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The Employment Aspects of Energy-Related Improvements in Construction in South Africa



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Foreword

Green Jobs have become an emblem of a more sustainable economy and society that preserves the environment for present and future generations and is more equitable and inclusive of all people and all countries. Green Jobs reduce the environmental impact of enterprises and economic sectors, ultimately to levels that are sustainable. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution. Green Jobs in emerging economies and developing countries include opportunities for managers, scientists and technicians, but the bulk can benefit a broad cross-section of the population which needs them most: youth, women, farmers, rural populations and slum dwellers.

However, many jobs which are green in principle are not green in practice because of the environmental damage caused by inappropriate practices. Moreover, the evidence shows that Green Jobs do not automatically constitute decent work. Many of these jobs are “dirty, dangerous and difficult”. Employment in industries such as recycling and waste management, biomass energy and construction tends to be precarious and incomes low. If Green Jobs are to be a bridge to a truly sustainable future, this needs to change. Green jobs therefore need to be decent work. Decent Green Jobs effectively link Millennium Development Goal 1 (poverty reduction) and Millennium Development Goal 7 (protecting the environment) and make them mutually supportive rather than conflicting.

The Green Jobs programme is a joint initiative by the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), the International Organization of Employers (IOE) and the International Trade Union Confederation (ITUC), which has been launched to assess, analyse and promote the creation of decent jobs as a consequence of the needed environmental policies. It supports a concerted effort by governments, employers and trade unions to promote environmentally sustainable jobs and development in a climate-challenged world.

Construction was the first specific sector of the economy to be studied in the Green Jobs programme. Construction has been recognized as a significant contributor to climate change through its emission of global warming gases (GWG). Construction of new buildings and refurbishment of existing buildings alike also represent the largest potential for technically feasible and economically viable reductions of emissions and of energy consumption. At the same time, energy efficiency in buildings encourages the development of new professional skills and generates significant employment opportunities. The greening of construction requires the development and implementation of new technologies aimed at reducing the negative impact of the sector on the environment, and enhanced performance of infrastructure. This green technology development requires investment into enterprise competency, new skill sets, new training methodologies and materials.

South Africa was the first country studied by the ILO in specific regard to Green Jobs in construction. The present document is an edited version of the research report. The research in South Africa has been disseminated to national actors and has also been discussed during a specific workshop on Green Jobs in construction held in May 2010 in Johannesburg. The ILO Office

in Pretoria has followed up with the preparation of an operational proposal for the upgrading of small- and medium-sized enterprises in the South Africa construction industry. Furthermore, the South Africa research has also been disseminated to other countries in which the ILO has later produced similar studies on Green Jobs in the construction sector. The present document will enable the ILO to further disseminate the findings, conclusions and recommendations of the research in South Africa.

The research was carried out by Llewellyn van Wyk, Marinda Kolev, Luke Osburn, André de Villiers and Zaid Kimmie of the CSIR (Council for Scientific and Industrial Research) of South Africa. They are the authors of the present document.

ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie, France) provided funding for the research in South Africa. In addition, ADEME, particularly Thomas Gaudin, actively participated in the discussions to define the framework and terms of reference for the research.

The work was technically supervised by Edmundo Werna, and edited by Michael Richter and Colin Smith, in the Sectoral Activities Department of the ILO.

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Explanatory note

This report is written in British English. All units are metric unless otherwise indicated.

Currency values are reported in South African rand, US dollar and euro.

Values as at 1 December 2008:

South African rand to 1 US dollar	Latest (Nov. 28)	Lowest (Aug. 4)	Highest (Oct. 22)
Over the previous 120 days	10.1	7.235	11.27
South African rand to 1 euro	Latest (Nov. 28)	Lowest (Sep. 8)	Highest (Oct. 22)
Over the previous 120 days	12.8209	11.1899	14.465
Source: http://www.x-rates.com/calculator.html .			

Executive summary

Global warming is a fact. It affects the environment and its life forms, including humans, in myriad ways. The worldwide need to reduce greenhouse gas emissions can no longer be disputed. According to some sources,¹ buildings are the number one contributor to global warming. Moreover, buildings account for 30–40 per cent of the world’s energy use.²

Much information is currently available on the impact of the emerging “green” economy on the patterns of employment. Many reports suggest such an economy can actually generate more and better jobs; and that these fall under the ILO’s umbrella term of “decent jobs”.

For our investigative research the primary question is: how, and in what way, can the relationship between technological changes with regard to energy-related improvements in buildings and the consequent employment potential be influenced in South Africa? Nine secondary points arise for discussion:

- (1) Energy demand and the economy’s reliance on cheap energy derived from fossil fuels, especially coal, are considered the main drivers for implementing energy-related improvements in construction in South Africa. These lead to the following issues: the energy demand of a growing economy, the country’s growing demand for infrastructure, and the energy demand of a growing population.

Several trends were identified. For example, South Africa’s lack of sufficient energy supply, a reduction in economic growth due to the lack of spare capacity, and the electrification of low-income households that has placed an additional burden on Eskom and the electricity grid. Other trends include the acquisition of fossil fuel-driven generators by buildings and homeowners to reduce the risk of energy outages, and the installation of energy-efficient technology (lighting and HVAC systems in non-residential buildings and lighting and solar water heaters in residential buildings).

- (2) The views and attitudes of the main stakeholders (central governments, local authorities, private companies) to energy-related improvements in construction in South Africa were described. It was found that government both strongly supports job creation and energy efficiency in buildings and has several strategies and campaigns in place in this regard.

The City of Cape Town, Ekurhuleni (East Rand) Metropolitan Municipality, eThekweni (Durban) Municipality and the City of Johannesburg are at the forefront of implementing energy efficiency measures. Varying levels of support are indicated in the larger metropolitan areas. Several private companies have implemented extensive retrofitting projects, and some developers are requesting information and design expertise with regard to meeting energy-legislation standards for large new developments.

¹ <http://www.cbsnews.com/stories/2007/11/01/sunday/main3441061.shtml>.

² <http://www.alertnet.org/thenews/newsdesk/L28183187.htm>.

- (3) The renovation/improvement measures with the best technical and economic efficiency with regard to energy-related improvements in building in South Africa were identified. The biggest users of electricity in non-residential buildings are lighting and HVAC. Thus, technologies aimed at reducing energy use in these two areas are most likely to realize big gains in terms of energy productivity.

The biggest users in residential buildings are appliances, especially hot water heating, stoves and heating. Technologies aimed at reducing energy use in these areas – such as solar water heaters – will yield immediate results.

- (4) South Africa faces several challenges with regard to energy-related improvements in building, including improving the energy efficiency of the existing building stock. For example, the abundant sunshine has hitherto been untapped; passive-energy building design often trails behind profit-making; and the high cost of energy-efficient products and low cost of electricity result in inertia to driving change. South Africa must research, find and develop appropriate technology solutions to provide robust and healthy housing for the 2.1 million backlog in housing units.
- (5) The elements of policies and programmes that are essential to initiate a move towards more energy-related improvements in construction are identified and described. South Africa appears to be well-positioned when compared to global policies and programmes; however, the country's built environment is inadequately equipped to take up the impressive array of innovative building and energy technologies that exist in other parts of the world. The appropriate legislation, regulation and implementable programmes are needed to trigger major energy efficiency applications in buildings and to reap the associated advantages.
- (6) Companies should develop and implement their own programmes with regard to energy, climate change, energy efficiency and the role buildings can play in the reduction of CO₂. Such programmes should form part of the corporate social responsibility and be reported in companies' annual reports. On the grander moral scale beyond legislation, companies and their workforce should continually familiarize themselves with new technologies, as well as with the relevant legislation, and they should establish their own benchmarks and indicators to measure, monitor, evaluate and report on the energy efficiency of their buildings.
- (7) It is imperative that government implements the necessary legislation and regulation. This will create a demand for energy-efficient buildings that can only be satisfied by a comparative supply of professional, technical, management, administrative and maintenance job resources to undertake the services required.

Rough prediction estimates are distinctly preliminary. A win-win situation, by which synergistic growth and development in energy-improvement demand is met by adequately developed job resources, can best be achieved by use of a carefully structured development model for regional application. Government could conduct a major retrofitting programme of its own facilities, balanced with a training programme for technicians developed in collaboration with the South African Association of Energy Services Companies and local (independent) ESCOs.

- (8) The related issues of employment creation and quality of work (social protection, workers rights and social dialogue) with regard to energy-related improvements in building are discussed. South Africa is committed to the ILO's Decent Work Agenda and has developed

several acts, amendments, codes of good practice, regulations and notices, and sectoral determinations to regulate its labour market. These acts promote the creation of more and better jobs, the extension of social protection, respect for fundamental principles and rights at work, and the pursuit of social dialogue.

It is of the utmost importance that (new) jobs created due to energy-related improvement in buildings are sustainable and that they lead to improvements in the lives of those who use the buildings and those who found employment because of the improvements. However, this may not always be possible because jobs in construction are often location-based, i.e. workers especially casual workers – often come from the local communities and, once the construction or retrofitting is completed, do not move on to the next location as workers there will then be employed.

- (9) Good practice with regard to energy-related improvements in building is described. Its components range from “soft guidelines”, such as the establishment of energy management teams, to “hard guidelines”, such as ISO 14000, Green Star SA and SANS 2004.

For our primary research question we found that the relationship between technology changes and employment creation from such changes is on the one hand quantitatively weak, in that the required skills sets already exist to a large extent, and on the other qualitatively strong, in that up-skilling through training of the existing skill sets is desperately needed for improved productivity and the creation of decent jobs.

We make several suggestions about how to achieve the necessary up-skilling and to provide the improvement in education and training for those that still require skills training.

Key points

This study looks at the influence that the green economy can have on South African job patterns by reviewing the South African construction sector, the energy situation in the country, several energy efficiency technologies – especially in buildings globally, in Africa and in South Africa – as well as the legislation, regulations and policies that govern energy efficiency in the world and in South Africa. It focuses on energy efficiency and employment with the aim of identifying job creation opportunities that may arise from the development and implementation of new and emerging energy-related improvements in buildings. In order to do this the study gives an overview of global trends in the green job market. It looks at different types of Green Jobs and at the requirements for decent work. The report also gives an overview of the current employment profile in South Africa and attempts to determine the impact of energy-related improvements in buildings on employment numbers and decent work in South Africa. It reviews the skills development environment and opportunities to train workers for energy-related improvements as well as the challenges and threats to the employment market. Good practice for energy-related improvements in buildings is outlined.

South African construction overview

The South African construction industry is a R1.800 billion industry, employing between 1.8 and 2.25 million people (the exact number is disputed). The industry has delivered significant growth over the past six years, with a concomitant increase in both formal and informal employment. Much of this growth is a result of the government’s commitment to spend over R400 billion on improving the South African infrastructure. In addition, there is a low-income housing backlog of 2.1 million units.

Transformation in the construction sector has caused specific drivers that will influence its course of development for many years. The construction sector in South Africa reflects its global structure insofar as most of the companies are either small, medium or macro enterprises; they are seldom large companies. Infrastructure development is one of the key pillars of economic growth, however, the housing backlog, building of stadiums for the 2010 FIFA World Cup, Gautrain and other construction projects put a lot of pressure on the sector's capability. This is very evident from the notable gaps in relevant work-related skills for the sector and is significant in the energy efficiency-related aspects within the construction industry. In direct relation to the work undertaken by the ILO to improve labour conditions in the form of decent work and basic needs, labourers in the construction sector often have few skills and are more easily exploited in terms of labour practices.

The industry's delivery system is fraught with a perception problem – it can be described as cumbersome with endless variations and combinations. Customers often expect the worst and perceive the industry as being incapable of improving standards. This is hardly surprising given that the construction sector employs the fourth highest number of uneducated people. There is a shortage of the demanded skills in the industry, not only at artisan but also at specialized levels. Enhancement of the capability and competence of the certification and inspection bodies is desperately needed.

The Department of Public Works (DPW), the Construction Industry Development Board (CIDB) and Construction Education and Training Authority (CETA) have very important roles to play in creating an enabling environment for reconstruction, growth and development within the construction industry.

South African energy overview

South Africa currently relies mainly on coal (making up 88 per cent of electricity generated) to sustain the country's energy needs. Buildings contribute over 40 per cent to national energy use. The Department of Minerals and Energy (DME) plays a significant role in advancing the South African economy towards becoming less carbon-intensive.

South Africa has a large potential to produce energy from solar and wind sources. However, these are long-term interventions. Short-term interventions are critically important and it is essential that energy users change their behaviour. In this regard, Eskom and the DME are discussing energy efficiency legislation as the voluntary programmes have not achieved the results that Eskom had hoped for. Equally, the role of the Central Energy Fund (CEF) to ensure that South Africa's renewable energy sources are developed and used efficiently should not be underestimated.

The South African Government has demonstrated its commitment to energy efficiency: several governmental buildings have been retrofitted and there are plans to retrofit an additional 106,000. Several government departments are involved in public-housing projects using renewable energy sources. Eskom has implemented the DSM programme to influence the time, pattern and amount of electricity usage in the country. Eskom also offered incentives in certain areas for installing solar powered geysers and exchanging old light bulbs for compact fluorescent lamps (CFLs). Several large South African companies, corporations and other players have demonstrated their commitment to energy efficiency by retrofitting office buildings and hotels.

It is difficult to accurately predict the exact nature of the job creation opportunities in South Africa resulting from these initiatives.

Energy efficiency technologies

Better energy efficiency in buildings has the biggest potential to reduce carbon emissions – not only in industrialized countries but also in developing countries. A major reduction (20 to 30 per cent) can be achieved by reducing the need for heating and cooling buildings.

Billions of dollars have been spent and are being invested globally in renewable energy sources.

Over 500 million people in sub-Saharan Africa lack modern energy, despite the fact that 17 of the top 35 countries for solar, wind, hydro and geothermal energy are in sub-Saharan Africa. Many African countries receive on average 325 days per year of bright sunlight. Several already have small-scale solar, wind and geothermal devices but this is still a minute percentage of the solar-energy output in the rest of the world.

In South Africa the focus falls on solar heating, natural space heating and cooling, and energy-efficient lighting. Effective building insulation is also very important. There are several methods and strategies available for energy-effective lighting and space heating/cooling of buildings in South Africa. The challenge is to establish an optimal technical and economic balance for each building.

The specific drivers, issues and trends regarding energy-related improvements are discussed in this report.

Legislation, regulation, policies and strategies/initiatives

Several countries have developed legislation and policies supporting renewable energy technologies and energy efficiency. In addition, international energy organizations have published documents with guidelines to governments on how to deploy such renewable energy technology principles in effective policies.

Consequently, governments are in the process of implementing or have already implemented energy efficiency legislation, regulation, policies and strategies/initiatives. Some include the following:

- Electricity utilities require a minimum percentage of demand from renewable and energy-efficient sources be met.
- An energy efficiency agency should be established.
- The implementation of energy-efficient tax incentives.
- Building codes need to be updated to include energy-efficient measures.
- Existing buildings must be retrofitted.
- Energy audits should be done, especially by large energy consumers.
- The establishment of ESCOs should be encouraged.
- Consumer education must be done.
- The energy needs of low-income households as well as low-cost housing should be addressed.

In South Africa legislation, regulations, policies and strategies needed to move towards a more energy-efficient environment, specifically regarding buildings, have been developed.

India, Brazil and South Africa have reached a voluntary, intra-governmental agreement to cooperate in the promotion of nuclear energy, clean energy technologies and other renewable energies, and in the support of climate change alleviation.

Several South African Government departments are actively involved in developing policies and strategies regarding energy-related improvements.

As depicted in the table below, South Africa appears to be on par with the rest of the world in terms of global legislation, regulations, policies and strategies/initiatives:

Global elements	South African performance
Electricity utilities must meet a certain percentage of demand from renewable and energy-efficient sources	Eskom must generate 10,000GWh of energy from renewable and energy-efficient sources by the year 2013
An energy-efficiency agency should be established	The National Energy Efficiency Agency was established
The implementation of energy-efficient tax incentives	Some incentives have been implemented, e.g. for solar geysers
Building codes need to be updated to include energy-efficient measures	The SANS 204 is being implemented; the aim is to make it part of the National Building Codes
Existing buildings must be retrofitted	Several very large buildings have already been retrofitted and there are plans for several more retrofitting projects
Energy audits should be done, especially by large energy consumers	Energy audits are being done, some by Eskom
The establishment of ESCOs should be encouraged	There are about 120 ESCOs in South Africa
Consumer education must be done	Consumer education has started, especially after the energy crisis earlier in 2008
The energy needs of low-income households as well as low-cost housing should be addressed	Several projects are ongoing to assist low-income households Projects researching energy efficiency for low-cost housing are under way

However, as long as these remain mere documents and are not actively and aggressively implemented, they will not deliver to their full potential. Nevertheless, the current level of implementation is encouraging.

The GBCSA aims to drive the adoption of green building practices in the South African property industry and move it towards sustainability through market-based solutions. Other private companies have also become very active in supporting energy-related improvements and energy efficiency.

Energy efficiency case studies

Several energy efficiency projects have been undertaken in South Africa. This report examines the financial, social and employment benefits (where such information was available) of these projects. The sustainability of the jobs assessed by these projects has not necessarily been established.

Employment and energy efficiency

South Africa is committed to the ILO's Decent Work Agenda and has developed several acts, amendments, codes of good practice, regulations and notices, and sectoral determinations to regulate its labour market. Examples are:

- Basic Conditions of Employment Act;
- Compensation for Occupational Injuries and Diseases Act;
- Employment Equity Act;
- Labour Relations Act;
- Occupational Health and Safety Act;
- Skills Development Act;
- Unemployment Insurance Fund (UIF) Act;
- Code of Good Practice on Arrangement of Working Time;
- Code of Good Practice on Pregnancy.

These promote the creation and improvement of work conditions, the extension of social protection, respect for fundamental principles and rights at work, and the pursuit of social dialogue.

With an unemployment rate of 23.1 per cent, South Africa has the available workers to fill jobs created by energy-related improvements. However, many of these currently unemployed workers may not have the relevant skills for the (rapidly) changing energy sector. Many of the jobs are not suitable for unskilled and semi-skilled workers, but rather for trained graduates.

Authorities tasked with training workers are currently not fulfilling expectations of preparing them with the relevant skills for the renewable energy sector. Scant training materials in the field of energy efficiency technology implementation are available.

However, some universities have developed courses that now form part of existing qualifications, for example engineering degrees but before these courses transcend to the labour market, existing projects will not be able to benefit from the acquired skills.

The major challenges regarding the possible influence of energy-related improvements on the creation of jobs are discussed in the report.

In terms of Good Practice ISO 14000 is a good guideline for energy management in buildings and considered good practice globally and in South Africa.

As mentioned previously, the Green Star SA-rating tool sets standards and benchmarks for green building and enables an objective assessment as to how “green” a building is. It was launched on the 4 November 2008 and is a voluntary system that will accredit buildings according to their performance in eight categories. Energy accounts for a quarter of the points.

SANS 204 specifies the requirements for the design and operation of energy-efficient buildings with artificial or natural environmental control and their sub-systems. It takes climactic zones into account and gives specific building guidelines.

Abbreviations and acronyms used in this study

ACEEE	American Council for an Energy-Efficient Economy
AsgiSA	Accelerated and Shared Growth Initiative for South Africa
BBEEE	Broad-based Black Economic Empowerment
CDM	Clean Development Mechanism
CEF	Central Energy Fund
CETA	Construction Education and Training Authority
CFL	Compact Fluorescent Lamp
CHE	Council for Higher Education
CIDB	Construction Industry Development Board
COSATU	Congress of South Africa Trade Unions
CPD	Continuous Professional Development
CSIR	Council for Scientific and Industrial Research
DEAT	Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DoH	Department of Housing
DoL	Department of Labour
DPLG	Department of Provincial and Local Government
DPW	Department of Public Works
DSM	Demand side management
DST	Department of Science and Technology
Dti	Department of Trade and Industry
EE	Energy Efficiency
EFT	Energy Training Foundation
ESCO	Energy service companies
ESETA	Energy Sector Training Authority
GBCSA	Green Building Council of South Africa
GEF	Global Environment Facility
GHG	Greenhouse Gas

HEQC	Higher Education Quality Committee
HESA	Higher Education South Africa
HET	Higher Education Training
HVAC	Heating, Ventilating and Air Conditioning
IEA	International Energy Agency
ILO	International Labour Organization
IPPs	Independent Power Producers
ITUC	International Trade Union Confederation
JIPSA	Joint Initiative on Priority Skills Acquisition
NBI	National Business Initiative
NDoT	National Department of Transport
NEDLAC	National Economic Development and Labour Council
NEEA	National Energy Efficiency Agency
NERSA	National Energy Regulator of South Africa
NQF	National Qualifications Framework
NT	National Treasury
RDP	Reconstruction and Development Programme
REDs	Regional Electricity Distributors
REEEP	Renewable Energy and Energy Efficiency Partnership
RET	Renewable Energy Technologies
SABS	South African Bureau of Standards
SAEE	Southern African Association for Energy Efficiency
SAQA	South African Qualifications Authority
SARS	South African Revenue Service
SETAs	Sector Education Training Authorities
Solar PV	Solar Photovoltaic
StatsSA	Statistics South Africa
SWH	Solar Water Heating
UEMP	Urban Environmental Management Programme
UNEP	United Nations Environment Programme
SEED	Sustainable Energy for Environment and Development

Definition of terms

Accreditation: The certification, usually for a particular period of time, of a person or an institution as having the capacity to fulfil a particular function in the quality assurance system set up by the South African Qualification Authority (SAQA) in terms of the SAQA Act: “To make authoritative, creditable, or reputable; sanction.”¹

Accreditation is a process in which certification of competency, authority, or credibility is presented.²

AsgiSA: Accelerated and Shared Growth Initiative for South Africa. AsgiSA has its origins in the commitment to halve unemployment (from 30 to 15 per cent) and poverty (from one-third to one-sixth of the population) by 2014.³

Best practice: An idea that asserts that there is a technique, method, process, activity, incentive or reward that is more effective at delivering a particular outcome than any other technique, method, process, etc. The idea is that with proper processes, checks and testing, a desired outcome can be delivered with fewer problems and unforeseen complications. Best practices can also be defined as the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeatable procedures that have proven themselves over time for large numbers of people.⁴

A practice which is most appropriate under the circumstances, especially as considered acceptable or regulated in business; a technique or methodology that, through experience and research, has reliably led to a desired or optimum result.⁵

Built environment: The physical world that has been intentionally created through science and technology for the benefit of mankind (according to the Built Environment Professions Bill).

CHE: Council for Higher Education, an independent statutory body responsible for advising the Minister of Education on all matters related to higher education policy issues and quality assurance within higher education and training.

CIDB: The Construction Industry Development Board was established to provide leadership to stakeholders and to stimulate sustainable growth, reform and improvement of the construction sector for effective delivery and the industry’s enhanced role in the country’s economy.⁶ It keeps a Register of Contractors.

Decent work: The ILO defines decent work as opportunities for work that are productive and deliver a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives, and equality of oppor-

¹ <http://dictionary.reference.com/browse/accreditation>.

² <http://en.wikipedia.org/wiki/Accreditation>.

³ <http://www.info.gov.za/asgisa/>.

⁴ http://en.wikipedia.org/wiki/Best_practices.

⁵ <http://dictionary.reference.com/browse/best%20practice>.

⁶ <http://www.CIDB.org.za/home/Default.aspx>.

tunity and treatment for all women and men.⁷ Decent work has four pillars: employment, social protection, workers' rights, and social dialogue.

CINTERFOR⁸ states that "within the ILO the following characteristics have been attributed to [decent work]:

- it is productive and secure work;
- it ensures respect for labour rights;
- it provides an adequate income;
- it offers social protection;
- it includes social dialogue, union freedom,⁹ collective bargaining and participation."

Decent work refers to opportunities for women and men to obtain work in conditions of freedom, equity, security and human dignity.¹⁰

The right to decent work encompasses productive and sufficient work of acceptable quality in which rights are protected and which generates an adequate income with adequate social protection.¹¹

ESCOs: (Independent) energy service companies – companies that are determined to save power – who are in partnership with Eskom that must effectively realize DSM. This is achieved through upgrading power facilities at existing buildings and ensuring that efficient systems are installed in new buildings. ESCOs must be registered with Eskom.

An ESCO will approach a potential client – for instance a commercial premises developer –and offer to carry out an energy audit at no cost. The objective is to determine whether energy savings can be made. If positive, the company uses its audit findings to draw up a proposal outlining the savings impact and related cost structure of the project. The electricity supplier then assesses the outcome and, if it is regarded as feasible, makes funds available to the ESCO for the project.¹²

ESCOs offer energy efficiency improvement services, including a guarantee of savings. The ESCO's remuneration is linked to the projects' performance (concept of performance-based contracting), which means that the ESCO's payment is directly linked to the amount of energy saved (World Energy Council, 2008).

Eskom: A South African electricity public utility established in 1923 as the Electricity Supply Commission (ESCOM) by the government of South Africa in terms of the Electricity Act (1922). The utility is the largest producer of electricity in Africa, is among the top seven utilities in the world in terms of generation capacity and among the top nine in terms of sales.¹³ Eskom generates 95 per cent of the electricity used in South Africa. Ownership vests in the South African Government.¹⁴

⁷ <http://www.ilo.org/public/english/decent.htm>.

⁸ http://www.cinterfor.org.uy/public/english/region/ampro/cinterfor/publ/sala/dec_work/ii.htm.

⁹ <http://www.southafrica.info/business/economy/policies/tradeunions.htm>: "Almost all sectors of the South African economy, including the public service, have representative unions which engage employers over issues affecting their workforce". Trade unions play a very active role in the workforce.

¹⁰ http://en.wikipedia.org/wiki/Decent_work.

¹¹ http://portal.unesco.org/shs/en/ev.php-URL_ID=4666&URL_DO=DO_TOPIC&URL_SECTION=201.html.

¹² http://www.eskomdsm.co.za/?q=ESCO_Registration_procedure.

¹³ <http://en.wikipedia.org/wiki/Eskom>.

¹⁴ http://www.eskom.co.za/live/content.php?Category_ID=14.

Gautrain: An 80-kilometre mass rapid transit railway system under construction in the Gauteng province that will ultimately link Johannesburg, Pretoria and the OR Tambo International Airport. It is hoped that this railway will relieve the traffic congestion in the Johannesburg/Pretoria traffic corridor as well as offer commuters a viable alternative to road transport, as Johannesburg has a limited public transport infrastructure.¹⁵

Green building: Building with a conscious effort to minimize the negative impacts and encourage positive impacts of buildings on both the indoor and outdoor environments. The practice of green building typically includes attention to the following primary concepts and systems:

- sustainability/durability/low-maintenance building design and operation;
- energy efficiency and conservation;
- site/land management, sustainability, reclamation and conservation;
- water efficiency, management and conservation;
- indoor air quality;
- outdoor air quality;
- material and resource management, recycling and conservation (including the reuse of building material and products); and
- innovation.¹⁶

Green building refers to designing and building structures that are environmentally sound and follow the tenets of sustainability. Such buildings consume less energy, are durable and can be recycled. During all phases, the building saves resources and places fewer burdens on the environment, protects workers and minimizes health exposures.¹⁷

Green building is the practice of increasing the efficiency with which buildings use resources – energy, water and materials – while reducing building impacts on human health and the environment during the building’s lifecycle, through better site location, design, construction, operation, maintenance and removal.¹⁸

Green Jobs: Positions in agriculture, manufacturing, construction, installation and maintenance, as well as scientific and technical, administrative and service-related activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect and restore ecosystems and biodiversity; reduce energy, materials and water consumption through high-efficiency and avoidance strategies; de-carbonise the economy; and minimize or altogether avoid generation of all forms of waste and pollution. But Green Jobs also need to be good jobs that meet long-standing demands and goals of the labour movement, i.e. adequate wages, safe working conditions, and worker rights, including the right to organize labour unions.¹⁹

Green technology: Also known as environmental technology, it is a subset of green living and refers to various sciences whose aim is to advance technology to help conserve and protect the environment, such as recycling or renewable energy.²⁰

¹⁵ <http://en.wikipedia.org/wiki/Gautrain>.

¹⁶ ICC Green Building White Paper http://www.iccsafe.org/news/green/pdf/ICC_Green_Building_White_Paper.pdf.

¹⁷ <http://www.lehighcement.com/Education/Lehigh-Education-Glossary.htm#G>.

¹⁸ http://en.wikipedia.org/wiki/Green_building.

¹⁹ UNEP/ILO/ITUC/IOE (2008).

²⁰ <http://www.greenerlivingguide.com/index.php?url=glossary-green-living&category=Energy>.

Green technology (GreenTech) or clean technology (CleanTech) is the application of the environmental sciences to conserve the natural environment and resources, and to curb the negative impacts of human involvement. Sustainable development is the core of environmental technologies. When applying sustainable development as a solution for environmental issues, the solutions need to be socially equitable, economically viable, and environmentally sound.²¹

HEQC: Higher Education Quality Committee – The White Paper on Higher Education and the Higher Education Act of 1997 makes provision for the Council on Higher Education (CHE) to establish a permanent subcommittee, the HEQC, with the mandate to:

- promote quality assurance in higher education;
- audit the quality assurance mechanisms of higher education institutions; and
- accredit programmes of higher education.²²

HESA: Higher Education South Africa. Its vision is to be the unified body of leadership in a transforming, dynamic and diverse system of higher education. Its mission is:

- to promote and exercise proactive transformation, leadership and expertise for the sector and the country;
- to address, through its members, national development imperatives;
- to position Higher Education at the centre of knowledge production, research and development and innovation strategies; and
- to provide value added services to its members.²³

Labour Force Survey: The Quarterly Labour Force Survey (QLFS) is a household-based sample survey conducted by Statistics South Africa (StatsSA). It collects data on the labour market activity of individuals aged 15 years or older who live in South Africa. The questionnaire accommodates both national requirements in terms of providing information to inform policymakers and international requirements that conform to the standards of the ILO. The sample size for the QLFS is roughly 30,000 dwellings (StatsSA, 2008).

NQF: National Qualifications Framework is a set of principles and guidelines that provides a vision, a theoretical base and an organizational structure for a qualifications system.

Photovoltaic (PV): The field of technology and research related to the application of solar cells for energy by converting sunlight directly into electricity.²⁴

Register of contractors: Any enterprise that tenders or enters into a contract for construction works with the public sector must be registered. Joint ventures established on a contract-specific basis do not have to register, provided that each partner of the joint venture is separately registered.²⁵

Ripple controls: Devices installed by qualified electricians on the electricity distribution boards of houses and designed to enable municipalities to switch off geysers (and other electrical appliances) by a remote control signal sent to the distribution board.

²¹ http://en.wikipedia.org/wiki/Environmental_technology.

²² <http://www.che.ac.za/heqc/heqc.php>.

²³ <http://www.hesa.org.za/hesa/>.

²⁴ <http://en.wikipedia.org/wiki/Photovoltaic>.

²⁵ <https://registers.CIDB.org.za/Default.asp>.

By disabling geysers and other appliances, pressure is alleviated on the national power grid.²⁶ Generally ripple controls are applied to appliances whose functioning can be delayed to run later, after the peak period, without significant inconvenience to households.

SAQA: The South African Qualifications Authority is a body of 29 members appointed by the Ministers of Education and Labour. The members are nominated by identified national stakeholders in education and training. SAQA must oversee the development and implementation of the NQF.²⁷

SEED: The urban Sustainable Energy for Environment and Development (SEED) programme aims to promote sustainable development through the integration of energy and environment issues in urban development around South Africa. SEED is coordinated by Sustainable Energy Africa and is funded by DANIDA (Ministry of Foreign Affairs of Denmark).

Social dialogue: Defined by the ILO to include all types of negotiation, consultation or simply exchange of information between, or among, representatives of governments, employers and workers, on issues of common interest relating to economic and social policy.²⁸

A social dialogue can be any communication activity involving social partners intended to influence the arrangement and development of work-related issues. Examples of social dialogue activity include mutual information, open discussion, concertation (ongoing tripartite dialogue with a common goal or entente), exchanges of opinions, and consultation and negotiation (agreements/common opinions).²⁹

Social protection: It covers issues related to prevention of occupational accidents and diseases, promotion of workers' health and well-being, and improvement of working and employment conditions, particularly wages and incomes, working time, work organization, maternity protection, work-family balance, violence and harassment at work. It also assists constituents on matters relating to labour inspection as an essential element of good governance.³⁰

It consists of policies and programmes designed to reduce poverty and vulnerability by promoting efficient labour markets, diminishing people's exposure to risks, enhancing their capacity to protect themselves against hazards and interruption/loss of income.³¹

The South South North (SSN) Project: a network of organizations, research institutions and consultants grouped into one developmental organization with considerable expertise to help public and private stakeholders develop the necessary confidence for dealing effectively with the Clean Development Mechanism (CDM). SSN operates in Brazil, South Africa, Bangladesh and Indonesia.

Township: In South Africa, the term "township" usually refers to the – often under-developed – urban living areas that, under Apartheid, were reserved for non-whites (principally black Africans and Coloureds, but also working class Indians). Townships were usually built on the periphery of towns and cities. Townships sometimes have large informal settlements nearby.³²

Workers' rights: These are a group of legal rights and claimed human rights having to do with labour relations between workers and their employers, usually obtained under labour and employment law.³³

²⁶ <http://energycrisis.co.za/?p=82>.

²⁷ <http://www.saqqa.org.za/>.

²⁸ <http://www.ilo.org/public/english/dialogue/themes/sd.htm>.

²⁹ http://en.wikipedia.org/wiki/Social_dialogue.

³⁰ <http://www.ilo.org/public/english/protection/>.

³¹ <http://www.adb.org/SocialProtection/default.asp>.

³² [http://en.wikipedia.org/wiki/Township_\(South_Africa\)](http://en.wikipedia.org/wiki/Township_(South_Africa)).

³³ http://en.wikipedia.org/wiki/Labor_rights.

1. Introduction

1.1. Background

International concerns about energy consumption in buildings and South Africa's national commitment to reduce energy consumption, as evidenced by its comprehensive legal framework of energy efficiency initiatives, have resulted in energy-related improvements being implemented in the built environment. The ILO requested the CSIR to undertake research on the employment implications of this development. The CSIR has therefore researched the employment aspects of energy-friendly construction in South Africa.

The construction of new buildings and refurbishment of existing buildings provide the opportunity to contribute to a reduction in climate change from a perspective of global warming impacts by decreasing CO₂ emissions through reduced energy consumption of fossil fuels. They further provide an opportunity to develop new work-skilled base sets leading to employment.

There is, however, a need to improve the understanding of the technical and economic dynamics of buildings as well as the relationship between technological changes and the issue of employment at national level to recognize these labour opportunities. In this way, there is the potential for a win-win situation in terms of predicting and optimizing a suitably equipped workforce for energy-related improvements in construction. It must include a mechanism and provision for developing job opportunities for quality and decent work. It is important to understand how the shift to environment-friendly technologies can and should be used to create and improve employment opportunities. There is a need to understand how companies can, and should, prepare themselves and their workforce in terms of new skills to better address the emerging requirements arising from environment-friendly and energy-efficient changes in buildings.

1.2. The aim of the study

The aim is to: (1) identify energy-related job-creation opportunities and threats arising from the development and implementation of environment-friendly and energy-efficient technology improvements in buildings; and (2) to determine the impact these may have on new jobs and skills.

1.3. The objective of the project

The main objectives of the research study are to:

- (a) attempt to assess whether or not synergies exist in developing countries;
- (b) assess the scope in individual countries (inventory of buildings, nature of the works, number and type of jobs);
- (c) establish whether current measures take into account the potential for improving energy efficiency and creating employment in the building sector; and
- (d) study the potential and conditions for tapping it in at least one developing country.

1.4. Scope

This report gives an overview of the extent of the South African construction sector. It identifies current drivers, issues and trends in the construction industry and reviews the role energy plays in both the industry and the general economy. It considers renewable energy and identifies the drivers of energy-related improvements in government, local authorities and private companies. It summarizes global trends in energy-efficient technologies, as well as renewable energy options available in Africa and trends in South Africa.

It sets out South African legislation, regulations, policies, strategies and initiatives that relate to built-environment energy improvements and reviews what is happening globally and locally. Selected case studies provide helpful information on projects encompassing energy-related improvements.

The study concludes with the employment implications of energy-related improvements in construction and the opportunities offered for job creation and decent work conditions.

Pointers towards an appropriate win-win or synergistic model are identified and discussed but not explored in depth due to the limited scope of this particular project.

2. Methodology

The first stage of the research involved an initial assessment of the research questions posed by the ILO for collecting and collating material by extensive desktop internet searches of journals, conference proceedings, press releases and unpublished reports. The material was categorized and consolidated to form a body of knowledge on the state of the built environment relating to labour, energy-related improvements in building, energy efficiency in buildings and related legislation. The specific research questions as posed by the ILO were then addressed in terms of this knowledge base to determine job capacity implications and opportunities emerging from the information and data.

The second stage of the research involved obtaining additional data from in-depth interviews with identified experts in the field, which was then used to further develop and enrich responses to the research questions and to validate the pointers towards an appropriate job development model.

2.1. Primary research question 1

How, and in what way, can the relationship between technological changes with regard to energy-related improvements in buildings and the potential of employment arising from it be exploited to create a win-win situation in South Africa?

2.2. Primary research question 2

How can and should companies and the workforce better prepare themselves (for example in terms of new skills) to address new requirements in the construction industry emerging from possible energy-related improvements in construction?

2.3. Primary research question 3

Is a possible win-win situation (how to use the shift to energy-related improvements in construction to also improve employment opportunities) forecasted and, if so, encouraged? If not, how can it be encouraged?

2.4. Primary research question 4

What are the related issues regarding not only employment creation but also quality of work (social protection, workers rights and social dialogue) with regard to energy-related improvements in building?

2.4.1. Sub-questions

Sub-question 1:

What are the current drivers, issues and trends with regard to implementing energy-related improvements in construction in South Africa?

Sub-question 2:

What are the views and attitudes of the main stakeholders (central governments, local authorities, private companies) to energy-related improvements in construction in South Africa?

Sub-question 3:

What renovation/improvement measures have the best technical and economic efficiency with regard to energy-related improvements in building in South Africa (i.e. are likely to be implemented first)?

Sub-question 4:

What are the main challenges for South Africa with regard to energy-related improvements in building, including improving the energy efficiency of the existing building stock? What are the obstacles or barriers that prevent cost-effective measures from being implemented?

Sub-question 5:

What elements of policies and programmes are essential to trigger a move towards more energy-related improvements in construction?

Sub-question 6:

How can and should companies and the workforce better prepare themselves (for example in terms of new skills) to address new requirements in the construction industry emerging from possible energy-related improvements in construction?

Sub-question 7:

Is a possible win-win situation (how to use the shift to energy-related improvements in construction to also improve employment opportunities) forecasted and, if so, encouraged? If not, how can it be encouraged?

Sub-question 8:

What are the related issues in not only employment creation but also in quality of work (social protection, workers rights and social dialogue) with regard to energy-related improvements in building?

Sub-question 9:

What constitutes good practice with regard to energy-related improvements in building?

3. South African construction overview

3.1. Introduction

This section presents an overview of employment in the construction sector in South Africa. It identifies the current drivers, issues and trends in construction and briefly describes the main challenges with regard to energy-related improvements in building in South Africa.

3.2. Employment and extent of the industry

In March 2001 there were 639,000 people between the ages of 15 and 65 employed in the construction sector. This number rose to 1,024,000 in September 2006.

Table 3.1. Employment numbers (age 15–65) in the construction sector, 2001–06 (in thousands)

March 2001	Sept. 2001	March 2002	Sept. 2002	March 2003	Sept. 2003	March 2004	Sept. 2004	March 2005	Sept. 2005	March 2006	Sept. 2006
639	634	578	605	591	664	659	824	813	935	864	1024

Source: StatsSA, 2008d

According to the Quarterly Labour Force Survey (published in August 2008) 1,138,000 persons were employed in the construction industry in the quarter April to June 2008. This represents 8.28 per cent of the 13,729,000 employed persons in South Africa. Twenty six thousand jobs were added in the construction sector in the second quarter of 2008 (StatsSA, 2008b).

According to the BMI report done for CIDB (2006), some 450,000 people are formally employed in building and construction (excluding manufacturing and distribution), with a further three to four informal subcontracting employees per each formal worker. This is a total of between 1,800,000 and 2,250,000 people in the construction sector. The report estimates that formal employment will grow by 30 per cent to 60 per cent to between 600,000 and 700,000 by 2010. Some 200,000 to 300,000 people are estimated to be employed in the manufacturing and distribution of building and construction materials. The report estimates that the growth to 2010 in this employment will be less than 10 per cent.

The total income for the construction industry in 2004¹ was R100,442 million. The main contributors are: Construction of buildings with R33,117 million (33.0 per cent), construction of civil engineering structures with R27,478 million (27.4 per cent), other building completions with R10,625 million (10.6 per cent) and building installations with R8,992 million (8.9 per cent) (StatsSA, 2004).

¹ Similar data for the years after 2004 is not available.

In addition, R6,535,000 million was spent on low-cost housing in 2006 compared to the R2,068,980 million spent in 2002 (StatsSA, 2008c).

The South African Government intends to invest approximately R400 billion² in infrastructure over the next few years (BMI, 2006), including in new and existing buildings (Kievani, Tah et al., 2008:35). The bulk of this is power stations, soccer stadiums for the 2010 World Cup, the rapid rail development (Gautrain) and roads.

3.3. Current drivers in construction

3.3.1. Transformation

Transformation in the construction sector has given rise to specific drivers. The Government's White Paper on Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry (1999) captured essentially two notions: growth and transformation:

- Transformation is aimed at increasing the ownership and participation of previously neglected persons in the construction industry
- Growth is focused on improving the economic performance of the industry.

These notions constitute two governmental initiatives: establishing a BBEEE Charter for the Construction Industry (the Construction Charter), and developing a Construction Growth and Development Summit Agreement (Construction Summit).

The Construction Charter is founded on the BBBEE Act (No. 53 of 2003) which establishes a legislative framework for the promotion of BBBEE and identifies measurable targets for the key objectives above. These targets should be fully achieved by 2013.

3.3.2. Small, medium and micro-enterprises

The construction sector in South Africa reflects the global structure of the sector insofar as the majority of construction enterprises fall within the definition of small, medium and micro-enterprise, with only a small percentage rated as large. It is difficult to target growth sectors for SMMEs as conditions change from year to year in response to sector cycles favouring different industries.

The spread of construction work between large, medium, small and micro construction enterprises is dominated by large construction enterprises, controlling more than 50 per cent of the category. In the subcontracting categories the smaller enterprises dominate, controlling those categories by 60 per cent, but the turnover per enterprise is far less.

3.3.3. Construction capacity and demand

Research confirms that properly managed growth is one of the most effective ways of reducing poverty and that infrastructure development is one of the key pillars of economic growth. Providing a developing country with good infrastructure along with the other drivers of growth – better health and education services, a positive investment climate, good governance that respects property rights and is corruption free – is central to the mission of reducing poverty (World Bank: 2003).

Table 2 below demonstrates that the total income for the construction industry in 2004 was R100,442 million (StatsSA, 2004). The total expenditure in the construction industry in 2004 was

² “The Government has stated on various occasions that it would spend more than R400 billion on infrastructure over the next few years. However, this must not be construed as all new work in addition to the current ongoing activity. Rather, the estimate includes all work to be undertaken.” BMI, 2006. An Engineering News press release in 2005 stated that this amount is R320 billion.

R96,375 million. The net profit before tax in the construction industry in 2004 was R3,968 million, with the largest contributions coming from the “construction of buildings” with R1,083 million (27.3 per cent) and “construction of civil engineering structures” with R825 million (20.8 per cent).

Table 3.2. Main contributors to construction income and expenditure, 2004

2004	Contribution to total income (R-million)	%	Contribution to total expenditure	%
Construction of buildings	33 117	33.0	32 037	33.2
Construction of civil engineering structures	27 478	27.4	26 746	27.8
Other building completions	10 625	10.6	10 221	10.6
Other building installations	8 992	8.9	8 127	8.4
TOTAL	100 442	79.9	96 375	80.0

Source: Van Wyk, 2006

The total number of people employed by the construction industry in 2004 was about 403,000 (StatsSA, 2004). The major employers were “construction of buildings” with about 126,000 employees (31.3 per cent), followed by “construction of civil engineering structures” with 89,000 (22.1 per cent), “other building completions” with 56,000 (13.9 per cent), and “electrical contracting” with 29,000 (7.2 per cent).

Despite the availability of funding, the provision of infrastructure remains hampered by public sector capacity constraints. The third quarter spending review for provinces confirmed that they are still spending too much on employees and too little on infrastructure (houses, hospitals and schools) where the provision here is aimed specifically at closing the gap between the so-called “first” and “second” economies in South Africa. Most provincial spending went on social development programmes, mainly education and health, where spending is at 73.4 per cent of the annual budget (Loxton, 2005a). The largest under-spending problem in provinces remains the slow rate of capital expenditure, currently representing only 46.4 per cent of the adjusted annual budget. The table below indicates the service provision still required at 1999.

Table 3.3. Overview of the extent of service provision still required

Service	Status Oct. 99 %
Water	
Proportion of households having access to clean water	83.4
Electricity	
Proportion of households using electricity for lighting	69.8
Telephones	
Proportion of households with a phone in the house or cell phone	34.9
Health care	
Proportion of households using public health sector	69.4
Proportion of households using private health sector	30.6
Housing	
Proportion of households in formal housing	69.9
Sanitation	
Proportion of households with chemical or flush toilets	55.8
Proportion of households with pit latrine	30.3

Source: Van Wyk, 2006

The existence of infrastructure and the location of future infrastructure exert substantial influence on the performance of the economy, and, therefore, the construction industry. Currently, Gauteng province is the economic powerhouse of South Africa and makes the largest contribution to GDP (37.73 per cent compared to second-placed KwaZulu-Natal at 14.9 per cent). The ongoing deterioration of its infrastructure is therefore cause for great concern. The national government considered giving the City of Johannesburg a one-off R800 million capital injection to boost the city's run-down electricity infrastructure (*Engineering News*, 2005).

3.3.4. Drivers with regard to implementing energy-related improvements

There are two drivers in the energy-related sectors in South Africa, namely energy demand (this specifically includes electricity demand) and the economy's reliance on energy derived from fossil fuels.

3.3.5. Summary

This section identifies some of the current drivers in construction. These have a very important influence on implementing energy-related improvements in buildings in South Africa. The following are the most important drivers in construction:

- (a) The construction industry is going through much needed transformation and growth.
- (b) The majority of the construction enterprises are small, medium or micro with very few being classified as large.
- (c) There is a huge demand for homes; this is apart from the demand on the construction sector for the construction of stadiums, Gautrain, power stations and roads.
- (d) There appears to be a shortage of qualified skilled workers as well as a lack of sufficient skills development.

3.4. Current (systemic) issues in construction

The initial results from the survey undertaken as part of the 2003 Status Report of the Construction Industry confirmed that industry performance and delivery across a broad range of issues remains highly variable and inconsistent, even where statutory obligations and procedures, such as the Government's Preferential Procurement Policy Framework Act, exist.

A lack of knowledge and deterioration in capability remains problematic, resulting in an "average" customer satisfaction rating of industry products. Fierce competition and low margins generate loss of knowledge and concomitant enterprise failure, predominantly in the R5 million and lower range.

The survey confirmed that very little human resource development is occurring within the industry. Consequently, skills are not being developed, nor are employment conditions that show "respect for people" being applied. The employment of casual labour (no permanent contract and poor practices) has become the norm, along with reduced wages, working conditions, remuneration, formal skills development or training, and resulting quality of life. Unfortunately, the socio-political legacy with regard to indigenous people since the establishment of the Dutch East India Company at the Cape in 1652 (which prevailed well into the twentieth century) considered such people as a source of cheap, unskilled labour underpinning a low skill base and furthered by the volatility in the industry.

The survey indicated high levels of uncertainty within the industry. This is changing with the establishment of the CIDB, CETA, BBEE, Preferential Procurement Policy Framework, and the proposal for the levying of royalties for exportation rights, etc. Nevertheless, macro-

economic issues around the R/\$ exchange rate, interest rates, export potentials, and cost fluctuations in imported goods and products, abound.

It also emerged that, where a high level of management skills existed and proper procedures were put in place, satisfactory results were produced. This indicates that success is obtained when the delivery process is client-led and demand-driven in spite of relying on the same procurement regime and delivery systems as those whose projects, in terms of both process and product, were less than satisfactory.

Given the above, the concerns and questions arising among the interviewees was: “what interventions may be needed to improve quality and delivery? Are there other more fundamental considerations – systemic issues – that may be undermining the development of the industry into a thoroughly modern industry”?

The following is an evaluation of what those systemic issues may be, particularly when seen against the background of the broader societal and economic transformation occurring globally as well as the transformation that has occurred in other industries, such as the automotive industry.

3.4.1. The delivery system

The industry’s delivery chain consists of many composite parts (complex), often operating and/or resulting in difficult and aggravating circumstances (complicated), involving multiple participants operating from inside and out of the industry, resulting in a system(s) that may be assembled with completely new and never-ending variations and combinations. This multi-partite structure results in unpredictable consequences, increasing risk to all participants without allocating liability to any. Entry and exit requirements are non-existent for many participants who often lack a thorough knowledge of the industry and show no understanding of the risks and liabilities.

Industry investment reveals a split persona. While public and private sector contributions to the entire construction industry spending are almost equal, the private sector spends in response to opportunity (short and sharp) whilst the public sector should, theoretically, spend according to the MTEF (longer term and consistent) – except it does not.

The construction sector profile is consistent globally with national profiles consisting of a small number of large (National and International) companies and a large number of SMME contracting companies (regional and city basis).

The variability of construction is significant between developed and developing countries: in developed countries it is orientated around renovation and maintenance (33 per cent and rising in Europe) and performance improvement thus requiring new technologies, whereas in developing countries it primarily concerns new construction, often relying on low-level technologies. This has adverse impacts on the domestic construction enterprises who find it difficult to compete against international construction enterprises for global construction work. Although competitive South African construction enterprises will probably discourage international competitors from competing for work in South Africa, other developing economies in the sub-Saharan region do not have equivalent construction enterprises and are therefore vulnerable to external competitors.

Yet, the South African construction enterprises will have to develop international credibility beyond their domestic profile and reputation by adjusting externally and internally (improving their business processes) to compete effectively.

3.4.2. Performance expectations

Unlike in the automotive industry, construction industry customers have very low expectations of the performance of the product they receive; their tolerance is too high and understanding of risks too low. Empowering consumers and raising their expectations for better performance will create critical mass and induce a demand-side performance quest.

Currently, there are no expectations for draft-free casement windows, for timber to be properly dried, nor for appropriate discharge distances of rainwater from the foundations. Issues regarding proper foundations and correct fitting of roof structures are even less evident. Quality assessment is essentially limited to a defined agenda of visible defects, such as plaster and paint finishes, tiling gaps, and physical damage to products.

3.4.3. The knowledge base

Skill enhancement in the construction sector faces its own challenge: the sector employs the fourth highest number of persons having no education (behind agriculture, households, and mining). Construction also has the fourth lowest percentage of employed persons possessing a higher education qualification, behind households, agriculture and mining, illustrating that construction skills are dominated by the most basic of manual labour skills. Since construction delivery in South Africa is still largely dependent upon labour-based technologies, there is no significant “mismatch” between employer skill requirements and worker skills availability. However, the net result is that the performance level of the construction sector is being determined by the low level of skill inherent in the industry as a whole.

The claim that there is a shortage of skilled people in South Africa in general, and in the construction industry in particular, must therefore be understood in this context. Research undertaken by the Human Sciences Research Council (HSRC, 2004) suggests that “The shortages are not as dramatic as made out,” limited to between 3 per cent and 4 per cent in most professions. It is often claimed that there is a shortage of engineers in South Africa, a claim disputed by the HSRC, which believes that “there’s currently little sign of a skills shortage of engineers” (HSRC, 2004). It suggests that there has been a major shift in demand from graduates towards post-graduate, who are almost by definition more difficult to find.

On the other hand, real shortages do exist among artisans covering the entire spectrum of mechanics, electricians, plumbers, building craftsmen and other trades, in large part due to the collapse of the apprenticeship schemes leading to a decline from 29,800 apprentices in 1986 to 16,500 in 1998 (HSRC, 2004). This is critical, since artisans form the backbone of developing economies.

However, the relevance of skills shortage becomes evident with regard to the new emerging technologies that are delivering high-performance infrastructure to globally competitive economies, and in turn promote growth in the economy. The debate in construction in South Africa needs therefore to shift from number to competency.

The low level of technology employed in the construction industry is undermining the industry’s ability to attract bright young people and not only to retain the world-class expertise that the industry contained but also to expand that expertise into the new emerging technologies. The “mismatch” is therefore occurring between the skills on offer within the South African industry, and those required by a world-class industry delivering infrastructure to an economy wishing to be globally competitive.

The Construction Education and Training Authority (CETA) has acknowledged surprise at the high number of workers in the industry who had no literacy and/or numeric skills. An organization established ostensibly to facilitate the provision of skill enhancement within the sector now faces the daunting challenge of facilitating basic schooling (ABET) as a precondition to the provision of skill enhancement.

The legislative and regulatory regime responsible for the establishment of qualifications and standards for training also over-complicated the provision of skill training. This has discouraged the private sector from participating fully in the implementation of training. A significant component in this problem is the lack of a single point of responsibility and overlapping of procedures and approvals by a variety of formal structures which, also, simply do not yet exist. In other in-

stances, existing training structures and facilities were disbanded, contributing to an uncoordinated and deprived skill enhancement environment.

The shift from formal employment to informal and/or short-term contract employment has undermined the employer's role as a supporter of skill enhancement who also sees no advantage in participating in skills training programmes. The net effect in South Africa is that financial backing for these programmes is far lower than in some other developed countries, notably Germany and Japan.

The income gap between educated and less-educated employees is widening. To the less educated, this almost guarantees a lifetime of poor earnings and short employment duration prospects given the low level of skill they offer to the market and the absence of opportunity to enhance their skill base. This will sustain an unskilled labour force that will enter and leave the industry in response to market opportunities elsewhere. The net result will be a continuing drop in the number of permanently employed – as older employees retire – and an increase in the number of unskilled casual employees to the ultimate detriment of the industry's knowledge and skills base.

The challenges are significant; as other economic sectors begin to require highly skilled employers, the unskilled will become more dependent upon the construction industry. As the construction sector is currently better off than the mining industry (in terms of the number of educated) and that the mining industry is rapidly shedding jobs (particularly at the lower level of skill availability) with a likelihood that these jobless may well turn to construction as alternative employment, albeit as informal workers, one can anticipate that the construction industry will soon have the highest number of uneducated employees. That being the case, construction could soon be ranked with agriculture and households in terms of skill level.

Under this scenario, construction workforce percentages with high school education will decline and those with little or no literacy, numeric skills, as well as low educational attainment, will constitute – by far – the largest share of the workforce. In parallel, technological improvements in construction practices globally will no doubt continue resulting in increases in employer skills needs over time. The combination of these two forces will exacerbate an existing domestic “skills”, “worker” and “wage gap” over the next ten years (and beyond) between skilled and unskilled labourers within South Africa as well as between South African industry performance and that required by the global economy. Local construction enterprises endeavouring to remain globally competitive, or deliver globally competitive industry products locally, will find it increasingly difficult to find the required skills. The industry's productivity and growth during this time will almost certainly be significantly constrained by these workforce limitations. This is a self-perpetuating cycle of decline, as a stagnating industry in terms of technological innovation and development, will not attract bright young school-leavers.

Another gap exists between less-skilled workers – especially those from disadvantaged communities – and the jobs that are potentially available to them resulting from the “spatial mismatch” between residence and work location. Areas of job opportunity are inaccessible to workers in poor neighbourhoods as South Africa lacks a reliable and extensive public transport system. Workers are therefore dependent upon mini-buses to take them to an informal labour depot from where they are collected and transported to their place of employment. Both modes of transport are unsafe and expose workers to life-threatening situations on a daily basis. In addition, many of these workers face job availability information “gaps” or lack access to strong and reliable informal networks.

The tragedy here is that, for once, the lack of training exists not because of scant financial resources but because of an intrinsic and inherited history of inadequate education and training – especially for Black South Africans – and an economic and administrative environment that does not encourage investment in human capital. The latter is evident in CETA statistics indicating that of the 18,740 registered enterprises within the construction industry (Department of Labour), only

8,365 pay levies. Workplace Skills Plans (WSP's) submitted to CETA cover only 48,885 of the 160,000 who are listed as formally employed, or the 520,486 in total who claim they are employed in the construction industry.

Management and administration efficiency of the construction delivery process requires a high level of management knowledge, expertise and experience. Effective and competent management is a prerequisite for enhanced industry performance. As such, those active in the industry need to be well informed, adaptable, responsive, sufficiently resourced, and appropriately mandated. This is of particular relevance to the public sector where the lack of understanding of the planning for the delivery of services (from identification of need through to completion of project) is most obvious.

The current knowledge base of industry participants is outdated and not integrated and relies on a craftsmanship-based approach to product manufacturing where various skill-set layers of labour manufacture products (some still in their raw state) to construct a final product that may or may not add value at delivery to the customer. The introduction of new products and systems requires that industry participants gain a better understanding about how buildings perform, and a better understanding of the risks to buildings and owner and user relationships.

The continuing development of highly sophisticated technologies will continue to place developing countries like South Africa in a dilemma: on the one hand it needs to participate fully in the global economy to achieve the levels of economic growth it requires, whilst on the other it struggles with the financing associated with the purchase and maintenance of new technologies. In order for South African companies to be competitive globally we have to focus on our core competencies and seek the services of other specialists for non-core activities.

This dilemma is based on the assumption that the two-tiered construction industry is permanently entrenched: one that is capable of engaging globally, and another that is incapable of progressing beyond the delivery model first introduced by the Mesopotamians over 4,000 years ago. The former is characterized by a few large players by contractual value; the latter consists of numerous small players accounting for the bulk of the contracts by number.

The perpetuation of this scenario will increasingly result in two industries having less use for each other, with the likely outcome that the bulk of construction work will be undertaken with outmoded technology, ensuring the inability of the industry to achieve the required product improvements.

Just as there is a mismatch between the skills required by and available to the new economy, so too is there a mismatch between technology currency and application. Those economic sectors that are export-driven have had to make the transition in order to survive; unfortunately, the absence of this and a lack of international competition have resulted in the construction sector falling into a false sense of security. As in the case of those export-driven sectors, external interventions will have to be introduced into the construction industry in order for it to make the step-changes required. These interventions will most likely be introduced through legislative and consumer pressure.

The real question remains whether the construction industry wishes to be forced into this required era of change, or whether it will do so voluntarily.

Construction technology is facing pressures such as that last experienced with the emergence of the Industrial Revolution. Labour costs; raw material scarcities; and safety, health and environmental concerns will all drive the development of technologies that will assist the industry in meeting these new performance standards.

3.4.4. Construction inspections

Enhancing the capability and competence of the certification and inspection bodies through accreditation, better information supply from the public regulator, and strengthening the enforcement powers of inspectors, will go a long way to demand improvement performance.

Self-certification by building practitioners is one way of addressing this problem. The registration and licensing of building practitioners are others.

3.4.5. Construction warranties and services certification

Unlike industries such as the automotive industry, the construction industry accepts very little liability for its products. Where warranties do exist, they exist under very limited time periods.³ Part of this problem results from the multi-faceted and sequential nature of the delivery chain. There is no single point of responsibility; and individual liability is extremely difficult to prove in a court of law.

3.4.6. The procurement environment

Government procurement practices have changed through the implementation of the Public Finance Management Act. In essence there is a lack of an effective regulatory regime.

Procurement practices and documentation currently used by client bodies are an additional cost to the industry, leading to additional tendering costs on projects and increasing the perceived risk. Tender documentation quality is generally described as deteriorating. Projects are often poorly scoped and detail with respect to specifications often cited as inadequate.

A step change in procurement is necessary to remove the risks impeding broader industry investment. Deemed to be excessive by industry participants, these risks manifest themselves in the industry by poor building practices and inadequate and inappropriate skills training, the use of casual labour by low levels of investment in innovation and R&D, and poor human resource development.

3.4.7. Social, environmental and economic issues

Buildings and structures alter the socio-economic, biological and physical environment. Many buildings still in use around the world are many centuries old. Their construction, use, repair, maintenance and demolition consume energy and, in some cases, scarce resources (water and energy), as well as CO₂ global warming emissions, air pollution, waste, soil contaminants and the destruction of existing vegetation.

Yet they are a crucial part of governments' strategy to improve the quality of life: they constitute the infrastructure through which health care, education, and housing are provided.

As the pressures on the natural environment increase, construction industry practices will come under increasing scrutiny in terms of environmental degradation contributions. Problems linked with the construction sector's ability to contribute toward sustainability are:

- (a) **A lack of an effective regulatory regime** – and a poor human rights record, is perpetuating the lack of respect for people as reflected in the status report. Safety issues remain a concern in spite of progress (337 injured people in 2000 in civil engineering, 68 of them fatally).
- (b) **Absence of good corporate governance as espoused by the King II Report** – is significantly absent in the majority of industry participants. A robust and effective regulatory environment is a driver of change.
- (c) **Poor enforcement regime** – not supporting existing legislation and poor union representation within the industry, renders intentions of that regulation impotent. Again, where the delivery process has been client-driven, significant improvements are quickly realized in this area.

³ A final completion list must be presented within seven calendar days of the practical completion; there is a defects liability period of 90 calendar days and a latent defects liability period from the start of the construction period that ends five years from the date of achievement of final completion.

- (d) **Poor water management** – South Africa has an average annual rainfall of 464mm, compared with a world average of 860 millimetres (SA Yearbook, 2001/02). In addition to regional disparities and yearly fluctuations, 500 millimetres – usually regarded as the absolute minimum for successful dry-land farming – is accounted for in 65 per cent of areas. Forty per cent of water consumed globally is for sanitation and other uses in buildings: clearly construction methodologies need to address water efficiency, and recycling.
- (e) **Poor energy management** – although South Africa’s GDP is ranked 26th in the world, its primary energy consumption is ranked 16th. Its energy intensity is above average, with only ten other countries having higher commercial primary intensities (SA Yearbook, 2001/02). This is largely due to the economy’s structure, with large-scale, energy-intensive minerals and mining industries constituting almost half of the total energy consumed; the other by households (22 per cent) and transport. However, 65 per cent of household energy is obtained from fuel wood, with the remainder coming from coal (9 per cent), illuminating paraffin (8 per cent) and a small amount from liquid petroleum gas. There are still over 2.8 million households without electricity. Clearly, as the rollout of electricity to households occurs, one can expect the consumption ratio of households to increase. Coal and liquid fuels are heavily relied on (and set to increase) in the country. South African coal is among the cheapest in the world. As a result more than 60 Mt of coal are discarded annually with poor investment in energy-efficient technologies. Electricity and coal provide about three-quarters of the energy consumed by these sub-sectors. Transport relies predominantly on liquid fuels such as petrol and diesel: rail transport accounts for less than 5 per cent of total national electricity consumption. The energy sector is therefore a major greenhouse gas contributor. The Sasol oil-from-coal process and a dearth of other indigenous energy sources, such as hydro, exacerbate these figures. In addition, 57 per cent of the coal-mining methane emissions can be attributed to these two uses of coal (SA Yearbook, 2001/02).
- (f) **Poor land management** – particularly agricultural land (which also suffers from poor land quality, crop-geography mismatch, warming climate change and rainfall variability, and a resulting insecure food supply capability for the future) has prevailed as a result of the abundance of land and the adoption of the suburban model of development. Rising land prices, poor local authority growth policies, and developmental pressures have also resulted in viable agricultural land being sold off for upper-income housing estates and/or recreational purposes.
- (g) **Absence of whole life costing** – as a result of the (at least) three development booms in South Africa since 1945, and in spite of considerable investments in immovable assets, the construction sector made no substantial investments in building life-cycle costing with a resulting ageing building stock which is proving inadequate in terms of its ongoing economic, social and environmental performance. Substantial investments are required.

3.4.8. Quality-based regulatory environment

The Constitution of the Republic of South Africa is one of the youngest, if not the youngest, adopted in the world. With a contemporary concern beyond identifying processes and mechanisms of government, it incorporates a value system that should drive governance. Embedded within the constitution is the government obligation to address human rights issues in the context of economic prosperity considerations, social well being, and environmental stewardship. Moreover, the Constitution instructs the state to “respect, protect, promote and fulfil the rights in the Bill of Rights.”

It is therefore profoundly disappointing to note the absence of value-driven and quality-based regulations within those administrative and statutory bodies operating within the built environment. Whilst it must be acknowledged that certain regulations of the South African Bureau of Standards (SABS) do attend to quality issues, they encompass a very narrowly defined quality regime unlike numerous international governments.

Performance enhancement and quality improvement in accordance with triple bottom-line auditing will therefore only occur when government creates the expectation through legislation and regulation.

3.4.9. Business acumen, management and innovation

As the largest single client of construction in South Africa, Government has a vital interest in the efficiency and effectiveness of the sector. There are five factors influencing the efficacy of government management processes:

- (1) **Inadequate project planning and management** – due to budget inadequacies leading to poor project scoping and definition.
- (2) **Poor budgetary planning and controls** – national and provincial department spending occurs disproportionately between January and March. Similarly, capital budgets are not adequately protected, resulting in tenders cancellations and delays in payments to professionals and contractors.
- (3) **Too many steps in the procurement process** – reforms in local government consolidation and boundaries, their election and formation structures, implementation of integration development planning and the devolution of new functions associated within creates operational and efficiency problems and lack of process understanding resulting in payment and budget issues.
- (4) **Poor decision-making** – perceived to stem from poor delegation and business ethics along with badly devised responsibility – a move to supply-chain management could worsen this.
- (5) **Loss of knowledgeable personnel** – has led to a reduction in management and technical skills. Inadequate succession planning and training in tune with the ILO's training needs initiative has interrupted the knowledge transfer and mentoring process.

Although construction procurement processes are well-entrenched within public corporations and private clients, opportunism and knowledge within private sector investment can lead to very short planning times, resulting in design-as-you-build approaches, speculation, and interrupted large building projects.

In spite of building professionals being highly respected for their knowledge and competence, 20 years of construction investment decline has resulted in the sub-sector losing capacity to international markets and other industries and consequent professional skill shortages. Moreover, the change from the fee-based system to a competitive proposal or tender system is resulting in fixed price quotations and fee discounting reducing funding of training and skills. Repeated cycles will lead to an inelastic labour, skills/competency supply and demand curve resulting in a deterioration of competency over time.

Large contracting companies have substantially moved their focus to securing work across the borders of South Africa (up to 50 per cent). This has allowed the previously medium-sized firms to step into the vacuum created. These structural shifts in the construction sub-sector have had three impacts:

- (1) **Inadequate working capital** – and a limited track record together with poor delivery quality result in significant customer dissatisfaction, particularly in new firms.

- (2) **High rates of business failure** – especially among small and micro enterprises, stemming from their inability to properly manage cash flows and raise sureties, and from their lack of adequate management and supervision resources.
- (3) **Little productivity improvement** – very little evidence of process or productivity improvement and very little attention is being paid to systematic performance improvement activities, even in the most advanced companies. They have not taken their activities beyond formal monitoring and control measures, and quality improvement has evidently not been a priority.

Consequently, construction enterprise managers are not being equipped to exploit the structural shift that has occurred and are unable to harness their company's hidden resources enabling them to deal with these new growth opportunities advantageously.

3.4.10. Research and development

The prolonged downturn in the South African economy over the last 20 years of the twentieth century has had a profound impact on spending on research and development and has exposed four critical risks:

- (1) **Inadequate Science and Technology (S&T) capacity** – this undermines South Africa's strategic considerations from a human, economic and security perspective.
- (2) **Inadequate S&T staff recruitment and retention** – the human resources for science and technology are not being renewed. Our report does not establish whether this is a result of a lack of training needs assessment, skills development programs or educational institution availability, or rather a result of labour not being replaced or skills being elevated.
- (3) **Insufficient private sector S&T investment** – the complex set of factors driven by globalization resulted in reduced levels of both investment and performance by the South African private sector in R&D, resulting in the loss of local control of the developing knowledge base that underpins the success of most competitive companies.
- (4) **Inadequate intellectual property legislation and infrastructure** – new developments in biotechnology have increased the country's vulnerability with respect to the exploitation of its biodiversity, and inventions and innovations from publicly financed research are not adequately protected and managed.

S&T institutions active in national R&D are fragmented. The roles of different departments in governance and in setting output targets for government research institutions is not clear or synergistic. Equally, there is no holistic view taken by the budgetary processes with regard to science and technology spending by government. The size and complexity of the issues at hand favour R&D in that substantial benefits for the public sector to meet their own needs of continuing performance improvements and to deliver improved value for money can be derived.

However, R&D in the built environment and the construction sector by both the public and the private sectors significantly lags behind R&D in other sectors. There is little or no long-term orientation and no implicit commitment to the ongoing development of research capacity.

As a result, the R&D base to support research into the built environment and the construction sector has shown signs of severe weakness with respect to competence and capacity. Much of this capacity has been lost to South Africa – and Africa – permanently.

While the recently approved National R&D Strategy recognizes the need to reconstruct the R&D capability of South Africa through the doubling of funds over the next three to six years, alarmingly the built environment and the construction sector were not included as potential recipients of the increased funds. The National R&D Strategy does, however, encourage the various

national departments to address the R&D needs of their own sectors in a holistic manner within the framework of the National R&D Strategy.

3.4.11. Summary of current (systematic) issues in construction

This section identifies some of the current issues in construction. These issues have a very important influence when implementing energy-related improvements in buildings in South Africa. The following are the most important in construction:

- The delivery system in South Africa is very complex and often results in complicated circumstances, some with unpredictable consequences.
- Customers of the construction sector often expect the worst and even believe that the industry is not capable of better performance.
- There is a huge gap concerning the knowledge base in construction. There is also a lack of skills relevant to emerging technologies.
- The capability and competence of the certification bodies must be addressed.
- Participants in the construction industry, including customers and providers of construction services, must have clearly defined rights and obligations in terms of compliance with the performance standards that are set.
- The variety of procurement practices and documentation currently used by client bodies are an additional cost to the industry, leading to increased tendering costs and perceived risk on projects.
- As the pressures on the natural environment increase, construction industry practices will increasingly come under scrutiny in terms of their contribution to environmental degradation.

3.5. Current initiatives and trends in construction

There are currently three public entities in South Africa that are implementing construction industry development initiatives: the DPW, the CIDB, and CETA.

3.5.1. Department of Public Works (DPW)

The DPW provides, manages and is the custodian of national government's immovable assets. It provides strategic leadership to the construction and property industries; and co-ordinates the implementation of the Expanded Public Works Programme.

Strategic leadership is provided within the context of the 1999 White Paper on *Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry*. The White Paper provides the strategic framework of enabling programmes on:

- developing a stable delivery;
- enhancing industry performance;
- restructuring industry education, training and human-resource development;
- promoting new industry capacity and the emerging sector;
- developing the capacity and role of the public sector;
- developing the capacity and role of the public sector;
- institutional arrangements.

The Department has identified investment in new infrastructure, maintenance and rehabilitation of existing social and economic infrastructure as a priority over the medium term. Five objectives follow:

- (1) Provide accommodation, housing and land for national departments according to prescribed standards and directives, in line with the proposed immovable assets policy framework and legislation.
- (2) Intensify the promotion of Black Economic Empowerment, including emerging contractors, by giving previously disadvantaged male and female contractors opportunities to tender for construction and maintenance contracts.
- (3) Meet the strategic intent of the second economy through advancing infrastructure delivery utilizing labour intensive methods through the Expanded Public Works Programme.
- (4) Promote human resources development within the Department and through training and job opportunities for the poorest rural communities where public works programmes are initiated.
- (5) Influence delivery and investment in the construction industry by implementing the provisions of the 1999 White Paper on *Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry*.

The Department has also undertaken a number of initiatives:

- Expanded Public Works Programme (EPWP);
- performance and management tool;
- best practice;
- regulatory review;
- strategy for the built environment professionals;
- Emerging Contractor Development Programme (ECDP);
- Community Based Public Works Programme.

3.5.2. Construction industry development board (CIDB)

The CIDB was established by an Act of Parliament (No. 38 of 2000) to:

- Provide strategic direction and develop effective partnerships for growth, reform and improvement of the construction sector.
- Promote sustainable growth of the industry and the sustainable participation of the emerging sector.
- Promote improved performance and best practice of public and private sector clients, contractors and other participants in the construction delivery process.
- Promote procurement and delivery management, the uniform application of policy throughout all spheres of government, ethical standards, including a code of conduct.
- Establish the registration of projects and contractors, and other suppliers, to systematically regulate and monitor the performance of the industry and its stakeholders for sustainable growth, delivery and empowerment and for improved performance and capability.

In support of these objectives, the CIDB is implementing the following strategies:

- construction registers service;

- standard for uniformity in construction procurement;
- toolkit infrastructure delivery management system;
- labour-intensive best practice guidelines;
- HIV/AIDS programme aimed at promoting awareness on construction projects.

3.5.3. Construction education and training authority (CETA)

CETA was established in terms of the Skills Development Act (No. 97 of 1998). The functions and objectives of the CETA include, inter alia, determining the education and training needs of the construction sector within the framework of the National Skills Development Strategy. It achieves these primarily through the development and maintenance of a Sector Skills Plan (SSP) with the active participation of all sector stakeholders. In addition, the CETA monitors the demand for and delivery of education and training in the sector.

The following performance indicators proposed for the CETA are relevant to the purpose of this study:

- By March 2010 at least 80 per cent of departments spend at least 1 per cent of personnel budget on training.
- By March 2010 at least 500 enterprises to achieve a national standard of good practice in skills development approved by the Minister.
- Annually increasing numbers of small BBBEE firms and BBBEE cooperatives supported by Skills Development.
- By March 2010 at least 700,000 employed workers must have achieved at least ABET Level 4.
- By March 2010 at least 450,000 unemployed people to be trained, of which no less than 25 per cent must undergo accredited training, 70 per cent should be in employment, self-employment or social development programmes (including EPWP) or engaged in further studies.
- By March 2010 at least 100,000 unemployed people must have participated in ABET level programmes, of which at least 70 per cent have achieved ABET Level 4.
- By March 2010 at least 125,000 unemployed people assisted to enter and at least 50 per cent successfully complete programmes, including learnerships and apprenticeships, leading to basic entry, intermediate and high-level scarce skills.
- One hundred per cent of learners in critical skills programmes covered by sector agreements from FET and HET institutions assisted to gain work experience locally or abroad, of which at least 70 per cent find placement in employment or self employment.
- By March 2010 at least 10,000 young people trained and mentored to establish sustainable new ventures and at least 70 per cent of such ventures to be operational 12 months after completion of the programme.

In addition to this, CETA spends about R10 million a year to pursue HIV/AIDS initiatives in the construction sector, and about R49 million on bursaries for over 1,200 young students in built environment studies (CETA, 2005).

3.5.4. Summary of current initiatives and trends in construction

This section identified some of the current trends in construction. It is important to take note of these when planning to implement energy-related improvements in buildings in South Africa.

The Department of Public Works, the CIDB and CETA are implementing several initiatives concerning construction industry development:

- developing a stable delivery environment;
- enhancing industry performance;
- restructuring industry education, training and human-resource development;
- labour-intensive best practice guidelines;
- achieving a national standard of good practice in skills development.

3.6. Summary – Section 3

There appears to be growth in employment in the construction sector. The Government has stated that it will spend R400 billion on South African infrastructures. There is a housing backlog of 2.1 million units.

Transformation in the construction sector has caused specific drivers that will influence the course of development in the construction sector for many years. The construction sector in South Africa reflects the global structure of the sector insofar as most of the companies are small, medium or micro enterprises; they are rarely large companies. Infrastructure development is one of the key pillars of economic growth, however, the housing backlog, building of stadiums for the 2010 soccer World Cup, Gautrain and other construction projects exert substantial pressure on the capability of the construction sector. This is very evident in the gaps in relevant skills for the sector, also relating to energy efficiency. Labourers in the construction sector often have few skills and could be exploited more easily.

The delivery system in the construction industry can be described as cumbersome with never-ending variations and combinations. Customers often expect the worst and there is a persistent perception that the industry is not capable of doing better. The construction sector employs the fourth highest number of uneducated people. There is a shortage of the demanded skills in the industry, not only at artisan level but also for specialized tasks. There is a real need for enhancement of the capability and competence of the certification and inspection bodies

The Department of Public Works, the CIDB and CETA have very important roles to play in creating an enabling environment for reconstruction, growth and development in the construction industry.

4. South African energy overview

4.1. Introduction

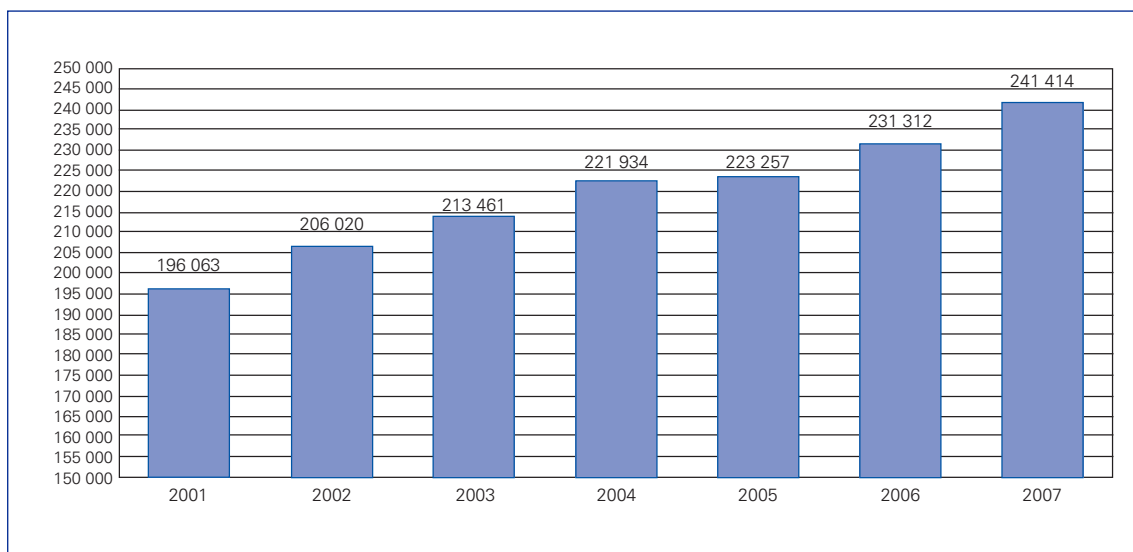
This section provides an overview of the energy situation in South Africa. It specifically looks at energy from an economic point of view as well as energy consumption in buildings. The renewable energy potential in the country is also reviewed. Particular attention is paid to the roles of different drivers of energy-related improvements, namely, the government, Eskom and other main stakeholders.

In this section, we examine the job implications that such transformations have and will deliver in terms of the labour market. For supporting information pertaining to the energy sector as a whole, please consult the draft report.

4.2. Energy in the economy

Energy comprises about 15 per cent of South Africa's gross domestic product (GDP) and creates jobs for about 250,000 people. Coal generates most of the country's electricity (SA Yearbook 07/08:406–7).

Figure 4.1. Energy consumed in South Africa in gigawatt-hours, 2001–07



Source: StatsSA, 2008d.

South Africa is among the top 20 leading emitters of greenhouse gases (GHGs) in the world and is the largest emitter in Africa, largely because of the economy's dependence on fossil fuels.¹ The total electricity sales by Eskom in 2003 grew to 196,980 gigawatt-hours (GWh). The peak demand on the integrated system totalled 31,928 MW.² That was an average of 16,415 GWh per month for 2003. The electricity available for distribution in May 2008 increased to 20,381 GWh.

4.3. Energy in construction and building

Engineering News reported in 2005 that the City of Johannesburg requires a capital injection of R800 million to boost its deteriorated electricity infrastructure. In 2007 *Engineering News* reported that some \$40 billion investment in infrastructure is needed in sub-Saharan Africa, of which \$8 billion is required for electricity. Rust, Van Wyk et al., quote statistics from *Engineering News* (2005) and *The South African Housing Foundation* (2007) that the South African Government aims to spend R400 billion in building and refurbishing infrastructure (power, roads, commuter rail, housing, bulk infrastructure, and research and development) and other projects to 2010. Included in this amount is R97 billion for coal-fired power plants and R100 billion for nuclear plants.

The current electricity crisis³ has delivered a dual blow to property developers: a slowdown in the number of new applications received by municipalities, and developers being forced to design more energy-efficient buildings. From an energy-efficient perspective, this is a positive point. However, it has negatively affected small- and medium-sized developers. According to Philip Harrison, the executive director of Johannesburg's development planning and urban management, the figures were difficult to quantify, [but] the city was aware of a marked slowdown in the applications for new developments. Applicants were now negotiating with Eskom and/or the municipality before submitting applications.⁴

4.4. Renewable energy in South Africa

The DME plays a prominent role in helping the South African economy move towards becoming less carbon-intensive. The department has introduced systems to access investment through the CDM of the Kyoto Protocol. It has developed the White Paper on *Renewable Energy and Clean Energy Development*, together with an energy efficiency programme, to support diversification in pursuit of a less carbon-intensive energy economy (SA Yearbook 07/08, p. 421).

According to the *White Paper for Renewable Energy* by the DME, potential exists in South Africa for 64.6 GW/36.22 TWh per year of electricity production from solar thermal sources. South Africa experiences some of the highest levels of solar radiation in the world. The average daily solar radiation in South Africa varies between 4.5 and 6.5 kWh/m² (16 and 23 MJ/m²), compared to about 3.6 kWh/m² for parts of the United States and about 2.5 kWh/m² for Europe and the United Kingdom.

¹ www.info.gov.za/aboutsa/minerals.htm.

² www.dme.gov.za/energy/overview.stm.

³ A healthy electricity supply has a reserve of about 15 per cent. This allows power stations to be shut down for maintenance and for unexpected failures, which occur constantly. Eskom's generation capacity is about 36,500MWe (megawatts electrical). In the winter of 2004, the peak load was more than 34,200MWe. This leaves a reserve of 6 per cent, which is far too low, www.citizen.co.za/index/article.aspx?pDesc=10864,1,22. Consequently, the country experienced huge power outages. The National Energy Regulator of South Africa (NERSA) estimated the cost of the energy shortage to be about R50 billion or R75 per kilowatt hour, www.fin24.com/articles/default/display_article.aspx?Nav=ns&ArticleID=1518-25_2382557.

Some of the world's largest gold and platinum producers stopped underground mining operations at all their South African mines on 21 January 2008 after Eskom could not guarantee supply. It requested its 138 largest industrial customers, which account for between 20 and 30 per cent of its load, to reduce consumption, www.miningweekly.com/article.php?a_id=125326.

⁴ www.property24.com/Property24/News/FullArticle.aspx?articleid=7750&Sec=Agricultural.

The current total installed wind capacity in South Africa is 26MW, with an estimated annual production of 32 GWh per annum. This figure consists of grid-connected, rural mini-grid, off-grid and borehole windmills and represents a combination of both grid-connected wind turbines as well as the energy equivalent of the mechanical pumping performed by the windmills. There are approximately 22,670 windmills in operation in South Africa, representing 86 per cent of this 32 GWh per annum. The DME estimates the theoretical potential for harnessing wind power in South Africa to be approximately 26,000 GWh per annum, which is equivalent to approximately 10 GW installed capacity (AGAMA Energy, 2003).

4.5. Drivers of energy-related improvements (in building)

4.5.1. The South African Government

The South African Government has stated its intention to retrofit about 106,000 government-owned buildings that are used by its departments throughout the country. Over 100 buildings in Pretoria, the Western Cape and the Free State have already been completed.

Smaller buildings and residences are often more thorough in implementing the principles of sustainability at grass-roots level. A good example is the public housing projects in the Kleinmond Municipality in the Western Cape and Buffalo City in East London.⁵

The *National Energy efficiency Strategy* was approved in March 2005 and sets a national target for improving energy efficiency by 12 per cent by 2015. If the target is met, it means a saving of more than R27,333 million (DME, 2005a, p. 3).

In June 2007, the DME launched the *Intensive Multimedia Energy efficiency Campaign* in partnership with the Department of Public Enterprises, Eskom and other state organs. The campaign targets ordinary households and industrial consumers with a view to influencing prudent consumer behavioural patterns without negatively affecting the economy (SA Yearbook 07/08, p. 407).

The Central Energy Fund (CEF)⁶ is expected to ensure that South Africa's energy is fully developed and used efficiently for the benefit of all South Africans. The CEF established two new energy bodies to deal with the country's energy challenges. These are the National Energy Efficiency Agency (NEEA) and the South African National Energy Research Institute (Saneri). The NEEA is a division of the CEF and will oversee the implementation of Eskom's DSM and other energy efficiency projects (SA Yearbook 07/08, p. 407).

CEF (Pty) Ltd is involved in the search for appropriate energy solutions to meet the future energy needs of South Africa, the Southern African Development Community and the sub-Saharan African region. The CEF also manages the operation and development of the government's oil and gas assets and operations. CEF is a private company, incorporated in terms of the Companies Act and governed by the CEF Act.⁷

The *SEED Programme* aims to promote sustainable development by integrating energy and environment issues into South Africa's urban development. SEED works with partner organizations, including national government bodies, metro local authorities and development NGOs. SEED also supports local and national-level government in other ways, such as energy audits of council buildings, setting city baselines for carbon emissions, technical expertise to advise on policy or other specialist issues, and research.

⁵ www.polity.org.za/article.php?a_id=120936.

⁶ www.cef.org.za/.

⁷ www.cef.org.za/content/view/3/10/.

At local government/municipality level, the City of Cape Town, Ekurhuleni (East Rand) Metropolitan Municipality, eThekweni (Durban) Municipality and the City of Johannesburg each received R15 million from the Urban Environmental Management Programme (funded by Denmark) to implement projects to boost the reduction of green house gas emissions. These funds are to be spent on, inter alia, retrofitting council buildings and solar water heating systems in Cape Town; installing energy monitoring and control systems and solar water heating systems in Ekurhuleni; retrofitting street lights and solar water heating systems in Durban; and the energy-efficient retrofitting of 20,000 houses in Alexandra and Cosmo City, near Johannesburg.

4.5.2. Eskom⁸

Government intends to spend R340 billion over five years on the Eskom infrastructure programme. This is the largest share of the public sector capital investment of R600 billion over three years.

Eskom's DSM programme broadly refers to the planning and implementation of activities designed specifically to influence the time, pattern and amount of electricity usage. It includes both reductions of consumption (electricity efficiency), as well as shifting the time of energy usage to lower energy demand "peaks" (peak shifting).⁹ This was needed as electricity demand exceeded supply, placing huge strains on the economy – platinum and gold mines stopped operations in January 2008 due to shortages. Eskom asked 138 of the largest industrial customers (20–30 per cent of its load) to reduce consumption (Van der Merwe, 2008). In August 2008 NERSA estimated the cost of the shortages to be about R50 billion (I-Net Bridge, 2008).

Eskom implemented DSM for energy efficiency in South Africa together with the DME and the National Electricity Regulator (NER) (for more information on NER and NERSA, refer to **6.4.4 National Energy Regulator of South Africa**). The DSM programme targets the residential, commercial and industrial sectors¹⁰ and contains energy savings advice as well as educational material (refer to website).¹¹

It must be noted here that Eskom and the DME are discussing energy efficiency legislation, as the voluntary programmes have not achieved the results that Eskom hoped for.¹²

Eskom Power Incentives¹³ include:

- **Solar energy:** Eskom has invited South Africans to register on its website for information on incentives for using solar energy to power much of their household needs (heating water with a solar geyser) which, in a return on investment period of two to three years, could cut household's monthly electricity bill by 40 and 50 per cent.¹⁴ Businesses can also register on the Eskom website if they provide SABS-approved solar powered geysers. Eskom will subsidize the cost of these to members of the public who install such a geyser through a business registered on the website.¹⁵ Eskom's programme forms part of its DSM project that aims to save some 3,000 MW of electricity by 2012 and up to 8,000 MW by 2025.¹⁶ However, only 352 electrical geysers were replaced with solar water heaters in 2008, despite 30,000 geysers being replaced per month. Twenty solar water heater suppliers have been SABS-accredited and there are 14 registered distributors (*Engineering News*, 2008).

⁸ Eskom is wholly owned by the South African Government.

⁹ www.eskom.co.za.

¹⁰ www.eepublishers.co.za/view.php?sid=1777.

¹¹ www.eskomdsm.co.za/?q=home.

¹² www.engineeringnews.co.za/article.php?a_id=145314.

¹³ www.southafrica.info/services/consumer/solar-210508.htm.

¹⁴ www.busrep.co.za/index.php?fArticleId=3658806.

¹⁵ <http://eskomplain.co.za/eskom-to-combat-the-electricity-crisis/>.

¹⁶ www.engineeringnews.co.za/article.php?a_id=125032.

- **Compact fluorescent lamps:** Since the programme began in 2004 more than 18 million CFLs have been exchanged for incandescent globes and there are plans to distribute a further 16.8 million CFLs in the 2008–09 financial year. In the 2009–10 financial year, they plan to distribute 8.15 million CFLs. The programme has reached more than 315,000 households and continues to reduce the energy demand from the household sector.¹⁷ During the three-month period from July 2008 to September 2008, 15,755 temporary jobs were created (*Engineering News*, 2008).
- **Energy-efficient motors:**¹⁸ The programme has replaced 200 of the intended 5,100 motors during 2008 (*Engineering News*, 2008).

4.5.3. Main stakeholders other than Eskom

These include Nedbank, Old Mutual and Mutual and Federal, Pick ‘n Pay, Clicks and Finish (premium dishwasher detergent brand)¹⁹, Sun Microsystems²⁰, and the Water Wise programme on behalf of the South African National Biodiversity Institute (SANBI).²¹

Examples of high-profile customers participating in the programme include: Southern Sun Hotels (all eleven Western and Eastern Cape Southern Sun Hotels are being upgraded and retro-fitted with energy-efficient solutions); Old Mutual Properties (five major Cape Town buildings and shopping centres); Volkswagen South Africa (Eastern Cape); Efficient Lighting Solutions; Shoprite Checkers; Sanlam; Woolworths; Game; and Pep Stores.

Several diverse role players have a mandate within the South African energy arena. Some form part of energy supply, others take part in energy conversion, efficiency or regulation. The following are some of the other main stakeholders:

- NER (National Energy Regulator);
- SABS, SANAS (South African National Accreditation System);
- DME;
- SARS, NT (National Treasury);
- Dti, DoH, NDoT (National Department of Transport);
- non-central government;
- education, SETAS;
- energy users;
- CEF;
- ESCOs;
- financial sector;
- CDM Services (Clean Development Mechanism);
- NGOs;

¹⁷ www.eskomdsm.co.za/?q=CFL_Exchange_Background_information.

¹⁸ www.eskomdsm.co.za/?q=Energy_Efficient_motors_Background_information.

¹⁹ www.savingenergy.co.za/content/efficiency_movement.php.

²⁰ www.savingenergy.co.za/content/sun_efficiency.php.

²¹ www.savingenergy.co.za/content/green_fingers.php.

- industry associations;
- Eskom, REDs (regional electricity distributor) IPPs (independent power producers);
- DPLG (Department of Provincial and Local Government);
- DoPW (Department of Public Works) (EES, pp. 25–26).

In response to this, the NBI is facilitating a collaborative initiative called the Technical Skills Business Partnership (TSBP). The partnership comprises of the following partners:

- Sasol (petrochemical industry);
- Arcelor Mittal (manufacturing, steel and engineering industry);
- Transnet (state-owned enterprise: transportation);
- Eskom (state-owned enterprise: energy);
- Anglo Platinum (platinum industry);
- Gold Fields (mining industry).

4.6. Summary

South Africa currently relies mostly on coal (making up 88 per cent of electricity generated) to sustain the country's energy needs. Buildings contribute over 40 per cent to national energy use. The DME plays a substantial role in helping the South African economy move towards becoming less carbon-intensive.

South Africa has a large potential to produce energy from solar and wind sources. However, these are long-term interventions. Short-term interventions are very important and it is essential that energy users change their behaviour – educational facilities, training and local workshops to sensitize the population need to be organized in this respect.

The role of the CEF to ensure that South Africa's renewable energy sources are developed and used efficiently should not be underestimated.

The South African Government has demonstrated its commitment to energy efficiency: several governmental buildings have been retrofitted and there are plans to retrofit an additional 106,000. Several government departments are involved in public housing projects using renewable energy sources.

Eskom has implemented the DSM programme to influence the time, pattern and amount of electricity usage in the country. Eskom also had incentives for installing solar powered geysers and exchanged old light bulbs for CFLs in certain areas.

Several large companies, corporations and other players in business in South Africa have demonstrated their commitment to energy efficiency by retrofitting office buildings and hotels.

5. Energy efficiency technologies

5.1. Introduction

We identify global energy efficiency trends in this section and look at the trends in South Africa regarding the changes that can be made to buildings to make them more energy efficient. Specific energy efficiency technologies available to buildings can be found in the more detailed draft report.

5.2. Global trends

Better energy efficiency in buildings has the biggest potential – not only in industrialized countries but also in developing countries – to reduce carbon emissions. A major reduction (20 to 30 per cent) can be achieved by reducing the need for heating and cooling buildings (Poschen, 2007).

UNEP estimates that the market for clean energy technology could be worth \$1.9 trillion by the year 2020, representing potentially a substantial increase in investment and jobs.¹

Global investment in renewable energy surged some 60 per cent to \$148 billion in 2007. Wind power attracted the most capital last year at \$50.2 billion or a third of all clean energy investment, according to the UNEP *Global Trends in Sustainable Energy Investment 2008* report. Investment in solar energy soared by 254 per cent to \$28.6 billion last year, while the bio-fuel sector foundered with funds falling nearly one-third to \$2.1 billion. Overall, clean energy accounted for 23 per cent of all new installed capacity in 2007. Public investment in renewable energy via the markets more than doubled to \$23.4 billion, up from \$10.6 billion in 2006. Investment in Africa's clean energy sector grew fivefold to \$1.3 billion in 2007, reversing a gradual decline that started in 2004. The renewable energy sector is expected to grow to \$450 billion in 2012 and up to \$600 billion by 2020 (UNEP, 2007).²

According to UNEP clean energy projects rose to almost €94 billion worldwide in 2007, 60 per cent more than in 2006. Twenty three per cent of the total new power generation added worldwide in 2007 comprised sustainable energies. €18 billion was spent on solar energy, an annual growth rate of 254 per cent since 2004. Europe continued to lead the world in clean energy investment, ahead of the US. The combined share of China, India and Brazil grew dramatically from 12 per cent in 2006 to 22 per cent in 2007.³

The UNEP *Global Trends in Sustainable Energy Investment* report (2008) stated that \$50.2 billion were spent on wind power, a third of all clean energy investment. The report also stated that “Sub-Saharan Africa, arguably the region that has the most to gain from renewable energy, remains largely unexploited.”⁴

¹ www.ilo.org/global/About_the_ILO/Media_and_public_information/Press_releases/lang—en/WCMS_082988/index.htm.

² www.news24.com/News24/Technology/News/0,,2-13-1443_2350263,00.html.

³ www.enn.com/top_stories/article/37628.

⁴ www.news24.com/News24/Technology/News/0,,2-13-1443_2350263,00.html.

The *Global Wind Energy Outlook* report (2006) describes three scenarios for future growth of wind energy around the world. According to the Reference (conservative) scenario, wind energy could be supplying 5 per cent of the world's electricity by 2030 and 6.6 per cent by 2050. This assumes that the "High Energy efficiency" projection has been introduced. Under the Moderate scenario, wind-energy growth projection, coupled with ambitious energy saving, wind power could be supplying 15.6 per cent of the world's electricity by 2030 and 17.7 per cent by 2050. Under the Advanced scenario, wind energy growth projection, coupled with ambitious energy saving, wind power could be supplying 29.1 per cent of the world's electricity by 2030 and 34.2 per cent by 2050.

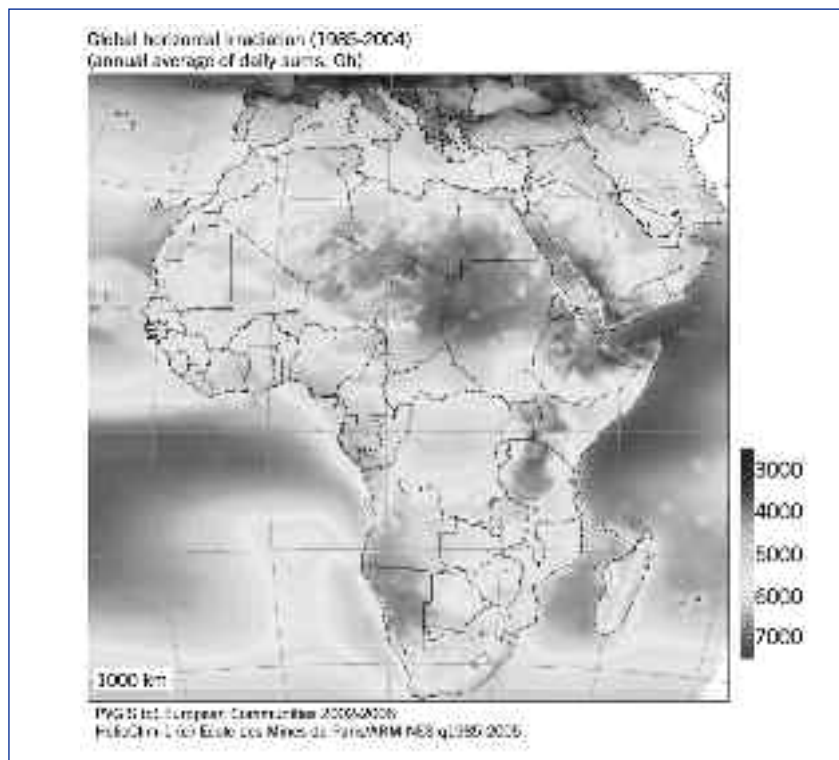
According to the *Solar Generation IV* report by Greenpeace the capacity of annually installed solar power systems would reach 179 GWp by 2030. About 60 per cent of this would be in the grid-connected market, mainly in industrialized countries.

5.3. Renewable energy in Africa

Over 500 million people in sub-Saharan Africa lack modern energy. This is despite the fact that, of the top 35 countries for solar, wind, hydro and geothermal energy, 17 are in sub-Saharan Africa (Buys et al., 2007).

Solar energy is becoming a very popular fossil fuel energy replacement. Many African countries receive on average 325 days per year of bright sunlight. Several African nations already have small-scale solar, wind and geothermal devices but it is still a minute percentage of the solar-energy output in the rest of the world.

Figure 5.1. Africa annual average solar radiation map



Solar power is particularly well suited to meet Africa's energy needs. Much of sub-Saharan Africa receives solar radiation of the order of 6–8 kWh/m²/day – some of the highest amounts of solar radiation in the world.

Source: Wikipedia, <http://blogs.cgdev.org/globaldevelopment/2007/11/>.

However, Africa is taking steps to no longer lag behind. The Forum for African Ministers of Energy was established in August 2005 with the following key objectives in an attempt to meet the Millennium Development Goals:

- to raise the profile of the energy sector, both nationally and regionally;
- to develop a coherent energy strategy for Africa;
- to promote a common approach through specific, national and regional projects that will benefit African countries;
- to speak with a collective voice;
- to promote interconnectivity, and to develop common technical standards and codes of conduct.

A 2007 World Bank report said Kenya has annual solar energy resources equivalent to almost 70 million tons of oil. The country already sells about 30,000 solar PV systems each year. The Kibera⁵ Youth Community Programme teaches some of the local youth to manufacture handheld solar devices that are mainly used to power mobile phones or radios.⁶

A training centre for solar energy technology in Kenya has trained people from all over East Africa (United Republic of Tanzania, Kenya, Uganda, Somalia) since the early 1990s.⁷

The following is a list of examples of renewable energy projects in some African countries:

- **Zambia:** The installation of solar PV systems in schools, clinics and community centres across Zambia. It will also provide training that will enable people to assemble and sell small solar chargers that can power radios, mobile phones and lamps.⁸
- **Zambia, Botswana:** The increased use of renewable energy, for example, PV systems. By the end of the project, over 40 rural schools in southern Africa will be lit by solar power. This project has generated over 120 jobs for people who now produce marketable renewable energy technologies, goods and services.⁹
- **Malawi:** The introduction of solar lighting and electricity into rural homes by local solar entrepreneurs.¹⁰
- **United Republic of Tanzania:** The creation of jobs for the poorest people and bringing solar power to local communities and school children.¹¹
- **Mozambique:** A project for the electrification of 60 rural health centres using solar energy.¹²
- **Somalia:** A project to erect ten windmills and ten solar-powered water systems, as well as 10,000 improved cooking stoves for more than 250,000 Somali people.¹³

⁵ Kibera is the second largest slum in Africa and home to more than a third of Nairobi's population. 80 per cent of residents aged 15 to 35 are unemployed (United Nations Development Programme).

⁶ www.worldwatch.org/node/5841.

⁷ http://en.wikipedia.org/wiki/Gaspar_Makale,_East_African_Solar_Energy_Pioneer.

⁸ http://en.wikipedia.org/wiki/Gaspar_Makale,_East_African_Solar_Energy_Pioneer.

⁹ www.voanews.com/english/archive/2007-03/2007-03-22-voa44.cfm?CFID=55518405&CFTOKEN=51638489.

¹⁰ <http://solar-aid.org/projects/health/lighting-malawian-homes.html>.

¹¹ <http://solar-aid.org/projects/education/solar-for-children.html>.

¹² http://7thspace.com/headlines/294270/the_eu_africa_strategic_partnership.html.

¹³ http://7thspace.com/headlines/294270/the_eu_africa_strategic_partnership.html.

According to the SA yearbook 07/08 and the NERSA website¹⁴ the following renewable energy sources are available in South Africa:

- biomass;
- solar;
- wind;
- hydro;
- ocean energy;
- gas energy;
- biofuels;
- geothermal energy.¹⁵

5.4. South African energy efficiency drivers, issues and trends

There are two drivers in the energy-related sectors in South Africa: (1) energy demand (specifically electricity for the building industry) and (2) the economy's reliance on cheap energy derived from fossil fuels, especially coal (please refer to the draft report for the issues arising from fossil fuel reliance in the same section).

The issues that arise from the energy demand are the following:

- the energy demand of a growing economy, especially from the mining sector;
- the country's growing demand for infrastructure, for example, railways, road networks, harbours, and buildings;
- the energy demand of a growing population.

The following trends arise out of the issues:

- the lack of sufficient energy supply – Eskom no longer has sufficient spare capacity. However, Eskom is embarking on a massive expansion programme;
- a reduction in economic growth due to the lack of spare capacity and the resultant electricity outages;
- the electrification of low-income households has placed an extra burden on Eskom and an extra demand on the electricity grid;
- the construction of new non-residential buildings arising in part out of the lack of construction during the 1998–2002 downturn has increased the demand;
- the ongoing growth in the construction of residential buildings – in part because of the rise of a black middle class. Many extended families no longer share dwellings as young and up-coming black professionals move into their own accommodation;
- the growth in higher-density gated communities. The reason for this is twofold: the increased demand for housing and the increased demand for security;
- the acquisition of fossil fuel-driven generators by building and homeowners to reduce the risk of energy outages;
- the installation of energy-efficient technology (in non-residential buildings' lighting and HVAC systems and in residential buildings' lighting and solar water heaters).

¹⁴ www.savingenergy.co.za/.

¹⁵ http://en.wikipedia.org/wiki/Renewable_energy_in_Africa.

5.5. Energy efficiency trends in buildings

The following section describes the renovation/improvement measures in office and residential buildings that may produce the best technical and economic efficiency with regard to energy-related improvements in construction in South Africa. A full description can be found in the draft report.

5.5.1. Office buildings

Office buildings generate significant amounts of heat and require air-conditioning to maintain a comfortable working environment. The building's temperature is of no consequence during the night because it is unoccupied but it must be kept cool during the day, preferably at the start of the day when it is occupied. Night flushing can achieve this outcome. Similarly, during winter, it is preferable that the building be warm when it is occupied.

The energy demand of office buildings falls roughly into three main categories:

- (1) lighting;
- (2) HVAC; and
- (3) “small power”, consisting of appliances within the building that use electricity, such as computers, copiers, printers and refrigerators.

These three categories comprise about 90 per cent of energy usage in buildings. The other 10 per cent nominally comprise elevators, cooking and water heating.

Building developers have minimal or no control over the use of appliances within a building and are unlikely to influence “small power” utilization. Thus, the construction industry should focus on improving the energy efficiency of buildings in terms of lighting and HVAC.

5.5.2. Residential buildings

Residential buildings operate very differently from office buildings, and construction measures should focus on passive designs that allow for a warm interior environment during the night with as little heating as possible, while maintaining a cool interior during the day when occupancy levels are low.

5.5.3. Lighting in office buildings

Lighting significantly impacts on the energy usage in office buildings. A reduction in lighting would mean a reduction in heat generation and, consequently, air-conditioning. Also, more efficient lighting schemes are cost-effective and easy to retrofit. The following measures support the reduction of energy consumption in office buildings:

- (a) **Fluorescent lighting** provides more efficient lighting than incandescent bulbs. Utilization of fluorescent instead of incandescent lighting is an easy and cost-effective way of reducing the energy demand for lighting in a building and is readily adopted in new construction projects. This is currently a best practice and no new job opportunities exist.
- (b) **Reflective backings** containing reflective sheets can optimize existing light by reflecting it back. Reflective backings will improve the efficiency of lighting fixtures and their implementation is easily performed by an electrical engineering consultant. However, it is not currently a best practice and no new job opportunities exist.
- (c) **Controlling lighting levels** can reduce intensity for a comfortable working environment. This is an operational saving intervention and will also result in a saving in the initial capital cost as less lighting equipment would be required. An electrical consultant can easily implement such a solution, which would marginally increase the amount of work for electrical engineering building consultants.

- (d) **Light shelves** placed by windows act as a reflective surface to enhance ambient light. Light shelves are easy and relatively cheap to adopt and implement, however, the controls required for the automatic dimming of fluorescent tubes are expensive and unlikely to be readily implemented. They are not currently general practice and may be implemented in a construction project if suggested.
- (e) **Static window shading** allows the winter sun to penetrate but blocks out the summer sun. This intervention is simple and easy to implement and some already exists in South Africa. Implementation would produce no new jobs.
- (f) **Automatic window shading** allows optimal light into a building. This intervention requires a significant additional capital expenditure and is of a technical nature. A mechanical engineering building consultant would be required to install such a solution, although it is currently outside the normal experience of such a consultant. If the implementation of automatic window shading devices becomes common, job opportunities would indeed be created.
- (g) **Individual light switches** illuminate specific areas. This is a relatively easy operational cost-saving and cheap solution and is being implemented in current construction projects where suggested. The work would easily be performed by an electrical engineering building consultant. No new job opportunities would be created.
- (h) **Task lighting** is basic minimum lighting over an open area. A cheap and easy solution, it can easily be implemented by an electrical engineering building consultant. No new job opportunities would be created.
- (i) **Feature lighting** lights up columns, art features or vegetation but is often omni-directional. In the case of halogen lights, these can be replaced by Light Emitting Diodes (LEDs). This intervention can produce significant operational cost savings but would require an increase in initial capital expenditure. The work could be done by an electrical engineering consultant, although it would be outside the scope of normal experience. There is potential for new job opportunities for specialists in this field.
- (j) **Motion detection switching** allows lights to switch off automatically in non-occupied areas. The technical skill and supply of components for this intervention are readily available in South Africa and likely to be considered in a new construction project if proposed. It is a cost-effective solution with an increased initial capital expense but with payback periods as low as two years, depending on the area in which the sensors are installed. They are particularly cost-effective in parking basement areas that have a low level of occupancy throughout the day. The work could be done by an electrical engineering building consultant or outsourced to a company specializing in such systems. There is potential for new job opportunities in this field.

5.5.4. Lighting in residential buildings

Residential and commercial buildings have different purposes and, therefore, differing energy-efficient interventions. These are discussed here:

- (a) **Automatic window shading** is effective when combined with a central system. It would be economically prohibitive to design and specify a system of this type for individual windows in a residential setting. Residential dwellings have a very low level of occupancy during the day and interventions that only affect daytime heating or cooling loads will be ineffective in energy use reduction.
- (b) **Motion detection switching** is only effective if lights are not turned off when not in use. Motion Detection may actually hamper cost saving due to delays in the lights switching off.

An energy-conscious household, which would consider such an intervention, would be better served by manually turning the lights on and off.

- (c) **Task lighting** adds to ambient lighting at desks, kitchens, and specific work areas. Task lighting is a cheap and effective means of lowering the lighting load. In large construction projects, an electrical engineer is an integral part of the design team but not required in smaller residential projects. A person with some technical knowledge would be required to achieve the correct lighting levels; consequently, there are job opportunities for this intervention within the residential market. The building architect may be able to fulfil this role in the future.

5.5.5. Heating, ventilation and air-conditioning for office buildings

Heating ventilation and air-conditioning is the largest consumer of electricity in an office environment and consequently has great potential to be reduced through the following measures:

- (a) **Natural ventilation** can significantly reduce the energy load of an air-conditioning system and thus provide an operational cost saving. However, a significant capital expenditure may be required, depending on design. Significant interest in natural ventilation systems has been shown and is likely to occur in new construction projects that are committed to the environment. The design and specifications of such a system are in the realm of the mechanical engineering consultant; however, there is very limited experience in this regard within South Africa. Job opportunities for individuals or companies with the appropriate skills and experience are available in this field.
- (b) **Thermal mass** uses the building's specific heat and cool capacity inertia. Introducing thermal mass to be used as a thermal battery is a basic concept with high operational cost-saving potential. Although there has been significant interest in implementing such a system within South Africa, the lack of appropriate skills and experience is a serious limitation. Consequently, job opportunities for those suitably qualified are available.
- (c) **Night flushing** cools buildings with night air until mechanical air-conditioning takes over. This intervention is easy to implement and offers a significant energy cost saving and should be readily adopted in new construction projects. The thermal mass being used is the physical building itself and thus the additional capital costs required to make this system work are minimal. Additionally, the cost of over- or under-designing the system is minimal and any errors can be corrected by altering the operating time of the fans which circulate the cool night air throughout the building. Alternatively, the fans can be linked to temperature sensors within the building and be shut down when the building is at the desired temperature. This work should be easily performed by the mechanical engineering or the building consultant.
- (d) **Earth cooling/heating tubes** buried to a depth of three metres where the ambient earth temperature ranges from between 10 and 23 degrees Celsius exchange heat and pre-cool the air pumped into the mechanical air-conditioning system. Earth cooling tubes can be an effective means of reducing the energy demand of HVAC; however, a lack of technical experience in this field limits its implementation. Additionally, the combined reluctance of mechanical consultants to accept responsibility for implementing a system in which they lack experience and the difficulty in maintaining it, limit the implementation of this intervention. Job opportunities in South Africa are available for individuals or companies with the appropriate skills and experience.
- (e) **Co-generation** can be utilized where electricity is produced on-site by means of a combustion-driven turbine using a variety of different fuels (natural gas, ethanol, wood or other flammable biomass). In this case, the heat produced can be used to operate absorption chillers

which would provide air-conditioning for the building in the summer or, alternatively, direct heat into the building in winter. Typically, efficiencies of 35 to 40 per cent are observed but, since the heat is also being utilized in co-generation plants, efficiencies in excess of 80 per cent are achievable. This method is particularly effective in producing very high-energy efficiencies and is used with success overseas. However, there is a reluctance to install such a solution in South Africa, due to a lack of technical experience, safety issues regarding the storage of flammable fuels, and a lack of availability of appropriate fuels. Biofuels, natural gas and biomass which can be used as a fuel are not readily available in South Africa and are hampering the implementation of this solution. Unfortunately, co-generation is consequently inherently limited in South Africa. Nevertheless, there is potential for it where appropriate fuel is available, such as waste wood chips from lumbering operations in Kwazulu Natal and the Western Cape.

- (f) **Solar air-conditioning** producing hot water from solar hot water panels can be used to operate low-temperature absorption chillers. These can work effectively with input hot water at 88°C generating a performance coefficient of approximately 0.8. Such technology is being used to good effect in Japan, Germany and Spain. South Africa's solar radiation footprint makes this an ideal solution to consider, especially as its efficiency peaks with high solar radiation, thus coinciding with the building's cooling demand. Such a solution has yet to be implemented in South Africa, largely due to lack of knowledge and technical experience. The potential for solar air-conditioning and attendant job opportunities in South Africa is high.
- (g) **Heat exchangers** are essential, as all buildings are required to have a minimum ventilation rate. In South Africa the minimum requirement is 5l/s/person. If the building is being cooled mechanically, then "expensive" cooled air is expelled from the building and warmer ambient air is imported. During winter, the opposite occurs. The energy embedded in the air can be reutilized via a heat exchanger and vice versa to pre-warm or pre-cool the air. This intervention is simple to implement and easy to perform by a mechanical engineering building consultant. It is also currently being adopted in environmentally friendly buildings within South Africa.
- (h) **Insulation** is an effective means for improving the energy efficiency of the building and providing an operational cost saving. Implementation, sizing and cost savings of the correct insulation can be done by mechanical engineering consultants. Only marginal job opportunities exist with the increased use of insulation.
- (i) **Thermal bridges** are highly thermally conductive elements that penetrate the building envelope and easily conduct heat into or out of the building. Thermal bridges are an inherent result of the building's design and can at times, depending on the building design, be costly to isolate or prohibit. There is scope for consultants or architects to operate on the prevention of thermal bridges, as and when such knowledge and skills become commonplace within the architectural community.

5.5.6. Heating ventilation and air-conditioning for residential buildings

Residential and commercial buildings have different purposes and as such, energy efficient interventions will have different applicability. Most residential buildings in South Africa lack or have very limited air-conditioning, although most have some form of heating. Energy saving measures could be implemented in the following areas:

- solar water heating;
- space heating and cooling;

- solar or gas cooking; and
- insulation in general or roof insulation in particular (Kievani, Tah et al., 2008:40).

Cooking and space heating consume the most energy. Most thermal energy in South African houses escapes through the roof. It has been argued that the single most effective intervention in the building shell is the installation of a ceiling.

Thermal mass in the structure of the house serves to minimize the extremes of the ambient temperature environment. The main heating load of a residential house during the day is from solar radiation and if the dwelling is unoccupied during the day, solar radiation should be the only heating load that it experiences. The daily solar radiation would be stored as thermal energy in the structure and would only raise the temperature inside the house by a reduced amount. Additionally, this stored heat would be released during the night to help heat the interior when the ambient environment is cold. The utilization of thermal mass is particularly effective in local climates that have large daily temperature variations. Thermal comfort of the dwelling would be improved, as well as an energy operational cost saving if the dwelling is mechanically heated or cooled. Initial capital cost of the construction is increased but the implementation can be highly beneficial in energy saving and in thermal comfort. Implementation of thermal mass is expected to be high in the appropriate local climates.

Architects or mechanical engineers should be able to specify the correct amount of thermal mass to be used in a residential setting, although experience in this work is not currently commonplace within South Africa. There is scope for individuals or companies to specialize in this field of work until when, or if, such work becomes commonplace either for architects or mechanical engineering building consultants.

Night flushing is not an appropriate intervention for residential dwellings. Residential dwellings should be kept warm at night as they are occupied and rarely require cooling at night.

Heat exchangers are not appropriate in residential buildings as they are very rarely mechanically ventilated.

Insulation can be highly effective in residential houses. To be effective the entire house should be well-insulated, including walls, ceiling and windows. Additionally, thermal bridges will compromise the efficacy of the insulation. Though easy and cost-effective to implement, insulation is often neglected in order to save on capital expense because an insulated house is not at the top of the average consumer's wish list. Nevertheless, the architect or mechanical engineer can easily perform this work. Job opportunities are available only at higher levels of insulation manufacture and installation.

Trombe walls consist of glass placed in a second wall in front of the main wall to create an enclosed space of entrapped "greenhouse effect" air warming high thermal mass walls. This system can be further optimized by allowing for convective air flow. Air from the dwelling can be allowed to enter into the base of the enclosed air space, where it is heated, rises and re-enters the dwelling. This allows for a more rapid heating approach and can be disabled if necessary. Though not complicated to install, this system has a high capital cost associated with it when compared to the potential energy savings, and would be limited to upper-market housing. Technical experience within the field would aid its implementation, especially regarding the sizing of the windows and walls. Additionally, it is more effective in climates with high daily temperature variations.

Solar hot water can be produced either with evacuated tubes or flat panel collectors. Evacuated tubes have higher performances but are mostly imported from China, while some flat panel collectors are being manufactured within South Africa. Solar hot water heaters can reduce residential electricity usage by 40 per cent and have a payback period of about five years. Eskom is providing a subsidy on solar hot water panels to encourage their use, however, the uptake of such panels so

far has been minimal. Several companies in South Africa already install solar hot water heating panels and the uptake of such panels is expected to increase as public knowledge of their efficacy increases. It is unclear whether the manufacture of evacuated tubes would be economically viable within South Africa.

Hot water insulation is vital to prevent energy loss. Unlike older geysers, modern geysers are very well insulated, do not require additional insulation, and are able to retain hot water in excess of three days. Insulation of older geysers is highly cost-effective and should be implemented as a very cheap and effective way of reducing residential energy demands. Additionally, any significantly long piping containing hot water should also be insulated – this would save water by not having to wait for the cold water to run through before being able to use the hot. Companies in South Africa already provide geyser insulation but this is unnecessary in new construction where modern geysers are installed. Insulation of piping should be encouraged.

5.6. Summary

The section on energy efficiency technologies identified the drivers, issues and trends regarding energy efficiency in South Africa. The main drivers are an increase in energy demand and the economy's reliance on energy derived from fossil fuels. The issues and trends flowing from the drivers were identified.

It also examined the renovation or improvement measures that are available globally, and those that have the best technical and economic efficiency with regard to energy-related improvements in building in South Africa.

Globally billions of dollars have been spent and are being invested on renewable energy sources. In South Africa the focus is on solar heating, natural space heating and cooling, and energy-efficient lighting. Effective building insulation is also very important. There are several methods and strategies available for energy-effective lighting and space heating/cooling of buildings in South Africa. The challenge is to find the improvement that has the best technical and economic advantage for a specific building.

6. Energy efficiency legislation, regulation, policies and strategies/initiative

6.1. Introduction

Section 6 identifies some of the global legislation, regulation, policies and strategies/initiatives developed and/or implemented regarding energy efficiency and energy-related improvements. It refers to an agreement between the South African Government and Brazil. Other initiatives also exist and can be referred to in the full draft report; these include the National Business Initiative (NBI), the Technical Skills Business Partnership, the GBCSA, the Renewable Energy and Energy Efficiency Partnership (REEEP) and the South African Association of Energy Services Companies (SAAEs).

6.2. Energy efficiency legislation, regulation, policies and strategies/initiatives

6.2.1. Global view

Nearly all global climate change policies concentrate either on traditional regulation (renewable portfolio standards, biofuels mandates, efficiency standards, building codes and emissions standards) or on innovation policy (feed-in tariffs, tax credits, direct subsidies and funding for research and development) (DB Advisors, 2008).

The following are some of the energy efficiency issues¹ that are likely to come before the US Congress in 2008 or 2009:

- *Renewable Energy and Energy Efficiency Resource Standards* – electricity utilities must meet 15 per cent of their energy requirements from renewable energy sources and energy efficiency measures.
- Energy efficiency tax incentives.
- Building Codes – must be updated for new buildings as well as for new manufactured housing.
- Industrial Assessment Centres – workforce has emerged as a critical issue for implementation of energy efficiency in manufacturing, as well as expansion of production and productivity improvements more broadly.

Several existing documents encourage all governments to take notice of the recommendations for policies supporting renewable energy technologies. They include:

- *Deploying renewables – Principles for effective policies*. 2008. The International Energy Agency (IEA).²
- The World Energy Council's report *Energy efficiency policies around the world: Review and evaluation*. 2008.

¹ <http://www.aceee.org/energy/national/nrgleg.htm>.

² <http://www.iea.org/>.

- The ACEEE published a report, *Energising Virginia: Efficiency First*, wherein certain policies are discussed.
- Greenpeace and the European Renewable Energy Council propose the following in their document *Energy [r]evolution: a sustainable global energy outlook*. 2008.

6.2.2. Summary

Several governments are in the process of implementing or have already implemented energy efficiency legislation, regulation, policies and strategies/initiatives. Some include the following:

- electricity utilities must meet a certain percentage of demand from renewable and energy-efficient sources;
- an energy efficiency agency should be established;
- the implementation of energy-efficient tax incentives;
- building codes need to be updated to include energy-efficient measures;
- existing buildings must be retrofitted;
- energy audits should be done, especially by large energy consumers;
- the establishment of ESCOs should be encouraged;
- consumer education must be done;
- the energy needs of low-income households as well as low-cost housing should be addressed;
- industrial assessment centres have ascertained that the workforce has emerged as a critical issue for implementation of energy efficiencies in manufacturing.

6.3. Intra-governmental policy between South Africa and Brazil

The second India–Brazil–South Africa (IBSA) summit was held in October 2007. These countries reached a voluntary, intra-government agreement to cooperate in the promotion of nuclear energy, clean energy technologies and other renewable energies, and in the support of climate change alleviation. In a presidential statement, the countries noted their agreement to pool resources to ensure a secure supply of sustainable and non-polluting energy to meet global demand, particularly in developing countries. The statement indicated that cooperation would include clean coal technologies and renewable energies, such as biomass, and innovative ways to transfer, develop and commercialize clean energy.³

6.4. Government policies regarding energy-related improvements

Several governmental policies exist in the energy-related improvements field. The associated literature is extensive and we encourage those who seek complementary information to consult the individual department websites. A point to bear in mind is that a “policy vacuum” exists concerning the South African renewable energy sector (Salgado, 2008). In a newspaper article in the *Business Report* (18 November 2008) Salgado stated that the City of Cape Town will not sign an agreement with Phieco⁴ to buy electricity from a nearby wind farm as it is not compelled by legislation to do so.

³ <http://www.iea.org/textbase/pm/?mode=re&id=3765&action=detail>.

⁴ Phieco is a South African company involved in the design, development, manufacture and distribution of quality renewable energy package solutions and products. <http://www.phieco.net/motorwind/>.

The Public Finance Management Act (Act No. 1 of 1999) requires municipalities to select the cheapest electricity options, or to justify the choice of alternatives. However, there is no legislation to facilitate the adoption of green power.

Of particular concern is the absence of a feed-in tariff to top up the price paid to producers of renewable energy by Eskom or direct buyers such as municipalities.

If policies and regulations are not put in place as a matter of urgency, South Africa could miss out on several job creation opportunities as Phieco is considering building its wind farms in neighbouring countries (Salgado, 2008).

6.4.1. Department of Minerals and Energy (DME)

Policy, mandate and governance

The mandate to govern and undertake energy efficiency initiatives is derived from the following documents:

- The South African Constitution;
- The White Paper on Energy Policy, 1998;
- The Municipal Systems Act No. 32 of 2000;
- The Electricity Act No. 41 of 1987 (as amended);
- The National Energy Bill (promulgated on 1 December 2008);
- The Standards Act;
- The Draft Electricity Regulation Bill (EES, p. 20).

The White Paper on *Renewable Energy* was implemented in 2003. Its general policy objective is “to increase the share of modern renewable energy consumed and provide affordable access to energy throughout South Africa – contributing to sustainable development and environmental conservation”.⁵

The DME outlined seven bills of which numbers four, five and seven are relevant to this study:

- **Bill No. 4:** A major undertaking in 2008 would be the tabling of an *Energy and Security Bill*. This would cover sustainable energy development and give certain powers to the minister. It would make interventions possible to ensure energy security and uninterrupted availability of energy supplies; make regulations pertaining to appliances; address environmental requirements on the subject of climate change and water use; enforce mandatory co-operation in the development of sector energy plans; and, lastly, establish a *National Energy efficiency Agency*.
- **Bill No. 5:** The expected and necessary *EDI Restructuring Bill* would be tabled, focusing on issues surrounding the establishment of REDs and the transfer of Eskom’s assets and business.
- **Bill No. 7:** A *National Energy Regulator Amendment Bill* would provide a legislative mandate for the present body over the whole energy sector.⁶

The DME has also developed an *Energy efficiency Strategy for South Africa*.⁷ The strategy has eight goals, of which goal 2 (job creation) is relevant to this study (EES, pp 4, 5).

⁵ <http://www.iea.org/textbase/pm/?mode=re&id=1450&action=detail>.

⁶ <http://www.dme.gov.za/DME%20programme%202008.htm>.

⁷ <http://www.dme.gov.za/energy/efficiency.stm>.

Goal 2: Job creation has had the following outcome:

Employment opportunities increased within the energy efficiency sector and related activities (EES, p. 16). In May 2005 32 large companies joined forces with the DME and Eskom by signing an energy efficiency accord, committing themselves to targets contained in the DME's strategy.⁸ An *Energy efficiency Technical Committee* (EETC) was established to implement the accord on a collaborative basis between industry signatories and government. The *NBI* acts as secretariat to the Technical Committee.⁹

The DME proposes "Mandatory Energy Audits for Commercial Buildings". These should be the responsibilities of the DME, Training Certification Authorities – SETAs and Public Works (EES, p. 31) and, according to the Energy efficiency Strategy, an *Energy efficiency Standard for Office Buildings* (SANS 204)¹⁰ must be developed. The SANS 204 will be made mandatory by its incorporation into the National Building Regulations and, in conjunction with the implementation of SANS 204, energy labels will be developed to assist with compliance rating (EES, pp. 30, 31).

The DME's nationwide appliance efficiency programme is monitored through energy labels on electricity appliances and minimum energy performance standards (EES, p. 18).

A group of Members of Parliament unveiled a private member's bill on 28 October 2008 in an attempt to accelerate the renewable energy development process: The *Renewable Energy Feed-In Tariff Bill*.¹¹ A feed-in tariff will allow people who are producing electricity (of an approved standard) from renewable sources to feed it into the grid and be paid for it. The bill suggests a tariff fixed for 15 to 25 years which may be up to four or five times the standard tariff.¹²

Additionally, the strategy will incorporate:

- Certification and Accreditation (EES, p. 18).
- Education, Information and Awareness under the NQF training programmes for skilled workers (EES, p. 19). The DME will also become involved in accredited performance standards and approved methodologies for energy efficiency audits as well as skills training accreditation (EES, p. 22).

Information and general awareness (which should start with pre-schooling and run through all learning fields under the auspices of the NQF) are key elements to achieve success in terms of changing South Africa into a more energy-efficient society. Once laws and regulations are established, architects will need guidance (from standards, codes of practice, etc.) on how to design houses according to the new regulations.

The DME will strive to ensure that:

- energy efficiency is taught and examined at all levels in all appropriate subjects, in particular engineering and architecture; and
- energy efficiency is a competence requirement under the National Qualifications Framework training programmes for skilled workers in the relevant construction and buildings services trades (EES, pp. 18, 19).

Incentives

According to the Energy efficiency Strategy, "at this stage of South Africa's development it is difficult to justify government subsidies for energy efficiency when there are so many other

⁸ *ibid.*

⁹ <http://www.nbi.org.za/welcome.php?pg=126>.

¹⁰ SANS 204: Energy Efficiency in Artificially Controlled Buildings.

¹¹ http://www.iol.co.za/index.php?set_id=1&click_id=13&art_id=nw20081028143620905C829236.

¹² http://www.urbansprout.co.za/how_would_you_like_eskom_to_pay_you_for_a_change.

pressing needs nationwide” (EES, p. 21). Refer to **4.5.2.2 Eskom Power Incentives** for information on this initiative by Eskom.

Commercial and public buildings sector programme

Core objectives

- To demonstrate the government’s commitment to sustainable energy development within its own building stock.
- To progressively upgrade the energy performance of existing public and commercial building stock.
- To achieve best practice energy performance in new public and commercial building stock.

The Government will lead by example through raising energy efficiency awareness and by implementing specific measures within its own estate. For instance, the DME, in collaboration with the Department of Public Works and Eskom, is retrofitting government buildings to make them more energy efficient. This contributes a saving of about R600,000 in electricity bills per year.¹³

Residential sector programme

Core objectives

- To combat pollution on health grounds.
- To mitigate the effects of peak demand on power capacity.
- To introduce standards for housing and labelling/efficiency standards for household appliances.
- To introduce state-of-the-art technologies.

The standard for energy-efficient housing (SANS 283)¹⁴ will be made mandatory by its incorporation into the National Building Regulations (EES, p. 32).

6.4.2. Department of Environmental Affairs and Tourism (DEAT)

DEAT has developed a *National Framework for Sustainable Development* (NSDF) that was available for public comment until December 2006.¹⁵ The NSDF would enter the Cabinet process soon and, once approved, the second phase – aimed at translating the framework into a strategy – would commence. Phase Two would focus on preparing and planning for action, and the third phase of the NSDF would be about roll-out, implementation, monitoring and review. The *National Framework for Sustainable Development* is only available in draft format.

DEAT is also one of the leading partners of the Urban Environmental Management Programme.¹⁶

6.4.3. The National Energy Efficiency Agency (NEEA)

The NEEA was formed in 2006 under the guidance of the DME and is a division within the CEF. Its broader task strategy is to reduce the overall energy demand in South Africa by 12 per cent by 2015.

¹³ <http://www.dme.gov.za/energy/efficiency.stm>.

¹⁴ SANS 283: Energy Efficiency in Naturally Ventilated Buildings.

¹⁵ http://www.environment.gov.za/nssd_2005/nssd_11082005_new.htm.

¹⁶ http://www.uemp.org.za/index.php/views/national_partner_view/departmant_of_environmental_affairs_and_tourism/.

The NEEA objectives relevant to this study are:

- To oversee the integration and co-ordination of training in energy efficiency; facilitate skills transfer, capacity building and the creation of additional jobs in the field of energy conservation.
- Co-operate with persons, associations and institutions undertaking energy efficiency programmes in other countries, to ensure that international “best practices” are adopted and applied in South Africa.¹⁷

6.4.4. National Energy Regulator of South Africa (NERSA)¹⁸

The National Electricity Regulator (NER) forms the basis of the NERSA, a regulatory authority established as a juristic person in terms of Section 3 of the National Energy Regulator Act (No. 40 of 2004). NERSA’s mandate is to regulate the electricity, piped-gas and petroleum pipeline industries in terms of the Electricity Regulation Act (No. 4 of 2006), Gas Act (No. 48 of 2001) and Petroleum Pipelines Act (No. 60 of 2003).

6.4.5. EDI Holdings (Electricity Distribution Industry Holdings (Pty) Ltd)¹⁹

EDI was established in March 2003 by the DME for the sole purpose of facilitating the restructuring of the National Electricity Distribution Industry in accordance with the requirement of the Energy White Paper and subsequent Cabinet endorsements.

The government called for the EDI to be consolidated, with Eskom distribution and various municipal electricity utilities being amalgamated into REDs. These will assume the responsibility of distributing electricity to all South African electricity customers across six national Metros and will operate on a sustained, financially viable basis as independent businesses.

6.4.6. Department of Science and Technology (DST)

The Minister of Science and Technology, Mosibudi Mangena, delivered the opening address at the Green Building Conference and Exhibition in November 2007 and said the following regarding the built environment:

A strong sign of the changes taking place within the built environment community is evidenced by the fact that a Green Building Council of South Africa (GBCSA) was established just last month. The aim of this organization is to promote green building in the commercial South African property sector. The establishment of the GBCSA is a move that will bring the country’s industry in commercial and industrial property in line with global environmental practice.

6.4.7. The DPW

The DPW in February 2008 committed itself in a media statement to:

- (1) Spearhead the accelerated efforts to implement the energy efficiency programme in all government-owned and government-leased buildings.
- (2) Recommend almost 20 energy-saving guidelines for immediate implementation.
- (3) Promote efficient individual use of air conditioners and heaters as opposed to centralized systems, installation of energy-efficient bulbs, card-controlled devices and motion detectors in government-owned and leased buildings, as well as formulate new specifications and general energy-saving guidelines on newly-acquired properties to make them energy efficiency compliant.

¹⁷ <http://www.savingenergy.co.za/content/about.php>.

¹⁸ <http://www.nersa.org.za/>.

¹⁹ <http://www.ediholdings.co.za/>.

- (4) Appoint consultants and contractors to introduce energy audits and install hardware, respectively. It is envisaged that a 50/50 split on realized savings will be affected between the Department and the service providers as the energy cost-saving programme is premised on the principle of rewarding suppliers for cost-savings realized through deliberate interventions.

6.5. National Business Initiative (NBI)

6.5.1. Technical skills business partnership²⁰

This collaborative initiative focuses on narrowing the gap in the national supply and demand of critical and scarce skills by growing the number of engineers, technologists/technicians and artisans available to the economy.

During 2006 the Joint Initiative for Priority Skills Acquisition (JIPSA),²¹ in support of the AsgiSA,²² produced two reports that identified the need for an additional 1,000 engineers and technologists/technicians per annum and 7,500 additional artisans per annum over the next four years (including 2007).

In response to this, the NBI is facilitating a collaborative initiative called the Technical Skills Business Partnership (TSBP) comprised of the following partners:

- Sasol (petrochemical industry);
- Arcelor Mittal (manufacturing, steel and engineering industry);
- Transnet (state-owned enterprise: transportation);
- Eskom (state-owned enterprise: energy);
- Anglo Platinum (platinum industry); and
- Gold Fields (mining industry).

The main focus of the partnership is to develop strategies and action plans to improve the participating companies' and their sector contribution towards alleviating the shortage in engineering and artisan skills in line with the JIPSA targets.

Senior industry role players have agreed to implement actions and systems towards:

- shaping and improving South Africa's capability and capacity to develop technical/engineering competence;
- ensuring timely delivery of competence requirements in these skills areas; and
- implementing sustainable competence development capability to meet current and future South African competency needs.

A Memorandum of Understanding that provides a framework has been signed. A steering committee was established in August 2007 as a mandated body to steer and guide the activities of the working committee. So far, progress has included:

- researching the historical and present contribution of member companies in the training of engineers, technologists, technicians and artisans;

²⁰ <http://www.nbi.org.za/welcome.php?pg=216>.

²¹ JIPSA consists of government, business and labour organizations and aims to speed up development of skills most needed in South Africa to help the economy to grow. It identifies skills shortages and ways to develop those skills. [http://www.info.gov.za/vukuzenzele/Pages/jipsa\(1\).htm](http://www.info.gov.za/vukuzenzele/Pages/jipsa(1).htm).

²² AsgiSA has its origins in the commitment to halve unemployment and poverty by 2014. <http://www.info.gov.za/asgisa/>.

- determining capacity in terms of facilities, equipment and training staff in order to understand the supply side better;
- analysing South Africa's labour scene and scarce categories; and
- sharing best practices in the training pipeline (from recruitment through to certification and funding).

6.6. Green Building Council of South Africa (GBCSA)

This council's mission is to drive the adoption of green building practices in the South African property industry and move it towards sustainability through market-based solutions.

Buildings consume 40 to 50 per cent of the world's energy (directly and embodied). Buildings account for 17 per cent of fresh water withdrawals, 25 per cent of the wood harvest, 33 per cent of the CO₂ emissions and 40 per cent of material and energy use.²³ A green building (one that is socially, economically and environmentally responsible) can reduce energy consumption by 70 per cent.

The Council has developed "Green Star SA"²⁴ – a measuring tool for green buildings. For more information on Green Star SA, see Chapter 9, section 9.9.

6.7. Renewable Energy and Energy Efficiency Partnership (REEEP)²⁵

REEEP was conceived at the World Summit on Sustainable Development in August 2002. It is a global public-private partnership that structures policy and regulatory initiatives for clean energy and facilitates financing for energy projects.

REEEP is backed by national governments, businesses, development banks and NGOs. The partnerships created are funded by a number of governments (including: Australia, Austria, Canada, Germany, Ireland, Italy, Netherlands, New Zealand, Norway, Spain, United Kingdom, United States and the European Commission) which have enabled the commission of over a hundred projects in its portfolio designed to help remove market barriers to clean energy in more than 40 countries, primarily in the developing world.²⁶

REEEP runs three projects in South Africa:

- (1) Commercialization of Large-Scale Solar Water Heating Systems (refer to 7.2);
- (2) Improving Electricity Governance in Brazil and South Africa (refer to 7.3); and
- (3) Financing Energy Upgrade in South African Low-Income Homes (refer to 7.4).

6.8. South African Association of Energy Services Companies (SAAEs)²⁷

SAAEs is a national trade organization in the energy services industry. The association was established in 2004 at the onset of the DSM programme in South Africa.

²³ <http://www.property24.com/Property24/News/FullArticle.aspx?articleid=7790&Sec=Agricultural>.

²⁴ <http://www.gbcsa.org.za/greenstar/greenstar.php>.

²⁵ <http://www.reeep.org/441/southern-africa.htm>.

²⁶ <http://www.iea.org/textbase/pm/?mode=re&id=4017&action=detail>.

²⁷ <http://www.esco.org.za/index.html>.

SAAEs purpose is to act as an industry voice for member energy services companies whose aims are to assist government and industry in achieving the targets of South Africa's energy strategy by developing the local (independent) ESCOs and energy services sectors, ensuring a healthy ESCO business environment, and creating an open forum between the role players in the energy services business in South Africa.

6.9. Summary

South African legislation, regulations, policies and policies/strategies, specifically regarding buildings, have been developed to move the country toward a more energy-efficient environment. Several of these, however, have not been implemented or have not been very successful (that is, the Eskom incentives).

As depicted in the table below, South Africa appears to be on par with the rest of the world in terms of global legislation, regulations, policies and strategies/initiatives:

Global elements	South African performance
Electricity utilities must meet a certain percentage of demand from renewable and energy-efficient sources	Eskom must generate 10 000 GWh of energy from renewable and energy-efficient sources by the year 2013
An energy-efficiency agency should be established	The National Energy Efficiency Agency was established
The implementation of energy-efficient tax incentives	Some incentives have been implemented, e.g. for solar geysers
Building codes need to be updated to include energy-efficient measures	The SANS 204 is being implemented; the aim is to make it part of the National Building Codes
Existing buildings must be retrofitted	Several very large buildings have already been retrofitted and there are plans for several more retrofitting projects
Energy audits should be done, especially by large energy consumers	Energy audits are being done, some by Eskom
The establishment of ESCOs should be encouraged	There are about 120 ESCOs in South Africa
Consumer education must be done	Consumer education has started, especially after the energy crisis earlier in 2008
The energy needs of low-income households as well as low-cost housing should be addressed	Several projects are ongoing to assist low-income households. Projects researching energy efficiency for low-cost housing are underway

The views and attitudes of government and some private companies have also been reflected in this section.

Legislation, regulations, policies and strategies/initiatives regarding the following were discussed:

- South African policy, mandate and governance;
- certification and accreditation;
- education, information and awareness;
- incentives;
- commercial and public buildings sector programme; and
- residential sector programme.

However, as long as these remain mere documents and are not actively and aggressively implemented, they will not deliver to their full potential. Nevertheless, the recent energy crisis ignited a spark and the current level of implementation is encouraging.

The roles of the following departments and other initiatives were considered:

- the DME;
- the DEAT;
- the NEEA;
- EDI Holdings;
- the DST;
- the DPW;
- the NBI;
- GBCSA;
- the REEEP; and
- the South African Association of Energy Service Companies.

7. Energy efficiency case studies

7.1. Introduction

This section reviews some case studies in South Africa where energy-related improvements were made, and examines the financial, social and employment benefits of these improvements (where such information was available). The sustainability of these jobs has not been proven.

7.2. Commercialization of large scale solar water heating systems¹

Renewable energy and energy efficiency partnership (REEEP)²

To establish a facility for SWH to boost current activities in large-scale SWH applications. This project has a budget of €250,000 including co-funding from Energyhouse Africa (TAS) E+Co Africa, and ended in 2008.

The expected impacts are as follows:

- the increased dissemination of clean, reliable and affordable SWH systems combining the benefits of renewables and energy efficiency and applying appropriate financial techniques;
- the provision of approximately 200,000 litres of hot water per day to approximately 4,200 individuals through the financed SWH systems;
- the development of concepts for a financially sustainable stand-alone SWH investment fund with investment capital of approximately €15 million;
- improving electricity governance in South Africa.³

Renewable energy and energy efficiency partnership (REEEP)⁴

To improve governance of electricity in Brazil and South Africa by building government and regulatory capacity to implement legislation that promotes renewable energy, energy efficiency and social welfare, in line with sustainable development and public interests.

This project has a budget of €317,500, including money from co-funding parties, and will be completed in 2009.

The expected impacts are as follows:

- New opportunities for diverse stakeholders, including consumer groups, environmental groups, regulators, energy ministry officials and private sector actors to identify common solutions.
- Enhanced capacity and credibility, enabling civil society actors to advocate more effectively for public interests.

¹ <http://www.reeep.org/showProject/655.10407029/commercialisation-of-large-scale-solar-water-heating-systems.htm>.

² <http://www.reeep.org/441/southern-africa.htm>.

³ <http://www.reeep.org/showProject/655.10601015/improving-electricity-governance-in-brazil-and-south-africa.htm>.

⁴ This is a different project of the same partnership.

- Better understanding of how better governance can help build political support for innovations to promote clean energy and efficiency.
- Improved transparency and public participation in the development of policy and regulation to help manage trade-offs between environmental, social and financial considerations.
- Enhanced accountability for implementation of policy and regulatory measures benefiting the public interest.

7.3. Financing energy upgrade in South African low-income homes⁵

Renewable energy and energy efficiency partnership (REEEP)⁶

To develop a financial model appropriate to the South African context that will enable the national replication of the “low-income urban-housing energy-upgrade project” currently being piloted in Kuyasa,⁷ Cape Town.

Kuyasa

Kuyasa is a low cost housing development in Khayelitsha, a township in Cape Town. Funding from the Department of Environment and Tourism’s (DEAT’s) Social Responsibility Programme is being used in close consultation with the Urban Renewal Programme of the City of Cape Town. The project aims to retrofit 2,300 houses. A few teams do some low-key installation of electricity and this will expand to SWHs, followed by the installation of ceilings. This project has created 60 contract work jobs – 50 of the people now employed were unemployed – all from the local area. Another 2,309 will be employed (one from each household) on a temporary basis – 1.5 days per month. Training is a huge hurdle as very few training programmes for SWH are available.

This is the first registered CDM project. It aims to retrofit existing low-income houses with solar water heaters in order to provide hot water on demand, insulated ceilings to improve the thermal efficiency of the household units, and two compact CFLs each to provide energy-efficient lighting. The savings of electricity consumption will result in emission reductions of ~2.85 tonnes of CO₂ per household per year over a 21-year crediting period.⁸ The budget for this project is €95,730 including co-funding from SSN and will end in 2008.

The expected impacts are as follows:

- increased energy savings;
- reduced emissions;
- increased renewable energy generation; and
- improved quality of life.

This project could create jobs for ~100 person-years for installation of technologies and associated infrastructure. This figure does not include jobs that could be created by local manufacturing of the technologies or any other infrastructure.⁹

⁵ <http://www.reeep.org/showProject/655.10307023/financing-energy-upgrade-in-south-african-low-income-homes.htm>.

⁶ This is another project of the partnership noted in 7.2.

⁷ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1121165382.34>.

⁸ <http://www.capetown.gov.za/en/EnvironmentalResourceManagement/projects/ClimateChange/Pages/KuyasaEnergyEfficiencyProject.aspx>.

⁹ *ibid.*

7.4. Renewable Energy Market Transformation (REMT) Project¹⁰

The World Bank board of directors has approved a R133 million Global Environment Facility (GEF) project to establish policy and regulatory frameworks and to build institutional capacity for renewable energy development in South Africa. The Renewable Energy Market Transformation (REMT) project was approved in June 2007 by the World Bank and is the first World Bank energy project in South Africa. The project's global environmental objective, in line with the GEF Operational Program, is to remove barriers to renewable energy technologies to help mitigate greenhouse gas emissions.

The project has two components:

- renewables-based power generation in South Africa; and
- Commercial Solar Water Heating (CSWH) as an integral component of South Africa's renewable energy policy framework.¹¹

The overall cost of the four-year project is being funded by a R46 million grant from the GEF, an estimated R18 million contribution from the South African Government and R69 million leveraged from the private sector.

The REMT project aims to:

- Remove the barriers and reduce implementation costs of renewable energy technologies to help mitigate GHG emissions.
- Assist government in meeting the target requiring that 4 per cent of electricity demand, which is equivalent to 10,000 GWh, be derived from renewable energy sources in 2013.
- Provide technical assistance and capacity building for professional, technical and business groups in key market segments, and provide advisory services and matching grants for small- and medium-size private enterprises to design and implement commercial solar water heating initiatives.

7.5. Alexandra CFL roll-out project¹²

Alexandra is a township north of Johannesburg and has a population estimated at approximately 350,000 people in an area of about 800 hectares.¹³ In addition to its original well-built houses, Alex (as it is commonly called) also has a huge number of informal dwellings or shacks – estimates range from 38,000 upwards. It was proclaimed a “native township” in 1912 and was one of the few areas where black people could own land under freehold title in urban areas.¹⁴

The DME was responsible for implementing the Alexandra CFL roll-out project in 2005 and designated the Development Bank of Southern Africa as the implementing agent. A pilot project for energy efficiency improvement, it aimed at replacing incandescent lamps with CFLs in the residential sector. A projected 13.8 million lamps were rolled out to almost 40,000 households. According to a statement by Eskom's DSM, households that change to energy-efficient lighting can save up to R144 a year. This means a saving of more than R2 million per year for Alexandra.

¹⁰ <http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=368057&menuPK=368109&Projectid=P073322>.

¹¹ <http://web.worldbank.org/external/projects/main?pagePK=64312881&piPK=64302848&theSitePK=40941&Projectid=P073322>.

¹² <http://www.eskomdsm.co.za/news8.php>, <http://mybroadband.co.za/vb/showthread.php?t=28905>.

¹³ 1 hectare = 10,000 square metres.

¹⁴ http://www.alexandra.co.za/01_about/status.htm.

To encourage community buy-in and empowerment, project staff was drawn from unemployed community members of Alexandra. These recruits were subsequently trained in compact fluorescent lighting and its advantages over incandescent lamps. They were also trained in safety issues, data-gathering forms and procedures on visiting households. Approximately 90 per cent of the 13.8 million lamps were distributed door-to-door. Each field worker could distribute about 100 lamps per day, which equated to 124,200 man-days of employment for casual unskilled labour. On average, a field worker was employed on a job for 10 days (there are restrictions placed on the project by the ward councillors in that they do not allow people from outside their wards to be used for implementation). Therefore, the project created approximately 12,420 short-term jobs during this rollout in the community.

Supervisors were employed over a longer period (normally three months) – 1,035 supervised teams of 12. An auditing team, employed for periods ranging from two to three months, matched the number of supervisors.

The project managed approximately 60 ESCOs during this rollout. Each ESCO employed approximately six data capturers, a total of approximately 360 data capturers for a period of two to three months. In addition, two to three people managed each ESCO, that is approximately 120 people over a period of six months. Approximately two thirds were already in the full-time employ of the ESCO.

Approximately three people per ESCO performed logistics and warehouse functions, that is approximately 180 people over a period of three months. For exchange points the ESCO would use approximately ten people for this process, that is 600 people over a period of two months.

The data can be summarized as followed:

Table 7.1. Alexandra CFL roll-out project

Alexandra CFL roll-out project	People employed (approximate numbers)	Period
Short-term (unskilled) jobs	12 420	10 days
Supervisors	1 035	3 months
Auditors	1 035	2–3 months
Data capturers	360	2–3 months
ESCO employees	120 (±80 already full-time)	6 months
Warehouse and logistics	180	3 months
Exchange points	600	2 months
Total	± 15 750	10 days –6 months

Source: Ravi Govender from Karebo Systems (Pty) Ltd.

7.6. Pick ‘n Pay¹⁵ project¹⁶

Pick ‘n Pay has super- and hypermarkets across the country. The company has converted its lighting and HVAC systems to energy-efficient systems. Energy-efficient lighting was installed in all its new stores and a retrofit on ninety-seven established outlets is also being done. This could amount to an annual saving of approximately R1.5 million (US\$250,000) in reduced energy bills. The capital costs of the project should be recouped in just over two years.

¹⁵ The Pick ‘n Pay Group is one of Africa’s largest retailers of food, clothing and general merchandise. http://www.picknpay.co.za/static/section/index.php?page_id=984.

¹⁶ <http://www.eskomdsm.co.za/news8.php>.

Pick 'n Pay worked in collaboration with the Eskom DSM programme and mostly used existing contractors.

7.7. Eskom DSM projects

DSM¹⁷ is a comprehensive process in which the planning, implementation and monitoring of the consumer's electricity use – and its modification – are considered against the levels of electricity available in the national power grid.

From May to August 2008 homeowners in selected areas of South Africa (Western Cape, Northern region, KwaZulu Natal, North Western region, Southern region and Gauteng) received free energy-efficient CFL lamps in exchange for their old light bulbs.

The industrial and commercial energy efficiency (ICEE) component of the accelerated Cape programme focused on two project areas among industrial and commercial customers in the Western and Eastern Cape, namely, energy efficiency and hot water load control. The following high-profile customers participated in the programme: Southern Sun (all eleven Western and Eastern Cape Southern Sun hotels are being upgraded and retrofitted with energy-efficient solutions); Old Mutual Properties (five major Cape Town buildings and shopping centres); Volkswagen South Africa (Eastern Cape); Shoprite Checkers,¹⁸ Sanlam,¹⁹ Woolworths, Game and Pep Stores.²⁰

Water heating is the largest single energy consumer in a domestic household. In the Western Cape alone, it accounts for 40 per cent of the domestic peak-time energy consumption. The biggest project in the water-heating programme was the installation of geyser blankets, which, for the duration of the project, were fully subsidized by Eskom in key communities in the Western Cape. These blankets reduce heat loss from geysers, thereby reducing the amount of electricity needed to keep the water warm, and each blanket represents a potential saving of 85W. In contributing to the Cape electricity emergency, more than 150,000 geyser blankets were manufactured and installed in the Western Cape area during a two-month period. More than 1,500 people were employed during the geyser blanket project, many of whom had previously been unemployed.²¹

The GeezerDuvet Project utilized the services of mentally and physically challenged people at the Valkenberg Psychiatric hospital,²² at the Oasis Association,²³ at Cape Mental Health²⁴ and at the Cerebral Palsy Association's Village Work Centre²⁵ for the manufacturing of their blankets. All these associations significantly benefited from the project.²⁶

In some cases, the ESCOs and subcontractors offered full-time employment to previously unemployed persons who worked on the project.²⁷

¹⁷ http://www.eskomdsm.co.za/?q=About_DSM.

¹⁸ Shoprite, Woolworths, Game and Pep Stores are retailers of food and/or clothing and/or general merchandise.

¹⁹ A financial services group. <http://www.sanlam.co.za/eng/aboutus/companyinformation/whoweare/who+are+we.htm>.

²⁰ http://www.eskom.co.za/live/content.php?Item_ID=2787.

²¹ *ibid.*

²² The Valkenberg Hospital is a large, government-funded, tertiary psychiatric hospital in the city of Cape Town – http://en.wikipedia.org/wiki/Valkenberg_Hospital.

²³ Oasis provides employment opportunities, skills development training, day care centres and residential homes for over 450 men, women and children in the greater Cape Town area – <http://www.oasis.org.za/Page.php?pageID=3>.

²⁴ Cape Mental Health Society provides or facilitates comprehensive, pro-active and enabling mental health services in the Western Cape – <http://www.capementalhealth.co.za/mission.htm>.

²⁵ A protective work centre for adults with cerebral palsy/multi disabilities in the Western Cape – <http://www.villageworkcentre.org.za/about-us.php>.

²⁶ http://www.eskom.co.za/live/content.php?Item_ID=2787.

²⁷ *ibid.*

Another means of managing hot water load in the residential sector is through radio or ripple relay systems, which can remotely switch a geyser on or off to reduce load. As part of the accelerated DSM programme, areas were identified where new systems would be installed or current systems repaired or replaced. These were Table View (with an existing system owned by Eskom), Kraaifontein, Kuils River and Eversdal – under the control of the City of Cape Town. By July 2006, these projects had achieved an estimated saving of 6.5MW.²⁸

7.8. Summary

Section 7 reviewed some case studies in South Africa where energy-related improvements were made, and examined the financial, social and employment benefits of these improvements (where such information was available). The sustainability of these jobs has not been proven.

²⁸ *ibid.*

8. Employment and energy efficiency

8.1. Introduction

Section 8 describes the global situation concerning jobs in energy-related sectors, especially renewable energy. It describes different definitions of *Green Jobs*. It examines the current employment profile in South Africa as well as employment opportunities and threats. It describes the existing regulations and bodies instituted to offer training. It also reviews several bodies already providing training in energy-related improvements.

8.2. Global trends

During a preparation meeting for the G8 summit, the G8 leaders linked labour issues and environmental policies for the first time. In a joint statement, they declared that ignoring the need for green-job stimulation “would entail catastrophic consequences for human society, the global economy and prospects for sustainable jobs.”¹

UNEP, ITUC and the ILO are collaborating on a Green Jobs initiative² called the *UNEP–ILO–ITUC Green Jobs Initiative*.³

In the article “Jobs in Renewable Energy Expanding”, Michael Renner claims that about 2.3 million people worldwide work either directly in the renewable energy sector or indirectly in supplier industries. He states that the renewable energy sector is more labour intensive than the fossil fuel industry and that a transition toward renewables would promise job gains.

M. Renner (2008) also refers to a study commissioned by the German government which found that in 2006 the country had some 259,000 direct and indirect jobs in the renewable energy sector. The number is expected to reach 400,000 to 500,000 by 2020 and then 710,000 by 2030.

The Spanish industry now employs some 89,000 people directly (mostly in wind power and PV) and another 99,000 indirectly. In Denmark the number of domestic wind jobs has stagnated at about 21,000. A study for the American Solar Energy Society found that in the US the renewables sector employed close to 200,000 people directly in 2006 and another 246,000 indirectly. India’s leading wind turbine manufacturers now employ more than 13,000 people in India, China, Belgium and the US. In China, close to a million people currently work in the renewables sector. Kenya has an estimated 1,000 to 2,000 solar technicians. Bangladesh aims to create 100,000 jobs for local youth and women as solar technicians and repair and maintenance specialists. Brazil’s ethanol industry apparently employs about 300,000 workers. Malaysia has an estimated half-million people employed in the palm oil industry. Optimistic projections in Indonesia forecast 3.5 million new plantation jobs by 2010. The Woods Hole Research Centre estimates that India could create some 900,000 jobs by 2025 in biomass gasification (Renner, 2008).

¹ www.worldwatch.org/node/5744.

² www.worldwatch.org/node/5744.

³ www.unep.org/labour_environment/features/greenjobs.asp.

According to the report on *The Size of the US Energy Efficiency Market* 1.63 million jobs are supported by efficiency-related investments in the US. The largest number of jobs is to be found in the buildings sector which has generated approximately two-thirds of all efficiency-related jobs, or nearly 1 million jobs.

According to research by the University of Massachusetts-Amherst and the Center for American Progress (Pollin, Garrett-Peltier, et al., 2008), if \$100 billion is invested in the retrofitting of buildings to improve energy efficiency, the expansion of mass transit and freight rail, the construction of “smart” electrical grid transmission systems, wind power, solar power and next-generation biofuels, as much as 2 million Green Jobs could be created. This includes the following jobs: roofers, welders, electricians, truck drivers, accountants, and research scientists. The researchers stated that a green economic recovery program would replace at least 800,000 of the jobs that were lost in construction over the next two years,

As mentioned in section 5.2. Global trends, the *Global Wind Energy Outlook* report (2006), describes three scenarios for future growth of wind energy around the world. This report also mentions the number of jobs created by wind energy for each scenario. The number of jobs will range from 480,000 in 2030 under the Reference scenario to 1.1 million under the *Moderate* scenario and to 2.1 million under the *Advanced* scenario.

The *Solar Generation IV* report (2007) estimated that solar electricity could provide two million jobs by 2020. “On the assumption that more jobs are created in the installation and servicing of PV systems than in their manufacture, the result is that by 2030, more than 6.3 million full-time jobs would have been created by the development of solar power around the world. The majority of those would be in installation and marketing”. Industry information postulates that ten jobs are created per MW during production and about 33 jobs per MW during the process of installation. Wholesaling of the systems and indirect supply (for example, in the production process) each create three to four jobs per MW. Research adds another one to two jobs per MW. As the use of automated machines increases, however, the number of jobs will, once again, decrease.

The *Solar Generation IV* report (2007) describes three scenarios for the future growth of solar energy around the world. According to the *Reference* scenario, the PV-related industry could provide 286,877 jobs by 2030, the *Moderate* scenario estimates 2,963,080 jobs and the *Advanced* scenario 6,328,909 jobs.

The three wind- and PV-related job forecasts can be summarized as follows:

Table 8.1. Wind and PV-related jobs

Scenario by 2030	Wind energy	PV-related industry	Total
Reference	480 000	286 877	766 877
Moderate	1 100 000	2 963 080	4 063 080
Advanced	2 100 000	6 328 909	8 428 909

On the 4 August 2007 the US House of Representatives approved the *Green Jobs Act of 2007* to help train American workers for jobs in the renewable energy and energy efficiency industries – industries that are key efforts to combat global warming. The Green Jobs Act (H.R. 2847) authorizes up to \$125 million in funding to establish national and state job training programs, administered by the US Department of Labor, to help address job shortages that are impairing growth in green industries, such as energy-efficient buildings and construction, renewable electric power, energy-efficient vehicles and biofuels development.⁴ That is 30,000 to 35,000 people being trained

⁴ http://solis.house.gov/list/press/ca32_solis/wida6/greenjobsaug4.shtml.

for decent work-related and sustainable jobs that cannot be outsourced. Additionally, 20 per cent of those dollars will be set aside for the most marginalized to help build green pathways out of poverty.⁵

On the 29 September 2007 the International Energy Agency made the following statement: “Nearly 50 per cent of global electricity supplies will have to come from renewable energy sources if we want to halve CO₂ emissions by 2050 in order to ‘minimise significant and irreversible climate change impacts’” (AFP, 2008). To meet such ambitious objectives, governments around the world would have to make unprecedented political and financial commitments and design effective policies that would require immediate action.

All things considered, it is important to keep the following in mind: “exactly how many jobs a green economic overhaul would create, or whether many of these jobs are any more lucrative than traditional income sources, remains widely disputed” (Block, 2008a). The jobs being lost when, for example, coal mines close, are often replaced with jobs in IT, logistics and nanotechnology – jobs that coal miners and steel workers cannot necessarily do (Block, 2008b). According to Block “Green Jobs are unlikely to replace the thousands of mining jobs that will disappear when Germany’s mines close.”

It is also very difficult to determine how the different numbers of Green Jobs estimated by researchers were calculated. Some researchers indicate jobs per MW renewable energy; others per million dollars invested or even the number of jobs per square meter in the case of solar panels. Most researchers give no indication as to how they determined the number of possible Green Jobs, which renders it difficult to make even a rudimentary estimation for the South African scenarios.

The World Business Council for Sustainable Development published a report that *\$10 billion could yield 2 million US ‘green’ jobs* wherein it ascertained that 2 million Green Jobs could be created in the industrial sectors (steel and construction) if the US Government would invest \$100 billion over two years.

The report on Green Jobs: “*Towards Sustainable Work in a Low Carbon World*” (2008), also states that the job numbers in the green economy are estimates and projections – often based on assumptions – rather than firm figures. The report echoes the sentiment that there are several different approaches which make it very difficult to aggregate or extrapolate the findings. The report also postulates the following concerning green job numbers:

The nature of these and other assumptions inevitably colours the general nature of the findings. Thus, sceptical assumptions about reducing greenhouse gas emissions or other environmental measures will likely produce studies that predict job losses, just as more positive assumptions will yield upbeat results. Most studies agree, however, that the likely impact is a small positive change in total employment.

8.3. Types of Green Jobs

Sarah White and Jason Walsh (2008a), describe Green Jobs as “family-supporting, middle-skill jobs, most of them in the primary sectors of a clean energy economy – efficiency, renewables, and alternative transportation and fuels”. They add that Green Jobs are community-based – the retrofitting of a building is ideally done by the local work force ⁶ The systematic retrofitting and upgrading of residential and commercial buildings offer many opportunities to create good (sustainable) new jobs in “need” geographical locations. The manufacturing sector can also create a

⁵ www.treehugger.com/files/2008/06/lieberman-warner-green-collar-jobs.php.

⁶ No one will ship a building from Chicago to be retrofitted in China.” White and Walsh (2008a).

substantial number of jobs as it is environmentally unsound and financially unviable to transport wind turbines and solar panels across oceans.

On the website www.greenforall.org, green-collar jobs are described as those done by workers who, among other things, “install solar panels, retrofit buildings to make them more efficient, construct transit lines, refine waste oil into biodiesel, erect wind farms, repair hybrid cars, build green rooftops and plant trees”.⁷

The *Green Jobs: Towards Sustainable Work in a Low Carbon World report*, is jointly prepared by UNEP/ILO/ITUC/IOE (2008), and describes Green Jobs thus:

Green Jobs are positions in agriculture, manufacturing, construction, installation, and maintenance, as well as scientific and technical, administrative, and service-related activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect and restore ecosystems and biodiversity; reduce energy, materials and water consumption through high-efficiency and avoidance strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution. But Green Jobs also need to be good jobs that meet longstanding demands and goals of the labour movement, i.e. adequate wages, safe working conditions, and worker rights, including the right to organize labour unions.

Some of the types of jobs that are likely to be directly created in green building and the retrofitting process are green designers and architects, auditors, engineers, estimators, project managers and various jobs in the construction trades, including pipe fitters, sheet metal workers, HVAC technicians, engineers, electricians and general construction workers (Kievani, Tah et al., 2008).

Pollin and Garrett-Peltier (2008) list the following as Green Jobs for building retrofitting: electricians, HVAC installers, carpenters, construction equipment operators, roofers, insulation workers, carpenter helpers, industrial truck drivers, construction managers and building inspectors.

It should be noted that Bezdek and Wendling (DATE) found that most of the five million jobs created in 2004 in the US environmental job sector were “standard” jobs, i.e. accountants, engineers, clerks, factory workers, etc. Purely environmental jobs, for example, environmental engineers and ecologists, comprised a small percentage.

8.4. Quality of work

Decent Work has four pillars: the creation of more and better jobs, the extension of social protection, respect for fundamental principles and rights at work, and the promotion of social dialogue.⁸

The South African Minister of Labour said the following at the 19th Annual Labour Law Conference in 2006: “As a member of the International Labour Organization (ILO) and as a signatory to its conventions and practices, South Africa unequivocally supports and is committed to the ILO’s Decent Work Agenda”. Moreover, the South African Government also states “that our commitment to the decent work agenda should be reflected in our attempts to reduce poverty and to achieve equitable, inclusive and sustainable development.”⁹

The South African Government has several acts, amendments, codes of good practice, regulations and notices, and sectoral determinations regulating the South African labour market. Examples of these are:

⁷ www.greenforall.org/resources/green-collar-jobs-overview/green-collar-jobs-overview.

⁸ www.ilo.org/global/About_the_ILO/Media_and_public_information/Press_releases/lang-en/WCMS_094092/index.htm.

⁹ www.labour.gov.za/media-desk/speeches/2006/19th-annual-labour-law-conference-1.

- Basic Conditions of Employment Act;
- Compensation for Occupational Injuries and Diseases Act;
- Employment Equity Act;
- Labour Relations Act;
- Occupational Health and Safety Act;
- Skills Development Act;
- Unemployment Insurance Fund (UIF) Act;
- Arrangement of Working Time Good Practice;
- Pregnancy Good Practice.

The DoL developed the Sectoral Determination 2 for the Civil Engineering Sector. This legislation applies only to employers and workers in the civil engineering sector, and sets the following:

- minimum wages;
- working hours;
- number of leave days; and
- termination rules.

The sectoral determination for civil engineering applies to employers and workers in the civil engineering sector, but not to:

- senior managerial workers;
- workers earning more than R56,000 a year; and
- workers engaged in emergency work.

The Basic Conditions of Employment Act applies in respect of any matter not covered by this sectoral determination.

According to the *Business Position* Paper presented at the Construction Sector Summit (2004) construction and social infrastructure complement each other. The construction sector creates and maintains social infrastructure via houses, schools, hospitals and service centres, which impact on community health, education, welfare and productivity. Better social infrastructure leads to healthier, more educated and more productive citizens.

Because of the large number of casual workers in the construction sector, there are far-reaching consequences for workers, employers and society at large, especially regarding the following:

- productivity;
- health and safety;
- funding for and access to training;
- lack of continuity and social benefits;
- lack of collective mobilization, representation and bargaining; and
- lack of awareness of legal rights (Construction Sector Summit, 2005).

The welfare of society is supported by permanent jobs. Permanent positions contribute to workers being mentored and trained. In turn, more productive workers could lead to higher profits

and yields, and re-investment in materials, training and the availability of *Decent Work (ILO)*, thus self-perpetuating all-round improved working conditions, productivity and company financial health. However, this employment is sustainable only when private and public investing occurs.

8.4.1. The creation of more and better jobs

South Africa had an unemployment figure of 23 per cent in 2007. The government aims to halve unemployment by 2014 and has developed several programmes¹⁰ to address unemployment, for example, the Expanded Public Works Programme (EPWP) is a nationwide programme aiming to provide unemployed people with productive work and training so that they can increase their capacity to earn an income.

Learnership programmes for unemployed young people have also been developed. The training occurs in a working environment and makes a learner eligible for permanent work.

The AsgiSA was launched in 2006. AsgiSA aims to raise the level of skills in areas needed by the economy.¹¹

8.4.2. The extension of social protection

The Basic Conditions of Employment Act (No. 75 of 1997) aims to protect the vulnerability of workers. The Occupational Health and Safety Act (No. 85 of 1993), the Compensation for Occupational Injuries and Diseases Act (No. 130 of 1993) and the Unemployment Insurance Fund (UIF) Act (No. 63 of 2001) all aim to diminish people's exposure to risks, enhancing their capacity to protect themselves against hazards and interruption/loss of income as well as to promote well-being and health. The Basic Conditions of Employment Act and the Pregnancy Good Practice guide protect the rights of pregnant women.

8.4.3. Fundamental principles and rights at work

According to the South African Constitution (1996), and specifically the Bill of Rights, workers have the following rights (as described in Section 23 – Labour relations):¹²

- Every worker has the right to fair labour practices.
- Every worker has the right to form and join a trade union; to participate in the activities and programmes of a trade union; and to strike.
- Every employer has the right to form and join an employers' organization; and to participate in the activities and programmes of that organization.
- Every trade union and every employer's organization have the right to determine its own administration, programmes and activities; to organize; and to form and join a federation.
- Every trade union, employers' organization and employer has the right to engage in collective bargaining. National legislation may be enacted to regulate collective bargaining. To the extent that the legislation may limit a right in this Chapter, the limitation must comply with section 36(1).
- National legislation may recognize union security arrangements contained in collective agreements. To the extent that the legislation may limit a right in this Chapter, the limitation must comply with section 36(1).

¹⁰ www.info.gov.za/issues/govtprog/infra_2008.html.

¹¹ www.info.gov.za/asgisa/asgisa.htm.

¹² www.constitutionalcourt.org.za/text/rights/know/workers.html.

- This section guarantees workers the right to fair labour practices, to form and join trade unions, and to participate in union activities and strikes.
- The right to strike is enshrined in the Constitution, but the right of employers to lock out their workers is not expressly included. However, the Labour Relations Act grants employers this right in certain situations.

The following sections in the Bill of Rights are also relevant to workers:

- Section 13 – no one may be subjected to slavery, servitude or forced labour.
- Section 17 – everyone has the right, peacefully and unarmed, to assemble, to demonstrate, to picket and to deposit petitions.
- Section 22 – every citizen has the right to choose their trade, occupation or profession freely.

In The Basic Conditions of Employment Act (No. 75 of 1997) underwrites the rights of workers in South Africa.

8.4.4. The promotion of social dialogue

Ravi Naidoo (2001) wrote in his report to the ILO/ACTRAV that there is a difference in understanding between Europe and South Africa concerning the meaning of the term “social dialogue”. In Europe social dialogue is synonymous with the tripartite arrangements between government, trade unions and capital. In South Africa social dialogue does not imply the existence of a “social partnership”. Such a partnership between the working class and capital would have to be underpinned by a common vision for society. However, the trade union movement, steered by the Congress of South Africa Trade Unions (COSATU)¹³, is socialist-orientated. Naidoo also states that “the size and significance of formal sector employment is less in Africa than in Europe. Indeed, with changing labour markets and growing informalisation of employment, formal sector employment may never become the norm in Africa”.

The National Economic Development and Labour Council (NEDLAC) is funded by the DoL, but other departments, for example, the Departments of Trade and Industry, Finance and Public Works, are also involved. NEDLAC’s aim is to make economic decision-making more inclusive through social dialogue, and to promote the goals of economic growth and social equity.¹⁴

Section 77 of the Labour Relations Act (No. 66 of 1995) gives workers the right to take part in protest action to promote or defend their socio-economic interest and be protected against dismissal and other disciplinary action.

8.5. Summary

South Africa is committed to the ILO’s Decent Work Agenda. In order to achieve this, the South African Government has developed several acts, amendments, codes of good practice, regulations and notices, and sectoral determinations to regulate the South African labour market. Examples are:

- Basic Conditions of Employment Act;
- Compensation for Occupational Injuries and Diseases Act;

¹³ COSATU represents 39 per cent of the South African formal workforce and 56 per cent of all unionized workers.

¹⁴ www.nedlac.org.za.

- Employment Equity Act;
- Labour Relations Act;
- Occupational Health and Safety Act;
- Skills Development Act;
- Unemployment Insurance Fund (UIF) Act;
- Arrangement of Working Time Good Practice;
- Pregnancy Good Practice.

These acts promote the creation of new jobs and their improvement through the extension of social protection, respect for fundamental principles and rights at work, and the promotion of social dialogue.

8.6. Current employment profile in South Africa

According to the StatsSA Labour Force Survey,¹⁵ the employment profile in September 2007 looked as follows:

- 30,413,000 persons aged 15 to 65 years in the labour market, of which:
 - 13,234,000 persons were employed;
 - 3,945,000 persons were unemployed (official definition);
 - 13,235,000 persons were not economically active;
 - 17,178,000 persons were in the labour force or economically active;
 - 3,425,000 persons were discouraged work-seekers.

In terms of the annual change in employment, an additional 433,000 people were employed in the year to September 2007. The unemployment rate declined from 25.5 per cent in September 2006 to 23.0 per cent in September 2007. The percentage of working-age South Africans with jobs rose from 42.7 per cent in September 2006 to 43.5 per cent in September 2007.

According to the StatsSA Labour Force Survey¹⁶ the employment profile for the first two quarters of 2008 looked as follows:

- In the second quarter of 2008, the number of employed persons was 0.8 per cent higher than in the first quarter of 2008, an increase of 106,000 from 13.6 million to 13.7 million.
- In the second quarter of 2008, the number of unemployed persons fell by 77,000 to 4.1 million largely on account of a decline of 72,000 among unemployed men.
- The unemployment rate declined from 23.5 per cent in the first quarter to 23.1 per cent in the second quarter (down 0.4 of one percentage point), due to the expansion in employment and reduction in unemployment.

¹⁵ www.statssa.gov.za/publications/statskeyfindings.asp?PPN=P0210&SCH=4133.

¹⁶ www.statssa.gov.za/publications/statskeyfindings.asp?PPN=P0211&SCH=4222

This information can be presented as follows:

Table 8.2. StatsSA Labour Force Survey

StatsSA Labour Force Survey	First quarter	Second quarter
Number of employed persons	13.6 million people	13.7 million people
Number of unemployed persons	4 100 000	4 177 000
Unemployment rate	23.5%	23.1%

Source: StatsSA Labour Force Survey, September 2008.

Over the two quarters, the percentage of persons in the South African working age population with jobs was 44.5 per cent in the first quarter and 44.7 per cent in the second quarter.

The following is mentioned in section 3.2 but is summarized here for clarity:

- Some 450,000 people are formally employed in building and construction (excluding manufacturing and distribution) with a further three to four informal subcontracting employees per each formal worker. Formal employment will grow by 30 per cent to 60 per cent to between 600,000 and 700,000 by 2010.
- It is estimated that some 200,000 to 300,000 are employed in the manufacturing and distribution of building and construction materials. The growth to 2010 in this employment will be less than 10 per cent (BMI, 2006).

8.7. Employment opportunities and threats in South Africa

In terms of the cumulative investment from 2008–15, the total projected investment in home improvement is R196.65 billion. If the above-noted ratio of investment to job creation in the South African building industry is used, approximately 837,750 jobs would be created over the estimated seven year period. The nature of these jobs is not clear.

Estimates of potential job creation often appear over-optimistic. However, they are based on findings of an official report for the CIDB in South Africa. In spite of this, we recommend cautiously accepting them at face value. Other reports indicate much lower employment expectations for major investments in other related sectors in South Africa. The R124 billion investment in the electricity and transport networks that is expected to produce only 55,000 jobs over a five year period is to be noted (Business Report, 2006). Nevertheless, all in all, even if there is uncertainty about exact employment figures, it can be certain that the planned investment in construction and refurbishment will have an important positive employment effect that will be much higher than other sectors (Kievani, Tah et al., 2008:36).

In his report, *Renewable Energy Future for the Developing World*, Professor Dieter Holm wrote that if South Africa generated just 15 per cent of the total electricity use in 2020 by using renewable energy technologies, it would create 36,400 direct jobs without taking any work away from the coal-based electricity industry. Over 1.2 million direct and indirect new jobs would be generated if a portion of South Africa's total energy needs, including fuels, were sourced from renewable energy technologies by 2020.

A summary table below represents this job creation. Tables 5 and 6 refer to conventional energy employment potential and potential data in renewable energy employment.

According to a report (2003) done for The Sustainable Energy and Climate Change Partnership (SECCP) by AGAMA Energy, coal-based generation provided 330 jobs/TWh, gas 130 jobs/TWh and nuclear 80 jobs/TWh in 2003. Even without growth in renewable electricity generation, there will most likely be a decline in the number of jobs in this sector.

Table 8.3. Summary of direct and indirect jobs from renewable sources in 2020

Technology	Direct Jobs	Indirect Jobs	Total Jobs
Solar thermal (10% of target)	8 288	24 864	33 152
Solar PV (0.5% of target)	2 475	7 425	9 900
Wind (50% of target)	22 400	67 200	89 600
Biomass (30% of target)	1 308	3 924	5 232
Landfill (5% of target)	1 902	5 706	7 608
Biogas Where 150.000 residential biogas digesters are installed in rural areas	1 150	2 850	4 000
Solar Water Heaters Includes the manufacture and installation of the equivalent of a 2.8m2 solar water heater on each house in the country	118 400	236 800	355 200
Biofuels Includes 15% ethanol and diesel substitution	350 000	350 000	700 000
TOTAL	505 923	698 769	1204 692

Source: Renewable-energy Future for the Developing World

Table 8.4.: Summary of conventional energy employment potential, in terms of jobs/MW installed or jobs/GWh produced

	Fuel		Mnfr		Inst		O&M		Total	
	/MW	/GWh	/MW	/GWh	/MW	/GWh	/MW	/GWh	/MW	/GWh
Coal (current)	0.8	0.2					0.9	0.2	1.7	0.3
Coal (future)	0.8	0.2			1.3	0.3	0.9	0.2	3.0	0.7
Nuclear							0.5	0.1	0.5	0.1
PBMR			?	?	0.4	0.1	0.9	0.1	1.3	0.2
Gas	?	?	?	?	1.0	0.1	0.1	0.0	1.2	0.1

Source: Employment potential of Renewable Energy in South Africa

Table 8.5. Core RETs employment potential data (gross direct jobs/MW and /GWh)

RET	Fuel		Mnfr		Inst		O&M		Other		Total	
	/MW	/GWh	/MW	/GWh	/MW	/GWh	/MW	/GWh	/MW	/GWh	/MW	/GWh
Solar thermal	0.0	0.0	1.7	3.0	4.0	7.0	0.2	0.4	0.0	0.0	5.9	10.4
Solar PV	0.0	0.0	18.8	32.9	12.1	21.2	2.5	4.4	2.0	3.5	35.4	62.0
Wind	0.0	0.0	3.2	8.4	0.5	1.3	1.0	2.6	0.1	0.3	4.8	12.6
Biomass	0.0	0.0	0.0	0.0	0.0	0.0	1.0	5.6	0.0	0.0	1.0	5.6
Landfill	0.0	0.0	1.9	7.1	1.9	7.1	2.3	8.8	0.0	0.0	6.0	23.0

Source: Employment potential of Renewable Energy in South Africa

According to the AGAMA Energy report, there could be 36,373 new RET-related jobs in 2020 (AGAMA Energy, 2003, p. vii). This figure is based on a projected electricity requirement of 267TWh in that year.

For the renewable energy (RE) sector as a whole, the breakdown of gross direct jobs in 2020 is as follows:

- 180,000 in the biofuels sector, with 15 per cent ethanol and diesel substitution;
- 118,400 in the solar water heating sector, to manufacture and install a 2.8 m² solar water heater in each house;
- 1,150 in the residential biogas sector with 150,000 residential biogas digesters installed in rural areas; and
- 36,400 in the electricity generation sector, representing 15 per cent of the total electrical generation.

These figures represent a conservative assessment of the total technical employment potential of the industries concerned. The total number of direct jobs in 2020 is about 500,000, with approximately 700,000 indirect jobs being created (AGAMA Energy, 2003).

According to the AGAMA report, the increased uptake of RETs for electricity generation will not displace jobs in the conventional energy sector by 2020, since this study projects a *total* of 52,000 jobs in the electricity generation sector in 2020. This would comprise 36,400 RET jobs and approximately 15,600 coal-related jobs. In the longer term, deployment of RETs can slow down the overall losses in employment in the energy sector as a whole.

The growth of the SWH industry means that there are many more challenges for installation teams, ranging from types of roofs to locations. SWH performance is closely linked to quality of installation. *Selected Energy* believes that the growth in jobs in the SWH industry will come from system installation not manufacture. MD Jim Hickey says: “Building a factory will create at most 30 to 50 jobs. Our various distributors and their installation teams already employ more than a 160 people and this is early days yet”. Hickey predicts that the number of jobs created by Selected Energy will triple within a year.

According to Hickey, “if Eskom and the consumer embrace SWH the massive growth in the industry will fuel job growth, not only from us but also our competitors”. A good four-person installation team can complete, at most, two installations per day. Eskom hopes to install one million systems in five years. It is difficult to calculate exactly how many jobs this will create because not all installations will be typical. Nevertheless, 200,000 systems a year will generate at least 1,500 new jobs.

More than 1,500 people were employed during the geyser blanket project in the Western Cape, many of whom had previously been unemployed.¹⁷ Approximately 2,200 temporary jobs were created during the CFL roll-out programme in the Western Cape region.¹⁸

8.8. Estimating the effect of renewable energy on job creation in South Africa – A modelling exercise

8.8.1. Introduction

This section provides an energy model for estimates of the impact of the use of renewable energy on job creation. The question will be answered in two parts: first, estimates will be made of the impact on employment by the use of renewable energy sources. These estimates are largely updates and refinements of the figures contained in *Employment Potential of Renewable Energy*

¹⁷ www.eskom.co.za/live/content.php?Item_ID=2787.

¹⁸ www.eskom.co.za/live/content.php?Item_ID=2787.

in South Africa produced by AGAMA Energy in 2003. Comments will be made where necessary on the report's methodology. Second, an attempt will be made to estimate the impact on employment by renewable energy using estimates of the increases in construction expenditure due to green buildings.

8.8.2. Employment effects of renewable energy

In the first part the modelling process will take into account the effect on employment of bulk generation of renewable energy and the reduction in demand due to local substitution of energy (using solar power for heating water) as well as the more efficient use of energy through engineering and architectural changes. It will thus be possible to compare the situation where all of South Africa's power requirements are supplied by nuclear and coal (gas and hydro-electric sources will be ignored for this discussion) to situations where part of the bulk supply is produced by renewable energy and the total amount of energy required is reduced due to DSM programmes.

The modelling process will consist of the following steps:

- (1) Calculate South Africa's additional energy requirements by 2020, assuming an average 5.5 per cent per annum increase in demand.
- (2) Estimate the number of jobs/MW produced by coal, nuclear and each of the renewable energy sources. A differentiation will be made between estimates that include the number of jobs created during the manufacturing process and those that do not.
- (3) Estimate the proportional mix of renewable energies used in bulk generation by 2020, and hence estimate the number of jobs per MW produced by renewable bulk generation, excluding manufacture.
- (4) Estimate the proportion of the total energy demand supplied by bulk renewable generation by 2020. Three scenarios will be considered: 1 per cent, 3 per cent and 5 per cent.
- (5) Estimate the reduction in demand due to the DSM programmes in offices. In addition, an estimate of the employment generation due to these changes will be made.
- (6) Estimate the reduction in demand due to the DSM programmes in homes and the employment generation due to this change.
- (7) Combine all of the above to estimate the impact on employment of a renewable energy programme as a whole.

Step 1: Assumptions

The employment impact of the use of renewable energy by the year 2020 will be estimated – over an approximate ten-year horizon. There were several limitations to this exercise – most notably that it was not possible to distinguish between different types or levels of jobs created, or to determine whether these jobs would be short- or long-term.

The following general assumptions were also made:

- only directly created jobs were considered;¹⁹
- when using international estimates of job creation it was assumed that the labour productivity under which that estimate was produced would be replicated locally;
- the estimations did not account for any job creation due to the local manufacture of equipment.²⁰

¹⁹ We have no access to any data indicating significant differences in the number of indirectly created jobs across the various technologies.

²⁰ Almost all of the power-generating equipment is currently manufactured outside of South Africa. Although this may change we will work under the conservative assumption of no local manufacture.

Table 8.6. Energy and Power Projections

	2008	2020
Power (MW)	32 000	60 839
Energy (GWh)	196 980	374 500

The assumption was made that energy demand will grow at an average rate of 5.5 per cent between 2008 and 2020.²¹ As indicated in the table below South Africa will require 28839MW of additional power in 2020.

Step 2: Employment creation

The following set of renewable energies was considered:

- wind;
- biomass;
- solar thermal (solar-powered geysers);
- landfill gas;
- solar PV.

For each of these alternative energy sources a wide range of estimates for the number of jobs created per MW was considered.²² In some cases these estimates have been disaggregated by the phases of the construction and operation process – manufacture, installation, operation and maintenance and other.

For each energy source the median of the collected estimates was used as the estimate for the number of jobs created. Since jobs created during the manufacturing process are not included, this component was removed from the estimates. This was achieved, in cases where estimates of the number of jobs created during the manufacturing process were available, by estimating the proportion of jobs created during non-construction phases. The median (or mean) of the totals was reduced by this corresponding factor.

By following this process, the table below could be produced (note that the figures for coal, nuclear and gas already exclude the manufacturing component, but the production of raw material (i.e. coal mining) for coal-powered plants and biomass plants²³ has been included).

Table 8.7. Number of jobs created per MW during non-construction phases

Type	Mean	Median
Biomass	0.2	0.2
Coal	3.0	3.0
Gas	1.1	1.1
Landfill	4.1	4.1
Nuclear	0.5	0.5
PBNR	1.3	1.3
SolarPV	75.6	18.7
SolarThermal	3.5	3.5
Wind	1.7	1.4

²¹ Eskom's approximate demand in 2020 was used (see Eberhard in www.gsb.uct.ac.za/gsbwebb/mir/documents/ElectricityBlackoutsPPC14FEB2007ae.pdf).

²² It is also possible to estimate the number of jobs per GWh (i.e. in terms of energy consumption).

²³ The raw material for these sources will have to be produced locally while the remaining renewable technologies have no cost for their raw materials.

Step 3: Mix of renewable energies

The authors of the AGAMA document specified a mix of renewable energies consisting of 50 per cent wind, 30 per cent biomass, 10 per cent solar thermal, 5 per cent landfill and 1 per cent solar PV (including solar CSP). Only bulk generation (i.e. excluding solar thermal) will be considered and, because biomass generation is expected to peak at 270MW, it is clear that the bulk of the power must be supplied by wind (the most developed technology) and solar power. For this model it was decided that wind provides the most likely route to mass power generation. The table below presents a likely reasonable mix of energies for the South African context:

Table 8.8. Mix of renewable energies

Type of renewable energy	Renewable energy mix
Wind	65%
Biomass	25%
Landfill	5%
SolarPV	10%

Using this specification it can be estimated that bulk renewable energy will produce 3.04 jobs per MW of power. It is worth noting that this is marginally more than the 2.5 jobs per MW produced by a combination of coal and nuclear power (using an 80 per cent coal and 20 per cent nuclear split). This is mainly the result of the large employment-creating estimate applied to the index for solar energy PV; the results should thus be treated with caution.

Step 4: Bulk generation impact

As indicated in the introduction, a number of possible scenarios for the supply of the additional 28839MW required by 2020 can now be modelled:

- (A) All of the additional power is supplied by a mixture of coal (80 per cent) and nuclear power (20 per cent).
- (B) 5 per cent of the additional power is supplied by renewable sources and the remaining 95 per cent by a mixture of coal (76 per cent) and nuclear (19 per cent).
- (C) As above, but with 3 per cent of the power supplied by renewable sources.
- (D) As above, but with 1 per cent of the power supplied by renewable sources.

Table 8.9. Scenarios (percentage)

Type of energy	Scenario A	Scenario B	Scenario C	Scenario D
Coal	80	76	77.60	79.20
Nuclear	20	19	19.40	19.80
Renewable	0	5	3.00	1.00

Table 8.10. Jobs created per scenario

	Coal	Nuclear	Renewable	Total
A	69 214	2 884	0	72 098
B	65 753	2 740	4 376	72 869
C	67 137	2 797	2 626	72 560
D	68 521	2 855	875	72 252

The renewable energy options all lead to small increases in employment. The rate of job creation is approximately 154 jobs per 1 per cent increase in the proportion of renewable energy. Thus, using renewable energy to provide 1 per cent of the bulk generation in the proportions given earlier will create an additional 154 jobs, while using renewable sources to generate 5 per cent of the bulk generation will create 770 jobs.

Step 5: Demand-side reduction in offices

Offices use an estimated 30 per cent of South Africa's power and it will be assumed that alternative energy sources (almost exclusively solar heating) will reduce the energy demand in offices by approximately 2 per cent. A further 8 per cent reduction is possible through other demand-side reduction techniques, such as installing energy-efficient light bulbs, architectural innovations and energy-conservation measures.²⁴ It will be assumed that the additional 8 per cent reduction is employment-neutral, i.e., these measures will have little to no effect on total employment. Finally, it will be assumed that these measures will apply to only 30 per cent of offices.²⁵

We can estimate the total reduction in demand as:

$$(0.02+0.08)*0.3*0.3*60839\text{MW}=548\text{MW}.$$

The net job effect would thus be the difference between the jobs created by the solar heating component and those lost due to the loss of jobs from the reduced demand for coal and nuclear energy (since it has been assumed that the other components of the demand-side reduction would have a negligible employment impact):

- Estimated jobs lost (or not created) = $548*2.5 \text{ jobs} = 1370 \text{ jobs}$.
- Estimated jobs created by office solar water heating = $3.5*2/10*548 = 384 \text{ jobs}$.

The net employment effect of the office energy saving technique is thus estimated at -986 jobs.

Step 6: Domestic demand side reduction

The above exercise can be repeated with domestic demand.

Domestic homes use an estimated 17 per cent of South Africa's power and it will be assumed that alternative energy sources (exclusively solar heating) will reduce the energy demand by approximately 2 per cent. No additional possibilities of reducing domestic demand will be considered. It must be assumed that these measures will apply to only 20 per cent of homes.

It can be estimated that the total reduction in demand will be:

$$(0.4+0)*0.17*0.2*60839\text{MW}=827\text{MW}.$$

The net job effect would thus be the difference between the jobs created by the solar heating component and those lost due to the loss of jobs from the reduced demand for coal and nuclear energy.

- Estimated jobs lost (or not created) = $827*2.5 \text{ jobs} = 2068 \text{ jobs}$.
- Estimated jobs created by office solar water heating = $3.5*40/40*827 = 2894 \text{ jobs}$.

The net employment effect of the home energy savings is thus estimated at 826 jobs.

²⁴ The European Union has estimated that office energy consumption can be reduced by 30 per cent by 2020 (www.europa.eu/scadplus/leg/en/lvb/l27064.htm). It is conservatively estimated that one-third of this target is possible in South Africa.

²⁵ There is no good data on the extent to which these measures can be implemented in the commercial sector. Given the earlier conservative estimate about the extent of energy savings a target of 30 per cent appears realistic.

Step 7: Conclusions

The results of the various modelling assumptions are:

- Using renewable sources for bulk energy generation will lead to a net increase in the number of jobs at a rate of approximately 154 jobs per 1 per cent of total energy generated by renewables. This estimate is sensitive to the selected proportional mix of renewables, and in particular to the proportion of solar energy (which produces significantly more jobs than other energy sources) that was included.
- Energy savings and substitution of energy sources in office buildings will lead to a net loss of 986 jobs. This estimate is sensitive to the proportion of the total energy savings that is expected from renewable sources (solar heating of water) compared to reduction in demand due to engineering or architectural changes. The estimate assumes that about 20 per cent of the reduction in office demand will be due to alternative sources and that the remaining reductions will have no significant employment effects.
- The use of solar heating for water in homes will result in a net increase of 826 jobs. This estimate is sensitive to the proportion of the home energy demand accounted for by the heating of water, which is estimated at 40 per cent.

It can thus be concluded that, as indicated in the table below, generating 1 per cent of the bulk energy from renewable sources will lead to a -6 change in net employment, while generating 5 per cent of the bulk energy from renewable sources will lead to a +610 change in net employment. These effects are relatively small – significant proportions of the energy would have to be produced through renewables in order to have meaningful employment effects. For example, if 50 per cent of the energy were produced through renewables the creation of 7,540 jobs would be expected. However, these effects do not include any potential employment impact due to local manufacture of renewable energy equipment. There are clearly significant employment effects if local manufacture is taken into consideration – using the existing estimates, 100 per cent local manufacture would contribute 3.9 extra jobs per MW of energy, while 50 per cent local manufacture would create 1.9 extra jobs per MW. Equally, the increased efficiencies have not been ascertained in terms of profits and the possibility for reinvestment at both manufacturing and labour-force levels.

Table 8.11. Employment impact of renewable energy, by proportion of bulk generation

Percentage of bulk energy	Net employment effect
1	-6 jobs
3	302 jobs
5	610 jobs

8.8.3. Employment effect of green buildings

It is not possible, using existing data, to directly estimate the impact of green buildings on employment. However, the link between construction expenditure and employment can be used to produce some rough estimates.

As above, the estimates for the period 2009 to 2020 will be provided. In order to produce the estimates the following inputs are required:

- An estimate, c , of the increase in construction cost due to greening buildings. International evidence suggests that the increase is approximately 15 per cent while evidence from local projects put it closer to 5 per cent. The lower figure will be used for the rest of this exercise. This is a safer assumption since it is certainly possible that increased expenditure on greening buildings may result in a decrease in construction expenditure in other areas.
- An estimate, β , of the number of jobs created for each R1 million of construction expenditure. Some experts have estimated that between 10 and 12 jobs are created for each million rand of construction expenditure. However, evidence suggests that the marginal effect of increased construction expenditure is significantly lower. Data from the *State of the Civil Industry* report²⁶ reveals that growth in employment in the civil engineering industry did not match growth in turnover. In the late 1990s approximately eight civil engineering jobs were created for every million rand of turnover, but this had dropped to four jobs per million rand of turnover by 2007. The most recent construction sector information²⁷ estimates the construction sector employment at 1.05 million people and construction sector turnover at R170.229 million. This gives approximately six jobs per million rand of expenditure. If the trends for the civil engineering industry apply more generally to the construction industry (and there is evidence that this is the case²⁸), then there is little reason to believe additional expenditure would translate into new jobs at an asymptotic rate. A conservative estimate of the impact of additional construction expenditure on employment is $\beta=1$ jobs per million rand.
- Estimates of the expected increases in real construction expenditure between 2009 and 2020 indicate from current estimates from the Bureau for Economic Research that real GDP will grow at approximately 4 per cent over this period.²⁹ The most reasonable assumption is that the construction industry, although more cyclical in nature, will in general grow at the same rate.
- Estimates, δ , of the proportion of construction expenditure that will be subject to greening show that there is no data on which to base any estimates, thus a very conservative figure of 10 per cent will be used.

Calculations

Based on the above data the total construction expenditure over the period 2009 to 2020 is estimated at R2,766,547 million. The increased expenditure (in million rand) due to greening buildings can then be calculated as:

$$\delta * c * 2766547 = 0.1 * 0.05 * 2766547 = 13833.$$

If the estimate of $\beta=1$ is used for the number this will lead over the 12-year period to 13,833 additional jobs due to greening buildings, or 1,153 jobs per year.

This estimate is extremely sensitive to the parameter values, in particular the value of β . If the extra expenditure easily translates into increased employment then β could easily be as high as 3 or 4; if the increased expenditure is absorbed by the existing workforce (through re-skilling or increased productivity), then the value of β could be significantly lower.

²⁶ [www.safcec.org.za/files/File/civil2007Q3\(7\).doc](http://www.safcec.org.za/files/File/civil2007Q3(7).doc).

²⁷ September 2007 Labour Force Survey, 2007 Annual Financial Statistics (both Statistics SA publications).

²⁸ Between 2006 and 2007 construction sector turnover increased by 25.1 per cent (from R136 billion to R170 billion) while employment increased by only 30,000.

²⁹ www.ber.ac.za.

8.9. The main challenges with regard to energy-related improvements in building in South Africa

8.9.1. Introduction

This section looks at the different underlying legislations for skills development in the construction and energy sectors in South Africa, specific “green skills” developments, as well as some tertiary institutions that offer training in new energy-related improvements.

8.10. Skills development

The need for green technology, innovations and energy efficiency is here to stay. Companies and the workforce should acknowledge this and prepare accordingly. It will increase companies’ competitiveness if they are up-to-date with the newest developments (relevant to the South African situation), and have the trained workforce to implement such changes. South African companies could sharpen their competitive edge by promoting environmentally sustainable construction as well as “smart”³⁰ buildings and infrastructure.

Companies and the workforce should develop a culture of “Thinking and behaving in the best possible way” – a best-practice culture. The link between achieving best practice and the existence of strong values and ethics should be recognized. Many reports plead with government to use its influence to drive improved ethical behaviour (Van Wyk, 2006:70).

Companies should recognize technology as an agent of change. The construction industry must become more innovative and embrace technology (Van Wyk, 2006:70).

It is important for big business to become involved in training workers. Eskom is helping to prepare the workforce by assisting in the development of a formal accreditation course for solar water-heater installers.³¹

Companies should be prepared for technological transformation. The preservation of existing jobs will prove futile – trade and technology will ultimately transform the economy with or without the industry’s consent. Recruiting and relying on unskilled or low-skilled workers are often only viable because the enterprise is using low-level technology. The use of higher technology increases the skills requirements. Winning economies of the future will be those who anticipated these changes and prepared their workforces accordingly. South Africa will secure a better future if it strives to develop its human talents. This presents very real challenges to the construction sector as a whole, for this is the one sector that has demonstrated minimal occupational transformation over almost 3,000 years (Van Wyk, 2006:107, 108).

The re-establishment of apprenticeships is crucial. South Africa in general and the construction sector in particular have a long tradition of ladder-climbing. The traditional route to higher-skilled and better-paid jobs was through the career ladder approach, aided and supported by the system of apprenticeship. Current qualification-setting legislation also facilitates career ladder by recognizing prior learning within the qualifications regime (Van Wyk, 2006:108).

Overcoming employer and employee resistance is an equal reality. Workers are obviously reluctant to attach themselves to a labour market that has a history of volatility and poor future prospects generally. In addition, continuing education faces some real obstacles: parenting responsibilities, financial costs, child-care arrangements, travel costs and a general lack of time.

³⁰ A building that mimics a living system, able to sense and respond appropriately to exterior conditions like varying winds, temperature swings or changing sunlight. Inside, the building may change to accommodate crowd flow or better circulate warm air. Available at: www.popularmechanics.co.za/content/news/singlepage.asp?key=110.

³¹ www.eskomdsm.co.za/sw_h_7_supplier.htm.

However, unless time off and financial resources are made available for training, the next rung may remain out of reach forever (Van Wyk, 2006:108).

Therefore, policies and regulations need to recognize that everyone who works should earn a decent wage and have health benefits as well as opportunities to pursue personal development (Van Wyk, 2006:109). This will self-perpetuate the striving of a whole society to achieve and optimize its sustainable development.

8.10.1. Built Environment Professions Bill (B53-2008)

Training of persons working in any of the built environment professions in South Africa is governed by the Built Environment Professions Bill:

Education and training

17. (1) Subject to the South African Qualifications Authority Act (No. 58 of 1995), the Higher Education Act (No. 101 of 1997), the Skills Development Act (No. 97 of 1998), and the Further Education and Training Colleges Act (No. 16 of 2006), no educational institution or training facility may offer or provide any education or training having as its object to qualify any person for the practising of any built environment profession to which the provisions of this Act apply, unless such education and training has been accredited by the professional board in question.
- (2) Any person, educational institution or training facility wishing to offer education or training contemplated in subsection (1) must, before offering or providing such education or training, apply in writing to the professional board in question for the accreditation of such education or training, and must –
- (a) furnish such particulars regarding the education or training as the professional board in question may require; and
- (b) pay the prescribed accreditation fees and annual fees to remain accredited.
- (3) The professional board concerned may grant or refuse any application lodged in terms of subsection (2) and, having granted such application, may impose such conditions and requirements as it may deem necessary, subject to which the education or training in question may be provided at such educational institution or training facility.
- (4) Any person who contravenes or fails to comply with any provision of this section is guilty of an offence and on conviction liable to a fine or to imprisonment for a period not exceeding 12 months, or to both a fine and such imprisonment.
- (5) A professional board is the education and training quality assurer for its built environment profession in terms of the South African Qualification Authority Act (No. 58 of 1995).

Accredited education and training institutions to furnish professional boards with certain particulars

29. (1) Every education and training institution at which a qualification may be obtained, which entitles the holder thereof to registration under this Act, must furnish the relevant professional board at the board's request with full particulars as to –
- (a) the minimum age and proof of compliance with set standards of education and training required of candidates to acquire such qualification;

- (b) proof of compliance with the set course of study, training and examinations or assessment methodologies required of a candidate before such qualification is granted;
 - (c) the results of any examinations conducted by it; and
 - (d) any other particulars relating to the education and training offered by such institution as the professional board may require for the accreditation of any qualification offered by that institution for the purposes of registration in terms of this Act.
- (2) If any institution contemplated in subsection (1) fails or refuses to furnish any particulars requested by the professional board under that subsection, or it appears to the professional board that a provision of this Act is not being properly complied with by that institution and that such improper compliance is having or may have an adverse effect on the standards of education and training maintained at that institution, the professional board concerned may, by notice in the Gazette, suspend accreditation of such education and training institution until such time as that institution complies with the conditions and terms determined by the professional board.
 - (3) A professional board may, upon representations made by the affected education and training institution that satisfactory provision has been made for complying with the requirement of this Act by the said institution, reinstate the accreditation of that institution by notice in the Gazette.
 - (4) A qualification specified in a notice issued under subsection (2) which has been granted by an educational and training institution to which such notice relates between the date specified in that notice and the repeal of that notice in terms of subsection (3), does not entitle the holder thereof to registration under this Act.
 - (5) The relevant professional board may appoint a person to be present whenever tests or examinations are being conducted by any educational and training institution to monitor academic progress made by candidates at such institution and to report to the relevant professional board thereon.

8.10.2. CETA

CETA was established in April 2000 after the promulgation of the Skills Development Act (No. 97 of 1998) which aims to develop and improve the skills of the South African workforce. CETA's primary objective is to influence the course of training and skills development in the construction sector. Various skills development projects and learnerships are initiated with a view to developing a pool of skilled and motivated construction workers whose skills are recognized and valued in terms of the NQF.³²

The primary focus of the CETA is:

- accreditation of training providers;
- registration of assessors and moderators;
- certification;
- Quality Assurance of Learner Achievements (QALA).

³² www.eskomdsm.co.za/sw_7_supplier.htm.

The following process is followed:³³

- (1) the education and training provider enrolls learners;
- (2) the education and training provider conducts training, assessment and moderation, and submits an achievement and moderation report;
- (3) the CETA regional office/contracted verifiers verify and endorse the learner achievement;
- (4) the CETA regional manager recommends certification; and
- (5) CETAQA issue certificates of competency to successful learners.

The learner should be in an employee relationship with an employer to be eligible. The employer pays the skills levy to CETA, which in turn pays the training provider. CETA also ensures that the training providers are accredited and verifies the employer-employee relationship.

8.10.3. Energy Sector Education and Training Authority³⁴

Energy Sector Education and Training Authority (ESETA) is one of 23 Sector Education and Training Authorities (SETAs) established in South Africa in terms of the Skills Development Act of 1998. Its mission is to facilitate development for energy and water sector stakeholders through the provision of education and training services.

The ESETA education and training quality assurance (ETQA) department is responsible for ensuring that training complies with the SAQA requirements. The ETQA accredits training providers, audits them regularly, and registers assessors and moderators.³⁵

A list of training providers and courses is available at: www.eseta.org.za/trainers/energy-chamber.

Most are Electrical Engineering NQF Level 2-4 and Power Plant Operations NQF 3-5.

A list of registered learnerships is available at: www.eseta.org.za/learnerships/registered-learnerships.

8.10.4. Energy Training Foundation (ETF)³⁶

The Southern African Association for Energy Efficiency (SAEE) is one of 67 international chapters of the American Association of Energy Engineers (AEE). It offers training through the ETF. The ETF offers a four-day Energy Audit Training Course to:

- develop the skills and knowledge required of individuals who conduct energy audits in government, commercial and industrial buildings; and
- develop the skills and knowledge required of engineers who will manage and monitor the audit programme.

The following groups are targeted:

- ESCOs;
- service providers;
- facility managers;

³³ www.ceta.org.za/QualityAssurance/ETQAProcedureQA.asp.

³⁴ www.eseta.org.za.

³⁵ www.eseta.org.za/etqa.

³⁶ www.saaee.co.za/energytrainingfoundationschedule.htm.

- building managers;
- industrial managers;
- maintenance personnel;
- property owners.

The following courses have CPD accreditation:

- Certified Measurement and Verification Professional (CMVP);
- Building Energy Management Training Course (BEMT);
- Certified Energy Manager Course (CEM);
- Industrial Energy Management Training Course (IEMT);
- Energy Audit Training Course (EAT);
- Cogeneration Course (Co-gen).

8.10.5. GBCSA's Green Star Accredited Professional Course³⁷

The GBCSA offers a course that will provide practitioners with an understanding of the Green Star SA-rating system and increase the ability to apply Green Star SA tools to projects. This one-day course will take participants through each category and credit in the Green Star SA system.

The course is relevant to a diverse range of professionals – academics, architects, contractors/builders, cost planners, engineers, facilities managers, general managers, interior designers, landscape architects, marketing managers, policy advisers, product manufacturers, project managers, quantity surveyors and solicitors.

The GBCSA is applying for accreditation through SACAP (the South African Council for the Architectural Profession).

8.10.6. Centre for Environmental Management at the Northwest University

The Centre for Environmental Management at Northwest University offers a course³⁸ in “Green governance at the local level (fleet management, green procurement, energy efficiency, etc.)”.

8.10.7. South African National Energy Research Institute (SANERI)

The South African National Energy Research Institute offers bursaries for Master’s and Doctoral research-based studies on the following:

- energy infrastructure optimization;
- energy efficiency and DSM;
- the impact of energy use on the environment;
- the role of energy in stimulating socio-economic development;
- cleaner fossil fuel development, including clean coal technologies; and
- renewable energy.

³⁷ www.gbcsa.org.za/education/education.php.

³⁸ www.puk.ac.za/.../export/PUK/html/fakulteite/natuur/soo/cem/training/on-site/CEM09.5.4_web_06.pdf.

8.10.8. University of Pretoria

A national hub offering a post-graduate programme in Energy Efficiency and Demand-Side Management (EEDSM) has been launched at the University of Pretoria.

The university was selected by the South African National Energy Research Institute (Saneri) to house the hub.³⁹

8.10.9. University of Stellenbosch

The University of Stellenbosch has been awarded the responsibility to act as the hub of a post-graduate programme in Renewable and Sustainable Energy Studies by the newly formed South African National Energy Research Institute (SANERI). A number of research chairs will form the spokes of a hub-and-spoke model.

In the Department of Electrical and Electronic Engineering novel electrical machines are studied to be used in wind and hydro-energy applications. A number of projects in energy storage, an important component of renewable energy systems, have been completed over the years. The Department of Process Engineering built and commissioned a pilot plant for the extraction of ethanol from fermentation wastes and for the production of biodiesel. The Microbiology Department is currently the leading group worldwide to demonstrate one-step fermentation of acid-treated cellulose to bio ethanol using recombinant yeast strains.

The Department of Forest and Wood Science and other departments at the Faculty of AgriSciences have recently completed projects in the production and sustainable supply of biomass, an important aspect of renewable natural resources. The planning and implementation of energy plantations, and their possible contribution to rural development, will become important fields of research and training within the hub.⁴⁰

8.10.10. Solar panel distributors

Selected Energy is an importer and distributor of SABS approved *Solahart* solar water heaters. Due to the growth of the SWH industry – especially since the Eskom shortages – it has established a solar water heater installation training programme for teams installing the *Solahart* heaters.

Previous skills, though not a requirement, are helpful. The training takes three days, or two if a trainee already has a plumbing qualification. Two courses are offered: one for installers and one for installer team supervisors. *Solahart Australia* provided extensive literature and video material for the training. On-going distributor training using field experience, and conducted via e-mail bulletins, is also offered. Initially *Selected Energy* would only certify *Solahart* installers. Once all *Selected Energy*'s training needs have been met, and if viable and desirable, the company will consider offering its training to other companies in the SWH industry.

Currently, the courses have no accreditation and the training is product-specific.

8.10.11. The main challenges

The following are some of the main challenges faced by the construction industry regarding the possible influence of energy-related improvements on the creation of jobs:

- A housing backlog of 2.1 million units, requiring 300,000 units to be built per annum to clear it by 2014 (van Wyk, 2007).
- 145,000 buildings in the Department of Public Works' portfolio. Retrofitting of 106,000 is planned.

³⁹ www.engineeringnews.co.za/article.php?a_id=136398.

⁴⁰ www.sessa.org.za/mediaandlinks/newsandarticles/2006/postgradarticle.

- Investors may balk at becoming involved in renewable energy projects. It is often investors and developers that bear the burden of substantial investment but the tenants that reap the benefits of energy-efficient changes to buildings.
- Designers and architects in this field lack both a professional mindset and knowledge (Kievani, Tah et al., 2008:38). Many professionals may be unaware of energy-related improvements or sceptical about their implementation due to large capital investment at the commencement of projects. Energy efficiency opportunities are frequently overlooked because of this unawareness. There are signs, however, of a change in attitude.
- A frequent misconception in the industry is that energy efficiency will disrupt production processes and that changes should not be made unless absolutely necessary (DME, 2005a).
- Slow and cumbersome regulatory systems (Kievani, Tah et al., 2008:38).
- The DME has argued (2005a) that the South African Government may be unable to justify subsidies for energy efficiency due to other pressing national needs (Kievani, Tah et al., 2008:50).
- Limitations imposed by technology that is not manufactured locally and must be imported (Kievani, Tah et al., 2008:50). This makes energy-related improvements more expensive, not only with regard to the importation of the technology but also with regard to skills development, maintenance and the consequences of goods untested in South African conditions.
- Provision of electricity at affordable prices so as to discourage wastage and promote the incorporation of sustainable energy efficiency measures (Kievani, Tah et al., 2008:50).
- Facilitating and motivating stakeholders in developing countries to engage in the energy market. As noted by DME (2005a), very few South African players operate in this market; those that do often lack sufficient experience and expertise (Kievani, Tah et al., 2008:51).
- The influence of a recession on the construction industry should not be discounted.
- Properly skilled workers are needed for green industries.
- Relevant government regulations have yet to be implemented. SANS 204 should be made mandatory.

8.11. Summary – Section 8

This section demonstrates that, with an unemployment rate of 23.1 per cent, South Africa has the available workers to fill jobs that are created by energy-related improvements. However, many of these currently unemployed workers may not have the relevant skills for the (rapidly) changing energy sector. Many of the jobs are not suitable for unskilled and semi-skilled workers, but rather for trained graduates.

Authorities tasked with training workers are currently not fulfilling the expectations of preparing them with the relevant skills for the renewable energy sector. Little relevant training material is available. However, some universities have developed courses that now form part of existing qualifications, for example, engineering degrees.

The major challenges regarding the possible influence of energy-related improvements on the creation of jobs were discussed.

9. Findings in terms of the research sub-questions

9.1. Sub-question 1:

What are the current drivers, issues and trends with regard to implementing energy-related improvements in construction in South Africa?

9.1.1. Current drivers in construction in South Africa

Transformation

The Government's White Paper on Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry (1999) captured essentially two notions: growth and transformation.

Transformation within this context is aimed at increasing the physical ownership and economic and decision-making participation of previously disadvantaged persons in the construction industry; while growth is focused on improving the economic performance of the industry. The relationship between the two is significant: minimal transformation will occur if the industry does not grow; minimal economic growth will occur if the industry is not transformed. The two concepts constitute the content of two governmental initiatives: establishing a BBEEE Charter for the Construction Industry (the Construction Charter), and developing a Construction Growth and Development Summit Agreement (Construction Summit) (Van Wyk, 2006:72).

Small, medium and micro-enterprises (SMME)

The construction sector in South Africa reflects the global structure of the sector insofar as the majority of construction enterprises fall within the definition of the small, medium and micro-enterprise, with only a small percentage rated as large.

According to the National Small Business Amendment Act (No. 26 of 2003), a medium enterprise employs 200 or fewer full-time equivalent of paid employees and generates a turn-over of less than R26 million. A small enterprise employs 50 or fewer full-time equivalent of paid employees and generates a turn-over of less than R6 million. A micro enterprise employs five or fewer full-time equivalent of paid employees and generates a turn-over of less than R0.2 million per year.

The CIDB keeps a Register of Contractors that was established in terms of the CIDB Act No. 38 of 2000. Any enterprise that tenders or enters into a contract for construction works with the public sector must be registered. Joint ventures established on a contract-specific basis do not have to register, provided that each partner of the joint venture is separately registered.¹

The tender value range refers to the contract value range a contractor is considered to be capable of executing and is selected on a scale of 1 to 9 for a particular class of construction works. A contractor with a tender value range of 1 is considered capable of executing contracts valued at

¹ <https://registers.CIDB.org.za/Default.asp>.

up to R200,000. A contractor with a tender value range of 9 is considered to be capable of executing construction contracts valued at more than R100 million.²

Construction capacity and demand

Research confirms that properly managed growth is one of the most effective ways of reducing poverty and that infrastructure development is one of the pillars of economic growth. Government also recognized the importance of infrastructure in policies such as the Reconstruction and Development Programme (RDP 1994), the Growth Employment and Redistribution (GEAR 1996) and the Accelerated Shared Growth Initiative for South Africa (AsgiSA 2006) (Rust, Van Wyk et al., 2007).

Providing a developing country with good infrastructure combined with the other drivers of growth – better health and education services, a positive investment climate, good governance that respects property rights and is corruption free – is central to the mission of reducing poverty (World Bank, 2003 and Van Wyk, 2006:74). However, South Africa's growth is currently hampered by two key constraints:

- (1) lack of skilled manpower; and
- (2) lack of appropriate infrastructure (Rust, Van Wyk et al., 2007).

The DoH has produced 2.4 million houses in the last 12 years and has in the process reduced the housing backlog from 2.4 million to 2.2 million. This is the first time in the history of the country that the backlog figure has been less than the number of houses produced (Jansen van Vuuren, 2007).

In June 2008 the housing backlog stood at 2.1 million units (while the population grows at 450,000 per year). It is estimated that 1.1 million of these are earmarked for people living in informal settlements and the rest for backyard dwellers.³

Skill shortages and gaps

Skills shortages are evident in Western Europe, North America, India and China by the following statistics: each has between 130 and 450 people per engineer; however, only one in every 3,200 South Africans is an engineer, a ten- to twenty-fold disadvantage (Rust, Van Wyk et al., 2007).

It is in light of these figures that the construction industry in general and its delivery processes in particular have been identified as a key component in the government's strategy to create a skilled workforce for the reconstruction and development of the country. The strategy seeks to combine the provision of skills development programmes and learnerships with the large-scale expansion of the use of labour-intensive construction methods to build, upgrade and maintain the social and economic infrastructure in both the undeveloped rural and urban areas (Van Wyk, 2006:76).

The employment of casual labour, i.e., workers employed on a temporary basis, has become the norm, with negative consequences: poor employment practices and working conditions, low wages and remuneration, inadequate formal skills development and training. The construction sector carries an unfortunate statistic: it employs the fourth-highest number of uneducated people (Van Wyk, 2006:76).

In this instance, skills shortage also refers to a shortage of new skills in terms of energy-related improvements.

² <http://www.CIDB.org.za/registers/RegisterOfContractors.aspx>.

³ <http://www.southafrica.info/about/social/housing-300608.htm>.

9.1.2. Current (systemic) issues in construction

The initial results of the 2003 *Status Report of the Construction Industry* confirmed that industry performance and delivery across a broad range of issues remain highly variable and inconsistent, even under statutory obligations and procedures, such as government's Preferential Procurement Policy Framework Act. Lack of knowledge and deterioration in capability remain problematic. Minimal human resource development is taking place within the industry and employment conditions that show "respect for people" are not being applied. Fierce competition among local contractors has further reduced margins and often results in losses.

New developments such as the CIDB, CETA, BBBEE, the Preferential Procurement Policy Framework, the proposal for the levying of royalties for exportation rights, etc. have led to high levels of uncertainty within the industry. Yet there seems sufficient evidence to indicate that the existence of good management skills and proper procedures has produced satisfactory results.

The following are some of the systemic issues discussed in *Foresight South African Construction 2014* (van Wyk, 2006).

The delivery system

The industry's delivery chain often faces difficult and aggravating circumstances involving multiple participants operating from inside and outside the industry, resulting in a system(s) that may be assembled with completely new and endless variations and combinations. This multipartite structure produces unpredictable consequences, increasing risk to all participants without allocating liability to any specific party. Entry and exit requirements are non-existent for many participants, who often lack a thorough knowledge of the industry and show no understanding of the risks and liabilities to themselves and the consumers.

Performance expectations

Evidence suggests that customers have very low expectations of the performance of construction products. Based on their bad experiences, they perceive the industry as incapable of doing better. This perception stems in part from their lack of understanding of what better performance entails in construction terms, and in part from their unwillingness to pay for quality.

The knowledge base

As stated earlier, the construction sector employs the fourth highest number of uneducated people. Construction also has the fourth smallest percentage of employed persons with a higher education qualification. On average, construction skills are dominated by the most basic of manual labour skills. Real shortages exist with regard to artisans, such as mechanics, electricians, plumbers, building craftsmen and other trades.

However, the skills shortage is especially relevant to the new emerging technologies that are delivering high-performance infrastructure to globally competitive economies. The debate in construction in South Africa needs, therefore, to shift from number to competency.

Construction inspections

Enhancing the capability and competence of the certification and inspection bodies through accreditation, better information supply from the public regulator and strengthening the enforcement powers of inspectors will go a long way in meeting improved construction performance.

Self-certification by building practitioners is one option, provided that a robust system for redress is available in the case of non-compliance. Registration and/or licensing of building practitioners are another. Ultimately government, in terms of its constitutional obligations, cannot ignore its responsibility as the ultimate custodian of the built environment to take such steps as are necessary to ensure compliance with performance-based regulations.

Construction warranties and services certification

Warranties in the construction industry (material warranties) exist under limited time periods⁴ and/or under stringent installation obligations that are extremely onerous to meet and ensure. There is no single point of responsibility, and individual liability is extremely difficult to prove in a court of law, especially in the case of service providers, many of whom are not contracted to supervise their own work.

The procurement environment

Government procurement practices have changed through the implementation of the Public Finance Management Act (No. 1 of 1999). Notwithstanding the Act's consolidation of the accounting officer's accountability and responsibility for decision-making on tender awards, there are often cases where governmental client bodies ignored the professional advice of their advisers with regard to the award of tenders. Many clients and contractors complain that extensions to tender validity periods are becoming more prevalent, indicating that decision-making is being delayed.

The variety of procurement practices and documentation currently used by client bodies is an additional cost to the industry, leading to additional tendering costs on projects and increasing the perceived risk.

Social, environmental and economic issues

Buildings and structures form and alter the nature, function and appearance of the natural and built environment. They impact on rural areas, villages, towns and cities. Construction activity is a consumer of materials and scarce resources (water and energy) and a significant contributor to global warming emissions (including CO₂ from the burning of fossil fuels). It also contributes to air pollution (smoke and dust), generates vast quantities of waste, contaminates the soil and destroys existing vegetation.

Yet buildings are a crucial part of governments' strategy to improve the quality of life: they constitute the infrastructure through which health care, education and housing are provided. The economic, social and environmental benefits that may result from a more efficient and sustainability-led industry are not difficult to imagine.

Poor occupational health and safety remain a concern. Although progress has been made, a total of 337 persons were injured during 2000 in the civil engineering field, 68 of them fatally.

Construction activity for the 2010 Soccer World Cup has boomed throughout the country. Unfortunately, accidents and fatalities in a sector that has a poor occupational health and safety reputation have also increased.⁵

The delivery system in South Africa is complex and strongly regulated, sometimes to the extent of discouraging development. The industry is comparatively not well-developed in terms of new and innovative building technology, leading to mediocrity and resistance to change. The industry suffers not only from a skills shortage but also from the absence of a dynamically innovative and technologically developed industry employing meaningful energy-related improvements for better decent working environments. A variety of procurement practices and documentation conventions currently used by client bodies is an additional deterrent to a process

⁴ A final completion list must be presented within seven calendar days of the practical completion; there is a defects liability period of 90 calendar days and a latent defects liability period from the start of the construction period that ends five years from the date of achievement of final completion.

⁵ [http://www.search.gov.za/info/previewDocument.jsp?dk=%2Fdata%2Fstatic%2Finfo%2Fspeeches%2F2008%2F08082609451006.htm%40SpeechesandStatements&q=\(\(mdladlana\)%3CIN%3ETitle\)+\)%3CAND%3E\(+Category%3Cmatche s%3Es+\)&t=M+Mdladlana+on+workplace+safety+in+construction](http://www.search.gov.za/info/previewDocument.jsp?dk=%2Fdata%2Fstatic%2Finfo%2Fspeeches%2F2008%2F08082609451006.htm%40SpeechesandStatements&q=((mdladlana)%3CIN%3ETitle)+)%3CAND%3E(+Category%3Cmatche s%3Es+)&t=M+Mdladlana+on+workplace+safety+in+construction).

of rationalization, simplification and improvement for added-quality buildings. There is, therefore, considerable risk involved in building, and risk management is a crucial factor. In particular, if developers are to respond positively in terms of potential energy improvements, then these risks and their management will require serious attention, especially in relation to potential energy improvements still relatively unknown to developers. For the current state of the construction industry please refer to section 3 and Annex 1 for detail.

The current transformation of the construction industry and the fact that most construction companies are micro-, small- or medium-sized means that construction capacity and demand, as well as a shortage of skills and gaps in the skills pool, may hinder both good practice and companies' capability to become involved in retrofitting or other energy-related changes.

The perceived costs involved in building energy efficiently or retrofitting existing buildings are also a problem for developers. The views of the interviewees strongly confirmed the desktop study findings on issues requiring attention. Training is critical in order to correct perceived notions that retro-fitting and more efficient buildings are a "hindrance" that generate short-term higher costs rather than a medium- and long-term instrument for savings. Energy-efficient lighting, for instance, can induce payback on an initial investment in a few weeks.

As regards energy improvements in buildings, professionals lack knowledge to design effectively and economically. Major improvements can be achieved in building design, but these require an understanding of the principles and skills involved in implementing the technology. Providing information in an appropriate format to promote ease of understanding and use should be the focus of this project. Retrofitting existing buildings requires an equally systematic set of guidelines for architects and engineers to apply creative and economical energy reduction measures.

9.1.3. Trends in construction

The current trends are largely dictated by government and parastatal institutions which provide a strong legislative framework within which energy-related improvements can occur. The various departments, institutions and programmes for the development and growth of the building sector strongly support energy conservation and energy efficiency in the context of sustainable development.

The DME plays a prominent role in helping the South African economy move towards becoming less carbon-intensive. The department has introduced systems to access investment through the CDM of the Kyoto Protocol. It has developed the *White Paper on Renewable Energy and Clean Energy Development*, together with an energy efficiency programme to support diversification in pursuit of a less carbon-intensive energy economy (SA Yearbook 07/08, p. 421).

The South African Electricity Supply Commission (Eskom), in cooperation with the DME and the National Electricity Regulator (NER), has implemented a DSM programme for energy efficiency in South Africa. The CEF was founded to search for appropriate energy solutions.

The ESETA was established to facilitate development for energy- and water-sector stakeholders through the provision of education and training services.

The DPW is strongly moving towards the establishment of a more stable delivery environment in South Africa where industry training can be restructured to enhance the performance of the construction industry and to respond to the infrastructure and building needs of the country. Energy-related improvements in buildings are becoming part of this drive, particularly considering the DPW is a major property owner and developer of public buildings in South Africa.

The government is in the process of implementing energy legislation and regulations. Minimum requirements for buildings regarding energy efficiency have been developed and it has been suggested that they will be incorporated in the National Building Regulations. But as yet, no definite time frame has been stipulated.

The urgent need for development and building, and the creation of appropriate buildings in an international context for the 2010 World Cup⁶ and beyond, has precipitated a trend toward better training. This trend is unfortunately still in its infancy but both the government and private sector are addressing legislative efforts to implement and enforce it.

Education structures as positioned by government are calling for higher, internationally competitive standards but their attainment remains problematic and should become a product and focus of this research project.

The energy crisis experienced during 2008 has forced developers to re-evaluate the current building environment and to propose sensible, economic but effective design measures for both new buildings and the retrofitting of existing buildings. The general trend, according to the industry experts who were interviewed, is to retrofit buildings and to develop standards for energy efficiency in buildings.

9.1.4. Drivers, issues and trends regarding energy-related Improvements

There are two predominant drivers in the energy-related sectors in South Africa: an increased energy demand (specifically electricity for the building industry) and the economy's reliance on cheap energy derived from fossil fuels, especially coal.

The issues that arise from the energy demand are: a growing economy, the country's growing demand for infrastructure, the relentless increase in energy demand, and a growing population.

Multiple issues arise from the economy's reliance on energy from fossil fuels: South Africa's abundance of coal, its advanced coal-processing capabilities, its existing capacity to generate energy from fossil fuels, and inadequate bodies of water (or the warm, temperate climate) to generate hydro-electricity. The economy's dependency on imports and exports is also a significant factor; the landlocked Gauteng Province generates 40 to 50 per cent of the country's GDP but must transport its goods to and from harbours over long distances by rail and road. Furthermore, the supply of electricity in South Africa has always been cheap and new buildings could connect to the grid without making provision for alternative energy sources, but such sources (for example, gas and geothermal) are almost non-existent in Gauteng.

The following trends arise from these issues:

- the lack of sufficient energy supply;
- a reduction in economic growth due to the lack of spare capacity and the resultant electricity outages;
- the electrification of low-income households has placed an extra burden on Eskom and an extra demand on the electricity grid;
- the construction of new non-residential buildings arising in part out of the lack of construction during the 1998–2002 downturn has increased the demand;
- the ongoing growth in the construction of residential buildings – in part because of the rise of a black middle class; and
- the growth in higher-density gated communities.

Related trends include the acquisition of fossil fuel-driven generators by building and home owners to reduce the risk of energy outages and the installation of energy-efficient technology (lighting and HVAC systems in non-residential buildings, and lighting and solar water heaters in residential buildings).

⁶ The Fifa Soccer World Cup event in South Africa.

9.2. Sub-question 2:

What are the views and attitudes of the main stakeholders (central governments, local authorities, private companies) to energy-related improvements in construction in South Africa?

9.2.1. Government

The South African Government strongly supports job creation and energy efficiency in buildings and has implemented several policies, strategies and campaigns. Eskom, in cooperation with the DME and the National Electricity Regulator (NER), has implemented a DSM programme for energy efficiency in South Africa. The CEF was founded to search for appropriate energy solutions.

The DME was given the mandate to govern and undertake energy efficiency initiatives. It has also developed an Energy efficiency Strategy for South Africa. The NEEA was formed in 2006 under the guidance of the DME and forms part of a broader strategy to reduce the overall energy demand in South Africa by 12 per cent by 2015. The Electricity Distribution Industry Holdings (Pty) Ltd (EDI Holdings) was established in March 2003 by the DME for the sole purpose of facilitating the restructuring of the national electricity distribution industry in accordance with the requirements of the Energy White Paper and subsequent Cabinet endorsements. There is clearly a broad commitment to implement sustainable development and energy conservation.

The Department of Environment and Tourism (DET) has also developed a National Framework for Sustainable Development (NSDF) indicating support for energy conservation.

The Department of Public Works leads the accelerated efforts to implement energy efficiency programmes in all government-owned and government-leased buildings. It has also carried out the education of its own staff by arranging a two-day CPD workshop on passive energy design of buildings. Its staff acts as coordinators of the professional teams involved in public building projects. Hopefully, the information and education programme will continue into other aspects of energy design in buildings. A major problem for many institutions is the identification of qualified persons to undertake such workshops or training programmes, which may also be in short supply because educational programmes for energy auditing and efficiency are still in their infancy.

Government commitment to achieve its goals, though strong, must face questions about the extent to which its vision behind legislation and policy actually filters through the various departments and down to their staff, and how easily accessible these interventions are to the public. The interviewees held different opinions, ranging from government being fully committed to energy efficiency to government getting involved only if this would burnish its image.

Generally, the government is aware of the need for its commitment to energy efficiency and is taking action in this regard. The adequacy of its involvement remains questionable.

9.2.2. Local governments

The City of Cape Town, Ekurhuleni (East Rand) Metropolitan Municipality, eThekweni (Durban) Municipality and the City of Johannesburg are at the forefront of implementing varying energy efficiency measures. In the larger metropolitan areas there is an indication of disparate support. Beyond that, many local authorities need to be equipped to understand and implement these strategies at local level. The necessary awareness appears to be lacking. An education and training strategy is needed to facilitate such knowledge acquisition in order to effectively implement government vision.

Two views predominated among interviewees:

- (1) municipalities were concerned about the costs involved and that they might lose money; and
- (2) local authorities did not have adequate knowledge to implement energy-related improvements. It is possibly at this level that the greatest impact can be made by equipping municipalities to understand and apply energy-improvement principles and not to obstruct projects that require such insight.

9.2.3. *Private companies*

Several private companies have implemented extensive retrofitting projects. For large new developments some developers are requesting information and design expertise with regard to meeting energy-legislation standards. Distributors of energy-efficient technologies have started to develop in-house training programmes. Local professional institutes are arranging lectures and workshops on energy-efficient design for their members.

According to the interviewees, private companies appear more cost-driven through competitive considerations and mostly execute retrofitting and other energy-related improvements when they are both owner and developer of the building. However, they exhibit the most potential for change towards positive energy-designed and serviced buildings.

The GBCSA wants to lead transformation of the South African property industry to ensure that all buildings are designed, built and operated in an environmentally sustainable way that will allow South Africans to work and live in healthy, efficient and productive environments. It offers a course that will provide practitioners with an understanding of the Green Star SA-rating system and increase their ability to apply Green Star SA tools to projects.

The REEEP is a global public-private partnership that structures policy and regulatory initiatives for clean energy and facilitates financing for energy projects.

Generally there is strong support for energy-related improvements in both new and existing buildings. Central government is clearly committed and infrastructure is in place, but properly qualified and equipped personnel are in short supply and this negatively impacts the industry and its capacity for creating more energy-efficient buildings.

9.3. **Sub-question 3:**

What renovation/improvement measures have the best technical and economic efficiency with regard to energy-related improvements in building in South Africa (meaning likely to be done first)?

The biggest users of electricity in non-residential buildings are lighting and HVAC. Thus, technologies aimed at reducing energy use in these two areas are most likely to realize the most gains in terms of energy productivity.

The biggest users in residential buildings are appliances, especially hot water heating, stoves and heating. Thus, technologies aimed at reducing energy use in these areas – such as solar water heaters – will yield immediate results.

The improvement measures applied most often are: the changing of incandescent lighting to CFLs, individual control for both lighting and HVAC systems, the addition of ceilings and ceiling insulation, solar water heater installations, and the insulation of solar geysers and pipes.

Research has found that the energy-efficient improvements depicted in the table below have the best technical and economic efficiency in buildings in South Africa.

Table 9.1. Energy-efficient improvements that have the best technical and economic efficiency

Energy-related improvement	Energy saving potential High/medium/low	Early adaptors High/medium/low	Economic efficiency High/medium/low
The energy-efficient lighting technology in commercial and residential buildings			
Fluorescent lighting	Medium	High	High
Motion detection switching	High	High	Medium
Individual light switches	Low	High	Low
Task lighting	Medium	Low	High
Reflective backings	Low	Low	Low
Controlling lighting levels	Medium	High	High
Light shelves	Low	Low	Low
Static window shading	Medium	Medium	Low
Automatic window shading	Medium	Low	Low
LED feature lighting	Low	Medium	Medium
The energy-efficient heating, ventilation and air-conditioning in commercial and residential buildings			
Natural Ventilation	High	Medium	
Thermal Mass	Medium	Medium	
Night Flushing	Medium	Medium	
Earth Cooling/heating Tubes	High	Low	
Co-generation	High	Low	High
Solar Air-Conditioning	High	Low	Low
Heat exchangers	High	Low	
Insulation	High	Medium	
Thermal bridges	Medium	Medium	
Trombe walls	High	Low	
Solar hot water	Low	High	Medium
Hot water insulation	Low	High	

The interviewees agreed that lighting, individual light sensors and motion detectors have the best technical and economic efficiency for application in non-residential buildings in South Africa. Solar water heaters and energy-efficient appliances will yield the best results in residential buildings.

9.4. **Sub-question 4:** What are the main challenges for South Africa with regard to energy-related improvements in building, including improving the energy efficiency of the existing building stock? What are the obstacles or barriers that prevent cost-effective measures from being implemented?

9.4.1. *Primary challenges*

South Africa enjoys an abundance of sunlight, hitherto only marginally tapped. Passive energy building design can be applied as an appropriate and economical tool to achieve environmental comfort in buildings as well as better and healthier living and working environments. Public awareness in this regard needs to be sharpened and appropriate teaching programmes (investment in education and training) and publications for all levels of application provided.

Primary challenges relate to the cost of introducing energy-efficient practices and materials (high cost of energy-efficient products and low cost of electricity) and, as a consequence, poor availability of state-of-the-art alternative technologies. A secondary challenge is the absence of smart meters (able to display energy usage per room/function), and smart grids (able to receive energy into the grid). A tertiary challenge is the absence of incentives, including subsidies, municipal tax rebates, easier repayment interest rates and payback periods, and mortgage interest rate deductions. There is a catch-22 situation, since the provision of adequate training to implement best practices requires investment in itself, which accounts for higher costs. The equilibrium point exists whereby the investment in training pays off in the longer term and the initial training investment is superseded by the gain in efficiency.

A considerable challenge for South Africa is to research, find and develop appropriate technology solutions to provide robust and healthy housing for the backlog of 2.1million low-cost housing units. This challenge presents a huge opportunity to apply innovative energy-efficient technologies, management and operational procedures to eradicate the backlog, and to create higher-skilled job opportunities capable of delivering decent work.

There are several thousand government and private buildings in South Africa that require retrofitting to reduce energy consumption and better satisfy human comfort needs. In this regard government, as a major property owner, could play a leading role in making its buildings energy efficient, improving the sustainability of indoor/outdoor environments and creating decent work opportunities. Its legislative role could be well-balanced with an active lead role in energy efficiency.

It remains a challenge to both the private and public sectors to implement government policy (for example, SANS 204) by structuring and refining new and existing educational and training programmes and mechanisms that will enable job creation and energy improvements in buildings for better working environments.

9.4.2. *Obstacles and barriers*

Financing the cost of energy improvements in buildings is a challenge to be addressed at all levels, particularly by government. Developers are generally profit-driven, and profit drives the economy. Energy efficiency must be seen and understood to augment rather than consume profit. Mandatory legislation has a role to play here but tax and other incentives in the context of South African

demographics must also be considered. A wide range of energy improvements can be made both in retrofitting buildings and in new designs. However, the cost-effectiveness of the various methods and applications varies considerably. The current financial condition, not only in South Africa but also worldwide, can lead to a dearth in investment, especially if investors are not convinced of a satisfactory return from energy-efficient improvements. The fact that tenants rather than investors and developers gain financially from such improvements further discourages such investment. Other motivators must press the notion of an improved environment by promoting not only physical and mental wellness but also earth-friendly environmentalism incorporating a sense of global-scale responsibility.

The lack of energy-efficient technical knowledge is a serious obstacle to energy conservation applications being implemented in the built environment, particularly in buildings. It arises out of a shortage of relevant skills for planners, designers, contractors, industry technologists and craftsmen able to apply innovative technologies creatively for better living and working environments. In this respect, the necessary synergy will be achieved only when energy improvements in buildings are combined with the essential “equipping” of people to do the work and the creation of job opportunities for decent work.

Incorrect perceptions of what energy efficiency entails are common and must be dispelled. In addition, most new technologies being applied in building design are being imported, with several negative consequences, for example, financial implications, effects on local skills development as well as on maintenance in South African conditions. The creation of a sustainable job situation that also underwrites the ideal of “decent work” is an important – even critical – component of the system as an attractive receptor of persons in training or those trained through the system.

Several interviewees were of the opinion that perceptions, ignorance and a lack of knowledge about energy-related technology were some of the biggest challenges that South Africa faces with regard to energy-related improvements in building.

The DPW uses private built-environment professionals to design and build its buildings. While DPW has already taken the initiative in organizing workshops to inform its professional and technical staff of potential energy-related improvements for its buildings, private consultants are not yet equipped to adequately perform this service. This also applies to all stakeholders in the built environment. The responsibility to train young architects, engineers and technologists is to some extent being absorbed by the universities but the bulk of the working professions remain ill-equipped for this task, leading to a backlog of trained professionals. Government interventions, such as the compulsory CPD programme, are actively being taken up by the professional institutes but are dependent on training programmes offered by informed researchers, academics and professionals. Certain institutes are prepared to facilitate the administration of such courses but this is dependent on educators and professionals offering them, in return for CPD points to qualify for renewal of professional registration.

9.5. Sub-question 5:

What elements of policies and programmes are essential to trigger a move towards more energy-related improvements in construction?

As depicted in the table on page 50, South Africa appears to be well-positioned in the context of global legislation, regulations and policies/strategies.

Despite the above context favouring – even – requiring energy conservation and energy efficiency in buildings, the built environment in South Africa is not adequately positioning itself, nor

is it equipped to take up the impressive array of innovative building and energy technologies available overseas. South Africa needs an environment that encourages and empowers built-environment professionals and technologists to understand the technologies, be exposed to their benefits, and enable them to use them creatively. Simultaneously, the industry requires equipping for quality building as well as the effective and efficient fitting and installation of technical interventions.

The necessary policies are in place but the built environment now needs appropriate legislation, regulation and implementable programmes to trigger major energy efficiency applications in buildings as models of what can be achieved and what associated advantages can be reaped. Government or large development companies can provide such initial demonstrator programmes but, while the expertise is available, it is likely to be insufficient for general application in the built environment.

Knowledge and information resources are needed to supply the theoretical and technical know-how to design and implement such improvements. Education and training institutions are to some extent taking up the challenge so that young graduates are being reasonably equipped to undertake appropriate energy-related interventions in building design. However, it will take time for the development of this expertise to leave its mark. While building professionals can find information on the Internet and in publications, they can seldom afford the time to conduct the necessary research to be able to design and build confidently without fear of risk. Their needs could possibly be met through the provision of appropriate multi-disciplinary guidelines for energy-related improvements in buildings in South Africa. Such a publication, prepared collaboratively by relevant institutions, would go a long way towards triggering the move towards these improvements.

Industry essentially responds to demand. With building programmes emerging and government initiatives taking shape with the objective of achieving a high Green Star rating, industry will respond further, initially through imports but then through local manufacturing as volume increases and licences are acquired. Training at this stage, however, is largely in-house and through overseas providers. Likewise, products are being imported because the market is small and, in the case of local components, expensive – government incentives in this regard should be considered.

As regards the continued use of fossil fuels in the building industry, a national target for renewable energy supply should be set to promote renewable power generation in buildings. Several of the interviewees mentioned the implementation of SANS 204 and the need to make it mandatory. Tax incentives and “green loans” were also cited.

Environmentally based legislation and the cost of energy are two essential drivers creating a demand for energy conservation and energy improvements in buildings. However, it was mentioned that government must communicate honestly and clearly about predicted higher energy prices and the essential need to build new capacity for environmental protection. The current South African price of energy is too low to warrant serious investment in energy-related improvements. There needs to be an economic incentive over and above a notional reason for an improved environment but this will likely be possible only after an environmental cost is factored in.

Prioritizing and offering incentives for retrofitting targets set for energy conservation will encourage energy improvements.

Essential stakeholders in central government should select appropriate building programmes for energy efficiency improvements in both new and retrofitting projects, and in private enterprise buildings as well. The same should be encouraged at provincial and local authority level as demonstrators of energy improvements and efficiency.

It is furthermore suggested that government be encouraged to commit itself to the energy-efficient retrofit of the national estate. All government buildings should be mandatorily required to have minimum energy-efficient standards in the future to set the tone, demonstrate leadership, and stimulate the market by creating demand. Government should be encouraged to set up incentives to encourage the building of manufacturing capacity in energy-efficient technology and products.

Energy audits on commercial buildings would, of necessity, also trigger energy-efficient building buildings.

Research institutions equipped with building-related professional know-how should be tasked with writing cross-discipline guidelines for energy-efficient design and buildings that also encapsulate the concept of decent work environments.

9.6. Sub-question 6:

How can and should companies and the workforce better prepare themselves (for example in terms of new skills) to address new requirements in the construction industry emerging from possible energy-related improvements in construction?

Companies should have an awareness of energy provision, climate change, energy efficiency and the role buildings can play in the reduction of CO₂. It should form part of their corporate social responsibility and be reported in their annual reports. Accountability for energy-efficient strategies should be escalated to board level. Thereafter, an energy-efficient culture should be driven in the company. There should be an energy efficiency advocate both at board and lower levels, including trade unions.

Companies and their workforce should continually familiarize themselves with new technologies. Minimal literature, however, is available on energy issues in building design, management and maintenance but examples of good practice can be found in professional books. CPD programmes are also being offered and considerable interest is being demonstrated in architecture but access to these is limited and the scope is invariably too wide to enable skills development. Considerable work needs to be done in this area to provide information for courses and workshops, and to train presenters from within the professional fraternity. Companies can and should appeal to professional institutes and universities to arrange relevant open lectures and workshops on the subject.

Companies must familiarize themselves with relevant legislation (CIDB) (p. 49). The government's website is a convenient means of access. Short summaries of legislation are available on the CIDB website to give a simple idea of content and coverage regarding energy efficiency. During the recent G8 Summit in L'Aquila, Italy, policies were adopted to cap a 2°C global temperature increase since pre-industrial levels. Additionally, policies were adopted to cut 80 per cent of carbon emissions from existing values for 2050 but, as an example of commitment issues, both Europe and the United States disagree on reduction levels by 2020. If success is to be reached at national level as well, the principles of a stepped but systematic reduction of carbon emissions must be promoted by both government and industry.

Certain commercial companies are already offering training for professionals and technologists for best practice in the use of their energy-related products. Other companies could avail themselves of these opportunities.

Laws and regulations which are not yet mandatory should be applied by companies as a requirement for best practice.

Companies should set up their own benchmarks and indicators to measure, monitor, evaluate and report on the energy efficiency of their buildings. One good option for preparing building owners, facility managers and workers is a readily available Building Users Manual that explains the company's energy efficiency strategies simply yet concisely.

The interviewees' answers ranged from "doing energy audits" to "appointing a designated energy manager". Training and research were also mentioned. It was also suggested that companies should make use of the services of the ESCOs.

9.7. Sub-question 7:

Is a possible win-win situation (how to use the shift to energy-related improvements in construction to also improve employment opportunities) forecasted and, if so, encouraged? If not, how can it be encouraged?

Assuming that government implements the necessary legislation and regulations, the resulting demand for energy-efficient buildings can be satisfied only by a comparative supply of professional, technical, management, administrative and maintenance job resources to undertake the services required. Two categories of job resources will be needed:

- (1) existing jobs augmented with additional knowledge and skills to perform energy-related work; and
- (2) a substantial supply of new resource jobs, the nature of which are discussed in section **8.3. Types of Green Jobs**.

While the first-mentioned group will develop of necessity, they deserve as much support as possible, as discussed earlier in this report. A win-win situation, as such, has not been specifically forecasted but equipping the built environment with the necessary job resources is a foregone conclusion and strongly intimated in section 8 (Employment and Energy efficiency). Nevertheless, just meeting job requirements with the labour force is not sufficient. All ILO principles of "Decent Work" must be met, including policies and amendments relating to the abolition of child labour, poor health and safety conditions at work, social provision and tripartite relations, and salary protection in the form of a minimum wage.

Rough prediction estimates have been made (sections **8.6. Current Employment Profile** and **8.7. Employment Opportunities and Threats in South Africa**) but these are distinctly preliminary due to the limitations imposed by the time and data available to undertake the research. Further research and modelling is required to accurately determine the number of "green" jobs that can be created and sustained and, when they are, they should be monitored in order to adjust demand and supply imbalances.

A win-win situation by which synergistic growth and development in energy improvement demand is met by adequately developed job resources can at best be achieved by use of a carefully structured development model for national and regional, and eventually local, application. Various regions in South Africa differ considerably from one another in this regard. Resources are available in South Africa for such modelling. Economy in the provision of job resources is essential and the delicate balance between the need for professional, technical, management, etc. job resources and their identification and training must be achieved. In this way growth and development in energy-related improvements can occur at the same time as the associated provision of job support enables such development.

Government could conduct a major retrofitting programme of its own facilities, sustained by a training programme for technicians developed in collaboration with the South African Association of Energy Services Companies and local (independent) ESCOs. A systemic model proposed and applied by the government, as one of the largest property owners in the country, to

create, mobilize and test the model will provide a strong lead and a constructive kick-start for such development.

The responses from the interviewees differed. Some said that a win-win situation is “absolutely” possible, whereas others said that a win-win situation is possible but not currently being encouraged.

9.8. Sub-question 8:

What are the related issues not only in employment creation but also in quality of work (social protection, workers rights and social dialogue) with regard to energy-related improvements in building?

Decent Work has four pillars: the creation of more and better jobs, the extension of social protection, respect for fundamental principles and rights at work, and the promotion of social dialogue.⁷

South Africa is committed to the ILO’s Decent Work Agenda and has developed several acts, amendments, codes of good practice, regulations and notices, and sectoral determinations to regulate the South African labour market. Examples which support the ILO’s Decent Work Agenda are:

- Basic Conditions of Employment Act;
- Compensation for Occupational Injuries and Diseases Act;
- Employment Equity Act;
- Labour Relations Act;
- Occupational Health and Safety Act;
- Skills Development Act;
- Unemployment Insurance Fund (UIF) Act;
- Arrangement of Working Time Good Practice;
- Pregnancy Good Practice.

These acts provide a framework from which employers can base themselves on existing jobs and in the creation of new jobs. This legal framework supports and promotes the four pillars of Decent Work.

The construction sector creates and maintains community services infrastructure, community spaces and buildings. These all have considerable impact on the health, education, welfare and productivity of the community. Better social infrastructure leads to healthier, more educated and more productive citizens. Creating energy-related jobs according to sound social principles and decent work environments is consistent with the country’s comprehensive statutory requirements and is an opportunity not to be missed.

There are a large number of casual workers in the construction sector (3–4 informal sub-contracting employees per each formal worker). This has far-reaching implications for workers, employers and society at large, especially regarding the following:

⁷ http://www.ilo.org/global/About_the_ILO/Media_and_public_information/Press_releases/lang—en/WCMS_094092/index.htm.

- lack of productivity;
- limited or no provision for health and safety;
- minimal funding for and access to training;
- lack of job continuity and social benefits;
- no provision for collective mobilization, representation and bargaining;
- lack of awareness of legal rights (Construction Sector Summit, 2005).

The welfare of society is supported by permanent jobs. Permanent positions contribute to workers being mentored, trained and more productive, leading to better profits. Employment is only sustainable when sustained private and public investing occurs.

It is of the utmost importance that (new) jobs created due to energy-related improvement in buildings are sustainable and that they lead to the improvement of lives of not only those who use the buildings but also those who found employment because of the improvements.

As mentioned earlier in the report, there are economic, geographical, social and logistic considerations which may not always make these improvements possible. Jobs in the South African construction industry are often location-based. Workers – especially casual workers – often come from the local communities and, after the construction or retrofitting is completed, they do not move on to the next location because workers from that area are then employed. Quite often these workers have no contracts and are therefore unprotected by the numerous employment regulations. Much work remains to be done in this regard towards fulfilling the ILO Agenda.

The construction sector is one of the four sectors in South Africa with the highest workplace injuries.⁸ Energy-related improvements in buildings ought to be safer than construction in general. However, the same hazards will exist on building sites, regardless of the energy technology being implemented.

The construction sector is one of four sectors with the lowest skills level, after mining, agriculture and domestic workers. The implementation of energy-efficient technologies in new and existing buildings will create a sustained demand and lead to the more permanent employment of workers and their concomitant skills improvement.

In Section 7 the proposed systemic model for the development of energy-related improvements in buildings should be augmented to ascertain, among other things, the availability and qualification of workers in particular regions. It should cater to both quantitative and qualitative issues surrounding labour and decent work. An important component of the model will be to reference a database of information relevant to all stakeholders including a knowledge base, potential energy improvements, and the nature and extent of the labour opportunity. The structuring, extent and content of such a model will need to be underwritten and supervised by an appropriate government department such as the Departments of Minerals and Energy or Public Works.

9.9. Sub-question 9:

What constitutes good practice with regard to energy-related improvements in building?

There are several components to good practice in energy-related improvements in buildings, ranging from “soft guidelines” such as the establishment of energy management teams to “hard guidelines” such as ISO 14001, Green Star SA and SANS 2004.

⁸ http://www.engineeringnews.co.za/article.php?a_id=142361.

ISO 14001 is the international specification for environmental management used by companies that want to minimize the unsound environmental effects caused by the construction and operation of their buildings. It addresses the necessity of creating an environmental policy, determining the environmental aspects and impacts of their products, activities and/or services. It also deals with planning environmental objectives and measurable targets, implementation and operation of programs to meet objectives and targets, as well as monitoring and corrective action. It stresses the importance of management review and involvement; it is very important that there is buy-in from all levels of an organization to support the energy-management programme. ISO 14001 focuses on organizational behaviour and how changing this behaviour can be beneficial to more effective energy use.

The Green Star SA-rating tool – being developed by the GBCSA – describes several standards and benchmarks that can be used to establish how green a building is. Its energy section measures the energy efficiency in terms of specified standards. For instance, greenhouse gas emissions, sub-metering, lighting power density, lighting zoning and peak energy demand reduction. Of all these categories, energy constitutes more than 25 per cent of the total rating score. Equally, the total score determines the rating. The rating could, for example, be a 4-Star (“Best Practice”), 5-Star (“South African Excellence”) or 6-Star Rating (“World Leadership”). The use of natural light and air ventilation, as well as grey and black water, counts favourably towards a Green Star rating.

Although it constitutes only the minimum requirement, the implementation of SANS 204 is a sensible starting point for good practice.

9.10. Primary research question

The primary research question posed at the beginning of the research project was:

How, and in what way, can the relationship between technological changes with regard to energy-related improvements in buildings and the potential of employment arising from it be influenced in South Africa?

In response to this question the report finds that this relationship is quantitatively weak insofar as the required skills sets already exist to a large extent. On the other hand, the relationship is qualitatively strong in that elevating the existing skills sets is desperately needed for improved productivity and the creation of decent jobs. The report has isolated this need from the research conducted as having the most potential in terms of meeting energy efficiency requirements, greening of existing jobs and the creation of new ones within the framework of decent work.

Thus, in order to achieve the necessary upskilling and to provide improvement in education and training for those that still require it, the following must be considered in addressing the Principle Research Question.

- (1) Compulsory legislation, preferably through a Code of Sustainable Building, in relation to energy in buildings and energy efficiency standards.
- (2) Charging the actual cost of electricity to encourage alternatives and energy improvements in buildings.
- (3) Government prioritizing improvements and offering a range of incentives for retrofitting buildings for energy conservation and setting up incentives to encourage the building of manufacturing capacity in energy-efficient technology and products.
- (4) Government using the opportunity presented by the introduction of energy-efficient technology implementation in buildings to create a “green” economy, and to link the “green” economy to “decent work” job creation, skills elevation and entrepreneur development, especially among the previously disadvantaged community and disengaged youth.

- (5) Skills elevation for improved productivity and decent jobs by:
 - building a body of knowledge for energy-efficient improvements and decent jobs;
 - skills development and training specifically for these new technologies Green skills embedded in training programmes of current curricula;
 - knowledge transfer and awareness, especially for property owners and built-environment professionals using CPD programmes;
 - cataloguing of best practice and rolling this out to the sector;
 - multi-disciplinary guidelines for designing energy-related improvements in buildings in South Africa.
- (6) Providing necessary “test” or “model” buildings with energy-related improvements incorporating decent job opportunities.
- (7) Mandatory energy audits on non-residential and residential buildings.
- (8) Government providing a centralized Energy Efficiency in Buildings Agency (EEBA) to oversee the required implementation and coordinate all the opportunities within the construction sector (manufacture, contracting, and professionals).

10. Conclusions

With reference to the answers listed in the primary research question regarding the transformation in the construction industry in South Africa in an energy efficiency context, the report has drawn the following conclusions:

- (1) Job creation opportunities are likely to be low in number. Studies performed on an international scale on calculating Green Jobs do not, on the whole, provide substantial evidence as to how they arrived at the predicted number of jobs. In addition, these numbers are largely for generation of renewable energy and not necessarily for construction-related or building jobs. However, time and scope constraints applicable to this study mean that only limited data sets could be gainfully used to undertake the quantitative analysis. As such, further in-depth research is required to derive more accurate conclusions.
- (2) Quality jobs will be created, meaning permanent or non-casual employment in a safer, cleaner and more secure working environment because of the higher skill base required, and the formalization of the employment conditions.
- (3) The main job creation opportunities will be found in the manufacturing side of energy-efficient technologies. Thus, for developing countries the introduction of energy-efficient technologies in buildings should occur in conjunction with a new manufacturing capability.
- (4) In South Africa, the chances of substantial renewable energy generation occurring is quite low due to the abundance of coal and the important economic role of the mining industry in the local economy, especially with regard to employment. Thus, a move to renewable energy generation will not result in a reduction or cut-back in coal mining and production in order to protect the jobs in that sector. This also means that the potential for CO₂ emission reduction is limited and not likely to be gained through renewable energy generation in the short or medium term. Nevertheless, scrubbers can be retrofitted while keeping coal production rates high or by using more energy efficient furnaces.
- (5) South Africa must explore other means to achieve its CO₂ reduction targets. A useful method for achieving those targets is the introduction of energy-efficient technologies in buildings. This in turn will favour conditions for existing and new jobs while supporting the development of a “green” economy and creating decent work.
- (6) South Africa has the natural qualities to support renewable energy, meaning wind and high solar radiation. Having regard for the circumstances surrounding the continued use of coal as a national energy generator, the introduction of private sector renewable energy suppliers is a significant opportunity. To promote the use of these, as yet, untapped resources, consideration must be given to ways and means of encouraging private regional, local and neighbourhood renewable energy generation capabilities which can react more quickly to technological change.

- (7) With regard to buildings, the immediate gains lie in the non-residential sector, and in our experience the greatest effect would be seen in the introduction of energy efficient lighting and HVAC.
- (8) The residential sector is more restricted because houses in South Africa are, as a general rule, not artificially cooled and only partially artificially heated. Opportunities in this sector will be found in lighting, solar water heating and energy-efficient appliances. This reduces the job creation impact because the current labour force can perform all of the above. Jobs created here will arise out of the additional volume from energy-efficient appliances and will probably offer higher skilled employment.
- (9) Government has the most important role to play if this relationship between energy efficiency in buildings and decent job creation is to be successful. The housing backlog at the low-income level is in the order of 2.2 million and the backlog for social housing probably much the same. Government mainly controls this sector and can thus create at will the necessary market for the introduction of a manufacturing capability, introduce mandatory energy-efficient technologies into its housing delivery programme, “Breaking New Ground” (BNG), and facilitate the training of skilled energy efficiency workers. Similarly, the government is perhaps the largest single owner of buildings in South Africa and its commitment to retrofit will support the creation of manufacturing demand and a greener labour market. In addition, the government needs to deliver substantially more social infrastructure, particularly schools and hospitals. There are early indicators that this role is understood but committed action is still pending.
- (10) An aspect that warrants more attention is the opportunity to use unemployed youth (especially those at risk) as installers and to develop as young entrepreneurs those who demonstrate entrepreneurial skills in energy-efficient technology. The country’s youth represents the future, and future policies on training young people will ensure the legacy of a commitment to a green-environment.
- (11) Skills development structures are in place but aimed at a different level, for example, Adult Basic Education Training (ABET). The opportunity for engaging young people will require the roll-out of targeted skills development and training in the “green” technology domain.
- (12) Voluntary implementation is likely to be slow. Thus, a mandatory strategy requiring government action with regard to building laws must be applied.

11. Recommendations: Creating an enabling environment

The following quote is worthy of a reiteration:

More time should be spent embedding green skills training within current curricula and less energy inventing new programs. Retrofitting American cities, for example, requires not “green construction workers”, but rather workers with traditional construction skills who also have up-to-date training on energy-efficient construction. And even those employers who focus more narrowly on a particular green technology, say solar installation and maintenance, require certified electricians who are thoroughly grounded in electrical theory and practice. The new energy economy will create some brand new industries and many brand new jobs. But even more of it will involve transforming the industries and jobs we already have. (White and Walsh in *Greener Pathways: Jobs and Workforce Development in the Clean Energy Economy*, 2008b).

In order to draw from such a quote, the following recommendations are proposed:

- (1) Government at all levels must introduce legislation and regulation on the one hand and the provision of skills development and training on the other, together with the opportunity presented by such legislation in terms of the promotion of new entrepreneurs, particularly from the previously disadvantaged communities their disengaged youth.
- (2) Government must take a very proactive stance in the introduction of energy efficiency technologies in South Africa. This includes supporting the creation of the necessary manufacturing capability, incentives and implementation.
- (3) Institutional structures must be put in place to deliver what is required. Currently there are many opportunities and incentives, but they are difficult to access and thus ignored. The government may want to consider the establishment of an Energy Efficiency in Buildings sub-agency within the NEEA to coordinate all the opportunities within the construction sector (manufacturing, contracting and professionals).
- (4) Skills development and training specifically for these new technologies must be developed and rolled out.
- (5) Knowledge transfer and awareness, especially for the built environment professionals and property owners, must be undertaken.
- (6) At the moment, there is insufficient hard evidence within the South African property market to prove the efficacy of energy efficiency technologies, especially with regard to payback periods. Further research and monitoring are required to provide hard evidence.
- (7) The cataloguing of best practice and its roll-out to the sector is required.
- (8) Energy efficiency standards should be made compulsory through the use of a Sustainable Building practice Code.

- (9) Essential stakeholders in central government should select appropriate building programmes for energy improvements. Both new and retrofitting projects, for example, trigger major energy efficiency applications in private enterprise buildings as well. The same should be encouraged at provincial and local authority level as demonstrators of energy improvements and efficiency measures that can be undertaken.
- (10) Multi-disciplinary guidelines must be formulated for energy-related improvements in buildings in South Africa. Such a publication, prepared collaboratively by relevant institutions, would go a long way towards triggering the initial impetus which would contribute towards these improvements.
- (11) Prioritizing and offering incentives for retrofitting targets for energy conservation will encourage systematic energy improvements.
- (12) Government must set up incentives, measures and legislation to encourage the building of manufacturing capacity in energy-efficient technology and products.
- (13) Energy audits on commercial buildings would provide a basis of measurement and a monitoring capability that would assist decision-making capability which, in turn, would trigger measures for building or retrofitting energy efficiency-oriented buildings.

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