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Towards Developing Quality Standards: A review for managing South Africa's Carbon Emissions

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Abstract

United Nations Sustainable Development Goals, Agenda 2030, entitled "Transforming our World" has tabled aspirations for urgent action on climate change. COP 24, held in 2018 in Poland, wants greater urgency of action from all countries in managing carbon emissions. Human activity is the prime contributor to generating carbon emissions, primarily from electrical power generation from coal, oil and gas and transport driven by carbon based liquid fuels. South Africa has an abundance of coal. South African electricity generation is historically embedded in thermal coal power generation, owning and operating large power stations of typical capacities of 6 x 600 MW turbo-generators. Most recently, South African is busy adding another 12 X 800 MW super-critical turbo-generators. South African imports all its crude oil and natural gas. These are used extensively in transportation of persons and goods. The South African economy is totally based on the carbon economy. Reducing the dependence on coal and liquid fuels will impact jobs and the economy. The interdependencies are complex. The paper presents the status of South Africa's contributions to carbon emissions and the country's aspirations as committed at COP 24. The key performance indicators for the transition period of 2020 to 2050 are considered. The paper concludes with a research proposal for developing strategies and quality standards of measurement and management in moving South Africa's transition away from a carbon based economy over the next three decades.

Keywords
Sustainable Development, Climate Change, International Quality Standards for Carbon Emission Management

INTRODUCTION

South Africa has a diverse nation with a population of 57.7 million [1]. South Africa is a significant industrial and economic power and has the largest economy in Southern Africa. It has a well-developed mining, transport, energy, manufacturing, tourism, agriculture, commercial timber and pulp production and service sectors[3][2]. Various factors influence greenhouse gas (GHG) emissions in SA. Greenhouse gases refer to the sum of seven gases that have direct effects on climate change: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3).

The South African economy is a carbon based economy; electricity generation is powered by coal and transport is powered by liquid fuels extracted from imported crude oil [4]. South Africa has experienced a seven-fold increase in fossil-fuel CO2 emissions since 1950, with 80-90% of emissions from coal.

The National Development Plan provides the foundation for South Africa's vision of economic and socio-economic growth and advancement. It recognizes the pivotal role that coal plays as the primary input in energy. It envisages that by 2030 South Africa will have an energy sector that promotes economic growth and development through adequate investment in energy infrastructure [6]. The plan also envisages that by 2030 South Africa will have an adequate supply of electricity and liquid fuels to ensure that economic activity and welfare are not disrupted, and that at least 95% of the population will have access to grid or off-grid electricity. The plan proposes that gas and other renewable resources like wind, solar and hydroelectricity will be viable alternatives to coal and will supply at least 20 000 MW of the additional 29 000 MW of electricity needed by 2030.

Managing climate change is about strengthening resilience and adaptability from hazards and natural disasters that are climate related. It is about developing and promoting mechanisms to increase the capacity of effective climate change-related planning and management. Under the United Nations Framework Convention on Climate Change (UNFCCC), the call was to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. At COP 21, the Paris Agreement, 187 countries adopted the agreement. The Paris Agreement requires all Parties to put forward their best efforts through nationally determined contributions (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts.

South Africa tabled its INDC consisting of three parts. GHG emissions will peak in 2025, plateau for a decade up to 2035 and then decline from 2036, in absolute terms, towards 2050[2]. In 2016, South Africa recorded 518 million tons of CO_2 emissions per year. The peak level of 2025 to 2035 was set at 614 million tons of CO_2 emission per year. The decline from 2036 to 2050 will be aggressive and rapid [2].

Problem Statement

The South African energy supply is dominated by coal with 59% of the primary energy supply followed by renewables with 20% and crude oil with 16%. Natural gas contributed 3% while nuclear contributed 2% to the total primary supply in 2015[13]. South Africa is a party to the United Nation Framework Convention on Climate Change (UNFCCC) which aims to achieve the stabilization of greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with climate change system [14].

South Africa is historically embedded in thermal coal power generation and liquid fuel transportation of goods; both being primary sources of contributions to carbon emissions, jobs and the economy. As a signatory to UNFCCC SA was required to compile a set of Nationally Determined Contributions (NDCs) which outline the country's contributions to the global goals to reduce national greenhouse gas emissions and adapt to the impacts of climate change. To achieve these commitments, reducing the dependence on coal and liquid fuels is essential. However this will also influence jobs and affect the economy. The complexities of these interdependencies require a systematic approach to assist in achieving NDCs by South Africa.

This paper seeks to propose the development of strategies, quality standards of measurement and management of climate change in moving South Africa's transition away from a carbon based economy over the next three decades. The key performance indicators for the transition period of 2020 to 2050 are considered.

Research Objectives

This study intends to presents the status of South Africa's contributions to carbon emissions and the country's aspirations as committed at COP 24. It will also analyze the key performance indicators for the transition period of 2020 to 2050. It will conclude with a development strategies and quality standards for managing South Africa's carbon emissions over the next three decades.

Scoping the Literature Review study

Climate change has taken a prominent role amongst the leading countries around the globe. A wide international study of many countries will be done to examine their practices and approach to improve the management of climate change. The scopes of study will place emphasis on the interrelationship between:

- International Standards
- Performance Management and Reporting
- Risk Management
- Sustainability and Resilience
- Stakeholder Management

International Quality Standards

ISO has published more than 22 000 International Standards and related documents that represent globally recognized guidelines and frameworks based on international collaboration and consensus [7]. These standards can provide a solid base on which innovation can thrive and are essential tools to help governments, industry and consumers contribute to the achievement of every one of the SDGs. ISO standards contributes to all of the SDGs. The graph below illustrates the number of ISO standards that are directly applicable to each Goal. There are over 100 ISO standards that directly to the United Nations Sustainable Development Goal [8].

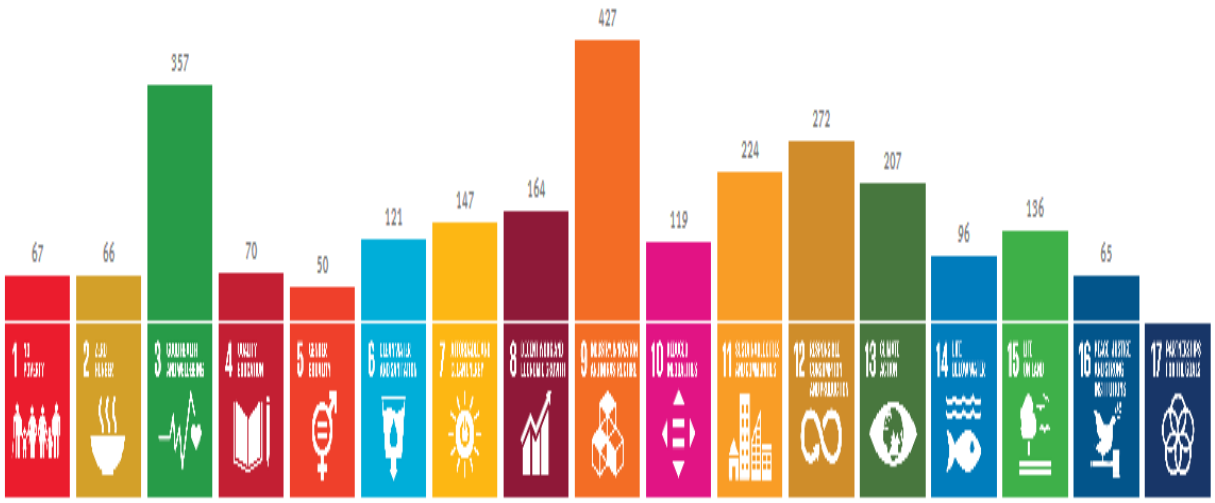

Figure 1: ISO Standards vs SDGs [7]

Risk and Risk Management of Carbon Emissions and Climate Change

Identification of climate change risk will help in execution and realization of climate change strategy and intended objectives. The effective determination of the management of climate change key risks starts with an understanding of the strategy and objectives. The key risks provide insight into potential risks that may affect the realization of objectives and may indicate the presence of new opportunities [9]. Risk management helps stakeholders identify and prioritize risks. ISO 31000:2018 Risk Management: Principles and Guidelines, is a major resource that will be employed in developing their risk management programs. Risk management will form the guiding principle for decision-making process at all levels.

Performance Measurement and reporting

Measurement and reporting of climate change performance will assist in alerting all stakeholders to trends towards the achievement of the objectives. The frequency of data collection and reporting of performance needs to be agreed. When measuring and reporting the following should be considered:
I. Availability of data
II. Sources of data
III. Data integrity

This will reduce the likelihood of the risks occurring and provide insight and information to stakeholders of any risks that could potentially hinder the achievement of the objectives and strategy. An integral part of data sourcing, processing and management will be industrial revolution 4.0 driven; the study will present a functional specification of internet of things, big data, and data analytics, blockchain management of carbon taxes and credits and performance monitoring and management.

Resilience

The World of today is characterized by high levels of uncertainty, volatility and constantly changing relationships between financial, social and environmental issues. It is critical for governments and organizations to remain aware of their impacts and dependencies on their non-financial relationships that attract unnecessary risk. They should build resilience in their systems and processes for them to prosper in this complex and turbulent world. The extent of uncertainty and volatility is one of the characteristics that will pose substantial challenges for many countries and governments in the achievements of Climate Change objectives.

For the countries to achieve Climate change NDC by 2050 they need to ensure that they are resilient both economically and politically. Resilience need to be embedded cross the organization, cutting across silos, organizational structures and hierarchies, aligning operational activities to strategic priorities [10]. Resilience should be informed by effective risk management practices. This ensures that they continue to perform under uncertain world [10]. Resilience might come down to three things, viz.

- The ability to adapt to changes,
- Anticipate what might happen next and
- Absorb shocks when they do come along.

Resilience requires the ability to make good decisions informed by and understanding of what the organization stand for and where it is trying to go, the environment, what matters to the organization and what resources are available. This will enable the organization to determine the actions necessary to make organization more resilient.

Stakeholder Management

Climate change programs operate within a complex landscape which involves many different stakeholders with diverging objectives. These stakeholders need to be engaged through several engagement channels. Stakeholder is defined as “persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively [12]. Stakeholders can be broadly classified in the following categories:

- Authorisers, e.g. Governments
- Enforcers, e.g. regulators
- Influencers, e.g. Civil society
- Partners, e.g. suppliers

Research Methodology

A new model will be developed to measure, record, analyze and report on carbon emissions from all human activity in South Africa.

For example, the electrical power producers files annually data with the National Electricity Regulator with respect to electricity generated, primary resources employed and environmental emissions and waste generated. The supply side data will be mapped to the demand side data and this will yield a pattern of human activity and its impact thereof.

A similar path will be followed for carbon based fuels and gases; for agriculture generated carbon emissions etc. The study will be comprehensive to yield an 80/20 outcome; 80% accurate and 20% estimated.

The supply side and demand side patterns will be referenced to international standards. Strategies can then be developed and built into the model for calculated reduction to internationally agreed limits. A project management plan of time, cost and quality management will be prepared to manage the transition from present day to the target period of 2050.

Given the uncertainty associated with climate change; what was predicted to occur in a few decades may start to occur earlier. For example, climate changes could become more violent and volatile and the set limits of COP 21 may have to be adjusted earlier. To this end, a feedback loop will be developed in the model to note actual performance at time t, but to have the ability to adjust performance in line with changing conditions.

Analysis of Present Day South African Data

Figure 2 presents the South African present day data of human activity generating emissions [DEA, 2017c].

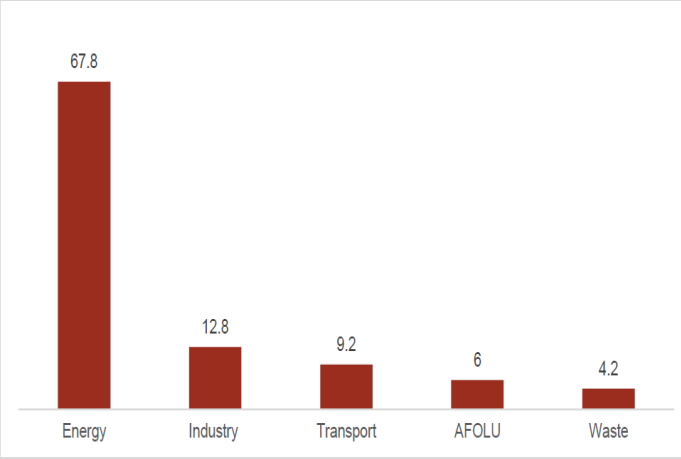

Figure 2: South African Activity Generating Emissions [3]

The energy sector accounted for 68% of the country's overall emissions in 2012. Industry accounted for 13 percent, transport contributed 9 percent, agriculture, forestry and other land use contributed 6 percent and waste contributed 4 percent.

South Africa's GHG emissions are 1.1 percent of the global emissions. The latest National Greenhouse Gas Emission Figure 2 shows that South Africa's total emissions increased from approximately 434 Mt CO2e in 2000 to 518 Mt CO2e in 2012 [DEA, 2017]

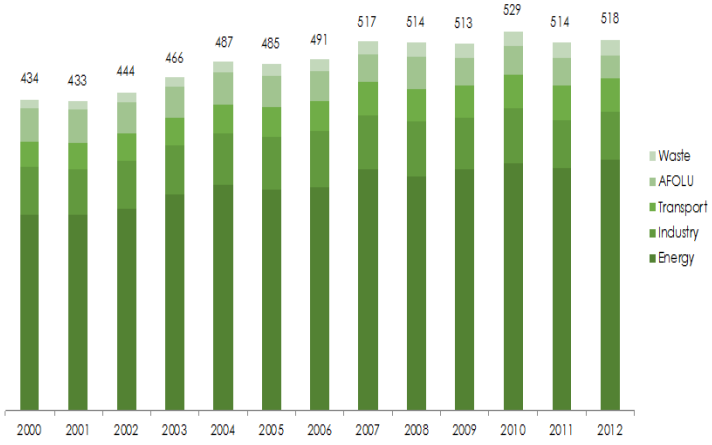

Figure 3: South Africa's Carbon Emission Profile [3]

Conceptual Design

A First Recommendation for Study

The first task of the study in managing South Africa's carbon emissions is to unpack the 105 standards pertaining to sustainable development goal, 13, taking urgent action to mitigate against climate change. Each of these standards will have key performance indicators. The data will need to be collected for each of the key performance indicators. Measured against the set targets of peak, plateau and decline for the periods 2020 -2025 – 2035 – 2050, will result in a management tool for the country and for the sponsor, the United Nations.

A Second Recommendation for Study

A second recommendation is to employ ISO 31000:2018. This standard covers risk management, its principles and guidelines. This major resource will assist in developing the risk management programs. Risk Management must operate at multiple levels with broad coverage, i.e. they must take into account the reach and range of all the risks faced by climate change program. Risk assessment is the part of the risk management process that measures the two attributes that comprise risk, namely, the magnitude of the consequences, and the likelihood that it will occur.

A Third Recommendation for Study

Measurement and reporting of climate change performance will assist in alerting all stakeholders to trends towards the achievement of the objectives. The frequency of data collection and reporting of performance needs to be agreed. When measuring and reporting the following should be considered:

Availability of data
Sources of data
Data integrity

Figure 4 demonstrates the mapping of objectives, KPIs and critical risks. This will reduce the likelihood of the risks occurring and provide insight and information to stakeholders of any risks that could potentially hinder the achievement of the objectives and strategy.

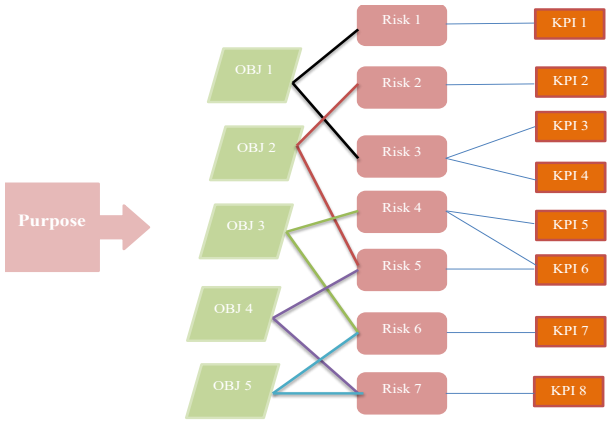

Figure 4: Mapping of Objectives, Risk and Key Performance Indicators (Adopted from [15])

A Fourth Recommendation for Study

World today is facing high levels of uncertainty and volatility. It is critical for governments and organizations to build resilience in their systems and processes for them to prosper in this complex and turbulent world. The extent of uncertainty and volatility is one of the characteristics that will pose substantial challenges for many countries and governments in the achievements of Climate Change objectives. For the countries to achieve Climate change NDC by 2050, they need to ensure that they are resilient both economically and politically. This ensures that they continue to perform under uncertain world. Resilience might come down to three things, viz. the ability to adapt to changes, anticipate what might happen next and absorb shocks when they do come along. Resilience requires the ability to make good decisions informed by and understanding of what are the intended objectives and the resources available in assisting to achieve those objectives. This will assist in mapping the actions necessary to remain more resilient. Figure 5 illustrates a continuous process for resilience.

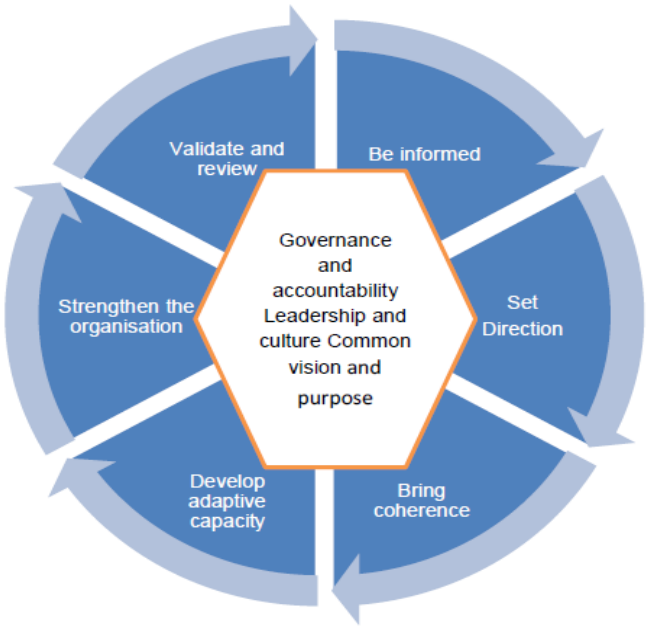

Figure 5: Continuous Modelling Process for Resilience [10]

Conclusion

The complexity of climate change requires a multifaceted approach. The proposed quality standard to be developed will need to be internationally acceptable, be standardized in data collection, analysis, measurement and reporting and have measurable impacts on national economic growth, risks and risk management strategies. Climate change is equivalent to poverty; it is man-made and it is only man with conditioned behavioral practices that could charter a new course for the environment. The exercise of measuring and reporting is to manage downwards GHG emissions from human activity of industrialization.

Acknowledgements

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Biography / Biographies

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A senior lecturer and Head of Department at the University of Johannesburg. She obtained a Masters in Quality from the Durban University of Technology and a PhD in Engineering Management from the University of Johannesburg. She is an upcoming young researcher in the field of total quality management and operations management. Her field of expertise also include quantitative analysis, quality management systems, quality auditing and risk assessment. She is a qualified Lead Auditor, proficient in ISO standards and certification. She is chairperson and director of the Society for Operations Management in Africa (SOMA), a senior member of the South African Society for Quality (SASQ) as well as the executive board member of the South African Quality Institute (SAQI).

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