AMEU/SAIEE Joint Virtual Webinar

"THE DIGITALISED MUNICIPAL Dx ELECTRICTY UTILITY OF THE FUTURE"

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Session 1 (Theory/Case Study)

FUTURE PROOFING THE DIGITALISED MUNICIPAL Dx ELECTRICTY UTILITY OF THE FUTURE

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PRESENTATION OUTLINE (1)

1. PURPOSE OF THE JOINT AMEU SAIEE WEBINARS
2. OUR UNDERSTANDING OF “FUTURE PROOFING”
3. THE DIGITALISED MUNICIPAL Dx ELECTRICITY UTILITY OF THE FUTURE - THE PROPOSED JOURNEY
4. THE EVOLVING POWER SECTOR
5. WHY THE NEED FOR “FUTURE PROOFING” OF POWER UTILITY
6. THE EVOLVING POWER SECTOR AND THE NEED FOR FUTURE PROOFING
7. POWER SECTOR IN TRANSITION AND THE NEED FOR FUTURE PROOFING
8. TRENDS DRIVING POWER UTILITY COMPANIES AND THE NEED FOR FUTURE PROOFING
9. KEY SUCCESS FACTORS FOR A FUTURE PROOFED POWER UTILITY
10. ROLE OF FLEXIBLE TECHNOLOGIES IN A FUTURE PROOFED ELECTRICITY SYSTEM
11. HOW DERS ARE CHANGING THE SCOPE FOR GRID OPERATORS AND THE NEED FOR FUTURE PROOFING .
12. OUR UNDERSTANDING OF GRID STABILITY AND THE NEED FOR FUTURE PROOFING

PRESENTATION OUTLINE (2)

13. THE NEW WAVE OF THE DECENTRALIZED ENERGY MARKET AND THE NEED FOR FUTURE PROOFING
14. GIVING CONTEXT TO SA's POWER CRISIS AND THE NEED FOR FUTURE PROOFING
15. WHAT COULD A FUTURE-PROOFED MUNICIPAL ELECTRICITY BUSINESS LOOK LIKE?

PURPOSE OF THE JOINT AMEU SAIEE WEBINARS

1. The leadership of both the AMEU and SAIEE decided over two years ago (before the COVID 19 pandemic) that given the significantly evolving power generation and power delivery landscape globally inclusive of inter alia:
   a) of the need to decarbonise the electricity energy landscape and
   b) the known challenges related to the current Eskom and municipal power utilities in effectively and efficiently executing their respective service delivery mandates

   there was a need to give serious thought and consideration in crafting out in a shared forum of all relevant and diverse stakeholders by debating, deliberating, discussing, views, ideas, positions, etc on how a future proofed digitalised municipal Dx power utility would need to look like in the future.
2. There was also cognisance and an appreciation that Eskom as a major and fellow power utility has to play a significant and important role in the aforementioned debate and deliberations
3. The AMEU is also of the view that restructuring only ESKOM in isolation is NOT going to solve the known challenges in power generation and power delivery sectors>. No doubt **"fixing Eskom"** as also inter alia encapsulated in the recently announced State Presidents electricity plan must be given top priority (and the AMEU supports this) but the restructuring of the EDI must follow soon as part of the "any future proofing of SA power utilities going forward

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OUR UNDERSTANDING OF "FUTURE PROOFING"

"Future-proofing" a business is a methodology that is utilised to support companies **(includes power utilities**) in defining the scope, scale, processes and specifics of how their businesses (includes power utilities) can evolve to meet critical challenges in climate change, nature loss, and mounting inequality and deliver true value across social, environmental, and economic dimensions.

[Source: Modified World Business Council for Sustainable Development's (WBCSD) definition

THE DIGITALISED MUNICIPAL Dx ELECTRICITY UTILITY OF THE FUTURE - THE PROPOSED JOURNEY

DEFINITION OF "FUTURE":

1. **0 -10 years** journey with year **"0"** being now and inclusive of an interim
2. **0-3 years** journey that will factor in the current SA electricity crisis.
3. >10 years , long term journey
4. The webinar series (and subsequent follow-up work) will focus on the periods (1) and (2) above.
5. Similarly "future-proofing" will also focus on the periods (1) and (2) above
6. Importantly, initiatives, activities, projects, etc for the above two periods will run in parallel
7. The intent is **"not to waste a crisis (0-3 yrs)"…**hence the opportunity will be taken to comment/advise on initiatives, projects, etc that could be fast tracked from for example 3-10 yrs into 0-3 yrs.
8. In respect of 0-3 yrs our comments will be in support of the government's initiatives in addressing the current electricity crisis. Our comments will be to complement/support the government's efforts in this respect

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THE EVOLVING POWER SECTOR (2)

5. In future proofing the **"THE DIGITALISED DIGITAL MUNICIPAL Dx ELECTRICITY UTILITY OF THE FUTURE"** we need to address the following situations:
   - What key distributed energy technologies can disrupt the power sector?
   - How might distributed energy resources (DERs) impact power system operations, markets, and regulations?
   - What business models may be developed, and how will they successfully serve both upstream electricity market actors and energy consumers?
   - What impact could these new business models have on incumbent utilities, and what opportunities may exist for other industry sectors to capitalize on these changes?
   - How will regulation need to evolve to create a level playing field for both distributed and traditional energy resources?
   - What are plausible visions of the future of the power sector, including changes for incumbent utilities, new electricity service providers, regulators, policy makers, and consumers?
6. The impact of the Just Energy Transition ("JET") and the current SA electricity crisis (0-3 yrs window) on the evolving future digitalised municipal power utility of the future (0-10 year window)

WHY THE NEED FOR "FUTURE PROOFING" OF POWER UTILITY (1)

1. The current electricity system is no longer fit for purpose or able to sustain the move to reliable and affordable renewable energy. The way the whole electricity system works must change, driven by a fundamental redesign of the grid itself
2. Most energy systems have traditionally been based on synchronous, centralised power generation using a hub-and-spoke model: a small number of large power plants supplying relatively constant power one way to centres of demand, such as cities and industrial areas.
3. The need to decarbonise, however, has driven the move to asynchronous renewable sources, such as wind and solar, which are distributed widely throughout the electricity grid. These provide more variable power, and change the quantity and direction of energy flows in the system.
4. At the other end of the system, the way we use energy is also changing, as consumption by digital devices continues to grow and more electric vehicles divert energy previously used in the transport sector on to the grid.

[Source: https://www.raconteur.net/sponsored/future-proofing-the-energy-system-relies-on-decentralisation/

WHY THE NEED FOR "FUTURE PROOFING" OF POWER UTILITY (2)

5. Despite these major changes to the patterns of supply and demand, the grid itself, which transports power instantaneously to where it is needed, fundamentally has not changed for more than 100 years. The challenge today is how to manage these new energy flows through century-old technology.
6. The physics of the near-instantaneous movement of energy makes it extremely difficult to control. Disturbances, such as power cuts or blackouts, are often caused because problems observed at the edge of the grid – sudden changes to supply or demand – can't be responded to fast enough from a central control point. As electricity generation becomes increasingly decentralised, with large fossil fuel plants replaced by renewables, these complexities create increasing and costly fragility in the grid.
7. The need to drive drastic improvements in the architecture of the electricity system is critical for the energy sector and, most importantly, for end-consumers. The cost of generating energy from solar and wind is now lower than coal or gas, yet the move to more renewable sources has in fact increased energy prices for consumers. This is because the cost of balancing services

[Source: https://www.raconteur.net/sponsored/future-proofing-the-energy-system-relies-on-decentralisation/

WHY THE NEED FOR "FUTURE PROOFING" OF POWER UTILITY (3)

8. With the rising cost of energy consumption more than offsetting the declining cost of generation, consumers and businesses will continue to suffer energy price hikes unless the complexities in the grid itself are comprehensively addressed
9. No one idea, technology or company can provide the silver bullet to solve all of the problems in the energy system

[Source: https://www.raconteur.net/sponsored/future-proofing-the-energy-system-relies-on-decentralisation/

THE EVOLVING POWER SECTOR AND THE NEED FOR FUTURE PROOFING (1)

1. According to a 2016 MIT Energy Initiative Study an important evolution in the provision and consumption of electricity services is now under way, driven to a significant degree by a confluence of factors affecting the distribution side of the power system.
2. A range of more distributed technologies—including flexible demand, distributed generation, energy storage, and advanced power electronics and control devices—is creating new options for the provision and consumption of electricity services.
3. In many cases, these novel resources are enabled by increasingly affordable and ubiquitous information and communication technologies and by the growing digitalisation of power systems.
4. In SA we are also currently faced by the electricity crisis which could prevail for the next 2 to 3 years and a future SA municipal power utility has to accommodate this situation in its evolution .

POWER SECTOR IN TRANSITION AND THE NEED FOR FUTURE PROOFING

1. The power system of TODAY is becoming more distributed
2. The power system is becoming increasingly digitalized, enabling more active and price-responsive demand
3. The resource mix is becoming more renewable and intermittent
4. Power systems are decarbonizing
5. Power systems are becoming increasingly integrated with other key sectors and critical infrastructure

Given the aforementioned the key question to be answered or responded to by power utilities going forward is the following

How will the electricity services that are today primarily provided in a centralized, top-down manner be provided in the future?

[Source: MIT Utility of the Future Study]

TRENDS DRIVING POWER UTILITY COMPANIES AND THE NEED FOR FUTURE PROOFING

1. The growth of intermittent renewable power generation (part of JET)
2. The challenging economics of traditional generation
3. The integration of Distributed Energy Resources (DER)
4. Increased customer expectations
5. The use of big data and analytics
6. Regulatory changes
7. New technologies
8. Market dynamics
9. Electrification

[Source includes : World Economic Forum]

KEY SUCCESS FACTORS FOR A FUTURE PROOFED POWER UTILITY

Key success factors for future power utilities…based on five (5) pillars:

1 Grid modernization

2. Adaptation to DER

3. Customer-centric evolution

4. Flexible generation

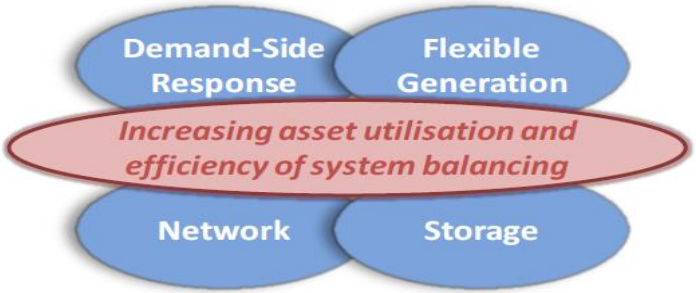
5. Adjusting market, regulatory and business and operational models:

UNDERPINNED BY DIGITILISATION ….4IR/5IR JOURNEY

[Source includes: World Economic Forum]

ROLE OF FLEXIBLE TECHNOLOGIES IN A FUTURE PROOFED ELECTRICITY SYSTEM

1. The future electricity system will be characterised by large volumes of intermittent renewable generation that increase the need for back-up reserves and ancillary services.
2. A lack of operational flexibility limits the system's ability to accommodate output from intermittent renewable technologies
3. It is clear that system flexibility will be at the core of facilitating a cost-effective evolution to a low-carbon energy future.
4. Flexibility can be provided by different technologies



Flexible Technologies

Source: "Delivering future--proof energy Infrastructure" by Cambridge U/Imperial College

OUR UNDERSTANDING OF GRID STABILITY AND THE NEED FOR FUTURE PROOFING

1. There needs to be a balance in production and consumption within an electrical grid. For there to be stability, the energy generated must be equal to the energy consumed. So, "unreliable" energy sources don't fare well with conventional grids. For a power grid, to remain stable, it needs to respond to volatility in voltage and frequency disturbances.
2. In the production of power with solar energy, the fluctuations in the supply and demand of energy for a particular place can cause instability in the grids.
3. The wind turbines used to produce renewable energy are also doing a great job. Still, the fluctuations in power production pose a threat to the stability of the grids.
4. **What Are The Grid Stability Problems With Renewable Energy Sources?**
    a) Frequency and voltage anomalies
    b) Overloading of existing transmission lines
    c) Demand and supply mismatch
5. **How They Can Be Solved.**
    a) Use of energy storage technologies
    b) Implementation of Smart grids

SA IS STILL NOT THERE YET WRT AFFORDABLE BESS AND SMART GRIDS [Source: Hive Power]

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HOW DERS ARE CHANGING THE SCOPE FOR GRID OPERATORS AND THE NEED FOR FUTURE PROOFING .

1. One of the most significant changes to electricity systems around the world has been the rapid expansion of distributed energy resources **(DERs).**
2. DERs are electricity-producing resources or controllable loads that are connected to a local distribution system or connected to a host facility within the local distribution system.
3. **How DERs are Changing the Scope for Grid Operators.**

   When it comes to expanding grid operations through new energy sources or distributed energy sources (DERs), there are four main aspects:

   a) Enabling technologies like utility-scale batteries, EV smart charging and renewable mini-grids
   b) Business models like peer-to-peer electricity trading and pay-as-you-go models
   c) Market design such as net billing schemes and innovative ancillary services
   d) System operations that include the future role of grid operators, virtual power lines and co-operation between transmission and distribution system operators

[Source: Hive Power]

THE NEW WAVE OF THE DECENTRALIZED ENERGY MARKET AND THE NEED FOR FUTURE PROOFING (2)

5. Given the intermittent nature of renewable assets, our grids are tasked with an even more precarious balancing act.
6. Distributed generation, caused by the increase of renewable assets, introduces challenges for transmission operators and new responsibilities for utilities.
7. As a result, they must engage in sophisticated energy contracting and trading transactions to serve their load efficiently, profitably, and in a balanced fashion on a near real-time basis.

THE NEW WAVE OF THE DECENTRALIZED ENERGY MARKET (1)

1. Ten years ago, the energy market was based around the conventional, centralized generation of oil and coal plants. It was predictable and formulaic.
2. These staples of yesterday's energy market are no longer the future of energy generation. Instead, we see a global push toward clean energy with wind and solar power, and companies are accelerating their ambitious renewable goals around the world.
3. The market is shifting to an increasingly decentralized and real-time model given the rise of batteries, prosumers, and electric vehicles (EVs).
4. This provides an opportunity for smaller generators and individual investors to join the playing field and for utilities to establish themselves as real-time traders in active energy markets.

GIVING CONTEXT TO SA's POWER CRISIS AND THE NEED FOR FUTURE PROOFING(1)

1. South Africa faces an unprecedented developmental crisis.
2. The pandemic has served as the final straw to plunge the country into its largest economic downturn in living history
3. Unemployment levels are at their highest on record,
4. Investment ratings have plummeted
5. Many in the emerging middle class have slid back into greater levels of poverty.
6. Meanwhile, the precarious state of state-owned entities – in particular Eskom power utility – remain a large burden on the increasingly constrained national fiscus.
7. An ailing coal- fleet and chronic power cuts continue to cripple economic growth prospects at a time that South Africa needs it most.
8. Rapidly increasing global concerns about climate change pose new threats to our economy, however, these also open up new opportunities

[Source: A 500-DAY GAME PLAN FOR SOUTH AFRICA'S ENERGY SECTOR, by Dr Grové Steyn, Celeste Renaud and Lonwabo Mgoduso; Meridian Economics; June 2021]

GIVING CONTEXT TO SA's POWER CRISIS AND THE NEED FOR FUTURE PROOFING (2)

…….our understanding of the burning platform/the case for change

The current performance of SA's power utilities (Eskom and munics included) is seemingly and arguably fast accelerating downwards in a negative spiral and if NOT arrested and turned around as a matter of urgency the consequences for the end-use customer (let alone SA Incorporated) is going to be diabolical because these power utilities may not successfully execute on their respective service delivery mandates.

GIVING CONTEXT TO SA's POWER CRISIS AND THE NEED FOR FUTURE PROOFING(3)

…….our understanding of the problem statement

How might these SA power utilities (Eskom and munics included) respond to their respective poor performances, current challenges and emerging disruptors as a matter of urgency to enable them to meet their mandated levels of service delivery on a sustainable basis

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GIVING CONTEXT TO SA's POWER CRISIS AND THE NEED FOR FUTURE PROOFING(4)

"Is the current model for providing basic services (includes power/electricity) contributing to increased standards of living, reduced household poverty and greater equality?

1. The current model of services delivery is unlikely ever to deliver its developmental goals, which goals are the main reason for the existence of local municipalities
2. This is not just a service delivery or a local government problem: the failure of the municipal services delivery model is undermining all South Africa's other efforts to reduce poverty and inequality
3. Within the constraints imposed by the current legislative and fiscal framework, the goal of genuinely affordable access to services cannot be achieved by most individual municipalities.
4. Any sustainable solution must clearly prioritise universal access to quality and genuinely affordable basic services, over all other outcomes, and create an enabling regulatory and institutional environment to achieve that priority "

[Acknowledgement: Dr Tracy Ledger; Report; Public Affairs Research Institute, South Africa]

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GIVING CONTEXT TO SA's POWER CRISIS AND THE NEED FOR FUTURE PROOFING (5)

The following challenges facing the ESI/EDI sector are listed in order of priority that the AMEU as a collective could exert on the resolution of such challenge(s) and in so doing attempt to respond to the earlier problem statement(1)

1. **Priority challenge 1**
   How might we (as an AMEU collective) serve the leadership within municipalities / electricity sector so that we can encourage collaboration?
2. **Priority challenge 2**
   How might we redesign cost-reflective tariffs so that it can improve or enhance the long term sustainability of the municipal utility?
3. **Priority challenge 3**
   How might we re-design the EDI business model so that distribution utilities can deliver value added services to their customers in an economic, environmentally conscious and sustainable way?

GIVING CONTEXT TO SA's POWER CRISIS AND THE NEED FOR FUTURE PROOFING (6)

The following challenges facing the ESI/EDI sector are listed in order of priority that the AMEU as a collective could exert on the resolution of such challenge(s) and in so doing attempt to respond to the earlier problem statement(1)

4. **Priority challenge 4**
   How might we prioritise and implement technical replacement and aging infrastructure turnaround plan so that utilities have a phased funding programme?
5. **Priority challenge 5**
   How might we convince national and local government to support and enable ring fencing of all electricity utility businesses so that these businesses can be managed separately from all other municipal services
6. **Priority challenge 6**
   How might we accurately collect and process customer and network data that we account for all the energy bought and sold, to ensure sustainable revenue collection and debt management

Note: The AMEU has made it very clear that it and its municipal membership (together with SALGA) will want to play a pivotal role in any restructuring of the SA power Dx sector. It does not wish to be consulted as a third party in such a restructuring.

WHAT COULD A FUTURE-PROOFED MUNICIPAL ELECTRICITY BUSINESS LOOK LIKE?)(1)

A sustainable energy business which could consist of:

- A ringfenced (but integrated) regulated Wires/Engineering and Energy Trading business, or
- A ringfenced and regulated Wires/Engineering business, or
- A ringfenced Energy Trading business, or
- An infrastructure/asset owner licensed for energy distribution/trading, but activities executed through a third party.

Self regulation vs "enforced" regulation

- Self imposed practices and processes to ensure compliance.
- Investor confidence

Flexibility and significantly different approach to "8 to 5" service delivery

- Customer centricity a reality
- Proactive customer participation and access to the utility – technology enabled

WHAT COULD A FUTURE-PROOF MUNICIPAL ELECTRICITY BUSINESS LOOK LIKE? (2)

One to many business relationship:

- Embedded generation/IPP's/energy storage.
- Energy wheeling.
- Energy trading vs energy retail:
  - Buying capacity & energy at the best terms available.
  - Competitive market & incentivised RE initiatives.

- **Significant technology/digital enablement – real time capabilities.**
- **Governance, leadership and resources competency driven.**

THANK YOU