

A structured approach to select energy efficiency incentives applicable to industry

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Abstract

Title:	A structured approach to select energy efficiency incentives applicable to industry
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In recent years, energy efficiency has grown significantly in importance. Energy efficiency improvements are among the most cost effective ways to reduce energy consumption and CO₂ emissions. Measures such as policies, incentives and disincentives have been put in place to encourage energy efficiency. South Africa's industrial sector is full of untapped potential for energy efficiency improvement through many available incentive programmes. Selecting an appropriate incentive for a project can have a large impact on the profitability and sustainability of a business.

Energy efficiency incentives offer great rewards in terms of financial or technical support. However, these incentives are often complex, governed by intricate rules and regulations. Extensive research is required to make an informed decision on which incentive to select. The research process is a timely and costly exercise because the information available is complex and wide-ranging. Therefore, a structured approach to select an appropriate energy efficiency incentive is required.

Developing an incentive selection process requires an analysis of previously implemented approaches. This study investigates various approaches, and key contributions from each study are incorporated in the selection procedure. Four main steps formulate a new structured approach. The approach focuses on refining information, selecting important facts, creating a flow diagram and lastly verifying the approach. The main outcome of the structured approach is an easily adaptable selection process, which is used to choose an incentive.

The structured approach is applied to energy efficiency incentives in South Africa specifically focusing on industrial applications. The resulting selection process is verified by using the literature reviewed and validated by using multiple case studies. The information used for each case study is obtained from previously implemented projects that made use of specific incentives. In each case study, the selected incentive is the same as the incentive implemented.

The structured approach is designed to be easily adapted as the incentives are updated. The approach can also be applied to incentives in different countries and for different sectors. The resulting flow diagram provides fast answers to complex questions, reducing the amount of time and money spent on investigating viable incentives. Therefore, the problem statement was addressed adequately.

Acknowledgements

I would firstly like to thank my God for His never failing love and grace. In the hardest of times, my peace comes from Him.

Now may the Lord of peace himself give you peace at all times and in every way.

The Lord be with you all. 2 Thessalonians 3:16

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“The best time to plant a tree was 20 years ago. The next best time is today.” – Chinese proverb

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List of Abbreviations

Abbreviation	Description
12I	Section 12I of the Income Tax, Act No. 58 of 1962
12L	Section 12L of the Income Tax, Act No. 58 of 1962
ACEEE	American Council for an Energy-Efficient Economy
B-BBEE	Broad-Based Black Economic Empowerment
BUSA	Business Unity of South Africa
CCI	Cluster Competitiveness Improvement
CDM	Clean Development Mechanism
CFL	Compact Fluorescent Lamp
CO ₂	Carbon Dioxide
CP	Cleaner Production
CSIR	Centre for Scientific and Industrial Research
DoE	Department of Energy
DNA	Designated National Authority
DPW	Department of Public Works
DSM	Demand Side Management
The dti	Department of Trade and Industry
ECS	Energy Conservation Scheme
EEl	Energy Efficiency Incentive
EELN	Energy Efficiency Leadership Network
EnMS	Energy Management System
ESCo	Energy Service Company

Abbreviation	Description
GEEF	Green Energy Efficiency Fund
HVAC	Heating Ventilation and Cooling
IDC	Industrial Development Corporation
IDM	Integrated Demand Management
IEA	International Energy Agency
IPAP	Industrial Policy Action Plan
ISO	International Organisation for Standardisation
kWh	Kilowatt-Hour
GWh	Gigawatt-Hour
KfW	Kreditanstalt für Wiederaufbau
M&V	Measurement and Verification
MCEP-LF	Manufacturing Competitiveness Enhancement Programme – Loan Facility
MCEP-PI	Manufacturing Competitiveness Enhancement Programme – Production Incentive
MEPS	Minimum Energy Performance Standards
mtpa	Metric tonnes per annum
MVA	Manufacturing Value Added
MYPD	Multi-year Price Determination
NBI	National Business Institute
NCPC	National Cleaner Production Centre
NEEA	National Energy Efficiency Accord
PCP	Power Conservation Programme

Abbreviation	Description
PLC	Programmable Logic Controller
PV	Photovoltaic
SANEDI	South African National Energy Development Institute
SARS	South African Revenue Service
SEZ	Special Economic Zone
SIC	Standard Industrial Classification
SMME	Small, Medium and Micro Enterprises
SO	Standard Offer
SP	Standard Product
SWH	Solar Water Heating
UNIDO	United Nations Industrial Development Organisation

Chapter 1

A structured approach to select energy efficiency incentives applicable to industry:

Introduction

1 INTRODUCTION

1.1 BACKGROUND

Energy efficiency has become important in recent years because the current deteriorating environmental conditions threaten future generations. The rapidly growing population in developing countries has led to an increase in energy demand and carbon footprint. Energy markets are, therefore, unstable and climate change from greenhouse gasses may be unavoidable. [1]

Due to the growing problems and increased awareness by the general public, energy efficiency is no longer the sole concern of engineers and environmentalists. People from all professions are involved in attempting to bring about a greener economy. [2]

The International Energy Agency (IEA) [3] estimates that energy efficiency could account for as much as 70% of the reduction in the projected global energy demand by 2035. Measures such as policies, standards, incentives and disincentives are put in place to encourage or enforce the implementation of energy efficiency. These measures aim to get the demand of energy under control, curb the depleting energy supply and improve the environmental impact. [4] [5] [6]

This chapter investigates the need for incentivised energy efficiency measures as well as the barriers preventing the successful implementation of incentives. Existing energy efficiency measures, internationally and in South Africa, are considered with focus placed on industry, building and transportation. A range of applicable incentives is selected for further investigation.

Selecting an appropriate incentive is a time-intensive and costly process because the information pertaining to each incentive is wide ranging and complex. The outcome of selecting an incentive can largely impact the financial state of a business [7]. In South Africa, energy efficiency is a relatively new field of investigation, identified by a lack of research and consequently, no simplified method to select an applicable incentive [4] [8]. The aim of this study is to develop a structured approach to select an energy efficiency incentive (EEI).

1.2 INTRODUCTION TO ENERGY EFFICIENCY INCENTIVES

1.2.1 OVERVIEW

An EEI or initiative can be defined as: *“An offering from an efficiency programme administrator intended to encourage or motivate customers to reduce the total amount of energy they consume for a given level of energy service provided, without compromising the quality or level of service.”* [9]

There are three main categories of EEIs as illustrated in Figure 1-1, redrawn from [9]. The first category comprises non-financial incentives that offer support services, technical assistance, information sharing, education and training. The second comprises financial incentives that offer rebates, discounts and financing for energy efficiency measures. The last category is referred to as bundle incentives that are a combination of financial and non-financial incentives.

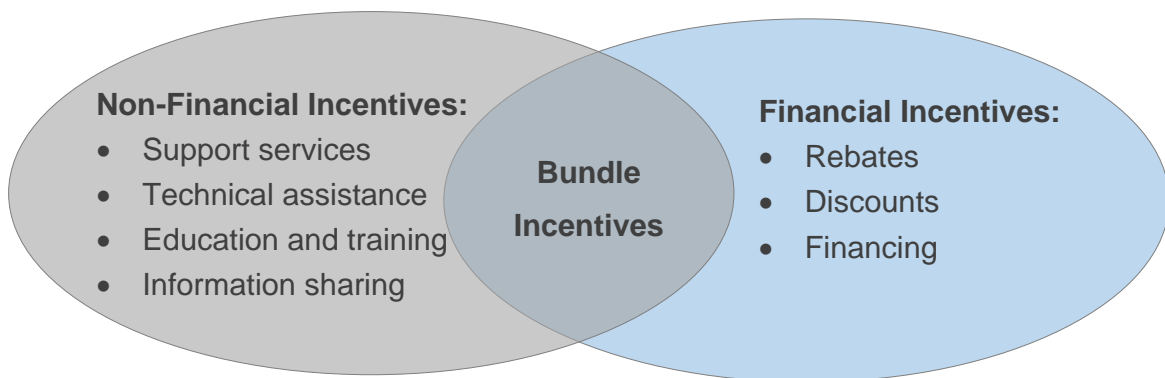


Figure 1-1: Overview of EEI types

The topic of EEIs is wide-ranging and there are incentives for many various sectors of a country, such as industrial, automotive, commercial or residential. Figure 1-2 [10] shows the number of measures taken by various countries within the European Union to improve their energy efficiency. The figure also includes the various types of incentives implemented with the most predominant being financial incentives.

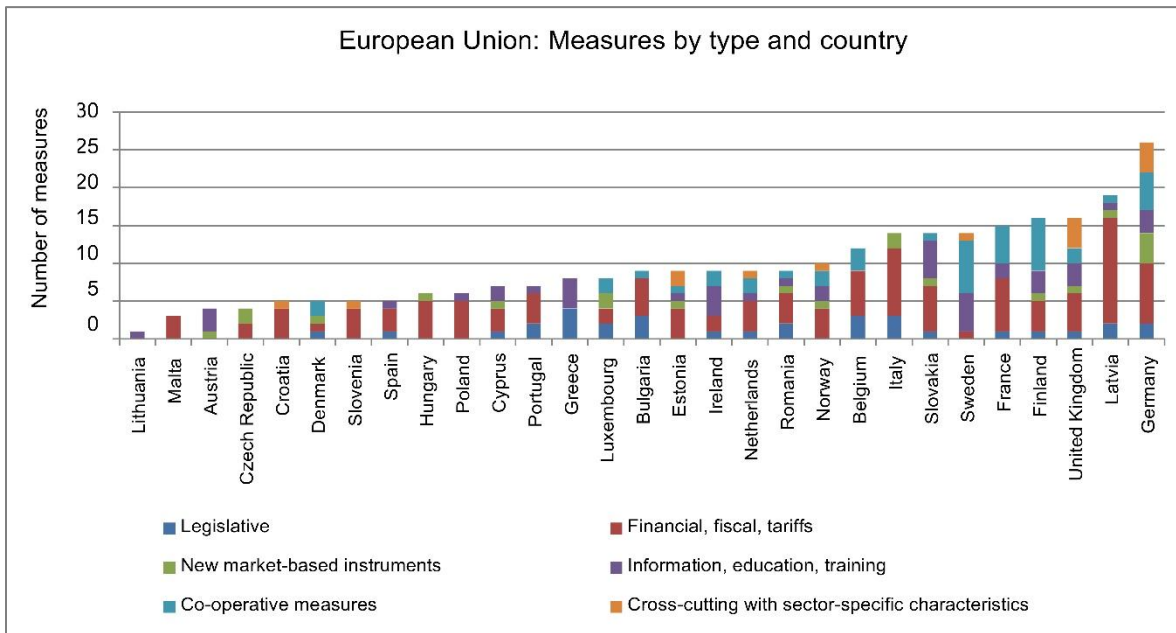


Figure 1-2: European Union: Measures by type and country

The United States is one of the largest CO₂ (carbon dioxide) producers in the world. Global pressure encourages the United States to take action to reduce their CO₂ emissions. There are over 53 different energy efficiency programmes available. [3] [11]

The implementations of various EEIs have resulted in a staggering amount of energy savings. Figure 1-3 shows the totalised savings in 2011 for 11 different IEA member countries. The amount of energy saved through energy efficiency measures is 15.55 GWh (gigawatt-hour). This total is compared to the total final consumption of Asia, China, the European Union and the United States. As shown in the figure, the energy savings achieved are larger than the total final consumption of the European Union and Asia (excluding China). [12]

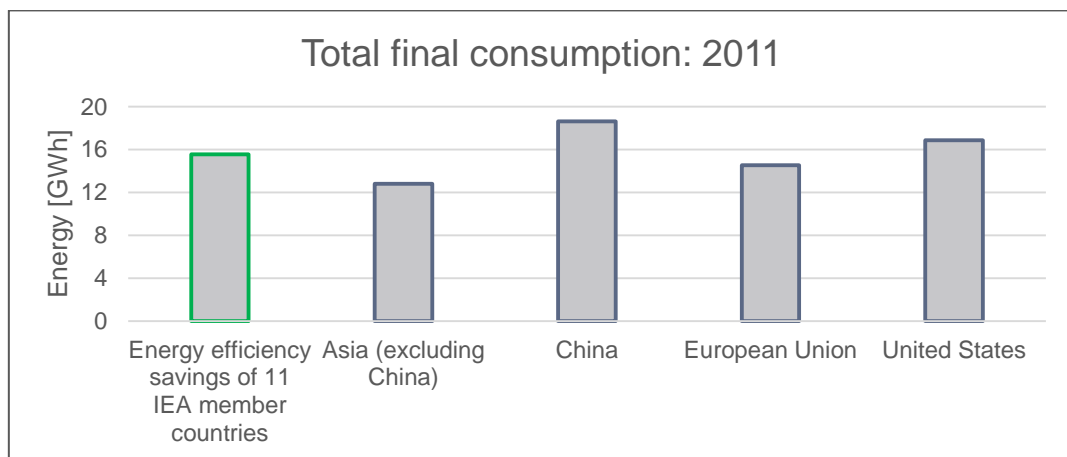


Figure 1-3: Energy efficiency savings for 11 IEA member countries

In South Africa, energy efficiency policies were first established in the White Paper on Energy Policy in 1998 [13]. This policy was created to provide the nation with wider coverage to electricity while ensuring that the environmental impacts of energy are minimised. Although this policy is dated, it forms the backbone of all energy-related policies in South Africa [14].

After a series of rolling blackouts and electricity shortages in 2007, the first notable step was taken in energy efficiency measures. President Jacob Zuma announced the split of the Department of Minerals and Energy. The 2008 National Energy Act gives the Department of Energy (DoE) authority to conduct the energy efficiency policies in South Africa. The Act also established the South African National Energy Development Institute (SANEDI) to conduct public interest energy research. [4]

1.2.2 THE NEED FOR ENERGY EFFICIENCY INCENTIVES

With the current global increase in energy consumption, the need for energy efficiency is clear. However, implementing energy efficiency measures can be costly and time-consuming. Therefore, EEIs have been put in place to provide support and financial assistance to curb the energy efficiency gap that exists between actual and optimal energy use. [15]

Internationally, due to the financial limitations of businesses, funds are made available to implement energy efficiency measures. The Energy Efficiency Market Report for 2014 estimates that the investment in energy efficiency markets worldwide in 2012 was more than \$310 billion [12].

Providing funding and knowledge for energy efficiency is also a means of enforcing countries to commit to energy savings. Countries such as China and Russia have set a goal to reduce their energy intensity over the next ten years by 16% and 40%, respectively. [16]

With South Africa's current challenging economic state and serious electricity shortage, institutions do not have the finances, time or knowledge to implement energy efficiency projects properly. Therefore, government and international investors have made incentives and initiatives available to assist with these projects. [4]

The expectation is that these EEIs will [14]:

- Help manage and control the demand for energy;
- Decrease overall energy consumption;
- Increase overall production output and exports;
- Increase the awareness of energy efficiency and the environmental impact; and
- Improve the profitability and competitiveness of businesses throughout South Africa.

1.2.3 BARRIERS TO ENERGY EFFICIENCY AND INCENTIVES

Despite the efforts to promote and incentivise energy efficiency, there are still many barriers to overcome. The barriers include institutional, organisational, financial, economical, knowledge, information, technological and behavioural factors. These barriers exist at both levels of EEs, i.e. administrative and implementation. [17]

In developing countries, these barriers are often heightened by additional challenges. The most predominant barrier is a weak governmental structure for energy efficiency. In countries such as South Africa, energy efficiency is being resisted because of the lack of knowledge regarding the available incentives, lack of available data that enables decision making for selection of EEs, complex governmental regulations and policy, and uncertain investment risks and returns. [16] [18]

The available incentives are so widespread that it is unlikely that there will be a single best policy solution. A study done on the market barriers to energy efficiency, believed numerous complementary approaches tailored to specific circumstances are more likely to be more successful [19].

1.3 EXISTING ENERGY EFFICIENCY MEASURES

1.3.1 ENERGY EFFICIENCY FOR DIFFERENT SECTORS

Globally, the three most energy intensive sectors are industry, transport and buildings.

EEs in transportation are focused on improving vehicle technology and efficiency, reducing travelling distances, changing driving behaviour and making use of the most viable modes of transport [20]. The IEA compiled a list of sector-specific recommendations for energy efficiency, the list for transportation included the following [21]:

- Mandatory vehicle fuel efficiency standards;
- Measures to improve vehicle fuel efficiency;
- Fuel efficient tyres and air-conditioning systems;
- Improving vehicle operational efficiency through eco-driving and in-car feedback instrumentation; and
- Transportation system efficiency.

Many factors influence the EEs for buildings. The most dominant is whether the building already exists or if the building is being designed. For existing buildings, energy efficiency measures include heating ventilation and cooling (HVAC) upgrades, insulation upgrades, lighting replacement, energy monitoring and automation systems. [22]

Energy efficiency policies for new buildings were investigated [23], notable points from the study included: implementation of building codes and standards, zoning of buildings and integrated design techniques.

The IEA's recommendations for energy efficiency in buildings are as follows [21]:

- Compulsory building energy codes and minimum energy performance standards (MEPS);
- Strive towards a net-zero energy consumption building that makes use of renewable energy;
- Improve the energy efficiency of existing buildings;
- Issue building energy labels and documentation; and
- Improve energy performance of building components and systems such as HVAC.

The IEA also compiled a list of energy efficiency recommendations for industry. These recommendations, however, are very broad because each industrial process (mining, cement, iron and steel) is drastically different. The recommendations are still notable and therefore listed below [21]:

- Energy management in industry should conform to International Organisation for Standardisation (ISO) 50001 or equivalent energy management protocols;
- High efficiency industrial equipment and systems, mandatory MEPS;
- Energy efficiency services for small and medium-sized enterprises; and
- Complementary policies to support industrial energy efficiency (remove energy subsidies, provide targeted incentives and access to funding).

In South Africa, the industrial sector is the largest energy consumer, as illustrated in Figure 1-4 [24]. The infrastructure is often old and inefficient; therefore, this sector has great potential for energy efficiency savings. Expert knowledge and funding is required to implement industrial energy efficiency projects successfully. Therefore, this study will focus on EEIs designed for industries in South Africa.

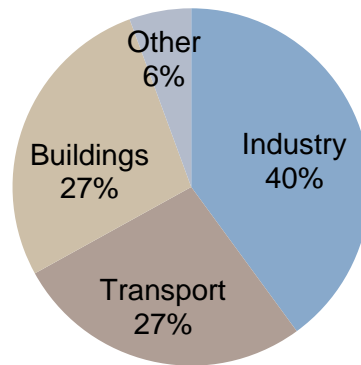


Figure 1-4: Total final energy consumption by sector [24]

1.3.2 INTERNATIONAL ENERGY EFFICIENCY INCENTIVES FOR INDUSTRIES

Internationally, a great deal of focus and funding is placed on energy efficiency projects. To investigate the types of incentives available, the main contributors need to be identified. The American Council for an Energy-Efficient Economy (ACEEE) [25] compiled an international energy efficiency scorecard for 2014. The results of this study can be seen in Figure 1-5, where the top five ranking countries are Germany, Italy, China, France and overall the European Union.

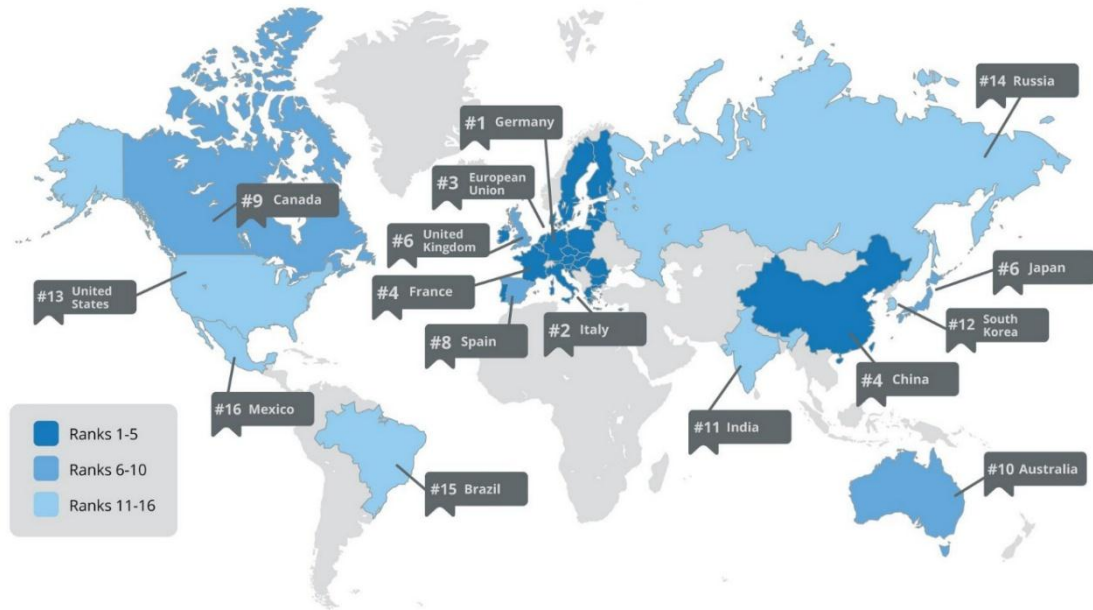


Figure 1-5: 2014 International energy efficiency scorecard [25]

The ACEEE took the investigation one step further and examined the top 16 countries according to their sector breakdown and untapped energy efficiency potential. The four sectors investigated were national, building, industry and transportation, as illustrated in Figure 1-6. The figure also illustrates that the top ranked countries are a mix of developing and developed countries. However, the developing countries have greater untapped energy efficiency opportunities.

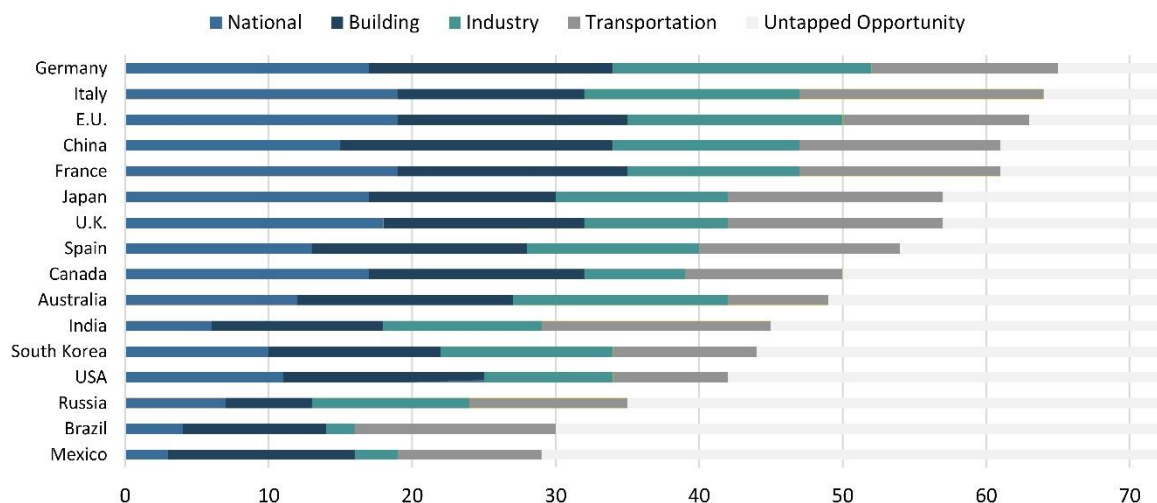


Figure 1-6: Top scoring countries with sector breakdown [25]

The author examined Germany, China and the United States in closer detail to explore their energy efficiency policies. Two conclusions are drawn from this short investigation:

- The countries have similar frameworks in place; however, the type of funding and the amount of funding differs; and
- There are substantial incentives available in each country for the different sectors.

Germany's energy efficiency measures are based on three main components: 1) a legal framework and strict regulations, 2) strong financial incentives and information, and 3) promotion and behavioural change.

The Kreditanstalt für Wiederaufbau (KfW) investment bank largely provides the funding for Germany's financial incentives, focusing on cost-effective loans and renewable energy. Noteworthy, such incentives include the following: support for energy efficiency and climate friendly production, small and medium-sized enterprise initiatives for energy transition and Energy Tax and Electricity Tax Acts. [26] [27]

In 2006, China implemented the "Top 1000 energy-consuming enterprise programme". The country aims to reduce the energy consumption of the largest industrial enterprises. The Chinese central government allocated a total of \$3.4 billion to fund energy efficiency. The most predominant incentives are a grant of \$29 for every 8141 kWh (kilowatt-hour) (one tonne of coal equivalent) saved and \$15 per tonne of CO₂ emissions reduced. [28] [29]

The United States has implemented numerous incentives, mainly to combat the country's rising CO₂ levels. The funding for these incentives is provided by utility tariffs, oil levies and nuclear waste storage agreement tariffs. The types of incentives available in the United States include the Clean Energy Fund, the Clean Energy Tax Credit, Energy Investments and Improvement Loan Programmes. [11] [30]

1.3.3 SOUTH AFRICAN ENERGY EFFICIENCY INCENTIVES FOR INDUSTRIES

Energy efficiency is a relatively new notion in South Africa; however, over the past decade, interest has grown immensely. The investment in energy efficiency started to gain momentum after the series of rolling blackouts in 2007 [4]. South Africa is also the 12th largest emitter of CO₂ emissions in the world. Therefore, international pressure also plays a role in the newly implemented EEs. [31]

To understand EEs in South Africa fully, one first needs to understand the rules and regulations that govern energy efficiency. SANEDI was established to bridge the gap

between research development, demonstration and implementation. SANEDI has three main functions; energy research, technology development and energy efficiency measures and implementations. [32]

SANEDI designed a high-level policy map for energy efficiency in South Africa. The basic layout of this map can be seen in Figure 1-7, redrawn from [33]. The supreme law that governs energy efficiency in South Africa is the DoE. There are many policies and strategies as well as regulations and legislations in play.

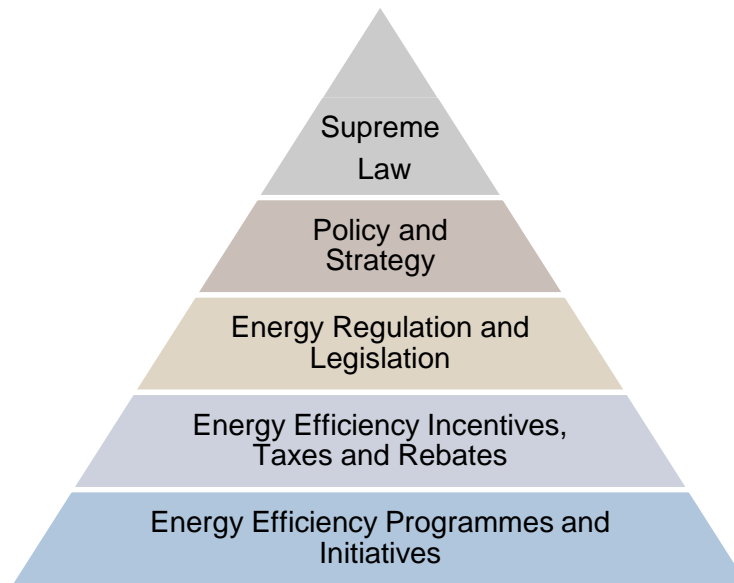


Figure 1-7: South African energy efficiency high-level policy map layout [33]

The focus of this study is placed on the bottom two tiers of the triangle, the EEIs, taxes, rebates, and energy efficiency programmes and initiatives. The two tiers are expanded in Figure 1-8 to include more detail. The main role-players are, the Department of Trade and Industry (the dti), South African Revenue Service (SARS), DoE and Eskom.

ENERGY EFFICIENCY INCENTIVES, TAXES AND REBATES	
All Mandatory Programmes are Mandated by National Treasury and then Implemented by the Appointed Ministries	
<p>1: Environmental Levy on Non-Renewable Electricity - Eskom (2009)</p> <p>2: Section 12L of the Income Tax Act, Act No.58 of 1962</p> <p>3: MYPD Funding for DSM Programme – Eskom (2011-2013)</p>	<p>Industrial - DTI</p> <p>1: Section 12I of the Income Tax Act, Act No.58 of 1962</p> <p>South African Revenue Services</p> <p>1: Carbon Dioxide Vehicle Emissions Levy (2011)</p> <p>2: Carbon Tax Discussion Paper, National Treasury, (2010)</p> <p>3: Carbon Emissions Tax in the National Budget Review (2012)</p>
ENERGY EFFICIENCY PROGRAMMES AND INITIATIVES	
<p>DoE and Eskom Existing</p> <p>1: IDM: ESCo Model; Performance Contracting; SP, SO, SWH Rebate & CFL Mass Rollout</p> <p>2: PCP, ECS & Electricity Growth Management</p> <p>3: Municipal EE with National Treasury and DPW</p> <p>4: NEEA with BUSA and NBI / EELN (DoE)</p> <p>5: Signatory Kyoto Protocol for CDM. DNA resides within the DoE</p> <p>6: EE monitoring & performance in 5 municipalities</p> <p>7: Awareness raising programmes</p> <p>Under Consideration or Development</p> <p>1: Standards and Labelling for selected residential appliances</p> <p>2: Extended awareness raising programmes</p>	<p>Other Government</p> <p>1: Building & Measurement Standards: SANS 204, 10400XA, 50001 and 50010</p> <p>2: Free Energy Audits conducted by NCPD</p> <p>3: Manufacturing Competitiveness Enhancement Programme (MCEP)</p> <p>4: Green Building Council of South Africa (GBCSA)</p> <p>5: New Vehicle Emissions Excise Tax.</p> <p>Under Consideration or Development</p> <p>1: Develop EE auditor accreditation (DTI)</p>

Figure 1-8: EEIs and programmes [33]

Figure 1-8 represents a high-level look at the various EEIs available in South Africa. The list of EEIs can be edited and reduced to better suit the problem statement: "...EEIs applicable to industry". The exclusions are therefore, building, municipal and automotive incentives as well as disincentives such as Carbon Emissions Tax. Therefore, the remaining incentives are as follows:

- Eskom’s incentives, specifically Integrated Demand Management (IDM);
- Section 12L of the Income Tax, Act No. 58 of 1962 (12L);
- Section 12I of the Income Tax, Act No. 58 of 1962(12I);
- Signatory Kyoto Protocol for Clean Development Mechanism (CDM);
- Free Energy Audits conducted by National Cleaner Production Centre (NCPD);
- Manufacturing Competitiveness Enhancement Programme (MCEP); and
- Green Energy Efficiency Fund (GEEF).

The Signatory Kyoto Protocol for CDM aims to reduce the emission of greenhouse gases on a global scale. This is achieved by industrialised countries financing greenhouse gas mitigation projects in developing countries, such as South Africa. However, this incentive has shown little success to date in South Africa and, therefore, will be left out of this study. [34] [35]

1.4 PROBLEM STATEMENT AND OBJECTIVES

EEl is a fairly new concept in South Africa. Business lacks the knowledge to make informed decisions on selecting an appropriate and relevant EEl. Therefore, this study aims to find a structured approach to select an appropriate EEl. The approach will be applied to EElS specific to industry in South Africa. The solution to the problem statement is summarised from the title of this report:

Develop a structured approach to select industrial EElS.

The need for this study exists because:

- There is no simple structured selection process available;
- Selecting an EEl is a time-consuming and costly process for a business;
- The information available on each incentive is often overwhelming, conflicting and complex; and
- An EEl selection can impact the financial state of a business directly.

The main objectives of this study include the following:

- Determine a range of incentives to include in the study;
- Research existing selection processes and structured approaches;
- Research existing industrial EElS available in South Africa;
- Develop a structured approach to select an incentive;
- Apply the structured approach to the industrial EElS available in South Africa;
- Verify the methodology using information from the literature; and
- Validate the methodology by applying the structured approach to various case studies.

1.5 OVERVIEW OF DISSERTATION

Chapter 1: Introduction

Provides an overview of the need for this study. The global importance of energy efficiency is highlighted, and EElS are identified as key role-players. The need for EElS is introduced along with the barriers that currently exist. The significance of selecting an appropriate incentive is discussed.

Chapter 2: Literature Review

Three main areas are investigated in the literature review. The first investigates existing selection processes for incentives. The second is a study on previously implemented structured approaches for various disciplines. The third is a summary of the various EEIs for industry in South Africa. Key components from each area are highlighted and further summarised.

Chapter 3: Development of a Structured Approach to Select Incentives

A structured approach to select incentives is developed. The approach comprises four main steps: refine, select, configure and verify. The main result of the approach is an easily adaptable flow diagram.

Chapter 4: Application of Methodology and Case Studies

The structured approach developed in Chapter 3 is applied to the EEIs investigated in Chapter 2. Each of the main steps and subsequent steps are implemented and a resulting flow diagram is created. The methodology is then validated by comparing the results obtained from the flow diagram with the official literature of selected incentives.

Chapter 5: Conclusion

The final chapter of this dissertation concludes the findings made, highlights the benefits of the developed structured approach and notes the recommendations for future studies.

A structured approach to select energy
efficiency incentives applicable to industry:

Literature Review

2 LITERATURE REVIEW

2.1 PREAMBLE

The literature review is divided into three research focus areas. The first area covers previous methods used to select EEIs. The second area focuses on a variety of implemented structured approaches from different disciplines. The third area summarises information on EEIs in South Africa. Once the literature has been reviewed for each focus area, it is then summarised further to highlight key components.

Research is conducted on different methods to select EEIs. The information found is summarised and the most significant research is included. However, little viable information is obtained for selecting incentives. Therefore, a new structured approach to select incentives needs to be developed.

The research conducted on previously implemented structured approaches includes a summary of the problem statement and the approach taken to solve the problem. Key elements of the various approaches are highlighted to be used later in Chapter 3, the methodology.

Several EEIs were included in the scope of this study. These incentives were selected using Figure 1-8 (Chapter 1) with the exclusion of disincentives, CDM, building, municipal and automotive incentives. The remaining incentives under investigation are as follows:

- Section 12L and 12I Tax Incentive;
- Eskom's IDM;
- NCPIC of South Africa;
- MCEP's Production Incentives and Industrial Financing and Loan Facilities; and
- GEEF.

Due to the nature and complexity of each incentive, a practical means of summarising the incentives is with a predetermined set of criteria. The criteria used will allow for ease of comparability of the incentives. Once the incentives have been summarised, the results found are tabulated to provide a quick overview of the EEIs. The criteria used for summarising the incentives are listed below, where qualifying questions can be defined as questions that determine the viability of an incentive:

- General information and aim of the incentive;
- Key benefits of the incentive;
- Key setbacks of the incentive;

- Eligibility; and
- Qualifying questions.

2.2 STRUCTURED APPROACHES FOR SELECTING INCENTIVES

Research is conducted on various structured approaches for selecting incentives. However, in most cases, the information obtained is not relevant to this study. A small portion of the findings are summarised and the most appropriate information is highlighted.

When investigating the research conducted on energy efficiency, three main focus areas are recognised:

1. Energy efficient practices that include policies, standards and general recommendations [21];
2. New energy efficient technologies or improving the efficiency of current technology; and
3. EEIs or funding.

Most of the available research focuses on the first two points (energy efficient practices and technologies). Implementing new practices or technologies is often costly and time consuming and therefore, not always a viable option. Insufficient published information is available on incentive schemes.

A large portion of the available research focuses on investigating and understanding the incentives. The findings are usually summarised in a table, often according to sectors such as industry, building and transport. The summaries provide background to the available incentives, and using the information can help narrow down which incentives to investigate. However, the research offers no means to select an incentive. [10] [28] [30] [36]

Some research papers such as [37]–[39], take the investigation one step further, summarise and then evaluate current EEIs and policies. The evaluation is used to design new EEIs to better suit the market or maximise energy efficiency potential for existing EEIs. Some of the key strategies from evaluation include increasing funding potential, establishing complimentary policies and expanding programmes to reach untapped markets. Once again, these studies offer no means to select an incentive.

The most significant finding is a tool developed to prioritise energy efficiency investments [40]. The study was conducted for energy efficiency in buildings and a Microsoft Excel tool was developed to compare incentives objectively. The tool incorporates over 770 energy efficiency measures. The tool uses established methodologies to evaluate the energy and cost saving potential.

The tool not only focuses on incentives, but on generic energy saving methods for buildings. The tool developed works well for buildings because main energy users are quickly identified, and baselines can be drawn up and compared. However, in industry the main energy users differ for each type of industry, such as cement, steel or mining. Therefore, a generic approach covering every situation is difficult to implement. A more structured analysis is required.

Most of the research found follows the process illustrated in Figure 2-1, redrawn from [37]. The steps for a basic process towards implementation of an EEI are to investigate, select, evaluate and implement. This dissertation will focus on step three of the figure, identifying potential incentives and in turn selecting an appropriate one.

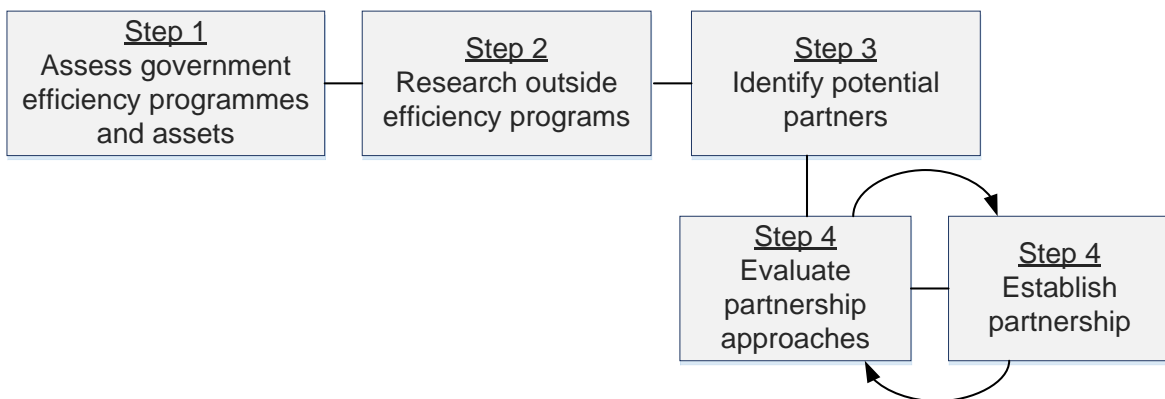


Figure 2-1: Steps to identify and implement local energy efficiency partners [37]

2.3 STRUCTURED APPROACHES IN OTHER DISCIPLINES

2.3.1 OVERVIEW

The definition of a structured approach can be broken down as follows:

Structure: to plan, organise or arrange the parts of something. [41]

Approach: to come near to something in space, time, quality or amount. [42]

Therefore, from combining the two definitions, it can be deduced that a structured approach is an organised way to get from point A to point B. In the case of this study, point A would represent an overwhelming amount of information and point B would represent the selected EEI.

The benefit of implementing a structured approach can be summed up into two main categories: efficiency and effectiveness. Where efficiency is defined by an internal performance measure of the process operations, effectiveness is defined by external performance measures of the process output. [43]

A more technical way to define a structured approach is method engineering. A report was compiled on the integration of information for a collection of engineering methods [44]. Figure 2-2 has been adapted from the report and represents an overview of the method engineering process. The search for existing methods as well as adopting, tailoring and developing the methodology is covered in the next section.

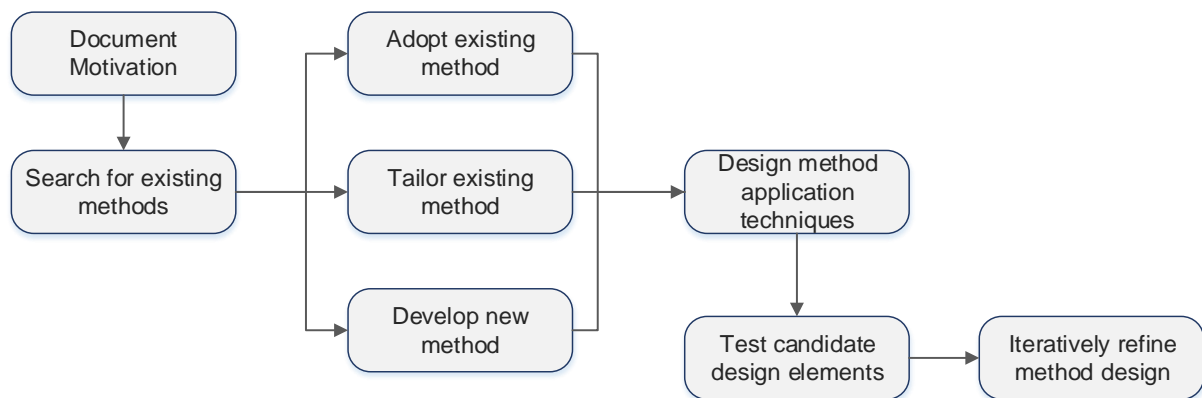


Figure 2-2: Method engineering

2.3.2 PREVIOUSLY IMPLEMENTED STRUCTURED APPROACH

Urban water infrastructure asset management

A structured approach on the urban water infrastructure asset management was implemented, where the sustainability of reliable and high-quality drinking water is under investigation [45]. The structured approach incorporates the IAM (Infrastructural asset management) principles based on the Plan-Do-Check-Act. [46]

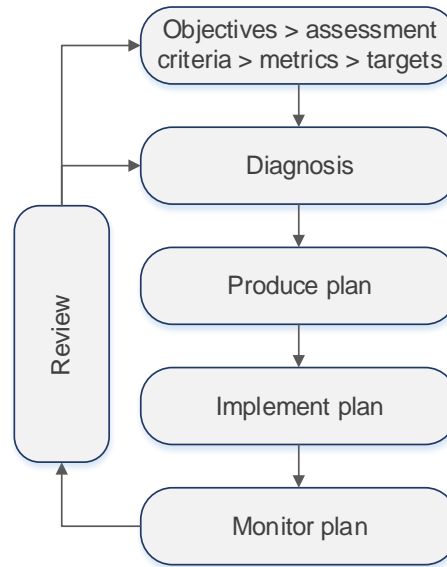


Figure 2-3: Structured approach: Urban water infrastructure asset management

The first step in the approach is to define the scope of the study as well as the intended result of the study. Once the direction of the study has been established, a diagnosis of the available information is conducted. A project plan is then produced, implemented and monitored. The structured approach is presented as a cycle because the objectives and diagnosis are adapted according to the results obtained from the executed plan.

The main notable contribution from this study is the process flow. The process is designed in the form of a cycle to ensure that the approach is verified and validated. Once the project has been reviewed, a diagnosis is done and the project plan is adjusted accordingly.

Hearing aid selection

A study was done to develop a structured approach to select a hearing aid [47]. The selection process is put in place to assist the audiologist in finding an optimal hearing aid for each patient. The approach is set up to utilise all of the data that reasonably can be obtained for a given patient and not just a comparative approach to different hearing aids.

The result of the structured approach is the flowchart shown in Figure 2-4, which is redrawn from the article. The selection process of a hearing aid is dependent on many factors, such as the doctor, the patient, the available technology, etc. Thus, it is crucial that the approach is flexible and easily modified as a result of basic research. The approach was implemented and tested. The results were compared and conclusions were drawn.

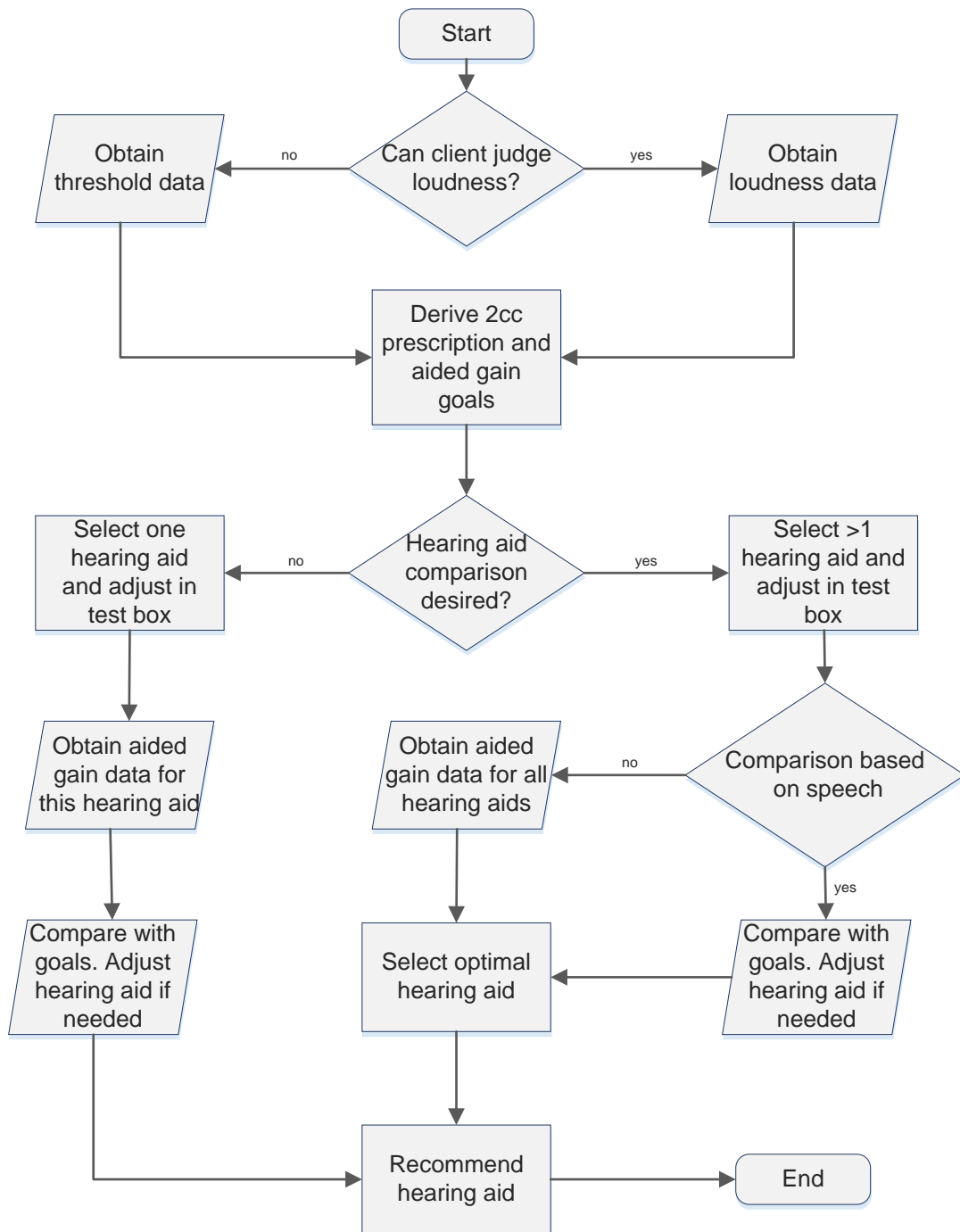


Figure 2-4: Flowchart for a generic approach to hearing aid selection

The main outcome and notable contribution from this study is the flow diagram. The flow diagram is developed for people with limited knowledge to quickly select an appropriate hearing aid. The design is generic and, therefore, can be adapted and updated easily as new information is made available.

Designing performance measures

A study was conducted to develop and test a framework that assists with the process of designing and auditing the performance measures for business [48]. The structured approach is based on an extensive literature review to enable the design of a scorecard. The aim of the scorecard is to improve the evaluation process for the company.

The scorecard is issued to a company to enable said company to evaluate their performance based on the following questions as defined in [48], [49]. A series of action research studies tested the framework and adapted it accordingly.

- How does a company look to their shareholders (financial perspective)?
- What should a company excel at (internal business perspective)?
- How do customers perceive the company (the customer perspective)?
- How can the company continue to advance and create value (innovation and learning perspective)?

The main contribution taken from this study is the list of questions used to formulate assessment criteria. The questions highlight key factors that need to be addressed when measuring the performance of a company. The questions can easily be adapted to suit various types of businesses.

Warehouse design

A study was conducted to investigate a structured approach for designing a warehouse [50]. The study was intended to develop further a more comprehensive methodology for a warehouse design to improve the cost and time efficiency of the building process. The study consisted of an extensive literature review, where the literature was divided into subcategories and evaluated accordingly.

Previously implemented approaches, as well as the tools and techniques used for each step in the design process, were examined. The steps employed in the previously applied approaches were highlighted and compared, which enabled the identification of commonalities and differences between each approach.

The results from the literature study were then validated and refined regarding warehouse design companies. The output of the study comprised a framework of steps along with the specific tools and techniques used for implementing each step.

The notable contribution taken from the study is the manner in which the literature is categorised. There is a vast amount of information available for different aspects of

designing a warehouse. Therefore, categorising the literature makes it easier to compare different components.

Occupational hygiene considerations for selection of chemical control strategies

A paper was written to explain the occupational hygiene basis of a new system to help small companies manage health risks from supplied chemicals [51]. The aim of the paper was to develop and predict a control strategy to ensure the safe use of hazardous substances. The control strategy was developed based on an empirical approach to risk assessment and risk management.

The control studies and exposure potential were reviewed in the literature and then characterised to aid in the development of a predictive model. Figure 2-5 is adapted from the paper [51] to depict this.

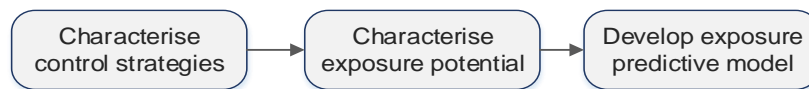


Figure 2-5: Overview of approach used to develop a predictive control model

Thereafter, the accuracy of the prediction model is validated using two methods. The first method compares the predictions using data from real life scenarios. The second method entails a peer review of the logic and the entire content of the core model by independent expert technical groups.

From this study, the main notable contribution is the categorisation of the literature. Once the literature has been reviewed, the information is further categorised to aid in the development of a predictive model.

Evaluation and comparison of alternative transportation plans

A study was conducted to structure the process of evaluating alternative transportation plans [52]. The approach was initiated by compiling a set of questions to define the overall process. These questions address the following: scope of the process, its interface with other activities such as model development, the actual process of evaluation and the interpretation of evaluation results.

A multidimensional evaluation process is designed within the framework of questions. The process involves steps aimed at identifying significant differences among alternative transportation plans. Procedures are suggested thereafter for eliminating criteria that are

not relevant to the discussion as well as alternatives that are clearly inferior. A simple example then illustrates the multidimensional approach and a conclusion is drawn.

The main notable contribution of this study is the exclusion of methods that are inferior. Quickly determining a viable solution to a problem is key to engineering design. Therefore, eliminating methods and components that do not help solve the problem can shorten the project time.

2.3.3 NOTABLE COMPONENTS FROM EACH CASE STUDY

The various case studies had little in common except for the fact that a structured approach is required to solve a particular problem. The case studies all followed the engineering method shown in Figure 2-2. However, different components were utilised to ensure appropriate results were obtained for each study.

Table 2-1 summarises the notable components from each case study. These components will be used later in Chapter 3 to aid with the methodology of designing a structured approach to select EEs.

Table 2-1: Notable contributions from previously implemented structured approaches

Case study	Notable contribution
Urban water infrastructure asset management	The cycle approach to problem solving ensures that the approach is correctly verified and validated
Hearing aid selection	The flow diagram that allows a user to quickly identify a solution
Designing performance measures	The list of questions that form the assessment criteria to measure performance
Warehouse design	Reviewing literature according to categories to easily compare key components
Occupational hygiene considerations for selection of chemical control strategies	The categorisation of data from the literature review to develop a model

Case study	Notable contribution
Evaluation and comparison of alternative transportation plans	The exclusion of obvious methods or components that are not applicable or inferior

From the table, the following predictions can be made regarding the methodology:

- The structured approach is designed in the form of a cycle so that the method can be updated and adapted easily.
- The literature is reviewed according to a set of criteria.
- Questions are formulated to determine viability.
- The literature is further categorised to aid in the development of a structured approach.
- Methods or components that do not help solve the problem will be excluded.
- The result of the methodology is a flow diagram that allows the user to identify an EEI quickly.

2.4 PRESENT ENERGY EFFICIENCY INCENTIVE SCHEMES

2.4.1 SECTION 12L TAX INCENTIVE

The first incentive under investigation is Section 12L of the Income Tax, Act No. 58 of 1962. Throughout the review, qualifying questions were composed and are shown at the end of this section. In the rest of the document, the 12L Tax Incentive will be abbreviated to 12L. The information for 12L is obtained from the following sources [53]–[57] and then summarised.

General information and the aim of the incentive

12L allows for a tax deduction in respect of energy efficiency savings. Where energy efficiency savings are defined as *“the difference between the actual amount of energy used in the carrying out of any activity or trade in a specific period and the amount of energy that would have been used in the carrying out of any activity or trade in the same period under the same conditions.”*

The Regulation came into operation on 1 November 2013 and savings can be claimed for an assessment year ending before 1 January 2020. The regulations are devised to

encourage the efficient utilisation of energy to safeguard the continued supply of energy, combat the adverse effects of greenhouse gases and minimise the financial impact of carbon tax.

The National Energy Act, 2008 (Act No. 34 of 2008), Section 7 (2) provides for SANEDI to direct, monitor and conduct energy research and development, and undertake measures to promote energy efficiency throughout the economy. The incentive, i.e. tax deduction is funded by the National Treasury and SARS.

- The procedure for application is as follows:
 - Register with SANEDI;
 - Appoint a Measurement and Verification (M&V) professional, and
 - Submit a report to SANEDI and obtain a certificate.
- The report issued to SANEDI should contain at least the following:
 - A baseline period comprised of 12 consecutive months' worth of data;
 - A reporting/assessment period comprised of 12 consecutive months' worth of data;
 - Motivation for energy efficiency savings;
 - The energy efficiency savings expressed in kWh;
 - The name and tax registration number of the person applying for the incentive; and
 - The details of the M&V professional who compiled the report.

Key benefits of the incentive

The incentive offers a 45 c/kWh (or kWh equivalent for energy sources other than electricity) claimable deduction against taxable income. The Minister of Finance announced that this value will increase to 95 c/kWh. The normal tax rate for companies in South Africa is currently 28%. Thus, the savings can be calculated using the following scenario as an example as shown in Table 2-2.

A company has a net profit of R5 000 000 that is to be taxed. The marginal rate of tax for the company is 28%. The company implements an Energy Saving Measure that qualifies for the tax incentive under the 12L regulation. The amount of savings that have been verified and approved by the SANEDI 12L panel is 2 000 000 kWh. This translates into a foregone revenue for SARS of $2\,000\,000 \times R0.45 \times 28\% = R252\,000$. The previously calculated tax on the R5 000 000 would have been R1 400 000. Therefore, the final tax payable would be $R1\,400\,000 - R252\,000 = R1\,148\,000$.

Table 2-2: Example of a 12L savings calculation

12L Example	
Verified approved savings	2 000 000 kWh
Tax incentive rate	R0.45
Marginal tax rate of the entity	28%
Tax revenue forgone	R252 000
Effective rate of kWh	R0.126
Final tax to be paid after the incentive	R1 148 000

The effective kWh rate after tax is therefore 12.6 c/kWh.

The incentive is available for both Brownfield and Greenfield projects. If energy efficiency savings are realised, the incentive can be claimed for each year until the incentive expires. Energy efficiency savings are valid for all forms of non-renewable energy that can be converted to a kWh value such as coal, gas, electricity and paraffin/petrol.

The 12L incentive encourages businesses to develop towards an ISO certification. Therefore, it is easier to obtain an ISO 5000 (energy management) certification. There is no minimum or maximum project application size.

Key setbacks of the incentive

The baseline year is adjusted for every year of assessment for which the allowance is claimed. The assessment year for which the savings were claimed now becomes the new baseline year for the next submission. The incentive is offered only for prior energy efficiency savings. Thus, no start-up capital is offered.

No incentives that are considered concurrent benefits may be included. This refers to funding from any sphere of the government or public entity listed in Schedule 2 or 3 of the Public Finance Management Act, 1999 (Act No 1 of 1999). The kWh savings should be subtracted from the baseline or assessment profile.

The exclusions for this incentive include the following: renewable energy, co-generation (exception: waste-heat recovery), a captive power plant with an output increase less than 35% of total input.

The cost of the M&V professional can be high and cut into benefits achieved by the incentive. The data submitted to the M&V professional has to be reliable, traceable and come from a calibrated or validated source. The M&V audit should comply with all the regulations set out by the South African National Accreditation system.

Eligibility

Any South African owned company/business that derives income in the operation of a trade is eligible for the 12L incentive and any single tax entity that complies with the above-mentioned criteria.

Qualifying questions

There are nine qualifying questions formulated for 12L and can be seen in Table 2-3. These questions are formulated using a summarised set of information and are in no way absolute. They do, however, formulate a guideline for the incentive, highlighting key points of information.

Table 2-3: Qualifying questions for 12L

Qualifying questions for 12L	Answer
Has the project already been implemented, therefore, claiming money for prior energy efficiency kilowatt-hour savings?	Yes
Has the company received funding from other governmental sources that are considered concurrent benefits?	No
Does the project make use of renewable energy?	No
Does the project make use of a captive power plant with an efficiency of over 35%?	Yes
Is co-generation of energy, except heat-waste recovery, used?	No
Can the data submitted be validated and verified for both the baseline and assessment year?	Yes
Are the meters used to measure the data regularly calibrated via an external accredited company?	Yes
Has the company appointed an external measurement and verification team to audit the process?	Yes
Is the company applying for the incentive a single registered tax entity?	Yes

2.4.2 SECTION 12I TAX INCENTIVE

The next incentive under investigation is Section 12I of the Income Tax, Act No. 58 of 1962. Throughout the review, qualifying questions were composed and can be seen at the end of this section. In the rest of the document, the 12I Tax Incentive will be abbreviated to 12I. The information for 12I is obtained from the following sources [58]–[60] and then summarised.

General information and the aim of the incentive

12I offers support based on capital investment and training. The incentive supports Greenfield (new industrial developments utilising only new/unused manufacturing assets) and Brownfield (expansions or upgrades to existing infrastructure) projects. The aim is to invest in manufacturing assets to improve South Africa's manufacturing sector, as well as training of personnel to improve labour productivity and the skills profile of the labour force. The incentive is funded by the dti and like 12L, the incentive is regulated by SANEDI.

Key benefits of the incentive

The incentive offers a minimum investment of R50 million for Greenfield projects and a minimum of R30 million for Brownfield projects. The maximum investment amounts are shown in Table 2-4, where the investment ranges from R350 million to R900 million or 35-55% of the qualifying assets. The allocation of a project's status is discussed along with Table 2-5, in the key setbacks of the incentive.

Table 2-4: Maximum investment allocation for 12I

Status	Greenfield	Brownfield
Preferred	R900 million or >55% of qualifying assets	R550 million or >55% of qualifying assets
Qualifying	R550 million or >35% of qualifying assets	R350 million or >35% of qualifying assets

The incentive also offers an additional training allowance of R36 000 per employee, which is deducted from taxable income. The training allowance per project amounts to a maximum amount of R20 million for a project with a qualifying status and R30 million for a project with a preferred status.

Key setbacks of the incentive

The status of a project is determined using Table 2-5. The table consists of different criteria, where each criterion is allocated a point value between 0-2. For a project to obtain preferred status, the project needs to score a minimum of 7 points out of 8. For a project to obtain qualifying status, the project needs to score a minimum of 4 out of 8.

The point system is the same for Greenfield and Brownfield projects. However, the criteria differ slightly. A Brownfield project can score one more point than a Greenfield project for small, medium and micro enterprises (SMME) procurement. However, no points are allocated for a Brownfield project located in a Special Economic Zone (SEZ).

Table 2-5: Qualifying criteria for 12I

Criterion	Greenfield	Brownfield
Innovation	1	1
Energy Efficiency	2	2
Business Linkages	1	1
SMME Procurement	1	2
Located in SEZ	1	-
Training of employees	2	2
Maximum Points	8	8

The project should ensure to comply with the following:

- Upgrade an industry within South Africa by utilising innovative processes;
- Provide general business linkages within South Africa;
- Acquire goods and services from SMMEs;
- Provide skills development in South Africa; and
- In the case of a Greenfield project, is located within an SEZ.

Eligibility

Enterprises should be classified:

- Under “Major Divisions 3: Manufacturing in the Standard Industrial Classification (SIC 3) of All Economic Activities, 5th Edition or SIC 7th Edition. Section C: Manufacturing.

- Any Greenfield project with a minimum investment in qualifying assets of R50 million.
- Any Brownfield project with a minimum additional investment in qualifying assets of R30 million.
- Due to the nature of the tax incentive, only one single tax entity can apply for the incentive.

Qualifying questions

There are fourteen qualifying questions formulated for 12I. These can be seen in Table 2-6. These questions are formulated using a summarised set of information and are in no way absolute. They, however, formulate a guideline for the incentive, highlighting key points of information.

Table 2-6: Qualifying questions for 12I

Qualifying questions for 12I	Answer
Does the project require a capital investment?	Yes
Is the project a Greenfield project?	Yes/No
Are the minimum qualifying assets for the Greenfield project more than R50 million?	Yes
Are the maximum qualifying assets less than R900 million for the Greenfield project with preferred status or less than R550 million for a Greenfield project with qualifying status?	Yes
Is the Greenfield project located in a Special Economic Zone?	Yes
Is the project a Brownfield project?	Yes/No
Are the minimum qualifying assets for the Brownfield project more than R30 million?	Yes
Are the maximum qualifying assets less than R550 million for a Brownfield project with preferred status or less than R350 million for a Brownfield project with qualifying status?	Yes
Does the project score a minimum of 4/8 criteria points?	Yes
Does the project upgrade an industry within South Africa by utilising innovative processes?	Yes
Does the project utilise new technology that results in improved energy efficiency and cleaner production?	Yes

Qualifying questions for 12I	Answer
Does the project provide general business linkages within South Africa?	Yes
Does the project acquire goods and services from small, medium and micro enterprises?	Yes
Does the project provide skills development in South Africa?	Yes
Is the company applying for the incentive a single registered tax entity?	Yes

2.4.3 ESKOM'S INTEGRATED DEMAND MANAGEMENT

The incentive under investigation is Eskom's IDM programme. Throughout the review, qualifying questions were composed and can be seen at the end of this section. In the rest of the document, Eskom's IDM programme will be abbreviated to IDM. The information for IDM is obtained from the following sources [61]–[64] and then summarised¹.

General information and the aim of the incentive

This incentive is fully funded by Eskom with the aim of offsetting electricity consumption from the national grid. The incentive was started to help curb the electricity shortages in South Africa. There are three main models aimed at industries. All of the data submitted for a project needs to be audited by an external M&V team.

The first is performance contracting. The aim of this model is to purchase bulk verifiable energy savings across multiple sites and technologies by contracting with a single project developer. The funding is provided to the project developer to implement technologies to ensure savings. The minimum project size is 30 GWh over a period of three years.

The second model is an Energy Service Company (ESCO) model. The ESCo serves as a link or intermediary between the client implementing the project and Eskom. An ESCo submits a project scope with a potential load saving of 100 kW or more. The funding is then issued to the ESCo to implement the project.

The last model is the standard offer model. This model funds projects for verifiable savings ranging between 50 kW and 5 MW directly to a client or ESCo. The model was intended to streamline the project approval process and timeframe to allow for a quicker

¹ Since the start of this study, the financial information for IDM has been revised by Eskom. However, the new information is not yet available from a reliable source.

payment process. The model is intended to provide funding for new technologies such as efficient lighting, solar water heating and process optimisation.

Key benefits of the incentive

The funding provided by Eskom differs for each model and for each project implemented. However, the funding is fixed at a predetermined Rand per kWh value basis. The funding is used to implement electricity efficient technologies.

Performance contracting has three different funding allocations and can be seen in Table 2-7. The funding is dependent on the time of the electricity savings. High and low rate periods are between 06:00 and 22:00 on weekdays. The remaining time is classified as weekends and off-peak times.

Table 2-7: IDM Performance contracting funding

Performance Contracting	Base Rate
High rate period	55 c/kWh
Low rate period	10 c/kWh
Weekend and off-peak period	Negotiated with client

ESCo model funding is dependent on the type of project implemented. The funding and project type can be seen in Table 2-8. The value of the funding provided ranges from R3.9 million R/MW and R6.3 million R/MW.

Table 2-8: IDM ESCo model funding

Programmes and Technologies	Benchmark Funding [million/MW]
Lighting and HVAC	R5.2
Hot Water	R6.3
Demand Response	R3.9
Compressed Air	R4.4
Process Optimisation	R5.2
Other	R5.2

The basis of the standard offer model is the same as an ESCo model. However, the type of technologies implemented differs. This is shown, along with the amount of funding provided, in Table 2-9. The funding ranges from R5.25 c/kWh to R6.86 c/kWh.

Table 2-9: IDM Standard offer funding

Target Technologies	Benchmark Funding
Energy efficient lighting systems	R5.25 c/kWh
LED lighting technologies	R6.86 c/kWh
Building management systems	R5.25 c/kWh
Hot water systems	R5.25 c/kWh

Key setbacks of the incentive

The main setback for each model is the time in which the electricity savings need to be sustained. The timeframe is three years for performance contracting and standard offer, and five years for the ESCo model.

To ensure an ESCo model project performs on target, Eskom has introduced penalties if the promised savings are not realised. These penalties are also based on an R/MW basis and are implemented if the average savings over five years fall below a threshold.

The standard offer model funding is paid over four intervals. The first interval is for 70% of the initial cost of a project. The next three payments are an annual 10% of the initial payment, based on the savings performance of the project.

The main aim of IDM is to offset electricity from the national grid, thus no other forms of energy (coal or gas) savings are funded. The increase of production is also not funded. Therefore, the only type of energy efficiency accepted is the reduction of electricity.

Eligibility

To be eligible for IDM the company should comply with the above mentioned electricity savings parameters namely: 30 GWh over three years for performance contracting, between 50 kW and 5 MW for standard offer and more than 100 kW for ESCo model.

Qualifying questions

There are seven qualifying questions formulated for IDM. These can be seen in Table 2-10. The questions are formulated using a summarised set of information and are in no way absolute. They, however, formulate a guideline for the incentive, highlighting key points of information.

Table 2-10: Qualifying questions for IDM

Qualifying questions for IDM	Answer
Does the project require a capital investment?	Yes
Does the project focus on electricity kilowatt-hour savings?	Yes
Can the data submitted be validated and verified for both the baseline and assessment period?	Yes
Does one of the funding models comply with the project scope?	Yes
Does the project save the minimum amount of the electricity required by the funding model?	Yes
Will the project be sustainable for the minimum number of years required by the funding model?	Yes
Has the company appointed an energy services company to manage the process?	Yes

2.4.4 NATIONAL CLEANER PRODUCTION CENTRE OF SOUTH AFRICA

The incentive under investigation is the National Cleaner Production Centre of South Africa. Throughout the review, qualifying questions were composed and can be seen at the end of this section. In the rest of the document, the National Cleaner Production Centre of South Africa will be abbreviated to NCPC-SA. The information for the NCPC-SA is obtained from the following sources [65]–[68] and then summarised.

General information and the aim of the incentive

The NCPC-SA is a national programme by government that promotes the implementation of resource efficiency and cleaner production (CP). This is achieved by providing industries with free energy audits. The methodologies assist industries to lower costs through reduced energy, water and material usage as well as waste management.

The incentive is a result of the cooperation programme between South Africa and the United Nations Industrial Development Organisation (UNIDO). Funding for the incentive is provided by the dti. The Council for Scientific and Industrial Research (CSIR) hosts the incentive.

The objectives of NCPC-SA are listed:

- Grow CP awareness in South Africa to lower CO₂ emissions;
- Provide CP assessments and advice to enterprises in all industrial sectors;
- Facilitate value-added outcomes through investments in cleaner technology;
- Grow CP capacity among the industrial workforce, management, government, service providers and students;
- Contribute to national priorities, for example, energy saving, water quality and waste minimisation through efficiency; and
- Contribute to the creation of green jobs through CP capacity building and recycling.

Key benefits of the incentive

The NCPC-SA offers a wide variety of benefits with very few setbacks. The main benefit of the incentive is the free energy efficiency investigations conducted by the CSIR. These investigations highlight areas in which companies can save on energy or increase production.

The incentive provides free training and courses for staff on energy awareness and the implementation of projects. Energy awareness workshops are also hosted on site by the Centre for Scientific and Industrial Research (CSIR) for the company and staff.

The CSIR offers an energy management system (EnMS) for individual components on an industrial plant. The EnMS is based in the Plan-Do-Check-Act cycle, providing a structured and holistic approach and focusing on all aspects of the production environment that may impact or influence energy usage.

The NCPC-SA can be used in conjunction with additional incentives such as 12L, IDM or a loan facility.

Key setbacks of the incentive

The NCPC-SA does not offer funding, therefore this incentive is a non-financial incentive. If the energy audit identifies costly projects that can be implemented, the company will have to find an alternative way of financing the projects.

Eligibility

The incentive is available for SMMEs and applicable to the following sectors: chemicals, agro-processing, automotive and transport equipment, metals and allied processes, pulp and paper, clothing and textiles, leather and footwear, tourism and hospitality, and lastly commercial buildings. These sectors are identified in government's Industrial Policy Action Plan (IPAP).

Qualifying questions

There are four qualifying questions formulated for NCPC-SA. These can be seen in Table 2-11. These questions are formulated using a summarised set of information and are in no way absolute. They, however, formulate a guideline for the incentive, highlighting key points of information.

Table 2-11: Qualifying questions for NCPC-SA

Qualifying questions for NCPC-SA	Answer
Is there a current proposal for an energy efficiency project?	No
Has the project already been implemented?	No
Does the company qualify as a small, medium or micro enterprise?	Yes
Is the company willing to pay for the initial project capital?	Yes

2.4.5 MANUFACTURING COMPETITIVENESS ENHANCEMENT PROGRAMME PRODUCTION INCENTIVE

The incentive under investigation is the Manufacturing Competitiveness Enhancement Programme – Production Incentive. Throughout the review, qualifying questions were composed and are shown at the end of this section. In the rest of the document, the Manufacturing Competitiveness Enhancement Programme – Production Incentive will be abbreviated to MCEP-PI. The information for MCEP-PI is obtained from the following sources [69]–[72] and then summarised.

General information and the aim of the incentive

MCEP-PI is a financial grant programme that supports manufacturing enterprises with competitive improvement interventions. The grant is issued by the dti. The main objective

of the incentive is to promote enterprise competitiveness and job creation. The incentive will run until 2018.

The MCEP-PI aims to stabilise and grow the production and employment of a business by investing in equipment and process upgrades as well as promoting enterprise competitiveness and maximising value-addition. This takes place while reducing the impact businesses have on the environment.

There are five main funding groups under MCEP-PI and these are listed below with a short description:

- Capital investment offers funding for equipment upgrades and business expansions.
- Green technology and resource efficiency improvement offer funding to improve CP and energy efficiency.
- Enterprise-level competitiveness improvement offers funding to enable an enterprise to achieve accreditation of conformity and standards.
- Feasibility studies provide funding to facilitate the investigation of possible projects that will lead to an increase in production.
- Cluster competitiveness improvement (CCI) and initiatives provide funding to a minimum of five individual enterprises for the improvement of competitiveness, innovation and access to new markets.

Key benefits of the incentive

The key benefit for MCEP-PI is the cash grant offered by the incentive. The funding percentage issued for each project differs for each funding group. The amount of funding is calculated using the Manufacturing Value Added (MVA) of a business and the size of the business, where the MVA of a business is equal to the manufactured sales minus the cost of materials used. The claimable MVA percentage is shown in Table 2-12, where it ranges from 10% to 25%.

Table 2-12: MVA percentage for MCEP-PI

Size of Applicant	%MVA Claimable
100% Black owned	25%
≥ R5 million; < R30 million	25%
≥ R30 million; < R200 million	20%
≥ R200 million	10%

The funding percentage provided by each group under the MCEP-PI is summarised in Table 2-13. The funding percentages range from 30% to 80% and the maximum investment ranges from R2 million to R50 million.

Table 2-13: Summary of the five MCEP-PI's

Funding Group	Size of Applicant	Minimum Investment	Percent Funded	Maximum Investment
Unit	[million]	[million]	[%]	[million]
Capital Investment	< R5	R0.5	50	R5
	≥ R5; < R30	R1	40	R30
	≥ R30	R2	30	R30
Green technology & resource efficiency improvement	< R5	None	50	R5
	≥ R5; < R30		40	R20
	≥ R30		30	R20
Enterprise-Level competitiveness improvement	< R5	None	70	R2
	≥ R5; < R200		60	R5
	≥ R200		50	R10
Feasibility studies	< R30	R30 project	70	R8
	≥ R30	investment	50	R8
CCI	None	None	80	R50

Claimable funding is calculated using either the MVA from Table 2-12 or the funding group percentages depicted in Table 2-13. The size and the nature of the project will determine the method of funding used.

Key setbacks of the incentive

There are a number of setbacks or qualifying criteria needed to apply for the incentive. These setbacks include:

- The company has to be registered as a legal entity in South Africa, operating for a minimum of 12 months. Applications from Trusts are prohibited;
- The company needs a valid tax clearance certificate with a level 4 Broad-Based Black Economic Empowerment (B-BBEE) contributor status in terms of B-BBEE codes [73];

- Investment projects may not result in a reduction of the base-year employment figures;
- Funding is only available for new equipment (No subsidy for second-hand equipment, no vehicles and no leased buildings); and
- Applicants that have received grants from other dti incentives and programmes such as 12I, are not allowed to apply for the MCEP-PI. However, applicants may apply for the MCEP-PI once every two years.

Eligibility

Entities that may apply include entities involved in manufacturing, engineering and support services, as well as conformity assessment agencies servicing the manufacturing sector. These sectors include, but are not limited to:

- Paper, board and pulp;
- Synthesisers, petroleum refineries and nuclear fuel processors;
- Basic chemical manufacturers;
- Iron and steel manufacturers; and
- Precious and non-ferrous metal manufacturers.

The following are excluded from applying for MCEP-PI:

- Greenfield projects;
- S21 companies (non-profit companies);
- Manufacturers of tobacco products; and
- Automotive, clothing, textile, footwear and leather manufacturers.

Qualifying questions

There are ten qualifying questions formulated for MCEP-PI. These can be seen in Table 2-14. The questions are formulated using a summarised set of information and are in no way absolute. They, however, formulate a guideline for the incentive, highlighting key points of information.

Table 2-14: Qualifying questions for MCEP-PI

Qualifying questions for MCEP-PI	Answer
Does the project require a capital investment?	Yes
Does the project aim to improve overall production and manufacturing	Yes

Qualifying questions for MCEP-PI	Answer
competitiveness?	
Has the company been operating for over 12 months?	Yes
Will the project decrease the overall employment levels of the company?	No
Has the company applied for this incentive in the last two years?	No
Does the project adhere to the minimum investment requirements?	Yes
Does the company adhere to the minimum qualifying assets?	Yes
Is the company a level four B-BBEE or higher?	Yes
If applying for the MCEP-Cluster incentive, does the project applying for the incentive, consist of a minimum of five independent companies?	Yes
Has the company benefitted from other incentives or programmes offered by the dti?	No

2.4.6 MANUFACTURING COMPETITIVENESS ENHANCEMENT PROGRAMME'S INDUSTRIAL FINANCING AND LOAN FACILITIES

The incentive under investigation is the Manufacturing Competitiveness Enhancement Programme – Loan Facility. In the rest of the document, this incentive will be abbreviated to MCEP-LF. Throughout the review, qualifying questions were composed and can be seen at the end of this section. The information for MCEP-LF is obtained from the following sources [70] [72] and then summarised.

General information and the aim of the incentive

The Industrial Financing Loan Facility is offered by the MCEP under the dti and funded by the Industrial Development Corporation (IDC). The incentive offers finance to manufacturers at a preferential interest rate. There are two types of loan facilities offered by the MCEP-LF.

The first type of incentive is the Pre/Post-Dispatch Working Capital Facility; this incentive offers a working capital facility. The aim of this incentive is to improve the competitiveness of a business by reducing the cost of capital financing.

The second type of incentive is an Industrial Policy Niche Projects Fund. The funding provided should allow a business to create new jobs, diversify manufacturing output and contribute to exports. This incentive is available for businesses that do not qualify for

commercial or IDC funding. Thus, the incentive only applies to candidates that have already applied for a loan from a different branch of the IDC and failed. Therefore, this incentive will not be included in the scope of this report.

Key benefits of the incentive

The incentive offers funding for pre/post-dispatch loans, where pre-dispatch loans can include production raw material, packaging and transportation. Post-Dispatch loans can include performance bonds and performance guarantees.

The maximum loan amount is capped at R30 million with a fixed interest rate of 6%. Finance is available for a term of up to 4 years, depending on the enterprise circumstances. Applicants that have funding requirements exceeding this maximum may qualify for IDC financing based on the normal IDC risk assessment. No fees will be levied by the IDC for this facility.

The facility is also available to support manufacturers in distress to turn around their enterprises. The aim is to aid businesses to improve competitiveness levels and viability. Applicants may be required to have turnaround plans approved by the IDC.

Key setbacks of the incentive

The main setback of the incentive is that it is a loan facility. The loan will need to be paid back over a certain timeframe. Therefore, the loan facility should only be used as a last resort. MCEP-LF is not available to fund normal overdraft requirements.

The facility is available on condition that the applicant possesses a confirmed contract, purchasing order, an order that forms part of the state owned enterprise competitiveness supplier programme or a designated products value chain.

Eligibility

The eligibility for MCEP-LF is the same as the eligibility for MCEP-PI. The eligibility can be summed up as follows: South African registered entities in manufacturing under SIC 3, engineering services that support manufacturing and conformity assessment bodies (SIC 88220) servicing the manufacturing sector.

Qualifying questions

There are only four qualifying questions formulated for MCEP-LF. These are shown in Table 2-15. These questions are formulated using a summarised set of information and

are in no way absolute. They, however, formulate a guideline for the incentive, highlighting key points of information.

Table 2-15: Qualifying questions for MCEP-LF

Qualifying questions for MCEP-LF	Answer
Does the company adhere to the minimum and maximum loan requirements?	Yes
Have all other options for project funding been explored, is a loan the last resort?	Yes
Will the company be able to pay back the loan within the specified time?	Yes
Does the project focus on increasing production and manufacturing competitiveness?	Yes

2.4.7 THE GREEN ENERGY EFFICIENCY FUND

The incentive under investigation is the GEEF. Throughout the review, qualifying questions were composed and are shown at the end of this section. The information for GEEF is obtained from the following sources² [74] and then summarised.

General information and the aim of the incentive

The incentive is a loan facility funded by the IDC and the German bank, KfW. Between the two departments, R500 million is available for investment. Funding is provided for energy efficiency and self-use renewable energy projects.

The GEEF provides an option for bridging finance to address the funding gap between actual investments and provided incentives. Projects making use of incentives such as IDM and 12L are eligible for financing and therefore, not considered concurrent benefits.

The incentive aims to assist South Africa's energy efficiency development by reducing energy consumption. This is achieved through supporting self-renewable energy technologies to create a low-carbon economy. GEEF supports South Africa's economic development and growth, through long-term enterprise competitiveness and job creation.

² The Information is obtained from a brochure titled: "Green Energy Efficiency Fund". The brochure is provided by the dti and KfW German Bank. <http://www.idc.co.za/home/idc-products/special-schemes/geef.html>

Key benefits of the incentive

The GEEF offers loans for energy efficiency initiatives with the main benefit being lower interest rates. The minimum and maximum loan amounts are R1 million and R50 million, respectively. There are a number of additional benefits offered by GEEF. These are summarised and listed below:

- Pre-screening for loans within one week and energy efficiency validation checks to reduce the risk of investment.
- Technical support for energy assessments.
- The upgrading of industrial equipment and use of energy efficiency interventions will reduce energy and costs, increase product quality and capacity and in turn increase company profitability.
- Increase company value while lowering vulnerability to increasing energy prices.
- Improving a company's image because of contributions to carbon footprint reduction and South Africa's sustainable development goals.

Key setbacks of the incentive

The main setback of the incentive is that it is a loan that needs to be paid back, unlike a cash grant from an investor. The loans are available at prime less 2%, but if the loan amount is larger than the maximum of R50 million, then standard conditions apply.

The payback period is limited to 15 years. The IDC fees also apply, including a raising fee of 1% and a commitment fee of 0.5% per annum. All IDC credit policies and procedures apply.

Eligibility

The incentive is available to companies in the private sector that plan to implement financially feasible energy efficiency projects that have substantial energy or CO₂ emission savings or projects that aim to offset grid-connected electricity through self-use renewable energy.

Funding is available for all sectors that fall within the IDC's funding mandate and can be used for efficient and innovative equipment and technologies. Priority will be given to companies that have less than or equal to, R51 million turnover, R55 million assets and 200 employees.

Qualifying questions

There are only four qualifying questions formulated for GEEF. These can be seen in Table 2-16. These questions are formulated using a summarised set of information and are in no way absolute. They, however, formulate a guideline for the incentive, highlighting key points of information.

Table 2-16: Qualifying questions for GEEF

Qualifying questions for GEEF	Answer
Does the project adhere to the minimum and maximum loan requirements?	Yes
Have all other options for project funding been explored, is a loan the last resort?	Yes
Will the company be able to pay back the loan over a period of 15 years or less?	Yes
Does the project focus on utilising renewable energy sources or cogeneration of energy?	Yes

2.4.8 SUMMARY OF ENERGY EFFICIENCY INCENTIVES

The summarised information for each incentive is still an overwhelming amount. Therefore, the incentives are further summarised in a table to create an overview of the fundamentals of each incentive. The headings used for the table are based on the criteria used to summarise the incentives with the exception of the governmental department.

The incentive summary can be found in Table 2-17 where the headings are as follows:

- Name;
- Objective, main aim of the incentive;
- Governmental department, which sphere of the government offers or regulates the incentive;
- Benefit, advantages of the incentive;
- Setback, disadvantages of the incentive; and
- Eligibility, who can apply for the incentive.

The table provides a great overview of each incentive, but it does not offer the user an easy way of selecting an incentive. Therefore, a structured approach is required to select

an EEI. The structured approach should be applied to the summarised information incorporating the qualifying questions.

A study on energy efficiency funding in the absence of IDM for ESCos was conducted [75]. This study included a similar comparison table, where the headings coincided with the heading seen in Table 2-17. This provides a simple verification for the information used to summarise the incentives. However, no approach is offered to select an appropriate EEI for a project or company.

Table 2-17: Summary of industrial EEIs

Incentive	Objective	Government department	Benefit	Setback	Eligibility
12L	To incentivise the energy efficiency measures of previously implemented projects	SARS and SANEDI	R0.45/kWh tax deduction for verified energy efficiency savings	Appointment of an M&V team. No concurrent benefits. No renewable energy	Any South African owned company that derives income in the operation of a trade
12I	Invest in manufacturing assets to improve South Africa's manufacturing sector	The dti and SANEDI	Large scale Greenfield and Brownfield investments	Only offered to large scale projects. Incentives need 4/8 points to qualify.	Major Divisions 3: Manufacturing in the SIC of All Economic Activities
IDM	Offset electricity from the national grid.	ESKOM	R/MW equivalent for verifiable electricity savings.	Appointment of an M&V team. Only available for electricity reducing projects	Any South African owned company that meets the MW requirements
NCPC-SA	Promote the implementation of resource efficiency and CP	The dti and CSIR	Free energy audit	No funding provided	SMMEs and sectors identified in IPAP
MCEP-PI	Increase the productivity and competitiveness of businesses	The dti	Funding for a percentage of the total investment	Funding only available for new equipment. No concurrent benefits.	Major Divisions 3: Manufacturing in the SIC of All Economic Activities
GEEF	Address the funding gap between actual investments and provided incentives	The dti, IDC and KfW	Loan amount at a preferred interest rate	IDC fees apply, including a raising fee of 1% and handling fee of 0.5%	Any South African owned company
MCEP-LF	Increase the productivity and competitiveness of businesses	The dti and IDC	Loan amount at a preferred interest rate	Loan period is only 4 years.	Major Divisions 3: Manufacturing in the SIC of All Economic Activities

2.5 CONCLUSION

This chapter addresses the problem statement by providing relevant information on:

- Selecting an incentive;
- Developing a structured approach; and
- EEIs in South Africa.

Methods for selecting EEIs are investigated. However, the established information does not address the problem statement. Therefore, a new structured approach needs to be developed.

Structured approaches from different disciplines are examined and key contributions from each case study are identified and tabulated. These contributions will be incorporated into the methodology of selecting an incentive.

The range of incentives selected in Chapter 1 are summarised according to the objectives, benefits, setbacks and eligibility of each incentive. Qualifying questions are formulated for each incentive, where a qualifying question is defined as a question that determines the viability of an incentive. The incentives are further summarised and the results are tabulated.

From the literature reviewed on EEIs in South Africa, it can be reasoned that selecting an appropriate incentive is a timely process. Each incentives has a website page, a main document (law or regulations), supporting documentation, conference proceedings and brochures. Locating and summarising this information involves numerous man-hours. Therefore, there is a need to develop a structured approach to select an incentive. This will ensure company resources are not wasted on investigating incentives that are not viable.

A structured approach to select energy efficiency incentives applicable to industry:

Development of a structured approach to select incentives

3 DEVELOPMENT OF A STRUCTURED APPROACH TO SELECT INCENTIVES

3.1 PREAMBLE

This chapter is an expansion of a paper presented at the Industrial and Commercial Use of Energy conference. The conference paper was written by the author (M. Budge) [76]. The paper briefly summarises applicable incentives, provides a flow diagram for selecting incentives and applies the method to various case studies.

The literature review presents a brief overview of the extensive amount of information available on EEs. Sorting all of the information into a constructive format is challenging. Therefore, a structured approach needs to be developed. Due to the complex nature of the information, the methodology for developing this structured approach is broken down into four main steps as shown in Figure 3-1.

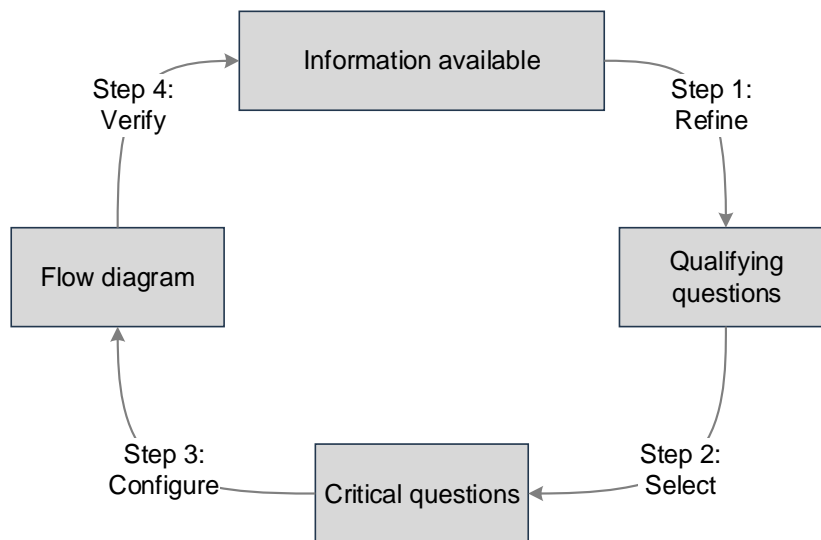


Figure 3-1: Basic visual representation of the methodology

Step 1: Refine

The first step of the methodology is to refine the available information. This is done by selecting a condensed range of information to summarise. The outcome of this step will be a list of qualifying questions. Where a qualifying question is defined as a question, it determines the viability of an incentive. The qualifying questions are compiled for each incentive, after the literature has been reviewed for that incentive.

Step 2: Select

Thereafter, the critical questions are selected. This is done by eliminating, grouping and selecting questions from the list of qualifying questions. This step is added to the structured approach because the list of qualifying questions can become very long. The outcome of this step will be a condensed list of critical questions. Critical questions are defined as questions that are used to distinguish between the incentives.

Step 3: Configure

The third step is to configure the critical questions into a more practical format. The critical questions are categorised and configured to develop a practical and easy to use flow diagram. The flow diagram will enable the user to find a suitable incentive for a project.

Step 4: Verify

The final step is to verify the methodology. This is done by selecting an incentive to verify and compare the questions from the flow diagram to the literature reviewed. If the method is proved to be invalid, then the outcome of this step will be to reassess the information available. This in turn restarts the cycle, the approach is repeated until a valid solution is found.

The structured approach incorporates the various notable contributions from the six case studies described in Chapter 2. The summary of the notable contributions is presented in Table 2-1 and repeated in Table 3-1, with the addition of an extra column to indicate where the contribution is utilised.

Table 3-1: Structured approach notable contributions

Case study	Notable contribution	Step utilised
Urban water infrastructure asset management	The cycle approach to problem solving ensures that the approach is correctly verified and validated	Backbone of the methodology and verification
Hearing aid selection	The flow diagram that allows a user to quickly identify a solution	Configure
Designing performance measures	The list of questions that form the assessment criteria to measure performance	Refine

Case study	Notable contribution	Step utilised
Warehouse design	Reviewing literature according to categories to easily compare key components	Refine
Occupational hygiene considerations for selection of chemical control strategies	The categorisation of data from the literature review to develop a model	Select
Evaluation and comparison of alternative	The exclusion of obvious methods or components that are not applicable or inferior	Select

Each of the four steps of the structured approach will be discussed in more detail throughout this chapter. The contribution from the literature chapter will be explained in each step. Finally, conclusions are drawn for the development of the structured approach.

3.2 REFINE THE INFORMATION AVAILABLE

Overview

There is a vast amount of information available for incentives. Refining the information minimises the amount of time spent on processing the information. Therefore, refining the available information is the first step of the structured approach. The process of refining the information can be broken down into two sections:

- Select a range; and
- Summarise.

The refining process is represented in Figure 3-2.

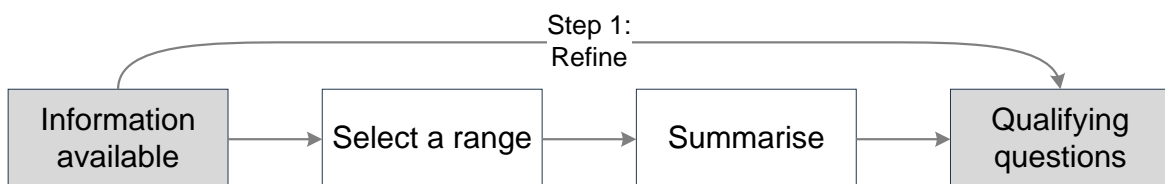


Figure 3-2: Visual representation of the methodology – step 1

Selecting a range is added so that time is not wasted by investigating incentives that do not form part of the scope of the study. Summarising the data from various sources ensures that more than one source is used to verify the information. This is important because there is a wide range of sources available for each incentive and the information can often be conflicting.

Select a range

The definition of a range is the area of variation between two limits. For the structured approach, the limits are based on criteria provided by a problem statement. A list of these criteria should be formulated and the information should be refined accordingly. Examples of criteria could include the following:

- Incentives specific to a certain country;
- Incentives specific to different sectors, i.e. industry, building or transport;
- Governmental or privately managed incentive schemes; and
- Disincentives or negative reinforcement such as penalties or taxes.

The number of different criteria that can be used to select a range is linked to the complexity of the problem statement. However, using more criteria to refine the information will result in less information to summarise. The circle represented in Figure 3-3 shows the impact that the number of criteria will have on the total amount of information, where the circle size represents the amount of information.

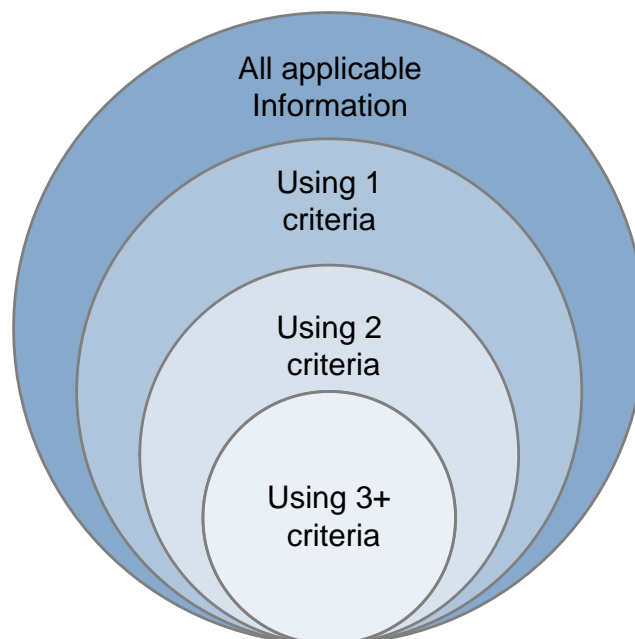


Figure 3-3: Selecting a range

Summarise

The incentives that have been selected using the criteria, are summarised to understand the fundamentals better of what makes each incentive different. Working with a condensed summary of information also speeds up the process of selecting an incentive.

However, summarising the information may not always include enough material to make an informed decision. Therefore, each incentive should be summarised according to the same predetermined set of criteria. This will ensure that the incentives are compared according to the same conditions.

The type and amount of criteria selected is dependent on the type of incentives, the number of incentives and the amount of available information. Examples of criteria could include:

- Who is funding the incentive;
- Advantages or disadvantages of the incentive;
- Incentive eligibility; and
- Amount of funding or support offered.

Throughout the summarising process, qualifying questions should be composed for each incentive. The qualifying questions serve as a checklist to determine if the project and the company can qualify for the incentive. This checklist also aids in highlighting the distinguishing characteristics of the incentive. Types of qualifying questions include:

- Does the project require funding, if so how much;
- Does the project require expert knowledge;
- Is the company willing to pay off a loan if necessary; and
- Is the project a Greenfield or Brownfield project?

The process of summarising the information can be seen in Figure 3-4.

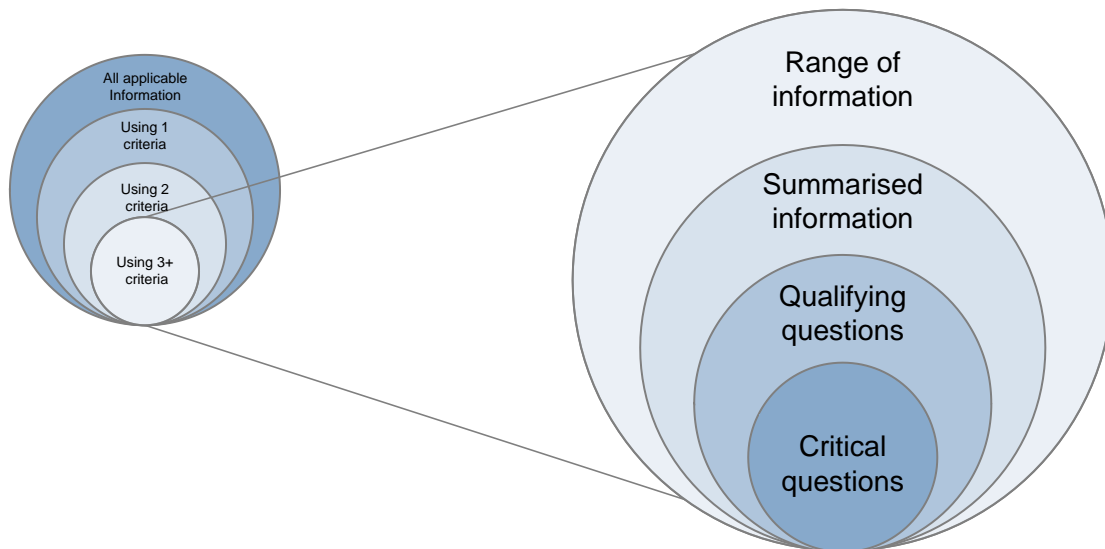


Figure 3-4: Refining and summarising the available information

The circle on the left of the figure is redrawn from Figure 3-3. The large circle on the right of the figure is an exploded view of the range of information that needs to be summarised. In this figure, the circle size represents the resulting amount of information used, while the colour signifies how condensed the information is.

The second largest circle represents the summarised information and the circle one size smaller represents qualifying questions. The smallest circle represents the critical questions. The critical questions are selected and discussed in step 2 of the structured approach.

Notable contributions from the literature

The contributions from two case studies are utilised in refining the information. The first contribution is from the study conducted on warehouse design [50], where various categories are used to summarise the data. This is incorporated in both selecting a range and summarising the information.

The second contribution is from the study on designing performance measures [48]. A list of questions is compiled to serve as an assessment criteria to measure the performance of a business. This is used when summarising the information where a list of qualifying questions is compiled for each incentive.

3.3 SELECT CRITICAL QUESTIONS

Overview

The list of qualifying questions can be extensive. Therefore, to speed up the process of selecting an incentive, a shorter and more condensed list of questions should be created. The questions that form part of the shortened list are referred to as critical questions and defined as questions that are used to distinguish between the incentives. The process of selecting critical questions can be broken down into three sections:

- Eliminate;
- Group; and
- Select.

The selection forms part of the second step of the structured approach and can be seen in Figure 3-5.

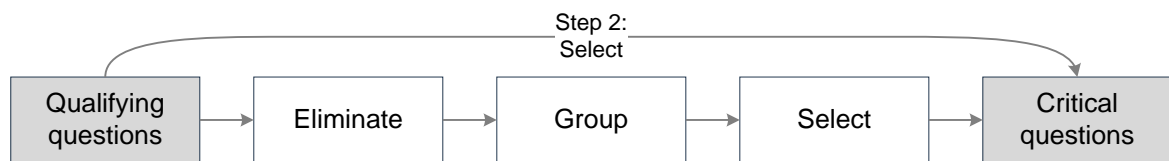


Figure 3-5: Visual representation of the methodology – step 2

Eliminate

The most efficient way to select critical questions is to narrow down the list of qualifying questions, using elimination. The process of elimination consists of the following steps as illustrated in Figure 3-6:

1. List the qualifying questions;
2. Determine criteria to eliminate the qualifying questions;
3. Highlight questions that comply with the criteria;
4. Eliminate the highlighted questions; and
5. List the remaining questions.

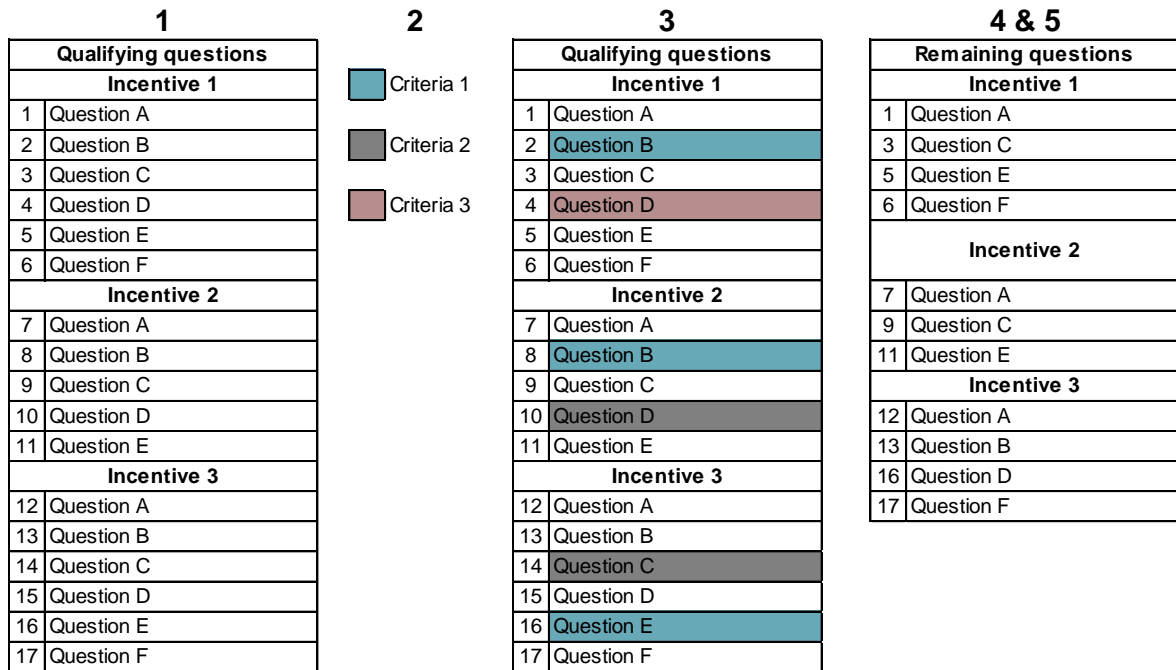


Figure 3-6: Process for eliminating qualifying question

The qualifying questions for each incentive are drawn up separately after the literature has been reviewed. Therefore, one long list needs to be created containing all the qualifying questions for each incentive.

Thereafter, the criteria for eliminating questions are selected. The criteria are based on whether the qualifying question will help distinguish between the different incentives. If the question is too broad, it is eliminated from the list. Examples of criteria are as follows:

- Questions that focus on a company;
- Questions that focus on a project; and
- Questions that focus on a specific incentive.

The criteria are colour coded and the qualifying questions that fit the selected criteria are highlighted accordingly. The highlighted questions are eliminated from the list and the remaining qualifying questions are now re-listed.

Group

The result after elimination is a reduced list of qualifying questions. However, this list is still too complex to find a quick solution to the problem statement. Therefore, the next step will be to group the incentives and qualifying questions. Figure 3-7 is an example of how the incentives are grouped.

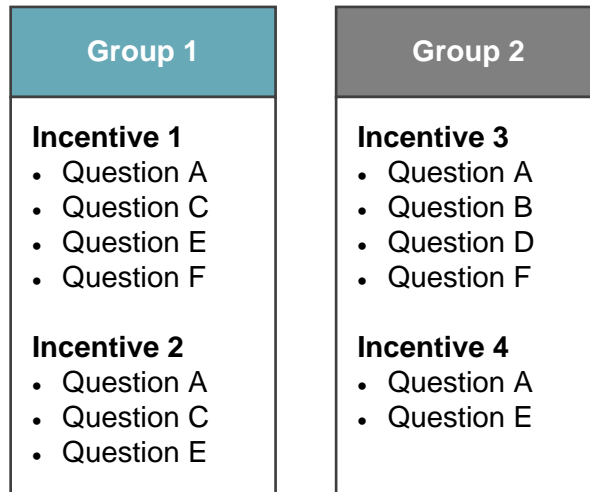


Figure 3-7: Grouping structure for the incentives and qualifying questions

The incentives are grouped based on one commonality such as time, funding or incentive provider as illustrated in Figure 3-8. This is a trial and error process to find an appropriate commonality. The number of groups and the number of incentives in each group are dependent on the selected commonality.

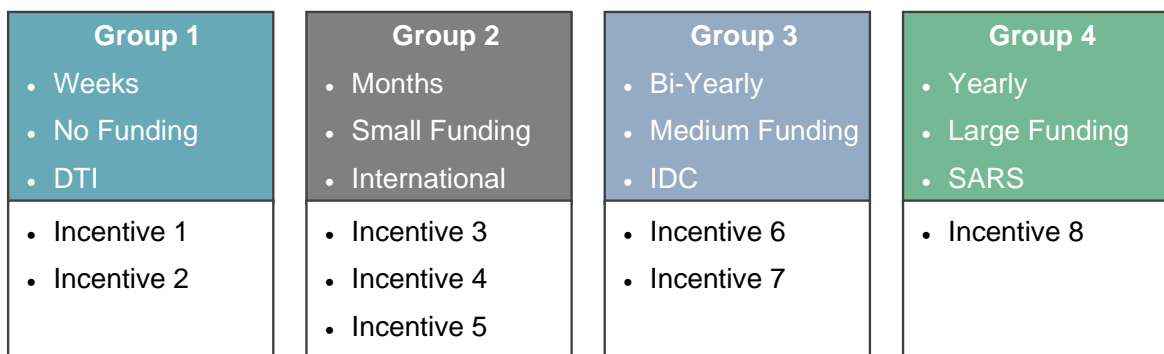


Figure 3-8: Grouping the incentives according to a commonality

The incentives are grouped to aid in the next step of the structured approach, the selection of critical questions. Where qualifying questions are selected individually to separate the different groups and incentives, this is explained in more detail in the next section.

Select

The critical questions are selected from the remaining list of qualifying questions. Critical questions are selected in two phases as illustrated by Figure 3-9. The first phase is shown on the left of the figure and the second phase is shown on the right.

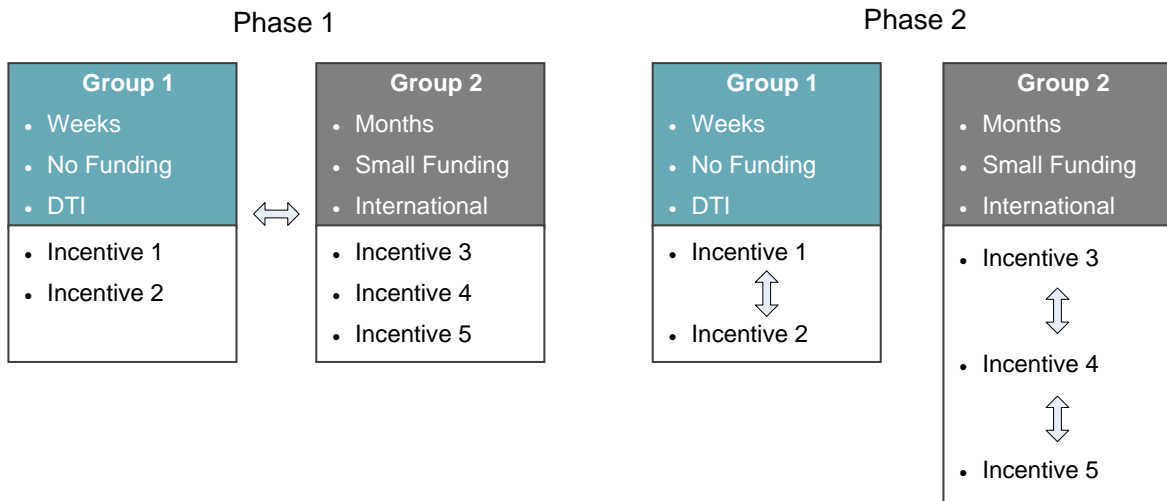


Figure 3-9: Reason for grouping the incentives

During the first phase, one question is selected from each group that separates that group of incentives from the remaining groups. If four groups of incentives exist, then three questions will be selected.

The second phase is to select a question from each group to separate the incentives within that group. If there are two incentives in a group, then only one question is selected. However, if there are three incentives in a group, then two questions will be selected.

The process for selecting critical questions is illustrated in Figure 3-10 and summarised below the figure.

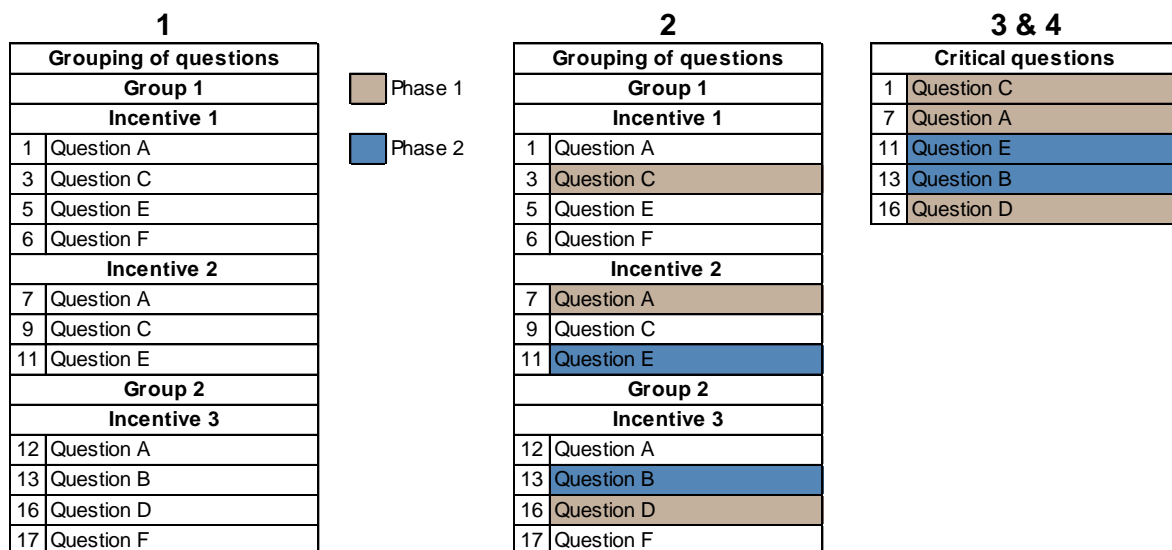


Figure 3-10: Process for selecting critical question

1. List the incentives and remaining qualifying questions under the grouped structure;
2. Colour code the two phases and highlight the questions that comply with either phase;
3. Remove the questions that have not been highlighted; and
4. List the critical questions.

The result of the selection process is a list of critical questions. Each critical question can now be shortened to improve readability of the flow diagram created in step three of the structured approach. Once all the questions have been rewritten, the list will pose as the final list of critical questions.

For example, the two questions below would be shortened as follows:

- Is the duration of the project, from start to finish, less than a year?
 - Will the project take less than a year?
- Can the data submitted be validated and verified for both the baseline period and assessment period?
 - Can the data be validated?

Notable contributions from the literature

Contributions from two case studies in the literature review are used in the second step of the structured approach. The first contribution stems from the evaluation and comparison of alternative transport plans [52]. The process is simplified by eliminating transport plans that were clearly inferior. This is utilised in the step of elimination where questions that do not help select an incentive are eliminated.

The second contribution is from a study conducted on the selection of chemical control strategies [51]. The study further categorised the information received from the literature review to aid in developing a model. This contribution is used to categorise the incentives into groups to aid with the selection of critical questions.

3.4 CONFIGURE THE CRITICAL QUESTIONS

Overview

Applying the critical questions to identify viable incentives may prove to be challenging without background knowledge of each incentive. This is due to the list offering abstract questions without indicating their underlying interactions. Graphically demonstrating the interaction will thus further simplify the application of the process and the evaluation of results.

The third step of the structured approach is to configure the critical questions to result in a flow diagram. This is illustrated in Figure 3-11, using the following steps:

- Categorise; and
- Configure.

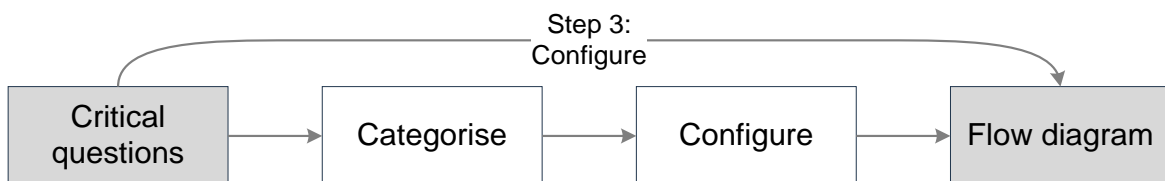


Figure 3-11: Visual representation of the methodology – step 3

Categorise

The critical questions are no longer associated with a specific incentive or group. Therefore, the critical questions need to be categorised to aid in configuring a flow diagram. Examples of categories include:

- Type or amount of funding;
- Time to complete implement project;
- Questions applicable to the company;
- Questions applicable to the incentive; and
- Questions applicable to a project.

The number of categories is dependent on the number of questions as well as the type of questions. The critical questions are inserted separately into blocks as shown in Figure 3-12. Each block is then colour coded to match the different categories. The questions are inserted into the blocks so that they can be configured easily to form a flow diagram.

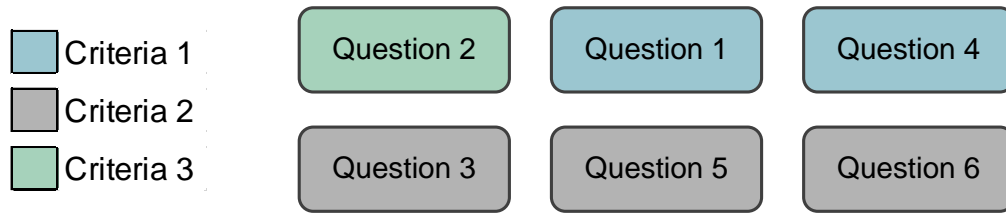


Figure 3-12: Colour coded categorisation of critical questions

The incentives are also inserted into blank blocks as shown in Figure 3-13. The incentives can now be manoeuvred along with the critical questions like a puzzle to create a flow diagram.

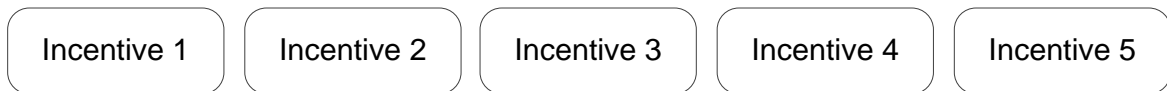


Figure 3-13: Blank blocks for incentives

Configure

The critical questions and incentives are now configured to form a flow diagram. The questions are placed in order of category, where the category with the least number of questions is placed first and the category with the most number of questions is placed last.

Each question should be placed with the purpose of singling out an incentive. Consequently, each question should be linked to another question and an incentive, as illustrated in Figure 3-14. The links between the questions and incentives are a series of “yes” or “no” answers.

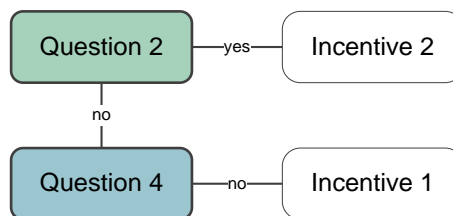


Figure 3-14: Configuring critical questions example 1

However, in some cases – if the question is too broad and does not easily single out an incentive – two questions can be linked to the one question. This is illustrated in Figure 3-15.

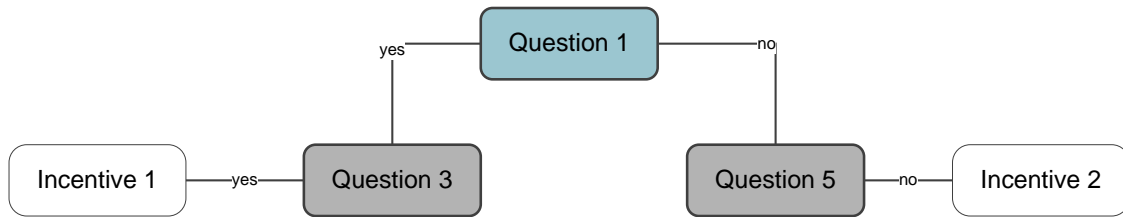


Figure 3-15: Configuring critical questions example 2

A flow diagram as illustrated in Figure 3-16 is the final result of configuring the critical questions and incentives. Configuring the critical questions is highly influenced by the summarised information, the incentives and the formulated questions. Therefore, configuring the flow diagram can be labelled as a “trial and error” process, which is dependent on the fourth and final step of the structured approach; the verification.

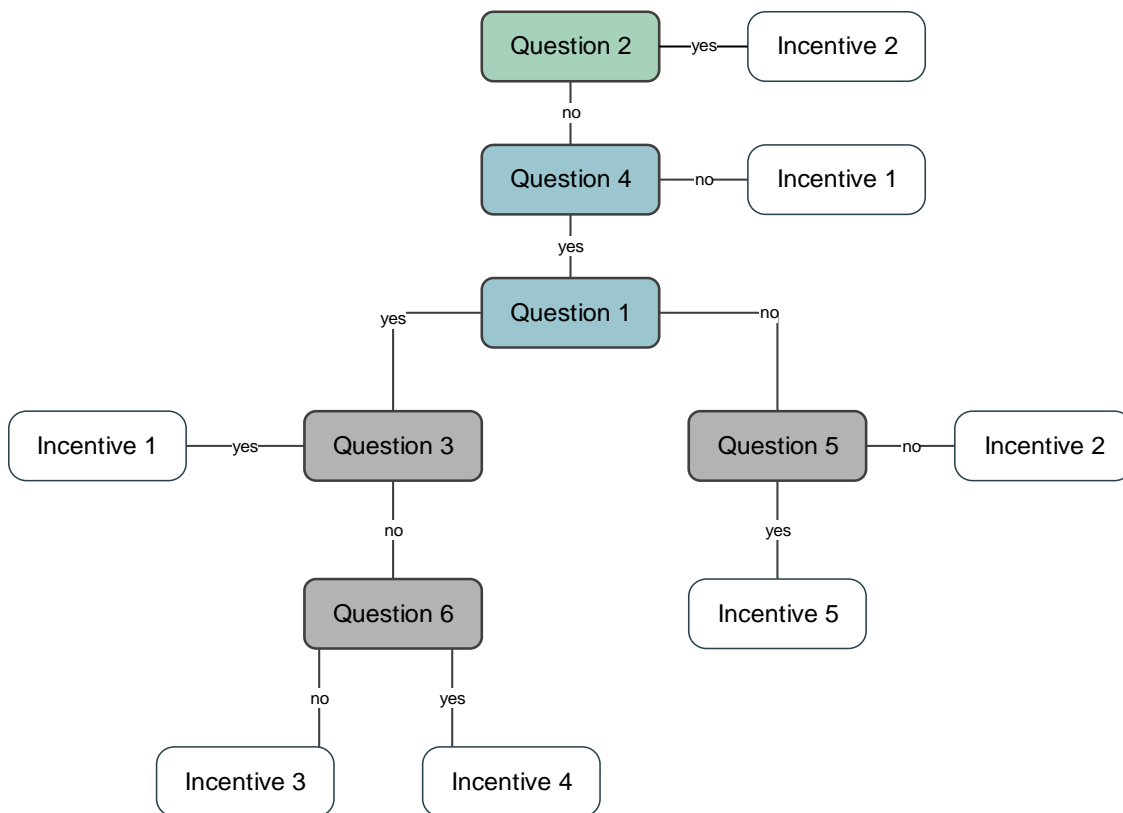


Figure 3-16: Example of a flow diagram layout

The result is a simplified approach to identify viable incentive schemes. The visual presentation of the diagram also enables users with no background knowledge to apply the process. Conversely, the information used to create the flow diagram is abridged, thus the process is not absolute and the possibility exists that more than one incentive is viable. In such case, more information is required and the impact of each incentive has to be compared and quantified.

Notable contribution from the literature

A contribution from the structured approach to hearing aid selection [47] is used in step three of the methodology. The main result of the hearing aid selection is a flow diagram used by doctors to determine correctly an appropriate hearing aid for a patient. Step three incorporates this selection and a flow diagram is developed to determine an appropriate incentive for a project or company.

3.5 VERIFY THE METHODOLOGY

Overview

The last step of the structured approach is to verify the method. Verification is done to curb human error throughout the process and to ensure the information is kept current. Figure 3-17 shows the verification that is done in three sections, namely:

- Select;
- List; and
- Compare.



Figure 3-17: Visual representation of the methodology – step 4

Select

The structured approach for each incentive needs to be verified, but not all the incentives can be verified at once. Therefore, one incentive is selected for verification, but the process is repeated for each incentive. For demonstrative purposes, incentive five, from Figure 3-16, is selected for verification, as shown in Figure 3-18.

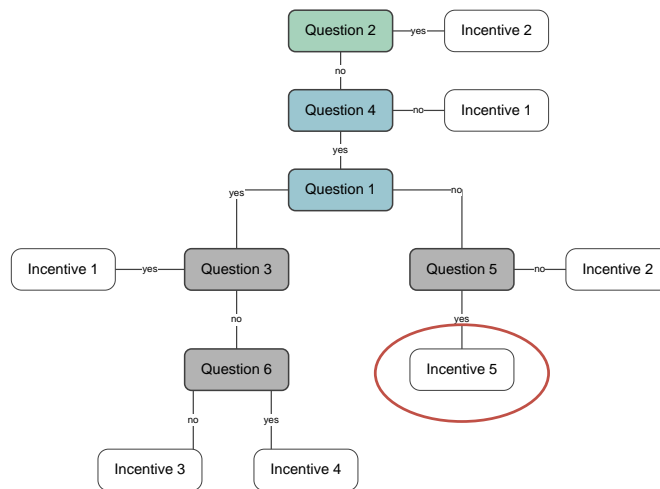


Figure 3-18: Incentive selection for verification

List

Once the incentive is selected, the path of questions leading to that incentive is identified, as shown in Figure 3-19. The questions that do not form part of the path are greyed out.

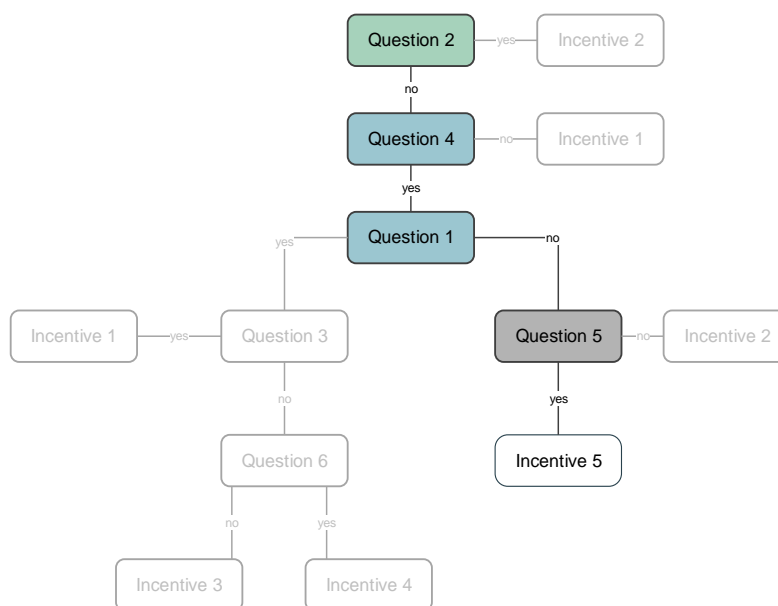


Figure 3-19: Flow diagram path for incentive five

For incentive 5, the questions that form part of the path are as follows:

- Question 2;
- Question 4;
- Question 1; and
- Question 5.

Compare

Thereafter, the questions and answers from the path are listed in a table. Every question is evaluated and verified according to the literature reviewed in Chapter 2. An example of the table, using the questions and answers from incentive 5, can be seen in Table 3-2.

Table 3-2: Verification of the methodology

Verification of selected incentive		
Question	Ans.	Verification Reasoning
Question 2	No	Supported by literature
Question 4	Yes	Supported by literature
Question 1	No	Supported by literature
Question 5	yes	Supported by literature

The verification process is now repeated for each incentive. If the questions and answers for an incentive are found to be invalid, the structured approach should be started again from the beginning. The qualifying questions for that incentive are re-evaluated and questions are changed accordingly. Once the structured approach has been verified for each incentive, the approach can be applied to case studies for validation.

Notable contribution from the literature

The study on urban water infrastructure asset management [45] provided a structured approach in the form of a cycle. The cycle approach ensures that the methodology is correctly verified and validated. This cycle is incorporated as the backbone to the structured approach, where the final step of the approach is verification. The methodology is assessed and the structured approach is restarted if the method is found invalid.

3.6 CONCLUSION

Each of the four steps in Figure 3-1 have been expanded and explained throughout the chapter. The final resulting structured approach can be seen in Figure 3-20. The figure illustrates all the processes that occur between each main step. The main outcome of each step is highlighted in grey.

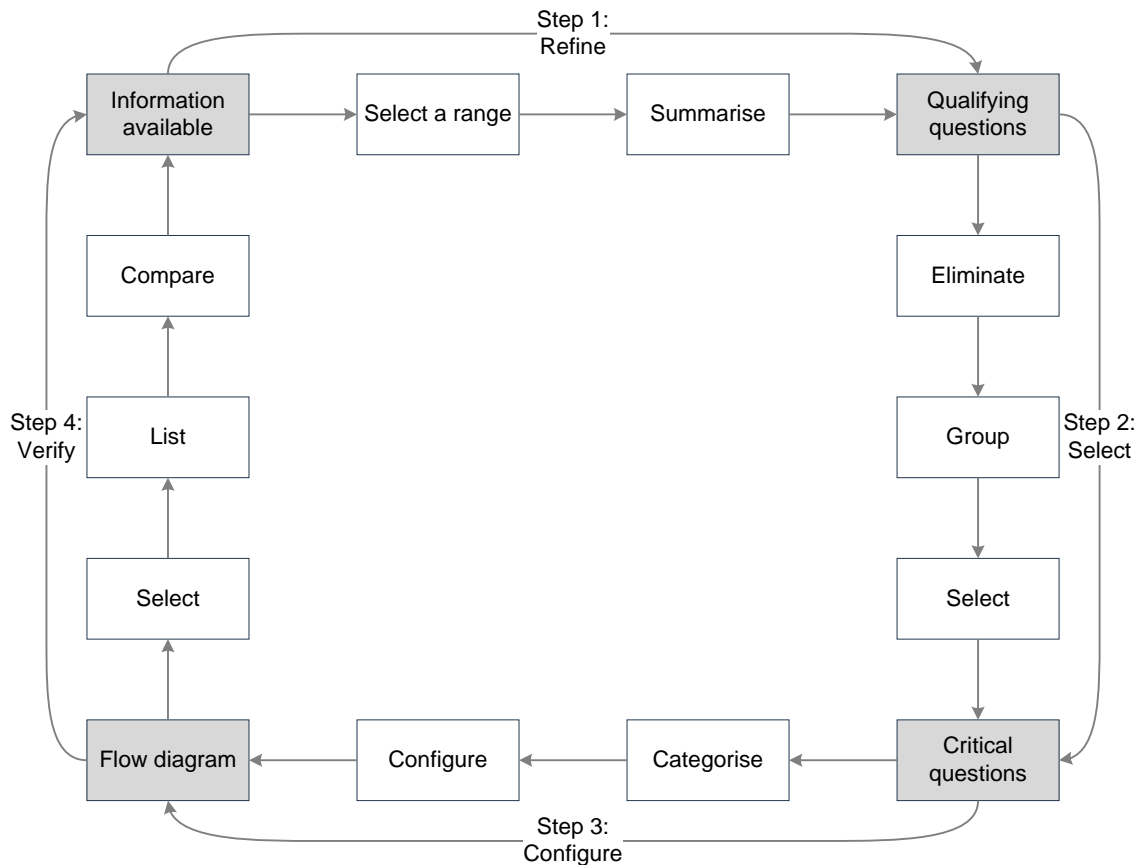


Figure 3-20: Result of the structured approach

The structured approach is designed to be a cycle, starting and ending with the information available. This is because the regulations for incentives often change, new incentives are formed and older incentives are phased out. The key to the structured approach is to stay current with the different incentives and adapt the flow diagram to the new changes.

The available information is refined and qualifying questions are drawn up. From the long complex list of qualifying questions, critical questions are selected. These critical questions are configured to create a flow diagram. The flow diagram is validated and updated when new information is available.

As stated in the literature review, selecting and summarising incentives is a time-consuming process. Therefore, the main outcome of the structured approach is a flow diagram of condensed available information. It is practical and easy to use, especially if the user has no background knowledge of each incentive. The flow diagram delivers fast answers to complex questions.

Throughout the chapter, the main contributions from the various case studies examined in Chapter 2 are summarised. Each contribution is incorporated in the design and methodology of each step to form a complete structured approach.

This chapter addresses the problem statement by developing a structured approach to select an incentive. The structured approach now has to be applied to various industrial EEIs in South Africa.

Chapter 4

A structured approach to select energy efficiency incentives applicable to industry:

Application of methodology and case studies

4 APPLICATION OF METHODOLOGY AND CASE STUDIES

4.1 PREAMBLE

In this chapter, the structured approach developed in Chapter 3 is implemented, using the information provided in Chapters 1 and 2. Each step depicted in Figure 4-1, repeated from Figure 3-20, is applied to the literature and discussed along with graphical representation where applicable.

Step 1 of the structured approach is refining the information. An example of this step is provided in Chapters 1 and 2. The remaining three steps are implemented in this chapter. The qualifying questions are eliminated, grouped and critical questions are selected. This is followed by categorising and configuring these critical questions to form a flow diagram.

The flow diagram is the main outcome of the structured approach, but before it can be applied to various case studies, it has to be verified. Verification is done by selecting an incentive to verify, listing the applicable questions from the flow diagram and comparing the questions and answers to the literature provided.

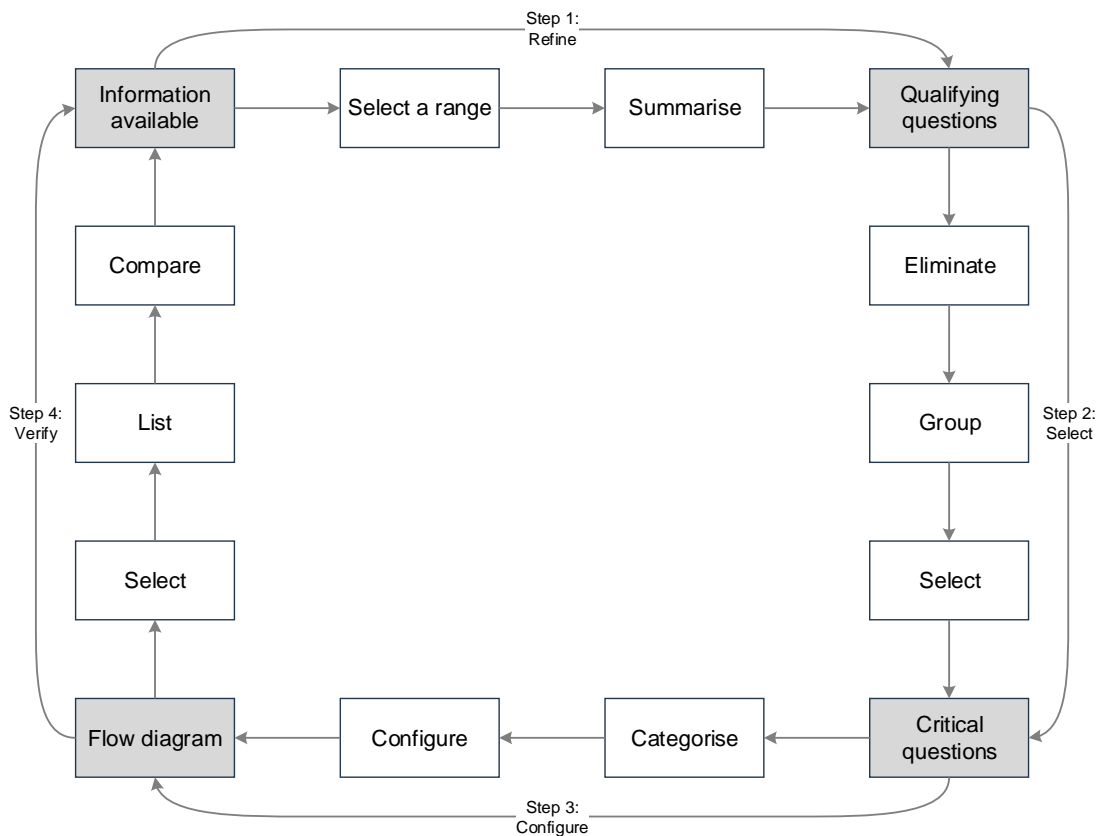


Figure 4-1: Result of the structured approach

Once the method has been verified, the approach can be validated by applying the flow diagram to practical case studies to select a suitable incentive. Eleven case studies from different industries are used to validate the methodology.

Lastly, the results from the case studies are discussed and the chapter is concluded.

4.2 APPLICATION OF THE METHODOLOGY ON SOUTH AFRICAN INCENTIVES

4.2.1 STEP 1: REFINE

Select a range

Selecting a range of incentives to include in the study is covered in Chapter 1. The criteria used to select the range are based on the given problem statement:

Develop a structured approach to select industrial EEIs.

The incentives that comply with the restrictions of the defined range are selected and included in the literature review. The criteria used to select the range are as follows:

- Incentives specific to energy efficiency initiatives;
- Initiatives in South Africa by a South African company;
- Incentives focused on the industrial sector;
- Incentives that can be applied to more than one type of industry; and
- Exclusion of disincentives or future planned incentives.

Summarise

Seven incentives comply with the range and need to be investigated and summarised. This is covered in Chapter 2 of this dissertation, the literature review. The incentives have been summarised according to set criteria to improve the comparability. These criteria are listed below:

- General information and aim of the incentive;
- Key benefits of the incentive;
- Key setbacks of the incentive;
- Eligibility; and
- Qualifying questions.

The first criterion is a general overview and aim of the incentive. This is added to determine why the incentive exists and who funds the incentive. The second and third criteria are the type of benefits and setbacks offered by the incentive. Lastly, the eligibility of the incentive is added to determine what types of projects and which companies can apply for the incentive.

Result – Qualifying questions

The qualifying questions are formulated after the literature for each incentive has been reviewed. These questions can be seen in Chapter 2, after the summary of each incentive or in Table 5-1, Appendix B. The resulting list of qualifying questions is lengthy and is therefore, not added to this section of the paper.

Examples of qualifying questions include:

- Does the project require a capital investment?
- Does the project adhere to the minimum and maximum loan requirements?
- Does the project save the minimum amount of the electricity required?
- Is the project a Greenfield project?

4.2.2 STEP 2: SELECT

Eliminate

There are over 50 qualifying questions composed in the literature review. To minimise this list, questions are eliminated according to different criteria. For this application, two different criteria are used to eliminate the questions. Figure 4-2 has been copied from Figure 3-6 in Chapter 3 to illustrate this process. The actual process can be seen in Table 5-2, Appendix C. The table is left out of this chapter to improve the readability of the document.

1		2		3		4 & 5	
Qualifying questions				Qualifying questions		Remaining questions	
Incentive 1		■ Criteria 1		Incentive 1		Incentive 1	
1	Question A			1	Question A	1	Question A
2	Question B	■ Criteria 2		2	Question B	3	Question C
3	Question C			3	Question C	5	Question E
4	Question D	■ Criteria 3		4	Question D	6	Question F
5	Question E			5	Question E	Incentive 2	
6	Question F			6	Question F	7	Question A
Incentive 2				Incentive 2		9	Question C
7	Question A			7	Question A	11	Question E
8	Question B			8	Question B	Incentive 3	
9	Question C			9	Question C	12	Question A
10	Question D			10	Question D	13	Question B
11	Question E			11	Question E	16	Question D
Incentive 3				Incentive 3		17	Question F
12	Question A			12	Question A		
13	Question B			13	Question B		
14	Question C			14	Question C		
15	Question D			15	Question D		
16	Question E			16	Question E		
17	Question F			17	Question F		

Figure 4-2: Elimination of qualifying questions

The first criterion is to eliminate questions that focus on the company applying for the project, instead of questions focusing on the actual project. These questions are highlighted in blue in Table 5-2, Appendix C. Examples of questions include:

- Has the company received funding from other government sources that can be considered concurrent benefits?
- Does the company qualify as a SMME?

The second criterion is to eliminate questions that are formulated to suit only one incentive. These questions are too specific to distinguish between the different incentives. These questions are highlighted in green in Table 5-2, Appendix C. Examples of questions include:

- Is the project located in a SEZ for a Greenfield Project?
- Will the project be sustainable for the minimum number of years required by the model?

Thereafter, the highlighted questions are removed from the list. The remaining questions are used for the following two steps of the structured approach. These questions will be grouped and then individually selected.

Group

The incentives are grouped according to a common characteristic to select critical questions in a more appropriate manner. Different commonalities are tested on the incentives such as time, advantages, disadvantages, source of funding, etc. The most successful commonality found is the financial payback of each incentive, which is used to group the incentives. Figure 4-3 shows the final grouping.

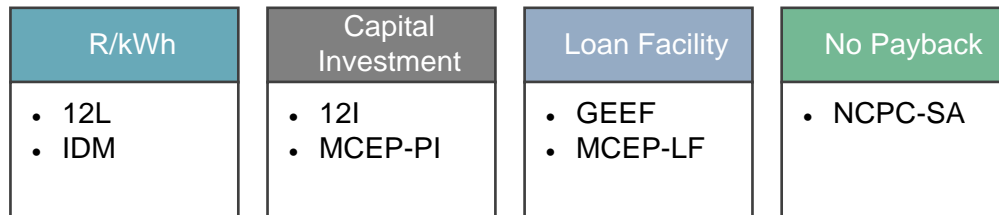


Figure 4-3: Grouping structure for the incentives

The first group is defined as Rand per kWh. The incentives that fall within this group provide a financial kickback for the actual measurable amount of energy saved through the implementation of energy efficiency projects. 12L and IDM both offer a Rand value per kWh saved, making the two incentives easily comparable.

The second group classifies incentives that offer a capital investment for the infrastructure needed to implement an energy efficiency project. The capital investment is paid upfront or throughout the duration of the project in instalments. 12I and MCEP-PI both fall into this category. For each incentive, maximum and minimum investment limits exist; this helps distinguish between the two incentives.

The third group exists for loan facilities; the GEEF and MCEP-LF fall into this group. Even though the capital contribution has to be paid back over a period of time, these two loan facilities are considered incentives because the loans are offered at special premiums for energy efficiency or renewable energy projects.

The fourth and final group is allocated to incentives that have no financial payback. The NCPC-SA is the only incentive that falls under this group. The NCPC-SA offers free energy audits and suggests possible energy efficiency projects.

Select

To minimise the list of questions further, questions are selected individually in two separate phases. Figure 4-4 has been copied from Figure 3-10 in Chapter 3 to illustrate this process. The actual table can be found in Table 5-3, Appendix C. The table is left out of this chapter to improve the readability of the document.

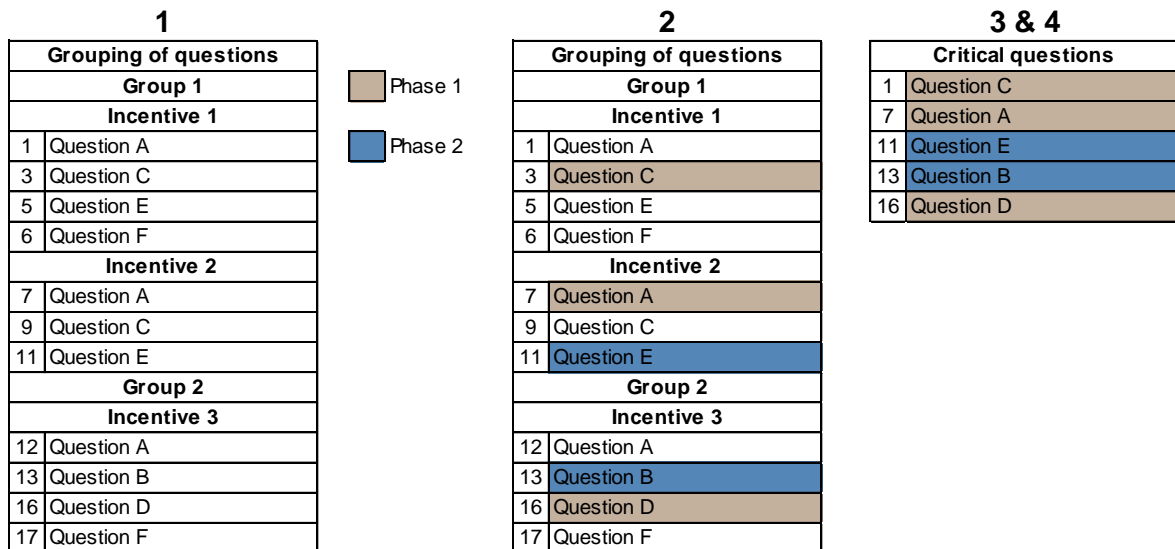


Figure 4-4: Process of selecting critical questions

The first phase is to select one question from each incentive that helps divide the groups defined in Figure 4-3. These questions are highlighted in pink and are shown in Table 5-3, Appendix C.

Examples of questions include:

- Does the project focus on electricity kWh savings?
- Have all other options for project funding been explored, is a loan the last resort?

The second phase is to select questions that divide the incentives in each group defined in Figure 4-3. These questions are highlighted in brown and are shown in Table 5-3, Appendix C. Examples of questions include:

- Is the project a Greenfield project?
- Is there a current proposal for an energy efficiency project?

Thereafter, the questions that are not highlighted are removed and the remaining highlighted list of questions is called the critical questions.

Result – Critical questions

The wording of the final list of critical questions is lengthy and needs to be shortened to aid in the compatibility and readability of the flow diagram designed in step 3. The before and after of such a shortening process can be seen in Table 4-1.

Table 4-1: Simplification of critical questions

Critical questions	
Directly from the literature	Simplified version
Has the project already been implemented, therefore, claiming money for prior energy efficiency kilowatt-hour savings?	Has the project already been implemented?
Does the project focus on electricity kilowatt-hour savings?	Does the project focus on reducing electricity usage?
Does the project require a capital investment?	Does the project require funding?
Is the project a Greenfield project?	Is the project a Greenfield's project?
Are the minimum qualifying assets for the Brownfield project more than R30 million?	Does the project require more than R30 million?
If applying for the MCEP-Cluster incentive does the project applying for the incentive consist of a minimum of five independent companies?	Are there 5 or more companies involved in the project?
Have all other options for project funding been explored, is a loan the last resort?	Is the company willing to take out a loan?
Is there a current proposal for an energy efficiency project?	Has a project been identified?

4.2.3 STEP 3: CONFIGURE

Categorise

The questions are categorised to aid in the design of a flow diagram. Three categories are selected and the questions have been colour coded accordingly. The categories are:

- Introduction;
- Type of funding;
- Type of project.

The questions have been inserted into individual blocks, as shown in Figure 4-5. For the configuration of a flow diagram, the incentives are also inserted into individual blocks as shows in Figure 4-6.

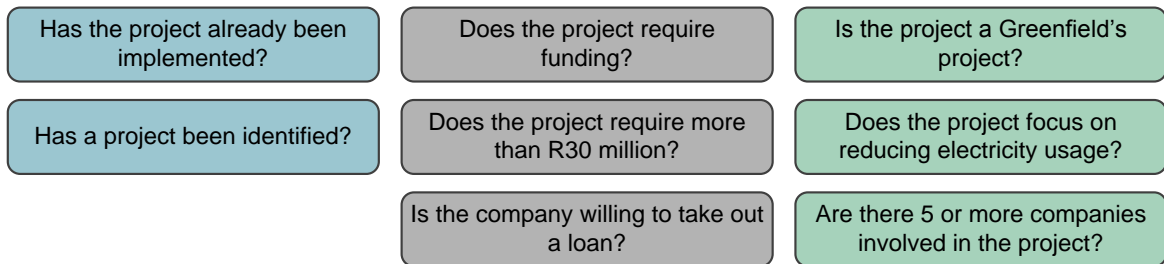


Figure 4-5: Colour coded categorisation of critical questions

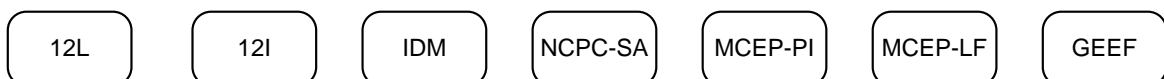


Figure 4-6: Blank blocks for the incentives

The blue category represents the introduction. These questions help to add background knowledge on a project and are vague enough to be applied to most incentives. This forms the starting point for the flow diagram.

The two questions that fall into this category will be:

- Has the project already been implemented?
- Has a project been identified?

The grey category identifies questions that focus on types of funding. This is similar to the groups defined in step 2. Three questions fall into this category:

- Does the project require funding?
- Does the project require more than R30 million?
- Is the company willing to take out a loan?

The green category is for questions that focus on the type of energy efficiency project being implemented. Three questions fall into this category:

- Is the project a Greenfield project?
- Does the project focus on reducing electricity usage?
- Are there 5 or more companies involved in the project?

Configure

Once the questions are categorised, they can be configured to create a flow diagram. The method of configuring the questions is a time-consuming, trial and error process. Configuring the questions was done numerous times before a valid result was obtained.

The final configuration of the questions started with the blue category – the introduction – and then moved on to the grey category, the types of funding and lastly the green category, the types of projects. Only one of the questions was repeated once in the flow diagram.

Result – Flow diagram

The main result of the structured approach can be seen in the form of a flow diagram in Figure 4-7. In the flow diagram, there is only one instance where more than one incentive can be selected. This is the case for the two loan facilities, GEEF and MCEP-LF. There is not enough information provided by the qualifying questions to separate the two incentives.

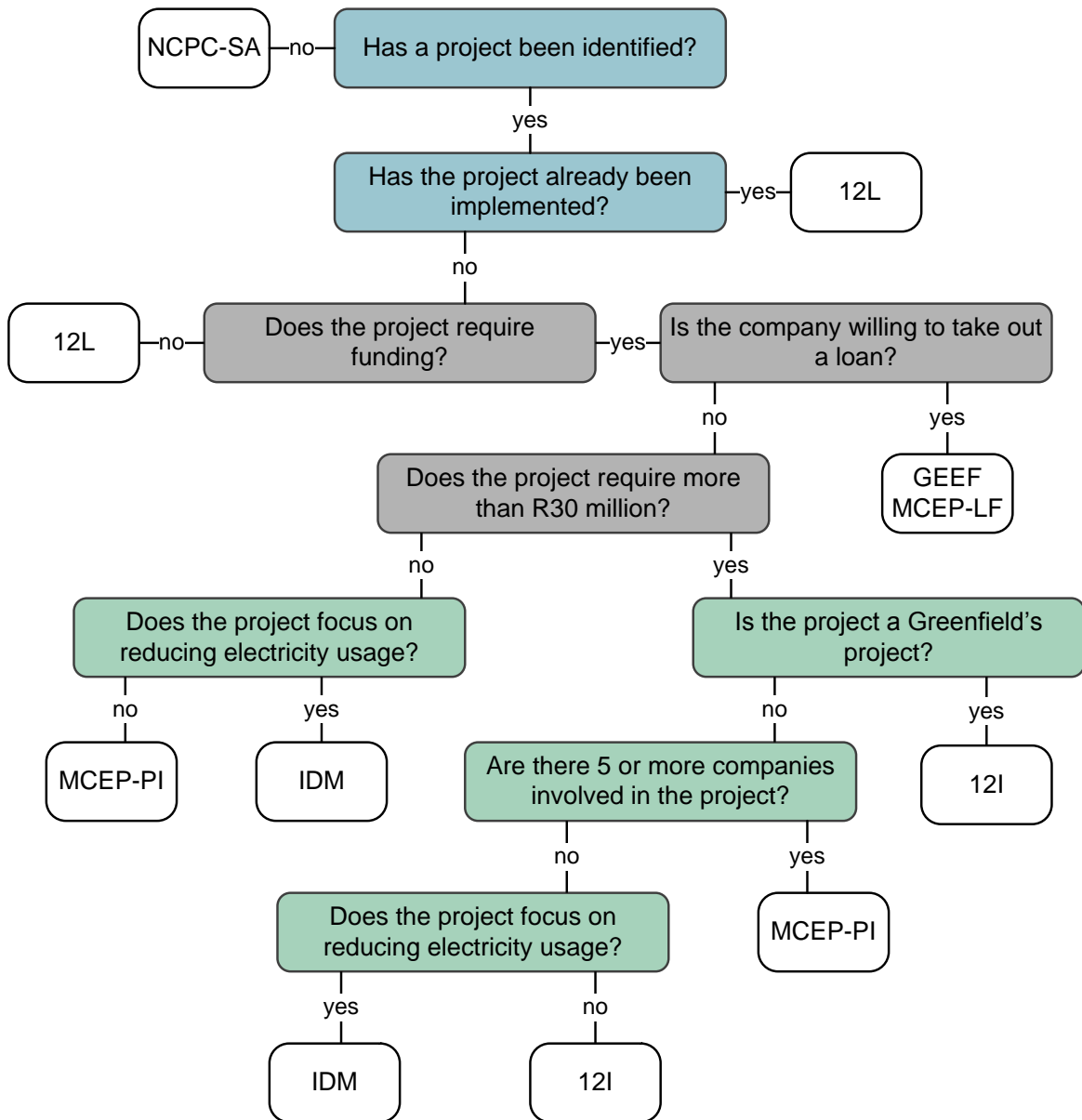


Figure 4-7: Resulting flow diagram from configuration

4.2.4 STEP 4: VERIFY

Select

The flow diagram has now been developed, but before it can be used for practical applications, it has to be verified. The first step in verifying the methodology is to select an incentive to verify. To illustrate the verification process, 12I is selected as shown in Figure 4-8.

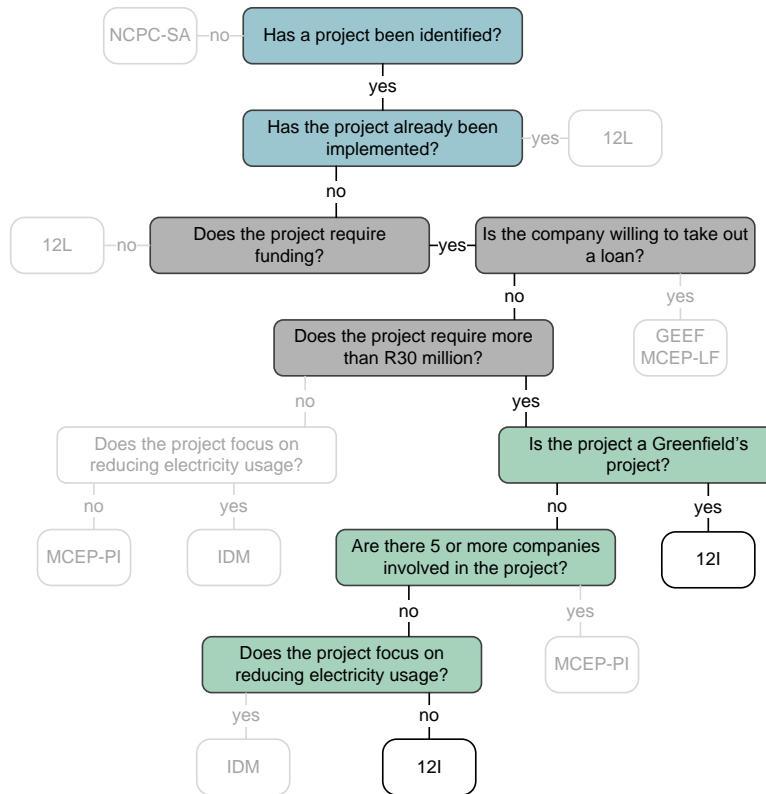


Figure 4-8: Verification of the structured approach for 12I

Verification, however, is repeated for each incentive to ensure the method as a whole is valid. To improve readability, the verification process for the remaining six incentives is moved to Appendix D.

List

Thereafter, the list of questions leading to 12I is identified. From Figure 4-8, it can be seen that 12I appears twice in the flow diagram; therefore, the list of questions needs to include both scenarios. The list of questions is listed below:

1. Has the project already been implemented?
2. Has a project been identified?
3. Does the project require funding?
4. Is the company willing to take out a loan?
5. Does the project require more than R30 million?
6. Is the project a Greenfield project?
7. Are there 5 or more companies involved in the project?
8. Does the project focus on reducing electricity usage?

Compare

The questions for 12I have now been listed. The next step is to compare the questions and answers to the literature provided in Chapter 2. The comparison is covered in Table 4-2 where the third column offers reasoning for the validity of the questions and answer.

Table 4-2: Verification of the structured approach for 12I

Question	Ans.	Verification Reasoning
Has a project been identified?	Yes	NCPC-SA is the only incentive that offers energy audits, so if a project has not been identified, then NCPC-SA should be a first choice.
Has the project already been implemented?	No	12L is the only incentive that offers a financial payback for a previously implemented project.
Does the project require funding?	Yes	One of the main objectives of the 12I tax incentive is to offer financial aid for energy efficiency projects.
Is the company willing to take out a loan?	No	If the company is not willing to take out a loan, then 12I could be a viable solution.
Does the project require more than R30 million?	Yes	The minimum threshold for a 12I project application is R30 million.
Is the project a Greenfield project?	Yes or No	12I is the only incentives that offers funding for both Greenfield and Brownfield projects.
Are there 5 or more companies involved in the project?	No	Due to the fact that the 12I is a tax incentive, only one tax entity may apply for the incentive.
Does the project focus on reducing electricity usage?	No	12I focuses on improving energy efficiency, this includes all forms of energy reduction, not only electricity, but also increasing production.

From Table 4-2, the questions and the corresponding answers are verified for the 12I incentive. This process is repeated on all of the incentives in Table 5-4 to Table 5-8, in Appendix D. All the incentives are verified; thus, the flow diagram in Figure 4-7 can now be applied to various case studies.

4.3 APPLICATION ON VARIOUS CASE STUDIES

4.3.1 PREAMBLE

The flow diagram, Figure 4-7, developed in the methodology is applied to eleven case studies in different industries. A short description of the project is given for each case study followed by the flow diagram. The flow diagram has been edited to illustrate the path of questions leading to the various incentive. To improve readability, case studies with the same resulting incentive have been grouped together.

Due to the nature of the study, it would be costly and time consuming to implement different projects to test and validate the flow diagram. Therefore, projects that have made use of incentives and have already been implemented will be used to test and validate the methodology.

The results of the flow diagram for the various case studies are compared to the actual incentive used. The results are then discussed, and in some cases, recommendations are made. Finally, conclusions are drawn.

4.3.2 CASE STUDY: MCEP-PI

Overview

After using the flow diagram, the following four projects all resulted in MCEP-PI. The projects focus on increasing production in order to grow a business. The companies all identified a specific project that required additional funding. The additional funding required is less than R30 million. The resulting flow diagram can be seen in Figure 4-9.

Diamond Manufacturer:

A diamond manufacturing company [77] cuts, polishes and sells high quality diamonds, locally and overseas. The company wishes to increase the size of their business by expanding the output of their business. To increase the production of polished diamonds, a new high-end diamond-polishing machine needs to be installed.

The desired machine improves the time it takes to polish a diamond from 3 hours to a mere 15 minutes per diamond. The installation of this machine will provide an additional six jobs and improve the skills of the labour force within the company. The company is looking for a 30% or more capital investment to assist with the purchasing of this machine.

Furniture Manufacturer

Cheap furniture imports from countries like China are crippling the furniture manufacturing industry in South Africa. Therefore, to stay ahead, furniture industries need to modernise their processes. New, cheaper developments have been made available, such as medium-density fibreboard (MDF) furniture.

A South African pine furniture manufacturer [78] wants to expand their business to include the manufacturing of MDF furniture. To do this, they need to build a new factory with new equipment, the cost is about R6 million. The new expansions are expected to increase the turnover of the business by up to 40% and enable the company to employ 40 new staff.

Foundry

A large-scale foundry [79], specialising in metal castings, wants to improve their technology and improve their production. To do this, the foundry needs to purchase new innovative software from Sweden, the cost of the software is less than R30 million. Increasing the production of castings and decreasing the production costs allows the company to be more competitive.

The software enables the workers to plan the metal castings better, thus creating higher quality pieces at a lower cost. Planning the castings also reduces the yields (metal offcuts) from about 55% to 75%. The software also creates a database of all the casts being produced, which allows workers to reuse casting designs, increasing production.

Plastic Manufacturer

With the weakening South African Rand and increasing labour and electricity costs, companies are struggling to return a profit. A plastic manufacturing company [80], specialising in blow moulding of jerry cans and containers, is looking to expand their business. To do this, the company requires two new blow moulding machines. The company is looking for a 30% capital investment amounting to less than R30 million.

The new machinery will increase the workforce of the company. With the new machinery, the production output is increased from 6 000 containers a day to 10 000 containers a day. The profits from this project will allow the company to invest in more equipment, thus growing the business.

Results (MCEP-PI)

The flow diagram in Figure 4-9, shows an output of MCEP-PI. This result is the same as the actual incentive used for each project. There are five sub incentives that fall under MCEP-PI, each with different qualifying criteria. Therefore, the appropriate one should be selected. If the funding offered by the incentive provider is not sufficient and the company does not have the funds available, then a loan facility could be used in conjunction with MCEP-PI.

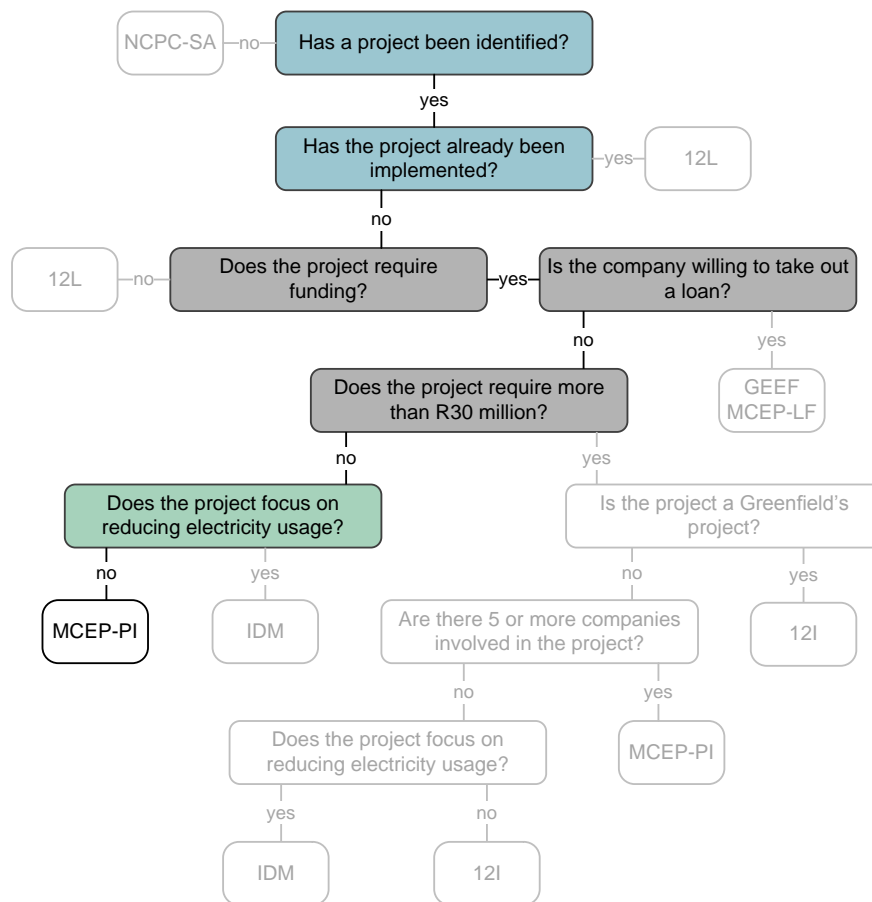


Figure 4-9: Case study result for MCEP-PI

4.3.3 CASE STUDY: 12I

Overview

Information from the following two case studies is applied on the flow diagram. The resulting incentive for both case studies is 12I. However, the flow diagram for each case study is different. One of the projects is Greenfield and the other is Brownfield. Both case studies require a substantial capital investment. The projects increase their production

using energy efficient technology, which reduces the total energy usage. Figure 4-11 and Figure 4-10 depict the resulting flow diagrams.

Glass Manufacturer

A glass manufacturing company [81] aims to increase their production with the addition of a new energy-efficient glass furnace. This furnace is said to be one of the most environmentally friendly and technologically advanced in the world, reducing water, emissions and energy usage. The furnace is 15% more efficient than the two existing furnaces.

To implement the project, the company needs to refurbish an old factory to allow for the addition of the new furnace. The addition of the furnace will increase production by more than 60%. The project will create 140 new permanent jobs in South Africa. The total cost of the project is roughly R1.2 billion. The company is looking for a capital investment of about 40%.

Cement Manufacturer

A cement manufacturer [82] is increasing the amount of cement and clinker production with the addition of a new cement plant. The plant will consist of a limestone mine, clinker and cement plant. The design of the plant is energy efficient with 97.5kWh/tonne, this will result in a cost saving of 25-30%.

The new plant has the production capacity of 1.8 metric tonnes per annum (mtpa) of clinker and 1.1 mtpa of cement, with the largest kiln in the country. The total cost of the project is roughly R1.3 billion

Result (12I)

The resulting incentive for both case studies used is 12I, this is the same incentive that was used for each case study. This is an appropriate selection because no other incentive provides a large enough capital investment. The incentive is not limited to production increase or energy decrease.

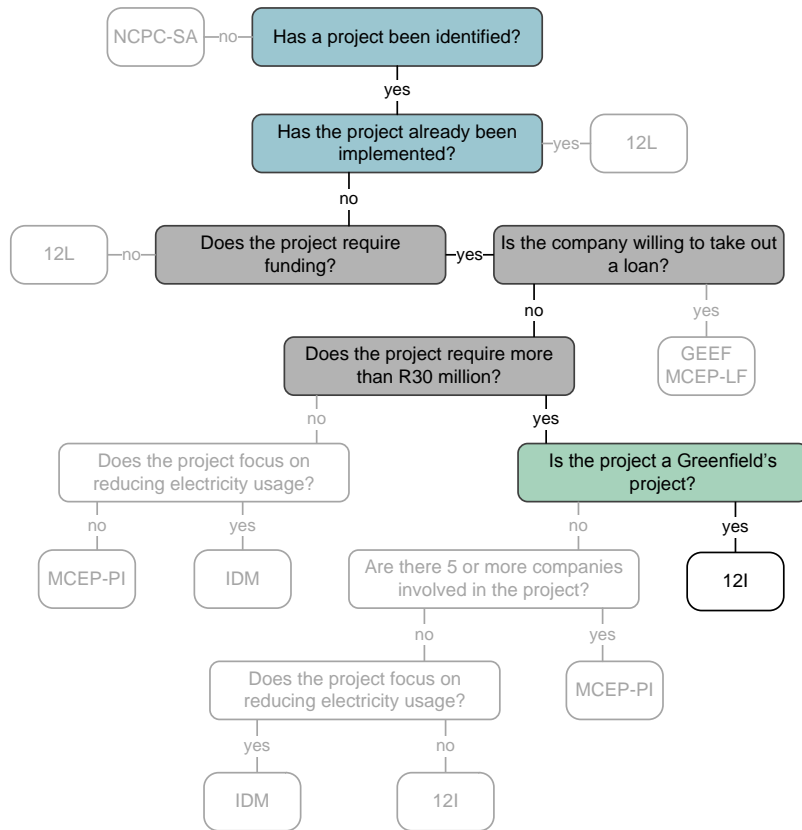


Figure 4-10: Case study result for 12I Greenfield project

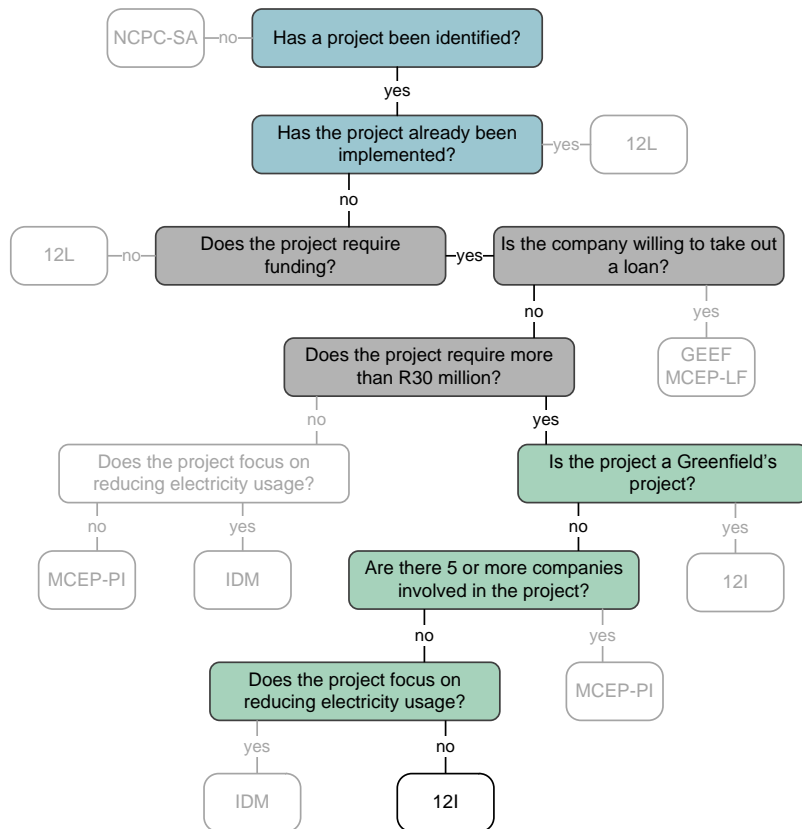


Figure 4-11: Case study result for 12I Brownfield project

4.3.4 CASE STUDY: IDM

Overview

When applying the flow diagram to the following two case studies, the resulting incentive is IDM. Information on the two case studies was made available with the help of project reports provided by the ESCo involved with the project. Both of the projects needed funding of less than R30 million to implement infrastructure. The infrastructure enables the mines to control the electricity usage through various measures. Figure 4-12 shows the resulting flow diagram.

Platinum Mine

A platinum mine needs to improve the energy efficiency of a shaft. The project plan is to improve the efficiency of the compressed air network. This is done by installing valves, pressure transmitters, flow meters and programmable logic controllers (PLCs) throughout the air network. These installations will aid in the control of airflow throughout the network, minimising the total amount of air used.

The project does not aim to increase production or provide new jobs. The main outcome is to reduce the overall electricity usage of a mine. The project is expected to reduce the electricity usage by 1.15 MW average per hour, per weekday. The total cost of the project is less than R4 million.

Gold Mine

A gold mine plans to reduce energy consumption on a shaft by reducing and controlling the amount of water used. The water in the shaft is used mainly for cooling down the shaft. Water pumping and cooling consumes a large portion of the overall energy. To achieve energy efficiency, valves, pressure transmitters and PLCs are installed.

The main outcome of the project focuses on electricity reduction. The total cost of the project is less than R8 million. The expected impact of the project is 1.51 MW average per hour, per weekday.

Results (IDM)

In both case studies, the resulting incentive is IDM, this is the same as the actual incentive selected for the projects. IDM is a good selection for companies that produce at maximum capacity, such as mines.

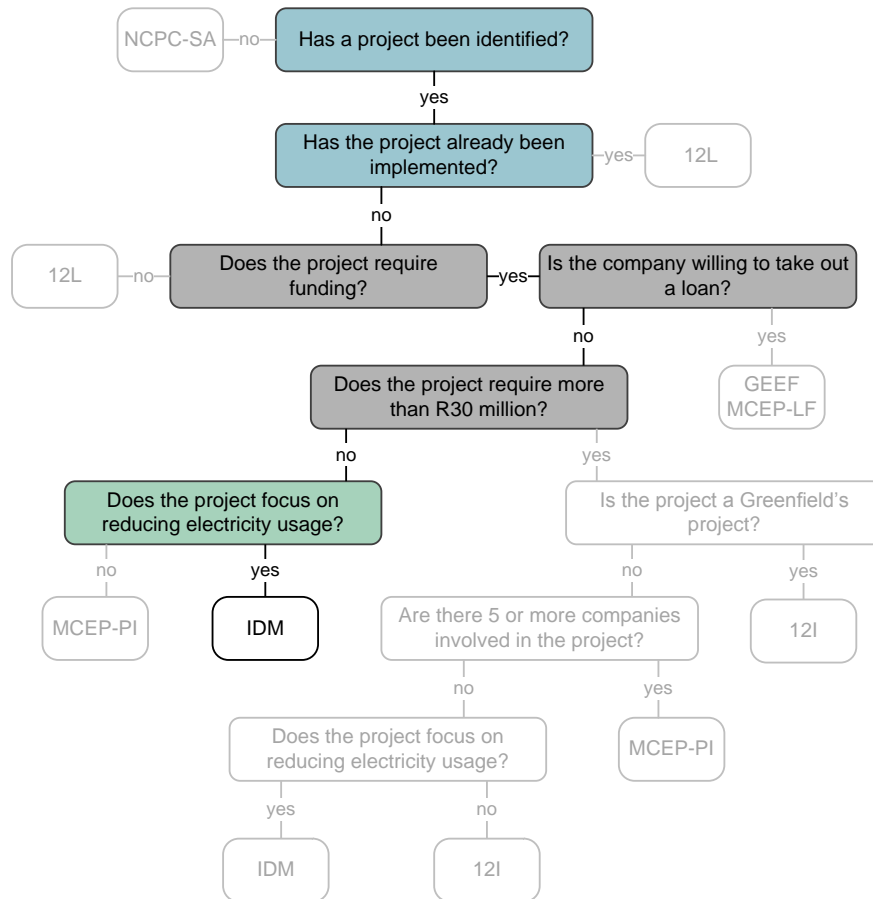


Figure 4-12: Case study result for IDM

4.3.5 CASE STUDY: NCPC-SA AND 12L

The following two projects both resulted in NCPC-SA and consequently 12L. The main commonality between the two industries is that the companies did not have an initial project to implement. The NCPC provided projects that focus on improving energy efficiency thus saving the company money. Figure 4-13 depicts the resulting flow diagram.

Paper Manufacturer

A paper manufacturing company [83] wants to improve their overall energy efficiency. The company, however, does not have a specific project to implement. Therefore, the company made use of the free energy audits provided by the NCPC-SA.

The NCPC-SA provides an EnMS to facilitate with a whole facility approach to energy efficiency. With the help of the EnMS, five projects have been identified. These projects all focus on energy savings rather than increasing production. The project requires start-up capital, but due to the nature of the energy cost savings, this initial capital is paid back within two months.

Steel Manufacturer

A steel company [84] wants to improve the overall energy efficiency on one of their sites, but they do not have project ideas yet. With the help of the NCP-ISA, twelve energy efficiency projects are identified. NCP-ISA also provides a whole facility EnMS to assist with these projects. The projects include optimisation of water cooling systems, cooling radial fan systems and compressed air.

The initial capital investment is less than R1 million, which is money the company has available. The electricity savings amounts to roughly R90 million per annum. This is due to the projects suggested by the NCP-ISA, being implemented. The payback period for the initial investment is less than four working days.

Results (NCP-ISA and 12L)

The incentives selected by the company are the same incentives selected from the flow diagram. The only exception is the addition of the 12L tax incentive. These two incentives are not considered concurrent benefits and, therefore, can both be used. The projects provided by the NCP-ISA focus on monetary savings from the reduction of energy. 12L on the other hand, provides a financial kickback from energy efficiency.

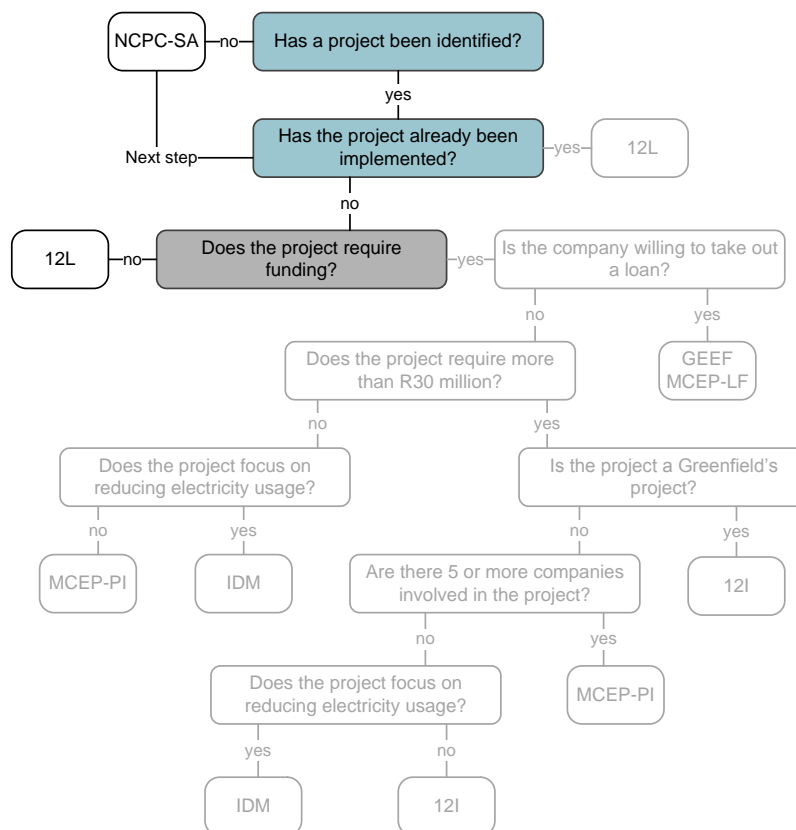


Figure 4-13: Case study result for NCP-ISA and 12L

4.3.6 LOAN FACILITIES

Overview

The following case study results in the GEEF or MCEP-LF. The flow diagram does not differentiate between the two loan facilities. When taking out a loan, there are many factors to consider such as the company's financial state, interest rate and payback periods. Figure 4-14 shows the resulting flow diagram.

Textile Manufacturer

A textile [85] clothing company is looking to reduce their carbon footprint. The company aims to be the first carbon-neutral company in South Africa. To do this, the company needs to install a solar photovoltaic (PV) system. The system is installed on the roof of the building and is grid-tied.

The PV system will reduce the electricity consumption from the grid by 25%. The electricity reduction amounts to an annual saving of 48.5 MWh of electricity and 50 tonnes of CO₂ per year. The electricity cost savings will allow the company to pay off a loan over a 14 year period if necessary.

Result (Loan Facilities)

The result from the flow diagram is GEEF or MCEP-LF. The company opts to make use of the GEEF for the project. From the diagram, it must be noted that if the company was not willing to take out a loan IDM would have been the resulting option.

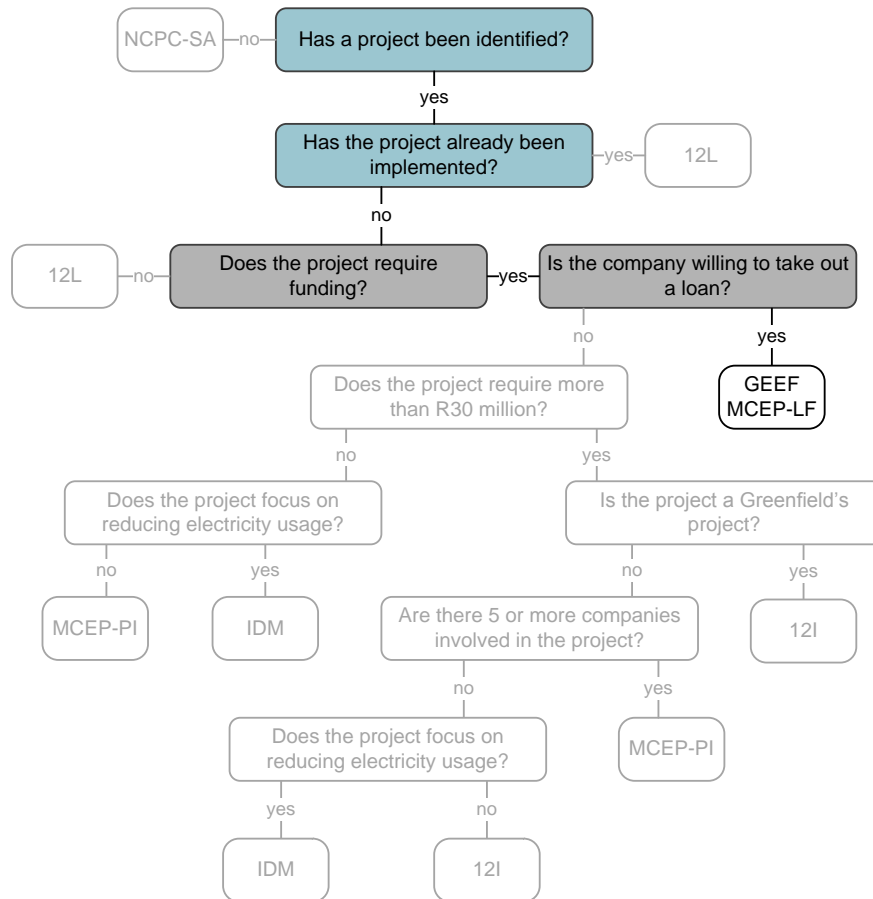


Figure 4-14: Case study result for GEEF

4.4 CONCLUSION

This chapter addresses the problem statement by applying the structured approach to industrial EEIs in South Africa to achieve a means to select an incentive. The first step of the approach is completed in Chapters 1 and 2. The remaining steps are implemented throughout the chapter and a flow diagram is configured and verified.

The approach is validated by applying the flow diagram to case studies from different industries to select an appropriate incentive for a project. In each case study, the selected incentive is the same as the incentive implemented. Further recommendations are given where more than one incentive could have been used.

A structured approach to select energy efficiency incentives applicable to industry:

Conclusion

5 CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Deteriorating global environmental conditions are forcing people to become more aware of their energy usage. Improved energy efficiency is one of the key components in creating a greener future. Incentivised measures, therefore, are put in place to encourage the uptake of energy efficiency.

Selecting an incentive can be a time-consuming and costly process and the outcome may have a large impact on the profitability of a business. The concept of EEIs is relatively new and few procedures are in place to select appropriate incentives. Thus, there is a need for a structured approach to select a viable EEI.

Chapter 2 investigates existing selection procedures for incentives. However, most of the research available for incentives only summarised the content, offering no means on how to select an incentive. Therefore, different structured approaches for various disciplines are investigated to create a new structured approach. Notable contributions from each case study are highlighted and later incorporated into the structured approach.

In South Africa, the industrial sector consumes the most energy, therefore this study focuses on incentives specifically designed for industry. Each incentive is summarised according to the same criteria to improve comparability of the incentives. Throughout the literature review, qualifying questions are composed for each incentive, where a qualifying question is defined as a question that determines the viability of an incentive. These questions are incorporated later in the structured approach.

In Chapter 3, a structured approach is developed for the selection of an incentive. The methodology is comprised of four main steps: refine, select, configure and verify. The available information is first refined by finding and summarising applicable incentives. Critical questions are selected from the list of qualifying questions, where a critical question is defined as a question that distinguishes between the incentives.

The main outcome of the structured approach is an easily adaptable flow diagram for selecting an incentive. The flow diagram is a verifiable configuration of the critical questions. The structured approach is designed to be updated and adapted easily as the information changes.

In Chapter 4, the structured approach is applied to the literature on energy EEIs applicable to South African industries. The resulting flow diagram is verified for each incentive. The verification ensures that nothing is missed throughout the process.

The approach is validated by means of case studies. The information used for each case study is derived from previously implemented projects that made use of incentives. Recommendations are given for case studies where more than one incentive could have been used. In all the case studies, the resulting incentive is the same and the incentive independently selected.

The case studies confirm that the structured approach is a viable means to select an incentive. Therefore, the results confirm that the problem statement is successfully addressed.

5.2 RECOMMENDATIONS FOR FUTURE STUDIES

The limited amount of research available on EEIs in South Africa reinforces the need for future studies.

Incentives offer different degrees of support for knowledge, training or funding. Therefore, the first recommendation is to quantify the effect of selecting different incentives for a specific project. Examining the effect incentives will have on the overall profitability, amount of energy saved and amount of CO₂ emissions reduced.

The second recommendation is to examine the financial impact of using incentives to help offset disincentives such as Carbon Tax. To promote energy efficiency without crippling businesses, the financial implications of disincentives should be counteracted by incentives.

Developed countries such as Germany and overall the European Union have drastically improved their energy efficiency over the last decade. The third recommendation is to further investigate international incentives, examining the most viable incentives and determine if South Africa could implement similar interventions.

The structured approach has only been tested on EEIs for industries in South Africa. Therefore, the fourth recommendation is to apply the structured approach to incentives from different sectors, nationally and internationally. This will validate the methodology further and develop a means to select incentives for different sectors.

Since the start of this study, many of the incentives have changed and new incentives have been made available, such as the Support Programme for Industrial Innovation. The fifth recommendation is to update continually the information for industrial energy EEIs used in the structured approach.

Loan facilities are not considered typical incentives. Therefore, in this study, little focus is placed on loan facilities. The final recommendation is to conduct a study on various companies that offer loans for energy efficiency interventions at preferred interest rates. The structured approach could be adapted to suit investment loans to assist companies in selecting an appropriate loan facility.

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- [85] Industrial Development Corporation and Green Energy Efficiency Fund, "Textiles powered by the sun," Sandton, 2012.

APPENDIX A: QUALIFYING QUESTIONS

The qualifying questions for each incentive from Chapter 2 have been assembled in Table 5-1. Qualifying questions are defined as questions that determine the viability of an incentive. These questions are the result from step 1 of the structured approach as illustrated in Figure 5-1.

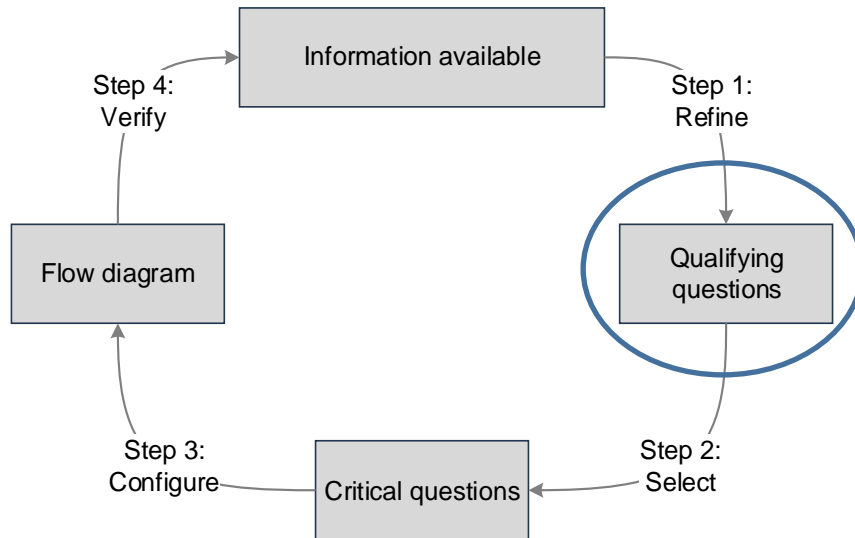


Figure 5-1: Structured approach, step one result

Table 5-1: Qualifying questions from each incentive

Qualifying questions
Qualifying questions for 12L
Has the project already been implemented, therefore, claiming money for prior energy efficiency kilowatt-hour savings?
Has the company received funding from other governmental sources that are considered concurrent benefits?
Does the project make use of renewable energy?
Does the project make use of a captive power plant with an efficiency of over 35%?
Is co-generation of energy, except heat-waste recovery, used?
Can the data submitted be validated and verified for both the baseline and assessment year?
Are the meters used to measure the data regularly calibrated via an external accredited company?
Has the company appointed an external measurement and verification team to audit the process?
Is the company applying for the incentive a single registered tax entity?

Qualifying questions for 12I
Does the project require a capital investment?
Is the project a Greenfield project?
Are the minimum qualifying assets for the Greenfield project more than R50 million?
Are the maximum qualifying assets less than R900 million for the Greenfield project with preferred status or less than R550 million for a Greenfield project with qualifying status?
Is the Greenfield project located in a Special Economic Zone?
Is the project a Brownfield project?
Are the minimum qualifying assets for the Brownfield project more than R30 million?
Are the maximum qualifying assets less than R550 million for a Brownfield project with preferred status or less than R350 million for a Brownfield project with qualifying status?
Does the project score a minimum of 4/8 criteria points?
Does the project upgrade an industry within South Africa by utilising innovative processes?
Does the project utilise new technology that results in improved energy efficiency and cleaner production?
Does the project provide general business linkages within South Africa?
Does the project acquire goods and services from small, medium and micro enterprises?
Does the project provide skills development in South Africa?
Is the company applying for the incentive a single register tax entity?
Qualifying questions for IDM
Does the project require a capital investment?
Does the project focus on electricity kilowatt-hour savings?
Can the data submitted be validated and verified for both the baseline and assessment period?
Does one of the funding models comply with the project scope?
Does the project save the minimum amount of the electricity required by the funding model?
Will the project be sustainable for the minimum number of years required by the funding model?
Has the company appointed an energy services company to manage the process?
Qualifying questions for NCPC-SA
Is there a current proposal for an energy efficiency project?
Has the project already been implemented?
Does the company qualify as a small, medium or micro enterprise?
Is the company willing to pay for the initial project capital?
Qualifying questions for MCEP-PI

Does the project require a capital investment?
Does the project aim to improve overall production and manufacturing competitiveness?
Has the company been operating for over 12 months?
Will the project decrease the overall employment levels of the company?
Has the company applied for this incentive in the last two years?
Does the project adhere to the minimum investment requirements?
Does the company adhere to the minimum qualifying assets?
Is the company a level four B-BBEE or higher?
If applying for the MCEP-Cluster incentive does the project applying for the incentive consist of a minimum of five independent companies?
Has the company benefitted from other incentives or programmes offered by the dti?
Qualifying questions for MCEP-LF
Does the company adhere to the minimum and maximum loan requirements?
Have all other options for project funding been explored, is a loan the last resort?
Will the company be able to pay back the loan within the specified timeframe?
Does the project focus on increasing production and manufacturing competitiveness?
Qualifying questions for GEEF
Does the project adhere to the minimum and maximum loan requirements?
Have all other options for project funding been explored, is a loan the last resort?
Will the company be able to pay back the loan over a period of 15 years or less?
Does the project focus on utilising renewable energy sources or co-generation of energy?

APPENDIX B: SELECTION PROCESS FOR THE QUALIFYING QUESTIONS

5.2.1 THE PROCESS OF ELIMINATION

There are over 50 qualifying questions composed in the literature review. This list needs to be shortened to a list of critical questions. The process used to eliminate qualifying questions is described in Chapter 3.

The first step in simplifying the questions is to eliminate any questions that focus on the company applying for the incentive rather than the project that will be or has been implemented. These eliminated questions are highlighted in blue in Table 5-2.

The second step is to eliminate questions that can only be applied to one incentive. This would be questions that are designed specifically to suit one incentive. These questions are highlighted in green in Table 5-2.

Table 5-2: Elimination of qualifying questions

Qualifying questions
Qualifying questions for 12L
Has the project already been implemented, therefore, claiming money for prior energy efficiency kilowatt-hour savings?
Has the company received funding from other government sources that are considered concurrent benefits?
Does the project make use of renewable energy?
Does the project make use of a captive power plant with an efficiency of over 35%?
Is co-generation of energy, except heat-waste recovery, used?
Can the data submitted be validated and verified for both the baseline and assessment year?
Are the meters used to measure the data regularly calibrated via an external accredited company?
Has the company appointed an external measurement and verification team to audit the process?
Is the company applying for the incentive a single registered tax entity?
Qualifying questions for 12I
Does the project require a capital investment?
Is the project a Greenfield project?

Are the minimum qualifying assets for the Greenfield project more than R50 million?
Are the maximum qualifying assets less than R900 million for the Greenfield project with preferred status or less than R550 million for a Greenfield project with qualifying status?
Is the Greenfield project located in a Special Economic Zone?
Is the project a Brownfield project?
Are the minimum qualifying assets for the Brownfield project more than R30 million?
Are the maximum qualifying assets less than R550 million for a Brownfield project with preferred status or less than R350 million for a Brownfield project with qualifying status?
Does the project score a minimum of 4/8 criteria points?
Does the project upgrade an industry within South Africa by utilising innovative processes?
Does the project utilise new technology that results in improved energy efficiency and cleaner production?
Does the project provide general business linkages within South Africa?
Does the project acquire goods and services from small, medium or micro enterprises?
Does the project provide skills development in South Africa?
Is the company applying for the incentive a single register tax entity?
Qualifying questions for IDM
Does the project require a capital investment?
Does the project focus on electricity kilowatt-hour savings?
Can the data submitted be validated and verified for both the baseline and assessment period?
Does one of the funding models comply with the project scope?
Does the project save the minimum amount of the electricity required by the funding model?
Will the project be sustainable for the minimum number of years required by the funding model?
Has the company appointed an energy services company to manage the process?
Qualifying questions for NCPC-SA
Is there a current proposal for an energy efficiency project?
Has the project already been implemented?
Does the company qualify as a small, medium and micro enterprise?
Is the company willing to pay for the initial project capital?
Qualifying questions for MCEP-PI
Does the project require a capital investment?
Does the project aim to improve overall production and manufacturing competitiveness?
Has the company been operating for over 12 months?

Will the project decrease the overall employment levels of the company?
Has the company applied for this incentive in the last two years?
Does the project adhere to the minimum investment requirements?
Does the company adhere to the minimum qualifying assets?
Is the company a level four B-BBEE or higher?
If applying for the MCEP-Cluster incentive does the project applying for the incentive consist of a minimum of five independent companies?
Has the company benefited from other incentives or programmes offered by the dti?
Qualifying questions for MCEP-LF
Does the company adhere to the minimum and maximum loan requirements?
Have all other options for project funding been explored, is a loan the last resort?
Will the company be able to pay back the loan within the specified timeframe?
Does the project focus on increasing production and manufacturing competitiveness?
Qualifying questions for GEEF
Does the project adhere to the minimum and maximum loan requirements?
Have all other options for project funding been explored, is a loan the last resort?
Will the company be able to pay back the loan over a period of 15 years or less?
Does the project focus on utilising renewable energy sources or co-generation of energy?

5.2.2 THE PROCESS OF SELECTION

The critical questions are selected from Table 5-3, according to the grouping structure illustrated in Figure 5-2. A critical question is defined as a question that distinguishes between the incentives. Questions selected in phase one are highlighted in pink. Questions selected in phase two are highlighted in grey.

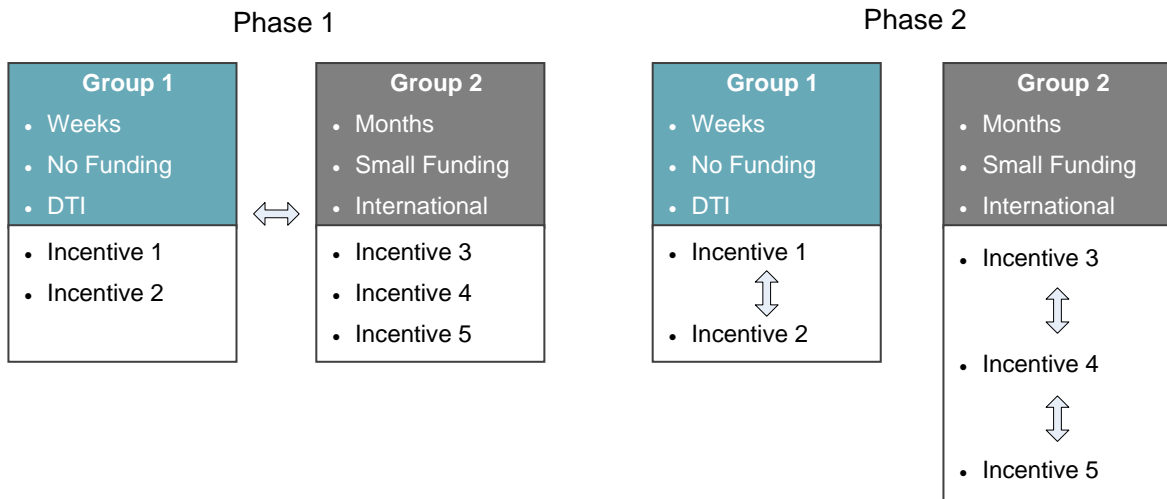


Figure 5-2: Selection of critical questions

Table 5-3: Selection of critical questions

Qualifying questions	
Group 1	
Qualifying questions for 12L	
Has the project already been implemented, therefore, claiming money for prior energy efficiency kilowatt-hour savings?	
Does the project make use of renewable energy?	
Does the project make use of a captive power plant with an efficiency of over 35%?	
Is co-generation of energy, except heat-waste recovery, used?	
Can the data submitted be validated and verified for both the baseline and assessment year?	
Qualifying questions for IDM	
Does the project require a capital investment?	
Does the project focus on electricity kilowatt-hour savings?	
Can the data submitted be validated and verified for both the baseline and assessment period?	
Group 2	
Qualifying questions for 12I	

Does the project require a capital investment?
Is the project a Greenfield project?
Is the project a Brownfield project?
Are the minimum qualifying assets for the Brownfield project more than R30 million?
Does the project upgrade an industry within South Africa by utilising innovative processes?
Does the project utilise new technology that results in improved energy efficiency and cleaner production?
Does the project provide general business linkages within South Africa?
Does the project acquire goods and services from small, medium and micro enterprises?
Does the project provide skills development in South Africa?
Qualifying questions for MCEP-PI
Does the project require a capital investment?
Does the project aim to improve overall production and manufacturing competitiveness?
Will the project decrease the overall employment levels of the company?
Does the project adhere to the minimum investment requirements?
If applying for the MCEP-Cluster incentive does the project applying for the incentive consist of a minimum of five independent companies?
Group 3
Qualifying questions for MCEP-LF
Does the company adhere to the minimum and maximum loan requirements?
Have all other options for project funding been explored, is a loan the last resort?
Does the project focus on increasing production and manufacturing competitiveness?
Qualifying questions for GEEF
Does the project adhere to the minimum and maximum loan requirements?
Have all other options for project funding been explored, is a loan the last resort?
Does the project focus on utilising renewable energy sources or co-generation of energy?
Group 4
Qualifying questions for NCPC-SA
Is there a current proposal for an energy efficiency project?
Has the project already been implemented?

APPENDIX C: VERIFICATION

In Chapter 4, the process of verification is illustrated using the section 12I tax incentive. The verification for the remaining incentives is completed in Table 5-4 to Table 5-8.

12L Tax Incentive

Table 5-4: Verification of 12L

Question	Ans.	Reasoning
Has a project been identified?	Yes	NCPC-SA is the only incentive that offers energy audits so if a project has not been identified then NCPC-SA should be a first choice.
Has the project already been implemented?	Yes/ No	12L incentive is the only incentive that offers a financial payback for a previously implemented project. However, if the project has not been implemented provisions can be made to utilise the incentive in the future.
Does the project require funding?	No	12L only offers financial payback after the completion of a project.

Eskom's Integrated Demand Management

Table 5-5: Verification of IDM

Question	Ans.	Reasoning
Has a project been identified?	Yes	NCPC-SA is the only incentive that offers energy audits so if a project has not been identified then NCPC-SA should be a first choice.
Has the project already been implemented?	No	12L incentive is the only incentive that offers a financial payback for a previously implemented project.
Does the project require funding?	Yes	IDM offers an R/kWh payback for the implementation of electricity management projects.
Is the company willing to take out a loan?	No	If the company is not willing to take out a loan then IDM could be a viable solution.
Does the project require more than R30 million?	Yes/ No	The funding provided is dependent on the amount of electricity managed.
Does the project focus on reducing electricity usage?	Yes	The main objective of IDM is to reduce and manage load on the national power grid.
Is the project a Greenfield project?	No	12I is the only incentive that offers funding for Greenfield's projects.

Question	Ans.	Reasoning
Are there 5 or more companies involved in the project?	No	MCEP-PI is the only incentive that offers funding for projects managed by a group of companies.

National Cleaner Production Centre – South Africa

Table 5-6: Verification of NCPC-SA

Question	Ans.	Reasoning
Has a project been identified?	No	NCPC-SA is the only incentive that offers energy audits so if a project has not been identified then NCPC-SA should be a first choice.

Manufacturing Competitiveness Enhancement Programme – Production Incentive

Table 5-7: Verification of MCEP-PI

Question	Ans.	Reasoning
Has a project been identified?	Yes	NCPC-SA is the only incentive that offers energy audits so if a project has not been identified then NCPC-SA should be a first choice.
Has the project already been implemented?	No	12L incentive is the only incentive that offers a financial payback for a previously implemented project.
Does the project require funding?	Yes	One of the main objectives of the MCEP-PI is to offer financial aid for energy efficiency projects.
Is the company willing to take out a loan?	No	If the company is not willing to take out a loan then MCEP-PI could be a viable solution.
Does the project require more than R30 million?	Yes/ No	MCEP has a range of incentives that offer up to a maximum of R50 million. The branch of MCEP-PI that offers more than R30 million is MCEP-Cluster.
Is the project a Greenfield's project?	No	12I is the only incentive that offers funding for Greenfield's projects.
Are there 5 or more companies involved in the project	Yes	The main condition for MCEP-Cluster is that there is a cluster of 5 or more companies applying for the incentive.
Does the project focus on reducing electricity usage?	No	One of the main objectives of MCEP-PI is to increase production, therefore they do not offer incentive for electricity reduction.

The Green Energy Efficiency Fund and the Manufacturing Competitiveness Enhancement Programme – Loan Facility

Table 5-8: Verification of GEEF and MCEP-LF

Question	Ans.	Reasoning
Has a project been identified?	Yes	NCPC-SA is the only incentive that offers energy audits so if a project has not been identified then NCPC-SA should be a first choice.
Has the project already been implemented?	No	12L incentive is the only incentive that offers a financial payback for a previously implemented project.
Does the project require funding?	Yes	One of the main objectives of the two loan facilities is to offer loans for energy efficiency projects.
Is the company willing to take out a loan?	Yes	MCEP-LF and GEEF offer loans to companies for projects that do not qualify for other incentives.