DEVELOPMENT OF AN ASSURANCE FRAMEWORK FOR SOUTH AFRICAN CARBON TAX

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ABSTRACT

The Carbon Tax on greenhouse gas (GHG) emissions, set to help transition South Africa towards a low-carbon economy, induces several uncertainties. Liable parties, as well as national bodies (e.g. the South African Revenue Service, SARS), are at risk due to the lack of published guidance. Such uncertainties and risks can be managed or mitigated by introducing assurance mechanisms focused on the different key structures within the process.

This paper presents an assurance-centered reporting framework developed to document and support all decisions affecting the values submitted to SARS. The framework merges several international and national best practice auditing assurance standards together with the technical and legal requirements of carbon tax. Assurance is thereby provided by a transparent and traceable process presented in such a manner that it can be easily audited by independent parties.

The developed framework assures the (1) dataset constructed and used in (2) GHG quantification methods to (3) report the results for industrial case studies. Several practical assurance mechanisms are identified and applied within each structure to address the associated uncertainties. Aggregating these mechanisms ultimately provides holistic assured results that are likely to pass all levels of scrutiny.

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1. SOUTH AFRICA’S CARBON TAX

Carbon pricing is applied in numerous countries as a strategy to mitigate greenhouse gas (GHG) emissions [1]. South Africa aims to transition to a low carbon economy with reduced emissions while promoting sustainable development [2]. In 2017, an updated “Draft Carbon Tax Bill” was published following the initial draft in 2015 [3], emphasising the government’s approach to impose an environmental levy on GHG emissions, to be known as carbon tax.

The design of carbon tax is portrayed to be a simplistic self-assessment that levy CO₂ equivalent GHG emissions at R120 per tonne. Assessments are reported to the South African Revenue Service (SARS) and paid accordingly [3]. Presently, liable parties are only required to submit a single value (carbon tax amount payable) to SARS. Accurately reporting an entity’s official carbon tax value to SARS is critically important. It is highly probable (as with all tax submissions) that some values may be audited from time to time.

The lack of assurance that the submitted value is correct presents a significant risk to both parties in the event of an audit [4]. SARS is at risk since results cannot be traced, audited or checked. The liable party is at risk for penalties, additional costs and the administrative burden of attempting to compile a report retrospectively for auditing purposes. It is therefore necessary to have a framework that can be used to document the process and support all values submitted to SARS [5].

Several areas of uncertainty exist within the design of the generic carbon tax process [4]. These uncertainties are related to the, (1) legislative compliance, (2) quantification of emissions, (3) potential mitigation of liability, (4) reporting the results, and (5) assurance that the submitted values are correct. It is therefore important to firstly understand the process and the uncertainties before assurance can be provided. Figure 1 illustrates the generic carbon tax process and highlights the uncertainties associated with the steps [4].

![Figure 1: Generic carbon tax process and the associated uncertainties [4]](image)

Before any steps are taken, industries and companies should know if they are required to submit and pay carbon tax. Liable parties are then required to quantify the emissions on which the tax should be paid. Deductions, such as offsets and other credits, need to be determined and subtracted from the liable emissions. The emissions and deductions should then be reported to SARS as part of the environmental accounts. After which the determined amount should be paid over to SARS.

Each area of uncertainty is broadly described with regards to the process steps.

Legislative uncertainty encapsulates the legal requirements that stakeholders should adhere to and provides answers to questions such as “who should pay the tax?” [4], [5].
Quantification uncertainty describes the uncertainty from the data and methodologies that are used to quantify the emissions. This highlights the underlying question of “how do you quantify the emissions?” [4]

The design of carbon tax allows for some Liability mitigation [3]. There are a vast number of deductions and allowances that can be claimed, but it is unknown for “what deductions do the liable party qualify?” [4]

Reporting uncertainty describes the queries experienced when compiling a report for relevant stakeholders [4]. This area of uncertainty stresses the question of “how should such a report look?”

Assurance uncertainty are provoked from possible errors and inaccuracies of the entire carbon tax process [4]. Matters associated with accuracy, correctness, and stakeholder confidence are accounted for in this area [5].

These uncertainties were identified by comparing the carbon tax process to the structure of the Section 12L tax incentive [4]. The Section 12L tax incentive provided a well-defined structure as reference point into handling similar issues [6]. However, there were a lack of clear reference documentation available that focus on carbon tax. Gous et. al. [4] presented a landscape of carbon tax specific references to assist in addressing each uncertainty. This landscape consists of references that are relevant to carbon tax and specific towards an area of uncertainty.

It is necessary to assess the landscape for each individual area of uncertainty to establish the core assurance for the final value. Analysis of the landscape would present multiple ways to assure the final results.

2. GENERAL ASSURANCE MECHANISMS

The approach to identifying the assurance applicable to each of the uncertainties is divided into two sections. The first identifies general mechanisms that are used to provide assurance. The second section identifies the assurance mechanisms that are applicable to the carbon tax process.

There are several fundamental requirements to obtain a high degree of the necessary assurance. These requirements are satisfied through general assurance mechanisms that are already available. Evaluation of such mechanisms will identify basic components that can be used within the assurance framework.

2.1 Requirements for assurance

The carbon tax landscape presents several documents capable of assisting with the areas of uncertainty. However, an analysis of the landscape is required to identify the requirements for providing assurance. Gous [5] critically analysed the landscape using a structured review to obtain assistance for assuring the different areas of uncertainty. The analysis identified general requirements for assurance and can be grouped under five topics [5]:

- accuracy and validation of results [7],
- addressing uncertainties [8], [9],
- independent assurance [10],
- traceability [6], and
- transparency [11], [12].

Accuracy and validation of results are assured by analyses and evaluations. These include historic, present and predictive processes. This evaluates the stability of results while identifying abnormal circumstances over a timeframe. Stable and representative results indicate a high level of assurance [7].

Addressing uncertainties similarly provides a high level of assurance. Uncertainties need to be known before they can be addressed [8]. A quantified uncertainty gives an indication of what impact it could have. Lessening this impact is done by addressing such uncertainties by obtaining additional knowledge or disclosing the associated information to stakeholders. Assurance is obtained by either the mitigation of uncertainties or the knowledge of its existence [9].
Independent assurance is often required when several stakeholders are involved [10]. The level of independence can differ but it is ultimately required that the entity that provides the assurance is not operationally involved [13]. Assurance is provided on the grounds that outcomes are checked and confirmed in an unbiased manner.

Traceability gives the pathway by which results were attained [6]. Knowing how and from what results are obtained provides assurance. Traceability mechanisms focus on the acquisition of materials that describes the flow of information from its origin to the reported result.

Being transparent with information gives a degree of certainty and assurance [11], [12]. Transparency can help stakeholders understand the context of results and aids in its interpretation [14]. Assurance is provided by increased acceptance of the results [14] through the disclosure of essential information [15].

2.2 Available assurance mechanisms

Several generic assurance mechanisms were identified from a detailed literature survey. Literature from several fields of study and countries were included to recognise mechanisms that are currently used. The identified mechanisms were further evaluated to understand their usability. Table 1 gives these mechanisms, a general description of the specific mechanism and the specific assurance it provides.

<table>
<thead>
<tr>
<th>Assurance mechanism</th>
<th>Mechanism description</th>
<th>Provided assurance</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archived records</td>
<td>Storage of records for an extended period for revaluation.</td>
<td>Traceability: Historic results traceable to the original source document.</td>
<td>[16], [17]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency: Information on process used during previous time periods.</td>
<td></td>
</tr>
<tr>
<td>Availability of information</td>
<td>Ease of accessing information used during an evaluation.</td>
<td>Transparency: Information is available within a predetermined domain and can be used to recreate results.</td>
<td>[10], [16]-[19]</td>
</tr>
<tr>
<td>Certified monitoring</td>
<td>Measurements and monitoring are certified to conform to technical requirements by an external party.</td>
<td>Accuracy and validation of results: Obtained information adheres to a set of technical requirements. Independent assurance: Certification is provided by external party.</td>
<td>[20]-[24]</td>
</tr>
<tr>
<td>Defined reporting structures</td>
<td>Designated platforms available for reporting information to stakeholders.</td>
<td>Transparency: Stakeholders obtain necessary information from an established platform.</td>
<td>[15], [17], [20], [23], [25]-[29]</td>
</tr>
<tr>
<td>Disclosure of methods and processes</td>
<td>Assumptions, methods and process used within to obtain the results are stated.</td>
<td>Transparency: Information used is known to stakeholders. Traceability: Information can be traced to the origin, be it an assumption or process.</td>
<td>[9], [10], [15], [17]-[20], [26], [30], [31]</td>
</tr>
<tr>
<td>Disclosure of uncertainty</td>
<td>Statements of known uncertainties with the potential to change the results.</td>
<td>Addressing uncertainties: Impact of uncertainty is known to stakeholders. Transparency: Uncertainties affecting the results are known for decision making.</td>
<td>[9], [20], [25], [32], [33]</td>
</tr>
<tr>
<td>Assurance mechanism</td>
<td>Mechanism description</td>
<td>Provided assurance</td>
<td>Ref.</td>
</tr>
<tr>
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</tr>
<tr>
<td>Documented procedures</td>
<td>Documents that describe the procedure that is followed for a set activity or process.</td>
<td>Traceability: Outcomes can be traced to the source by evaluating the descriptions.</td>
<td>[9], [20], [27], [31], [34]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transparency: The descriptions provide insight into what is included or not.</td>
<td></td>
</tr>
<tr>
<td>Expert judgement</td>
<td>Opinion and/or recommendations from an individual or a team with specific technical knowledge or expertise.</td>
<td>Accuracy and validation of results: Assumptions and processes are based on information received from an expert in a specific field.</td>
<td>[19], [21], [35], [40]</td>
</tr>
<tr>
<td>External evaluation</td>
<td>Evaluations performed on an activity by an entity which is not responsible for the operation thereof.</td>
<td>Accuracy and validation of results: Results are validated through additional evaluations and operational bias is reduced. Independent assurance: Evaluation by an external entity provides confidence in the results and lessens any bias.</td>
<td>[15], [18], [21], [24], [25], [27], [33]</td>
</tr>
<tr>
<td>Historic-predictive analysis</td>
<td>Using historic analyses to predict and evaluate current assessments.</td>
<td>Accuracy and validation of results: Validation of results through the comparison between expected and actual results.</td>
<td>[6], [10], [41], [15], [20], [21], [23], [26], [29], [32], [37]</td>
</tr>
<tr>
<td>Independent M&amp;E V</td>
<td>Measurement and verification of activities performed by an independent entity.</td>
<td>Independent assurance: Independent confirmation that outcomes are correct and trustworthy.</td>
<td>[10], [15], [33], [37], [17], [20], [21], [24], [27], [32]</td>
</tr>
<tr>
<td>Management of uncertainty</td>
<td>Processes or structures to mitigate and/or eliminate uncertainties.</td>
<td>Addressing uncertainties: Known uncertainties are addressed and the impact thereof is reduced.</td>
<td>[9], [15], [18], [20], [32], [42], [43]</td>
</tr>
<tr>
<td>Supporting documentation</td>
<td>A document that presents and confirms given information.</td>
<td>Traceability: Source documentation confirms stated information.</td>
<td>[6], [20], [43], [44]</td>
</tr>
<tr>
<td>Trend analysis based on key indicators</td>
<td>Using operational key indicators to trend and analyse outcomes.</td>
<td>Accuracy and validation of results: Outcomes are validated against trends of key operational indicators.</td>
<td>[23], [26], [29]</td>
</tr>
<tr>
<td>Uncertainty quantification</td>
<td>Quantified value of the potential impact that uncertainty may have on the outcome.</td>
<td>Addressing uncertainty: A quantified value that indicates the trustworthiness and potential risks of the results. Accuracy and validation of results: A quantified margin of accuracy of the results.</td>
<td>[9], [15], [18], [20], [32], [37], [43], [45]</td>
</tr>
</tbody>
</table>

The results summarised in Table 1 show that each mechanism is designed differently and achieves a specific outcome in a unique manner. These designs include strategies, processes and calculations that are not universally applicable to all areas of uncertainty. However, the different designs create the opportunity to combine and adapt several mechanisms to address specific needs.
2.3 Combining mechanisms to deliver holistic assurance

The assurance requirements can be reduced to a generic set of mechanisms/topics. However, the evaluation of available mechanisms shows that the universal implementation of specific mechanisms is not always possible. In these situations, alternatives mechanisms should be combined to allow for a framework that provides assurance. Several of the mechanisms presented in Table 1 provide the same assurance, but through alternative means. It is therefore possible to select the more practical mechanism to achieve a required assurance. However, it is necessary to know what assurance is required before an alternative mechanism can be selected.

3. ASSURANCE APPLICABLE TO CARBON TAX

Assurance is required to address the uncertainties associated with the carbon tax process. Such assurance can be provided by the generic mechanisms. However, these mechanisms need to be matched to the relevant areas of the carbon tax process. Therefore, the relationship between the assurance mechanisms and carbon tax needs to be established.

3.1 Framework development process

The framework, that establishes a relationship between carbon tax and assurance, expands on existing literature. Acting on shortcomings that are still present within the carbon tax process. Figure 2 illustrates the expansion on literature from uncertainty identification to the assurance framework for the final results.

![Figure 2: Development process of the assurance framework](image)

Uncertainties for the carbon tax process was identified and a resource landscape was developed to provide focussed assistance. These resources were analysed to obtain the necessary assistance through assurance requirements. Adherence to the requirements provided sufficient assistance for some areas of uncertainty. However, several shortcomings were identified that could not be addressed from the landscape.

Shortcomings are used to identify focus areas for an assurance framework. Additional mechanisms that provide assurance are identified to resolve such shortcomings. The available mechanisms are applied to the focus areas to provide specific assurance.
Specific assurance for each focus area aggregates into the final results. The final results are therefore holistically assured by the confidence in the underlying focus areas. Which ultimately provides guidance for the uncertainties from the carbon tax process that could not be addressed by the landscape.

3.2 Matching assurance mechanisms to areas of uncertainty

The carbon tax landscape does not only provide numerous generic assurance mechanisms but also assistance for some of the areas of uncertainty. Specific resources provide the necessary clarification and support to address the respective uncertainties.

Two areas of uncertainty, legislative and liability mitigation, have detailed resources to help stakeholders manage the unknown. These resources include legal documents that can be queried relating to specific matters. This consequently provides assurance for these areas of uncertainty within the carbon tax process. The assurance framework therefore focuses to assure the uncertainties where shortcomings are currently not addressed.

Shortcomings were found with regards to quantification (including the data and methods), reporting and overall assurance [5]. The quantification sections will have a significant effect on the final quantified emissions. However, accurate and true reporting is not guaranteed by delivering assurance on the quantification results alone [15]. Items such as review processes and undisclosed information can potentially influence how the reported values are observed and interpreted by stakeholders. Reports that are deemed as misleading will decrease stakeholder confidence and could lead to legal consequences, such as penalties and imprisonment [17]. Assurance of the report and associated processes is therefore necessary to provide stakeholders with a high degree of confidence [27].

Presenting an overall assurance for the combined sections is complex and not easily performed due to their interrelated nature [39], [46], [47]. It is therefore necessary to separate the concepts and assure each uncertainty individually in order to simplify the process [46].

The framework therefore focuses on three specific areas to obtain the individual assurance. Focusing on assuring the (1) data and (2) methods that are used during quantification of GHG emissions and the (3) reporting thereof. These focus areas were identified from the shortcomings that were observed for the areas of uncertainty.

This approach requires the various assurance focus areas (data, calculation methods and reported results) to be matched to the available assurance mechanisms, linking the areas of uncertainty, respective shortcomings and the mechanisms together to meet the assurance requirements.

3.3 Mechanisms applicable to specific focus areas

Three focus areas (data, calculation methods and reported results) were identified from the uncertainties that could not be sufficiently addressed by the carbon tax landscape. The quantification data focus area assures that the uncertainty induced from the dataset are managed. Which can then be used to quantify emissions. However, using good data does not constitute good quantified results.

Emission quantification methods are therefore assured to provide confidence that the results were obtained in a suitable manner. The third focus area is centred around the way these results are reported. Assurance of each respective focus area will ultimately provide overall assurance.

Several mechanisms (Table 1) can potentially be applied to each focus area to attain the desired assurance. However, not all mechanisms are always practical/applicable for a specific scenario [48]. It is therefore necessary to evaluate the available mechanisms and understand what is practically applicable for carbon tax.

3.3.1 Data assurance:

Constructing a dataset is one of the first phases towards quantifying carbon tax. Table 2 provides a summary of assurance requirements and the mechanisms for the quantification data that can be found within the landscape.
Datasets should firstly be accurate, representative and valid. The accuracy of data can have a significant influence on the results [6], [7], [49] and therefore requires assurance. Uncertainties need to be addressed to ensure that the impact of data uncertainty is minimised [47]. One of the main strategies to assure a dataset is through independent assurance that confirms the properties of the data [10]. There is a normal variance within data and this contributes to data uncertainty [50]. It is thus required that data should be traceable to the measurement point before assurance can be confirmed [6].

Assurance on the dataset can be conferred through the applicable mechanism. Administrative and calculation mechanisms, such as record keeping and analyses, form the basis for dataset assurance. These are combined with unbiased evaluations to adhere to the requirements. The practicality of this combination causes concern due to the difficulty of unbiased evaluations.

Independent evaluators are either limited to a specific field or expensive due to their expertise [51]. An alternative is to make use of certified monitoring. Equipment and measurement procedures need to be periodically evaluated to confirm that they are within specifications before they are certified. Such certification can only be provided by an individual with the necessary competency and accreditations [22]. Similar to independent evaluators, certification providers are also limited or expensive [52]. Implementing as well as maintaining these mechanisms can therefore place a financial burden on an entity.

Several carbon-intensive industries are already under financial pressure and would not be able to use these mechanisms [53]. Practical implementation of these mechanisms is thus required to attain assurance of a dataset.

### 3.3.2 Quantification methods:

Methods are used to interpret the dataset and determine the emission quantities. In Table 3, the mechanisms and assurance requirements are listed for the quantification methods.

<table>
<thead>
<tr>
<th>Carbon tax focus area</th>
<th>Assurance requirements</th>
<th>Applicable mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission quantification methods</td>
<td>Accuracy and validation of results</td>
<td>Archived records</td>
</tr>
<tr>
<td>Emission quantification methods</td>
<td>Addressing uncertainty</td>
<td>Availability of information</td>
</tr>
<tr>
<td>Emission quantification methods</td>
<td>Independent assurance</td>
<td>Certified monitoring</td>
</tr>
</tbody>
</table>
Carbon tax focus area | Assurance requirements | Applicable mechanisms
---|---|---
| Transparency | Defined reporting structures | Disclosure of methods and processes | Disclosure of uncertainty
| | | Documented procedures | Expert judgement
| | | External evaluation | Historic-predictive analysis
| | | Independent M&E | Management of uncertainty
| | | Trend analysis based on key indicators | Uncertainty quantification

Three of the requirements for assurance are the same for the data and the method focus areas. Transparency replaces traceability when assuring the methods, indicating that the methods used should be presented to stakeholders in an understandable manner.

No method will be 100% accurate due to its sensitivity to the provided inputs [8]. This introduces uncertainty to the outcome and needs to be addressed before it is reported [54]. Assurance is therefore required on the accuracy and relevance of the methods, while uncertainty is addressed. Such assurance is commonly provided by adhering to the industry best practices [9].

Best practices are available through guidelines and standardised processes, thus also providing assurance that the methods would be able to obtain independent assurance [55]. Independent assurance is provided against a set list of criteria (best practices) that are available in standards, such as the SANS 14064 standards [10], [18], [19].

Independent and external evaluations are required to confirm that the calculated results are correct and true. However, the competency requirements for quantification evaluations are extremely specialised. Verification specialists require expertise and experience in general M&E, GHG quantification methods as well as the relevant production process [13]. The specialist nature of the work leads to a significant shortage of verification specialists capable of providing assurance.

Transparency is important for processes where other forms of assurance are either not available or impractical [56]. Assurance on transparency is provided by using clearly defined structures for reporting, while disclosing details of the process and providing stakeholders with access to the information.

Providing stakeholders with the relevant information will additionally address the uncertainty of the methods [6]. Uncertainties can be mitigated and managed if stakeholders are kept aware of all relevant information. Although assurance on the methods can be provided through the different mechanisms, some form of adaption might be required to practically implement the mechanisms.

3.3.3 Reporting results:
Data and methods are used to calculate results that have to be presented to various stakeholders. The requirements and assurance mechanisms for reported results are given in Table 4.

<table>
<thead>
<tr>
<th>Carbon tax focus area</th>
<th>Assurance requirements</th>
<th>Applicable mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting results</td>
<td>Addressing uncertainty</td>
<td>Archived records</td>
</tr>
<tr>
<td></td>
<td>Traceability</td>
<td>Availability of information</td>
</tr>
</tbody>
</table>
When reporting results, assurance is required for traceability, transparency and uncertainty. These requirements are essential for stakeholder confidence, since the results are provided at a low level of detail [57]. Stakeholders therefore need to know and understand how the results were obtained. Supporting documentation allows stakeholders to trace results back to the source, while definite structures describe what was specifically done to obtain the results.

Uncertainty can be addressed with the applicable mechanisms, but also by managing the potential risks that it induces. Statements and proof that uncertainty is addressed, managed and quantified will provide stakeholders with assurance. Assurance for the reported results are thus provided twofold, for the actual submitted value as well as understanding the accompanied risks.

4. RESULTS AND FINDINGS

The assurance framework was applied to an industrial case study to show the practical implementation thereof. The case study focusses on the three focus areas within the framework. Assuring each individual focus area would provide the necessary support to present the overall deliverable with a high degree of confidence.

Different elements (data variable, calculation strategies and results) that are used to present the final outcome are evaluated for the level of assurance. Assurance was judged sufficient when one or more of the applicable mechanisms were present for the evaluated element. Results from the assurance presented by the framework are finally compared to a published report from industry.

4.1 Assurance of the constructed dataset

The data used to quantify the carbon tax value for an industrial processing plant was evaluated to determine whether assurance can be provided for it. The assurance results are displayed in Table 5. Assurance was evaluated against all five criteria even though transparency is not a specific requirement for data. Each variable was evaluated for its respective level of assurance.

<table>
<thead>
<tr>
<th>Carbon tax focus area</th>
<th>Assurance requirements</th>
<th>Applicable mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparency</td>
<td>Defined reporting structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disclosure of methods and processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disclosure of uncertainty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Documented procedures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Management of uncertainty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supporting documentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncertainty quantification</td>
<td></td>
</tr>
</tbody>
</table>

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## Table 5: Assurance of quantification data

<table>
<thead>
<tr>
<th>Framework structure</th>
<th>Calculation element</th>
<th>Carbon tax assurance requirements</th>
<th>Carbon tax assurance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Accuracy and validation</td>
<td>Addressing uncertainty</td>
</tr>
<tr>
<td>Data assurance</td>
<td>Off-gas flares</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
</tr>
<tr>
<td>Product flares</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process gas flares</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel gas distribution</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas feed distribution</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas 1 distribution</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas 2 distribution</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel handling</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product transfer</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quantification assurance</th>
<th>Emission factor</th>
<th>Direct measurement</th>
<th>Mass balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

| Reported results assurance | Results | ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ |

denotes sufficient assurance; , plausible assurance but not confirmed; , assurance not available.

The results show that the data used has an acceptable level of assurance associated with it. Ten data sources were sufficiently assured, while the remaining seven sources did not obtain a perfect score. Assurance was not deemed sufficient, since not all requirements were satisfied or even potentially satisfied. However, assurance was still deemed plausible due to the majority of requirements being satisfied.
It is seen that the independent assurance requirement was not achieved for all data sources. Further evaluation showed that the sources that do not meet the requirement are related to either flares or auxiliary streams (fuel gas and oil). These sources are not fundamentally important to the operation of the plant and would thus explain the lack of checks in an independent manner. However, these sources do play a role towards the calculated carbon tax and were therefore highlighted as potential risks.

Assurance that was obtained for the data sources was provided by several mechanisms. Trend analysis, certified monitoring and external evaluation were the most common mechanisms to assure the accuracy and validation of results. Uncertainty was managed for most sources through onsite processes that monitor the specific data. Detailed documents are available to describe the uncertainty management and provide detailed information on the production process. These supporting documents assured a clear traceability pathway for the data from the different sources.

4.2 Assurance of GHG quantification strategies

GHG emissions for the processing plant were quantified using three different strategies and methodologies. The methodologies were evaluated to see whether mechanisms were utilised or specifically applied during the quantification process. The results are shown in Table 5.

Results show that the quantification strategies have a high level of assurance for all of the requirements. The most prominent mechanisms that provided assurance were: trend analysis, disclosure of uncertainty, external evaluation and documented procedures. These mechanisms were present within all three of the strategies that were applied. This showed that it is possible to sufficiently assure the quantification strategies using the generic mechanisms.

4.3 Assurance of reported results

The reported results are difficult to evaluate as a single component due to the limited information reported. Assurance on the reported results are also presented in Table 5. The assurance requirements for the reported results were confirmed by the presence of archived records and uncertainties that were disclosed. Reported results with a high level of assurance provides a high degree of confidence to all stakeholders.

Incorporating several mechanisms into the process will present a high level of confidence to all parties involved during different stages of an audit or evaluation.

4.4 Holistic assurance of carbon tax

The previous sections focussed on the individual focus areas within the framework and how the assurance aggregates to assure the final reported results. Results from the framework were compared to the annual reports published by the processing plant. Table 6 indicates the assurance provided by the annual report and the framework.
Table 6: Assurance comparison between the developed framework and independent results

<table>
<thead>
<tr>
<th>Evaluation criteria</th>
<th>Annual report</th>
<th>Assurance framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dataset assurance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy and validation of results</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Addressing uncertainty</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>Independent assurance</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Traceability</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Overall assurance</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Quantification assurance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy and validation of results</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Addressing uncertainty</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Independent assurance</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Transparency</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Overall assurance</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Reported results assurance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addressing uncertainty</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Traceability</td>
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<tr>
<td>Transparency</td>
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<td>✓</td>
</tr>
<tr>
<td>Overall assurance</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

denotes sufficient assurance; , plausible assurance but not confirmed; , assurance not available.

Assurance within the annual report could not necessarily be linked to specific mechanisms. The report was therefore surveyed for either descriptions, values or figures that would be able to provide assurance for the different requirements.

It is important to note that the processing plant is in compliance with legislative requirements, as well as a forerunner regarding GHG management and public participation into mitigating climate change. However, from the results it is evident that assurance was not sufficiently provided by the annual report when compared to the developed framework. It is possible to improve the assurance by incorporating the developed framework into the current reporting structures, thereby improving stakeholder confidence that is already present.

5. **THE DEVELOPED ASSURANCE FRAMEWORK**

The developed framework combines available assurance mechanisms with specific focus areas that were identified from the carbon tax uncertainties. The three focus areas are combined to deliver a framework to assure carbon tax. Figure 3 illustrates the framework and the assurance requirements that are given for each area.
The framework focuses firstly on constructing a dataset that is accurate and traceable, which can then be used to calculate the taxable emissions according to international best practice and in a transparent manner for stakeholders to understand. The outcome of these components is presented in a report that addresses uncertainties and provides stakeholders with confidence in the results.

Assurance provided for the dataset manifests in the outcome due to confidence in the reliability of quality of the data. This allows the relevant party to use quantification methods that are already widely available without significant risks. Potential risks are continuously communicated or disclosed through different assurance mechanisms, thus allowing informed decision making based on the results.

Reported results are compiled from information that has been exposed to different levels of scrutiny. Reports can furthermore be adapted to provide additional assurance to all relevant stakeholder. The reported results are thus highly resilient against uncertainties, placing a high level of assurance on the value submitted to SARS and would provide confidence to all stakeholders in the event of an audit.

6. CONCLUSION

Carbon tax is one of the strategies aimed at helping South Africa transition towards a low carbon economy. The carbon tax process has several inherent uncertainties within the process that decrease stakeholder confidence in the payable amount. By looking at general assurance mechanisms and linking them to carbon tax areas of uncertainty, an assurance framework was developed.

Results from applying the framework to an industrial case study highlights how assurance can be provided for the dataset used, the quantification strategies and the reported results. It also showed that it is possible to increase the assurance presented in public reports. The reported tax amount is thus resilient against scrutiny during different stages of an audit through assurance.

7. REFERENCES


Addressing uncertainties in the South African Carbon Tax landscape,” in Industrial & Commercial use of Energy (ICUE), 2017, pp. 204-211.


[57] Intergovernmental Panel on Climate Change (IPCC), “Reporting instructions.” pp. 5-7, 1996.