It is critical to be one network of municipalities, not competing and not atomized – municipalities are stronger together – and energy plays a key role here.

Megan Euston-Brown Director Sustainable Energy Africa

Energy is at the heart of the municipal system and revenue – there is no option but to look forward...however we are still failing to unlock the stubborn attachment to the status quo.

Xolile George CEO SA Local Governments Association

State of Energy in SA Cities 2020 launch
The aim of the South Africa Buildings Programme is to achieve net zero carbon (NZC) new buildings by 2030 – and to make this as simple and achievable as possible.

It is a pioneering city-wide, market-scale transformation climate action in a developing country context and focuses on 3 cornerstones – policy, regulation and awareness. The C40 Cities Climate Leadership Group (C40) programme, made possible by funding from the Children’s Investment Fund Foundation (CIFF), has been operating in four South African cities for 3 years now, building on a foundation of 20 years of energy and climate change activity in these cities.

Under the South Africa Buildings Programme (the Programme) each of the cities has dedicated Net Zero Carbon (NZC) capacity in the form of technical officers, with extensive expert support. Two city policy documents have been council approved for public participation (completed) and draft bylaws have been developed. Vertical and horizontal teams and processes of collaboration have been established across the wide variety of built environment actors from the private sector to national government. Legal and financial briefings have untangled complexities and provide accessible information and insight. Data on buildings has been collected and analysed to underpin the evidence base for policy impact. Essential tools have been developed for the market including the *Getting To Zero* manual for developers and compliance software benchmarked for South Africa. Extensive NZC education is being rolled out and a communications campaign and web-hub initiated to build the knowledge and interest of a range of stakeholders. NZC is now common parlance in all four cities, and in national government circles.

Buildings, the basic fabric of a city, can be thought of as the ‘gateway’ sector for reducing carbon emissions – they have the lowest abatement costs when compared to other sectors, and both municipalities and national government have significant control over buildings. It is, however, a sector of extremely detailed regulation at the national level, with the split responsibilities of national and local powers being somewhat contested. It is an area of very variable enforcement at the local level – in its research, the Programme found that it is not unusual, for example, for almost half of approved buildings to be non-compliant with energy efficiency regulations. It is an area often hampered by a serious lack of capacity in building control departments; an area where safety issues preclude focussing on other issues; and a sector which is heavily impacted by economic recession. Not least, a fifth of dwellings in these cities are in informal settlements where there is zero building control; and formal subsidy housing is severely constrained by lack of funding and capacity to deliver.

This Programme must by necessity interweave politics and process with technical issues to drive the urgent climate step-change needed to reduce carbon emissions in this critical sector.
Overview

In 2018 four South African metros - Johannesburg, Cape Town, eThekwini and Tshwane - signed the Net Zero Carbon Buildings Declaration, established by C40, joining other pioneering global cities in a commitment to decarbonise buildings.

This commits the cities to achieving ultra-efficient buildings, powered by renewable energy for all new construction by 2030 and for existing buildings by 2050. This is aligned with achieving the ambitious goals of the Paris Agreement, pursuing efforts to keep global heating at 1.5 degrees Celsius. It also aligns powerfully with national strategy and the post-COVID recovery approach to ‘build it back better’.

The C40’s ‘Deadline 2020’ report, following on from the 2015 Paris Agreement, set out the critical role that the world’s greatest cities have to play in preventing catastrophic climate change by acting NOW, ramping up ambition and going to scale.

As municipal government in South Africa has the function to regulate and enforce building codes under the National Building Regulations, cities can contribute significantly to the South African government’s commitment to making a fair contribution to the global effort to reduce GHG emissions through energy efficiency and renewable energy actions. Together Johannesburg, Cape Town, eThekwini and Tshwane aim to accelerate implementation by developing policy and regulation that goes beyond the current national building regulations.

The Programme target is for all new buildings (including renovations/extensions) to be Net Zero Carbon (NZC) by 2030 (all existing buildings should be NZC by 2050). If this is achieved, the four cities would contribute one quarter of total national mitigation potential in the buildings sector.

The Programme depends on the strong foundation of climate work in South African cities which dates back to 1998 when the first sustainable energy advisors were placed in cities under the Sustainable Energy and Environment (SEED) programme. Since then, cities across SA have been producing state of energy and carbon reports, energy and climate action plans and implementing projects.

It is intended under the Programme that policy and regulation be put in place to drive NZC new build by 2030. To this end a technical officer (TO) was deployed in each city in 2018 to drive and hold the work, and Sustainable Energy Africa (SEA), a South African not-for-profit of 20 years standing, was appointed by C40 as the local implementing partner and manager of the Programme. SEA manages the TOs, provides training and technical support, facilitates programme outreach and ensures vertical integration with national government departments. In the cities, the work is generally located in the development planning/climate change structures of the cities, and is horizontally integrated with building control, spatial planning, energy/electricity and environment.

Running in parallel with the Programme is the C40 Climate Action Plan Programme (CAP) in which all the four cities are also engaged. On the one hand, the Programme provides a critical ‘test’ implementation area of the cities’ mitigation and resilience plans, and on the other, the CAP provides vital context and perspective for the Programme: NZC buildings are a ‘big hitter’ building block in the greater plan for NZC cities.
A Net Zero Carbon (NZC) building is a highly energy efficient building with all remaining operational energy use from renewable energy (preferably on-site) to achieve net zero carbon emissions annually in operation.

Also see the ASHRAE Guide to NZC building in South Africa

How does the market see green building?

While internationally evidence indicates that green buildings are a higher-value, lower-risk asset than standard structures, there is still a hurdle to uptake in South Africa due to efforts to keep costs as low as possible and perceptions amongst some developers of negative impact on property developer or investor financial feasibility. However, change is happening - GBCSA research found that the average premium for green office buildings dropped sharply to an average 3.9% for the 2015-18 period. Green star certifications increased from 100/annum in 2015 to 600/annum in 2020.

The larger property companies are showing an increasingly positive response. Growth Point Properties, South Africa’s biggest property developer, had this to say in 2019, “The latest index indicates a significantly higher return in the case of green-certified office properties, based on lower vacancy rates and higher net income per square meter. The outperformance is further based on a lower discount rate, offering green-certified office investors lower risk investments; an aspect to definitely focus on in this property market.” (MSCI, 2019). Most new development in South Africa which is subject to building regulation is in high-end, residential complex development done by large property companies – if these ‘big guns’ are on board, it is likely that the smaller developers will start to follow suit.

Investors are also looking to boost green portfolios and developers are aware of this. As the market delivers more green buildings and so a solid base of experience and technologies across South Africa, it can be anticipated that financial confidence will improve, particularly as the demand for better buildings from buyers and tenants increases. There is much evidence internationally that regulation in this sector is an important grounding for market transformation.
South Africa is a middle-income industrialised developing country, with an economy based primarily in the finance, service and manufacturing sectors.

It has a high emissions energy sector and ranks 14th globally for GHG emissions. Over 67% of the population lives in cities. The population growth rate at 1.3% is similar to other lower middle-income countries. Its economy has been stagnating for a number of years and is constantly verging on recession. South Africa’s debt-to-GDP ratio is rising sharply and reached 81.8% in mid-2020, with the government Budget Policy Statement estimating that it will reach 100% by 2023 (the debt-to-GDP ratio was 44% in 2013 and 60% in early 2020). South Africa has one of the highest Gini coefficients in the world (0.65 in 2015) – and this extreme inequality is concentrated in the cities. The unemployment rate is 28% with youth unemployment at over 55%. Half the population of the cities is poor to very poor with almost a quarter of the cities’ populations residing in informal settlements.

Electrification rates are generally high, as is access to water and to health services. National government is actively driving future growth in renewable energy supply (see Figure 2 IRP 2019) with powers being at last extended in 2020 to local government to purchase/develop renewable power supplies.

This is a challenging environment within which to drive such a fundamental change to NZC buildings, but as it is a developing economy and society, constantly in flux and probably only ‘half-built’ so far, it is perhaps more open to change than developed northern countries and cities.

Figure 1: City carbon emission reductions: Top 12 opportunities by action area

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Average range of 2030 emissions reduction potential across city types % of 2030 target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decarbonising the electricity grid</td>
<td></td>
</tr>
<tr>
<td>Centralised renewables</td>
<td></td>
</tr>
<tr>
<td>Distributed renewables</td>
<td></td>
</tr>
<tr>
<td>Optimising energy use in buildings</td>
<td></td>
</tr>
<tr>
<td>New build standards</td>
<td></td>
</tr>
<tr>
<td>Building envelope retrofits</td>
<td></td>
</tr>
<tr>
<td>HVAC and water heating</td>
<td></td>
</tr>
<tr>
<td>Lighting upgrades</td>
<td></td>
</tr>
<tr>
<td>Building automation and controls</td>
<td></td>
</tr>
<tr>
<td>Enabling next-generation mobility</td>
<td></td>
</tr>
<tr>
<td>Transit-orientated development</td>
<td></td>
</tr>
<tr>
<td>Mass transit, walking and cycling</td>
<td></td>
</tr>
<tr>
<td>Next generation vehicles</td>
<td></td>
</tr>
<tr>
<td>Commercial freight</td>
<td></td>
</tr>
<tr>
<td>Improving waste management</td>
<td></td>
</tr>
</tbody>
</table>

The top two blocks relate almost exclusively to energy use in buildings - so clearly demonstrating the importance of NZC buildings programmes.

1. Emissions reduction potential as modeled for a "focused acceleration" scenario across 6 illustrative city types, with highest and lowest outliers removed.
2. 2030 target is based on Deadline 2020 pathways for specific city types.
3. Percentages given are for system level mix. Balance between centralised and distributed generation will vary by region.
The Constitution which followed South Africa’s first free and fair election in 1994 gave municipalities increased powers and established local government as an equal and separate layer of government, having its own responsibilities. The 2016 Integrated Urban Development Framework which promised ‘a new deal for urban areas’ clearly set out that cities have a leadership role to play and for the first time acknowledged that they are economic drivers. A prodigious constraint for local government however is their restricted ability to raise their own funds – only property taxes (based on valuations) and at-cost service charges may be levied.

The cities are significantly different to each other which lends strength in diversity, but can also be challenging: they are ruled by different political parties and their political environments are volatile; they are driven by different economic sectors; their institutional structures and capacity vary.

Joburg and Tshwane are in the economic hub of the country and are part of a conurbation of cities; Tshwane is primarily residential; Durban and Cape Town are port cities; Durban is an industrial city with a densely populated rural hinterland on its boundary; Cape Town is far from everywhere and tourism dominates its economy.

Each technical officer (TO) is placed as appropriately as possible in their particular city’s current institutional structure – this is informed by issues such as the objectives of the department, association with effective senior champions, willingness to host and likelihood of success. They are all in departments with a strong strategic/policy focus – rather than within the more technically oriented building approval departments. This Programme is part of transformation in the sector

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>2019 installed MW</th>
<th>2030 installed MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSP</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Wind</td>
<td>4%</td>
<td>21%</td>
</tr>
<tr>
<td>PV</td>
<td>3%</td>
<td>10%</td>
</tr>
<tr>
<td>Storage</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Hydro</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Coal</td>
<td>40%</td>
<td>71%</td>
</tr>
</tbody>
</table>

**Figure 2:** South Africa’s Integrated Resource Plan 2019 (SSEG is included as reduced demand)

Source: Building the future electricity system Nov 2020 - presentation by SEA

<table>
<thead>
<tr>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributed Gen etc.</td>
</tr>
<tr>
<td>Gas and diesel</td>
</tr>
</tbody>
</table>

2b. Where is the Programme located in each city

South African city office vacancy is 11.6% with just 2/3rds fully let.
Azola Zulu is an urban planner. She was co-hosted for the 3-year period by the Environment and the Development Planning Departments. She moved to a post in ICLEI from 2021.

Naseema Elias is an environmental scientist with honours in energy studies and was in the Energy Office in the Development Planning Department. She has now moved to a climate change/energy post in a private company.

Hlompho Vivian is an environmental scientist who formerly worked for GBCSA. She is in the Sustainability Unit in the Office of the Mayor which deals with mainstreaming sustainability and is not affiliated to any particular department.

Lesley Sibanda is a chemical engineer with two masters in sustainable engineering. She was formerly with GBCSA. Her position is now permanent in the Sustainable Energy Markets Department under the Energy and Climate Change Directorate.

Azola Zulu

Hlompho Vivian

Lesley Sibanda

Naseema Elias

City of Johannesburg

City of Tshwane

City of Cape Town

eThekwini Metro

Source: www.southafricanmi.com/south-africas-gdp

Source: see data table for all sources and dates
How do we get to NZC

Owing to the complexity of the South African landscape both politically and institutionally, and because of the unevenness of capacity at all levels, the Programme is built to be responsive and adaptable. It must reach broadly as well as deeply, and involve as many relevant actors as possible. It must work dynamically with opportunity as it arises. This is a journey which is constantly evolving.

3a. The continuous evolution of the Programme roadmap

In this environment there are many actions and routes to NZC, and all need to be engaged with. There is opportunity for constant activity in one form or another – when one avenue gets stuck, there is always another road to follow.
3b. Who is involved and what are their roles? The challenge of change...

A core intent of the Programme is to make NZC simple to understand and easy to achieve.

The building sector involves both national and local levels of government and a range of actors within each; it involves the private sector from banks and investors to developers, buyers and tenants; it involves built environment professionals from architects to planners to builders, and their institutes and associations; it involves material suppliers and product developers.

It is a huge challenge to work effectively and robustly across all of these groups and individuals – getting them interested; acknowledging and understanding the issues and blockages which affect each and working in detail with these; working collaboratively and keeping everyone on board. Below is a mapping of stakeholders relative to their influence/decision making and interest/benefit. This is not a static landscape of course.

**Figure 4: Stakeholder mapping according to interest and influence**

- **Keep informed**
  - Property associations
  - Buyers
  - Tenants
  - National Business Initiative
  - Built environment institutes
  - Green Building Council SA
  - SA Cities Network
  - SA National Energy Dev Institute
  - National Home Builders Council
  - Manufacturers and Suppliers
  - Contractors
  - Media

- **Manage closely**
  - City
    - Building control
    - Climate change, Environment, Planning
    - Policy, Strategy
    - Energy, Electricity
  - Political
    - Mayor
    - Council committees: Energy, Planning
    - Ministers
  - Private
    - Investors
    - Developers
    - Built environment professionals
  - Govt
    - Dept Trade and Industry
    - Regulator
    - SA Bureau of Standards
    - National Treasury
    - Dept Environment

- **Less contact**

- **Keep happy**
  - Govt
    - Dept of Energy
    - Dept of Human Settlements
  - City
    - Transport
    - Housing
    - Facility Management

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“Having the Mayor’s by-in and endorsement for the programme has removed a lot of hurdles. It opens doors and changes the conversation.”
These responses are increasingly open and confident and come from people who are eager for information, learning, and improved skills.


This continuum provides useful insight into where a person (or an organisation) is relative to change - and the reasons for their stance. In a change process, it is essential to take these reasons seriously and address them with care. The very uniformity intended by the National Building Regulations to establish ‘sound building practice’ across the country is potentially disrupted by this Programme, by cities establishing their own approaches and rules. Building control officers are deeply in a world of compliance and targets; they often lack sufficient skilled staff; they are answerable to both city level and national level ‘bosses’; and spend much time in court defending decisions. Technical people are to boot often sidelined in policy or strategic processes which can be immensely alienating. Passing regulation in a city is a very serious thing – all the unintended as well as the intended consequences must be considered. Shifting of powers, changing the balance of power, means having to let go for some and having to take on responsibility for others. Change is hard.

The Programme delivery relies heavily on partnerships. SEA, as implementing partner is leading the cities in inter-governmental engagements, which it does in collaboration with GBCSA, SA Cities Network, SALGA and the City Support Programme (in National Treasury). Local green architects have lent invaluable support and the CSIR has become a further technical partner through its work with Tshwane.

The South Africa Buildings Programme activities timeline

- Technical Officers deploy to the four partner cities
- Policy and global NZC Best Practice review
- Evidence base: emissions and financial impact models
- NZC policy and bylaw templates
- National stakeholder meetings
- Evidence base: study of energy efficiency building regulations compliance in each city
- SANS XA training for building control officers
- National department meetings
- Finance and legal policy briefs
- Getting to Zero Guide for Developers by ASHRAE
- EDGE Tool working group; South African benchmarking of EDGE
- SANS XA Update – input by Programme partners
- eThekwini and Joburg approve draft NZC policies for public comment
- Tshwane Green Building Policy review
- NZC communications strategy
- Cape Town ‘Climate Change Strategy + NZC buildings approach’ for public comment
- NZC awareness raising for city officials
- Smart Building web hub launch
- eThekwini and Joburg NZC policies Council approval
- Tshwane Policy and Bylaw to Council for approval
- Cape Town Climate Change Strategy to Council for approval; building bylaw Dec
Changing the law to NZC

Buildings policy and legislation

Energy efficiency and renewable energy for buildings have been addressed over the last 10 years in national policies, strategies and regulation as set out in the timeline graphic below.

Cities want to, and need to, be brought into the process of national policy and law making in order to more effectively align approaches and resources and to ensure that there is no contradiction with, or clash between, national and local government intentions and legislation. Global best practice provides valuable benchmarks.

National policies, regulations and initiatives with direct bearing on buildings

<table>
<thead>
<tr>
<th>Year</th>
<th>Document</th>
<th>Intention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>National Framework for Green Building</td>
<td>Focuses on adoption of green building regulations, standards and best practice.</td>
</tr>
<tr>
<td></td>
<td>National Building Regulations – Amendment SANS 10400 XA v1</td>
<td>Details EE building code requirements for building approval.</td>
</tr>
<tr>
<td>2012</td>
<td>National Development Plan</td>
<td>Commits to EE requirements in SA National Standards to achieve NZC building standards by 2030.</td>
</tr>
<tr>
<td>2020 May</td>
<td>Sustainable Financing Initiative Report - National Treasury</td>
<td>Aims to regularize, build capacity and awareness across financial sector to redirect R2tn capital to lower carbon and climate change risk future.</td>
</tr>
<tr>
<td>2020 Oct</td>
<td>Amendment to Section 34 Electricity Amendment Act</td>
<td>Enables municipalities to develop their own power generation projects and to procure from IPPs.</td>
</tr>
<tr>
<td>2020 Dec</td>
<td>Energy Performance Certificates mandatory for non-residential buildings</td>
<td>EPCs to be issued by an accredited body and displayed – valid for 5 years. Monitored by DMRE.</td>
</tr>
</tbody>
</table>

Figure 5: National policies, regulations and initiatives with direct bearing on buildings

The industry and the building owners just want an enabling environment to do the right thing.
Who has the right to regulate buildings in South Africa and how should they be regulated?

Despite the extensive legal work undertaken by the Programme, there remains contention on where responsibility lies and how far the responsibility extends. In South Africa buildings are historically regulated by national legislation: the National Building Regulations and Building Standards Act of 1977 (the Act) standardised legislation and went far beyond creating norms and guidelines into prescriptive detail (with the good intent of creating standards across the whole country). The SA Bureau of Standards develops standards for the application of the Act - the standard that regulates building energy matters is SANS 10400XA of 2011.

The 1996 Constitution changed the role and relative position of local government: it allocated specific powers to local government and mentions ‘building regulations’ as an area of concurrent competence between national, provincial and local government. While it is clear that day-to-day decision making on building plan approval lies with the municipality, there is disagreement as to whether the Constitution confers powers on the municipality to further regulate buildings and establish building standards via bylaws.

It seems clear that the municipality can add to (but not contradict) the regulations through by-laws ‘for the effective administration’ of its function – in this case building plan approval. A specific challenge is the three routes to compliance allowed under the Act: deemed to satisfy; prescription; rational design. Based on global best practice, NZC can really only be achieved through rational design, but if the NZC municipal bylaw promotes only a single route to compliance, does this contradict the Act? Another challenge is that cities are keen to include other resources in their bylaw such as water, waste and transport, which so far are not addressed by the Act. Do they have the right to do this?

Another complexity is that every municipality has different local conditions. Should each municipality have bylaws specific to its conditions or should alignment and simplicity be prioritised? A coherent and secure legislative environment is important to the property business which operates across the whole country, and to supporting the ease of doing business, a priority for both national and local government.

Where to next?

Clarity on this matter could be determined by the Constitutional Court (as has happened in some planning disputes), but it seems that a more optimal route and outcome can be achieved via the Intergovernmental Relations (IGR) process which seeks alignment and simple effective solutions to these kinds of problems. This would require participation by key national and local departments dealing with environment, buildings, energy and finance.
Overcoming finance hurdles

The major hurdle to investment by the private sector in NZC buildings is negative impact on financial feasibility: if investors cannot maintain or improve their risk-adjusted financial return, they will prefer conventional buildings.

The Programme drives two elements critical to change:

1. Providing high quality, accessible information - the value of growing the market knowledge base is often underestimated by the public sector.

2. Public policy and regulation - these actively shape the market response, in part by internalising externalities (such as a carbon tax and operational costs).

Lower operational costs will in time be a significant driver of more resource efficient development as buyers and tenants demand this, but we are not there yet. The government’s EPCs (Energy Performance Certificates based on certified Energy Use Intensity documentation) regulation (Dec 2020) is a big step forward in making the financial value “felt” as EPCs are required by law in all buildings except residential and must be displayed, so providing hard visible data.

Several financial incentives already exist (taxable income deductions for EE interventions - S.12L and S.12B, carbon tax act, feed-in tariffs for SSEG, some municipalities are even offering property rates reductions for ‘as built’ green building certifications). EPCs and green building certification may also be understood by investors and banks as ‘lowering risk’ (so banks may lend at lower interest rates) – but they need the hard data. Large scale municipal and government programmes in their own buildings (such as lighting retrofits) can have a substantial impact on reducing the price of green technologies through localising production (and so also localising jobs).

Cities are generally loath to offer financial incentives due to the impact on their income and a host of other complexities. Some however are clearly fair – for example reduced development contributions for NZC developments due to the proven lower bulk services requirements.

The value of growing the market knowledge base is often underestimated by the public sector.

Electricity departments are worried about NZC impact on consumption, but the structural reality of decreasing consumption as well as localised electricity provision (SSEG) must inform electricity planning. If bulk infrastructure cost savings are indeed passed on to property developers so that they are not having to “pay twice”, this can only work if a development can commit to maximum demand and to a demand curve. This changeful environment indubitably makes grid management and planning very tricky.

Other incentives which have financial implications:

- Greater bulk: most cities, in the effort to undo the legacy of apartheid development and increase densities appropriately are driving maximum bulk anyway – and are requiring that development is concentrated around activity routes in order to support transit-orientated development (and further undo the atomisation of apartheid planning).
• Speeded up application process: this is clearly open to abuse (how does a plan qualify for this before engagement with the plan?); all cities already have maximum time targets for responding to development applications.

• Green technical support to developers and investors. Some cities are proposing an expert “green desk” service to help drive and support greener building, and alleviate pressure on building approval departments.

Resource-inefficient buildings run the risk of losing economic value or becoming stranded assets due to increasingly stringent regulations, pressure from financial regulators to manage and disclose climate risks, changing consumer preferences, and shareholder demands. Non-compliant buildings could become subject to legal action and fines, making them more expensive to operate and insure, and harder to lease or sell.

Solutions to the NZC challenge developed by Sustainable Solutions for the Programme, as in Figure 6 below, sets out the deterrences to investors, causes, levers and practical solutions – and it considers how outcomes can be supported by shaping the project market environment.

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**The NZC challenge financing solutions**

**Investor disincentive**

- Higher building cost
  - Short term: Absorb extra cost
  - Medium term: Reduce extra cost
  - All: Transfer extra cost
  - Direct: Incentives to absorb cost
  - Direct: Local knowhow
  - Indirect: Economies of scale through supplier growth
  - Direct: Finance or guarantee third party ownership contacts
  - Indirect: Build ESCO capability, industry database

- Unchanged property value (esp. in short term)
  - Short term: Support premium discovery
  - Medium term: Boost premium
  - Direct: Align with valuer best practice (e.g. RICS)
  - Indirect: Implement supportive regulations (e.g. EPC, ESG, carbon tax)

- New or unproven business model/case
  - Short term: Catalyse market through stimulating supply or demand
  - Medium term: Develop knowledge base
  - Direct: Reduce cost of NZC supply (grants, tax incentives, soft loans) or guarantee demand incl. extra cost (e.g. public sector procurement)
  - Indirect: Raise customer awareness of benefits
  - Direct: Supply data on operational savings implement supportive building regulations

- Supply chain challenges
  - Uncertain supplier & technology reliability, after sales service, maintenance profile
  - Short term: Establish credible supplier base
  - Direct: Incentivise NZC as above
  - Indirect: Develop technology & supplier quality standards, accreditation, etc.

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Figure 6: Financing solutions to the NZC challenge


Note: the implementation of projects by government in its own buildings can help in many of these issues - increasing supply of a technology such as LED lightbulbs, testing Rol, providing tested projects to the market place etc.
Enabling tools

To support NZC development – verified, simple, accessible.

In order to provide solid 'how-tos' and verified information to support the Programme, research and the development of accessible tools have been a major focus, from financial RoI modelling for EE and RE for all building sectors, Energy Unit Intensity (EUI) tables for all building types; design guidelines, Guide to developing NZC buildings in SA, ASHRAE SA et al 2020 which provides detailed and accessible design and technical information to users, and the benchmarking for South Africa of a software design and EUI assessment and reporting tool.

Energy efficiency and renewables by building type

Return on investment

(Considering both building [capital] and energy [operational] costs)

Breakeven year by building type

Testing of the financial case

- At a 3.8% green premium, there is a strong financial case for green buildings.
- Exception is high-cost houses because green premium is off a higher cost base.
- PV adds a cost burden, in particular to the opposite ends of the housing market (low-cost and high-cost houses).
- Lowering the finance rate decreases the cost burden to an acceptable level for low-cost houses.

Model sensitivity:

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Finance rate/period</td>
<td>• Demand met by PV</td>
<td>• Discount rate</td>
</tr>
<tr>
<td>• PV capital cost</td>
<td>• Proportion of PV exported</td>
<td>• Climate data for each city</td>
</tr>
<tr>
<td>• Energy efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Green premium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Building code stringency</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7: Green buildings cost model RoI breakeven year

Source: SEA Green Building Costs Model 2020

Note: this model is available to be used with your own data at the link above
6a. The NZC Pathway

This NZC Pathway established under the Programme provides the general sense of what EUI must be met by when for all the different building types in order to reach the NZC goal. The figures have been reviewed by local green building modelling experts and are considered to be reasonable and in line with building EUI requirements elsewhere (global benchmarks).

The Pathway drives energy efficiency first (based on percentage reductions in EUI off the national baseline, but represented as absolute values) so that the design of buildings is driven by least-possible energy use. Renewable energy (RE) then comes in to supply the remaining energy demand - the Pathway has no RE requirement before 2030. There is strong indication that on-site RE is likely to be delivered by the market anyway as it is already a good investment for commercial buildings.

Along the way there have been interesting challenges, and adjustments have had to be made. The cities met resistance from building control / development management departments which contend that approval is only possible for basebuild energy, not operational energy (the current SANS 10400XA national standard is concerned with basebuild energy and excludes plug loads). To accommodate this, it was decided to adjust the EUI requirements to basebuild only. However, the full NZC policy remains for total load (base and operational) to be provided by renewable energy - it therefore makes financial sense for the developer to maximise efficiency from the outset. The Programme intends to build on and align as closely as possible with national regulations.

Another area of contention for the National Regulator and local building control, is that the proposed bylaw does not allow for a prescriptive route ('deemed to satisfy' tick box route) as per the current legislation. Options for resolving this include applying to the Minister for local government to be exempted from portions of the national regulations; and/or including a more stringent 'deemed to satisfy' route.

The initial rationale for the 'deemed to satisfy' compliance route is important to understand and to address. This route came into effect because of the unacceptably high burden of modelling costs and of a 'competent person' to sign-off on the rational design or modelled route. To address these hurdles, the Programme is focusing on enabling the market to comply through an accessible modelled EUI tool.

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Net Zero Carbon Pathway

This is an example pathway for office buildings in all four metros.

Figure 8: Pathway to Net Zero Carbon for office buildings

Source: AGAMA Energy 2019
Table 1: Energy Use Intensities for different building types

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Class of occupancy or building</th>
<th>Occupancy description</th>
<th>Energy Use Intensity (EUI) kWh/m²/annum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2020</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SANS 10400 XA V2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SANS 10400 XA + 30% EE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SANS 10400 XA + 55% EE</td>
</tr>
<tr>
<td></td>
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<td>SANS 10400 XA + 65% EE</td>
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<td></td>
<td></td>
<td></td>
<td>SANS 10400 XA + 75% EE</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2050</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>To be reviewed before 2040</td>
</tr>
<tr>
<td>Public gathering /</td>
<td>A1 Venues for sedentary</td>
<td>80</td>
<td>56</td>
</tr>
<tr>
<td>entertainment</td>
<td>behaviour</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 Venues for non-sedentary</td>
<td>120</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>behaviour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theatrical</td>
<td>A2 Theatres and cinemas</td>
<td>95</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>A2 Sport performance</td>
<td>120</td>
<td>84</td>
</tr>
<tr>
<td>Places of instruction</td>
<td>Conference halls, auditoria, lecture halls, laboratories, etc</td>
<td>95</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>A3 Urban, suburban, rural</td>
<td>55</td>
<td>39</td>
</tr>
<tr>
<td>Schools</td>
<td>A3 Urban, suburban, rural</td>
<td>55</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>A4 Large venues</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>A4 Large venues</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>A4 Small venues</td>
<td>45</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>A4 Small venues</td>
<td>45</td>
<td>32</td>
</tr>
<tr>
<td>Detention</td>
<td>E1 Place of detention</td>
<td>55</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>E2 Large and medium hospital</td>
<td>175</td>
<td>123</td>
</tr>
<tr>
<td>Hospitals</td>
<td>E2 Day hospitals, clinics</td>
<td>90</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>E3 Institutional (residential)</td>
<td>120</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>E4 Health care</td>
<td>85</td>
<td>60</td>
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<tr>
<td>Retail</td>
<td>F1 Large shop &gt;250m2</td>
<td>145</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>F2 Small shop &lt;250m2</td>
<td>80</td>
<td>56</td>
</tr>
<tr>
<td>Offices</td>
<td>G1 Large multi-storey office</td>
<td>95</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>G1 Standalone blgs in office parks</td>
<td>80</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>G1 Call centres</td>
<td>145</td>
<td>102</td>
</tr>
<tr>
<td>Hotel</td>
<td>H1 Hotel</td>
<td>145</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>H2 Dormitory</td>
<td>70</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>H3 Domestic residence</td>
<td>70</td>
<td>49</td>
</tr>
<tr>
<td>Dwelling houses</td>
<td>H4 Low income houses &lt; R450k</td>
<td>70</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>H4 Middle income/luxury houses &gt;R450k</td>
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<td>49</td>
</tr>
<tr>
<td></td>
<td>H5 Hospitality</td>
<td>70</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>H5 Hospitality</td>
<td>70</td>
<td>49</td>
</tr>
</tbody>
</table>

Table 1: Energy Use Intensities for different building types

Source: CSIR summary report on net zero pathway table for cities Nov 2020

Figure 9: Projected energy demand according to regulation and compliance

Source: SEA model 2019
The Programme does not endorse any particular product, but EDGE has a number of advantages.

The Programme has engaged with EDGE because this is the only tool available that can easily bridge ‘deemed to satisfy’ and rational design; plus there are a number of other advantages:

- it is free to use for self-assessment (payment is only required for certification)
- it is technically sufficiently detailed, while being simple to use, for all professionals from architects to BCOs
- it is produced by a reputable global organization - the International Finance Corporation - and provides a global standard. As an internationally recognised platform, it provides security that an investment is ‘green’ and can contribute to leveraging development finance
- it can be benchmarked for South Africa (this is taking place currently)
- it is extendable to a suite of building sustainability aspects – water, embodied energy, etc.

And, perhaps most importantly:

- it supports design flexibility: the owner/designer can choose how they get to the EUI target (AND it can be used in a ‘deemed to satisfy’ approach as the sector transitions to performance-based assessment).

EDGE is a good bridge from ‘deemed to satisfy’ (which is based on a checklist) to ‘rational’ design. In reality, NZC is NOT an incremental change of a % improvement per annum in EUI, but requires a fundamental change in the way buildings are designed – for example, buildings will have to return to being naturally ventilated so that for at least 80% of the year it is comfortable not to use HVAC. By 2025 it will not be possible to reach the required EUI via the prescriptive route.

A vertically integrated EDGE Working Group has been set up to adjust and develop the tool for SA conditions – it is made up of the cities (TOs and BCOs), IFC, Treasury and SALGA, the national custodians of the building regulations - the Department of Trade and Industry, and the Regulator.

This working group is focusing on:

- finalising the South African benchmarking of EDGE
- getting EDGE Agreement Certified (municipalities can recommend the use of any tool that has this certification)
- encouraging the market to use EDGE (or any similar certified tool) – the market will anyway be looking to use EDGE (or other tools) to show compliance
- educating and popularizing this tool - through courses run by GBCSA, architectural institutes, cities, and by promoting it for use in built environment tertiary degrees, especially for BCOs.

EDGE makes rational assessment easy, so upping everyone’s NZC game.
Building buy-in

Behaviour change campaign, stakeholder engagement and market transformation

Internal and external stakeholders who are integral to the successful drafting and implementation of policies and regulations are not always involved in the background thinking on the importance of green buildings and the cities’ commitments to achieving NZC.

As the Programme’s developed it has become increasingly clear just how important co-creation is – and this can only happen if accessible information is provided and active engagement is encouraged.

To this end, the Programme is working with a team of behaviour change experts to design and implement a “hearts and minds” campaign that creates positive sentiment towards green building and motivates and enables stakeholders to change behaviours.

A recognisable Smart Buildings logo and a web hub will carry the messages to the public (who are not interested in the regulatory side of things), professionals in the built environment including developers, and government from officials to councillors and politicians. The hub will be actively promoted to internal stakeholders via email and activations and external stakeholders via social media, paid media and digital PR.

It is also recognised that moving the full market value chain along the NZC path will require substantial collaboration between government and the private sector. A joint position statement on the development and implementation of NZC which can be supported by all the key industry stakeholders is being developed with compelling title of SABENZA (SA Built Environment Net Zero Agenda) meaning “to work”.

As the Programme participants have seen, just talking is helpful – Tshwane was pleasantly surprised by the positive response from stakeholders in engagements on their bylaw. The stakeholders were also impressed by the work the city is doing. They clearly want to contribute to making a better, greener city.

The existence of the Programme (especially as it is, for now, THE implementation Programme of the CAP and lays the path for HOW in a critical sector) is getting the message out there – it’s a strong narrative in itself.

Smart Buildings web hub

www.smartbuildings.org.za

Promotion vehicles for the web hub

Email database Digital PR Paid media

Internal stakeholders External stakeholders

Activations Social media Trade blogs / press

Source: Behaviour Change Agency 2019
South African municipalities have very different approaches borne out of local conditions such as politics, capacity, location, champions and local activist organisations – these approaches range from caution to zealous enthusiasm to get a bylaw out there.

Some cities are happy to keep the focus on energy efficiency and renewable energy (for now) while others are stressing the need to include broader sustainability issues now such as water, location and land use which could lead to better buy-in across the political and institutional space. Some cities are fine with working on a bylaw which is not perfect (because there are unknowns), but can be perfected over time. Others are nervous of litigation and want all i’s dotted and t’s crossed before any exposure to public participation.

Some cities are preferring to emphasise policy for now. Policy can send a strong message if used prudently – for instance, in those intimate pre-meetings with developers (required by all the cities on development proposals above a certain scale). Policy can be a strong lever if it is appropriately integrated into all city plans and policies (this requires work and attention!). While some cities welcome open ‘let’s create this policy/bylaw together’ engagement with the public, others hang back, having had experience of bullish developers and harsh public criticism. Some cities are already demonstrating leadership within their own buildings.

The next phase will be crucial. The future of development is uncertain, but the post-COVID world may provide the great ‘reset’ that is needed. The vacant office (working from home) and retail (shopping online) spaces may be converted to residential so addressing housing backlogs: structurally, while the demand for office and retail space plummets, the demand for housing is expected to remain robust. People’s demand for more functionality and amenity in their work spaces may drive a NZC building response as this can addresses many of these needs: uninterrupted electricity supply, better building management systems and performance, healthier environments and so on.

Economic contraction / change and longer-term regulatory threats posed by carbon tax and energy performance certificate requirements may see investors ‘futureproofing’ against high running costs as well as uncertain energy supply. Resource-inefficient buildings run the risk of losing economic value or becoming stranded assets; their insurance costs may be higher – and retrofitting is comparatively extremely costly.

Perhaps most critically, COVID has taught us how quickly systems and processes can be changed – can this translate into our response to the absolute urgency of climate change action?

What are the four cities up to now?

**Johannesburg**
- NZC policy approved for consultation Oct 2020
- Public comment closed Jan 2021
- Final policy to Council for approval May 2021
- Drafting of bylaw then commences

**Tshwane**
- Stakeholder engagement on reviewed Green Building bylaw Oct/Nov 2020
- Mayoral Committee Mar 2021
- Public participation May-Jul 2021
- Final approval Aug 2021
- Implementation planning underway

**Cape Town**
- Climate Change Strategy (includes building policy) for public comment Oct 2020
- Council approval Apr 2021
- Building bylaw to incorporate NZC Dec 2021

**eThekwini**
- Public comment on policy to Council Apr 2021
- Approval Apr 2021
- Draft bylaw is with the legal department
Acknowledgements

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The briefs, presentations and other documents can all be found at cityenergy.org.za and smartbuildings.org.za.

The partners in this programme are Agama Energy, ASHRAE, Behaviour Change Agency, Council for Scientific and Industrial Research, Green Building Council SA, Pegasys, Solid Green, Sow & Reap and Sustainable Solutions.

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