Retrofits/ renewals in buildings for energy efficiency and the building control regulations in local authorities in South Africa

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Abstract:

More than one-third of energy is consumed in buildings worldwide, accounting for about 15 percent of global greenhouse gas emissions. In cities, buildings can account for up to 80 percent of CO_2 emissions. The built environment is therefore a critical part of the climate change problem – and solution. Most existing buildings were not designed for energy efficiency, but by retrofitting with up-to-date products, technologies and systems, a typical building can realize significant energy savings. Improving the energy efficiency of buildings is a priority for reducing both greenhouse gas emissions and energy costs.

In South Africa, the developmental Local Government paradigm makes local authorities the focal points of implementing the various regulations, standards and codes for energy efficiency in buildings set by the national and provincial governments. This borrows heavily from the often repeated phrase, "Think globally, and act locally". Local authorities provide a necessary and practical supplement to national government efforts and deliver a substantial impact by just changing their regulations. Besides, they are mandated by statute, and have put in place mechanisms whereby all new buildings and retrofits/refurbishments/renewals to buildings under their jurisdictions have to go through their building control and approval departments before they are implemented.

This paper investigates the current building control and approvals regulations in local authorities in relation to energy efficiency policies for buildings in general, and for retrofits/refurbishments/renewals in particular. The paper highlights the building regulations & control mechanisms, with regard to energy efficiency for retrofits/refurbishments, in the key Metropolis of South Africa. The National policy proposal for energy efficiency in buildings, with emphasis on retrofits/refurbishment was reviewed too. It compared this with promising and innovative regulations and controls which deliver higher energy efficiency in retrofits /refurbishments in buildings in other countries to make deductive conclusions.

It has been found that City governments, commercial buildings/property portfolio owners, schools, universities, and public housing authorities can identify, design, and implement energy efficiency retrofits in all renewal building projects. Different mechanisms for increasing building efficiency include retro- commissioning, building technology replacement, and energy performance contracting.

These mechanisms can be perfected by the building regulations control departments of the various local authorities to be best practices and can be widely shared and easily adopted among them.

In conclusion, Building on the experience gained through initial retrofit projects along with awareness & education and developing sustainable financial instruments, Local Authorities can partner other organizations like the Green Building Council of South Africa in developing standardized procedures in the building regulations and control process, to accelerate the implementation of energy efficient retrofits nationwide.

Key words: Energy Efficiency, Retrofits/Refurbishment/Renewals, Local Authorities, Buildings, Building Regulations and control, Approvals, Policy.

1.0 Introduction

Buildings consume energy throughout their lifecycle - from construction to operation and then demolition (City of Johannesburg, et al, 2008). Buildings in the US are responsible for 71% of the country's total electricity consumption, and 33% of emissions (Clinton Climate Initiative, 2006). In the quest for stability in electricity supply and eventual energy security, South Africa needs to emphasise energy/electricity demand reduction via energy efficiency and real-time energy scheduling apart from increasing the supply sources.

In 2004, there were 11.2 million dwelling units in the country, and 70.6 million sq m of non-residential building space. In Pretoria, cooling and lighting alone was responsible for 75% of energy use in office buildings (CSIR 2004). Cost effective energy efficiency retrofits to this existing building stock can result in major energy savings.

Ward and Schäffler (2008) in a trends paper for Gauteng Province in South Africa, clearly outline energy security, carbon mitigation and environmental impacts, and economic development and competitiveness among other things as the main motivation behind the urge to use renewable energy and implement energy efficiency policies. Further on, Ward and Schäffler (2008) report that energy consumptions in Johannesburg and surrounding metropolis indicate that industry accounts for 16% and transport for 60% of energy demand, Domestic use 16% and government, commerce and local authority 7 %(refer to Figure 1). The combined energy use by the domestic, government, commerce and local authority sectors contribute to a total of 22%; the energy in this sector is mainly used in buildings thus emphasising the need to implement energy efficiency polices in that area.

Retrofits of buildings is a sure way of improving energy efficiency in buildings, this is supported by Maisely and Beverly (2007) and Reeves (2008) who reiterate that it reduces energy consumption by the elimination of aged components and also by ensuring that the technology used is not obsolete.

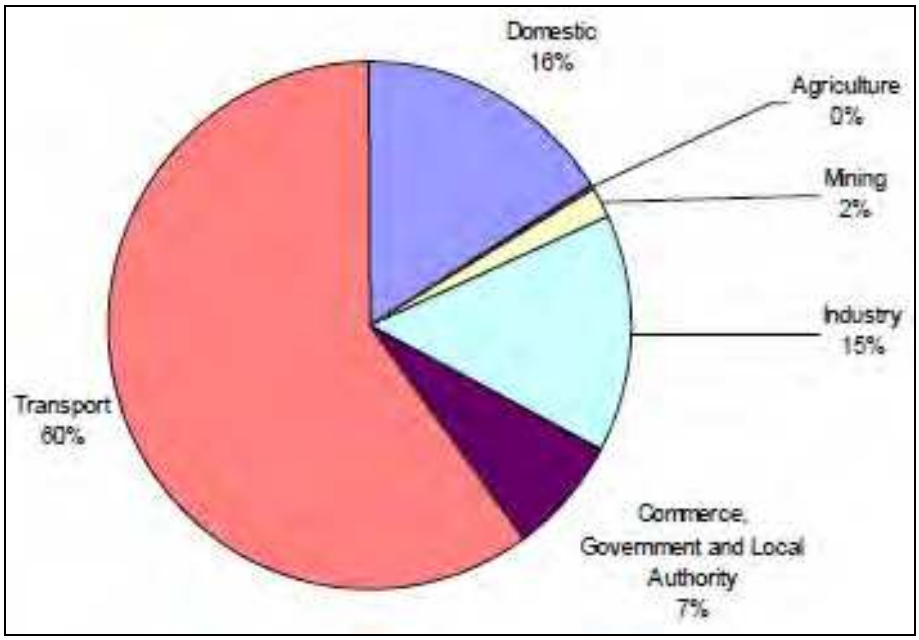

Figure 1: Energy consumption by sector in metropolitan areas around Gauteng Province; Source: Ward and Schäffler, 2008

Ürge-Vorsatz et al (2006) report that the la rgest savings in gross electricity de mand can be delivered by applying electricity efficien cy m easures such as efficient ligh ting, ventilation and cooling; in the case of bu ilding retrofits accounts for up to a third of these savings. In support of this the Ener gy Efficiency Strategy suggested by the Republic of South Africa (2008) proposes retrofits as one of the higher-cost interventions m easures with sho rt p ayback peri ods; this is in addition to a cocktail of measures th at are low cost and can be ca rried out with imm ediacy. As part of the strategy, the following are proposed (Republic of South Africa, 2008): (1) m andatory standards and audits for en ergy efficient HVAC, lighting a nd non-electric appliances and (2) energy m anagement system s in the buildings sector fo r r etrofits. Th ese proposals could be effectively led and im plemented by the local authorities through the building regulation control function. In specific , the energy efficiency m andatory audits should be carried out alongside the schedule of others like fire, health and safety, which the local authorities do periodically.

Bennet (2001), du Toit (2006) and Reinink (2007) demonstrated that developing national regulations and standards for buildin g's energy efficien cy and/or sustainab le buildings is critical in achieving greater energy efficiency and provides a great potential towards reduction in green house gas (GHG) em issions, apart from being a sound investment. South Africa's nati onal building regulations and building standards act (Act no 103 of 1977) [1] is adm inistered by local autho rities and is the enabling legislation for the national building regulations (Holde n 2004, du Toit 2006). This act details the process of enforcing the national building regul ations by lo cal autho rities. As a result, all building plans (including m ajor alterati ons/retrofits) must be approved by the 'building control and approval' departm ents in th e local au thorities be fore

[1] National Build ing Regulations and Build ing Standards Act 103 of 1977. Avai lable at http ://www.capetown.gov.za Accessed on 2009/06/10

implementation. This provides an important opportunity for the local authorities to intervene by insisting on mandatory or voluntary regulations for energy efficiency in their building control and approval process. This concept is further aided by the fact that the local authorities are permitted to make by-laws within their areas of jurisdiction. As such the introduction of energy efficiency by-laws by the local authorities could be used to effect regulations for retrofits in these areas. However, it is important to note that South Africa's national building regulations and building standards act (Act no 103 of 1977) is silent on the idea of retrofits for energy efficiency. This therefore makes it a necessity for the local authorities to enact by-laws which are specific to energy efficiency retrofits so as to ensure controlled implementation and regulation to derive maximum benefits. South Africa is not alone on this, it has been written that former US Vice President, Nobel Laurite and Global warming activist Al Gore once got blocked from installing solar panels on his house because the local authority by-laws did not allow it. It took several months to change the building codes, which were unrelated to solar power, to grant him permission for the installation.

It is encouraging to note that energy efficiency based retrofit regulations are affordable, this is demonstrated by UNEP (2008) and WGBC (2009) who are of the opinion that 'available commercial technologies' make it possible to halve energy consumption in both new and old buildings without significant investments. These could be done at least cost by incorporating measures like improved ventilation and insulation, increased use of natural lighting, the use of energy efficiency appliances and lighting alongside the use of renewable energy sources in the building control and approvals regulations.

There is general acceptance that building energy codes in building regulations as effected by local authorities are an important energy policy instrument (IEA2008, EC 2006). Usually, Building energy regulations impose mandatory minimum energy performance requirements on new buildings and, deemed to include large extensions. This being true, it's therefore relatively a small step to apply the same to refurbishments/renovations/renewals, especially major refurbishments of entire buildings (building research establishment, 2008). This can be through mechanisms like energy labelling and periodic mandatory energy audits by the building control departments of the local authorities. For existing buildings, energy upgrading regulations would demand replacement of components after a certain number of years, (Klinckenburg and sunikka, 2006).

2.0 Methodology

The paper focused on literature review on the use of regulatory and control mechanisms as a policy strategy towards achieving greater energy efficiency in existing building stock with the local authorities' department of building control and approvals process as the enforcing agent. A general scenario on the regulatory framework on retrofits in the world is presented followed by specific situation studies/cases in South Africa. It must be acknowledged that this area is relatively new in South Africa and in many developing countries around the world and as such, much is yet to be published. This paper is therefore limited by scope because of its over-reliance on literature review. It should be pointed out that this forms a preliminary stage of an ongoing research and a field based study is scheduled later this year.

3.0 Energy efficien cy regulations in buildings in general and for retrofits/refurbishments/renewals in particular in local authorities

Several instrum ents or options are available for the prom otion of energy efficiency in buildings. Van Egm ond (2001), OECD (2003) , Kuijsters (2004) and Reinink (2007) separately affir m these options as regulat ory, fiscal, econom ic, or comm unications instruments. These instrum ents m ay take th e for m of direct re gulatory instrum ents, indirect regulation or information instruments (refer Figure 2). It is worth noting that the choice of these instruments by governments is determined by the level of success that is achievable when applied. This is however variant on the socio-econom ic and pol itical context of the locality.

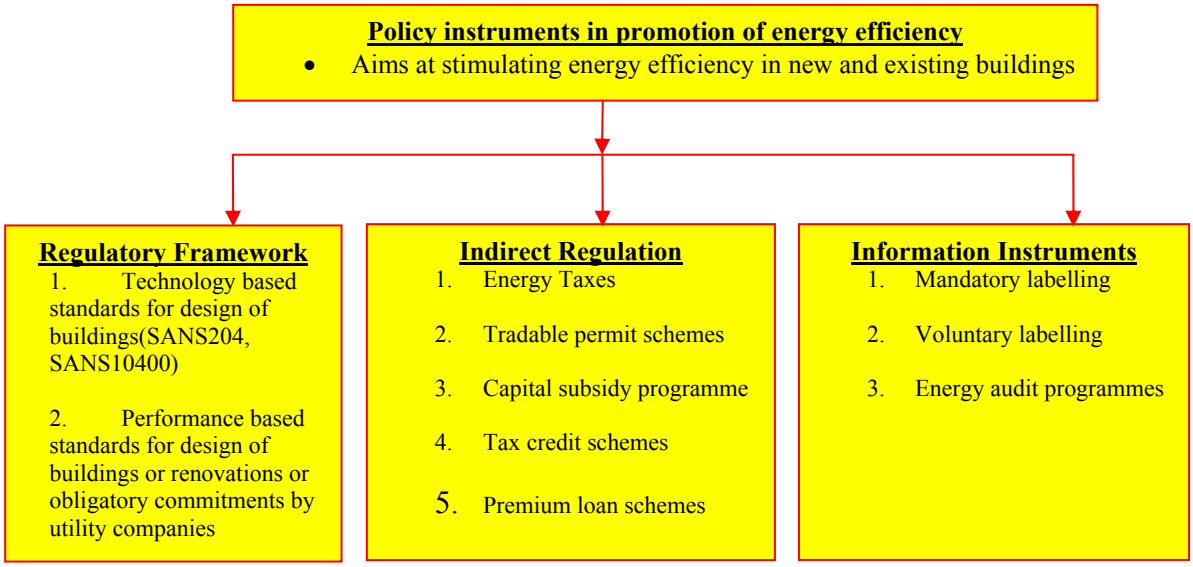

Figure 2 Instruments for energy efficiency implementation in buildings; Adapted from OECD, 2003)

It is noted as an example that implementation of the building codes have reduced energy consumption of dwellin gs in the U SA by a bout 30%. The local autho rities here h ave taken leadership in energy efficiency legisl ations in bu ildings and throug h the Na tional Association of Counties (NACo) and the Mayors Conference have achieved 97% use of more efficient lighting in buildings, about 90% require, or anticip ate requiring in the next year that new c ity buildings an d lar ge retr ofits be energy efficien t. The Chinese government have established an energy consum ption target in buildings which is 65% less than the current pra ctice in exis ting buildings, this is via an 'energy consum ption standard' for the construction sector whose co mpliance is en couraged by tax and fees rebate system for low energy buildings to encourage their constr uction and retrofits (UNEP, 2007). On the other hand energy regula tions in buildings in Netherlands have reduced the consum ption rates by 15% on its introduction in 1995 and later by 27% on

tightening of requirements (Ecofys, 2004). Other countries where the introduction of energy regulations have been successful are Denmark where the act to promote energy and water savings in buildings (DEA, 1996) [2] is in use and India where the energy conservation act was enacted in 2001[3].

In South Africa, regulations governing energy efficiency in buildings is still at an infancy stage. The specific ones dealing with retrofits/renewals or refurbishments are almost non-existent. This is mainly covered under the electricity regulation act [4] that stipulates that the regulator shall take into account the energy efficiency measures undertaken by the client while deciding on tariff structure and the Electricity regulations for compulsory norms and standards for reticulation services[5].

It is expected that these regulations would stimulate increased drive towards energy efficiency in new buildings and existing stock. In addition, it should be noted that the draft standard for energy efficiency in buildings was unveiled in 2008 and if adopted as the national standards would contribute greatly to energy efficiency in buildings. These are SANS 204[6] Parts 1, 2 and 3, Edition 1.

The newly published building standard is expected to eventually legislate on insulation levels, solar water heaters and energy-efficient lighting and will be prescriptive. While intended for mandatory application in new buildings, SANS 204 can also be used for voluntary energy efficient retrofits of existing buildings, as the owners strive to reduce their electricity and energy accounts. At the same time, the SABS 0400 (the Building Code) is in the process of being rewritten to be SANS 10400 to take into account the energy efficiency standards of existing buildings (Reynolds, 2007, du Toit, 2007).

SANS 204 specifies the general requirements for design and operation of energy efficient buildings with both natural and artificial environmental control and subsystems. One key issue in SANS204 which targets retrofits (Standards South Africa, 2008)[6], is the emphasis on purpose driven planned maintenance of the mechanical/electrical components; which is advised to be in line with broader economic and energy efficiency agenda.

Enforcement of energy efficiency regulations in buildings by Central or Local government department/agency charged with reviewing designs and performing pre, in-situ and post construction inspections is the most common situation in the world

[2] Danish Energy Authority (DEA) 1996, Act to promote energy and water savings in buildings, no. 485 of 12 June 1996, legislative document

[3] Government of India, 2001, Energy Conservation Act, 2001, September 2001

[4] Republic of South Africa, 2009, Electricity Regulation Act, 2006 Notice 139 of 2009, Government Printers, Pretoria.

[5] Republic of South Africa, 2008, Electricity regulations for compulsory norms and standards for reticulation services, Government Printer, Pretoria.

[6] Standards South Africa (2008) SANS 204-1:2008 Edition 1, Pretoria, South Africa.

(Building Research Establishment, 2008). In South Africa, it is envisaged that the implementation of SANS 204 will fall under the docket of local authorities. It is however noted that it will take considerable time for South Africa to effectively start applying energy efficiency requirements in building regulations in new buildings, besides the retrofits. Holden (2004) approximates this to take a minimum of five years.

At the moment, it is clear that local authorities are ill equipped in implementing and enacting local building regulations due to legal and technical incapacity (du Toit 2007). In fact, the National and Provincial governments are equally handicapped. As a result it is envisaged that the problem be sorted out by rewriting their bylaws with energy efficient regulations such as limiting the quantity of energy consumption in buildings through setting maximum energy/m^2 caps and making the same to be part of the building applications and approval regulations. This will then subsequently cause all existing stock to be retrofitted to meet this requirement. In the absence of local regulatory powers, cities can consider developing local guidelines or standards. For uniformity and acceptability, these should ideally be based on existing standards and norms and best practices from similar jurisdictions.

The approval process for new buildings or alterations as prescribed by the National Building Regulations and Building Standards Act 103 of 1977 and effected by the local authorities revolves around Administrative matters, protection of property and public health, safety and convenience for the users and occupiers of the buildings. During submission for approvals, key items required are as follows (City of Johannesburg, undated):

i. Completed application form, signed by the owner of the property or his/her authorised representative (proof of authorisation is required)
ii. A copy of the registered title deed
iii. A copy of the approved Site Development Plan is also needed, if this is required in terms of the zoning regulations that apply to the stand.
iv. A separate form also needs to be completed by a professional engineer or technologist registered with the Engineering Council of South Africa when structural work such as reinforced concrete floor and roof slabs, special reinforced foundations, and so forth are part of the proposed building.
v. Different certificates or designs need to be submitted depending on the technical aspects of the plan. You should consult an architect or engineer in this regard.
vi. In the case of non-residential developments (for example, offices, factories, shops, institutional buildings and so on), a zoning certificate with a copy of the most recent Amendment Scheme is to be furnished.

There is no requirement for energy efficiency codes certification to deal with envelop energy issues, HVAC systems, lighting & hot water systems in the building, or for retrofits to be energy efficient in the case of alterations.

A preliminary evaluation of an energy efficient retrofit project in Ekurhuleni Metropolitan Municipality, in greater Johannesburg is presented below.

4.0 Results of energy efficient retrofits: The case of Ekurhuleni Metropolitan Municipality, Greater Johannesburg

In a case to retrofit the buildings at the Germ iston Civil Centre at Ekurhuleni Metropolitan Municipality in 2005, 23 zip hydroboils, 2003 CFL lights, 90 LED lights, 15 Geyser Timers and 96 8ft. fluorescent tubes were used (Parra, 2005). Results on the case study undertaken at the at Ekurhulen i Metropolitan Municipa lity(EMM) indicate that close to 53% of energy savings coul d b e re ached in build ings in the g reater Johannesburg area(Parra, 2005). (Refer Figure 3 and 4)

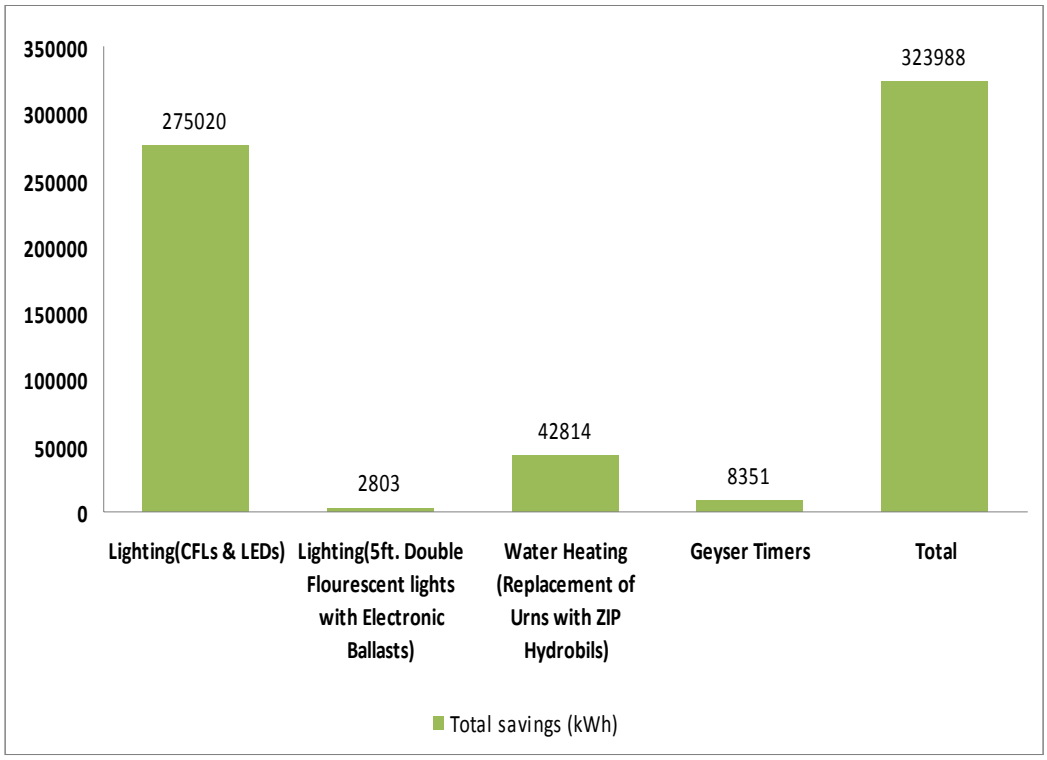

Figure 3: Electricity Savings in kWh for retrofits at Ekurhuleni Metropolitan Municipality

Considering that EMM represents about 5.6% of South Africa's electricity demand savings realized in this case study is rem iniscent of the possibilities that could be achieved with properly regulated and controlled energy ba sed retrof its in buildings (Ekurhuleni Metropolitan Municipality, 2004).

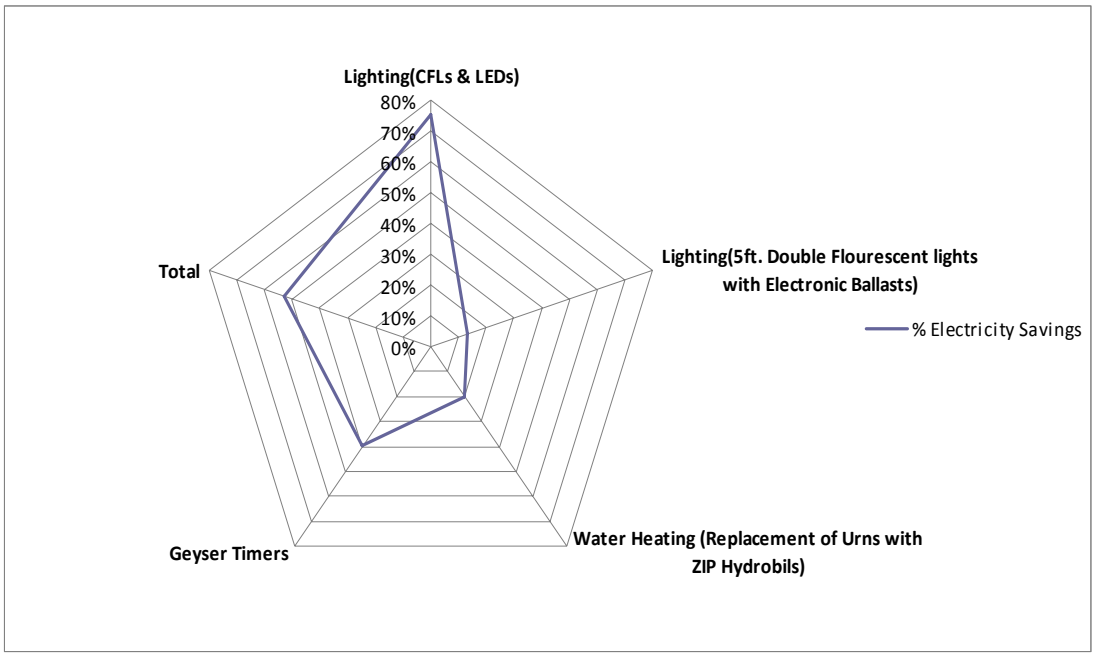

Figure 4: Radar Plot showing % Electricity Savings due to retrofits at Ekurhuleni Metropolitan Municipality. Source; Parra, 2005

5.0 Possibilities towards compliance to Energy Codes

The Building Research Establishment (2008) proposes mandatory compliance with minimum energy performance requirements for both new and existing buildings. Thus the buildings are required to be formally certified by private assessors paid for by the building owners. It is further suggested that the process be audited by the authority under which the code is issued (Building Research Establishment, 2008). Thus the following enforcement model is idealized by RICS (refer Figure 4). In South Africa however, the local authorities have a well established buildings control and regulations framework and structure and there is a deliberate intention by government to retain and create employment at local levels. In consideration of this the model proposed by Wafula *et al* (2009) is recommended; under this model the enforcement and the certification be done by these local authorities (refer Figure 5)

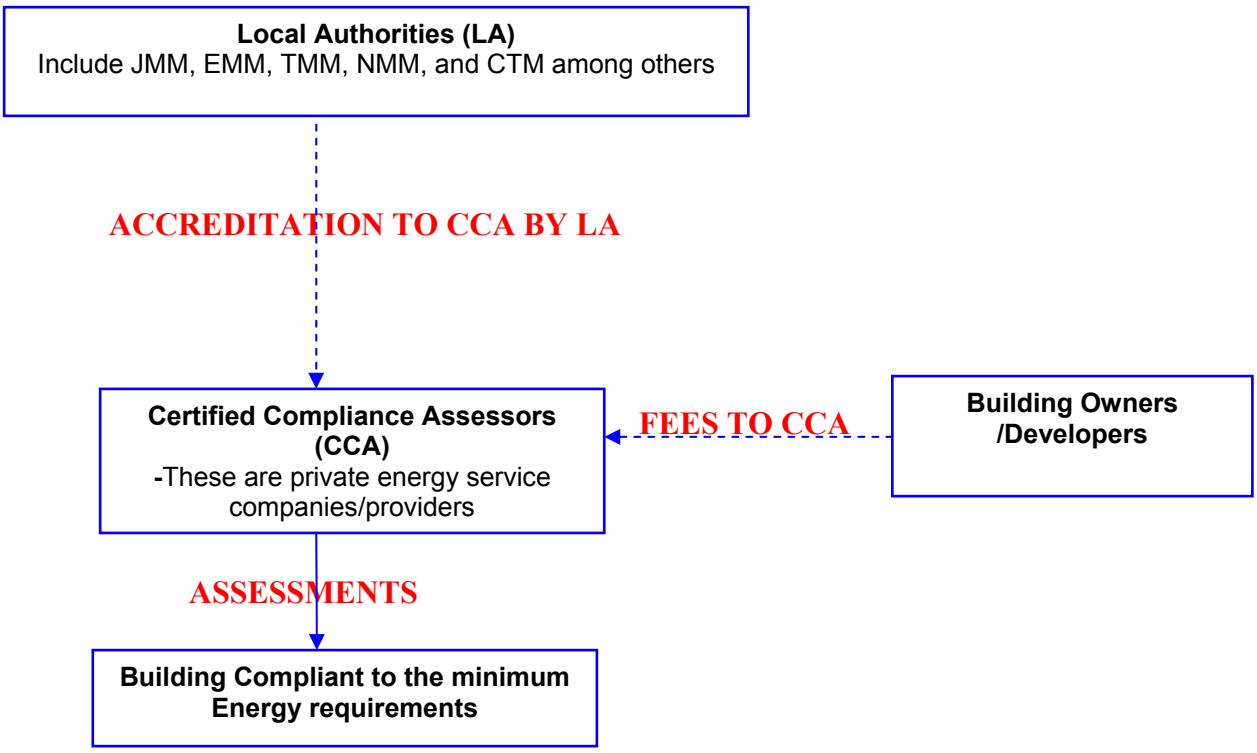

Figure 5: RICS compliance enforcement model, Source: Building Research Establishment, 2008

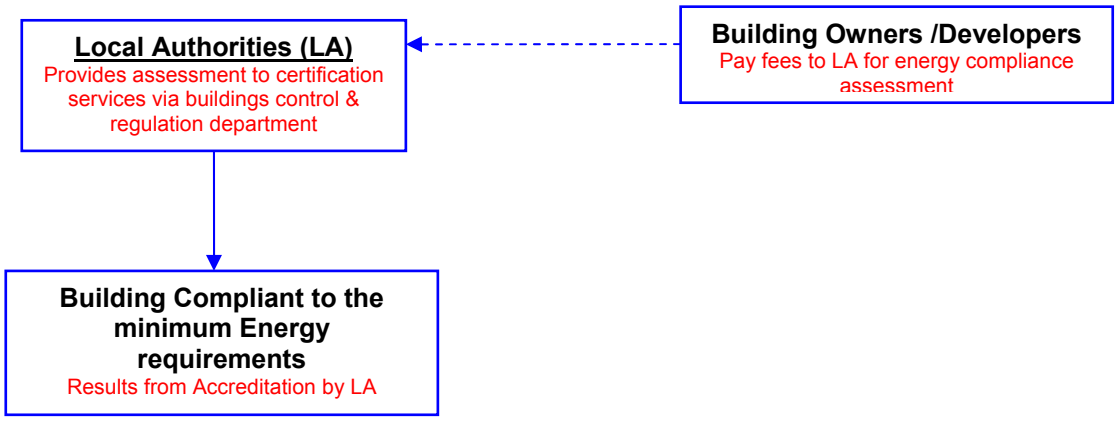

Figure 6: Proposed compliance enforcement for the Local Authorities in South Africa, Wafula *et al*, 2009

As indicated earlier in this pap er, local authorities are m andated to e nforce build ing regulations within their areas of jurisdiction, as per the Act (103 of 1977). Som e cities have exp lored this p ossibility b y de veloping loca l e nergy ef ficiency bu ilding regulations, but have since abandoned this pr ocess given that building regulations are

established nationally in order to prom ote uniformity within a vast sector, and the regulations for retrofits are ev en more difficult to enforce because of the high financial costs involved. However, few building tenants in South Africa are starting to show signs of de manding better energy perform ance, a nd som e landlords have discovered the financial benefits of improving efficiencies, although landlord / tenant relationships and building management systems in m any cases work against change. The Green building council of South Africa (GBCSA) and the South African Property Owners Association have partnered to bring into the m arket an energy efficiency rating tool especially f or commercial new and large retrofit projects. This is supposed to be a requirem ent as part of the sell and transfer documents for properties among their members. Currently, this is a voluntary mechanism targeting large prope rty holding companies and developers but it is hoped that eventually, when the above start to show m onetary savings in their operations, other sm all scale p roperty owners w ill sca le up their ac tivities and r etrofit for energy efficiency. Municipalities are also actively and continuously looking at new by-laws to address these issues, like Johanne sburg has energ y efficiency guidelin es for new buildings. It is hoped that the next step will be the publication of requirem ents for retrofits and m aking the sam e m andatory. It is therefore urgent that property owners/developers smarten up quickly.

6.0 Worldwide Scenarios

Around the world, building controls and regulat ions with regards to energy efficiency for retrofits are evolving and are bei ng im plemented significantly by voluntary standards (refer to Figure 7).

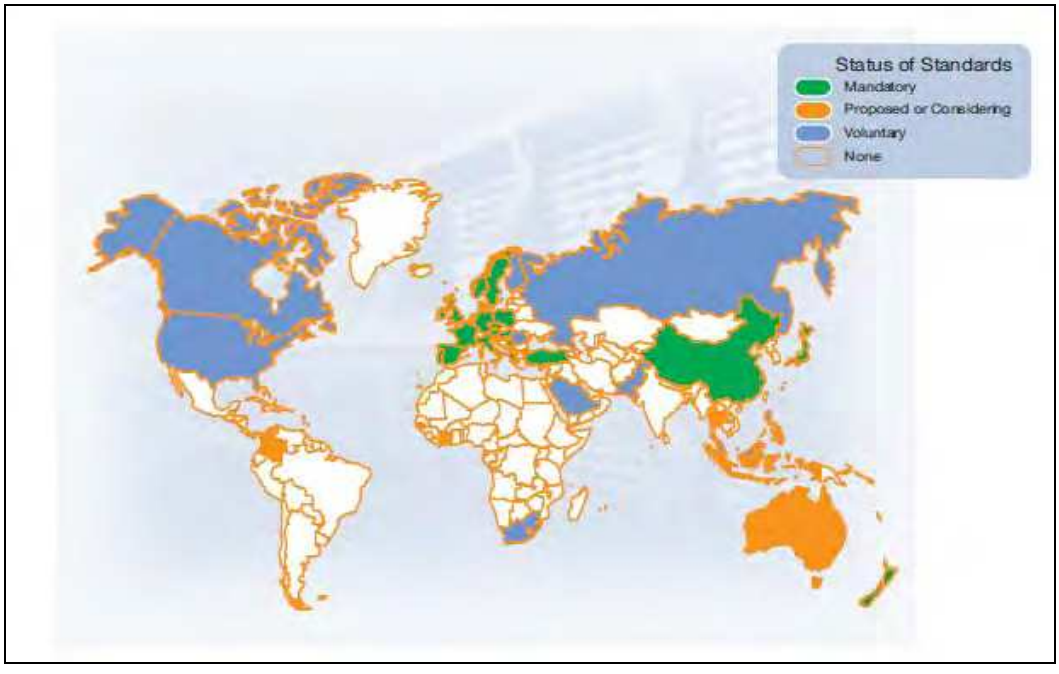

Figure 7: Status of energy building standards around the world; Source: Busch 2000

In the Scan dinavia, there is a g eneral norm of using nationa l building codes and standards, which regulate phy sical, the rmal and ele ctrical requirem ents of building

components, service systems, indoor conditions, health and safety standards, operation and maintenance procedures and energy calculation methods (UNEP 2007b). A number of building codes currently include energy performance standards, limiting the amount of energy that buildings can consume. The building codes in Scandinavia are enforced by the various building development control agencies in the respective countries.
It is reported that currently there is the renewable energy and energy efficiency partnership (REEP) project aimed at promoting the concepts of low-energy buildings in China, the results will be incorporated in proposed new legislation regarding low-energy buildings by Chinese government in order to ensure that appropriate policies and building codes are implemented to encourage and deliver the required reduction in energy consumption (UNEP, 2007). This targets retrofits as well as new buildings. The implementation of elements of these codes are to be piloted by the four major municipality cities of Beijing, Shanghai, Tianjin and Chongqing and other economically developed big cities such as Shenzhen (Ling et al, 2007).

The European Union is the one area which has a specific regulatory requirement for energy efficiency for retrofits. It often uses directives for regulating various environmental themes whose implementing agents are various government departments in the respective member states. In most cases, this falls in the ambit of local authorities in the respective countries. The directive on the energy performance of buildings was enacted in January 2003 and its main elements are specified as follows (UNEP 2007b):

i. Minimum energy performance requirements, for new buildings and for major renovation of existing buildings larger than 1000m^2;

ii. Energy performance certificates to be made available when buildings are constructed sold or rented out;

iii. The year 2010 is the reference year after which the rules will be extended to apply to all buildings and renovations(at the moment buildings below 1000 m^2 are not covered)

In the United States Green Building council (USGBC) has been central in developing the energy efficiency standards for both new buildings and existing stock. Using a member's consensus system, they have developed a LEED rating tool for commercial construction and major renovations/retrofits. It ranks buildings as Certified, Silver, Gold or Platinum depending on the level of sustainability achieved by construction or retrofit (Sussman, 2008). It is a credible and universally applicable system which has gained wide acceptance.

7.0 Discussions, Recommendations and Conclusions

From the foregoing literature, it is evident that several developing countries have already enacted legislation on energy efficiency in buildings. These regulations and guidelines, including the ones issued by the city of Johannesburg, target new buildings. However, only a few evaluations or studies are available to show the best way to apply this legislation to achieve energy efficiency goals in buildings and especially in retrofits. Due to late entry into energy efficiency practice, most developing countries lack quantitative data and are mainly reliant on data from the developed nations; this poses a

contextual problem taken that their programmes may not be applicable to the prevailing local condition. This can be seen in the cas e for South Africa which has had to borrow quite heavily from the Nordic countries and Australia in for mulating its energy efficiency codes in buildings (Reynolds, 2007).

Developed countries find solace in the fact that increasing energy prices will continue to be the catalytic driver for im proved energy efficiency policies in developing countries. In South Africa, th e m ain electricity utili ty co mpany 'Eskom' success fully lobbied to raise tariffs by near ly 32% and currently is seeking 35% increase pe r year for the next three years (Engineering News, 2010). As a resu lt it is expected th at the South African government will in respo nse empower the local authorities as the electricity dis tributing agencies to incorporate energy efficiency m easures in the ir build ing control processes and bylaws, besides en gaging in tr aining of the built environm ent practitione rs a nd advocacy to the general citizenry.

The end of an Era of cheap energ y in S outh Africa, and the need to create more construction work in the building industry fo llowing the end of world cup associated works, m akes it n atural tha t re trofits a re goin g to be an im portant driver of the construction work in the econom y. It is therefore strateg ic and necessary for South Africa to capita lise on this and use the local authorities as the enforcing agents for energy efficiency cod es in building s. This is m ade easier by the f act that in So uth Africa, the local au thorities are considered th e most important party in service delivery (Republic of South Africa, 1995). It is noted that in S outh Africa, energy efficiency policies are in various governm ent agencies and departments (these are Departm ent of Energy, Departm ent of Minerals, ESKOM, NE RCSA, De partment of Public W orks, Roads and Transport), the policy implem entation details is therefore a challeng e. For the building sector, it is recommended that the local authorities should take the initiative and follow the lead prov ided by the city of Potchefstroom and effect energy efficiency regulations for retrofits through their bui lding control and a pprovals regulations processes and systems.

The m ost direct and comprehensive way to ach ieve en ergy efficiency in building s in general and existing building stock in partic ular is throu gh the change of building regulations. Local authorities find them selves in positions of developing and implementing the building regulations in ar eas under their jurisd iction. Through this authority, they can get direct and assured en ergy efficiency benefits in retrofits by enacting and im plementing high yield specif ic design regulations which require no additional cost. This may include a planning tool like addition of vegetation requirement in an alread y built up area. This will lo wer temperatures during sum mer and reduce heating costs. As new technologies develop, many other specific cost effective design elements will presen t opportunities for target ed m andates in retrofits. Changing fro m conventional hot water heating system to solar water heater s in dom estic buildings is another key regulation which should be implemented urgently in retrofits. Heating water can take up to 15-25% of the energy use in a hom e and a solar water heater can cut annual operating costs by up to 50-80%. In 2000, Barcelona im plemented such a requirement and was subsequently followed by other cities all ove r Spain successfu lly.

In South African cities, several former Apartheid Era 'Hostels' and many other former office blocks are being converted into residential use. This gives local authorities an opportunity to require mandatory incorporation of solar water heaters with every retrofit application submitted for approval. This can then be rolled out to all other residential applications retrofits made to the respective local authorities.

It should be emphasized that the success of the Building Regulations is highly dependent on compliance by the construction industry hence the need for Local Authorities to invest in continuous training and advocacy of Building Control Officers and Built Environment Professionals on the energy efficiency regulations and their application. Getting voluntary action is slow and sometimes difficult to measure results. Local authorities should make it mandatory for the professional practitioners submitting retrofit/refurbishment plans for developers to show an energy efficiency commitment statement in their briefs as a precondition for approval for redevelopment. Similarly, such mandates should also be required upon sale of commercial and residential real estate before a transfer can be effected. This provides a unique attractive opportunity for enhancing energy efficiency in both new buildings and retrofits.

For the case of the existing stock owned by the municipalities and the local authorities themselves, operational practically requires that they examine them first for energy efficiency and retrofit them appropriately as pilot/case projects. There are many obvious resources which can be explored in detail to deal with this. One stand out practise is the employment of Energy Service Company (ESCO). The ESCO develop, design and finance the energy efficiency project/program on behalf of the local authority on its premises. They install and maintain the energy efficiency equipment involved, measure, & monitor and verify the programs energy savings. They also assume the financial risk that the program will deliver the amount of energy savings guaranteed. This is appropriate for the local authorities since they do not have upfront costs and the ESCO's get paid from the savings generated by the program. This allows the local authorities to deliver their normal operations without additional financial burden for energy efficiency programs on their building stock. Significantly, results of these programs can subsequently be rolled out to all other large building stock holders in their jurisdiction. The challenge to the local authorities in this arrangement lies in establishing appropriate procurement legislation which protects its interests at all times. For South African local authorities, this is an attractive and fiscally sound means of financing an energy efficiency upgrade/retrofit in local authority buildings.

Energy efficient retrofits/renewals and refurbishments do involve a high financial outlay. Getting appropriate finance for it is therefore important to its success. In South Africa, these interventions in refurbishments could be viewed as reducing demand. This should then be eligible for funding from sources like Eskom DSM Fund. Appropriate partnerships should be created between the local authorities building regulations control entities and the above funds administration systems to make it mandatory for the recommendations of the local authorities to be part of the criterion used for developers to draw from it. However, the South African local authorities can develop additional revenue streams to support energy efficiency new and renewal/retrofit programs in their jurisdictions and compliment the Eskom DSM programs. In a scheme that can serve both to raise funds and promote installation of renewable energy, the local authorities

can introduce a fee, of say R5000 for all new developments and large retrofits of over 2000 square feet if they fail to include the installation of a two kilowatt solar photovoltaic system or equivalent renewable energy system. Similarly, homeowners who consume energy beyond reasonably forecasted budgets, especially on energy intensive activities such as heating outdoor pools or spas can be charged a mitigation fee of say R5000 if they fail to install energy efficiency or renewable energy systems. The funds collected can be used to promote energy efficiency and renewable energy policies in buildings. Also, the South African policy makers should look at the Property Assessed Clean Energy (PACE) financing mechanism as a tool in overcoming barriers to commercialised building retrofits (Pike Research, 2010). This way, the goal of energy efficient retrofits will have made a giant step forward.

In terms of the mode of policy implementation, South Africa can borrow a leaf from the EU and set a minimum space (in area terms) for retrofits which must be certified by the local authorities. It should also be noted that although best practices and experiences can be shared and regional cooperation is useful, building code specifications especially for retrofits cannot be uniform for all parts of a country due to climatic, financial and other peculiar differences. This further fosters the idea of local authorities as the ideal enactor and enforcer for energy efficiency codes for retrofits in buildings.

An appropriate Education and Outreach programme to raise awareness is key to implementing successful energy efficiency retrofits regulations through the building regulations and control mechanism, in the local authorities. This should target developers on the economic/financial benefits of energy efficient buildings, and demonstrate the technical options for retrofitting of existing buildings to the technical professionals in the industry.

Research gaps exist in several areas of energy efficiency in buildings in South Africa, an example is the lack of costs estimation data for energy-efficient retrofits vis-a-vis ordinary business as usual retrofits. Financial specialists in organisations do not look at energy efficient retrofits as Investments, but rather as facilities Expenses measured on straight line depreciation scale just like building consumables; hence there is no efficient market guidance for energy-efficient retrofits in buildings. This causes low sensitivity to energy-efficient retrofits issues in the maintenance of buildings. Research and studies in these areas will enhance learning and help make improvements in program designs for energy-efficiency retrofits in buildings in future.

South African Local authorities play a significant role in the energy efficiency agenda. This is because much of the implementation is done at the local level. They can move forward and enact and implement proactive and innovative building regulations which address the challenges of energy efficiency in existing building stock.

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