



Harnessing Data for High Performance Buildings: Overview of the City of Cape Town’s Energy Performance Certificate Compliance Initiative

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Introduction and background

Globally, buildings are responsible for the largest portion of carbon emissions of all sectors, accounting for nearly 40% of annual emissions¹. This trend is no different nationally and locally. In Cape Town, buildings account for 22% of energy consumption and as a result, are responsible for the largest proportion of carbon emissions (approximately 45%), with the City’s municipal building portfolio consuming 4% of all electricity used in Cape Town (figure 1 and 2). Energy efficiency in buildings is the most cost effective intervention for emissions reductions and a key starting point on the journey towards net zero carbon buildings. As such, the City is committed to improving the management of energy in all its municipal operations with the aim of improving resource efficiency, saving money and reducing its associated carbon emissions towards the ambitious City-wide target of carbon neutrality by 2050.

The first step in energy efficiency is developing and understanding the baseline before plotting incremental improvements. This relies on rigorous data monitoring and management and creating an information feedback loop between the building occupants, the facilities managers, and the building owners.

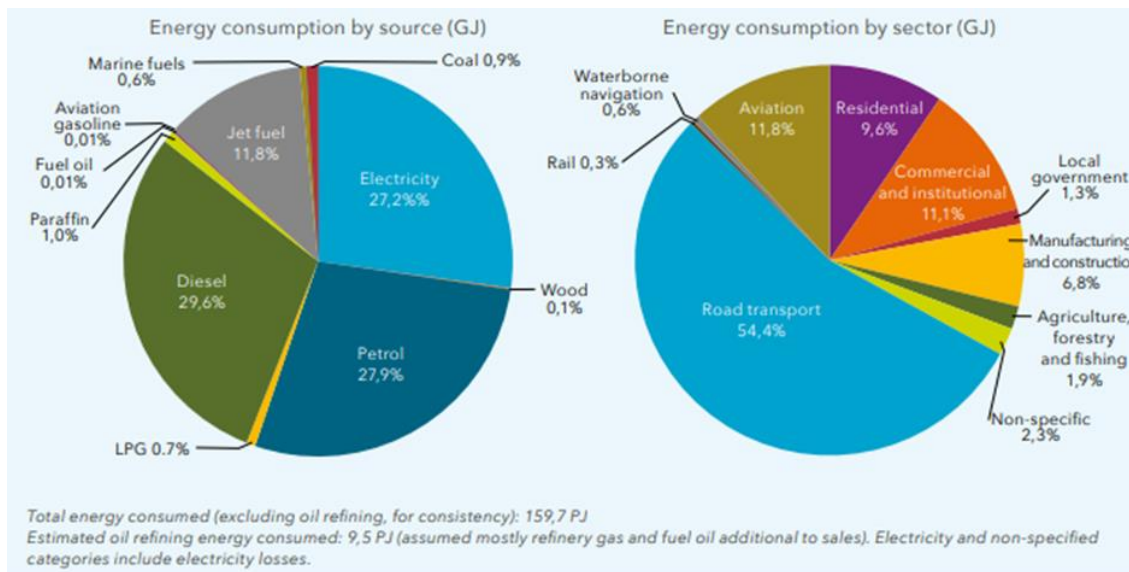


Figure 1: 2018 Energy Consumption for Cape Town by source and sectors (source: Cape Town State of Energy and Carbon 2021 Report²)

¹ [World Green Building Council](#)
² [Cape Town State of Energy and Carbon 2021 Report](#)

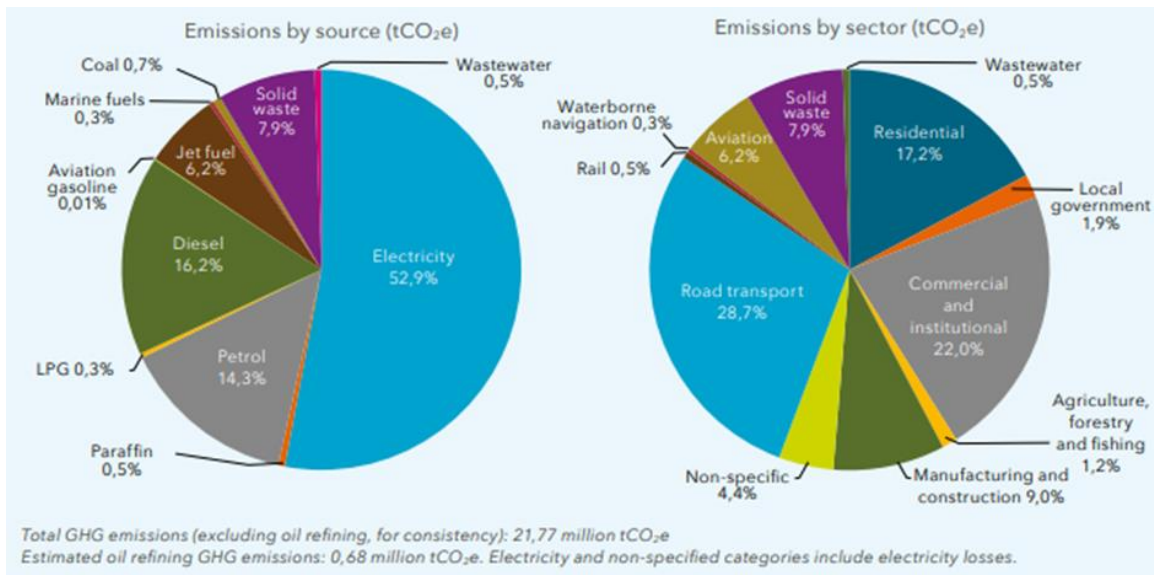


Figure 2: 2018 CO₂ emissions for Cape Town by source and sectors (source: Cape Town State of Energy and Carbon 2021 Report)

In December 2020, under section 19(1) (b) of the National Energy Act, the South African National Department of Mineral Resources and Energy (DMRE) promulgated the regulations for the Mandatory Display and Submission of Energy Performance Certificates for Buildings. This means for all buildings that fall into certain categories, the operational energy consumption must be publically displayed through an Energy Performance Certificate or EPC. The criteria for compliance includes:

- Buildings must have been in operation for over a period of two years, with no major renovation within the past two years.
- The buildings predominant occupancy class is one of the following;
 - places of instruction,
 - entertainment and public assembly,
 - theatrical and indoor sports,
 - offices;
- The building has a net floor area (NFA) of greater than 2000m² for privately owned buildings or 1000m² for state-owned buildings.

For the City of Cape Town this meant approximately 100 buildings out of 1400 City facilities require publically displayed EPCs in place by 7 December 2022.

Energy Performance Certificates indicate the amount of energy used in a building in kilowatt hours per square meter per year (kWh/m²/annum). This energy use intensity is then correlated against a nationally regulated benchmark on a colour coded scale from A - G, allowing building owners to determine how much energy their building uses and to compare this performance against other buildings of a similar type. Figure 3 below shows an EPC issued for one of the City of Cape Town buildings. Once a building is certified, each certificate is valid for a period of 5 years. As defined in the mandatory regulations gazetted on 8 December 2020, failure to comply risks a possible fine of approximately R5 million – R10 million, five years imprisonment or both.

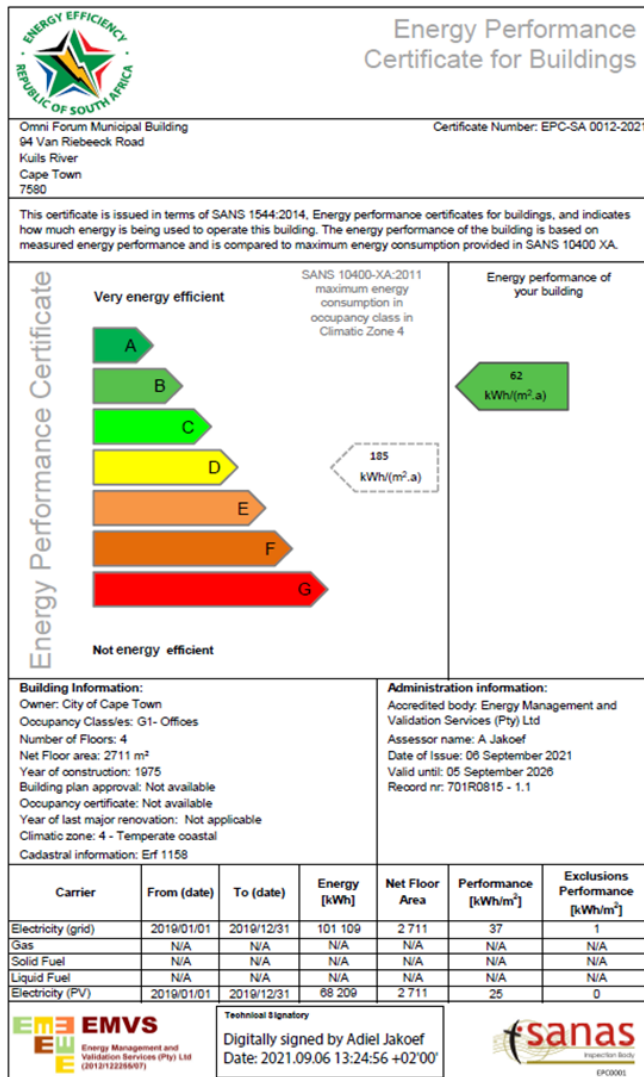


Figure 3: Energy Performance Certificate issued for Omni Forum Municipal Building

Despite inevitable challenges, the City of Cape Town has made great strides in complying with the regulations and is the first South African municipality to achieve compliance for twenty five (25) of its municipal buildings. With many municipalities requiring EPCs for their buildings, the City of Cape Town's experience provides some valuable insights and lessons for all building owners required to comply. This paper shares the City of Cape Town's experience, opportunities and challenges of complying with the regulations.

EPCs as a stepping stone towards Net Zero Carbon buildings

Buildings have always been a priority focus area for the City of Cape Town, as evidenced by the City's involvement in the C40 Net Zero Carbon Buildings Accelerator and the development the City's Climate Change Strategy³ and Climate Change Action Plan⁴ (CCAP) with net zero carbon buildings as strategic focus area.

The accelerator together with the CCAP aims to ensure that;

- New buildings operate at net zero carbon by 2030;
- All existing residential and commercial buildings to be retrofitted with energy-efficient technologies to be net zero carbon in operation by 2050
- All new facilities owned, occupied and developed by the municipality are net zero carbon in operation by 2030, and that to the extent possible, the same is true for existing facilities

³ [Climate Change Strategy](#)

⁴ [Climate Change Action Plan](#)

To meet these ambitious targets the City needs to focus on measures such as:

- Ambitious building energy performance requirements for new buildings city-wide;
- Net zero carbon municipal building specifications for all new municipal buildings;
- Establishment of a roadmap that outlines the retrofit plan for all existing municipal buildings to net zero carbon performance;
- Evaluate the current energy demand and carbon emissions from the City's municipal buildings, and identify opportunities for reduction;
- Incentive packages for net zero carbon performance buildings and precincts,
- Accelerate the transition to a cleaner energy supply by driving the decarbonisation of the grid and provision of renewable energy to municipal buildings.

However, turning the commitments into reality means that the City of Cape Town needs to determine three unknowns:

- Where are we? (What is the baseline?),
- Where are we going? (What are the targets?)
- How do know we are on track to meet the targets? (How are we monitoring against our ambitions?)

The key to answering these questions is data: Data collection, data monitoring, data processing, data reporting and the feedback of that data to the people making decisions about the operation and future retrofits of the building.

While the City of Cape Town has long understood the importance of data in managing and improving performance in its own operations, nationally legislated EPCs, in which building energy performance data is monitored, benchmarked and displayed, is a first for South Africa. This mechanism has proved effective in many countries around the world where the first step of displaying building performance is followed by requirements for incremental improvements. For example, the National Australian Built Environment Rating System (NABERS) has transformed the Australian commercial sector. Over the past 14 years, Australian offices rated using NABERS Energy have benefited from an average energy savings of 42% and have reduced greenhouse gas emissions intensity by 53%. This has resulted in an estimated AU\$1 billion saving in energy costs.⁵

This initial phase of South Africa's EPCs only requires displaying energy performance and does not yet require commitments to improve, let alone aim for net zero carbon, however many built environment professionals see this a crucial step. By legislating the setting of a baseline and public display of large buildings' energy performance, the groundwork is laid for large scale adoption of energy efficiency retrofits and ultimately net zero carbon performance in the built environment.

For the City of Cape Town, EPCs provide a benchmark performance and a standard against which buildings can be compared and ranked. This performance ranking allows the City to prioritise scarce resources for efficiency improvements and the kWh/m²/annum energy performance for buildings can be tracked against the net zero Carbon Targets which uses the same unit of measurement. Furthermore, the very act of making data public, engages occupants around energy usage and efficiency and invites them to initiate and take part in programmes to improve their buildings. As a result, the EPC compliance initiative is seen as a valuable step towards achieving the Net Zero Carbon Municipal Buildings Target by 2030 and the broader city-wide ambition to be Carbon Neutral by 2050. A good target would be that every municipal building achieves a Grade B on their EPC by 2027.

Besides being a tool for public and private sector property managers to assess the performance of their portfolios, EPCs will also provide much needed data to assess and monitor what proportion of the country's emissions can be attributed to buildings. This in turn will inform a plan for how energy efficiency in buildings can make a positive contribution towards South Africa's Nationally Determined Contributions (NDCs) reduction targets. There is currently no baseline, which means we do not know how much carbon must be mitigated to achieve net zero carbon by 2050 for existing buildings or how well we are doing to get there. EPCs, while still a somewhat crude tool, are an important step in that journey.

⁵ NABERS; *Energy efficiency in commercial buildings: How the National Australian Built Environment Rating System transformed the market*; May 2022

Cape Town's EPC Compliance Initiative

To comply with the EPC regulations, the City of Cape Town embarked on a comprehensive EPC Compliance Initiative. This included an initial survey of the City's building portfolio, followed by a pilot study, which in turn informed the full rollout of EPCs across the relevant buildings.

Through the initial review of City's building portfolio, approximately 100 buildings, were identified, that fell into the criteria of having a Net Floor Area (NFA) of greater than 1000m². These were mostly office buildings owned and operated by five different City departments namely, Electricity Generation and Distribution Department, Facilities Management Department, Water and Sanitation Department, Strategic Assets Department, and Recreation and Parks Department. The pilot study was initiated and a South African National Accreditation System (SANAS) accredited service provider was appointed via a Request for Quote (RFQ). Three buildings of different occupancy classes, with one having an installed PV system, were identified and chosen specifically for their comprehensive energy data sets to enable a relatively quick review and certification. A further advantage of this selection was to test and develop an appropriate EPC methodology in the context of three different building occupancy classes and energy mixes. The pilot study resulted in the City of Cape Town achieving the first three public sector EPCs in South Africa and the establishment of the EPC methodology outlined in figure 4 which designed a coordinated, efficient approach for the broader EPC initiative – taking a portfolio-level approach to data collection and procurement of the service provider.



Figure 4: City of Cape Town's EPC Compliance process

Enablers for EPCs

Through the pilot study and subsequent rollout of Cape Town's EPC Compliance Initiative, three key enablers were identified that brought opportunities as well as challenges and lessons learned:

- Coordinated approach and stakeholder engagement
- Data
- Procurement and institutional arrangement

Coordinated approach and stakeholder engagement

The EPC Compliance Initiative was designed to enhance collaboration, reduce the time and cost associated with compliance and ensure a cohesive and cost effective approach across all six departments impacted by the regulations. As a result, an EPC task team made up of five departments who own buildings that require EPCs was established, together with the Sustainable Energy Markets (SEM) within the Energy Directorate, as the coordinator of the EPC compliance initiative. The departments were required to formalise their involvement by signing an MOU and appointing a representative who would be the key focal point throughout the duration of the

project. The task team defined the roles and responsibilities for each department and ensured ongoing communication between departments to develop understanding of EPCs, knowledge sharing, and coordination of work to achieve compliance.

Department	Role
<ul style="list-style-type: none"> Facilities Management Water Department Recreation and Parks Department Energy Generation & Distribution Strategic Assets 	<ul style="list-style-type: none"> Provide requested data Member of EPC Task Team Ensure compliance with regulations of all owned buildings Source budget for own buildings Transversal Use Application Payment of service provider
Sustainable Energy Markets	<ul style="list-style-type: none"> Provide technical assistance and strategic support to line department Lead of transversal tender process Chair of EPC Task Team Engage with external stakeholders Quality Control of outputs
Supply Chain Management	<ul style="list-style-type: none"> Support on transversal tender process

Figure 5: Role of each department in the EPC task team

Challenges and lessons learned

- Developing relationships with all departments owning buildings can be quite a challenge, but it is essential for the success of the project. Critically, it was important to ensure buy-in for this process from technical City staff and senior management. To do so, the EPC task team was discussed at an Executive Management Team meeting, with relevant technical staff nominated by the directors of each relevant department.

Data

Data is a core part of the EPC compliance initiative and any performance-enhancing programme. The City of Cape Town has long understood this, and in 2012 embarked on a process of establishing a robust system of building resource data management. SmartFacility®⁶ was developed to automatically capture and process data based on the success of a manual system that had been established and used for a number of years prior. See figure 5 for City's building data journey. This tool has been assisting departments, project managers and facility managers in City facilities to monitor and track daily water and electricity consumption patterns, plan and manage energy efficiency and renewable energy retrofits. Figure 7 shows an example of monthly energy consumption data for a City of Cape Town facility as captured and displayed by SmartFacility®.

With the new EPC requirement that relies on comprehensive energy data sets, SmartFacility® became the essential catalyst that allowed City of Cape Town, for many of their buildings, to leapfrog initial energy data collection challenges that many other property portfolio managers are still grappling with. Going forward, it is anticipated that SmartFacility® could be adapted to directly track and monitor compliance against EPC regulations as well as net zero carbon targets.

⁶ SmartFacility® is a facility resource management tool developed and managed by the City of Cape Town that captures near-real time data for energy consumption and any on-site energy generation, along with being a repository of building information

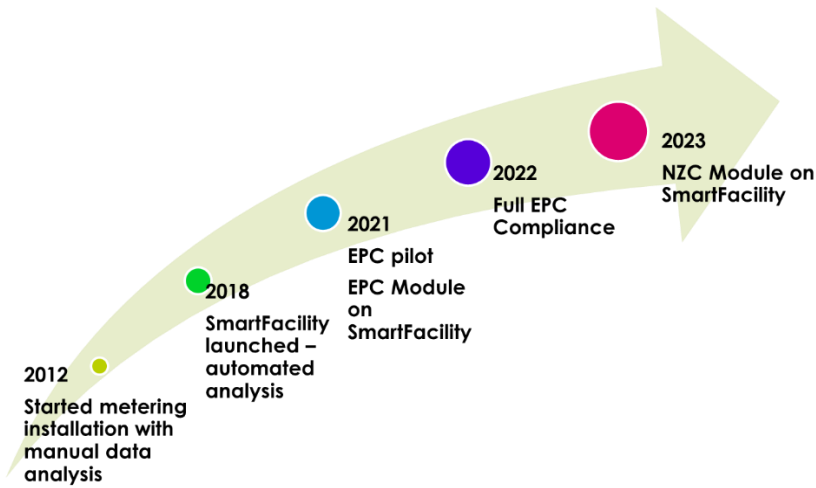


Figure 6: Building data journey on SmartFacility®

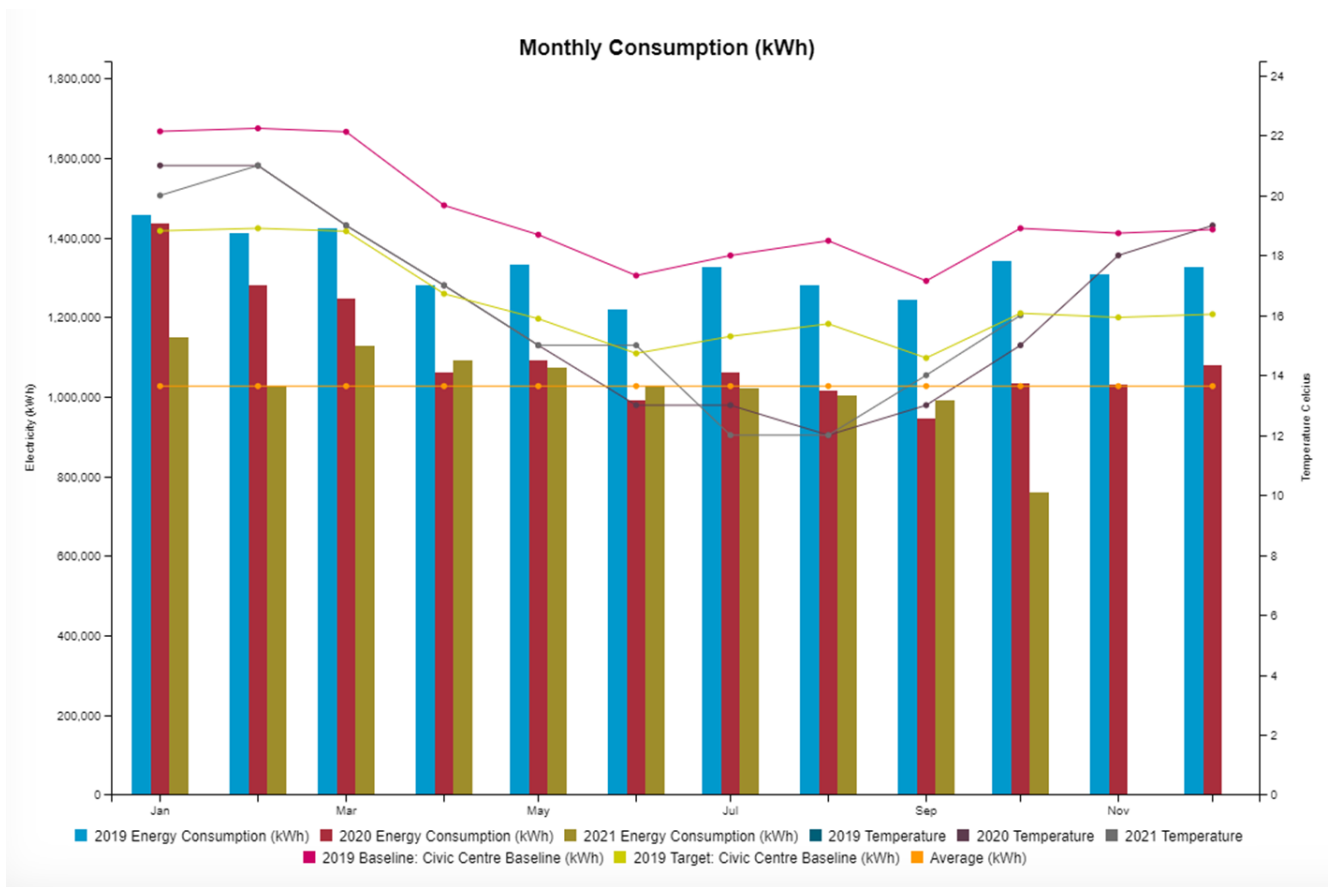


Figure 7: example of a Facilities Manager’s dashboard on SmartFacility®

For the EPC initiative itself, a rigorous data collection process was followed to ensure that all required data was collected prior to the appointment of an accredited service provider. The data collection process considered 2 data types; energy data and building data.

For energy data the following datasets were collected: electricity consumption, energy generated and exported by solar PV and liquid fuel used by diesel generators. During the implementation of the initiative, about 858 City facilities had been metered and connected to SmartFacility®, making it easier to collect and process the required data for electricity consumption and energy generated and exported by solar PV. However, not all buildings identified for the EPC compliance initiative have smart meters, nor are they connected to SmartFacility®. As a result, the billing data from the City’s SAP portal had to be utilised to obtain electricity data for those buildings.

SmartFacility® is the cornerstone of the EPC Compliance Initiative and is now being developed further to host all EPC data.

For the diesel data, generator fuel purchases or top-ups for each building were required. These were in the form of;

- Meter data
- Diesel tank storage capacity of and litres of fuel used
- Diesel invoice purchases
- Diesel generator run hours

However, obtaining this data proved to be challenging. Most buildings did not have this data, and an alternative approach was required. Using the City of Cape Town's and national load shedding schedules, and the 30 minute energy data profile provided by SmartFacility®, the service provider was then able to estimate when the generators were operational and for how long.

Building plans are also critical to determine the Net Floor Area (NFA) for the EPC calculation. As such, collection of the building plans began well before a service provider was appointed. Building plans were mainly obtained from City district offices, and where district offices were unable to provide the plans, a request was sent to building owner departments to provide them. However, it was also noted that many of the buildings that required EPCs were old, and building plans weren't available, this resulted in two options for the departments;

- To physically measure the buildings NFA to determine whether the building was above 1000m² or;
- Have the appointed contractor go on site and physically measure the NFA.

The second option was an expensive approach for the City particularly for buildings that were close in size to the 1000m² NFA cut off. If, after determining the floor area to be less than 1000m², the service provider would still issue an EPC as the pricing schedule outlined in the tender did not include for buildings that did not meet the NFA requirement. This could be considered wasteful expenditure for the City.

Once all the data was collected and buildings were grouped according to data availability, a phased approach was taken, starting with buildings with all the required data, making it easier and less time consuming for the service provider.

Challenges and lessons learned

- The City is well-positioned to obtain EPCs using SmartFacility®.
- There are significant differences between the estimated NFA and the actual NFA: This indicates the need to standardise the method of calculation to align with the EPC standards and the importance of on-site data verification.
- It is also imperative to create internal capacity to determine NFA estimates for buildings with no building data, otherwise EPCs will be issued to buildings with NFA less than 1000m², resulting in wasteful expenditure for the municipality/building owner.
- Verification of the data is required, however, access to the correct documents, such as calibration certificates of meters and bills for data verification tends to be difficult and time consuming to obtain.
- There are only a few SANAS accredited service providers in the market, and with the deadline fast approaching, this makes it very difficult for building owners with a large building portfolio to appoint service providers to issue EPCs for all buildings required to meet the regulation.
- Building owners not disclosing critical information such as having diesel generators on site significantly delayed the process. In addition, poor diesel monitoring is highlighted as a challenge.
- Sub-metering is critical to determine accurate consumption. When buildings within a precinct are not sub-metered, the energy performance of a building will be distorted.
- The EPC methodology is still in its early phase of development and is not as nuanced as some of the more complex building modelling tools. This can result in stark discrepancies between a modelled outcome versus the EPC. We anticipate that this will improve as the methodology matures and datasets become more granular.

Procurement

Certifying a building with an Energy Performance Certificate is a new process for all South African building owners, and the energy modelling industry itself. Prior to undertaking the full initiative, it was important for the City of Cape Town to understand the process of acquiring an EPC. This led to the pilot study. A Request for Quotation (RFQ)

process was followed, with Sustainable Energy Markets (SEM), funding the initial study. The pilot study helped determine what would be the biggest pricing cost factors, what data gaps were missing from SmartFacility®, and any recommendations to improve EPC data collection. Through the pilot study, three City buildings were issued with certificates, making Cape Town, the first South African city to receive an EPC. Once the pilot study was concluded, the City needed to take the next step. Given that SEM, the coordinating department does not own buildings and nor hold budget for compliance requirements, a transversal tender was required to complete the procurement process for the broader initiative. The tender was structured with a balance between specifications, pricing schedule, eligibility (accredited entities) and functionality criteria to get the right service provider and value for money. The City's large portfolio of buildings requiring EPCs meant that a fit for purpose procurement mechanism was needed.

While data collection began prior to appointing a service provider, the long lead time associated with municipal procurement processes meant that the procurement processes needed to start before a full picture of data availability was obtained and the resulting pricing schedule needed to be as flexible as possible to accommodate this. Using similar work as a reference, such as an energy efficiency audit tender that looked at rates per square meter categories based on the building size, was key to determining how much time would be spent, and ultimately the pricing structure. The combined procurement process helped to standardise processes by aggregating demand across departments. It also allowed for efficient timeframes for compliance and ruled out duplication by relying on SEMs knowledge to develop one set of specifications that would apply for the whole program of work rather than each department developing their own specifications, pricing schedule and functionality criteria. The City of Cape Town was able to get this jumpstart on the EPC work due to;

- A unique institutional arrangement ie the establishment of a Department (SEM) within the Energy Directorate that had amongst others a focus on data management, net zero carbon buildings and change management.
- Staff with capacity and knowledge in data management, green building design and practice, strategy and stakeholder engagement.
- Acknowledgement and support for the development of data tools and systems.
- Inclusion of EPC targets in SEMs SDBIPs and scorecards.

Challenges and lessons learned

- When developing a tender, ensure that the pricing schedule includes buildings that do not meet the NFA requirement (i.e. buildings with NFA less than 1000m²) in order to avoid paying for issued EPCS on buildings smaller than 1000m².
- Start data collection as early as possible to avoid any delays with the procurement process
- Work closely with Supply Chain Management practitioners and building owners
- Start procurement early to allow for processes that take time
- Have representatives from other building owner departments on Bid Evaluation Committees and Bid Adjudication Committees

Case Study

Observatory Metro Police Academy is a building owned by the City of Cape Town and is located in Observatory. It consists of two occupancy classes, namely G1- Offices and A3- Places of instruction. The building consists of two floors and has a net floor area of 1136 m². Through the EPC compliance initiative, the building's energy consumption was calculated to be 46 kWh/m²/annum and thus achieved a B rating. A comparative building with the same occupancy classes and in the same energy zone has a maximum energy consumption of 141 kWh/m²/annum as per the SANS 10400-XA: 2021 energy efficiency regulations. This means that the Observatory Metro Police Academy performs at least 200% better than what is required by the national regulations when compared to similar buildings of the same size and typology.

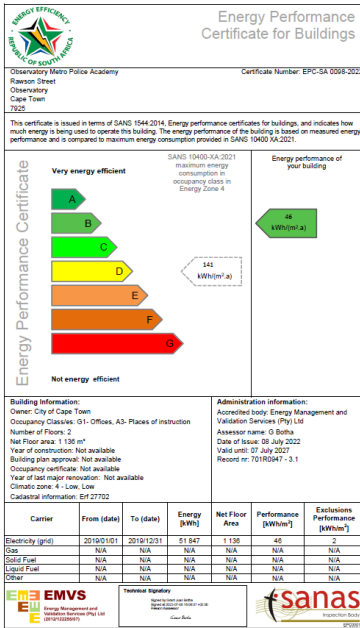


Figure 7: EPC issued and handed over at the Observatory Metro Police Academy

Conclusion

Since the National Government gazetted the regulations and in the face of inevitable challenges, the City of Cape Town embraced the regulations, by becoming the first South African municipality to achieve compliance for 25 municipal buildings. We are on track for full compliance by the deadline of 7 December 2022. For the City, complying with the EPC regulations means many things such as improving data collection and establishing energy performance baselines and scope for improvement that results in cost savings and a reduction of carbon emissions associated with a building’s operation. EPCs are therefore an important mechanism for the City to further understand the energy consumption of municipal buildings and identify energy efficiency measures that could save money and increase the value of the municipal buildings. This is also a crucial step to help the City achieve its commitments of delivering net zero carbon municipal buildings by 2030 and city-wide carbon neutrality by 2050 (CN2050).

Although many lessons were learned throughout the initiative, it is important to highlight the value of a pilot program such as the one that the City undertook, especially when there are many unknowns. Taking a coordinated approach and ensuring regular engagements with relevant stakeholders is critical to enhancing collaboration, reduce the time and cost associated with compliance and ensure a cohesive and cost effective approach across departments impacted by the regulations. Lastly, a rigorous data collection process, through tools such as SmartFacility®, before appointing a service provider is the foundation to a successful implementation of the this initiative, however, this does not mean that municipalities without such tools cannot create innovative solutions to meet EPC compliance.

Through the EPC compliance initiative, the City of Cape Town has established a process which will see that approximately 100 identified buildings will have EPCs issued before the deadline of 7 December 2022.