SANEA
Thinking Energy

EW SETA
ENERGY AND WATER SECTOR EDUCATION AND TRAINING AUTHORITY

Energy Risk Report

RECOMMENDATIONS FOR DECISION MAKERS 2024-2025

FOREWORD

MPHO MOOKAPELE - CEO EWSETA

In a complex and uncertain energy sector in South Africa, there are several competing priorities and agendas. One of the significant priorities is the pact of the just energy transition on current fossil fuel and related jobs with jobs being lost and new jobs created, together with the impact on associated economic growth. There are many reports that detail jobs lost with focus on creating job within the energy sector because of the energy transition in South Africa, but very few of them dive deep into the practicalities of these developments on the individual.

The International Renewable Energy Agency (IRENA) has identified 4 major ways in which there can be a disconnect between the loss of fossil fuel related jobs and the generation of new ones in clean energy sectors. These are either time based, when jobs are not lost and created at the same time; geographically based when jobs are in new places; educationally based when the skills are not in place when needed; and sectorally based when there are new value chains created in different sectors which now require more skills to deal with increased demand.

At the plethora of workshops and conferences about the just energy transition, there are two very different conversations happening. The one group is consumed with figures and estimating the number and types of jobs, and the other is pointing out the vulnerability of people on the ground today with the highest GINI co-efficient in the world. Those that are close to the ground are starting to ring alarm bells about this misalignment in South Africa.

The question being asked is what are the safety nets to make sure we manage this transition carefully and not have any misalignment? We are already on the tipping point of a time-based misalignment and most of the new jobs in clean technologies will be in very different geographic areas. We also know that many of the jobs in the renewable energy sector are going to be in construction rather than in operations and maintenance so do we have an educational misalignment too?

Recent work done by the South African National Energy Association (SANEA) on an Energy Skills Roadmap points out that although growth in renewable energy is expected to happen all over the country with huge potential in the Northern Cape, there is no focus on renewable energy courses by the local TVET Colleges. There are new supply chains that are already happening or could potentially happen in South Africa (for example green hydrogen) as a result of the just energy transition, and this is strongly aligned with government trade and investment policy. Whilst some of these are further out into the future, we need to interrogate whether we are doing enough now to ensure we have the right skills and competencies to be able to take advantage of these opportunities.

South Africa has a huge challenge ahead of us and with the many players in the space as well as the timeframes over which we need to manage this it will take a new type of mindset. The mindset must be one of taking a holistic approach to make sure there are no unintended consequences together with innovation to find new ways to manage the uncertainty. We need to be proactive but also encourage radical collaboration as we cannot afford to not work together and to hear all voices.

The EWSETA is well aligned with SANEA and its energy Risk Report as this report points out that implementation is a key lever to address the many uncertainties that characterise the energy sector. Collaboration and implementation go hand in hand to ensure that we move the sector forward. The report also identifies skills as being a critical area – nothing can happen without the right skills and competencies across the ecosystem of needs. Given South Africa’s high dependence on energy in our economy, we therefore need to align conversations and deepen collaboration to ensure consensus on what is critical for South Africa and to develop and implement plans that meets the needs of now whilst unfolding a more prosperous future for South Africans.

EXECUTIVE SUMMARY

The energy system in South Africa is intricate, influenced by internal and external forces. To navigate the risks providing positive opportunities but also negative outcomes, a systemic approach is vital. This is the 6th iteration of the South African National Energy Association (SANEA) Risk Report. Since its inception the report has evolved from a listing of risks to a deep analysis of the complex energy environment, providing recommendations for decision makers on how to enable the ecosystem for the benefit of South Africa.

The SANEA Risk Report aims to focus on Identifying future looking or emerging risks so that risks can be anticipated and proactively responded to and develop recommendations on treatment plans to mitigate future risks or seize opportunities when they arise.

For the 2024 risk report the SANEA Energy Experts group reviewed and adjusted the uncertainties highlighted in the 2023 report and SANEA members were surveyed to enrich the input further.

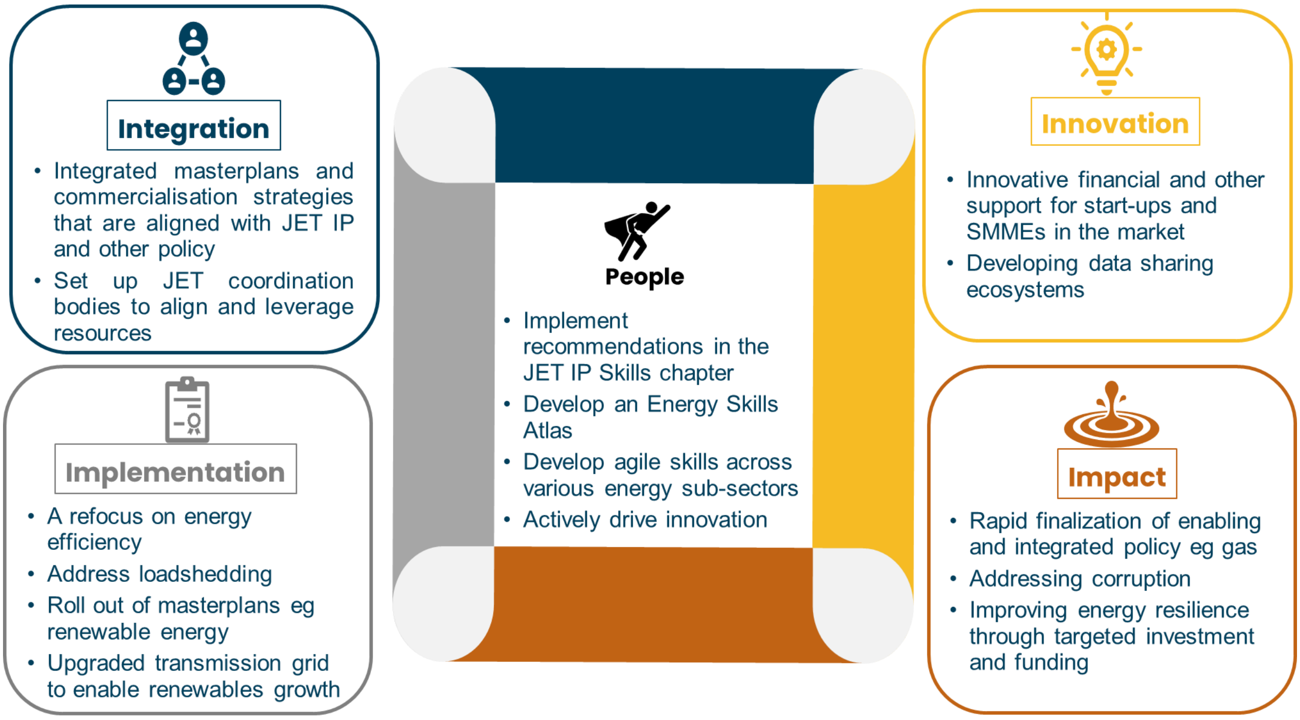
The Energy Experts group therefore undertook the following:

- Identified major shifts in the environmental context for the energy sector in South Africa
- Assessed the key uncertainties: some were removed, with others combined or added
- Reviewed the members survey on current uncertainties in the energy sector
- Provided deep dives into key areas around which the future energy landscape may pivot
- The previously used uncertainty framework was reviewed, and recommendations adjusted where necessary
- Confirmed the validity of the systems diagram and constellations of disruptions which were refreshed in the last report.

Overall, the Energy Experts were of the view that the South African economy continues to be impacted negatively by uncertainties in the energy sector that are increasing in pace and impact. Conclusions for the energy sector specifically include the following:

- **Policy uncertainty is a mixed bag** with the uncertainty coming from the new and emerging technologies as well as pace of implementation. The revised Integrated Resource Plan (IRP) has given some certainty for the electricity sector, but the final version needs to be announced as soon as possible given the proposed shift in approach. Potential changes in the South African political scene could accelerate this.
- **Localisation and industrialisation is not being incentivised** or planned optimally impacting on national competitiveness, cost and socioeconomic growth.
- **Siloed efforts from policy development to skills provisioning** and therefore the emergence of a sub-optimal energy ecosystem is an obvious barrier to progress, impacting national competitiveness and resilience. Integration opportunities are emerging but this needs to be accelerated and scaled up.
- **Implementation capability has emerged as a significant pivot** and at present is not optimal. Slow progress on transmission grid strengthening as well as the roll out of REIPPP and infrastructure strengthening are evidence of this. It is also clear that this lack of implementation is hindered by 'corruption' and 'parochial decision making', the latter moving over the last year into the driver category, moving from being a pivot.
- **Leadership is lacking across the board** with contradictory messaging and activities as well as duplication of effort. New and radical forms of collaboration need to be found to leverage collective effort and to grow the collective impact for the benefit of the country. This requires less parochial decision making.
- **Energy governance is lagging** behind progress and needs to be addressed to enable faster progress as the sector evolves.
- **The window for development of gas is closing rapidly** and key decisions on its role in the South African energy sector need to be made.
- **Green hydrogen is growing but off a very low base** and the market is nascent at present. Green hydrogen is a pivot and if it is to be turned in a positive direction an integrated strategy is needed to ensure it can benefit South Africa in future.

The recommendations made in the 2022-23 framework of 'People and the 4 I's' were reviewed in terms of their relevance and whether they address the uncertainties identified. 'People' remain at the centre of all decisions and so they form the heart of the recommendations. The recommendations are interconnected in some cases, so it is essential that all the elements of the framework are simultaneously addressed for maximum benefit at a national level.



The Energy Experts were of the view that several of the opportunities discussed above were time sensitive and if they were to be realised, then **quick action** needs to be taken in the following areas:

- Skills development
- Ensuring an appropriate electricity grid to unlock investment in renewables and help address loadshedding
- Integrated policy implementation
- Implementation capability
- Political stability
- Energy data availability and confidence

These uncertainties are all primarily within our control and should therefore be the focus.

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1 INTRODUCTION

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2 APPROACH

The SANEA Risk Report aims to focus on the following:

- Identifying future looking or emerging risks so that risks can be anticipated and proactively responded to
- Develop recommendations on treatment plans to mitigate future risks or seize opportunities when they arise.

The objectives outlined in the National Development Plan (NDP) for energy, that serve as a roadmap for South Africa's energy sector, guiding risk assessment and decision-making, were used as a guide and to determine risk in this report. The NDP of 2012, outlines the following objectives for the energy sector that were adopted in the Energy Risk Report:

"South Africa will have an energy sector that promotes:

- *Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.*
- *Social Equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households*
- *Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change."*

The definition of risk is the impact of uncertainty on the achievement of objectives. SANEA embarked on a refinement of the risk methodology in 2020, to focus on identifying the uncertainties that drive risk in the energy sector and to analyse possible outcomes for that uncertainty. The impact on our objectives was assessed as either positive or negative.

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3 2024 CHANGES IN UNCERTAINTY

3.1 MAJOR CHANGES OR ONGOING ISSUES OVER THE LAST YEAR

The Energy Experts identified the following additional or ongoing major shifts in the global, regional and national contexts that are either in the energy sector, or beyond, but which affect the energy sector in South Africa, impacting the level and direction of uncertainty:

POLICY AND POLITICS

- Disconnect between government departments
- Time taken for Electricity Regulation Act (ERA) and Electricity Pricing Policy (EPP)
- Green finance taxonomy unclear and vague
- PCC in place and some integration of policy but limited legislative teeth to drive outcomes
- Automotive development policy stalled at DTIC
- NPC active in energy debate eg loadshedding paper
- Release of the National Infrastructure Plan 2050
- Release of updated IRP 2023 and the next round of IPPs
- Political risk increased in the run-up to the elections and potential coalition governments
- Industrialisation Policy and JET not fully aligned
- New market designs not yet clarified for the liberalised electricity sector and slow transformation
- Municipal governance and financing uncertain
- Lack of a clear plan on a public renewable energy procurement programme
- Lack of well-skilled and resilient candidates for a succession plan for management SOEs

CLIMATE CHANGE

- Increasing number of extreme weather events
- Climate and Just Energy Transition (JET) accepted as a focal point to manage change
- Climate funding to South Africa increased
- Carbon border tax adjustment becoming a reality
- Climate framework finance being contested

GEOPOLITICS

- Russia/Ukraine war
- War in the middle east that may expand
- Slow global energy growth
- Cybersecurity breaches increased

HYDROGEN

- Uncertainty whether South Africa can be competitive
- Ability to ramp up renewable power generation capacity and use of available grid capacity which could be used for projects to avoid load shedding
- Alignment between hydrogen projects and economic growth

ELECTRICITY

- Distribution infrastructure decay and backlog
- Transmission infrastructure constrained or not available
- Increase in capex costs to expand the grid
- Increase in licensing limit but slow uptake at large scale
- Slow wheeling uptake at municipality level
- Compliance to the grid code complex with increasing numbers of wheeling agreements and generators
- Slow implementation of policy e.g. IPP process
- Land availability for plant and servitudes
- Commodity price uncertainty and fluctuation
- Delays at Koeberg and uncertainty about long-term future of nuclear
- Uncertainty on market design and risk sharing model
- Capacity to ramp up in key and emerging areas
- Increase in renewable energy costs across the supply chain globally
- Eskom communication and transparency improved
- Risk mitigation procurement slow, legal challenges
- The shift to electric and hybrid vehicles a clear trend
- Eskom EAF low impacting load shedding
- Affordability resulting in localised coal use

SOCIO-ECONOMIC

- South African energy security and economic impact of loadshedding
- The widening energy cost gap- affordability for the poor
- Electricity and other energy costs rising above inflation
- Increasing and sporadic social unrest
- Low economic growth over several years
- Local content: tipping point for localisation of manufacturing not achieved as yet
- Pressure on the fiscus from SOEs
- Pressure on government when fuel prices increase in the short term to medium term (decreasing revenue from fuel levies and social activism)
- Inflation increasing and a depreciating local currency
- Cost of finance increasing
- Low level of applied research impacting innovative solutions
- Uncertainty about energy pricing trajectory
- Increase in crime and low prosecution levels
- A rise in the power of NGOs and other stakeholders

RELATED INFRASTRUCTURE AND LOGISTICS

- Ports and rail infrastructure backlog and congestion
- Transnet pipeline challenge
- Volatility of container prices, impacting renewable energy
- Infrastructure theft and vandalism
- Geo-location: uncertainty about location of new plant and related infrastructure/security including hydrogen (some provinces excluded)
- Importation of key products no longer made in South Africa, price, quality and supply an issue eg transformer oil supply and bitumen
- Continuing decentralisation in electricity and storage
- Grid stability/capacity and ability to cope with increasing renewable generation
- Urgent need for transmission upgrades and financing
- Distribution capacity, maintenance and focus lacking
- The construction mafia impacting cost and planning
- Increased costs to access the grid due to the upgrade fee by Eskom Transmission and related delays
- Uncertainty as to who pays to allow improved access to grid infrastructure
- Uncertainty in construction of transmission lines impacting on supply chain development

LIQUID FUEL AND GAS

- Supply risk for petroleum products due to closure of refineries
- Increased risk associated with higher volumes of refined product and the ability of ports to handle increased numbers of ships
- Importation of finished product experiencing bottlenecks along the supply chain corridors (rail, trucks and pipelines)
- Gas supply uncertainty from 2026
- Financing of new oil and gas projects are a high risk and finance is not readily available
- Volatility in commodity prices can affect revenue streams, profitability, and investment decisions
- Rapid technological advancements in the oil and gas industry introduce both opportunities and risks.
- Companies that fail to adopt or adapt to new technologies may face operational inefficiencies and increased costs

In recent times, climate change has become a significant driver within the energy system, while gas supply has emerged as a notable short- and long-term risk. Load shedding and energy security continue to pose critical uncertainties, with load shedding reaching an all-time high in 2023 and limited progress in strengthening the transmission grid.

Geopolitical issues, especially in the oil and gas sector, remain sources of uncertainty.

Although positive policy developments have been observed in the electricity market, slow implementation remains a challenge. The execution of various masterplans and lags in implementing commercialisation strategies affecting local initiatives and national competitiveness. Municipal infrastructure issues also persist, impacting adaptability in a dynamic market.

It is noted that attention has shifted toward associated infrastructure, driven by a focus on future green hydrogen production, the need for an alternative gas supply and constrained port capabilities. Overall, the energy sector experiences significant flux across all carriers, maintaining its interconnected and complex nature.

4 TOP UNCERTAINTIES FOR THE SOUTH AFRICAN ENERGY SECTOR FOR 2024-2025

The Energy Experts considered changes in context together with the related analysis of the potential impact. They then identified new uncertainties or changes to existing uncertainties that had displayed a decrease in importance. The recommendation was to remove these as top or priority uncertainties. Other uncertainties that had changed and could be combined with another uncertainty, or required rewording were as follows:

New:

- Emerging exponential technologies: Technologies occurring at a global scale that will significantly impact the energy sector e.g. artificial intelligence, blockchain, etc.
- Energy cost reflective tariff: The extent to which the energy price is reflective of the cost
- Implementation capability: The ability to implement policy at the pace required and provide an enabling environment for business to do the same
- National competitiveness: The ability of South Africa to compete for investment and produce goods and services at a competitive rate and localise value chains
- Political stability: The stability of the political ecosystem in South Africa and ruling party or any coalition that arises from the 2024 elections

Modified:

- Climate framework and finance: The acceptance and adoption of international policies such as the United Nations Framework Convention on Climate Change (UNFCCC) dealing with Greenhouse gas adaptation and mitigation efforts **towards net-zero**, leading to an energy transition and the inflow of climate finance
- New business models **that incorporate decentralised new technologies and/or services and the resultant rate of change is uncertain**

The table below presents the top uncertainties identified by Energy Experts for South Africa in 2024 and 2025, crucial for achieving the National Development Plan (NDP) energy-related objectives. These uncertainties are in alphabetical order and categorised according to the Institute of Risk Management in South Africa’s classification, with energy-specific issues highlighted separately in light turquoise.

Table 1: Top uncertainties for the South African Energy Sector in 2024-25

1	Activism and legal challenge	The extent of activism and legal challenge including strikes and actions aimed at catalysing political or social change
2	Appropriate electricity grid	Whether the transmission and distribution grids enable the changing market structure and business models or delay their implementation
3	Appropriate policy, vision and planning	Long-term vision for the country supported by the approval and implementation of energy sector and related policy to encourage investment certainty, flexibility and agility
4	Civil disobedience, lawlessness, sabotage	The number of unlawful protests, riots, illegal activities and targeted acts of sabotage that impact the energy sector
5	Climate framework and finance	The acceptance and adoption of international policies such as the UNFCCC dealing with GHG adaptation and mitigation efforts towards net-zero, leading to an energy transition and the inflow of climate finance
6	Corruption	The extent of corruption in any part of the energy value chain or spheres of government, impacting costs and confidence in the energy system
7	Decentralised systems	New business models that incorporate decentralised new technologies and/or services and the resultant rate of change
8	Economic growth	The effects of economic growth (or lack thereof) on energy markets
9	Emerging exponential technologies	Technologies occurring at a global scale that will significantly impact the energy sector e.g. artificial intelligence, blockchain, etc.
10	Energy affordability	Energy price levels that impact on country competitiveness and the ability to drive economic growth and the ability of the poor to access modern energy forms
11	Energy and related infrastructure (in addition to electricity)	Energy infrastructure for the oil and gas industry as well as hydrogen and Power-to-X products including pipelines, ports, IT and processing and manufacturing facilities
12	Energy cost reflective tariffs	The extent to which the energy price is reflective of the cost
13	Energy data availability and confidence	The widespread availability of a consistent, transparent energy data set for planning and short- and long-term decision making
14	Energy price volatility and uncertainty	Uncertainty due to rapid and sudden price changes for energy and related commodities including key minerals such as lithium and cobalt as well as coal, oil and gas prices
15	Energy security	The continuous and uninterrupted supply of all forms of energy to meet national demand
16	Energy storage	The capture of energy for use at a later time and in support of grid stability, etc.
17	Energy-water nexus	Competition for water resources and water availability due to changing weather patterns and its effects on energy production, choice of technology and energy supply, as well as food production
18	Green hydrogen and Power-to-X	Hydrogen produced from water using electricity produced using renewable resources and then transformed into other synthetic fuels and chemicals
19	Implementation capability	The ability to implement policy at the pace required and provide an enabling environment for business to do the same
20	Investor confidence	Investors' willingness to invest in South Africa
21	Macroeconomic performance	Exchange rate fluctuations and currency devaluation which impact on energy operations and investments, including access to capital and price of fuel
22	Market design, business models and energy governance	The extent to which new market designs and policies to enable new business models for renewables integration, secure back-up and storage capacity in natural gas and electricity markets are made available and implemented
23	National competitiveness	The ability of South Africa to compete for investment and produce goods and services at a competitive rate and localise value chains
24	Parochial interests and decision making	Extent to which energy players are driving narrow interests, not in the collective interest, impacting on the ability to reach consensus and the quality of decisions
25	Political stability	The stability of the political ecosystem in South Africa and ruling party/coalitions
26	Regional geopolitics	The interaction of geographic and political factors influencing a region
27	Renewable energies	Existence of country policies to encourage the use of renewable sources of energy
28	Sufficient talent and skills	The availability of people with the necessary skills, qualifications, credibility and experience at all levels (including leadership)

Economic Environmental Geopolitical Societal Technological Energy industry

4.1 RESULTS OF THE MEMBER SURVEY ON MODIFIED UNCERTAINTIES

In 2023, SANEA members conducted a thorough review of uncertainties previously identified and later modified by the Energy Experts Group in the 2022-23 Report. During this process, experts and members assessed the following aspects:

1. Impact and Uncertainty Level:
   - Determined the impact of each uncertainty on the energy sector.
   - Evaluated the level of uncertainty associated with each factor.
2. Dynamic Nature of Uncertainties:
   - Monitored how the identified uncertainties were evolving.
   - Considered the pace of change for each uncertainty.
3. Emerging Uncertainties:
   - Identified any new uncertainties that had arisen.

This comprehensive assessment helps inform strategic decision-making and risk management within the energy sector. The series of figures below illustrate the results:

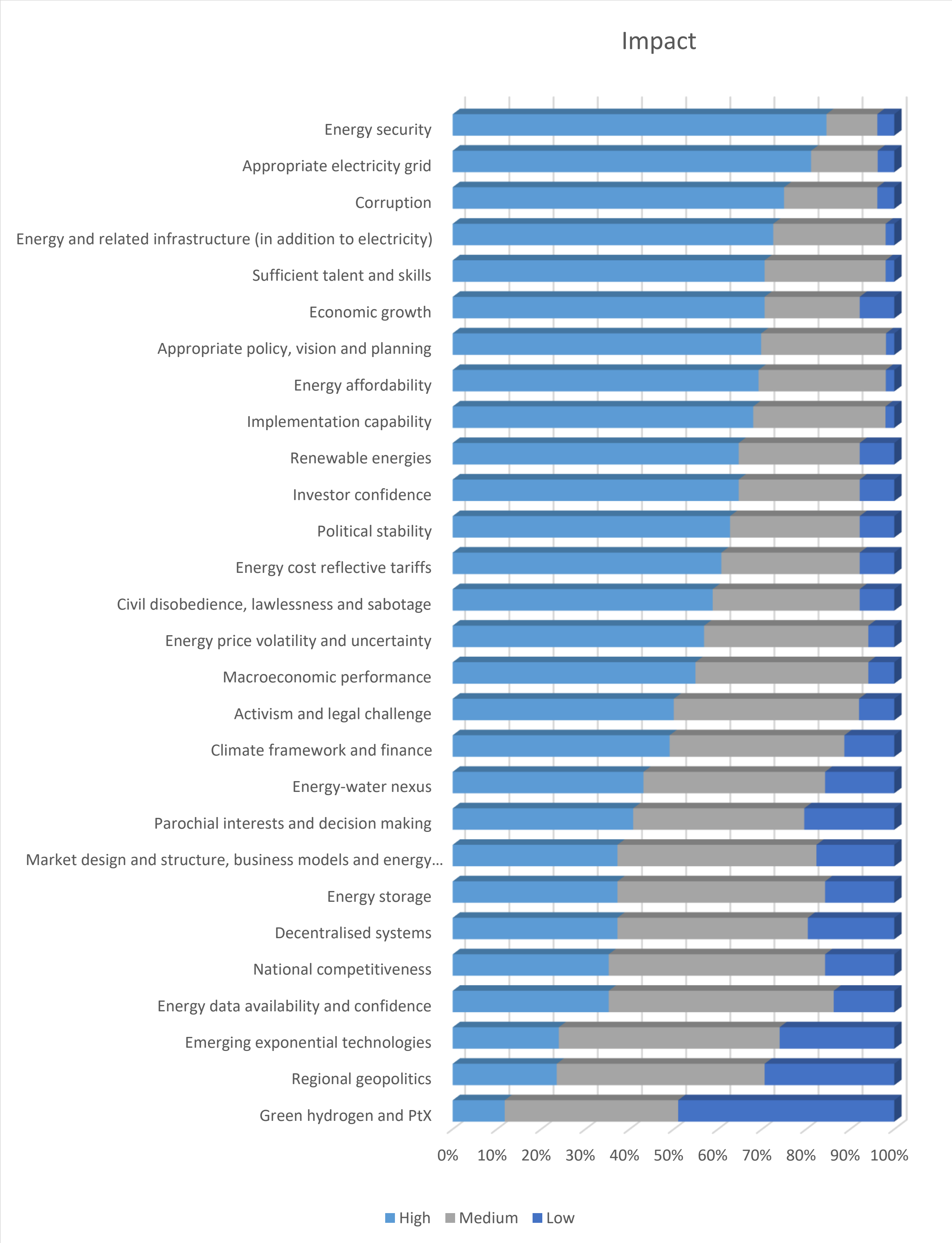

Figure 1: Results of the SANEA members' views on the impact of the various issues on the energy sector in South Africa in 2024-25

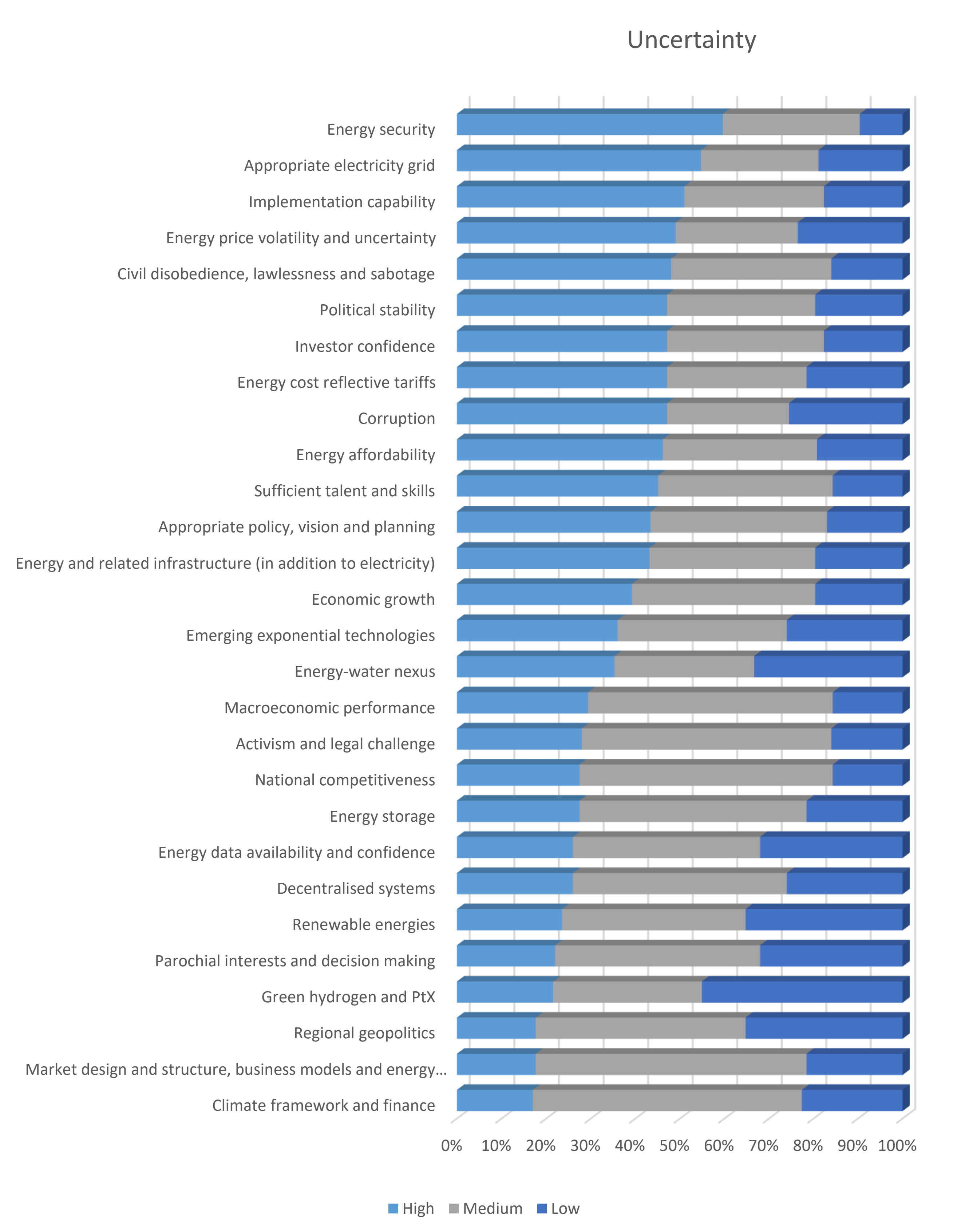

Figure 2: Results of the SANEA members' views on the level of uncertainty of the various issues on the energy sector in South Africa in 2024-25

When managing risk, it is critical to understand the **velocity** of those risks, i.e., which uncertainties are changing and/or risks are emerging at the fastest pace. As detailed in the figures below, the integrated results of the member survey were analysed for the integrated impact, pace and direction of change.

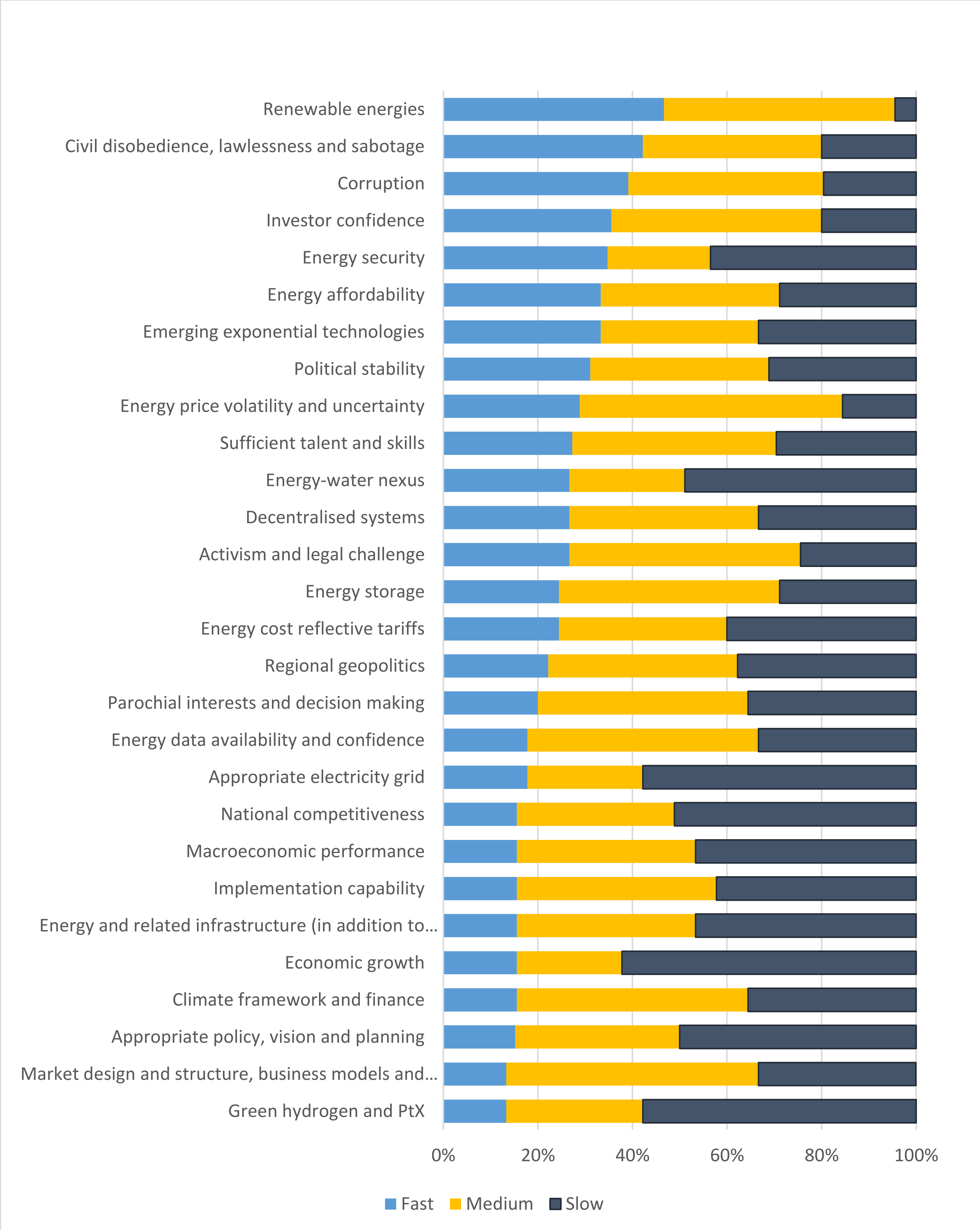

Figure 3: SANEA members' views on the pace of change of the top energy sector uncertainties

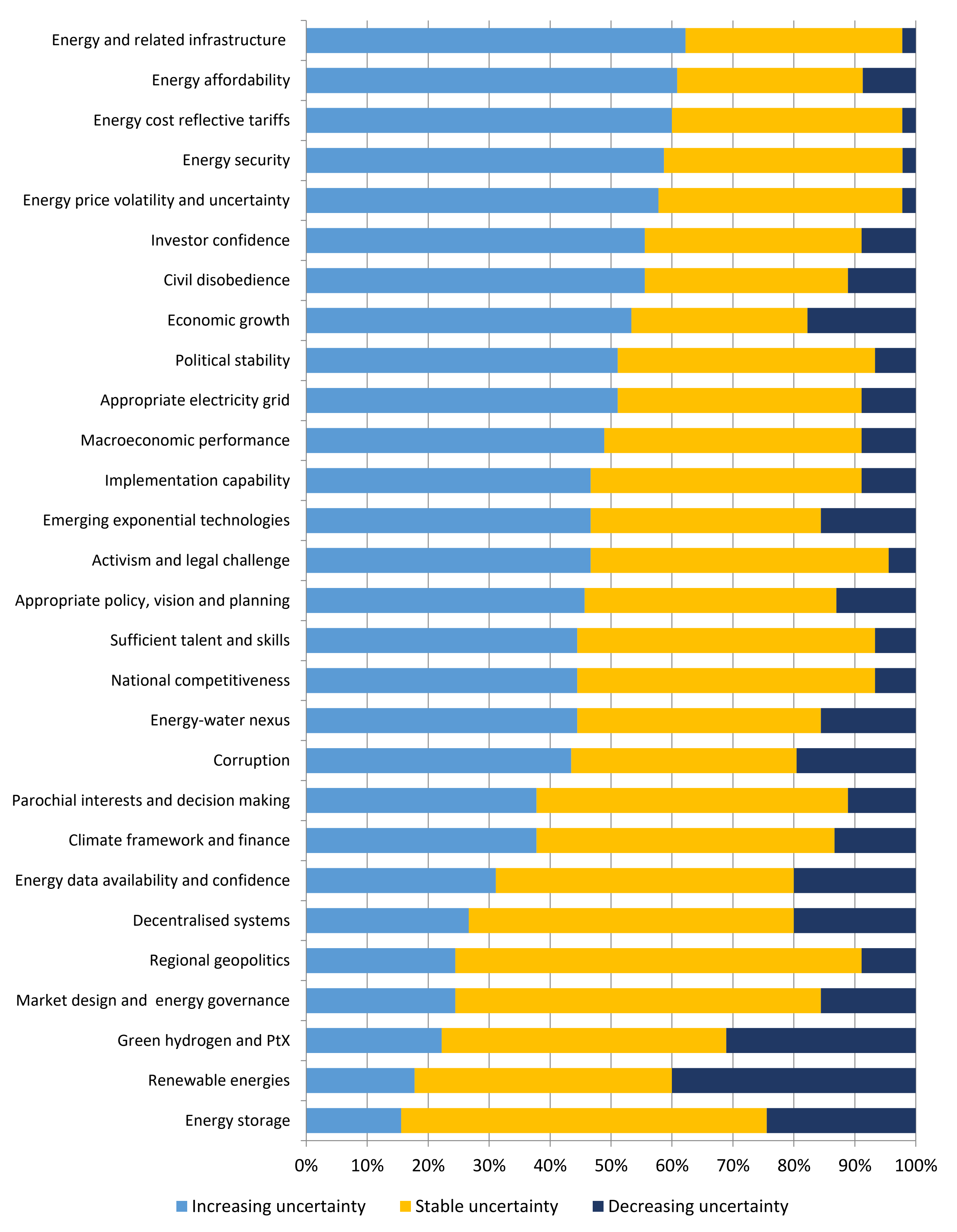

Figure 4: SANEA members' views on the direction of change of the top energy sector uncertainties

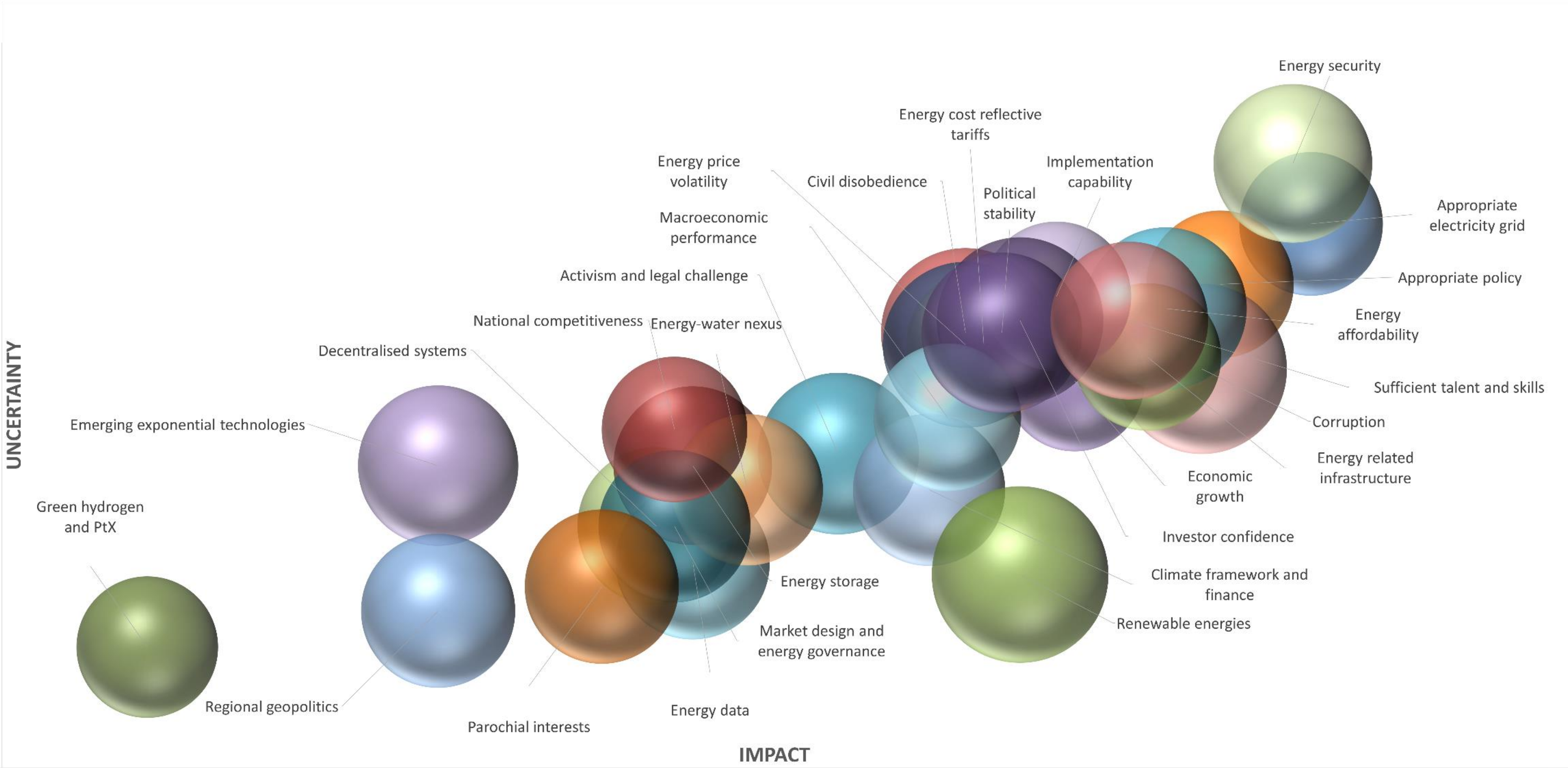

Figure 5: Combined impact vs uncertainty (size of bubble illustrates the pace of change)

Unsurprisingly, the issues with the highest uncertainty and impact are energy security, an appropriate electricity grid, appropriate policy, vision and planning and energy affordability. As has been the trend over the last few years, climate framework and finance availability, together with renewable energy, have a moderate impact but a relatively low uncertainty as they are more action orientated and are already being implemented or accessed (climate finance). A low impact and uncertainty was found for green hydrogen which given that it is a nascent technology and slowly evolving, is not unexpected. Other low impact and uncertainty issues were regional geopolitics and emerging exponential technologies.

5 CONSOLIDATED ANALYSIS

5.1 SYSTEMS ANALYSIS TO DETERMINE DRIVERS, PIVOTS AND OUTCOMES

The table below illustrates the updated drivers pivots and outcomes for 2024-25. The uncertainties within the orange border are drivers of the system i.e. those that impact others rather than being impacted. Those with the green border are pivots which are more or less equally impacted by or have an impact on other uncertainties. If pivots are changed, they change the entire system. Lastly the uncertainties within the blue box are outcomes as they are mostly impacted by other uncertainties. The 5 new uncertainties are in bold.

Table 2: Updated mapping of uncertainties as categorised as either drivers, pivots or outcomes

UNCERTAINTY	IMPACTED BY OTHER UNCERTAINTIES	IMPACTS OTHER UNCERTAINTIES
Appropriate policy, vision and planning	5	11
Corruption	1	11
Sufficient talent and skills	2	11
Geopolitical disruption	0	6
Activism and civil disobedience	2	6
Energy-water nexus	0	5
Cost reflective tariffs	0	5
Parochial interests in decision making	1	6
Climate framework and finance	2	5
Implementation capability	7	5
Energy price volatility and uncertainty	5	5
Macroeconomic performance	3	4
Political stability	3	5
Decentralised systems	2	3
Exponential technologies	3	3
Energy storage	4	3
Green hydrogen and PtX	4	3
Energy data availability and confidence	1	2
Access to capital markets	5	2
Renewable energies	4	2
Activism and Legal Challenge	5	2
Market design, business models and governance	6	3
Energy security	8	3
Economic growth	8	2
National Competitiveness	8	2
Investor confidence	9	1
Appropriate electricity grid	8	1
Energy affordability	8	0
Energy and related infrastructure	11	3

This analysis shows that the **strongest drivers** of the energy ecosystem are appropriate policy, vision and planning; corruption; sufficient talent and skills; geopolitical disruption; activism and civil disobedience**;** energy-water nexus; cost reflective tariffs; parochial interests in decision making; and the climate framework and finance. Those drivers that are underlined (three) are new into this category, one of which (cost reflective tariffs) is a new uncertainty. The other two have moved into the driver category from the pivot category because of the five new uncertainties in the system. Parochial interests in decision making is closely linked to corruption and so a move to being a driver is to be expected. The three strongest drivers by far are appropriate policy, vision and planning, corruption and sufficient talent and skills; all of which are in our control.

The **major pivot** areas are implementation capability; energy price volatility and uncertainty; macroeconomic performance; political stability; decentralised systems; exponential technologies; energy storage; green hydrogen and PtX; and energy data availability and confidence. This includes 3 of the 5 new uncertainties (underlined above). Political stability, the new pivot, reflects the national uncertainty around upcoming elections and the potential impact of the outcomes on policy, investor confidence and national competitiveness. These pivots are a mixture of issues in our control, such as implementation capability, political stability and energy data availability and confidence, together with global issues over which we have no or limited control. Examples of these are energy price volatility (for oil and gas and electricity to some extent), energy storage and exponential technologies. Change is therefore inevitable, and emerging technologies like AI, robotics, and automation will indeed reshape the energy landscape. Our challenge lies in adapting and adjusting to these shifts effectively.

Major outcomes are access to capital markets; renewable energies; activism and legal challenge; market design; business models and governance; energy security; economic growth; national competitiveness; investor confidence; appropriate electricity grid; energy affordability; and energy and related infrastructure. Outcomes are impacted by the drivers and pivots and the new outcome of national competitiveness is the ultimate outcome of the performance of the energy sector in the energy intensive South African economy. This is reflected in the cluster of outcome uncertainties of capital markets, investor confidence, national competitiveness and economic growth.

5.2 CONSTELLATIONS OF DISRUPTION

Another way in which to assess the energy ecosystem of uncertainties is to assess where several uncertainties all change pace or direction at the same time and have a collectively bigger impact than if the changes happened at different times. The Energy Experts identified four major uncertainties around which these constellations of disruption could occur (detail can be found in the 2022-23 report) and these remain unchanged:

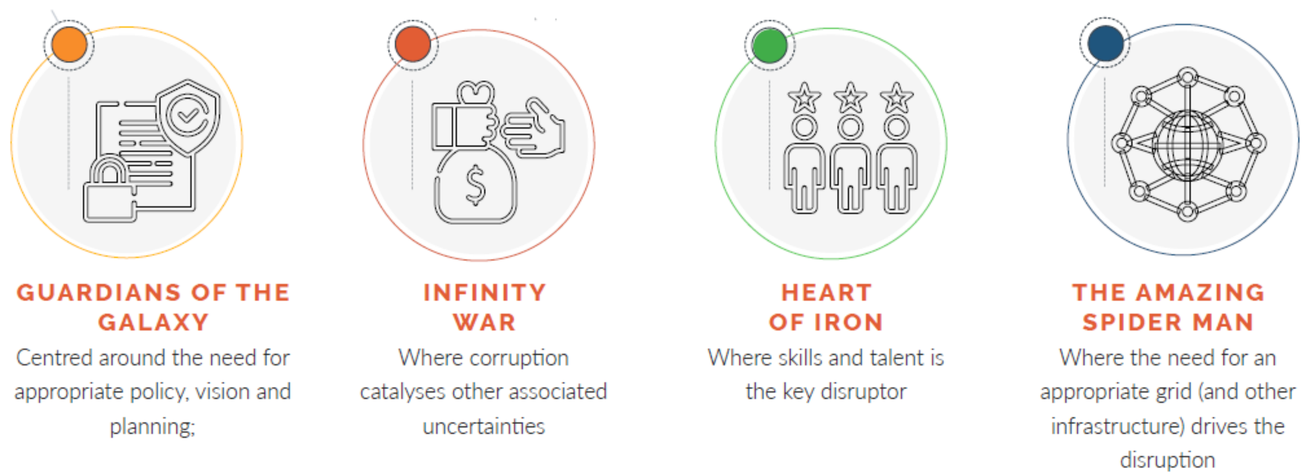

Figure 6: Constellations of disruption for the energy sector in South Africa.

6 DEEP DIVES

The Energy Experts identified key areas where the uncertainties needed to be further unpacked and additional insights obtained to make appropriate recommendations. These were:

- Market design and risk sharing
- Skills in the energy sector
- Green hydrogen applications and markets
- Oil and gas sector
- Combination and impact of emerging technologies on the energy sector
- Upstream oil and gas

These deep dives are detailed below.

6.1 MARKET DESIGN AND RISK SHARING – KIREN MAHARAJ

A. Context

In July 2022, President Ramaphosa launched measures to tackle the energy crisis, which included a programme to address the current electricity challenges in South Africa and to establish a competitive electricity market as one of the ways to achieve long term energy security with an ultimate goal of reviving the economy and creating jobs.

In April 2024, the South African Wholesale Energy Market (SAWEM) code was shared with the industry by Eskom, who has largely been developing the market code to date. A series of information sharing workshops with a process for commenting on the code will continue for much of the remainder of the year.

While there is open enthusiasm in the sector for the introduction of a competitive market in South Africa, there is a need for all businesses in the sector to re-evaluate their current business models in order to participate effectively in a competitive market and ensure that risks from the market are appropriately addressed and mitigated.

B. Key Issues and uncertainties

The sharing of the SAWEM code is a big step in bringing the industry into the fold of what the new electricity market will look like and how it is intended to operate. As the sector engages in the process of understanding and assessing this market, one of the key issues to be considered is whether this market structure and way of operation is ideally suited to the current environment prevalent in the electricity supply sector and how the sector is intended to evolve in the future.

The IRP published earlier this year by the DMRE seeks to introduce gas to power generation plants as well as increase the nuclear power generation capability of South Africa in the long term. A key consideration for the market model will be the ability to dispatch electricity at an efficient market price given the upstream resource costs, funding and contracting conditions for the different technologies.

One of the issues to be well understood by the IPPs who have contracts with the Central Purchasing Agency (CPA) will be the risks arising from the CPA's participation in the day ahead market, what this will mean for revenue risk and conversely payment risk for the IPP and CPA respectively and ultimately how this will affect the financial viability of the CPA.

The Grid Operator has expressed challenges with renewable energy integration. As the energy landscape in South Africa is set to substantially increase renewable energy power generation from the implementation of the IRP requirements through the REIPPPP, the continuously increasing uptake of self generation and off grid renewable energy options for price, loadshedding and availability mitigation and the requirements for the development of South Africa's green hydrogen commercialisation strategy, it remains to be seen how the intermittency, grid connection and power stability issues are handled by the Grid Operator and whether the extent to which these issues can be dealt with are equitably supported with fair risk sharing in a competitive market.

Based on the goals that a competitive electricity market is expected to deliver, which are energy security underpinning an economical revival and job creation, the economic viability of the electricity market will have to be considered as it unfolds. The economic viability of electricity markets are hard to measure and are impacted by various issues such as energy prices, electricity prices, infrastructure costs and demand and supply patterns.

The unfolding and implementation of an electricity market will require a well governed and timeous approach to formulating and implementing all necessary policy, legislation, and regulation requirements. The changes in the energy market have already seen an evolution in the functional requirements of many key players in the overall energy selector structure, and the introduction of a competitive market could see even further changes. A level of efficiency and maturity in ensuring that the key enablers from a policy and functional perspective are well defined, timeously implemented, and effective.

The economic viability of the market as well as the certainty created by well-developed and effectively implemented policy and regulations will ultimately create an attractive sector that encourages investment, participation and long term attractiveness for new technology and robust development.

Skills and talent (discussed in further detail in section 6.2.) to ensure that market participants across the value chain (supply, demand, operations, services etc) have identified new and evolving skills and talent requirements to ensure that their participation in the market is optimal. Investment in upfront training and development will probably be a key success factor for participants but delays in implementation of a competitive electricity market could result in loss of skills.

C. Changes over the next 18 months

Over the next 18 months and as per the process rolled out by Eskom, the industry will be engaged in understanding the SAWEM and tabling comments on the market code. For entities in the value chain, in tandem with this process, internal business adaptation and readiness for participation in a competitive market will be key focus areas.

There needs to be a concerted effort from all involved parties to ensure that policy, legislation, and regulation changes are well syndicated with the sector and timeously developed and implemented.

D. Recommendations

Uncertainty pertaining to market design and risk sharing will come from a good understanding of the market and how it operates and an internal focus on assessing how the uncertainties with the SAWEM will affect businesses. Having skilled resources and investing in developing the necessary skills will underpin understanding of risk and mitigation thereof.

6.2 SKILLS AND TALENT - WENDY POULTON

A. Context

The Just Energy Transition cannot happen without a shift in skills and competencies. The nature of the transition means that some jobs will be lost and new ones emerging as technologies and markets change. Skills and competencies cannot be developed overnight. A complex system of aligned curricula, community college, TVET and higher education programmes and qualifications and reskilling and on the job, training is required.

B. Key issues and uncertainties

The SANEA Energy Skills Roadmap states that what is needed overall, is a coherent vision and concurrent work on several key recommendations as enablers for a well-functioning system. Unfortunately, the coherent vision has not materialised, although a new version of the Integrated Resource Plan (IRP) is being finalised and the DMRE DG indicated at a recent SANEA event that the Integrated Energy Plan (IEP) was again on the table.

The IEP will be a significant step in the right direction for developing a longer term vision around which skills planning can coalesce, but major uncertainty remains in the shorter term, even with the IRP update. Work on developing an IEP has commenced within the sector, driven by the WWF. Emerging skills risks are around the changing roles of gas and nuclear, as predicted in the roadmap, as both skill sets are difficult to source and retain and at a low level in South Africa.

One major development for short term certainty is the Just Energy Transition Implementation Plan (JET IP) as it defines key technologies to focus on for low carbon investment namely renewables and transmission, green hydrogen, and electric vehicles. The JET IP also covers recommendations at all levels of government and on mechanisms to develop a pipeline of skills in the key technologies and coordinate energy skills development and uptake.

2023 was South Africa's worst year in terms of load shedding (and other energy infrastructure failures) and this has put pressure on the energy skills system not only for energy supply, but also amongst energy users, who have put contingency plans in place, with many of them taking the self-generation step. New or additional skills have therefore been required and not just technical skills but also in procurement, finance, HR, environment, and social liaison, amongst others. There is a significant growth in the market for same scale back up energy solutions, including for residential users, which is increasing the demand for skilled installers and technicians.

As a result of load shedding the new IRP has been divided into a short term phase where coal infrastructure may continue to operate longer than anticipated with all the associated skills consequences. The war in Ukraine has had significant impacts on energy security globally and resulted in increased energy prices in some cases. The concerns about energy security means that the demand for export coal has risen and the short term losses in coal jobs have been lower than first anticipated.

Lastly there has been an upsurge in renewables uptake driven by policy changes, load shedding, climate change and energy prices in the short term and green hydrogen in the medium term. Concerns therefore emerge around the skills needed for related infrastructure such as ports, pipelines, electricity transmission and distribution as well as the retention risk for renewables risk given the global demand.

Given the need to reduce electricity demand and thus load shedding and cost, it is incomprehensible as to why energy efficiency and adaptation skills are not a critical priority. Skills development areas that have not progressed as much as they should and that must also be highlighted as a serious risk and deficit, are the lack of promotion of skills for energy efficiency and associated skills and for climate change adaptation. This includes technical skills but also audit skills, behavioural skills and systemic thinking.

The consequence of doing nothing or increases in indirect costs are considered together with direct costs. This systemic thinking also applies to developing people for long term sustainability and not skills development in areas where they can either not find a job, or do not have decent work and career prospects.

Many SMMEs in the energy sector have been on the receiving end of this siloed and short term approach, and if industrialisation through SMMEs is to be successful in South Africa, then developing resilient and agile SMMEs that are internationally competitive, is fundamental. This means a change to a holistic and needs driven approach.

Overall, although there has been some notable progress, the risk of inadequate implementation remains. The risk of not having the right skills at the right time and in the right quantity will thus stay on the SANEA Energy Risk Register as one of the most important issues

C. Changes over the next 18 months

Increasing policy certainty on green hydrogen and the start of a process to develop the IEP should be obtained. South African Renewable Energy Master Plan will be rolled out. As Eskom is divisionalised, the new market and operations will become clearer. The JET IP implementation will also drive the demand for skills as well as their coordination through proposed coordination structures such as a JET Skills Desk, a National JET Skills Advisory Forum and Skills Development Zones in key technology areas (renewables and transmission, electric vehicles and green hydrogen).

D. Recommendations

Recommendations for decreasing uncertainty include a long-term vision for the sector, finalisation of the IRP 2023, acceleration of updating the IEP and integrated policy that addresses the ecosystem rather than siloed areas of the energy and related sectors. Implementation of the recommendations made in the skills chapter of the JET IP as a matter of urgency.

6.3 GREEN HYDROGEN APPLICATIONS AND MARKETS – MIKE LEVINGTON

A. Context

In 2022, a part of the post-COVID Economic Reconstruction and Recovery Plan, the Presidency developed a Country Investment Plan (CIS). The CIS identified 5 “Big Frontier” economic sectors that government wished to support as part of South Africa’s economic recovery plan and the first of those “Big 5” was green hydrogen.

The interim period has seen the following national strategic plans developed

- The Hydrogen Society Road Map developed by the Department of Science &. Innovation and approved by Cabinet in September 2022.
- The Green Hydrogen Commercialization Strategy developed by the Department of Trade, Industry & Competition and approved by Cabinet in October 2023
- The Just Energy Transition Investment Plan developed by the Presidency and approved in December 2023, which contains support for green hydrogen as one of the focus areas for JET financial support.

In 2024, South Africa needs to move from strategies to implementation on its green hydrogen and PtX ambitions.

B. Key issues and uncertainties

- Lack of clarity on the responsibility of state actors and the private sector around their roles and responsibilities for enabling infrastructure for green hydrogen.
- Strategic national green hydrogen plans need to be embedded into the countries medium-term strategic planning and budgeting process.
- Relevant departments at all levels of government need to embed the green hydrogen strategy in their plans
- State-owned companies need to be given clearer guidance on enabling infrastructure to be catered for in for example, transmission and port planning
- Allocation of sector emissions targets to drive appropriate policy and regulation to meet 2030 goals
- How will Just Energy Transition funding for the green hydrogen ambitions roll out?
- What set of criteria will need to be exhibited by green hydrogen projects to be considered as Just?
- If the state is going to invest in enabling infrastructure, it needs to establish a Value For Money for green hydrogen projects wanting access to publicly funded infrastructure
- Access to green and carbon financing
- Need to finalize relevant frameworks e.g. certification of origin and framework to allow for the recognition of renewable hydrogen and products to be recognized in target markets
- Skills alignment

C. Changes over the next 18 months

The status is unlikely to change over the next 18 months. Mega green hydrogen projects will need the collaboration of different spheres of government, SOCs and other stakeholders and this will take time to conceptualise and bring to financial close. Government has attempted to deal with the lack of intergovernmental cooperation via initiatives e.g. SEZ Act, District Development, with only limited success.

D. Recommendations

The Green Hydrogen Commercialization Strategy (GHCS) needs to be implemented and embedded in South Africa's strategic and budgeting process via the Medium Term Strategic Framework and the Medium Term Expenditure Framework.

6.4 OIL AND GAS SECTOR – CATHY LAING

A. Context

The South African oil and gas sector operates in a complex and evolving landscape, with multiple factors contributing to uncertainty. These include global oil price volatility as South Africa is a net importer of crude oil and petroleum products impacting the economy, inflation rates, trade balances, and government revenue and domestic production challenges. There are limited domestic oil and gas reserves, including potential offshore resources. The exploration and production sector faces challenges such as regulatory hurdles, technical difficulties, and environmental concerns.

B. Key issues and uncertainties

Effective management of these uncertainties requires a comprehensive view of economic, environmental, regulatory, and geopolitical factors, along with proactive policy-making and strategic planning by industry stakeholders and government authorities. Key uncertainties include:

- Domestic value chain inadequacies related to the adequacy, resilience, and maintenance of this infrastructure, including ports, pipelines, refineries, storage facilities and investor confidence can pose risks to energy supply reliability
- The gas sector is serviced by imported natural gas from Mozambique brought into South Africa through pipelines, and bottled LP gas that was produced by the local oil refineries, but now is mainly imported. Uncertainty lies in where to source alternative gas supplies in time to service industrial customers whose imported supply of natural gas is to be terminated in 2026
- The plan for the expansion of the gas transmission and distribution infrastructure is also uncertain. To this end, on 19 January 2024 the draft Gas Amendment Bill was published for public comment. the bill seeks to amend the gas act of 2001 by providing for the construction of gas transmission, storage, distribution, liquefaction, and re-gasification facilities, the promotion of efficient, effective, and sustainable gas transmission services, and the promotion of competitive and sustainable trade in gas
- The transition to decarbonise and increase renewable energy in South Africa introduces uncertainty for the oil and gas sector future demand and long-term investment decisions
- Overall regulatory uncertainty surrounding changes in regulations, taxation, and licensing procedures will impact investment decisions by both domestic and foreign companies. The abovementioned draft Gas Amendment Bill, the Upstream Petroleum Resources Development Bill (UPRDB) and the draft South African National Petroleum Company Bill, which will establish a national oil company, can contribute to a positive regulatory environment provided investment risk is reduced
- Geopolitical factors such as political instability or conflicts in oil-producing regions have already disrupted global supply chains and affected prices, while diplomatic relations and trade agreements can impact South Africa's access to energy resources
- Technology and innovation: advances in technology, such as hydraulic fracturing (fracking) and deep-sea drilling techniques, could potentially unlock previously inaccessible oil and gas reserves in South Africa. however, the adoption of these technologies has faced opposition from environmental groups and local communities, leading to supply uncertainty

The implications for the South African economy of an ageing and stagnant oil supply industry, and a gas sector under threat of supply constraints, are to further constrain growth opportunities. Without regulatory and political certainty reducing investment risk, investor confidence is further weakened, reducing our access to funds for the required infrastructure or to develop local resources.

Opportunities include enhanced energy security, reduced impact of global upheavals, and economic growth. Southern Africa is set to benefit from huge offshore oil and gas discoveries in Namibia. These discoveries offer opportunities for regional integration better energy security, and stronger economic growth in the region. There is therefore opportunity for the development of oil and gas infrastructure, including refineries, pipelines, and storage facilities, creates opportunities for investment and job creation. Gas will play a large role in enabling the renewable component of the electricity generation mix as per the latest IRP.

In summary, South Africa's oil and gas sector has the potential to contribute significantly to the country's energy security, economic prosperity, and sustainable development. By strategically leveraging these opportunities, South Africa can position itself strongly in a changing energy landscape.

C. Changes over the next 18 months

By nature, the oil and gas sector is a longer-term industry. Regulatory and policy uncertainty should be reduced in the next while through the promulgation of the various pieces of legislation, although the continuity of this process could be impacted by the political environment and the general election outcome. Should the legislative process proceed unhindered and current concerns be addressed satisfactorily, the impact of this could be to encourage investment in developing local resources and new infrastructure being constructed.

Uncertainty in the gas sector could be reduced as the imminent 'gas cliff' becomes a reality. The positive impact could be to galvanise the private sector to provide alternate solutions to the industrial customer base, bringing innovation and new thinking to the table.

D. Recommendations

Better intelligence on the structure of the economy going forward which informs likely energy demand patterns; industrial activities; transportation trends, and consumer behaviour can reduce the impact of uncertainty in the oil and gas sector. Efforts to improve energy efficiency, diversify energy sources, and promote sustainable consumption patterns can also help mitigate demand-side risks.

South Africa's resilience to external shocks, such as natural disasters, cyber-attacks, and pandemics, is critical for maintaining energy security, particularly in the oil and gas sector. Efforts to ensure the resilience of energy infrastructure, emergency response capabilities, and continuity planning can assist in the mitigation and recovery from such shocks.

Addressing these uncertainties requires a comprehensive approach: diversification of energy sources; enhancement of domestic production capabilities; investment in infrastructure resilience; development of clear and stable energy policies that equitably share risk and reward; promotion of renewable energy technologies and strengthening of African cooperation on energy and climate issues.

6.5 COMBINATION AND IMPACT OF EMERGING TECHNOLOGIES ON THE ENERGY SECTOR – SANJAY BHANA AND BARRY MACCOLL

A. Context

"An interplay of various factors creates a dynamic, exciting and uncertain landscape for AI adoption in the energy industry"

The energy sector is at the precipice of a transformative era, with AI offering potential benefits amidst unique uncertainties. The dynamic landscape for AI adoption in the energy industry is shaped by a combination of government policies, economic factors, social considerations, technological maturity, data security, and legal regulations.

B. Key issues and uncertainties

AI's expansive role in the energy sector impacts energy production, distribution, and consumption. It promises to revolutionize the sector by enhancing efficiency, reliability, and sustainability while optimising costs and environmental impact. However, challenges related to data privacy, cybersecurity, and workforce displacement necessitate careful navigation. Key areas of AI application are tabled below:

Table 3: Key areas of AI application

AI Application	Description
Energy Production Optimization	AI enhances power plant operations and optimizes renewable energy output.
Grid Management	AI enables smarter grid management through data analysis.
Energy Storage	AI optimizes the efficiency and lifespan of energy storage systems.
Demand Response	AI-driven systems manage energy consumption based on grid conditions and pricing signals.
Energy Efficiency	AI identifies opportunities for energy efficiency improvements across sectors.
Predictive Maintenance	AI enables proactive maintenance, reducing downtime and costs.
Energy Trading and Market Forecasting	AI algorithms predict energy prices and market trends.
Reservoir Management	AI optimizes reservoir characterization and management strategies.
Drilling Optimization	AI improves drilling efficiency and minimizes risks.
Equipment Monitoring and Control	AI systems optimize operations and prevent safety incidents in oil and gas facilities.
Natural Language Processing (NLP)	NLP technologies extract insights from unstructured data.
Optimizing Renewable Energy Integration	AI's forecasting abilities are crucial, but uncertainties remain.

The above benefits must be balanced against potential negative impacts of rapid AI adoption, including cybersecurity threats, job displacement, and affordability and accessibility of AI solutions.

C. Anticipated Changes in the Next 18 Months

We can expect an increased focus on AI for grid management, renewable energy integration, operations and maintenance, weather forecasting, and oil/gas exploration. Advancements in cybersecurity will address some energy security concerns, and the industry will witness initial deployments of AI solutions. The dialogue around AI and the future of energy jobs will intensify. The pace of change will however hinge on government funding, successful pilot projects, and collaboration between energy companies and technology providers. The AI integration will likely be gradual, starting with specific tasks before wider application.

D. Recommendations

At the end of the day, we must always keep in our minds that AI is a tool, and it's people like you and I that will make decisions on how to leverage these in the pursuit of our organisational aspirations. The key issue we all face is Building Trust, Reducing Uncertainty and Maximising Impact.

Trust in AI can be fostered by addressing key factors such as:

- Transparency: AI systems should provide comprehensible explanations for their decisions.
- Accountability: Developers and deployers of AI should take responsibility for system outcomes.
- Fairness and Bias Mitigation: AI systems should be designed to ensure fairness and mitigate biases.
- Robustness and Reliability: AI systems should be robust and reliable under various conditions.
- Ethical Guidelines and Standards: Adherence to ethical guidelines and standards can ensure AI systems align with societal values and norms.
- User Education and Empowerment: Users should be educated about AI technologies, their capabilities, limitations, and potential risks.
- Data Privacy and Security: Robust data privacy measures and security protocols are crucial for building trust in AI systems.
- Human-Centric Design: AI systems should be designed with usability, accessibility, and inclusivity in mind.
- Regulatory Compliance: Compliance with relevant laws and regulations ensures that AI systems meet legal requirements and adhere to ethical principles.

- Invest in AI Research: Investment in research on AI for specific energy applications can drive innovation and progress.
- Conduct Pilot Projects: Testing and validating the effectiveness of AI solutions through pilot projects can provide valuable insights and learnings.

Moving Towards Positive Outcomes:

Embracing AI requires a cultural shift within corporations to foster an environment conducive to its adoption and integration. Here are some ways in which corporate culture may need to change:

- Innovation: Cultivate a culture valuing innovation.
- Data-Driven Decisions: Prioritize data collection and analysis for informed decisions.
- Cross-Functional Collaboration: Encourage interdepartmental collaboration for AI projects.
- Continuous Learning: Support lifelong learning and upskilling opportunities.
- Ethical AI: Prioritize ethical considerations in AI development.
- Leadership Support: Leadership is crucial in driving AI adoption.
- Agility: Cultivate a flexible culture for rapid AI strategy iteration.
- Employee Empowerment: Empower employees to contribute to AI initiatives.
- Customer-Centric: Ensure AI serves customer needs and interests.

By fostering a culture that embraces the above, companies can successfully integrate AI into their operations and drive competitive advantage in the digital age. By proactively addressing these uncertainties, the energy industry can harness the power of AI to create a more efficient, sustainable, and equitable energy future.

6.6 UPSTREAM OIL AND GAS SECTOR – DAVE WRIGHT

A. Context

The development of any progress in the upstream oil and gas sector in South Africa is being held back due to uncertainty of the policy and the lack of clarity from government on environmental issues related to exploration.

B. Key issues and uncertainties

As far as policy uncertainty is concerned, the key issue is that the Upstream Petroleum Resources Development (UPRD) bill has yet to be finalised. The process of developing this bill in its current form started in 2021 and it is still not approved. While this uncertainty exists exploration and production companies will consider opportunities in other countries where the legislation is clear.

From the environmental point of view, recent attempts to initiate offshore exploration for oil and gas have been stopped by legal action based on environmental grounds. The lack of clarity from government in this area creates further uncertainty for exploration companies so they avoid coming to South Africa and go to countries where there is greater certainty of success for them.

C. Changes over the next 18 months

The government has been trying to pass the UPRD bill into law for many years now. If this could happen in the next 18 months, it may encourage exploration and production companies to begin exploration of their South African leases. However, the timing of the imminent elections (May 2024) is likely to slow the approval process down.

Also, the government needs to make the environmental requirements clear for oil and gas exploration in South Africa so that exploration and production companies can undertake exploration activities without being prevented or stopped from doing so on legal grounds.

D. Recommendations

It is recommended that the UPRD bill is passed into law as soon as possible and that the government make the environmental requirements for oil and gas exploration clear to all players so that the Upstream oil and gas sector can stimulate job creation and economic growth.

7 CONCLUSIONS

Overall, the Energy Experts were of the view that the South African economy continues to be impacted negatively by uncertainties in the energy sector that are increasing in pace and impact. Conclusions for the energy sector specifically include the following:

- **Policy uncertainty is a mixed bag** with the uncertainty coming from the new and emerging technologies as well as pace of implementation. The revised Integrated Resource Plan (IRP) has given some certainty for the electricity sector, but the final version needs to be announced as soon as possible given the proposed shift in approach. Potential changes in the South African political scene could accelerate this.
- **Localisation and industrialisation is not being incentivised** or planned optimally impacting on national competitiveness, cost and socioeconomic growth.
- **Siloed efforts from policy development to skills provisioning** and therefore the emergence of a sub-optimal energy ecosystem is an obvious barrier to progress, impacting national competitiveness and resilience. Integration opportunities are emerging but this needs to be accelerated and scaled up.
- **Implementation capability has emerged as a significant pivot** and at present is not optimal. Slow progress on transmission grid strengthening as well as the roll out of REIPPP and infrastructure strengthening are evidence of this. It is also clear that this lack of implementation is hindered by ‘corruption’ and ‘parochial decision making’, the latter moving over the last year into the driver category, moving from being a pivot.
- **Leadership is lacking across the board** with contradictory messaging and activities as well as duplication of effort. New and radical forms of collaboration need to be found to leverage collective effort and to grow the collective impact for the benefit of the country. This requires less parochial decision making.
- **Energy governance is lagging** behind progress and needs to be addressed to enable faster progress as the sector evolves.
- **The window for development of gas is closing rapidly** and key decisions on its role in the South African energy sector need to be made.
- **Green hydrogen is growing but off a very low base** and the market is nascent at present. Green hydrogen is a pivot and if it is to be turned in a positive direction an integrated strategy is needed to ensure it can benefit South Africa in future.

8 2024 RECOMMENDATIONS TO MOVE UNCERTAINTIES IN A POSITIVE DIRECTION

The recommendations made in the 2022-23 framework of 'People and the 4 I's' were reviewed in terms of their relevance and whether they address the uncertainties identified. 'People' remain at the centre of all decisions and so they form the heart of the recommendations. The recommendations are interconnected in some cases, so it is essential that all the elements of the framework are simultaneously addressed for maximum benefit at a national level.

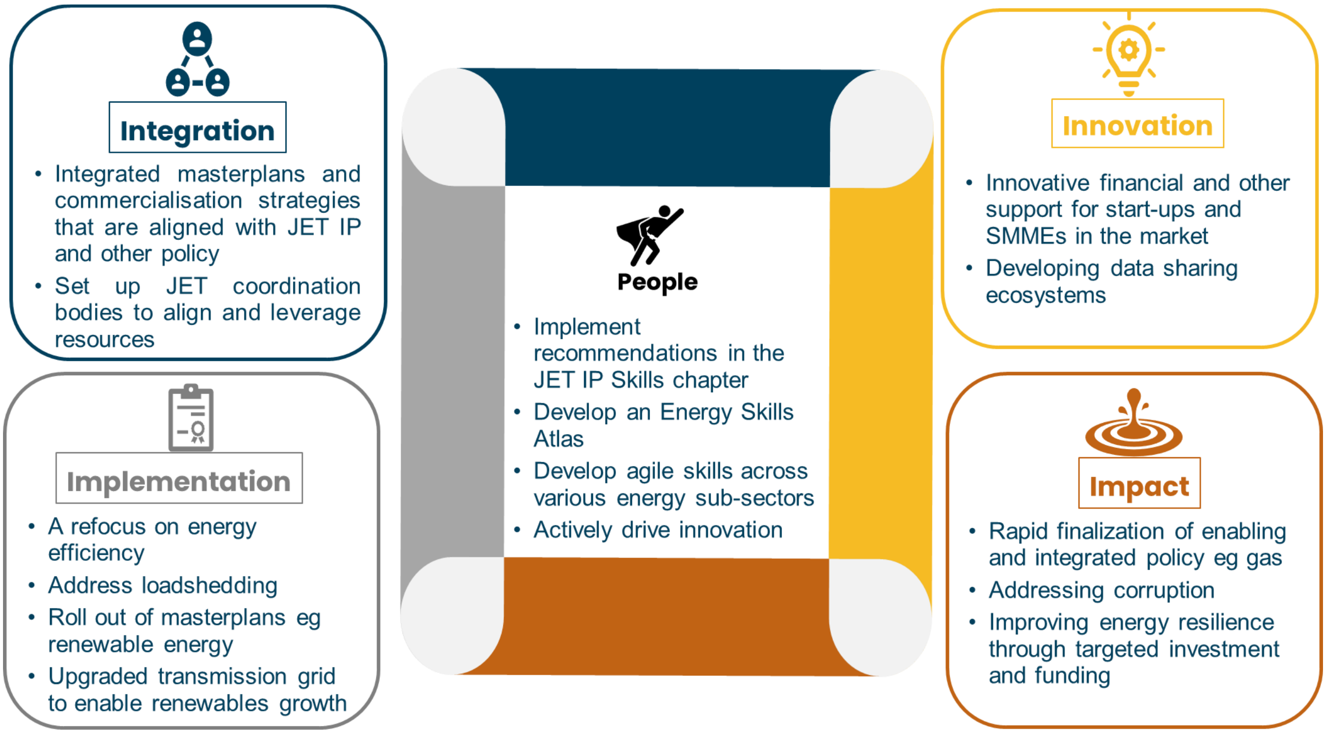

Figure 7: Recommendations to maximise positive and minimise negative direction of uncertainties in the energy sector

The Energy Experts were of the view that several of the opportunities discussed above were time sensitive and if they were to be realised, then **quick action** needs to be taken in the following areas:

- Skills development
- Ensuring an appropriate electricity grid to unlock investment in renewables and help address loadshedding
- Integrated policy implementation
- Implementation capability
- Political stability
- Energy data availability and confidence

These uncertainties are all primarily within our control and should therefore be the focus.

9 APPENDIX 1: MEMBERS OF THE ENERGY EXPERTS GROUP

The following people were members of the 2024 Energy Experts Group. Their contribution is gratefully acknowledged.

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SANEA

The South African National Energy Association (SANEA), founded in 1924, represents a hub for objective thought leadership on energy and related matters. In so doing, **SANEA** stimulates original thinking to catalyse transformation of the South African Energy Sector.

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