

Challenges of providing Energy infrastructure in a big City



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Abstract

While the challenge of limited resources continues to hamper delivery, most utilities are faced with the exponential increase on energy requirements. The economic growth primarily depends on the availability of energy sources, whereas the exploration of the direct effect on this growth.

This paper will look at the common challenges as well as those unique challenges that are facing Johannesburg.

1 Introduction

Planning usually takes long to compile formidable plans for the city and utilities involved. The rapid development within the big cities has presented great challenges to this crucial phase in the growth strategy of the cities. Some authorities cannot respond fast enough to the demands of the cities and the volume of work that comes with all the city's needs.

Both the speed and scale of urban development in big cities, particularly along Johannesburg, have been taking place at an unprecedented pace and scale. The rapid

urban spatial encroachment into urban boundaries has been driven by enormous economic growth for business development and by a strong individual desire for a better quality of life (measured by housing consumption, infrastructure improvement, increased transportation accessibility, and the building and preserving of urban green space). The remarkable urban spatial developments in big cities do not occur without great costs and unwanted consequences, reflected in environmental deterioration, open space destruction, increased transportation expenses, overloaded infrastructure.

This paper will then focus on these fundamental issues that during the rapid transition period will emerge as urban spatial development patterns that have substantial long term efficiency or cost implications and affect sustainable growth trajectories and reduce city's competitiveness.

Rapid urban spatial expansion and dramatic changes in institutions governing resource mobility in the country throughout the past decade may provide a rare opportunity to investigate the interaction between urban spatial developments and infrastructure development.

Systematic and quantitative analyses of urban spatial structure and their association with infrastructure provision require extensive data at both the micro- and macro-levels for measurement as well as in time series for possible causality examination. This kind of data, however, rarely exists.

2 Challenges within Planning environment

Below are the common challenges that most electrical supply authorities are faced with to provide electrical supply.

2.1 Challenges with environmental authorities

The implementation of the environmental laws in the country meant that each and every activity that is seen to be changing the original nature of environment from one form to the other must be assessed by the environmental officers and determine the extent of the impact and they can give the necessary guidance on how to implement that particular activity without major impact on the environment.

The Department of Environmental Affairs has identified a number of activities that needs assessments. Because of the nature of energy supply, electrical installations fall within the listed activities. They have categorised the activities into three categories i.e. basic assessment, scoping and full EIA. Depending on the complexity of the surrounding environment and community, these processes can take a long time to complete. In the case of Johannesburg some EIA approvals have taken more than two years. This not only affects the duration but also the cost of the entire project as material escalations seem to multiply every year. The land costs are also escalating at a very high rate and a general discomfort to the public as most of the developments are usually on hold during the process.

2.2 Challenges on finding the best service corridors

With the high rate of development in the big cities, open spaces are just diminishing. These developments demand a lot of power and with every available piece of land comes at rate, developers are very skeptical to release any piece of land for other uses. The situation makes it almost impossible to find adequate service corridors in these cities.

With the high demand of power in high density areas, supply authorities are forced to provide a number of substations few kilometers apart and this call for increased number of servitudes. To accommodate these supply points, the supply authorities are now looking at high voltage cables to wheel power through these areas.

These cables bring their own challenges i.e.

- **Sizes of pavements** – these pavements are not big enough to accommodate all the services within the developments. To accommodate these cables, authorities are still forced to acquire servitudes within the developments.
- **Cost of cable vs. the overhead line** – the price gap between the two technologies is increasing. The cable is now more than four times the cost of overhead lines and this

put a big pressure on limited capital funding.

2.3 Inadequate resources i.e. funding and personnel

2.3.1 Shortage of Engineers

It has been proven that for the past few years, the higher education institutions are not producing enough graduate engineers as required by the industry. This shortage forces everybody to fight for these limited resources. The spiraling effect on the shortage leads to high production costs and the salaries just leads to low productivity on small businesses as they can't afford highly trained personnel. They're forced to leave with the inexperienced personnel who have to stumble along without any proper guidance or proper mentoring.

2.3.2 Shortage of Skills

The country is now experiencing dire shortage of skills and it is very important for an engineer to be a jack of all trades. Companies have no choice but to appoint an engineer from a completely different field with the hope that application of his experience might be of crucial importance to some applications within the company. These hybrid engineers sometimes bring much needed ingredient in the company to

improve policies and procedures. The companies need to provide guidance and enabling environment to fuse their experience with their current environment.

2.3.3 Shortage of Funds

Due to nature of current networks, the growth in power demand has triggered the investment need in all spheres i.e. expansion, strengthening, refurbishment and maintenance. For these cities to sustain growth, expansion projects have overtaken all other categories and the network integrity become more vulnerable

2.4 Matching new technology with the old technology

Most of the big cities were built in 18 and 19th centuries and they have expanded with time due to urbanization and immigration to economic nodes of the country. The old infrastructure was installed with the best technology at the time but with evolving innovation in the industry, there have been many changes on the latest technology.

Due to budget constraints and system configuration, utilities are sometimes forced to merge different technologies or retrofit new equipment with newer technologies. This presents many challenges as it require too much modifications and interface systems which require more maintenance

and increases the risk of failure. Utilities are sometimes forced to change the entire system because of the compatibility challenges.

The old technology poses risk to personnel and new equipment where designers have spent years of work trying to improve the total safety of the system and personnel e.g. extension of old oil switchgear with the new SF6 technology switchgear, the oil gear will always be the weakest link and will compromise safety on adjacent equipment.

2.5 Balancing network integrity with the fast growing city.

Due to budget constraints and high demand on power requirements, authorities are facing a challenge to provide the required level of service while maintaining the network integrity. Balancing the technical and political compliance has proven to be a bit of a challenge. One often find that urban areas are fully developed and overcrowded and for government to be able to fulfill the housing responsibility, they have to look at the outskirts of the cities to find open space for new housing. Due to the nature and timeframes of these projects, some of the technical requirements have to be relaxed with the intention of rectifying the situation at as the areas grow to full capacity.

Network improvement lags the rate of development in big cities and this result in

increased restoration times in case of outages.

2.6 Synchronisation of activities among the role players.

For a utility to produce sound developmental plans, it's important that all the role players provide the most accurate input within the defined time frames. Some of the most important role players are:

- **City Town planners** – these are the most critical people in the loop as they have to give direction on the city's strategic direction on the land developments. It's important for infrastructure providers to align themselves with their plans. This will pave a direction on how to align the resources such as funds and personnel.
- **Eskom** – as a national service provider, most municipalities rely heavily on the supply from Eskom. For Eskom to be able to forecast correctly, all municipalities have to provide a fairly accurate plans with reasonable time frames. Both parties have to agree and stick to the plans.
- **Developers** – it is very important for the developers to discuss their plans with the utilities as early as they firm up their ideas on type of developments they are planning. As

much as the town planners will give direction on the zoning, it's only the developers who can give the exact type of developments and their time frames.

- **Environmental Authorities** – the approval of EIA does contribute to the duration and cost of the project. The time frames are crucial to this process as utilities cannot start any activities without the necessary approvals. Recommendations can sometimes mean major changes or a complete change of the designs.

It is important that all these stakeholders forge a good working relationship and adhere to agreed time frames.

3 Conclusion

Urban spatial development patterns for smart growth have drawn a lot of attention because they directly influence planning policies that advocates mixed uses, compacted and dense developments, transit oriented development, and corridor development.

Efficiency of urban spatial structure should be measured and gauged from the prospective of urban agglomeration, transportation implication, allocation of resources (land and capital), infrastructure

accessibility and environmental and social impacts.

It is anticipated that Gauteng will experience rapid urbanization far into the 21st century, which will merge the two developing frontiers—rural and urban areas—more closely together and will result in a need for integrated infrastructure among the neighboring cities. The cities has demonstrated great abilities in promoting growth in past decades and it is hopeful that the government takes appropriate actions and measures to promote efficient spatial patterns for sustainable urban growth.

4 References

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