



69TH AMEU CONVENTION

1 - 4 October 2023

CSIR International Convention Centre

Confronting South Africa's Electricity Crisis in the context of a 'Balanced Just Energy Transition' (BJET) and the need for a reliable and resilient national electricity grid

Confronting South Africa's Electricity Crisis in the context of a 'Balanced Just Energy Transition' ('BJET') and the need for a reliable and resilient national electricity grid

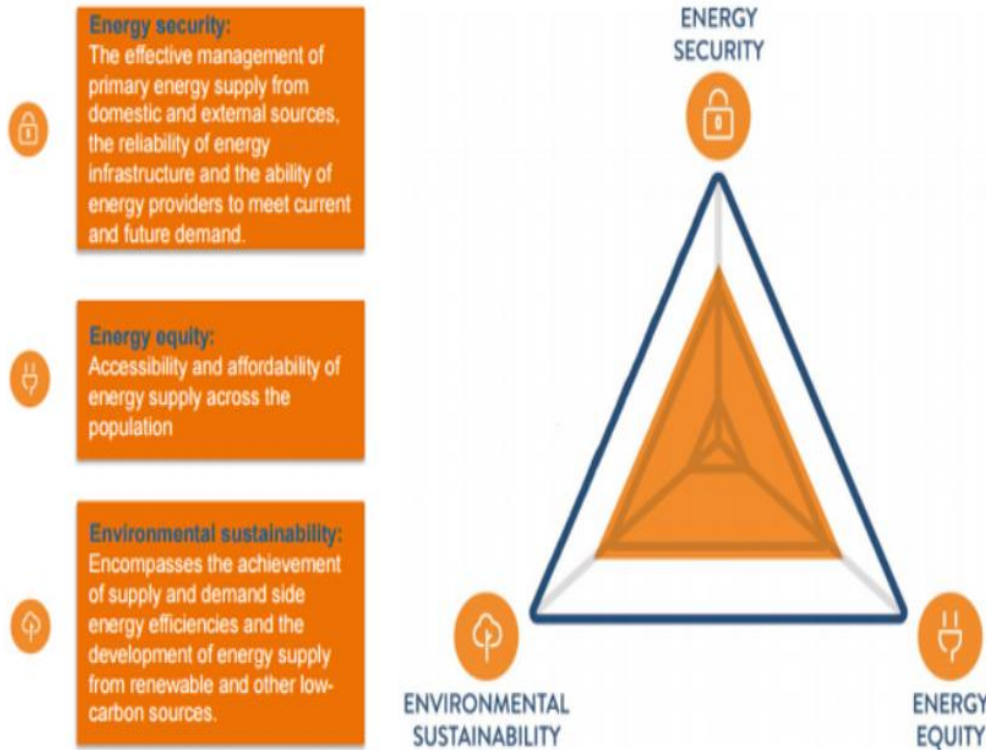
Presented by Elmah Mabuza

Boiler Systems Engineer, Pr.Tech Eng, C Eng.

Kelvin Power (Pty) Ltd

1. Introduction

- Countries all over the world need to manage and sustain the balance of three dimension of energy trilemma.
- Maintaining a balance energy transition in the context of decarbonization, decentralization, digitalization and deregulation can be a serious challenge for the policy makers.



The intention of this presentation include the following factors:

- Legislative matters pertaining to the industry
- Managing environmental sustainability in electricity crisis.
- The benefit of green economy
- Hybrid power generation systems.
- Risk management in an electricity crisis situation
- Reliable and resilient grid
- Conclusion.

2. Legislative Matter Pertaining to Energy Industry



Climate change Policy

- Ensure coordination between society, academia, government and private entities.
- Establish mitigation and adaptation policy to implement climate change corrective measures.
- Implementation of CO2 emission targets to ensure compliance in the energy sector.

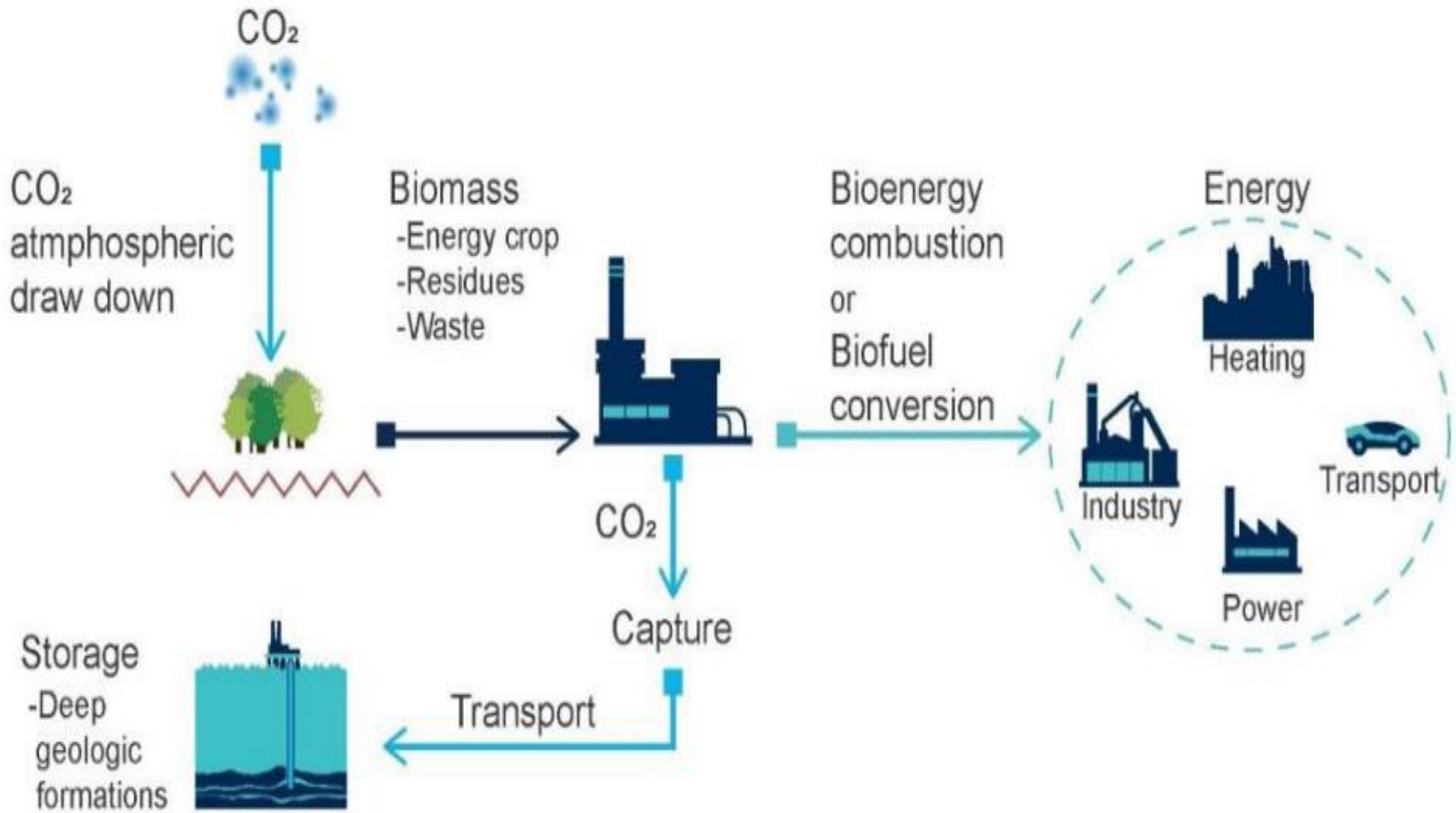
White Paper : Energy Policy (1998) objectives

- Increase energy accessibility for affordability
- Stimulate economic development.
- Manage environmental energy related impacts.
- Secure energy supply through diversity developments.

Integrated Resource Plan(IRP) 2019

- To implement energy efficiency strategies to decrease CO2 emission.
- To execute deployment of clean energy technologies.
- To increase energy capacity from renewable energy sources.
- To establish Independent Power Producer Procurement Programme (REIPPP)

3. Managing Environmental Sustainability in Electricity Crisis



3. Managing Environmental Sustainability in Electricity Crisis

Energy efficiency strategies to decrease carbon emission.

- Electricity can be generated using biomass and waste fuels in either solid, liquid and gaseous forms.
- SA has higher possibilities of replacing coal with cleaner energy sources:
- Coal can be switched to :
 - Waste.
 - Biomass.
- Future primary energy supply can be:
 - Municipality solid waste
 - Agricultural crop and
 - Forestry residues

Deployment of technologies related to clean energy using bioenergy/biofuels:

- Carbon dioxide removal
- Carbon capture storage
- Carbon capture and utilization

In Japan Mikawa was a coal power plant producing 50MW.

- The station successfully piloted carbon capture in 2009.
- The fuel was switched from coal to biomass (palm kernel shell)
- The boiler was retrofitted 100% to burn biomass.
- The system was designed to capture 50% CO₂ emission from biomass.
- The station captured up to 180 000 tons of CO₂ per year.
- Daily 500 tons of carbon was captured from CO₂ emissions.

In Netherlands at Duiven waste was transformed into energy.

- The carbon capture utilization was developed.
- A waste to energy power plant was successful through CCU.
- In 2019, the first 7.5 KtCO₂ was captured in Duiven.
- In 2020 the CCU was planned to capture up to 50 KtCO₂ per year.
- The Carbon dioxide was sold to the greenhouse horticulture sector.

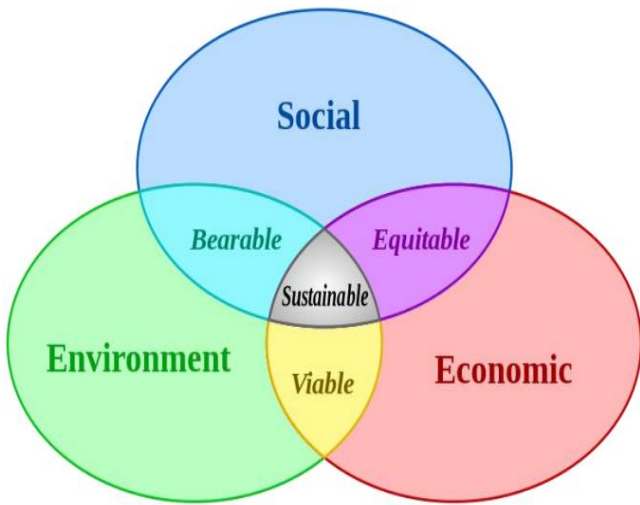
5. The Benefit of Green Economy



In the next century South African population will continue to grow increasing the energy demand escalating economic developments.

The benefits of green economy includes:

- Reduction of environmental risk and carbon emission.
- Transition from coal to renewable energy supply.
- Renewable energy disrupting imported fossil fuel like crude oil.
- Surplus renewable energy exported to the global market.
- Power utilities adopting strategies to embrace cleaner technologies.
- Open market allowing competition to disrupt monopolies.
- Energy reform to privatize state owned power utilities.
- Promote energy market competition and reduce electricity prices.
- Attract investors for clean energy and increase the rate of employment.
- Improve education and skills development regarding clean energy.
- Promote public and private partnership in the energy sector.
- Establish green economy integrated policy and decision-making.



5. The Benefit of Green Economy

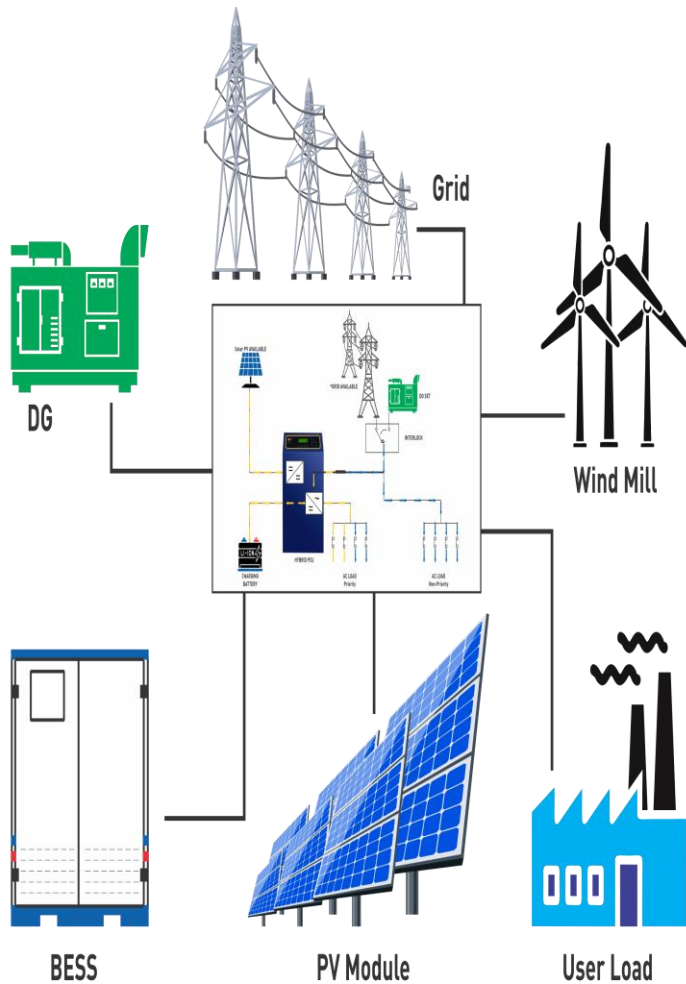
South Africa has large potential benefits from renewable energy resources.

The contribution from renewable energy will tackle electricity crisis:

- Improve South African economy, energy sectors, and lifestyle of communities.
- Increase energy equity for accessibility and affordability of the growing population.
- Develop the overall capacity of hydropower electricity in South Africa.
- Support water imports from neighboring countries like Lesotho and Botswana.
- Produce biomass using bagasse from sugar mills and paper packaging.
- Generate 210 GWh of power supply per year from biomass.
- Exploit the Northern Cape solar resources which is the best in the world.
- Produce the energy of 1300 MJ/m² per year from Northern Cape province.
- Generate wind energy approximating 500MW to 56 000 MW.
- Increase energy supply from electricity generating plants such as Eskom, REIPP, SAPP, peaking and private firms.
- Power from various generation plants will be supplied to the transmission system operator to
 - Maintain balance between energy supply and demand
 - Regulate electricity prices and manage transmission constrains.
- Design the best business model for renewable energy sources such as biomass, wind, solar and hydro.
- Resolve electricity crisis, enhance economic growth and create employment opportunities in SA.



6. Hybrid Power Generation Systems



SA is a carbon intensive economy however hybrid energy storage systems offers the following:

- Carbon emission reduction.
- Avoid coal dependency to generate electricity.
- Opportunities for electrification in remote areas.

Hybrid energy storage (HES) is a combination of:

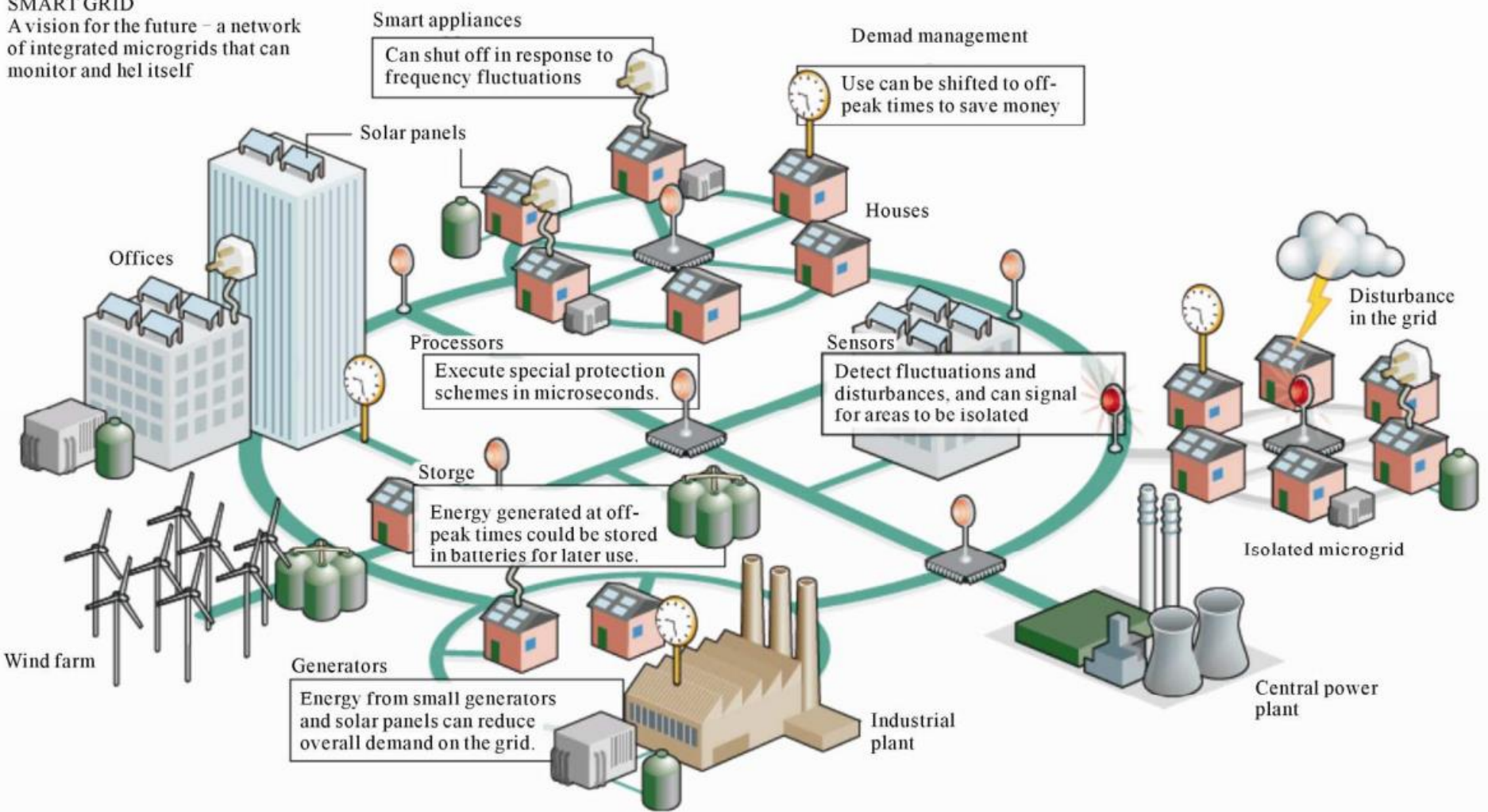
- Diesel generator
- Conventional coal power plant
- Battery energy storage
- Renewable energy (Wind and Solar)

HES offers the following benefits:

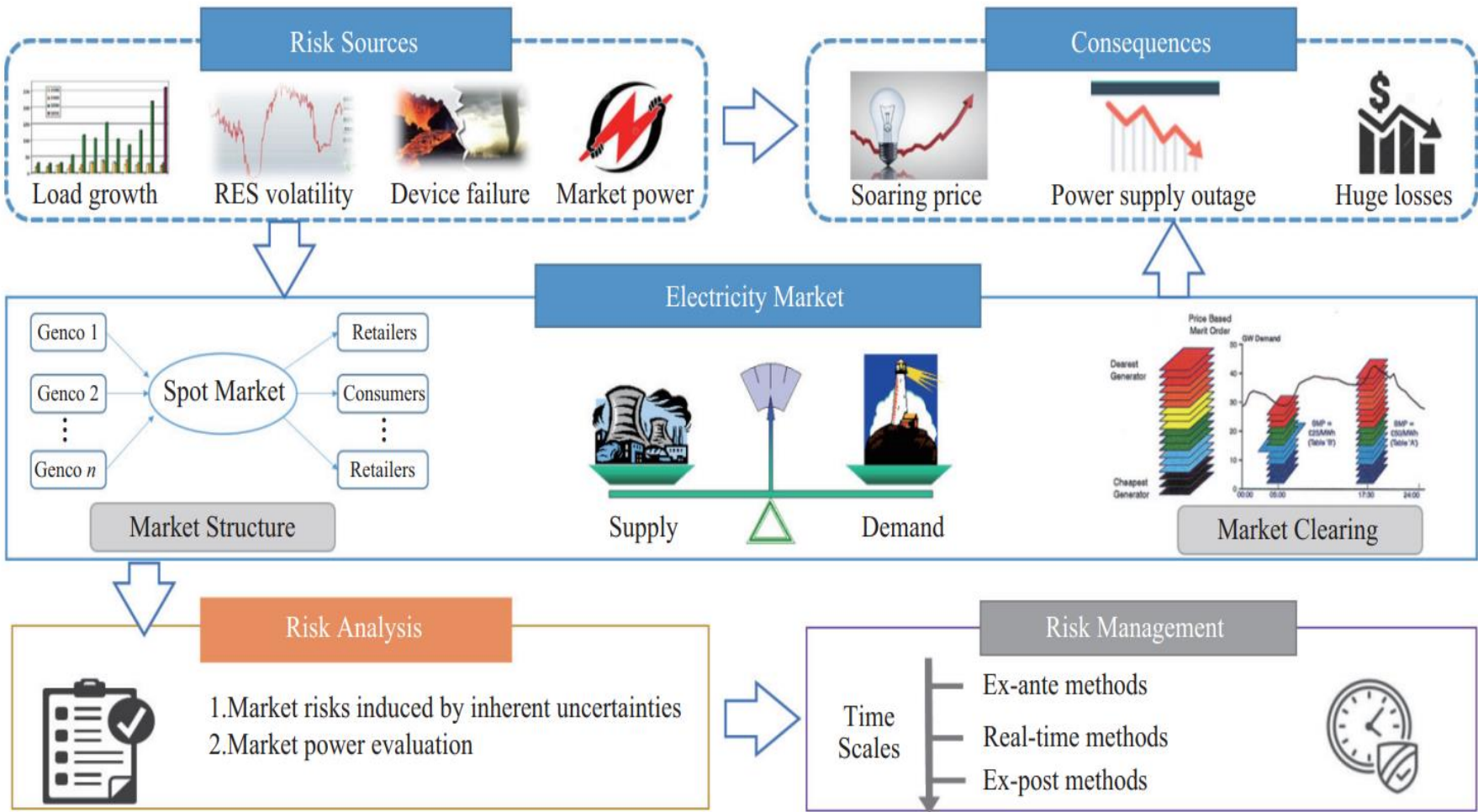
- Sustainable energy solution for microgrids
- Best implemented on a small scale
- Use small generators for flexibility during peak hours.
- Reliability of intermittent renewable sources
- Can be interconnected into the central grid system
- Can function as a small power plants.
- Designed for medium voltage grid-connected systems.

7. Reliable and Resilient Grid

SMART GRID
 A vision for the future – a network of integrated microgrids that can monitor and help itself



4. Risk Management in an Electricity Crisis Situation



8. Conclusion

- The energy trilemma influences the performance measures of national police and develop areas identified for improvements.
- Pillars of energy sustainability (4Ds) are required to balance the energy trilemma during electricity crisis in SA.
- National policy can maintain the balance between energy supply and demand using economic developments recommended from the white paper.
- Energy efficiency strategies can decrease CO2 emission when carbon capture technologies are implemented.
- Deployment of various renewable energy sources will guarantee sustainable green economy.
- Modernization of transmission and distribution grid will be established successfully using smart grid technologies.
- The technology has the ability to reduce power consumption during peak hours via DSM.
- Long term risk management concerning the growth of energy demand can be controlled by increasing system and market capacity, improving price caps and robust market policy.
- Risks sources from the grid are the results of demand fluctuations, extreme weather conditions and participant behaviors.
- Ex-ante reserve and regulate market through price caps and ensure sufficient ancillary services.
- Real time operation test the market power for cost regulation and modify of restriction.
- Ex- post monitors incorrect conducts using punishment like ex-post prohibitions.

69TH AMEU CONVENTION 2023
Confronting South Africa's Electricity Crisis in the context of a 'Balanced Just Energy Transition' (BJET) and the need for a reliable and resilient national electricity grid

Thank you!

