coal mining sector cut the number of employees in its service by 23%. This in an environment of extremely high unemployment and negligible social safety net.

City energy planning

Recognizing the central role energy can play within poverty and development and recognising the global threat of climate change has led a number of local authorities in South Africa to embark on strategic energy and climate change planning, projects and programmes on a voluntary basis.

Energy is central to delivery of services and to the productive base of a city. If city government does not play an active and effective role in managing trends in energy supply and use in the area of the city’s

²⁵ DME 2002 Digest of South African Energy Statistics.

²⁶ [http://www.bullion.org.za/publications/facts & figures/04coal.pdf](http://www.bullion.org.za/publications/facts&figures/04coal.pdf)

jurisdiction then the economy of the city is unlikely to succeed, due to ‘unmanaged risk’. City government has to take action to attract, promote and support industries that will provide the sustainable economic activities that cities require for their well-being: taxes these industries bring in, the jobs they provide for citizens and the goods and services that city residents rely on. Energy is a key factor in the increasing global competition between cities.

City Energy Planning aims to integrate and entrench sustainable energy approaches and practices at the local level, within a framework that has a clear vision and direction. It aims to prioritize and coordinate ad hoc energy and climate change projects and activities, and will help to integrate energy and climate change objectives into relevant functions and programmes. It can improve service delivery and quality of life, save money and reduce greenhouse gas emissions. It will assist the city in building its overall city development strategy. Energy is the backbone of the city, and, while being very specific, it is also an entirely cross-cutting sector which has serious social, economic and environmental impacts. As such, an energy strategy provides a means for cities to work with and implement integrated development planning and so build their ability to apply this throughout the city. The detrimental impacts of modern energy consumption practices cannot be reversed overnight, so sustainable energy planning must be an ongoing, dynamic activity.

The Integrated Development Plan (IDP) is the overarching map for the strategic planning of the city, and includes processes of public participation. The outcome of an IDP should be that projects on the ground are directly linked to the city budget. This should include an analysis of resources and needs, a strategy, proposed projects and then a budget. This has profound implications for the development of a local energy strategy. A City Development Strategy is more strategic than an IDP and is the macro strategy for the city that positions it to be globally competitive. Energy management has to be integral to this. City energy planning locates itself within these broad strategic approaches.

The supply and management of energy and energy related policies, programs, services and regulations, contained with city energy strategy planning, is a prerequisite for successful city development. Cities need to decide on appropriate policies and implement successful programs based on these policies. They need to ensure the provision of necessary services and the effective administration of regulations. If they do not, their economic bases will decline as industries re-locate to jurisdictions that provide environments conducive to success in a global economic climate that places increasing value on efficient, clean and socially responsible practice.

