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Moving beyond basic service delivery for inclusive reliable infrastructure

Significance:

In the last 30 years of democracy, the focus has been on delivering basic services to households. Yet there are larger infrastructure challenges faced at a local level, including rising dissatisfaction regarding the quality of services delivered. Insights generated from ongoing discussions on Gauteng's energy and water landscape indicate that, central to the service delivery discourse, delivering services goes beyond mere physical access. Using household survey data for Gauteng, we show it is necessary to make services more affordable and reliable, emphasising the need for innovation, inclusion, and placing equitable distribution at the core of infrastructural and service delivery planning.

Service delivery in Gauteng

South Africa celebrates 30 years of democracy in 2024, and while much progress has been made to address past inequalities and create opportunities for all citizens, many challenges remain. Issues of service delivery remain central to political debates now as much as they did in 1994. Over the past three decades, the government has focused on providing basic services to all citizens and reversing apartheid spatial planning. Underpinned by the South African Constitution, the first decade of post-apartheid South Africa saw a range of new legislation and policy development to guide the rollout of services. Significant progress has been made, and the 2022 Census showed that 88.5% of South Africans now live in formal dwellings, up from 65% in 1996.[1] A total of 82.4% of households have access to piped water in their homes or yards, and 94.7% have access to electricity. However, these statistics do not reflect whether those services are reliable or affordable. There is no denying that challenges remain to rolling out services to those households that still lack access, as evidenced by rising service delivery protests.

In Gauteng, significant progress has been made in the delivery of services. Over 90% of households have access to water, sanitation and electricity, and the recent national census has shown that access to those services has remained stable over time.[1] More so than in the rest of the country, housing in Gauteng is formalised, and the proportion of households living in informal dwellings has decreased from 20.2% (2011) to 11.5% (2022).[2] This trend also translates into service delivery. In Gauteng, the total number of households increased by 1 409 643 between 2011 and 2022, but 1 560 956 more households gained access to water inside their dwellings in the same period, reducing the service delivery gap. A similar trend exists for sanitation, where there has been a reduction in households that use a pit latrine (13.7% to 5.6%) and those that have no toilet facilities (2.4% to 0.4%). Access to electricity in Gauteng is high, but there are notable shifts in the choice of energy sources, most likely due to load shedding. These shifts include a significant change in the energy source for cooking, with a third of households (32%) using gas for cooking in 2022, compared with only 3.1% in 2011.

Increasingly, though, much of the conversation about infrastructure is about infrastructure failure, particularly driven by the impact of load shedding by Eskom. Increasing evidence supports the severe economic impact of electricity disruptions on the economy, households and society.[3,4] This is also true for water infrastructure, and Day Zero events in the Western and Eastern Cape, as well as rising water interruptions in Gauteng, which also impact households and the broader economy.[5,6]

Data on household satisfaction with water and electricity services and reported service interruptions can shed some light on the extent of the challenge in municipalities in Gauteng. Data show that reliability and satisfaction with basic services in Gauteng mirror the inequalities in South African society, with poorer and more marginalised communities struggling with the least reliable services. Table 1 presents data on reported household access to water and electricity services, service interruptions, and satisfaction with these services at a municipal level for 2020/2021. Generally, service delivery is higher in metropolitan areas, yet service interruptions are also high. The City of Johannesburg has the second-highest weekly water interruptions (12%) in Gauteng after Emfuleni (18%). This translates to 1 in every 10 households reporting weekly water supply interruptions. The numerous infrastructure challenges in Emfuleni municipality are evident, with reported satisfaction and service interruptions below the Gauteng average across all measures.

The City of Johannesburg provides a good illustration of the service delivery challenges in Gauteng. As an urban municipality with some of the highest levels of service delivery and infrastructure rollout in South Africa, some of the highest levels of water and electricity interruptions have been reported across Gauteng.

However, focusing only on service delivery misses some of the larger infrastructure challenges faced at a local level, with increasing dissatisfaction amongst citizens concerning the quality of services delivered. In the next section, we explore water and electricity services to understand the levels of service interruptions and their consequences, using Gauteng as a case study.

Service delivery case studies: Water and energy

Water interruptions

Increasingly, major cities around the world are experiencing conditions where urban growth and increasing demand for water have begun to stretch the limits of locally available water. Additionally, increasing climate challenges such as the unpredictability of rainfall and rising heat levels has led to a situation in which several cities have seen conditions where water demand exceeds supply, creating a water crisis. While the challenges in Cape Town may be

Table 1: Access, satisfaction and service interruptions for water and electricity* services expressed as the percentage of households in each municipality in Gauteng. Shaded areas indicate municipal values below the Gauteng mean.

Municipality	Piped water in the dwelling or yard	Always clean water	Access to adequate sanitation	Satisfied with sanitation services	Satisfied with access to water	Regular water interruptions*	Water interruptions every week	Use electricity for lighting	Use electricity for cooking	Regular electricity interruptions*	Electricity interruptions every week	Satisfied with energy sources	Satisfied with cost of municipal services
Ekurhuleni	93%	73%	96%	79%	89%	28%	6%	95%	86%	63%	20%	74%	38%
Johannesburg	95%	79%	96%	74%	87%	37%	12%	94%	84%	74%	30%	64%	32%
Tshwane	91%	72%	86%	69%	78%	33%	5%	93%	78%	66%	12%	69%	28%
Emfuleni	94%	73%	95%	59%	74%	49%	18%	88%	80%	74%	37%	56%	15%
Lesedi	94%	74%	95%	84%	92%	20%	2%	94%	76%	48%	10%	73%	29%
Midvaal	79%	79%	88%	73%	84%	16%	2%	83%	59%	53%	18%	66%	35%
Merafong	86%	73%	84%	51%	78%	38%	4%	92%	87%	69%	31%	65%	16%
Mogale City	87%	68%	90%	72%	84%	21%	5%	90%	78%	33%	9%	75%	31%
Rand West	86%	74%	83%	56%	80%	21%	4%	84%	76%	35%	9%	67%	20%
Gauteng (mean)	93%	75%	93%	73%	84%	33%	9%	93%	81%	64%	22%	68%	31%

Data source: Gauteng City-Region Observatory[7]. Public access data for use under a CC-BY licence.

**Regular water/electricity interruptions are defined as interruptions that occur at least once a month in a 12-month period.*

Table 2: Percentage of households reporting frequent water interruptions compared to income category in Gauteng

		Frequency of water interruptions over 12 months				
		Every week	A couple of times a month	Once a month	A couple of times a year	Never
Household income per month	ZAR1–800	12%	19%	10%	32%	27%
	ZAR801–3200	11%	18%	9%	34%	29%
	ZAR3201–12 800	9%	16%	9%	34%	31%
	ZAR12 801–25 600	5%	13%	8%	40%	34%
	ZAR25 601–51 200	4%	11%	6%	40%	39%
	ZAR51 201 or more	1%	8%	4%	46%	40%
Gauteng (mean)		9%	16%	9%	35%	31%

Data source: Gauteng City-Region Observatory[7]. Public access data for use under a CC-BY licence.

the most well known to South Africans, Mexico City, São Paulo, Lahore and Los Angeles have all recently experienced water challenges.

The most well-documented South African case is the Day Zero crisis in Cape Town in 2017/2018, when the city counted down the days of water supply it had left whilst also severely restricting water usage across the City. Gauteng also faced critical water shortages during a severe dry spell in 20152016. In the last two years, Gauteng has had further infrastructure and water supply challenges during periods of high demand. Gauteng's experiences with water shortages are a factor of water availability challenges, infrastructure challenges and urban dynamics.[8] In most cases, interventions into water are focused on water availability and infrastructural issues, and little consideration is given to residents' experiences with water or water infrastructure within urban growth and densification and how this enables or disables growth and development.

The challenge in Gauteng has become less about access to water infrastructure and more about the reliability and quality of services provided and consumption levels. Between 2018 and 2021, the number of households reporting frequent water interruptions (water interruptions once a month or more) rose by 3% to 33%, or a third of all households. Households in Johannesburg (37%), Merafong (38%) and Emfuleni (49%) were the most likely to report frequent water interruptions.[9]

Recent challenges in Gauteng with water supply have often resulted in water entities pointing to consumer overconsumption, particularly in areas like Alexandra, the Johannesburg CBD, and Soweto. Yet these typically high-density township areas are more likely to report water interruptions and have high levels of water leakages.[9] Townships and peripheral areas are more likely to experience challenges with both access and satisfaction with water.

Table 2 shows the frequency of water interruptions over 12 months (2020/2021) with household income. The lower the household income, the more likely these households are to experience water interruptions.

Comparing data on the access and reliability of water infrastructure shows that water delivery challenges mirror historical and current inequalities in South African society. Table 2 shows that, as incomes rise, so does the reliability of water services. For example, 12% of the poorest households (those earning less than ZAR800 per month) report weekly water interruptions compared to 1% of the wealthiest households (earning more than ZAR51 201 per month). Overall, the poorest households are the most likely to struggle with regular access to water services.

The data show that lower-income households are more likely to have negative experiences with water and that poor and more vulnerable households disproportionately bear the burden of water supply challenges. Although also affected, wealthier households are less likely to experience water supply challenges and more likely to have disposable income to shield themselves from service interruptions.

Electricity interruptions

Similarly, Gauteng has experienced electricity access and supply challenges, both as a result of load shedding and infrastructure failures at the local level. Over the past two years, Eskom's inability to meet the country's electricity demand has resulted in unprecedented load shedding, with the country experiencing 205 days of load shedding in 2022.[10] Electricity interruptions are affected by factors such as generation and distribution constraints, inadequate maintenance of ageing infrastructure leading to breakdowns, vandalism, lightning, transformer malfunctions, illegal connections, theft of electricity infrastructure, and debt.[11,12] Figure 1, from the GCRO's QoL Survey (2020/2021)[7], revealed that 94% of respondents had prepaid or postpaid electricity. Of these, 22% (or 1 in 5 households) experienced electricity interruptions at least once a week – a significant increase from 4.8% in the previous (2017/18) survey.[11] There has been a general increase in electricity interruptions across all municipalities in Gauteng. The most affected municipalities, with over 30% of respondents enduring weekly electricity interruptions, are Emfuleni (37%), Merafong (31%), and Johannesburg (30%).

Moreover, the spatial distribution of electricity interruptions is concentrated in areas in or near Wedela (West Rand District), Lawley (City of Johannesburg) and Tsakane (Ekurhuleni).[13] These areas are predominantly townships, state housing projects, and informal settlements characterised by rapid expansion and growth, high population densities, and infrastructure that was initially developed for much smaller populations.

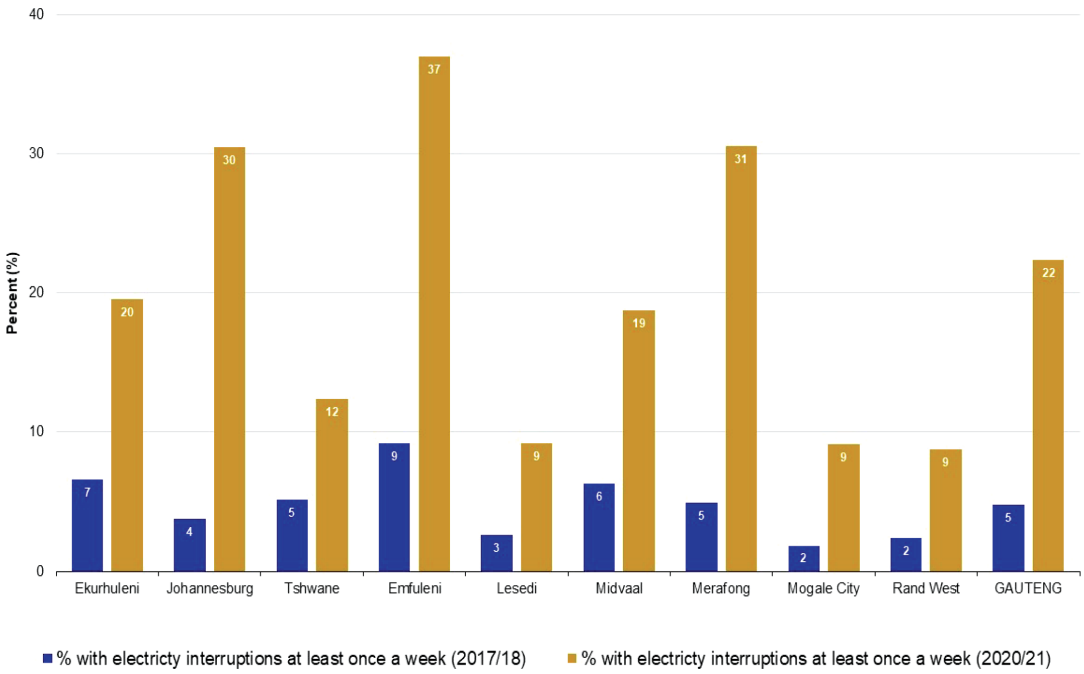
Following a similar trend to the water interruptions data, Table 3 further shows that households with lower incomes, such as 30% of those with a monthly household income between ZAR1 and ZA800, reportedly experience electricity interruptions weekly, compared to those in higher-income categories (earning ZAR12 801 or more per month).

These findings indicate that both water and electricity interruptions are more prevalent in predominantly lower-income, historically underserved communities. This is particularly concerning as the lack of access to electricity during these interruptions disrupts basic household activities and compounds existing challenges faced by underserved communities, such as a lack of adequate infrastructure and the delivery of other basic services. Moreover, lower-income households are less likely to have access to resources to shield themselves from the impact of load shedding. The unpredictable nature of electricity outages also impacts household food storage as food goes to waste. At the same time, electricity interruptions significantly impact informal and small businesses, the backbone of local economies, as they cannot operate during these times.[14]

Rising electricity interruptions are concerning, as access to electricity is critical for supporting economic development and growth. Ledger[15] argues that additional electricity generation capacity, of a third to half of the current capacity, is required to increase economic growth and development. In addition, electricity interruptions have also been noted to impact other infrastructure, such as water infrastructure. Specifically, in 2022, the severe electricity interruptions were accompanied by reports of damage to water infrastructure and supply challenges in Gauteng.[10,12]

Lessons from and consequences of electricity interruptions

Examining the transition to alternative electricity sources and going off-grid offers insights into the complexities and opportunities that define service delivery in Gauteng. Over the past seven years, the country has battled electricity generation and supply issues, resulting in a clear and concerning trend in the rise of load shedding days. This was followed by the South African government announcing incentives to encourage households and businesses to invest in alternative electricity sources in early 2023, in efforts to address the country's energy crisis. In this context, many residents in Gauteng have invested in alternative electricity sources to protect themselves from supply interruptions.



Source: Adapted from Mushongera et al.[13] with permission.

Figure 1: Percentage of respondents reporting electricity interruptions at least once a week in 2017/2018 and 2020/2021, by municipality.

More generally, the energy landscape in Gauteng and South Africa has changed in recent years, with more residents opting to use alternative energy sources. One of the notable aspects of this transition has been the dynamic nature of energy choices and adaptability. While individuals and communities seek alternatives to conventional grid-based systems, only about 1 in 20 households accessed alternative electricity in 2020/2021.[16] Although this is only a small minority of Gauteng residents, this number has been steadily increasing as load shedding increased, and the costs of the systems dropped. Only 5% and 4% of Gauteng respondents reported accessing solar or wind energy and diesel generators, respectively, by 2021.[16]

Data show that affluent households are more likely to invest in alternative electricity sources than poorer households.[12] Figure 2 shows that less than 5% of those households with an income below ZAR12 800 had access to solar and wind energy and generators. By contrast, 12% and 17% of those households with an income of ZAR51 201 or more had access to solar and wind energy and generators, respectively.

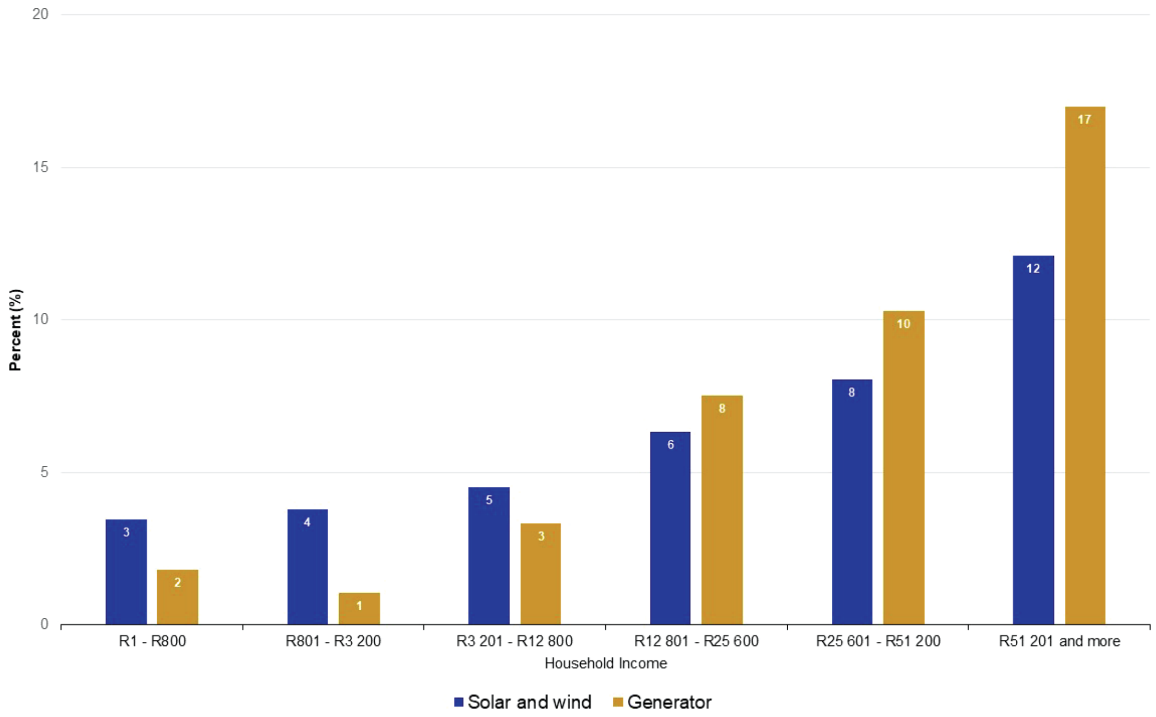
The transition to off-grid energy sources, especially among affluent households and businesses, has been critiqued as it could further widen the gap between affluent and poorer households and influence municipal service provision. Municipalities depend on revenue from basic services and utilities. Ledger and Rampedi[11] argue that moving to renewable energy sources may undermine municipalities' financial stability. However, municipalities could play a role in increasing energy generation capacity through renewable energy deployment.

The key drivers and consequences of going off-grid vary depending on socio-economic status, geographic location, and individual circumstances. Some households go off-grid to escape electricity interruptions and escalating tariffs. For instance, between 2007 and 2022, electricity tariffs increased by 653%, while inflation increased by 129% over the same period.[17] This means that the price of electricity increased by more than four times the inflation rate. Some households choose to go off-grid for sustainability and climate change reasons. Others do not choose to go off-grid but are instead forced into it by economic

Table 3: Percentage of households reporting frequent electricity interruptions compared to income category in Gauteng

		Frequency of electricity interruptions over 12 months				
		Every week	**A couple of times a month**	**Once a month**	**A couple of times a year**	**Never**
Household income per month	ZAR1–R800	30%	34%	9%	21%	6%
	ZAR801–3200	26%	35%	8%	25%	5%
	ZAR3201–12 800	23%	37%	8%	25%	6%
	ZAR12 801– R25 600	16%	37%	9%	30%	8%
	ZAR25 601–51 200	14%	32%	9%	37%	7%
	ZAR51 201 or more	14%	36%	11%	34%	5%
Gauteng (mean)		22%	36%	8%	27%	6%

Data source: Gauteng City-Region Observatory[7]. Public access data for use under a CC-BY licence.



Source: Adapted from Culwick Fatti and Khanyile[12] with permission.

Figure 2: Access to alternative electricity by income.

constraints or a lack of access to reliable services. Ledger[15] highlights the realities of the existing electricity tariff structure and its disproportionate burden on the economically disadvantaged, keeping them in a cycle of financial strain and energy insecurity. This can be seen in the communities caught in Johannesburg's electricity tariff trap, indicating how the system reinforces rather than lessens existing inequalities.

Parallel to these discussions on electricity pricing, the transition has been commended for its active role in climate change mitigation. However, it has also been critiqued for only offering temporary solutions to grid shortages, requiring further research to become more scalable and affordable[18], and leading to lower energy availability and higher associated costs for heating, cooking, and other needs compared to grid-connected homes.[19] Additionally, energy consumption rises particularly after electricity interruptions. All these factors add increasing complexity to the grid and grid maintenance.

Conclusion

The insights generated from ongoing discussions on Gauteng's energy landscape indicate that recognising that delivering services such as electricity goes beyond mere physical access to the service is central to the discourse on going off-grid. It is necessary to make services, such as electricity and water, more affordable and reliable, emphasising the need for innovation, inclusion, and placing equitable distribution at the core of infrastructural and service delivery planning.

The lessons from the transition to alternative sources of electricity indicate the far-reaching impacts of load shedding and should be a warning for municipal service delivery. Very little is understood of the longer-term consequences of residents attempting to take water and electricity services off-grid. Recent media reports indicate an increase in wealthier households installing backup water tankers or sinking boreholes to shield themselves from water interruptions. In December 2023, the City of eThekwini issued a statement urging residents to disconnect static tanks connected to the municipal water reticulation system in Phoenix, noting the impact on poorer households.[20] In this case, many wealthier households had installed static tanks to store water during prolonged water outages, placing pressure on the water reservoir to maintain adequate storage levels. Those poorer households without static tanks then faced even longer water outages as these static tanks were also filled.

Service delivery, particularly the delivery of basic services such as water and electricity, in Gauteng, has seen considerable strides since the end of apartheid. However, significant challenges still need to be addressed, particularly regarding the resilience and reliability of these services. Water and electricity interruptions disproportionately affect poorer communities, while affluent households are increasingly investing in alternative electricity and water sources in an attempt to go off-grid and bypass municipal services. Currently, some of these choices may be further entrenching existing inequalities in communities.

The challenges for service delivery for the next 30 years of democracy may well relate to the consequences of poor infrastructure maintenance and rising customer dissatisfaction.

Declarations

We have no competing interests to declare. We have no AI or LLM use to declare. Both authors read and approved the final manuscript.

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