1. Introduction

The core role of energy within towns and cities, in terms of socio-economic development and environmental sustainability, is being increasingly recognised by local authorities. Energy plays a key role in providing basic services and meeting basic human needs, such as jobs, food, running water, sanitation, education and health services. Addressing these issues, inevitably involves an increase in the level of energy service. In South Africa, the production of energy is largely fossil fuel based. This type of energy production is the key factor in what is seen as the most serious environmental threat facing the world today – global warming and related climate change.

The Earth's atmosphere is now warming at the fastest rate in recorded history, a trend that is projected to cause extensive damage to forests, marine ecosystems, biodiversity and agriculture. Human settlements are also threatened by climate change as sea levels rise, storms become more intense, and episodes of drought and flooding increase. Many local authorities are therefore planning more sustainable approaches to their energy production and use, to promote economic development and meet social needs while reducing local and global environmental impacts. In parallel with these mitigation efforts, a need has been identified to minimise the harmful and negative impacts of climate change on vulnerable communities and ecosystems. This strategy forms part of Hessequa's overarching Integrated Hessequa Environmental Policy (IHEP).

WHAT IS IHEP?

Through the Integrated Hessequa Environmental Policy (IHEP), Hessequa has acknowledged its custodianship of its environment by adopting a broad definition of the environment, which includes the physical, built, cultural and socio-economic factors. In this regard, FIVE strategies have been developed, i.e. a Biodiversity Strategy, Coastal Zone Management Strategy, Energy and Climate Change Strategy, Environmental

Education and Training Strategy and a River Strategy, in order to ensure sustainable resource use and management of a very unique environment

WHAT WILL THE HESSEQUA ENERGY AND CLIMATE CHANGE STRATEGY ACHIEVE?

The strategy aims to, on the one hand reduce the manmade causes of climate change through the promotion of a more sustainable use of energy, and on the other, to identify communities and ecosystems most vulnerable to the impacts of climate change in order to minimise these impacts. This will be achieved through the integration of sustainable energy approaches in core regional functions; within a framework that provides a clear vision and direction. Co-benefits include improved service delivery and financial stability in Hessequa operations, improved air quality, green house gas reduction and the promotion of socio-economic development.

TRANSLATING GLOBAL ACTION INTO A LOCAL STRATEGY

In its response to Energy and Climate Change, Hessequa recognises the global concerns and acknowledges and aims to support the responsibilities and efforts of all spheres of government and all other relevant role players in responding to the issue. The initial National Communication under the United Nations Framework Convention on Climate Change (UNFCCC), South Africa was completed in 2000. In October 2004, the Cabinet approved a National Climate Change Response Strategy (NCCRS) from the Department of Environmental Affairs and Tourism. The key aspects for climate change mitigation, as well as adaptation, outlined in the initial National Communication were expanded on by the NCCRS. The latter also makes provision for the regulation of the Clean Development Mechanism (CDM) in South Africa.

Furthermore the Provincial Government of the Western Cape (PGWC) has prepared a status quo vulnerability and adaptation assessment of the physical and socio-economic

effects of climate change in the Western Cape. These initiatives will inform this strategy and Hessequa aims to co-ordinate its efforts toward the implementation thereof with all relevant stakeholders.

ENERGY DEMAND

Reports show that Hessequa's energy-use profile is dominated by petrol, electricity and diesel. The remaining energy sources – paraffin, liquid petroleum gas (LPG), coal, and wood – together comprise 9% of total use. The transport sector is responsible for over half of total energy use, followed by industry and commerce, and households. While Hessequa has industry, its economy is not energy intensive compared to other parts of the country, where heavy industry is more evident. Almost 70% of this sector's energy needs are met by electricity.

2. Energy use in Hessequa

TOTAL ENERGY USE BY SECTOR

TRANSPORT 54%
LOCAL AUTHORITY 2%
RESIDENTIAL 19%
COMMERCE, AGRICULTURE & INDUSTRY 24%

ENERGY SUPPLY

Hessequa's energy supply picture largely mirrors that of the rest of the country, with significant dependence on imported petroleum products and coal-fired electricity generation. As South African coal is very cheap, electricity is very cheap. This factor has a huge influence on South Africa's energy picture – it has hampered the promotion of energy efficiency and the development of cleaner supply options such as wind and solar energy.

ELECTRICITY

Hessequa generates none of its own electricity – the only source being purchased from the Eskom national electricity grid. The national generation mix is dominated by coal-generation plants located near the coalfields, mainly in Mpumalanga and Gauteng provinces. Around 95% of the national grid electricity is coal-generated, about 5% comes from nuclear, and small amounts from hydro.

NUCLEAR

Africa's only nuclear power plant is Koeberg Nuclear Power Station, which is located to the north of Cape Town. The electricity generated at Koeberg is fed into the national grid for general distribution. Although in theory Koeberg could meet almost all of Cape Town's electricity demand, in reality it is merely one of a mix of generation plants feeding into the national electricity grid. Koeberg has 20 years of economic life remaining. Eskom is proposing to construct a series of Pebble Bed Modular Reactor (PBMR) nuclear power stations around the country, as well as for 'export'. The first local PBMR would be in the vicinity of Koeberg. However, there remain strong arguments both for and against the nuclear expansion route, as well as the feasibility of PBMR technology.

LIQUID FUELS

Of South Africa's four crude oil refineries, CalRef is the only one located in Cape Town. It generally produces all of The Western Provinces' liquid fuel needs. The Western Cape accounts for 15% of total national demand for liquid fuels, and 25% of LPG demand. Liquid fuels supply-side decisions and policies, such as those regarding low-sulphur diesel and unleaded petrol, are dealt with at national level. Another potentially significant national supply option is natural gas, which offers a cheaper and cleaner alternative to existing energy sources. While natural gas finds in Mozambique are substantial, and will feed into Gauteng industry and other sectors, prospecting in areas

nearer Cape Town, such as offshore West Coast, has not yet yielded commercially exploitable reserves.

HESSEQUA TOTAL FUEL ENERGY CONSUMPTION

PRIVATE 65%
OTHER 7%
PUBLIC – RAIL 3%
PUBLIC – BUS 8%
PUBLIC – MINIBUS TAXI 19%

RENEWABLE & CLEAN ENERGY

Hesssequa has a wealth of untapped renewable energy resource potential – primarily in wind, small-scale solar, and possibly wave applications. After 2013, the Department of Minerals and Energy's projection is that the majority of new renewable energy will have to come from wind power. In the medium and long-term, solar thermal, solar photovoltaic and wave can and will also play a significant role.

Hessequa's renewable energy focus at present is on wind generation and solar water heaters, and the region will begin making commitments to the International Renewable Energy Commision in this regard. In addition, Hessequa will begin adopting a strong energy efficiency focus.

EMISSIONS

Local emissions

'Local' emissions are those that affect the air quality in the Hessequa area and can begin to have local health and visual impacts. They include nitrogen and sulphur oxides, volatile organic compounds and particulate matter. Due to the significant role petrol and diesel play in Hessequa's energy-use profile, these energy sources are responsible for

much of the local pollutants in the atmosphere. Estimates are that diesel contributes about 40% to the 'Brown Haze' phenomenon, and petrol 25% in the Western Cape.

Global emissions

Total CO2 emissions from energy use

ELECTRICITY 69 %
HFO 2%
DIESEL 9%
PETROL 17%
COAL 2%
LPG 0%
PARAFFIN 1%
WOOD 0%

'Global' emissions are those that impact on climate change globally. Carbon dioxide (CO2) is the principal energy-related global emission, and is largely responsible for the alarming global warming phenomenon. Electricity is responsible for most of the CO2 emissions. CO2 emissions reduction via efficient use of electricity and changing to renewable sources of electricity generation are thus important components of this Energy and Climate Change Strategy. The planned landfill methane capture projects (see section on 'Energy Supply') are also significant in terms of global emissions, as methane has 21 times the global warming potential compared to an equal quantity of CO2.

THE PATH TO SUSTAINABILITY

At present the Western Cape is heavily reliant on fossil fuels mainly for electricity generation and transport energy. The local and global environmental consequences of such a situation makes it unsustainable in the long-term, and the Western Cape needs to think ahead in this regard. A more sustainable future will inevitably include the following:

- steadily reducing dependence on fossil fuels;
- introduction of cleaner fuels such as natural gas into the current fossil fuel mix where feasible;
- increased use of renewable energy (solar, wind, wave, etc);
- a focus on energy efficiency;
- economic development based on efficient resource use rather than increased resource use;
- moving to cleaner alternatives to current transport fuels.

In addition, social sustainability requires that all households have access to safe and affordable energy sources.

3. Future of Energy in Hessequa

The future of Hessequa is strongly influenced by energy-related decisions made in provincial government today. Hessequa does however face massive challenges in terms of, amongst others, population increase, housing demands, transport systems and air pollution, and indicate how decisions to embark on a more sustainable development path can improve our future. The energy future of Hessequa is dependent on a progressive energy strategy that encompasses the interests and needs of all who live here. The goals of economic growth, a clean and safe environment, access to safe and affordable energy sources for all, and a cheap, safe and sustainable transport can all be achieved, but are dependent on far-sighted strategies being implemented today.

4. Strategic Visions and Goals

IHEP recognises the importance of energy and its role in development along with the negative effects that energy production may have on the environment, and provides a commitment to sources of energy with the least impact on the environment and the health of communities. An assessment of the State of Energy in Hessequa needs to be

carried out to identify issues within the energy sector, and prioritise them based on the region's stated priority areas as well as other key national and international imperatives and commitments. These issues will in turn directly inform the Energy and Climate Change Strategy Visions and Goals listed below :

ENERGY VISION 1:

A Region where all people have access to appropriate, affordable, safe and healthy energy services.

- 'Appropriate' means the most suitable energy source for the application, such as electricity for lighting.
- 'Affordable' means that the poor should be able to access and use the energy sources for basic services.
- 'Safe' means that feasible alternatives should be provided for unsafe energy sources such as paraffin and candles
- 'Healthy' means that alternatives to paraffin, with associated unacceptable levels of child paraffin poisoning, should be provided (e.g. electricity), and that alternatives to energy sources, which cause current high indoor and outdoor pollution levels, should be provided.

GOALS:

- Universal access to electricity:
- Formal housing
- Informal housing
- Cheap electricity for poor households (social tariffs)
- Households using paraffin and candles more safely (reduced poisoning and fires)
- Safer paraffin appliances
- Clean air

ENERGY VISION 2:

To become a leading region in meeting its energy needs in a sustainable way, and thus fulfilling its constitutional obligations and global responsibilities.

'Sustainable' implies:

- reducing dependence on non-renewable energy (increasing use of renewable energy, improving energy efficiency); and
- reducing harmful environmental impacts of energy production and use (pollution and global warming).

Benefits of being more sustainable include:

- health benefits (clean air);
- employment creation (renewable energy generally creates more jobs); and
- increased energy security for Hessequa (less dependent on external, centralised sources) and an environmental profile that will enhance competitiveness in investment, trading and tourism.

GOALS:

- Increasing renewable energy contribution to the energy supply mix (starting with the most financially viable options)
- Improved energy efficiency
- Cleaner air
- Reduced contribution to CO2 emissions

ENERGY VISION 3:

A Region that uses and manages energy in an efficient way. This applies to both Hessequa's operations as well as to residential, commercial, industrial and other sectors of the region.

GOALS:

- Demand-side management (DSM) to be used as a 'first call' for increased energy needs
- Energy efficiency in government improved
- Energy efficiency in commerce and industry improved
- Domestic energy efficiency improved

ENERGY VISION 4:

A Region with an efficient and equitable and sustainable transportation, based on compact planning, to enable all residents to enjoy the benefits of urban and rural life.

GOALS:

- Bicycle and pedestrian transport use maximised
- Compact city planning, which reduces the need for multiple and long trips

ENERGY VISION 5:

A Region where energy supports economic competitiveness and increases employment.

GOALS:

- Energy prices are to remain competitive
- Energy planning takes place and includes full economic cost of energy
- Hessequa energy profile supports key industry sectors such as tourism
- The energy sector in Hessequa maximises employment opportunities

5. Transport

The transport sector is responsible for more than half of the total energy use in Hessequa (54%), with petrol accounting for 68%, and diesel the remainder. This sub-sector is thus among the most critical from an energy perspective, and is the main contributor to local air pollution problems. The transport sector accounts for approximately 46% of Hessequa's total carbon dioxide emissions. Hessequa's energy use by mode of transport mirrors that of the rest of the country, in that land transport (as opposed to rail) uses the most energy. Furthermore, there is a high annual growth in motor vehicle numbers, leading to higher consumption of petrol and diesel, and correspondingly high gaseous and particulate emissions. They also result in a decline in other quality of life indicators such as distances needed to be covered.

6. Commerce & Industry

ENERGY IN THE COMMERCIAL AND INDUSTRIAL SECTOR

Important energy-related considerations for established businesses in Hessequa are (1) reliability of supply, (2) cost of energy, and (3) environmental concerns. Industry and commerce consumes relatively small amounts of energy within Hessequa. This is low compared partly because of the relative prevalence of commercial activity in the local economy rather than the more energy intensive primary or secondary industries more common in other parts of the country. Commercial use is mostly electricity for lighting and air-conditioning in offices and businesses.

LOWER INCOME SECTORS

Detailed information on the energy needs and issues Hessequa's lower income sector is not readily available. While total energy consumption by this sector is not a significant

component of overall energy use, access to appropriate energy sources can support the sectors development. The lower income group is significant both in terms of economic output and employment. The sector needs to be flagged by the municipality as a development focus area.

KEY ISSUES

Some of the key issues which have been identified in the commercial and industrial sector include:

- There are numerous financially viable opportunities for improving energy efficiency in commerce and industry. The 'cheapness' of South Africa's electricity means that there has been little incentive to be more energy efficient. However, the escalating cost of electricity as new national generation plants are constructed (as well as the possibility of accounting for energy-related environmental costs on a national basis) means that industry and commerce need to start implementing efficiency programmes now to keep operational costs from escalating.
- Electricity is responsible for the vast majority of CO2 emissions for the region, efficiency in this sector must be a focus for greenhouse gas reduction.
- Energy efficiency in industry and commerce will increase Hessequa's competitive advantage nationally and internationally. The international investment market is increasingly looking at environmental performance as an input into investment decisions, including energy efficiency.
- Energy needs in the informal sector are not well understood at present, yet supporting this sector is a priority. However, energy needs are only one part/aspect of the needs for small and informal business growth, and a more complete development package needs to be provided in parallel.

7. Residential

ENERGY USE IN THE RESIDENTIAL SECTOR

Almost all formal houses are connected to electricity due to the Western Cape's active involvement in the national electrification programme that started in 1994. However, in spite of an active informal dwelling electrification focus, electrification rates in these areas are low – around 10% to 15%. Low-income households, whether electrified or not, typically still use paraffin to meet some of their energy needs. Middle to high-income households make use of electricity. Poor households spend between 10% to 15% of their incomes on meeting their energy needs (excluding transport) while wealthier households only spend between 3% to 5%. The residential sector is responsible for a large proportion of Hessequa's total energy use.

LOW INCOME GROUPS

Low Income groups are still partly dependent on fuels such as paraffin, particularly in informal settlements

PROBLEMS

- 10%- 20% of income spent on energy
- Paraffin & candles cause fires
- Paraffin poisoning of children
- Indoor air quality poor
- Paraffin use inconvenient

CO2 IMPACT per household

- 230 kg $C0_2$ per month (electrified)
- 60 kg $C0_2$ per month (unelectrified)

EFFICIENCY POTENTIAL

- Thermally efficient housing design could save 15%
- Efficient lighting could save 5%

MIDDLE TO HIGH INCOME GROUPS

Use electricity almost exclusively, spend 3%-5% of income on energy

PROBLEMS

No problems for the household (but the significant consumption of these households contributes to the problems arising from the generation of energy – such as local emissions at the power generation plant and global emissions).

CO2 IMPACT per household

- 750 kg of C02 per month

EFFICIENCY POTENTIAL

- (Saving of about 40% in energy use and C02 emissions feasible, yet currently little being done)
- Solar water heater use would save 20%-30%
- Efficient lighting could save 10%
- Thermally efficient housing design could save 5%
- Changes in user habits could save 10%

KEY ISSUES

Some of the key energy issues in the residential sector include:

- the cost of meeting a household's energy needs being a significant burden on poor households and a major contributor to poverty;

- access to convenient, appropriate, affordable, clean and safe energy sources is limited for many poorer households, particularly informal households. It must be recognised that even electrified low-income households use a range of energy sources for a variety of reasons. This multiple fuel use should be supported and promoted as appropriate.

HOUSEHOLD GREENHOUSE GASES

(kg C02 per household per month)

Unelectrified households: **60 kg**
Low-income electrified households: **240 kg**
Mid/high-income households: **750 kg**

Energy is a significant contributor to poor health (nutrition and respiratory health) in low-income households. This is due to poor indoor air quality or lack of adequate access to cleaner energy sources to cook food or keep warm. Paraffin and candle have been the main cause of the devastating fires in poor households in Hessequa. The extent of the devastation is exacerbated by the population densities and consequent lack of access for emergency vehicles, as well as strong prevailing winds. Middle to high-income households are high energy consumers with large 'carbon footprints'. Electricity is relatively cheap and extremely convenient for these households so there is little incentive to implement energy efficiency measures.

GOALS

Increasing renewable and clean energy contribution to the energy supply mix, and reducing dependence on unsustainable sources of energy (starting with the most financially viable options - the 'low hanging fruit')

Target: 10% of all households to have solar water heaters by 2015

Target: 10% of households – owned housing to have solar water heaters by 2015

Short-term (2 years)

- Promote the use of solar water heaters, including via following:
- Undertake an assessment of solar water heater market access mechanisms, industry capacity, and incentives to stimulate the market.
- Compile standards and codes for the installation and performance of solar water heaters or adopt suitable national standards.
- Keep abreast of national and provincial situation and initiatives regarding solar water heaters, and coordinate and support where appropriate
- Promote solar water heaters for residential institutions such as old-age-homes, boarding houses etc. through information dissemination.
- Installation of solar water heaters on residential housing.

Long-term (2+ years)

- Establish a solar water heater financing scheme for households.
- Solar water heaters to be mandatory for all new houses. The necessary enabling financial mechanisms (e.g. incentives) to be developed and applied so that this is feasible.

GOALS

Domestic energy efficiency improved ;

Target: All town-owned housing to have compact fluorescent lights (CFLs) installed by 2015

Target: 30% of all households to have CFLs by 2015, and 90% by 2027

Target: All new subsidised (low-income) houses to have ceilings (effective immediately)

Target: All existing homes to be fitted with ceilings by 2027

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Short-term (2 years)

1) Promote more energy efficient/passive solar designed housing construction via:
   a) Developing guidelines for housing design & construction.
   b) Information dissemination programme for builders, developers and architects.

2) Promote compact fluorescent lights (CFLs) via:
    a) Information dissemination on benefits of CFLs (in collaboration with relevant organisations such as Eskom demand-side management).
    b) Facilitate the development of CFL dissemination mechanisms for various target groups: households (2) residential institutions (3) flats and hostels.
3) Facilitate and promote residential energy efficiency initiatives in the mid- to high-income sector (these are the major consumers of energy)

Long-term (2+ years)

- Mandatory code for more energy efficient housing design.
- Develop guidelines for residential lighting efficiency, including light pollution control in residential areas.

8. Vulnerability & Adaptation

CONCLUSION

The 20th century has seen the greatest warming in at least a thousand years, and natural forces cannot account for it all. The Intergovernmental Panel on Climate Change's (IPCC) Third Assessment Report concluded that the globally-averaged surface temperature in the 20th century increased 0.6 +/- 0.2°C (IPCC, 2001). Climate models now predict that the atmosphere's temperature will rise by about 1.4 to 5.8°C by 2100. This will be larger than any climate changes experienced over the last 10 000 years. Climate change will continue to occur even if the global greenhouse gas emissions are curtailed significantly in the short to medium term. Therefore, while controlling emissions is still essential, we must combine this with efforts to minimise the negative effects of climate change on vulnerable people and sectors through adaptation. Vulnerability is an indication of people's exposure to external risks, shocks and stresses and their ability to cope with, and recover from, the resulting impacts. It is the extent to

which climate change may damage or harm a system. This will depend not only on the system's sensitivity but also on its ability to adapt (Climate change information kit, UNEP, UNFCCC, 2001). Adaptation is generally defined as an adjustment in bio-physical, social or economic systems in response to an actual or expected climatic impact and its effect. It is also the degree to which the system can adjust in response to, or in anticipation of, changed climatic conditions. Some of the expected impacts of climate change are sea level rise (due to melting of the ice caps), an increase in natural disasters and extreme events (flooding, drought, storms etc.) as well as the extinction of plant and animal species due to sudden climate change induced temperature changes and shifts in climatic zones.

REGIONAL CLIMATIC CHARACTERISTICS

The Provincial Government of the Western Cape (PGWC), Department of Environmental Affairs and Development Planning has released a status quo vulnerability and adaptation assessment of the physical and socio-economic effects of climate change in the Western Cape (June 2005), which reveals that our province is experiencing the impacts of climate change and will continue to feel its effects in the future. Projections for the province as a whole are for a drying trend from west to east, decrease in winter rainfall and a possibility of slightly more summer rainfall (in the east). Irregular and more intense rainfalls, as well as a rise in the mean maximum and minimum temperatures, are predicted. Because Hessequa has a coastline it is particularly vulnerable to sea level rise and storm surges. Hessequa also has a number of low lying areas with high water tables. These areas are particularly prone to flooding. Due to the water stress currently experienced in Western Cape Province as a result of a drop in annual rainfall, the demand for water for residential, industrial and agricultural use, makes the region particularly vulnerable to the effects of climate change. Hessequa also exists in a particularly sensitive biophysical environment. There is high biodiversity within the Hessequa borders with a number of red data species present. These systems are already under threat from environmental degradation and urban development. It is therefore imperative that we are prepared for the effects of climate change so that people and

ecosystems are able to adapt and cope with the immediate and long term impacts. Building on these efforts of the PGWC, Hessequa aims to identify its communities and ecosystems that are most vulnerable to climate change, in an attempt to minimise potential impacts.

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