

ISSUE 05

SMART CITY.za

B U L L E T I N

**SMART CITY
IMPLEMENTATION:
ENERGY**

**INTERVIEW WITH
ANDRES DETOMASI**

DBSA  **WORLD BANK GROUP**

**AN ECOSYSTEMS
APPROACH TO
SMART ENERGY**



**SMART ENERGY
PROJECTS IN SOUTH
AFRICAN CITIES**

FOREWORD

By **LUNGA MADLALA**

It does not seem to be very long since I contributed to [SmartCity.za Bulletin #3: Journeying to the Smart City: Preparedness](#); 2022 was clearly short and fast. Since then, we have been busy in eThekweni, alongside our peers in the cities of Johannesburg and Tshwane, working on both strategic matters (see [Bulletin #4 on Smart City Strategies](#)) as well as pushing into project identification and implementation. Energy has been identified as one of three key domains/sectors that must be prioritized in the identification of the pipeline of projects for smart city implementation.

Energy management is one of the most demanding issues within such urban centres owing to the complexity of the energy systems and their vital role. The rise in population and excessive energy usage habits have resulted in increased use of presently available energy. South Africa is currently going through load shedding which tries to balance the supply and the demand using the existing energy mix. Therefore, significant attention and effort need to be dedicated to the energy problem. Our strategy is to reduce reliance on Eskom by 20% in 2025, and achieve energy independence by 2050. This will restore energy security and contribute meaningfully to the economic growth of the city.

Digitalization is at the core of our smart city vision and it can be a powerful means for increasing efficiency, productivity and energy savings. To ensure a more systematic and coordinated approach to our efforts, the alignment of our Digitalization and Energy strategies is crucial. The 4Ds of our energy strategy include digitalization as a fundamental

principle in transforming the energy industry in eThekweni. In fact, the 4D's, which include deregulation, decentralization, and decarbonisation, embody smart principles and make way for innovative solutions that will improve the energy system, and effectively make the required transformation of the energy industry. Our recent energy policies have been daring enough to make room for the required changes in our energy industry. It is now up to us and the city leadership to channel these principles into everyday practice so that energy independence is achieved. The Energy Deep Dive hosted by Andrew Detomasi, the World Bank's international energy expert, provided valuable lessons and guidance on our selection of Energy priority projects. It helped us focus on installing green power, improving efficiencies and the environment, and improving customer experience by implementing appropriate information systems. We hope the identified energy priority projects will contribute to some of the changes that the city is making towards using smart approaches to meet the needs of the eThekweni community.

The Digital Deep Dive hosted by Microsoft in November 2022 has encouraged us and our pilot city counterparts to implement digital energy solutions in a coordinated and integrated manner in order to profit from the synergies among all these solutions. We were honored to share our [Strategic Hub platform](#)¹, which is a simplified public dashboard that provides access to city data to all city stakeholders. The Strat Hub platform brings digital governance to our fingertips and demonstrates that

digitalization at eThekweni is no longer just a vision for the future, it has already begun.

Digitalization holds great promise to help improve the safety, productivity, efficiency and sustainability of energy systems worldwide, but it also raises questions of security, privacy and economic disruption. Furthermore, with digital technologies changing so rapidly, there are many unknowns about how technology, behavior and policy will evolve over time and how these dynamics will impact energy systems into the future. To ensure a more systematic and coordinated approach to our efforts, eThekweni is considering establishing a cross-city Digitalization and Energy Working Group that will be drawing on expertise from the World Bank and learning from other cities that are ahead of us.

As we enter 2023, I would like to offer the following words of motivation to our city practitioners and partners. The transition journey to a smart city is a process and not an event. Consultation with stakeholders becomes important to get things done the right way from the beginning. Taking a step or two back may be required if there are other foundational elements that are not in place yet. Alignment of the business with the technology is crucial. Strategies have to be developed and then aligned. The selection of a champion that will look at the city from the horizontal (helicopter) view to ensure integration across all sectors, is critical.

¹ Strat Hub: <https://strathub.durban.gov.za>



Mr. Lunga Madlala
 is the Chief Digital Officer and Smart City
 Champion at eThekweni Municipality.

PREFACE FROM THE EDITORS

by **GECI KARURI-SEBINA** with **LETHU MASANGO**

Photo credit: Pixabay

2023 has continued to find South Africa battling with load shedding, and cities struggling with complicated political, socio-economic and financial challenges. The Smart Cities pilot programme has carried on nonetheless with the three cities (Tshwane, Johannesburg, and eThekweni), and progress is being made. To match where the programme is, we now go into a mini-series with the bulletins which will focus on the common priority sectors and ecosystems that the pilot cities have selected through the pilot process: smart energy, smart water, and smart public safety.

This first Bulletin in the mini-series focuses on energy, which captures well the zeitgeist of both the global and local times that we find ourselves in. Globally - climate change remains one of the most pressing issues of our times, with countries pledging to reduce CO2 emissions under the Paris Agreement. The C40 network of world megacities is focused on fighting the climate crisis and driving urban action in line with the 1.5°C climate mitigation target, but also champions energy equity and a just energy transition - so seeking to reduce greenhouse gas emissions and climate risks, while increasing the health, wellbeing and economic opportunities of urban residents. Locally - a collapse in South Africa's generating capacity has resulted in widespread national blackouts of electricity supply. Inadequately developed alternative energy and energy management systems nation-wide means that smart

responses have been urgent but also challenging.

In this issue, we explore the role and approaches to energy in smart cities. The eThekweni case demonstrates the progress that the city is making with their "4Ds" (deregulation, decentralization, decarbonization and digitalization), but also the challenges they are facing such as an inadequate finance mechanisms, rapidly changing business models, limited technical skills, and a highly regulated sector. We also reflect on smart energy projects identified in the pilot cities. The projects reflect some common city needs - to improve energy efficiency and reliability, and to increase energy independence.

An insightful interview with World Bank energy expert Andres Detomasi highlights the political, social and economic priority of energy in South Africa right now, and focuses his recommendations around encouraging local electricity companies to implement 'smart activities'. This would include for example implementing and upgrading basic Management Information Systems to efficiently manage outages and consumer complaints. Detomasi also suggests that cities should focus on increasing their generation capacity.

What the practitioners and research seem to tell us in this Issue is that we need to build healthy smart city ecosystems. Also, energy is recognised both as a precondition, as well as one of the key pillars of a smart city which is affected by other

pillars - e.g. by environmental resources, digital systems (such as effective information systems), and public safety.

The key takeaways that emerge are that;

- Energy should be approached as a social project - its impacts on job creation, education, etc mean that it needs to be viewed more broadly
- It is important to take a holistic approach to smart city development - what happens in one corner of our smart city plans affects all other dimensions.
- Collaboration and continued knowledge sharing between multiple stakeholders is key to develop solutions that are sustainable and impactful.

This sectoral mini-series follows upon the first four SmartCityZA Bulletins which focused on Smart City Definition, Partnering, Preparation and Strategy respectively. Looking now at issues of Smart City Implementation, we see that practical and intersecting issues begin to come up about sectoral planning, programmes and projects - and inevitably about the ecosystems that enable successful implementation. We look forward to continuing to share local knowledge and experiences as our cities journey through their respective smart missions.

See you in the next issue!

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LEARNING EVENT UPDATES



B y L e s e g o T s h u w a

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Peer Learning Event Hosted by Microsoft South Africa

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15 November 2022

 By Lesego Tshuwa²

The third Peer Learning Event (PLE) of the DBSA Smart Cities Programme was hosted on November 15th, 2022, by Microsoft South Africa at its Bryanston Head Office in Johannesburg. Forging meaningful partnerships with industry players from which the pilot cities in the Programme can benefit has been of great importance for the programme. The theme for this iteration was Data and Digitalization. The event was attended by the various water, energy, and safer cities lead officials from eThekweni Municipality, the City of Tshwane and the City of Johannesburg. Also in attendance were Information and Communications Technology (ICT) representatives from the cities. The three city sectors have been working towards identifying three priority projects to which Terms of References for pre-feasibility studies will be developed. ICT, and data and digitalization informs a large and important piece of how best these projects will be supported at the municipal level.

The third PLE highlighted that data is positioned between business and technology. Missing important data causes shortcomings and makes a business lose direction. Therefore, the

institutionalisation of data management practices is important, that is, data conceptualisation, data engineering or science, data manipulation, data consumption, and data governance and security.

Oscar Santiago, a World Bank expert in safety, conflict resolution and violence prevention, reflected that understanding the urban ecosystem will be important for the cities. Additionally, understanding the city vision is critical. What city do we want to live in? What kind of city do we want to contribute towards? What future nation do we want to be? These questions framed by Santiago were found to be quite relevant by attendees. The questions do not only affect how cities plan for citizens, but also indicate the level of thought that needs to go into improving the living experiences of city inhabitants.

In usual PLE fashion, the cities provided presentations on their progress within the Programme and indicated their areas of need and support per sector. Across the sector presentations and discussions, officials noted the need to appreciate who their customers are, locally and regionally, to draft models for payments from customers that can

help the cities get revenue. Capacity and financial constraints are limiting the work that can be done by each sector. This is evident in real time as many of the pilot cities continue to be plagued by complaints about lack of adequate service delivery. Cities are experiencing a lack of capacity and technical skills. Community participation is not being done properly and systems in place are not necessarily what communities want, which makes it difficult for communities to take ownership of what is currently being delivered.

It is through the sharing of how best to align to smarter ways of working, and with the assistance of the respective global experts that lived experiences of city residents can improve within the pilot cities. This PLE was geared to set the ground for further discussions with the cities where in the coming months the focus will be on the completion of concept notes per project, by each sector. These concept notes will set the tone for informed Terms of Reference to be drafted for pre-feasibility studies, and then after the implementation plans developed to assist each city getting closer to realising meaningful project implementation.



² Lesego Tshuwa is a World Bank Consultant in the Smart City South Africa Pilot Programme.

Digital Deep Dive

By Lesego Tshuwa

The Smart Cities South Africa Peer Learning Events are designed to gain external expert views and this event was no different as the host, Microsoft South Africa, invited data experts to share their insights with the city representatives in the last session of the day. Presentations ranged from what can be useful from an academic standpoint to how industry players can assist the municipalities to know better and use the right tools in the market for improved operations and efficiencies. The discussions were mostly technical, proving that the data space is filled with complexities. The data space jargon and processes can be quite difficult to follow. A presentation by eThekweni Municipality showcasing their work with Microsoft support was highly important as this contextualisation of what can be feasible at Municipal level allows for any audience member to relate to data in a different manner.

“SO WHERE DOES THIS LEAVE OTHER EXTERNAL PLAYERS?”

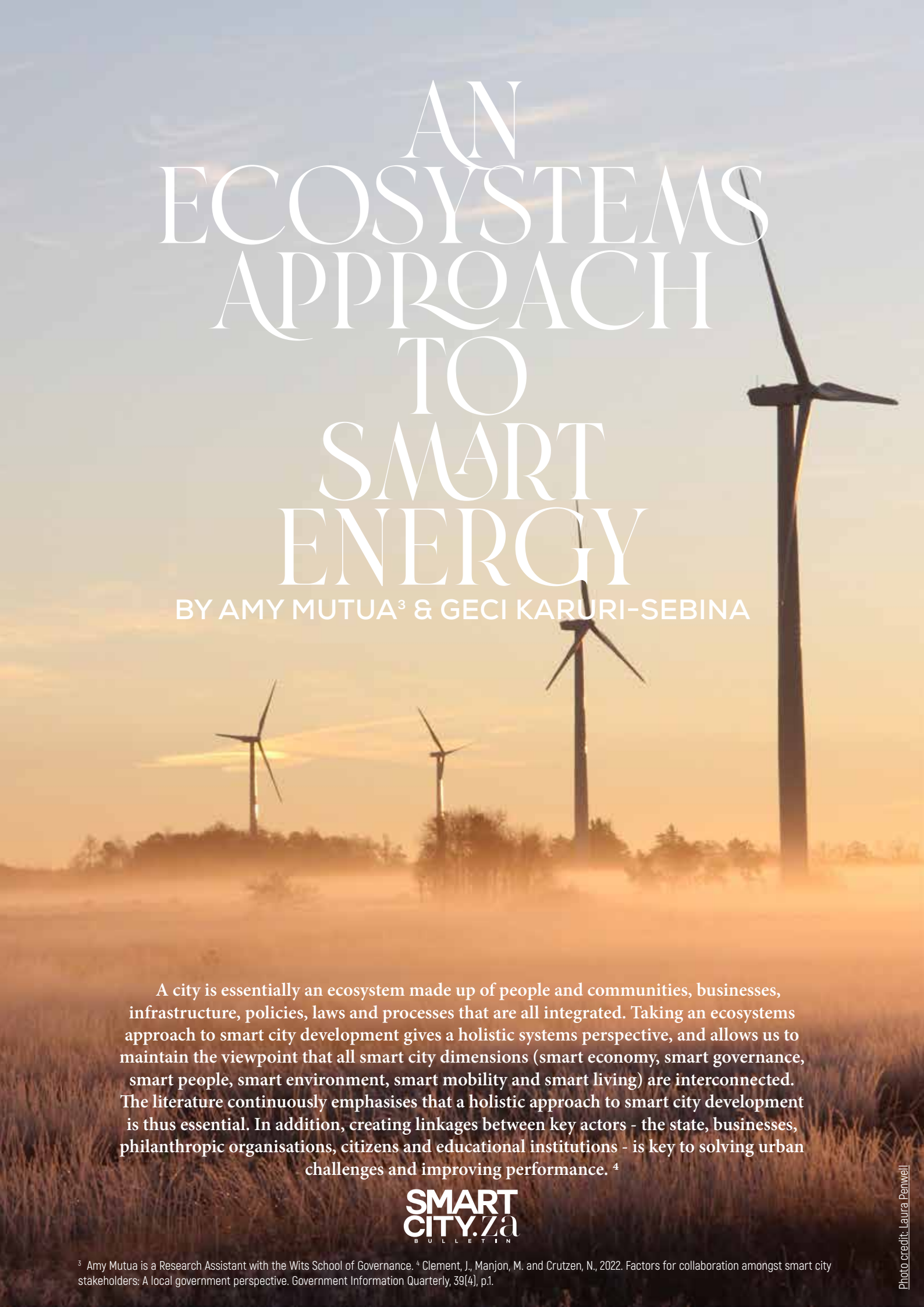
Essentially when one thinks back to the session, a critical question that arose from the deliberations is How can cities be best supported by those working in the data space? The above mentioned reference to the eThekweni Strat Hub therefore becomes relevant herein. In the session the eThekweni team showcased the eThekweni Strat Hub, a simplified portal for ac-

cess to governance structures. This access to eThekweni Municipality dashboards which provide the public with access to information so that they know how best to respond to issues that affect their communities is a step in the right direction. Further discussions with eThekweni Municipality have highlighted that the development of this Strat Hub has been through the city's relationship with Microsoft. The Strat Hub is an internally developed domain by city officials who have taken on this work over and above their day-to-day responsibilities. This team of 5 members were motivated by the advent of the Covid-19 pandemic and what this meant for innovative thinking and practice. Noting that municipalities are often criticized for not being accessible to citizens, the team has developed interactive dashboards that not only curb this gap for ordinary eThekweni residents but city officials themselves as some of the data gathered assists with improving efficiencies for departments themselves. Microsoft, as an existing client of the city, offers its services by providing knowledge and capacitating officials that run the Strat Hub where applicable. These are technical and focused interactions which have saved the city millions as adaptation is applied internally.

During the PLE session it was recommended that cities work towards an integrated approach model that can help with efficiencies. Officials were encouraged to ask; how can I use IT to make my life better? The City of Tshwane, inspired by the eThekweni Strat Hub presentation, requested a meeting with eThekweni Municipality for further learning and collab-

oration. A discussion really encouraging for the project team as we push the cities to work better together for a transformative South Africa beyond regional boundaries! Very telling is how municipalities are seeing the vision to do things themselves. By learning from eThekweni, the City of Tshwane can also potentially save millions, capacitate staff that will be involved in this work and empower officials to ask the relevant questions around what citizens in those municipalities actually need. Such an initiative is not only forward thinking, but signifies how data complexities can be lessened if more people work together to find solutions that are sometimes readily available i.e. the already existing relationship with Microsoft and how this has been converted into a powerful win for eThekweni Municipality. So where does this leave other external players? Perhaps the eThekweni example indicates that where cities can reduce high costs in data management and application, they should. This refreshing way of operating is commendable and very aligned to smart thinking that not only improves city efficiencies but is citizen centric. Any cost saving measures that shape progressive ways of operating are highly encouraging, especially for technical experts in such a Programme that recognises the need for municipalities to be driving projects that are transformational and impactful. This alignment to what the data on the ground is translating is beyond impressive and should be replicated in other cities to also empower them to do better for their citizens.





AN ECOSYSTEMS APPROACH TO SMART ENERGY

BY AMY MUTUA³ & GECI KARURI-SEBINA

A city is essentially an ecosystem made up of people and communities, businesses, infrastructure, policies, laws and processes that are all integrated. Taking an ecosystems approach to smart city development gives a holistic systems perspective, and allows us to maintain the viewpoint that all smart city dimensions (smart economy, smart governance, smart people, smart environment, smart mobility and smart living) are interconnected. The literature continuously emphasises that a holistic approach to smart city development is thus essential. In addition, creating linkages between key actors - the state, businesses, philanthropic organisations, citizens and educational institutions - is key to solving urban challenges and improving performance. ⁴

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³ Amy Mutua is a Research Assistant with the Wits School of Governance. ⁴ Clement, J., Manjon, M. and Crutzen, N., 2022. Factors for collaboration amongst smart city stakeholders: A local government perspective. Government Information Quarterly, 39(4), p.1.

Energy & Smart Cities

Energy is an essential component of the smart city because of its impact on other urban dimensions.⁵ As depicted below in figure 1, energy affects economic activities, the health of our environment, transport systems, the development and management of the built environment and infrastructure as well as the overall quality of life that residents can enjoy. The impact of energy on different elements of the smart city demonstrates the value of the ecosystem approach and makes evident why energy challenges should be addressed as a core part of a smart city strategy.

Cities are major energy consumers with the construction and maintenance of buildings accounting for a large percentage of energy consumption.⁶ Optimising energy systems in building can lead to significant energy savings without affecting the comfort of users. In addition, through the use of smart technologies such as microgrids, buildings can move from being passive energy consumers to active participants in the energy system.⁷ Similarly, the transport system consumes a considerable amount of energy. Here, smart technology can be used to improve efficiency and save energy through the management of traffic and congestion as well as through the provision of real-time information on routes, public-transport options and available parking.⁸ Thus, utilising smart approaches can contribute to greater energy efficiency and promote sustainable consumption as part of demand management. Efficient energy

management will also have positive outcomes for both the environment and the health of residents.

An important component of energy systems are the grids which form the ‘energy backbone’ of a city, transmitting energy from generators to city residents.⁹ While traditional grids have limited flexibility, a smart grid “gives energy providers the flexibility to distribute energy where and when it is needed most, while giving customers the information needed to make environmentally conscious and cost-effective energy choices” by utilising information and communication technology.¹⁰ In this way, smart energy systems allow for more effective distribution of energy resources. However, developing these smart grids is a massive task and depends on public-private collaboration to provide the financial support and technical knowledge and skills needed.

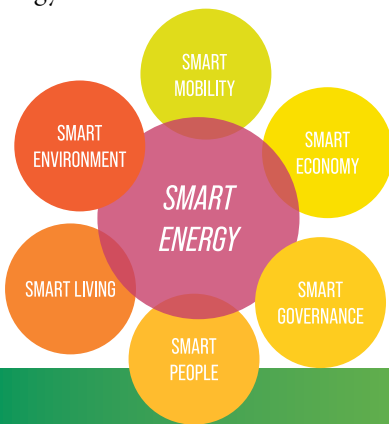


Figure 1: Energy's Impact on Smart City Dimensions (authors own)

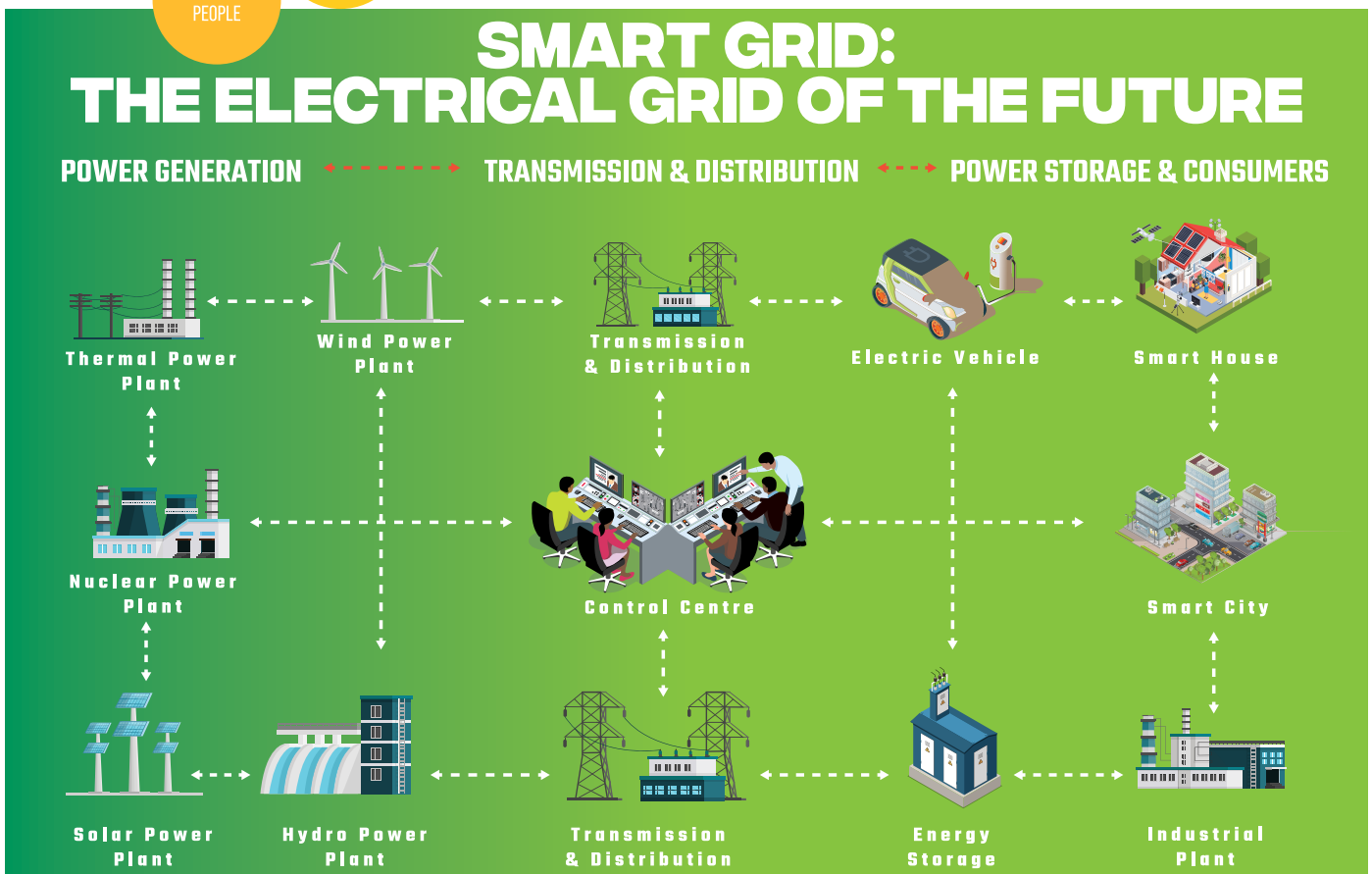


Figure 2: Smart Grid: The Electrical Grid of the Future (Bhowmick, 2022)

⁵ Calvillo, C.F., Sánchez-Mirallas, A. and Villar, J., 2016. Energy management and planning in smart cities. *Renewable and Sustainable Energy Reviews*, 55, pp.273-287. ⁶ Calvillo, C.F., Sánchez-Mirallas, A. and Villar, J., 2016. Energy management and planning in smart cities. *Renewable and Sustainable Energy Reviews*, 55, pp.273-287. ⁷ Ibid. ⁸ Ibid. ⁹ Ibid. ¹⁰ Schell, C., 2022. "The future of energy is systemic, open and collaborative – and runs on a smart grid," *World Economic Forum*, 22 December.

In South Africa, coal and oil make up the majority of energy consumption with only a small percentage comprising natural gas and nuclear power.¹¹ Despite years of renewable energy being championed, especially in the developing world, it still contributes only a negligible amount of the overall energy consumption. Calvillo et al. stress that smart cities must be moving towards utilising renewable energy sources such as wind and solar energy.¹² However, a shift to renewables needs to strike a difficult balance between being “economically justifiable, financially viable, institutionally sustainable and locally replicable”.¹³

Smart City Reliance on Energy

Although cities are not principally responsible for power generation, the smart city relies on base infrastructure, including energy systems. This emphasises the ecosystem nature of smart cities, where actors and roles are interconnected.

The case of South Africa’s energy crisis demonstrates the importance of energy management in cities and its widespread impact on other dimensions of urban life. If a city is working towards being smarter, a lack of reliable energy supply presents a significant

challenge. One example of the impact of load shedding relates to smart mobility, specifically e-hailing apps which require network connectivity. Load shedding leads to network outages as cell phone towers lose their power supply resulting in connectivity issues. Riders who rely on these apps to get around the city may have difficulty requesting a ride for the period of time an area is experiencing load shedding.

The Ecosystems View

It is useful to explore the conditions that are important to develop when fostering a healthy smart city ecosystem. If energy challenges are better addressed as a whole rather than separately, then there is a need for effective collaboration between a variety of actors. This can lead to complex working arrangements. According to the literature, there are certain prerequisites to maintain internal alignment between smart city actors and ensure the success and growth of smart [energy] initiatives. Oomens and Sadowski outline three below:

1. Facilitating networking relationships

The first prerequisite is facilitating networking relationships between all partners and stakeholders. Oomens and Sadowski¹⁴ explain that “networking visioning requires strong interactions be-

tween partners to enable smooth transactions, collaborations and knowledge sharing between all participants in the ecosystem”.¹⁵ Weak relationships between partners can hinder growth due to a misalignment of goals/priorities/intentions. They state that alignment is affected by how networking relationships between partners are organised, how value is created and captured and how ecosystem strategies are implemented. Building these relationships during the initial formation of smart city strategies requires the building of trust as well as agreeing on a well-defined and shared vision. “Shared vision was underpinned by implementing the structures to brainstorm and prioritise agendas, envision opportunities and risks and designing activities that allow for the development and operationalisation of shared vision across the ecosystem”.¹⁶ This can be a challenge at times as different stakeholders have different motives for participating in smart city initiatives. Because of this, expectations need to be communicated early on.

2. Ensure good governance

A smart city ecosystem, made up of multiple stakeholders can be difficult to govern and local governments should take on a mediating and guiding role with the city acting as the primary organiser of their smart city ecosystems.¹⁷



Ofentse Mokwena
@hlulani_com

Chaos for e-hailing services amid load-shedding | @ITWeb “South Africa has been having a lot of conversations about becoming a smart city, and the basics of that are internet integration and consistent connectivity and energy supply.”

Figure 3: Chaos for e-hailing services (Ofentse Mokwena Twitter account)

¹¹ Van Rooyen, H., 2008. A holistic framework for the conceptualisation of the energy crisis. *Discourse*, 36(1), pp.16-27. ¹² Calvillo, C.F., Sánchez-Mirallas, A. and Villar, J., 2016. Energy management and planning in smart cities. *Renewable and Sustainable Energy Reviews*, 55, pp.273-287. ¹³ Van Rooyen, H., 2008. A holistic framework for the conceptualisation of the energy crisis. *Discourse*, 36(1), pp.21. ¹⁴ Oomens, I.M. and Sadowski, B.M., 2019. The importance of internal alignment in smart city initiatives: An ecosystem approach. *Telecommunications Policy*, 43(6), pp.485-500. ¹⁵ *Ibid*, 486. ¹⁶ Gupta, A., Panagiotopoulos, P. and Bowen, F., 2020. An orchestration approach to smart city data ecosystems. *Technological Forecasting and Social Change*, 153, p.7.

When conflicts between partners arise – “ecosystem strategies driven by a focal firm should lead to internal alignment with the rest of the partners in the ecosystem, but should maintain, at the same time, independence of the partners in the ecosystem while pursuing a joint value proposition.”¹⁸ Good governance is vital and roles and responsibilities should be clearly defined early on as establishing normative rules and structures at the formation stage provides a level playing field for all actors.¹⁹ To this end, it is important to have developed a smart city strategy.²⁰

3. Maintaining knowledge sharing

Lastly, maintaining knowledge sharing between partners is vital. It is important to continuously and intentionally provide opportunities to improve learning capabilities and technical skills through knowledge sharing between actors. Gupta et al. echoes this idea stating that “openness, diffusion and shared vision are key enablers for the coordination of a city’s data initiatives” in response to the complex management challenges faced.²¹ While, openness prevents the duplication of smart city efforts, diffusion leads to sustainability as new practices are embedded.

Case Study: Smart Otaniemi

Smart Otaniemi²⁶ in Finland is an example of an ecosystem that connects experts, organisations, technologies, and pi-

lots.²² It provides an innovative ecological cooperation framework for leading voices in the smart energy field to collaborate and build a new, smart energy system.²³ In 2018, the Finnish Ministry of Commerce granted Smart Otaniemi (along with 11 companies and 3 research institutes) nearly five million euros for the development of a smart energy system test platform.²⁴ Pilot projects included exploring the use of 5G and IoT platforms to improve energy efficiency and create more flexible electricity markets.²⁵

Smart Otaniemi aims to create relationships with networking partners through incubators, corporate venturing and co-creation events. They believe that it is impossible to achieve breakthrough alone, especially in the energy sector because of its systematic character. To this end, Smart Otaniemi collaborates with research organisations, the public sector, financiers as well as a variety of companies and organisations. Some of these partnerships include: Flexens, a company using their capabilities to initiate, develop and invest in projects that enable societies to run on a 100 % renewable energy mix; The Finnish District Heating and Cooling Association, a non-profit association whose goal is to strengthen research and development activities related to district heating; Smart Energy Systems Competence Center, a knowledge ecosystem that focuses on the ongoing energy revolution and the opportunities that arise with digitalization; and EnergyVaasa, a significant

international actor in the field of smart electronic solutions, sustainable energy, flexible power generation and digitalization. These partners all share the same vision for smart energy and are able to create value and support Smart Otaniemi’s vision to reinvent energy production and consumption by creating smarter solutions for industrial use and for everyday life.

“BUILDINGS CAN MOVE FROM BEING PASSIVE ENERGY CONSUMERS TO ACTIVE PARTICIPANTS IN THE ENERGY SYSTEM”

Conclusion

The issue of energy provides an instructive example of the importance of taking a holistic approach to smart city development. It helps us understand that what happens in one corner of our smart city plans affects all other dimensions. A systems perspective is therefore crucial for the smart city, and calls for us to build strong partnerships, strengthen collaboration efforts and promote knowledge sharing. This is the only way to develop solutions that are sustainable and create a thriving smart city ecosystem.



¹⁷ Clement, J., Manjon, M. and Crutzen, N., 2022. Factors for collaboration amongst smart city stakeholders: A local government perspective. *Government Information Quarterly*, 39(4), p.1-11. ¹⁸ Oomens, I.M. and Sadowski, B.M., 2019. The importance of internal alignment in smart city initiatives: An ecosystem approach. *Telecommunications Policy*, 43(6), pp.487. ¹⁹ Ibid. ²⁰ Clement, J., Manjon, M. and Crutzen, N., 2022. Factors for collaboration amongst smart city stakeholders: A local government perspective. *Government Information Quarterly*, 39(4), p.1-11. ²¹ Gupta, A., Panagiotopoulos, P. and Bowen, F., 2020. An orchestration approach to smart city data ecosystems. *Technological Forecasting and Social Change*, 153, p.1. ²² Dai, C., Tang, M., Liu, Y., He, J., Yang, Z. and Yang, Y., 2020, August. Designing Smart Energy Network Ecosystem for Integrated energy services in urban areas. In *2020 IEEE 16th International Conference on Automation Science and Engineering (CASE)* (pp. 305-310). IEEE. ²³ Ibid. ²⁴ Ibid. ²⁵ Ibid. ²⁶ Collaboration is gold in ecosystems. 2021. Smart Otaniemi. Available at: <https://smartotaniemi.fi/posts/collaboration-is-gold-in-ecosystems/>

LOCAL PERSPECTIVE

INTERVIEW WITH SBU NTSHALINTSHALI

The energy sector was identified by the eThekweni Municipality as one of the key priority sectors where smart interventions are required to impact the greater city ecosystem. The eThekweni Municipality is implementing some transformational policies and adopting smart approaches to improve the livelihood of residents in eThekweni. Chuma Mbambo catches up with Sbu Ntshalintshali, who is leading eThekweni's energy projects in the DBSA Smart Cities Programme.

Sbu is responsible for the development of the energy industry in eThekweni Municipality. Prior to joining eThekweni Municipality, he worked for the Dow Chemical Company. The city has finalized its new strategic direction and is now conceptualizing actions that are required to create a sustainable and smart energy sector. Sbu chats to us about the city's energy activities over the past 10 years and the outlook for the energy sector in eThekweni.

INTERVIEW

WITH **SBU NTSHALINTSHALI**

Q: How would you define a smart energy sector?

Sbu: I would say that smart energy refers to the efficiency and effectiveness of the energy system within the city. Being ‘smart’ means we can measure and quantify the impact of the infrastructure projects that will be rolled out over time. It also means we will be able to digitize our infrastructure to effectively respond to the socio-economic issues that are being faced by people.

Q: How has the eThekweni Energy Department begun to align itself with the ‘smart’ approach?

Sbu: We have several policies in the energy sector, the first policy position of the municipality was the Energy Strategy which was adopted by the council in 2008. Then we upgraded in 2015 to the Natural Gas Strategy, and the Sustainable Development Plan. Recently we developed the most important policy framework called the Energy Strategic Roadmap, as well as the Citywide Integrated Resource Plan. Those two policy documents are the ones that guide the development of the energy industry in eThekweni, the procurement of new generation capacity and regulate how we bring in the smart city approach and are likely to transform our energy system and overall supply value chain as we move towards the low-carbon economy. Most importantly, they are likely to address the issue of declining energy security that we are facing now.

In terms of energy initiatives, we started as an office that was primarily rolling out solar PV panels at household and municipal operations. But we realized over time that we are unable to measure our savings due to the ‘smart’ elements not being integrated into our approach. That’s why we have started to look at the 4Ds of the energy sector, that is: deregulation, decentralization,

decarbonization and digitalization.

With deregulation and decentralization, we realize that we need to be flexible to make a place for smart practices in all our projects. These will pave a conducive environment for smart thinking in our energy infrastructure projects. We also have the decarbonization approach which starts to bring the elements of climate change closer to all our energy projects over time. Then we also look at the broader aspect of digitalization in terms of understanding how we can transform and modernize our energy system.

“WITH DEREGULATION AND DECENTRALIZATION, WE REALIZE THAT WE NEED TO BE FLEXIBLE TO MAKE A PLACE FOR SMART PRACTICES IN ALL OUR PROJECTS.”

So that has been our transition since we established the Energy Office in 2011. Today we have optimized to a point where we can evaluate and include the 4Ds in our energy infrastructure projects and want to continue to implement these principles in all our projects to be able to measure the savings we are getting from this, and then use them to implement more meaningful projects over time.

Q: You mentioned the Solar PV programme that is being implemented by the city. Are there

any other projects that the city has implemented that are smart and directed at addressing the city’s urban challenges?

Sbu: There are quite a number of initiatives that we’ve just started. The solar PV project showcased the transition of the municipality and how we can reduce our bulk operational expenditure in municipal buildings. Other initiatives include the community-based solar PV infrastructure in the form of a microgrid economy, which we called the Energy Emergency Programme. This programme helps us integrate the community into our energy system and starts to identify how we can electrify certain communities to achieve a 100% electrification rate by renewable energy.

We’ve got other projects such as the 1 Panel 1 Household programme where we try and deploy solar panels to all households to ensure and improve the socio-economic aspects of our communities and reduce the impact of load shedding.

We also want to identify and deal with illegal connections, electricity theft and the vandalism of community infrastructure. These programmes have been designed and conceptualized, and it’s a matter of rolling them out in the future. This programme becomes crucial especially now that we’re facing the energy crisis, and higher crime levels, as load shedding gives criminals more opportunities to steal and vandalize.

We have a bigger programme called the Municipal Independent Power Producer Procurement Programme. That programme has been designed to reduce our reliance on the national grid, as you know, we have to deal with the issue of declining energy security and economic growth.

So, we will see a rapid industrialization of energy infrastructure deployment here in Durban because we want to build new power plants, to reduce our reliance on Eskom. There is a very clear strategic direction adopted by Council, that we intend to reduce our reliance by 20% in 2025, reduce it by 40% in 2030, and by 2035 we want to ultimately become self-sufficient and be energy independent as the City of Durban.

WE DON'T WANT TO MOVE ALONE; WE WANT TO SHARE KNOWLEDGE WITH SECONDARY CITIES IN KZN.

Then, all our electricity needs will be met by the city and we can minimize electrical losses because currently, we buy our electricity from Mpumalanga, meaning that we have to transport electricity 700km from Mpumalanga to Durban, and we have to pay for all electricity losses that occur along this route.

Through smart grids and decentralization, we want to build those power plants closer to the demand, so that we minimize electrical losses over time. The programme will be implemented in the broader KZN region, not just in eThekweni. So, we will be working with other districts, 10 of them in total, to ensure that we bring regional transformation. We don't want to move alone; we want to share knowledge with secondary cities in KZN. The programme is worth R324 billion and 400MW of that has been approved by National Treasury. We are currently in the process of finding a new energy consortium company that will help the municipality put together the procurement documents, manage the RFP bidding process and help reach the final investment decision

(FID). This is a huge project that will create hundreds and thousands of jobs for South Africa/KZN over time.

Some of these programmes will officially be launched in our energy transformation summit on the 1st and 2nd of March 2023.

Q: You mentioned earlier that there are often risks of theft and vandalism, and that links to the safety and security sector. Have you collaborated with other sectors or actors to address energy challenges in eThekweni?

Sbu: Absolutely. When we say energy is a catalyst or oxygen of the economy, that's exactly what we mean. We work with other stakeholder departments to ensure that we roll out energy projects at the household level. We have been working closely with them to conceptualize our Energy Emergency Programme and our 1 Panel 1 Household Programmes, in recognizing the impact of energy in human settlements and other socio-economic aspects, particularly energy poverty which we believe is a huge challenge. The Energy Strategy Roadmap states that people use 10-15% of their income to buy electricity. Can you imagine the consequence or impact on someone who does not work at all?

We also work with architecture services which is another critical department in the municipality that looks at how we plan for all the buildings that are owned by the municipality. We can talk about households, and the impact of theft and vandalism, but at the same time municipal operations are also critical in ensuring that we are reducing operating costs and decarbonizing those operations as well. So, the energy department continues to work very closely with architecture, human settlements, and the electricity departments.

Q: What have been the challenges in implementing smart initiatives in the eThekweni, and how can these be resolved?

Sbu: There are some generic challenges that you'll find in any sphere of government. The first is the lack of finance. The project can either fail or do very well depending on the availability of finance. Without a clear funding instrument for these programmes, it can be very difficult to implement them. Let alone that energy infrastructure projects by municipalities are not sovereign backed and municipalities must guarantee themselves.

The market conditions for the energy sector are also fast changing. This requires that the municipalities change their business models quite rapidly or face a death spiral. The business model requires that we have modernized institutional structures and technically inclined employees that are adequate for the challenge. Human resources are a big challenge in achieving our goals, for sure. However, we are working hard to address that.

Lastly, we work in a sector that is highly regulated and I can tell you that our journey towards obtaining Provincial and National concurrences has been full of regulations. I don't know how many times we've had to present to different structures of government. The regulation of the market environment could be a good and bad thing, but given the energy crisis we have right now, I would even say it is a result of the over-regulated environment in the energy industry.

Q: What does the future of smart energy look like in eThekweni?

Sbu: Well, let me take you back to the 4D's that I mentioned. First of all, in the future the sector will be deregulated, meaning that there will be more competition, new generation capacity penetration, technological advancements, innovations and more small emerging companies entering the market.

We've already seen the exemptions within the Electricity Regulation Act, and how the department of mineral resources and energy (DMRE) is working tirelessly to address the issues of regulations in the sector. Our role in local government is to create an enabling environment for policy certainty and investor confidence.

Second, we have decentralization policies. I've made the example of how our role is being limited to operate within the boundaries of eThekweni, but I can assure you that this will soon change to a role that is even far beyond the city boundary. For example, the R324 billion Power Plan is about building more power plants, and some of these plants will be located outside of the eThekweni boundary, in other districts of the KZN province, whether it will be between King Cetshwayo, uMgungundlovu, Ilembe, and the Ugu Districts. Ultimately, the energy infrastructure will be operated from eThekweni whilst located in other districts, meaning that we will

have to monitor all these power plants across KZN.

“BEING ‘SMART’ MEANS WE CAN MEASURE AND QUANTIFY THE IMPACT OF THE INFRASTRUCTURE PROJECTS THAT WILL BE ROLLED OUT OVER TIME.”

The other one is decarbonization. Looking at climate change and how best we can move away from a high-carbon-intensive economy to a low-carbon economy, decarbonization will be very crucial in the future. You may also be aware that some of the commercial banks are no longer

funding infrastructure that comes from fossil fuels, so those changing market conditions are more likely to be tighter in the future.

Obviously, our immediate focus will be energy security, economic growth and employment because you can't fight climate change without energy security.

The fourth and last aspect is what we're doing with the DBSA and World Bank, the digitalization of energy infrastructure. Here we look at how will we design a power grid that is modernized and integrated with other energy services. For example, if I have an electric car, I should easily be able to plug it into the grid. Where there is load shedding, there must also be an opportunity to feed electricity back into the grid. We can also modernize and digitize all operations in the grid, and monitor the performance of our grid. We can even monitor illegal connections and vandalism on our infrastructure through a digitalized system. These will be the core competencies of the smart grid in the future.



Mr. Sbu Ntshalintshali

is the head of Energy Transition at eThekweni Municipality, and is leading eThekweni's energy projects in the DBSA Smart Cities Programme for eThekweni Metropolitan Municipality.



SMART ENERGY PROJECTS IN SOUTH AFRICAN CITIES

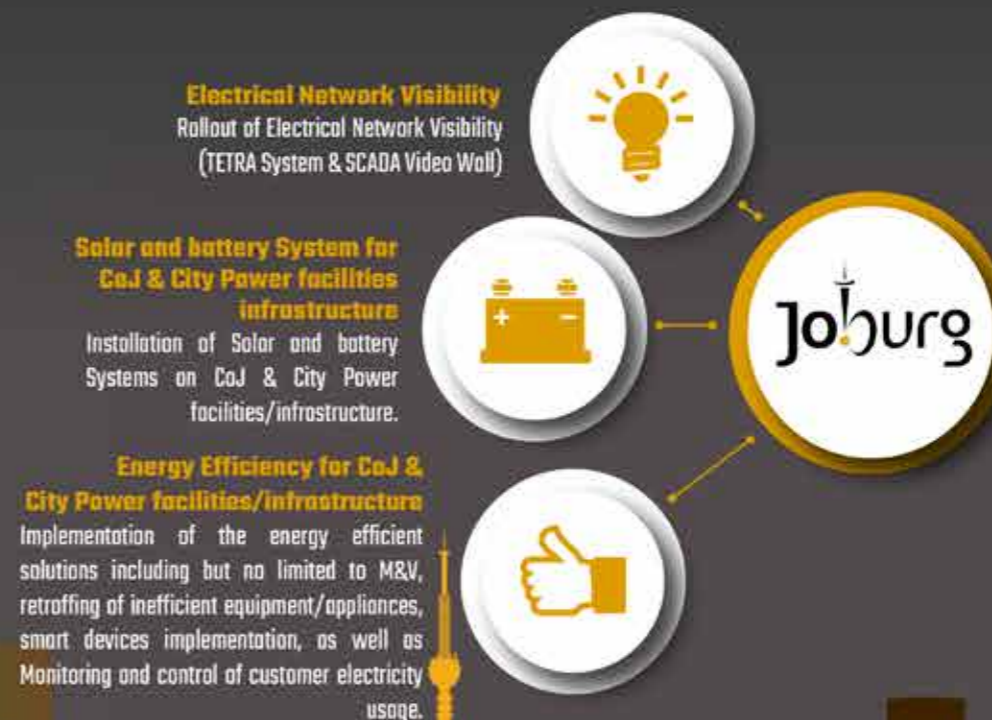
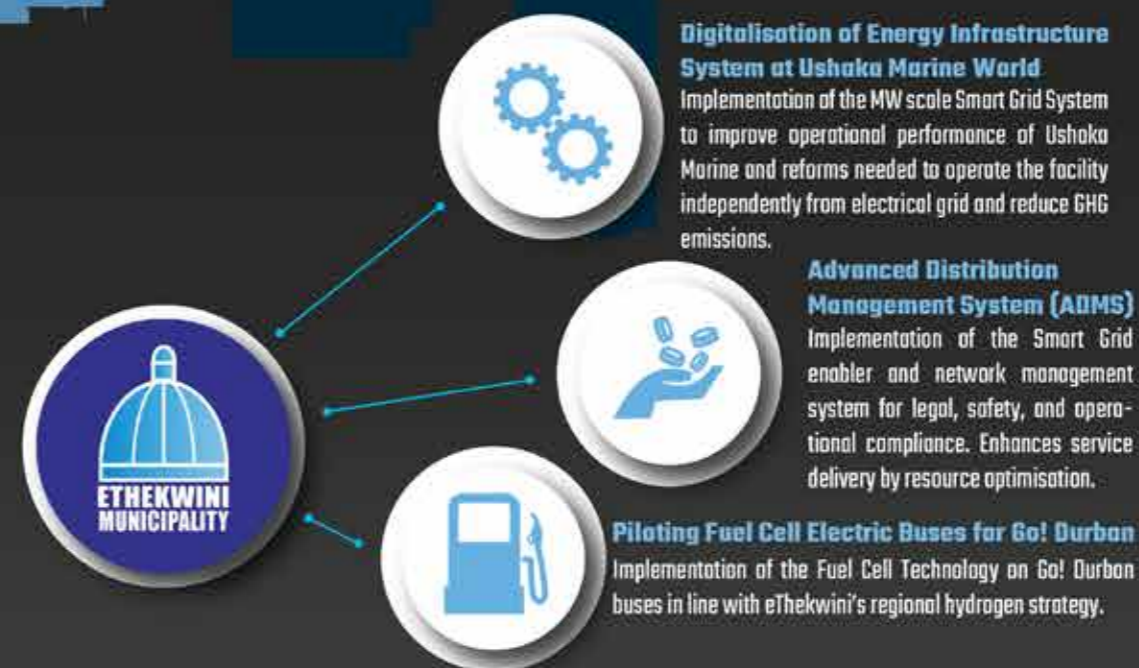
by Chuma Mbambo²⁷

The South African President Cyril Ramaphosa has declared a National State of Disaster to respond to the energy crisis and its effects. It is therefore unsurprising that energy was identified as a key priority sector in pilot cities participating in the DBSA smart cities programme. The priority projects identified in the programme come from sectors where urgent interventions will be required, and which have fundamental impact on the cities' smart city ecosystems.

This issue provides insight from a global expert on the energy crisis, as well as a local perspective from the eThekweni municipality. Below are some smart energy projects that have been identified by the Smart City South Africa pilot cities to be

considered for support in the DBSA smart cities programme. These projects provide some smart solutions for effectively and efficiently responding to the cities' energy challenges. Inevitably, the projects identified in the energy sectors also show a linkage to other city sectors.

There are ongoing engagements with the pilot cities and their energy project teams on refining the scope of work for the identified projects. The aim is to focus on how these energy projects can contribute to the ongoing energy challenge in South Africa, whilst being as realistic as possible on what these energy projects can achieve in the short and medium term.



²⁷ Chuma Mbambo is a World Bank Consultant in the Smart City South Africa Pilot Programme.

GLOBAL PERSPECTIVE

Interview with Andres Detomasi



A smart city consists of an ecosystem of services that improves the day-to-day experience of citizens. Energy is a key component of the smart city ecosystem, on which most smart city functions rely. To get an international perspective on smart energy systems, Geci and Chuma spoke to Andres Detomasi on the energy sector in South Africa and Globally. Andres is a global energy sector expert in the DBSA Smart Cities Programme and works on World Bank energy projects, including African countries such as South Africa, Kenya, Ethiopia, Somalia and Angola.

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Photo Credit: Lio Voo

INTERVIEW

WITH **ANDRES DETOMASI**

Andres prefaced the conversation by declaring that although he currently supports the DBSA Smart Cities Programme, he doesn't consider himself a smart city expert per se, but rather an energy expert who was trained as an electrical engineer and has been working in the energy sector in Africa since 2016.

Q: How would you describe “smart energy” and its impact on the smart city ecosystem?

Andres: Smart energy includes using “smart things”, this could mean using smart systems for running the electricity business, which involves 3 roles of a utility company; the network development factory (Planning and Construction); the energy seller (Commercial operations) and; the network maintainer and operator (“wires” business). As you can see, this is not a single business. In the case of SA, Eskom and municipalities run the electricity business and plays all three of these roles in the electricity industry.

The state of the distribution sector in SA, makes evident the urgent need to improve the operational performance of municipalities in distribution operations and commercial functions so that they can permanently provide good quality services to their customers, and generate revenue from all electricity consumed. Currently, the energy distribution sector of SA is facing the following main issues:

- Lack of capacity installed at the generation level, which results in the implementation of an aggressive load shedding plan (by Eskom). The average “customer of Johannesburg” faced more than 100 hours per year²⁸ without power, considering all type of outages.²⁹ This is typical country wide and represents a burden and hinderance to South Africa's development. This also has the most severe im-

impact on the poorest, and it is not fair for poor people to pay for the poor planning of the energy system.

- The high level of total energy losses clearly exceeds the level which can be attributed to technical losses. As an example, the total energy losses reported by Johannesburg's City Power are 29% of amounts of energy purchased.³⁰ Total energy losses have systematically increased, driven by the poor performance recorded by some municipalities, representing a red light in terms of commercial operation of the sector.

“IT IS NOT FAIR FOR POOR PEOPLE TO PAY FOR THE POOR PLANNING OF THE ENERGY SYSTEM.”

- Some Municipalities don't work with of state-of-art tools such as, information systems and advanced metering technologies, to support the efficient execution of all processes and activities in all business areas within a framework of transparency and accountability. This represents a bottleneck in terms of customer experience.

Therefore, in addressing some of the above-mentioned issues faced by Metros, I would consider the following projects that have been identified through

the DBSA smart cities programme to be “smart energy” projects:

- Fostering the use of green power, for example, by using clean energy for transport as proposed by the eThekweni Municipality to use renewable energy in the Go! Durban buses.

- The Supervisory Control and Data Acquisition (SCADA) rehabilitation project proposed by City of Tshwane is also a good example of smart energy projects. Traditionally, energy utilities restore power by dispatching maintenance crews to the fault location following customer calls. This implies long times for service restoration, depending on how quickly customers report the power outage, and the maintenance crews to locate and solve the problem. Instead of relying exclusively on call centers to keep track of power cuts, utilities could incorporate a SCADA system to remotely operate, supervise and control their high and medium voltage infrastructure. From an electricity distribution network point of view, the basis for any progress towards “smartness” is an effective SCADA system. Without proper visibility and control from a central point there is no possibility of adding “smartness”. An effective and complete SCADA system makes possible the addition of smart systems centrally as a first step towards achieving smart city goals. Although these might just be outage recording and management programs, or maintenance management systems which assist in the administration functions, they start down the road to customer centric improvements.

²⁸ System Average Interruption Duration Index – SAIDI, calculated as per IEEE1366, including all type of outages. ²⁹ Kenya Power – KPLC reported 12h/year as SAIDI for Nairobi as part of the Doing Business Report 2021 (published by the World Bank) ³⁰ City Power – Integrated Annual Report FY 2019/20.



- The Implementation of Distribution Management Systems (DMS) as proposed by eThekweni and the City of Tshwane. DMS is a tool to quickly and accurately identify location and analyze extent of any interruption in electricity supply, and enable fast resolution and service restoration. The system is supported by a detailed representation of the distribution network and links between points of electricity supply and network assets, using a Geographic Information system (GIS). In addition to allowing fast identification of incidents in electricity supply at all voltage levels, enabling effective management of those incidents and restoration of electricity service to customers in the shortest possible time, DMS also makes possible to record starting and ending times of all interruptions in supply affecting each individual consumer, and therefore measure frequency and duration of interruptions at the end-user level. DMS supports management and resolution of customers' complaints and other incidents in electricity supply.

Q: If you were to think about some of the strategic approaches to energy that South Africa could learn from in terms of what some of the other countries or regions have done differently, what would some of those be?

Andres: That's a really big question. Let's take the case of Kenya's KPLC³¹ An average urban consumer of KPLC in Nairobi faces a period about 12 hours without power annually.³² At present, an average customer of RSA faced more than 100 hours without power.³³ That's a big difference!

If we look at, for example, the City of Cape Town in FY2020/21, about 97% of the duration without power was related to issues recorded at the point of supply³⁴, i.e. at Eskom. So essentially the problem is the reliability of the electricity supply. There are also other issues related to commercial operation, energy losses and collection rates that are related to the distribution business, but the major issue at the moment, which is load shedding, has to do with the reliability of the energy supply.

South Africa needs to work as a unit to phase out load shedding activities, as Kenya did for expanding and improving its electricity system. This challenge is not just about electricity, this also about the social impact on the ground. It's about job creation. It's impossible to create jobs without improving the electricity service.

Regarding best practices in terms of commercial performance, we don't need to go abroad, and eThekweni could be taken as reference, with 7.7%³⁵ of energy losses in 2019/20, which results in an outstanding performance. What's interesting is that most of the engineering services firms in Africa are from South Africa. So, the problem of South Africa is not the lack of knowledge, South Africa is a leader in terms of knowledge related to the electricity business. The challenge is in finding ways of installing additional capacity at the generational level, strengthening the transmission system, and improving the commercial performance of local electricity companies.

Q: So you are saying that we have expertise and knowledge, also that there are African experiences that we can learn from. Could you tell us more about the Kenyan story? What did Kenya do differently to address its challenges?

Andres: The government of Kenya has over the last few years embarked on an ambitious journey to provide access to competitively priced, reliable, quality, safe, and sustainable energy.³⁶ Tremendous achievement in scaling up connectivity was made in the last three years with the access rate rising from 32% in 2014 to 75% in 2018. This has been achieved through interventions by the government in collaboration with development partners. This achievement was possible because Kenya managed the electricity business as a social project. They knew that if they don't have electricity then children cannot study, the country cannot properly run water facilities, have street lighting which probably makes them more vulnerable to crime, and so on.

In South Africa, entities have been running the electricity business and neglecting the social component. Even the Free Basic Electricity (FBE) tariff³⁷ represents a little portion of total energy sales by metros, although this is supposedly available to consumers located in areas with extreme level of poverty. Extending the FBE benefit is one of the activities that can make a big difference in protecting the poor from the crisis.

³¹ Kenya Power & Lighting Corporation. ³² Reported by KPLC to the World Bank for FY19/20 (<https://archive.doingbusiness.org/en/doingbusiness>) ³³ Including unplanned and planned outages, and load shedding outages. ³⁴ Reported by City of Cape Town to IFC for Q1 of FY 2020/21, as part of the project titled "The improvement of the Getting electricity Process". ³⁵ Annual Report 2019/20. ³⁶ As stated in the document titled "Kenya National Electrification Strategy: Key Highlights 2018". ³⁷ FBE: Limited free amount of electricity supply deemed necessary to support the basic energy services of a typical poor household as determined by Government from time to time [source: NERSA].

Q: What are the key opportunities you see with an initiative of this nature (the Smart Cities Program, involving three metros) that cities should take advantage of?

Andres: Sorting out the South African energy crisis will take time. It's not just about the cities, you know, it's about the whole energy sector of the country and a range of bigger issues. But we can start with the implementation of smart activities by local electricity companies.

Have you ever tried to complain about your electricity service?. Cities can improve the customer experience by implementing/upgrading basic Management Information Systems, for example, through the Distribution management System, Customer Relationship Management, Enterprise Asset Management System. A model that represents the network's current topology and connection to the end consumer is essential to determine the location of the incident. An opportunity for improving the performance of the South African electricity sector in terms of customer experience is the development of the Customer-Network Link, where, when an outage happens, the distribution sector should be able to say: "Dear Consumer, please be aware that we do know that you don't have power, and the estimated restoration time is X." This is currently impossible for most of metros in SA.

"IT'S IMPOSSIBLE TO CREATE JOBS WITHOUT IMPROVING THE ELECTRICITY SERVICE."

There are opportunities for the improvement of the distribution management systems (DMS), to properly deal with outages and consumer complaints. Some municipalities do not currently utilize an outage management system. Such a system will allow the utility company to properly record outages and to get the big picture in terms of the reliability of supply. You cannot improve the reliability of supply if you don't have proper key process indicators related to this. That's probably why two of the pilot cities have proposed the implementation of a DMS as part of the programme, which is an important smart component.

Cities like eThekweni for example, need to increase the local generation capacity available by installing a mix

of Large scale Gas to Power (GTP) peaking generation and green power facilities. In this regard it's pointed out that for increasing total capacity installed in SA, just the implementation of green power is not enough, and it's also required the installation of firm capacity.³⁸ So, the solution is not just about greening power. RSA also needs adequate "firm capacity" to manage these facilities, meaning the use of gas, diesel, or hydro energy.

KEY TAKEAWAYS

- Smart energy systems should protect the poor from the energy crisis. It is most effective to treat the energy programme as a priority social project.
- Fortunately, SA has the technical knowledge for providing solutions, but they will take time due to some bigger issues that are at the supply level and not necessarily at the city level.
- Here is what cities can do:
 - Have systems in place to link the consumer and the network (DMS)
 - Increase firm capacity at generation level
 - Implement an integrated Revenue Protection Plan with the aim of improving commercial performance of the distribution sector.

³⁸ Generation - Firm Capacity A guarantee of a level of supplied power committed to by a supplier to be always available during a period covered by a commitment. Source: <https://www.wartsila.com/encyclopedia/term/firm-capacity>



Andres Detomasi

is a lead global energy sector expert in the DBSA Smart Cities Programme and works on World Bank energy projects, including African countries such as South Africa, Kenya, Ethiopia, Somalia and Angola.

SMART CITY.ZA SNIPPETS

Photo Credit: Vividrange



Mini-grids: Africa's new tool to improve energy access, empower livelihoods

Article (Dec, 2022)

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Article (Dec, 2022)

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The future of energy is systemic, open and collaborative — and runs on a smart grid

Article (Dec, 2022)

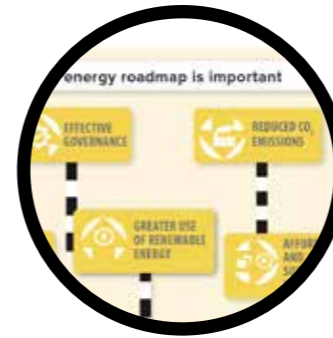
Climate change and the global energy crisis intersect on our energy grids, which increasingly appear unfit for purpose. Read more about why we need smart grids moving forward.



The Smart City Ecosystem Framework – A Model for Planning Smart Cities

Article (June, 2022)

A smart city is an ecosystem made up of multiple "capability layers". This article discusses how these capabilities must integrate and coordinate with each other to carry out the smart city mission.



A Renewable Energy Roadmap for African Cities

Article (Nov, 2020)

A guide that aims to assist African cities to develop a renewable energy roadmap. It draws on the experience of cities in sub-Saharan Africa and particularly eThekweni, South Africa.



Smart City: African cities demonstrate leadership in renewable energy deployment

(March, 2021)

A REN21 report on the smart energy achievements of five African cities: Cape Town, Dakar, Kampala, Tsévié and Youndé IV.



Smart Energy Solutions for Africa (SESA) Database

Smart Energy Solutions for Africa (SESA) is a collaborative project between the EU and nine African countries (Ghana, Kenya, Malawi, Morocco, Namibia, Nigeria, Rwanda, South Africa and Tanzania) that aims at providing energy access technologies and business models through living labs.



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CONTACT



Dr. Patrick Ntsime,
DBSA Programme Lead
Coverage Division: Metros, Intermediate Cities & Water Boards
T: +27 11 313 3911
M: +27 82 900 2541
E: patrickn@dbsa.org
W: www.dbsa.org



Mr. Lethu Masango,
World Bank Task Lead
Urban Resilience and Land
T: +27 21 724 3204
M: +27 82 331 0158
E: cmasango@worldbank.org
W: www.worldbank.org



Mr. Konstant Bruinette,
Senior Deal Originator
Coverage Division: Metros, Intermediate Cities & Water Boards
T: +27 11 313 3911
M: +27 83 391 0104
E: konstantb@dbsa.org
W: www.dbsa.org



Dr. Geci Karuri-Sebina,
Visiting Associate Professor,
Wits School of Governance
M: +27 72 148 1132
E: Geci.karuri-sebina@wits.ac.za
W: www.civictech.africa



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