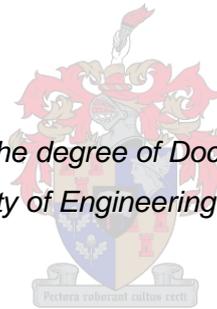


# Development of a participatory planning approach for energy sustainability at a local government level

by  
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*Dissertation presented for the degree of Doctor of Philosophy in Industrial Engineering in the Faculty of Engineering at Stellenbosch University*



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## Declaration

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This dissertation includes three original papers published in peer-reviewed journals. The development and writing of the papers were the principal responsibility of myself and, for each of the cases where this is not the case, a declaration is included in the dissertation indicating the nature and extent of the contributions of co-authors.

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## Abstract

Planning for a sustainable energy future is a necessity, but doing so, especially at a local government level, is complex. A sustainable energy future requires systemic changes to the current energy landscape, which requires a collective understanding of many perspectives, multiple objectives and interrelated variables within an environment faced with many uncertainties and risks. To deal with the complexity at a local government level, stakeholder involvement is non-negotiable. This study developed a participatory planning approach for local energy sustainability by answering the following research question: What should a participatory planning approach at a local government level entail to enable a move towards a sustainable energy future?

The research comprised a single instrumental qualitative case study, conducted with Hessequa Municipality in the Western Cape province of South Africa, combined with a literature review of public participation, collaborative governance, participatory approaches, and problem-structuring methods. The identified research objectives were addressed through three published papers in peer-reviewed journals. A synthesis of planning and decision-making literature shows that a participatory approach should facilitate mutual understanding of the problem, incorporate all stakeholders' values and, ultimately, provide better trust in and acceptance of future decisions. The research elicited success factors that can inform the development and implementation of a participatory planning approach (research objective 1). An investigation of how renewable energy forms part of the strategy of a local government concluded that renewable energy plays a role in the strategic objectives of local government, although it has not been explicitly discussed as a main priority during the development of the municipal Integrated Development Plan and strategy (research objective 2). In addition, participatory processes formed an integral part of the strategy formulation, but limitations were identified. To overcome some of these limitations, a visualised strategy is proposed for effective communication with the public (research objective 3). The final research objective focused on the development, application, and evaluation of a participatory approach to plan for local energy sustainability, namely EDAS: to Explore, Design and Act for Sustainability. The research showed that EDAS could

be a way forward for local governments and other institutions to plan for local energy sustainability; however, more work is needed at a local level to enhance public and stakeholder participation and to improve the EDAS approach for institutionalisation (research objective 4).

The findings from this study contribute to the research fields of public administration, stakeholder participation, soft operational research, and energy sustainability. The research provides a novel participatory approach, namely EDAS, to plan for local sustainability and through application provides a solid case study of a local municipality in its journey towards sustainable energy. It is recommended that more research be conducted on applying and evaluating the EDAS approach in other local government contexts as well as in public enterprises.

## Opsomming

Beplanning vir toekomstige volhoubare energie is 'n noodsaaklikheid, maar 'n ingewikkelde proses, veral op plaaslike regeringsvlak. Toekomstige volhoubare energie verg sistemiese veranderinge van die huidige energielandskap, wat gesamentlike begrip van talle perspektiewe, veelvuldige doelstellings en onderling verbonde veranderlikes behels in 'n omgewing wat talle onsekerhede en risiko's in die gesig staar. Die betrokkenheid van belanghebbendes is ononderhandelbaar ten einde die kompleksiteit op plaaslike regeringsvlak te hanteer. In hierdie studie is 'n deelnemende beplanningsbenadering vir plaaslike energievouhoubaarheid ontwikkel deur die volgende navorsingsvraag te beantwoord: Wat moet 'n deelnemende beplanningsbenadering op plaaslike regeringsvlak behels om die oorgang na toekomstige volhoubare energie in die hand te werk?

Die navorsing het 'n enkele instrumentele kwalitatiewe gevallestudie, uitgevoer met Hessequa Munisipaliteit in die Wes-Kaapse provinsie van Suid-Afrika, tesame met 'n literatuuroorsig van openbare deelname, samewerkende staatsbestuur, deelnemende benaderings en probleemstruktureringsmetodes behels. Die geïdentifiseerde navorsingsdoelstellings is deur drie gepubliseerde artikels in eweknie-beoordeelde vaktydskrifte uitgevoer. 'n Sintese van beplannings- en besluitnemingsliteratuur toon dat 'n deelnemende benadering wedersydse begrip van die probleem in die hand moet werk, alle belanghebbendes se waardes moet insluit, en uiteindelik beter vertrou en aanvaarding van toekomstige besluite moet verseker. Die navorsing het suksesfaktore aan die lig gebring wat die ontwikkeling en implementering van 'n deelnemende beplanningsbenadering (navorsingsdoelstelling 1) kan rig. 'n Ondersoek na die manier waarop hernubare energie deel van die strategie van 'n plaaslike regering vorm, het bevind dat hernubare energie 'n rol in die strategiese doelstellings van die plaaslike regering speel, alhoewel dit nie uitdruklik as 'n hoofprioriteit in die ontwikkeling van die munisipale Geïntegreerde Ontwikkelingsplan en -strategie (navorsingsdoelstelling 2) bespreek is nie. Hierbenewens het deelnemende prosesse 'n integrale rol in strategieformulering gespeel, maar beperkings is geïdentifiseer. Ten einde enkele van hierdie beperkings te oorkom, word 'n gevisualiseerde strategie vir doeltreffende kommunikasie met die publiek (navorsingsdoelstelling 3) voorgestel.

Die laaste navorsingsdoelstelling het gefokus op die ontwikkeling, toepassing en evaluering van 'n deelnemende benadering om vir plaaslike energievouhoubaarheid te beplan, naamlik EDAS: "Explore, Design and Act for Sustainability". Die navorsing het getoon dat EDAS 'n weg vorentoe kan wees vir plaaslike regerings en ander instellings om vir plaaslike energievouhoubaarheid te beplan, maar verdere werk is egter op plaaslike vlak nodig om deelname deur die publiek en belanghebbendes te bevorder en die EDAS-benadering vir institusionalisering te verbeter (navorsingsdoelstelling 4).

Die bevindinge van die studie dra by tot die navorsingsgebiede van publieke administrasie, belanghebbende-deelname, sagte bedryfsnavorsing en energievouhoubaarheid. Die navorsing bied 'n nuwe deelnemende benadering, naamlik EDAS, om vir plaaslike volhoubaarheid te beplan en bied deur toepassing 'n grondige gevallestudie van 'n plaaslike munisipaliteit se reis na volhoubare energie. Verdere navorsing oor die toepassing en evaluering van die EDAS-benadering in ander plaaslike regeringskontekste asook in openbare ondernemings word aanbeveel.

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## TABLE OF CONTENTS

Chapter 1	Introduction .....	1
1.1	Research background .....	1
1.2	Research rationale .....	5
1.3	Research question and objectives .....	7
1.4	Research strategy, design, and methodology .....	9
1.5	Theoretical framing and literature review .....	13
1.5.1	Public participation, stakeholder participation and collaborative governance .....	16
1.5.2	Soft operational research and problem-structuring methods .....	21
1.5.3	Other participatory approaches .....	27
1.5.4	Risk assessment methods .....	27
1.6	Case study: Hessequa Municipality .....	29
1.7	Overview of the dissertation .....	33
Chapter 2	A literature review of energy-planning and decision-making approaches in the local government sphere .....	40
2.1	Introduction .....	40
2.2	Methodology .....	41
2.2.1	Research methodology and literature selection .....	41
2.2.2	Review procedure and results .....	43
2.3	Research findings .....	47
2.3.1	The what and why of stakeholder participation .....	47
2.3.2	The benefits and limitations of applying approaches inclusive of stakeholder participation .....	48
2.3.3	Factors to guide the implementation of an approach inclusive of stakeholder participation .....	55
2.4	Conclusion .....	59

Chapter 3	Journey towards renewable energy for sustainable development at the local government level: The case of Hessequa Municipality in South Africa	.61
3.1	Introduction	61
3.2	Research methodology	64
3.3	Results	69
3.3.1	Five main strategic themes and their causal links to renewable energy options	69
3.3.2	Investigating the participatory nature of Hessequa	75
3.4	Discussion	79
3.4.1	How does renewable energy form part of the Hessequa strategy and what are the current constraints for implementing renewable energy solutions?	79
3.4.2	Drivers of and barriers to the implementation of small-scale renewable energy projects in South Africa	83
3.4.3	How are participatory processes utilised in the communication and development of the municipal strategy?	84
3.4.4	Limitations and future research	85
3.5	Conclusions	85
Chapter 4	Explore, Design and Act for Sustainability: A participatory planning approach for local energy sustainability	88
4.1	Introduction	88
4.2	Review of the characteristics of a complex problem and the problem of local energy sustainability	89
4.3	Requirements of an approach to plan for a local sustainable energy future	93
4.3.1	The approach must be participative and inclusive	94
4.3.2	The approach must be holistic	94
4.3.3	The approach must be simple and transparent	94

4.3.4	The approach must include the identification and assessment of risks as part of the deliberation process .....	95
4.3.5	The development of a realistic action plan must be attainable at the end of a two-day workshop .....	96
4.3.6	The approach must be dynamic .....	96
4.3.7	The approach must be formalised with clear institutional arrangements .....	97
4.3.8	Evaluating the comprehensiveness of the requirements to plan for a local sustainable energy future .....	97
4.4	Explore, Design and Act for Sustainability .....	97
4.4.1	<i>Explore</i> to determine sustainable options and future conditions ..	101
4.4.2	<i>Design</i> desirable sustainable strategies .....	104
4.4.3	<i>Act</i> for sustainability .....	105
4.5	Results from the Hessequa Sustainable Energy Journey workshop ...	106
4.5.1	Background .....	106
4.5.2	<i>Explore</i> to determine sustainable options and future conditions ..	109
4.5.3	<i>Design</i> desirable sustainable strategies .....	117
4.5.4	<i>Act</i> for sustainability .....	120
4.6	Evaluation of the EDAS approach .....	122
4.6.1	Feedback from the workshop participants .....	122
4.6.2	Reflection on the EDAS approach .....	124
4.7	Conclusion .....	129
Chapter 5	Conclusions .....	132
5.1	Introduction .....	132
5.2	Summary and discussion of key findings .....	135
5.2.1	Objective 1: To review evidence of participatory planning approaches to determine factors necessary for the successful development and implementation of such approaches .....	135

5.2.2	Objective 2: To determine whether and how renewable energy options form part of a local government strategy and long-term plans .....	137
5.2.3	Objective 3: To investigate how participatory approaches are utilised in the development and communication of a municipal strategy .....	139
5.2.4	Objective 4: To develop, apply and evaluate the use of a participatory planning approach for energy sustainability in a local government in South Africa	141
5.3	Summary of key contributions .....	145
5.4	Limitations of the study and future research directions .....	148
5.5	Personal reflection .....	150
5.6	Final word .....	153
	References .....	155
	Appendix A .....	184
A.1	Consent from Hessequa Municipality .....	185
A.2	Consent from participants of the Hessequa True North workshops .....	186
A.3	Consent from participants of the Hessequa Sustainable Energy Journey workshop .....	187
	Appendix B .....	188
B.1	Research paper 1 abstract and Chapter 2 declaration .....	189
B.2	Research paper 2 abstract and Chapter 3 declaration .....	192
B.3	Research paper 3 abstract and Chapter 4 declaration .....	195
	Appendix C .....	198
C.1	Ten rich pictures developed during the Hessequa True North workshops .....	198
	Appendix D .....	203
D.1	Hessequa Sustainable Energy Journey workshop agenda .....	203
D.2	Hessequa Sustainable Energy Journey workshop evaluation form .....	205
	Appendix E .....	207

E.1 The barriers, obstacles, opportunities and strenghts of implemening sustainable energy solutions at a local government level in South Africa.....	207
Appendix F .....	211
F.1 EDAS Facilitation Guide .....	211

## LIST OF FIGURES

Figure 1-1 Location of Hessequa in the Western Cape province of South Africa	30
Figure 1-2 Diagrammatic presentation of the research design and dissertation layout .....	39
Figure 3-1 Cognitive map of the Hessequa strategic themes with causal links to renewable energy options .....	70
Figure 3-2 Hessequa visualised strategy .....	80
Figure 4-1 Explore, Design and Act cycle .....	99
Figure 4-2 Building blocks of the EDAS approach .....	100
Figure 4-3 Stakeholder map .....	101
Figure 4-4 Stakeholder representation at Hessequa Sustainable Energy Journey workshop, Day 1 .....	108
Figure 4-5 Stakeholder representation at Hessequa Sustainable Energy Journey workshop, Day 2 .....	108
Figure 4-6 Future conditions and positioning of Hessequa .....	115
Figure 4-7 Overall rating of the Hessequa Sustainable Energy Journey workshop held .....	123

## LIST OF TABLES

Table 1-1 Conceptual framework of the research design.....	10
Table 1-2 Description of core theoretical constructs .....	14
Table 1-3 Sustainable development projects implemented and studies conducted at Hessequa.....	32
Table 1-4 Summary of research objectives and activities .....	33
Table 2-1 Keywords used in literature search.....	42
Table 2-2 Inclusion and exclusion of criteria used for refinement of search terms .....	44
Table 2-3 Initial articles selected for review .....	45
Table 2-4 Matrix of some participatory techniques with their degree of involvement (Luyet <i>et al.</i> , 2012) .....	48
Table 2-5 Checklist to ensure successful development and implementation of a participatory approach.....	57
Table 3-1 Municipal interactions that formed part of the research.....	65
Table 3-2 Summary of evaluation findings on the participative nature of Hessequa .....	77
Table 4-1 Characteristics of a complex problem.....	90
Table 4-2 Evaluation of the characteristics of a complex problem against different PSMs .....	93
Table 4-3 Matrix to evaluate the comprehensiveness of the requirements of a participatory approach to plan for local sustainable energy .....	98
Table 4-4 Hessequa's envisaged futures.....	110
Table 4-5 Sustainable energy options worth pursuing .....	111
Table 4-6 Hessequa energy system naming options .....	117
Table 4-7 Decision areas identified during the Hessequa Sustainable Energy Journey workshop .....	119
Table 4-8 Agreed action items to be implemented within five years.....	121
Table 4-9 Agreed action items to consider in five to ten years.....	122

## LIST OF ABBREVIATIONS AND ACRONYMS

CATWOE	Customers, Actors, Transformation, Worldview, Owners, Environment
CRSES	Centre for Renewable and Sustainable Energy Studies
CSIR	Council of Scientific and Industrial Research
DMCE	Deliberative multi-criteria evaluation
DoE	Department of Energy
EDAS	Explore, Design and Act for Sustainability
GCBR	Gouritz Cluster Biosphere Reserve
GWh	Gigawatt hours
IDP	Integrated Development Plan
IPP	Independent power producer
IRP	Integrated Resource Plan
KWh	Kilowatt hours
LED	Local economic development
MCDA	Multi-criteria decision analysis
MW	Megawatt
MWp	Megawatt peak
NERSA	National Energy Regulator of South Africa
OR	Operational Research
PESTLE	Political, Economic, Socio-cultural, Technological, Legal and Environmental factors

PSM	Problem-structuring method
PV	Photovoltaic
RA	Robustness analysis
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SALGA	South African Local Government Association
SCA	Strategic choice approach
SDM	System dynamics modelling
SDP	Spatial Development Plan
SODA	Strategic options development and analysis
SPL	School of Public Leadership
SSEG	Small-scale embedded generation
SSM	Soft systems methodology
Stats SA	Statistics South Africa

# Chapter 1 Introduction

## 1.1 Research background

The transitioning to a low-carbon energy economy is a global drive to address climate change. Climate change refers to an ongoing trend of changes in the earth's general weather conditions as a result of an average increase in the temperature of the earth's surface, usually referred to as global warming. This increase in temperature is a result of the increased concentration of greenhouse gases in the atmosphere emitted by human activities.

Sustainable energy implies the use of energy that “meets the needs of the present without comprising the ability of future generations to meet their own needs” (Lemaire, 2010: 10). Sustainable energy has two key components, namely renewable energy, and energy efficiency. Renewable energy is generated by resources that are self-replenished, such as wind, solar, renewable biomass and hydro power (SALGA, 2018). Energy efficiency, on the other hand, includes using less energy (kWh) to achieve the same benefits (Lemaire, 2010).

South Africa has a history of being heavily reliant on coal-based fossil fuels to produce electricity. This resulted in South Africa being the 14<sup>th</sup> largest emitter of greenhouse gases (McSweeney & Timperley, 2018) and ranking among the highest per capita emissions in the developing world (Schmorl, 2020). South Africa is a signatory to the United Nations Framework Convention on Climate Change (Paris Agreement) and pledged under the Copenhagen Accord to peak its emissions between 2020 and 2025, allowing it to plateau for approximately a decade before it starts to fall (McSweeney & Timperley, 2018). Commitment towards the pledge is shown in the successes achieved with the implementation of the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP). As at March 2019, 64 independent power producer (IPP) projects with a combined capacity of 3 976 MW have been connected to the national electricity grid (Independent Power Producer Office, 2019). Since the first large REIPPPP project became operational, 35 669 GWh of energy has been generated from renewable energy sources and these IPPs contributed to a reduction of 36.2 million tons of carbon dioxide and saved 42.8 million kilolitres of water since inception in

2010 (Independent Power Producer Office, 2019). The IPPs created 40 134 full-time equivalent jobs for South African citizens to date. The Integrated Resource Plan (IRP) 2019 (DoE, 2019) sets a target to produce a total of 26 630 MW of renewable power by 2030. In addition, 500 MW per annum has been allocated to generation-for-own-use between 1 MW and 10 MW (also known as distributed generation). To realise these IRP targets, action needs to be taken on all levels of government, also at a local government level.

Additional to the mitigation of the impact of climate change, and more relevant to a local government level, is the problem of energy security and energy prices in South Africa. According to the South African Local Government Association (SALGA) (2018: 2) ...

... [c]hanges in the electricity sector have the potential to create both risks and opportunities for municipalities. Without adequate preparation, municipalities may not be able to adapt quickly enough to the changing markets. This could have a significant impact on income streams for municipalities, as well as result in a potential loss of opportunities in the new emerging sector.

A recent study by the Council of Scientific and Industrial Research (CSIR) (Wright & Calitz, 2019) shows that load shedding in the first three months of 2019 had been more intensive than ever before, with 769 GWh offline for a total duration of 272 hours. Load shedding, or load reduction, is a controlled protocol of South Africa's primary electricity producer, Eskom, to respond to unplanned events to protect the electricity power system from a total blackout (Eskom, n.d.). In the decade 2007–2017, electricity tariffs increased by 333%, bringing the current Eskom tariff to 98 c/KWh (Wright & Calitz, 2019). The high electricity price, with accompanied periods of load shedding, has a direct impact on the production of products and services in South Africa.

The interrupted power supply caused by load shedding has a direct impact on local government in terms of local economic growth, customer satisfaction levels and municipalities' cash flow. Continuation of increases in electricity tariffs, accompanied by periods of load shedding, could lead to high-income citizens moving to an alternative energy supply, which has a direct impact on municipal

cash flow (Korsten, Brent, Sebitos & Kritzing, 2017). In addition, electricity will become unaffordable for low- to medium-income citizens, which could also lead to non-payment of municipal bills. Although the revenues from service charges are the largest source of municipal income, these incomes largely flow from the municipality to its supplier, namely Eskom, in the case of electricity. The rapid increases in electricity tariffs force municipalities to absorb some of these increases in order to keep tariffs affordable for their citizens. Approximately 65 to 85% of municipal electricity revenue goes to paying for bulk electricity from Eskom (National Treasury, 2012). The squeezed surpluses of the municipality, together with a decrease in electricity sales, therefore put the current municipal financial model at risk.

Many municipalities showed innovation and interest to embark on the journey of sustainable energy, but have found multiple barriers on their road to success. The City of Cape Town is currently following legal proceedings against the National Energy Regulator of South Africa (NERSA) and the Minister of Energy in a request to buy electricity directly from an IPP. The legal proceedings are the next step after two years of unsuccessful discussions between the City of Cape Town, NERSA and the Department of Energy (DoE). NERSA requested ministerial determination to grant generation licences as per Section 34 of the Electricity Generation Act (No. 4 of 2006), but the Minister of Energy is refusing to gazette the determination (Isaacs, 2019; Phakathi, 2019). Ekurhuleni Metropolitan Municipality is currently following a process proposed by SALGA to explore the possibility of procuring electricity from IPPs. In 2012 an assessment was done of appropriate service delivery mechanisms for a waste-to-energy project and related infrastructure in Drakenstein (Jan Palm Consulting Engineers, 2012). The study showed that a waste-to-energy project will be beneficial to the municipality given the potential to generate 20 167 MWh/annum of net energy, to create approximately 116 jobs and to extend the lifespan of its Wellington landfill. The municipality, on its own, could not provide the capital resources and human expertise, skills or capacity to successfully establish a waste-to-energy facility (Hermanus, 2017). Risk is a key characteristic of any renewable energy project (Gatzert & Kosub, 2016; Ioannou, Angus & Brennan, 2017). The risks associated with renewable energy projects entail technological, financial and regulatory risks (Ioannou *et al.*, 2017). Risk in

the power generation investment sector is multidimensional and depends on the perspective of different stakeholders (International Actuarial Association, 2010). Research by The Economist's Intelligence Unit (Freudmann, 2011) shows that financial risk is the most significant risk associated with renewable energy projects, followed by political and regulatory risks heightened by the uncertain macro-economic outlook of many countries.

At a presentation by the Western Cape government held at the Premier's Forum in February 2019, it was stated that municipalities must find ways to become more resilient and that "[t]he financial and supply crises at Eskom and the success of REIPPPP [are] challenging the way in which the energy sector has been traditionally run in South Africa" (Fast, 2019a: 13). Former Minister of Energy, Mr Jeff Radebe, stated at the Energy Indaba in 2019 that the government of South Africa is providing the policy and regulatory framework for South African municipalities to develop their own generation and is enabling the orderly development of alternative energy systems (Government of South Africa, 2019). However, the current municipal regulatory environment for energy is perceived as uncertain and inconsistent, which makes it unclear what the energy options are for local governments in South Africa going forward (Fast, 2019b).

Changing the energy landscape is a complex problem encompassing a broad set of aspects, such as changes in technologies, energy networks and infrastructure, social practices, public attitudes, policies and regulations, to name a few (Alvial-Palavicino, Garrido-Echeverría, Jiménez-Estévez, Reyes & Palma-Behnke, 2011; Bale, Varga & Foxon, 2015; Shove & Walker, 2014). Consistently providing affordable energy services, achieving security of energy supplies and reducing carbon emissions require the deployment of low-carbon technologies and energy efficiency measures, of which the costs and benefits are often uncertain (Bale *et al.*, 2015). For a local municipality in South Africa, the role of planning for future electrical infrastructure falls under the jurisdiction of the Director: Technical Services. To understand the complexity of a changing energy landscape in a local government context, the traditional role of the technical services director needs to be understood. Traditionally, the provision of an electricity service has been a relatively simple function, where electricity is supplied by Eskom, electricity prices are determined by NERSA and the municipality then adds a cost for service

delivery to distribute the electricity to households and businesses. Lately, the adaptation needed due to climate change and the inability of Eskom to provide reliable and affordable electricity to municipalities is changing the energy landscape of municipalities. Households can now, at a relatively affordable cost, set up their own renewable energy infrastructure to produce their own electricity and can even decide to go off the electricity grid. This is not only a financial risk to municipalities due to the potential loss of income, but also has an impact on the planning of future electricity infrastructure. Therefore, the energy landscape in the local government context is changing from a relatively simple electricity distribution service to a complex system that needs to account for consumer behaviours and needs, net metering and bidirectional electricity supply. The role of the technical services department is therefore changing from not only providing a distribution service, but also providing guidelines for the safe implementation of small-scale embedded generation (SSEG) and delivering an audit function to ensure that citizens comply with the installation rules of alternative electricity options, while planning for the municipal area's electricity generation needs. In addition, long-term planning of electrical infrastructure is needed in an environment that is uncertain and complex due to the unpredictable nature of human behaviour and the uncertain impacts of a changing climate. This brings us to the research rationale, discussed in the following section 1.2.

## **1.2 Research rationale**

It is evident that the changing local energy landscape, as described in Section 1.1, necessitates that the role of the municipality of being a distributor of electricity changes and that a different approach is needed to plan for a sustainable energy future. Planning for a sustainable energy future is complex. According to literature, a complex problem comprises of multiple stakeholders with many perspectives and multiple objectives (Ackoff, 1974; Jackson & Keys, 1984; Pidd, 2009), a complex structure of interrelated factors (Ackoff, 1979; Pidd, 2009; Rittel & Webber, 1973; Simon, 1973) as well as many uncertainties and risks (Churchman, 1967; Coyne, 2005). In order to deal with these complexities in the transitioning to a sustainable energy system, it is argued that diverse stakeholders must be involved from the start of the process (Ackermann, Franco, Rouwette & White, 2014; Ernst, Biß, Shamon, Schumann & Heinrichs, 2018; Head, 2014; Rickards, Wiseman, Edwards

& Biggs, 2014; Wiek & Kay, 2015). Participatory methods are considered beneficial due to the inclusion of the many perspectives and values of the stakeholders as well as a better understanding of the social environment (Ernst *et al.*, 2018). Energy scenario development, traditionally, is based on quantitative calculations and does not consider the underlying values and behaviours of individuals or societal actors in the process (Ernst *et al.*, 2018). Many problem-structuring methods (PSMs) (Ackermann *et al.*, 2014; Mingers & Rosenhead, 2004) and other participatory approaches (Luyet, Schlaepfer, Parlange & Buttler, 2012) are available in literature, yet these methods have not been developed to plan for energy sustainability in a local government context, specifically in South Africa.

From a South African local government perspective, the participation of citizens and stakeholder groups forms part of the South African Constitution, which states in Section 152 that local government needs to “ensure the provision of services to communities in a sustainable manner” and “encourage the involvement of communities and community organisations in the matters of local government” (RSA, 1996: 1331(2)). Participation in municipal decision making, planning, budgeting and finances is clearly set out in the Municipal Structures Act (1998), the Municipal Systems Act (2000), the Municipal Finance Management Act (2003) and the Municipal Property Rates Act (2004) (RSA, 1998, 2000, 2003, 2004).

- The Municipal Structures Act (1998), Section 19 (3), states that a municipal council must develop mechanisms for public participation in performing its functions and exercising its powers. In addition, the Act stipulates that a municipality’s executive must give an annual report on the extent to which the public has participated in municipal affairs.
- The Municipal Systems Act (2000), Chapter 4, determines that a municipal council must develop a culture of participatory governance, and for this purpose must encourage and create conditions for residents, communities and other stakeholders in the municipality to participate in local affairs, such as the preparation, implementation and review of the Integrated Development Plan (IDP) and strategic decisions related to municipal services.

- The Municipal Finance Management Act (2003) encourages the participation of communities in the finances of municipalities, including the development of municipal budgets.
- The Municipal Property Rates Act (2004) stipulates that the public must participate in the determination of municipal property rates.

Although public participation is seen as a fundamental democratic right in South Africa (RSA, 1996), the application thereof in a local government context remains consultative and the decision-making authority remains with the municipal council (Slutsky, Tumilty, Max, Lu, Tantivess, Hauegen, Whitty, Weale, Pearson, Tugendhaft, Wang, Staniszewska, Weerasuriya, Ahn & Cubillos, 2016). Literature shows that the engagement of public agencies and non-state holders in collective decision making or collaborative governance is still in its infancy in South Africa (Kamara, 2017; Leck & Simon, 2018). Also, no distinction is made between the approaches that need to be followed for operational planning, such as budgeting and finances, and more complex matters, such as a total redesign of the energy landscape.

The research gap was identified in the limited evidence of formal participatory approaches applied at a local government level in South Africa with regard to improving local government decision making and planning of sustainable energy. In addition, a clear description of such a participatory planning approach that specifically deals with a complex problem was lacking in literature. The rationale for the research was therefore to investigate participatory approaches at a local government level in order to understand who should participate, how and when they should participate and how the wider public needs to be involved in order to improve decision making in complex matters such as a sustainable energy future.

### **1.3 Research question and objectives**

The research aimed to integrate various multidisciplinary methods and theories in developing a participatory planning approach for energy sustainability for a local government in South Africa. To this end, the following research question was formulated: What should a participatory planning approach at a local government level entail to enable a move towards a sustainable energy future?

In order to achieve the aim to develop a participatory planning approach to support energy sustainability at a local government level in South Africa and to answer the research question of what such a participatory approach should entail, the research needed to fulfil the following objectives:

1. To review evidence of participatory planning approaches to determine factors necessary for the successful development and implementation of such approaches
2. To determine whether and how renewable energy options form part of a local government's strategy and long-term plans
3. To investigate how participatory approaches are utilised in the development and communication of a municipal strategy
4. To develop, apply and evaluate the use of a participatory planning approach for energy sustainability in a local government in South Africa.

The following main activities of the study were completed during the research period: A systematic review of participatory approaches found in literature was undertaken to determine factors necessary for the successful development and implementation of such approaches; action research was conducted, as part of a case study with Hessequa Municipality in the Western Cape province of South Africa, where the researcher became an observer and participant in the development of the municipal IDP in order to investigate how a local government utilises participatory approaches; the facilitation of strategy workshops with Hessequa Municipality and a qualitative analysis of municipal data were conducted and triangulated with other relevant literature to determine whether and how renewable energy forms part of the local government's strategy and long-term plans; and finally a participatory planning approach for local energy sustainability was developed from multidisciplinary theory and methods, and applied and evaluated in a case study conducted with Hessequa Municipality in the Western Cape province of South Africa. These research activities are further explained in Section 1.4.

## 1.4 Research strategy, design, and methodology

The research followed a dissertation by publication strategy, where the main research objectives were answered separately in order to be publishable in peer-reviewed journals. The research methodologies for each of the research objectives therefore differ. Overall, the research entailed a combination of reviewing literature and using a single instrumental case study approach. The researcher acted as an observer, participant, and facilitator in the process.

The conceptual framework of the research design used, as shown in Table 1-1, was based on an action research design methodology (Riel, 2019). The action research methodology is beneficial because it provides a cycled approach that allows collaboration and reflection throughout the different cycles in order to improve the developed planning approach throughout the research period. Riel (2019) sees action research as a process of deep inquiry into one's practices in service of moving towards an envisioned future aligned with values. The component of reflexivity ensures that an opportunity exists to adapt and improve the approach when necessary. Action research provides several cycles where the researcher 1) studies and plans, 2) acts, 3) collects and analyses evidence and 4) reflects in order to plan the next cycle.

Cycle 1 in the research design focused on a qualitative systematic literature review to determine factors necessary for the successful development and implementation of participatory planning approaches. The research orientation was exploratory, and the systematic literature review approach provided conceptual clarity and understanding of the current literature on participatory approaches and future research agendas. The sample used in the research was peer-reviewed academic journal articles in English identified through a keyword search in the Scopus and Web of Science Core Collection databases for the period 2009 to 2015. The process steps as set out by the Collaboration for Environmental Evidence (2013) were followed and additional literature was included using the snowball sampling technique. The data were analysed using thematic content analysis. The research findings have been published in the journal *Administratio Publica*, and the article is included in the dissertation as Chapter 2.

Table 1-1 Conceptual framework of the research design

Cycle / research steps	Study and plan	Act	Collect and analyse evidence	Reflect
<b>Cycle 1 (research objective 1)</b>	<b>What:</b> Determine factors necessary for the successful development and implementation of a participatory planning approach	Jan 2015 – Jun 2016	<b>Published article:</b> A literature review of energy-planning and decision-making approaches in the local government sphere (Fouché & Brent, 2016)  <b>Journal:</b> <i>Administratio Publica</i>	Reflect on the output of each research cycle to plan the next cycle
	<b>How:</b> Systematic literature review			
	<b>Who:</b> Researcher			
<b>Cycle 2 (research objectives 2 &amp; 3)</b>	<b>What:</b> Create an understanding of a local government context. Determine how renewable energy options form part of a local government's strategy. Investigate how participatory approaches are utilised.	Jan 2016 – Jun 2018	<b>Published article:</b> Journey towards renewable energy for sustainable development at the local government level: The case of Hessequa Municipality in South Africa (Fouché & Brent, 2019)  <b>Journal:</b> <i>Sustainability</i>	Reflect on the output of each research cycle to plan the next cycle
	<b>How:</b> Document analysis and literature review, observations from participation in municipal meetings and facilitation of two workshops			
	<b>Who:</b> Researcher with participants			

<b>Cycle 3 (research objective 4)</b>	<b>What:</b> Develop, apply, and evaluate a participatory planning approach to plan for a sustainable energy future at a local government level	Jan 2018 – Jan 2020	<b>Published article:</b> Explore, Design and Act for Sustainability: A participatory planning approach for local energy sustainability (Fouché & Brent, 2020)  <b>Journal:</b> <i>Sustainability</i>	Reflect on the output of each research cycle to plan the next cycle
	<b>How:</b> Literature review, inductive reasoning, open discussions, and facilitation of a workshop			
	<b>Who:</b> Researcher with participants			
<b>Cycle 4</b>	<b>What:</b> Critically reflect on the developed participatory planning approach in order to improve the approach and to identify opportunities for future research	Aug 2019 – Mar 2020	<b>Conclusion of</b> research dissertation summarising key findings, contributions, limitations and reflections to propose future research directions	Summary of personal reflection given as part of Chapter 5
	<b>How:</b> Critical reflection			
	<b>Who:</b> Researcher			

The researcher further utilised Cycle 1 to establish which municipality in the Western Cape was willing and open to the research. Working closely with the School of Public Leadership (SPL) and participating in several discussions with Mosselbay Municipality, Prince Albert Municipality and Hessequa Municipality, a decision was taken to focus on Hessequa Municipality as a suitable case study. At the time of starting with the research, Hessequa had already embarked on a sustainable energy journey and easy access to the municipal management and council was possible due to the already established collaborations with SPL and Stellenbosch University.

Cycle 2 of the research focused on establishing trust with the participating stakeholders at Hessequa Municipality, while becoming familiar with the inner workings of a municipal government organisation through open discussions with the municipal management team, attending integrated development planning meetings and facilitating strategic workshops. The second and third research objective was answered during this research cycle. A single instrumental case study approach was considered appropriate, as it allows in-depth analysis and investigates complex social phenomena in a real-life context (Yin, 2009). For research objective 2, namely to determine whether and how renewable energy options form part of a local government's strategy and long-term plans, a strategy workshop was designed and facilitated with Hessequa Municipality, as a starting point, after which additional literature on local sustainable energy options was incorporated as part of the research findings. Data were collected in the form of rich pictures (Bell, Berg & Morse, 2016; Bell & Morse, 2013; Checkland, 1981) and transcribed audio recordings, together with analysing municipal documentation and other literature. For the data analysis, thematic content analysis was conducted and causal relationships were identified using cognitive mapping (Eden, 2004). For research objective 3, namely to investigate how participatory approaches are utilised in the development and communication of a municipal strategy, the researcher acted as an observer and participant during several municipal meetings held with ward committees in their respective towns to formulate the municipal IDP. The data were analysed and evaluated against the factors necessary for the successful development and implementation of participatory planning approaches, as determined as part of research objective 1. The research output of Cycle 2 was published in the journal *Sustainability*, and the article is included as Chapter 3.

Cycle 3 of the research involved the development, application, and evaluation of a participatory planning approach for energy sustainability in a local government in South Africa. Again, Hessequa Municipality was selected as the case study to answer research objective 4. Having worked closely with Hessequa Municipality and its stakeholders, it became clear that the planning approach should be developed from multidisciplinary theories and methods such as soft operational research (OR), strategy management and systems thinking in order to formulate

the problem through the involvement of the relevant stakeholders and decision-makers. The cycle started with a detailed literature review as well as open discussions with the participating stakeholders as to what the requirements are for such a planning approach at Hessequa. Based on these requirements, the characteristics of complex problems and the factors necessary for the successful development and implementation of participatory planning approaches, as determined as part of research objective 1, a participatory planning approach for energy sustainability was developed, namely EDAS: an approach to Explore, Design and Act for Sustainability. In order to evaluate the use of the EDAS approach, a two-day workshop was held with Hessequa Municipality with the aim of developing a plan for sustainable energy. EDAS was applied in this workshop setting and the proposed stages, namely to Explore, Design and Act for Sustainability, were evaluated. An evaluation form was used to evaluate the effectiveness and practicality of the approach and to investigate whether EDAS could be suitable for other municipalities in South Africa. The researcher then also critically reflected on the different steps of the EDAS approach, as part of evaluation, in order to suggest improvements. Chapter 4 provides the details of the research and the output was published in the journal *Sustainability*.

Cycle 4 involved a critical reflection of the research done to date in order to summarise the key findings and research contributions and to identify opportunities for future research. These proposed future research directions, with a summary of the key findings and key research contributions, are presented in Chapter 5. The cycled approach of action research, as summarised in Table 1-1, allowed time and space to develop and improve the participatory planning approach and to operationalise the approach for a local government context in order to facilitate the planning of sustainable energy decisions.

## **1.5 Theoretical framing and literature review**

The study was framed around the understanding of how people make decisions, how people deal with complexity and the fundamentals of problem-solving approaches that acknowledge complexity. The core theoretical constructs on which the study drew are defined in Table 1-2.

Table 1-2 Description of core theoretical constructs

<b>Core construct</b>	<b>Description</b>
<b>Bounded rationality</b>	'Bounded rationality' is a term used when making decisions under conditions where it is difficult or impossible to know all the alternatives, where uncertainty is evident and where there is an inability to calculate the consequences. Bounded rationality seeks for the achievement of goals, rather than optimisation (Simon, 1979).
<b>Complex problem</b>	Complex problems can be approached from multiple, sometimes competing, perspectives and may have multiple possible solutions (Center of Economic and Community Development, 2019). A complex problem is also known as a mess (Ackoff, 1979, 1981), a wicked problem (Rittel & Webber, 1973) or an ill-structured problem (Simon, 1973).
<b>Complexity theory</b>	Complexity theory is an interdisciplinary theory that allows us to better understand the characteristics of complex systems, which are networks of many interdependent parts. Complex theory draws from research that examines uncertainty and non-linearity (BusinessDictionary, 2019).
<b>Personal construct theory</b>	In personal construct theory, organisms construct mental representations in order to construe the phenomena they encounter in the real world. These multiple constructs are constantly revised and modified to make them fit more consistently with perceptions of reality (Kelly, 1955).
<b>Public participation in the South African context</b>	"Public participation is a two-way communication and collaborative problem-solving mechanism with the goal of achieving representative and more acceptable decisions. Other terms sometimes used are public involvement, community involvement or stakeholder involvement" (South African Legislative Sector, 2013).
<b>Risk assessment</b>	'Risk assessment' is a term used to describe the overall process of identifying risk factors, analysing and evaluating the risk associated with the identified risk factors and determining appropriate ways to mitigate or eliminate the identified risks. The risk field is about understanding the world (in relation to risk) in order to find ways to better manage the world (Aven, 2016).

<b>Scenario planning</b>	Scenario planning has been used by Royal Dutch/Shell since the early 1970s in strategic planning and is a “disciplined method for imagining possible futures that companies have applied to a great range of issues” (Schoemaker, 1995).
<b>Soft operational research</b>	Soft OR stems from Ackoff's (1979) realisation that the traditional OR methods, focusing on finding optimal solutions for a given problem using only quantitative data, do not necessarily focus on the correct or total problem due to the absence of qualitative data such as the different perceptions of multiple stakeholders. Soft OR methodologies constitute a new paradigm of analysis compared to traditional OR, resulting in the naming convention of PSMs (Mingers & Rosenhead, 2004).
<b>Strategy making</b>	Strategy making is both an analytical and a social process that entails the development of a robust and coherent strategy with a group of people. The strategy should consist of prioritised actions that the people (participating in the process) want to implement (Ackermann & Eden, 2011).
<b>Systems thinking</b>	<p>Systems thinking is a holistic approach to examining problems more completely and more accurately before acting. It focuses on the way that a system's constituent parts interrelate and how systems work within the context of larger systems over a time period. Systems thinking originated from systems dynamics (Forrester, 1989).</p> <p>Checkland (1981) uses the notions of systems thinking in soft systems methodology (SSM) to represent the real world in a conceptual model, which shows interconnected human and organisational factors in the way they are perceived by stakeholders. Systems thinking deals with understanding and structuring the complex problem in a way to better manage the problem, and not to solve the problem.</p> <p>Maani and Cavana (2007) define systems thinking as a scientific field of knowledge for understanding change and complexity through the study of dynamic cause and effect over time. Maani and Maharaj (2004) adopted the notion of systems thinking as a paradigm, which refers to systems thinking as a 'worldview' of seeing things holistically and as interconnected.</p>

A description of the main theories and approaches used as the foundation of the developed participatory planning approach is given next to define the scope and research focus.

### **1.5.1 Public participation, stakeholder participation and collaborative governance**

Several definitions of public participation are given in literature:

- According to Creighton (2005: 7), public participation is “the process by which public concerns, needs, and values are incorporated into governmental and corporate decision making. It is two-way communication and interaction, with the overall goal of better decisions that are supported by the public”.
- Davids (2005: 19) states that public participation is an “inclusive process aimed at deepening democracy through formal participatory mechanisms” and advocates that participation should lead to collective decision making, implementation, monitoring and evaluation.
- According to Holmes (2011), public participation is a democratic process that provides individuals and groups from the community with an opportunity to influence socio-political and economic conditions for the better.

Creighton (2005) states that although the definitions of public participation differ, the common elements are that public participation is about interaction and not just about information sharing, it entails an organised process for involving the public and participants have some level of influence on the decisions being made.

Public participation can take place on different levels, as given in Arnstein’s (1969) ladder of citizen participation, such as information sharing, consultation, involvement or empowerment. The motivation for public participation found in literature is information sharing and creating awareness (Bayley & French, 2008), ensuring a form of democracy (Bayley & French, 2008; Davids, 2005; Holmes, 2011; Madumo, 2014), enabling social cohesion (Bayley & French, 2008), improving decision quality (Bayley & French, 2008; Reed, 2008; Rowe & Frewer,

2000) and better acceptance of decisions (Creighton, 2005; Rogers, Simmons, Convery & Weatherall, 2008).

Different formalised public participation methods, as given by Rowe and Frewer (2000), are referenda, public hearings, public opinion surveys, negotiated rule making, consensus conferences, citizens' juries, public advisory committees and focus groups. When designing these participation methods, it is important that the wider public is involved or at least represented within the participation group (Rowe & Frewer, 2000). In a cross-national study of 12 countries aimed at exhibiting patterns of public participation, it was found that patterns of public participation are widely variable with regard to public character, the accountability of public representatives to the public they represent, the effectiveness of the representatives and the representatives' role in decision making (Slutsky *et al.*, 2016). Those taking part in these interventions also differ due to the different ways the 'public' is defined by analysts, administrators and policymakers (Slutsky *et al.*, 2016).

In South Africa, public participation has been established as a requirement for local government and mainly forms part of municipal budget development and integrated development planning processes (Barichievy, Piper & Parker, 2005). Municipalities of South Africa are mandated by the Constitution of the Republic of South Africa (RSA, 1996) to focus on growing local economies and provide infrastructure and services by involving citizens in local policy and decision making. Citizen involvement in local government matters is a fundamental democratic right and it occupies a key role in facilitating local democracy and promoting values of good governance.

Local government public participation in South Africa is organised through institutions of ward committees, where members of the public become part of a local government to represent the wider community within their ward areas (RSA, 1998). Critique against the current form of public participation at a local government level in South Africa is that the institutional arrangement of ward committees is poorly designed and disempowering (Piper, 2011). Braun and Schultz (2010) argue that participatory governance is a conceptual ideal and fails to honour the general will of citizens. The South African structure provides an

enabling environment for public participation, but protects the state in its role as the decision-maker (Slutsky *et al.*, 2016). Piper (2011) further argues that the relative weakness of civil society also hampers meaningful public participation in South Africa, resulting in civil society being either disengaged (not being represented or not attending ward committee meetings) or enraged (evident from public protests where citizens raise their concerns outside of government provided channels) (Slutsky *et al.*, 2016). Madumo (2014) argues that the challenges facing public participation in municipalities are two-fold. Firstly, municipalities are faced with systematic challenges – those challenges causally linked to public participation such as enacted legislation, the political environment, and the quality of the community members. The second challenge, according to Madumo (2014), lies with the structure of the ward committees in a municipality and it is questioned whether the structure of ward committees truly fulfils the objective of effective public participation. Madumo (2014) summarises these structural challenges as ward committees lacking original power, recognition and legitimacy, political stability, focus and clarity in their responsibility and the capacity to promote public participation. One specific challenge that municipalities face with regard to the IDP process, as pointed out by Sinxadi and Campbell (2015), is that municipal councillors do not always participate in IDP formulation and review programmes, but then want to change certain decisions in the approval phase without clear insight into the process that led to the priorities and decisions.

In literature, the terms ‘public’ and ‘stakeholders’ are not used consistently and may cause confusion. According to Luyet *et al.* (2012), the public is a collection of individuals generally unstructured and unorganised, whereas stakeholders can be seen as any group of people organised who share a common interest or stake in a particular issue. In the South African public participation framework, a distinction is made between civil society and stakeholders. According to the South African Legislative Sector (2013: 8), civil society ...

[i]ncludes a wide array of non-governmental and non-profit organisations, community groups, charitable organisations, labour unions, indigenous groups, faith-based organisations, professional associations, and foundations. These have a presence in public life; expressing the interests

and values of their members or others based on ethical, cultural, political, scientific, religious or philanthropic considerations.

Stakeholders, on the other hand, “are people who have a specific and clearly definable interest in what is undertaken and have an interest in the institutional outcome” (South African Legislative Sector, 2013: 8). To avoid confusion, Luyet *et al.* (2012) suggest that a better term to use is ‘stakeholder participation’ or ‘stakeholder involvement’.

Reed (2008) provides a detailed historical description of how the approaches of stakeholder participation progressed from awareness raising in the late 1960s, incorporating local perspectives in planning in the 1970s, the development of approaches that recognise local knowledge in the 1980s, the increased use of participation as the norm in the sustainable development agenda of the 1990s, subsequent critique of participation in 2001, and lately reaching ‘post-participation’ consensus on best practices and lessons learnt. Reed (2008) further emphasises that these developments took place in parallel geographical and disciplinary contexts and that although many claims are evident in literature for the benefits of participation, such as improved democratic society, citizenship and equity or a better quality and durability of decisions, the evidence for these claims are limited. Reed (2008) provides eight key features of best practice participation, namely 1) stakeholder participation needs to be underpinned by a philosophy that emphasises empowerment, equity, trust and learning, 2) where relevant, stakeholder participation should be considered as early as possible and throughout the process, 3) relevant stakeholders need to be analysed and represented systematically, 4) clear objectives for the participatory process need to be agreed among stakeholders at the outset, 5) methods should be selected and tailored to the decision-making context, considering the objectives, type of participants and appropriate level of engagement, 6) highly skilled facilitation is essential, 7) local and scientific knowledge should be integrated and 8) participation needs to be institutionalised. Reed’s publication in 2008 received 3 170 citations (34 in 2020) to date, which shows that stakeholder participation is widely used and relevant, especially in the fields of environmental management and sustainability.

In 2008, a relatively new form of governance, namely collaborative governance, emerged (Ansell & Gash, 2008). Collaborative governance brings public and private stakeholders together in collective discussions with public agencies to engage in aligned decision making. Where the critique and evidence of public participation (Ansell and Gash [2008] use the term 'managerialism') showed that the role of the public in decision-making authority is limited, collaborative governance requires stakeholders to be directly engaged in decision making. Ansell and Gash (2008: 546) refer to stakeholders as both "the participation of citizens as individuals and the participation of organized groups" and see collaboration as two-way communication and multilateral deliberation to influence and discuss matters of governmental importance. With collaborative governance the focus moves to collective decision making and not only consultation, which is mostly evident in the cases of public participation, as pointed out by Slutsky *et al.* (2016). The implication of this viewpoint is then that collaborative governance is merely another term used for public participation, which features on the higher levels of Arnstein's ladder of participation (Arnstein, 1969).

The main conclusion from the literature review is that many terms and forms of involving stakeholders in government matters exist. The rationale for involving non-state stakeholders in the decision making of sustainable energy matters at a local government level is due to the complex nature of a local government's energy landscape, which is discussed in Section 1.1. The involvement of stakeholders in discussions on sustainable energy at a local government level is new and not formalised, as might be the case with the consultation process followed when municipal budgets and IDPs are being developed. For the purpose of the research, the definition of stakeholders as those people who have an interest and can influence the decisions that are undertaken (South African Legislative Sector, 2013) was adopted. The stakeholders are "partners in the design and implementation of better solutions and outcomes" (South African Legislative Sector, 2013: 8). These stakeholders should at least include the ward committees, which represent the public, the council, the municipal management team, the top electricity users in the municipal area, subject matter experts in the field of electricity and sustainable energy and regional or provincial government.

Participation within the scope of the research is defined as two-way communication and deliberation, and not only information sharing and consultation.

In a South African context, involving stakeholders in local government matters will still take place under the umbrella term of 'public participation', because the public will be presented through the ward committees (with the limitations as mentioned in literature). The theories of public participation and collaborative governance were used as overarching frameworks in the development of a participatory planning approach for local energy sustainability. Important to note is that the wider public or civil society, for the purposes of this research, was not included in the sample size. The main reason for this was that it was felt that strategic direction first needs to be established with a small group of stakeholders before the wider public is involved, mainly to avoid the creation of expectations that cannot be fulfilled.

### **1.5.2 Soft operational research and problem-structuring methods**

Soft OR stems from Ackoff's (1961) realisation that traditional OR methods, focusing on finding optimal solutions for a given problem, do not necessarily focus on the right or total problem. These traditional OR methods focused on quantitative data only, omitting qualitative data such as the viewpoints and perceptions of different stakeholders. In addition, traditional OR methods do not adequately deal with uncertainty (Rosenhead & Mingers, 2001). Since 1961, many academics in the OR community (Graham, 1978; Mitchell, Bishop, Boothroyd, Bugden, Cantellow, Elton, Hicks, Kingsman, Martin & Talbot, 1974; Simpson, 1978; Thunhurst, 1973) echoed Ackoff's concerns to find ways to determine what the real problem is before trying to solve the problem (Woolley & Pidd, 2014). The need for approaches that consider different perceptions from multiple stakeholders led to the development of soft OR methodologies. Rosenhead (1989) identified that these soft OR methodologies constituted a new paradigm of analysis compared to traditional OR and since then, the consistent naming convention of 'problem-structuring methods' emerged (Rosenhead & Mingers, 2001). Rosenhead and Mingers (2001) further established characteristics of these PSMs, namely that they are non-optimising, are less dependent on quantitative data, integrate hard and

soft data with social judgement, are simple and transparent, conceptualise people as active subjects, facilitate planning from the bottom up, accept uncertainty and aim to keep options open. Recently, Smith and Shaw (2019) highlighted through an exploratory review of literature that four additional characteristics of PSMs can be added based on a four-pillar framework that focuses on system characteristics, knowledge and involvement of stakeholders, the values of model building and structured analysis. These additional characteristics of PSMs are as follows: The approach identifies a system to model, the model-building process is generic and transferrable to multiple problem contexts, the approach structures knowledge through different stages of analysis and the approach has distinct phases of divergent and convergent thinking. The major PSMs that confirm all the characteristics as listed by Smith and Shaw (2019) are SSM (Checkland, 1981), strategic choice approach (SCA) (Friend & Hickling, 2004), strategic options development and analysis (SODA) (Eden & Ackermann, 2001) and robustness analysis (RA) (Rosenhead & Mingers, 2001). A description of these PSMs is given next, with a specific focus on reviewing these PSMs against the characteristics of complex problems, namely multiple stakeholders and perspectives, multiple objectives, many interrelated variables, a complex structure, uncertainties, and risks.

#### **1.5.2.1 Soft systems methodology**

SSM was developed through action research during the late 1960s at the University of Lancaster in the United Kingdom to guide problem-solvers' thoughts in a pragmatic and structured way to better understand the system of human activities under consideration (Checkland, 1972, 1981, 1985, 2000). Human activity systems include varying viewpoints and behaviour, are not programmable, such as in technical systems, and are dependent on context and personal judgements (Larsson & Malmsjo, 1998). Checkland (1985) draws a comparison between the hard and soft traditions of systems thinking and shows that for some problems the orientation should be towards learning rather than goal seeking and the language used during discussions should aim to discuss issues and how they can be accommodated, rather than finding solutions to problems.

SSM is a participative approach that guides stakeholders and problem-solvers through seven steps to better understand the problem situation (steps 1 and 2), to define the ideal state of the system through the development of a root definition (Step 3) and a conceptual model (Step 4), and to then compare the ideal system against the current reality (Step 5). From the comparison of the ideal system against the current reality, feasible desirable changes (Step 6) are developed, which then need to be actioned in order to improve the problem situation (Step 7). The participative nature of this methodology (Mingers & Taylor, 1992) allows for the viewpoints and objectives of multiple stakeholders and increases the engagement of the persons involved (Larsson & Malmso, 1998; Mingers & Taylor, 1992). Checkland's *Weltanschauung* or 'worldview' further highlights the perception aspect of this approach. The systems perspective, understanding the complex interconnectedness of the whole, is used to highlight and understand the many interrelated issues and factors that may impact the system directly or indirectly. Uncertainties are dealt with when describing the Customers, Actors, Transformation process, *Weltanschauung*, Owners and the Environment (CATWOE) in Checkland's systems thinking tool (Checkland, 1981). CATWOE can be explained as follows (2009):

- Customer: The immediate beneficiaries or victims of what the system does
- Actor: The people who carry out one or more of the activities of the system
- Transformation process: The core process of the system in which some definite input is converted into some output delivered to the customer
- *Weltanschauung*: The underlying worldview for the transformation process, which gives sense to the system within a defined context
- Owner: The individual or group responsible for the proposed system in the sense that they have the power to modify it or even close it down
- Environment: The rules and constraints imposed by the external environment on the system.

When applying CATWOE, uncertainties emerge, especially when identifying environmental constraints over which one does not have control and that are in many instances uncertain, such as financial, regulatory, and political uncertainties.

The practical application of SSM is questioned in a study conducted by Mingers and Taylor (1992), where they concluded that although the methodology of SSM is sound, the respondents felt that training is necessary to gain confidence and knowledge to apply SSM. In addition, SSM has been perceived as time-consuming and possibly unsuitable for managers. Development opportunities for the methodology itself are to include techniques to help with the process of client interaction and to better deal with change management. In order to overcome some of these shortcomings, SSM has been used in combination with other methods, including simulations, influence diagrams, SCA, cognitive mapping and interactive planning (Mingers & Rosenhead, 2004). Another shortcoming of SSM is that it does not explicitly identify and measure the associated system's risks as part of the seven proposed steps. One could argue that risk mitigation could be included as activities as part of the development of the conceptual model, but no explicit mention of risk or risk mitigation could be found in the studies reviewed that apply SSM (Coelho, Antunes & Martins, 2010; Liu, Meng, Mingers, Tang & Wang, 2012; Mehregan, Hosseinzadeh & Kazemi, 2012; Novani, Putro & Hermawan, 2014; Scott, 2005; Siddiqui & Tripathi, 2011).

### **1.5.2.2 Strategic choice approach**

SCA is best known as planning under pressure, where stakeholders are focusing on managing the many uncertainties associated with real-world complex problems. In this practical approach to collaborative decision making under uncertainty, when working under real-time pressure, the judgements and negotiations through which such choices are tackled can have immense influence on the decisions made (Friend & Hickling, 2004). SCA was developed through research initiated in the 1960s at the Tavistock Institute of Human Relations in London, and was conducted with teams of OR workers and social scientists (Friend, Norris & Stringer, 1988).

SCA consists of four stages, namely the shaping mode, design mode, comparing mode and choosing mode. In the shaping mode, stakeholders will consider various decision areas and the interconnection between these decision areas. In the design mode, possible options within each decision area are identified and debated. In this stage, all possible combinations of compatible options are considered in order to reach a list of potentially feasible decision schemes or

strategies. The comparing mode entails the comparison of the different decision schemes based on selected criteria and their associated uncertainties. In the choosing mode, commitments are developed and actioned. Uncertainties are identified during all four stages and applicable actions to better understand or monitor these uncertainties are listed as part of the commitment package in the choosing mode. According to Rosenhead (1989), the distinctive features of SCA and other soft OR methodologies lie in the structuring of the problem situations rather than the solution of the problem and in the process of encouraging participation from diverse stakeholders. Risk is dealt with in SCA as part of the identification and management of the different uncertainties (Siddiqui & Tripathi, 2011).

The specific focus of SCA is on the perceptions and viewpoints of multiple stakeholders to better understand the interconnections of different decision areas as well as to identify the uncertainties in which decisions need to be managed. The distinctive features of SCA and other soft OR methodologies lie in the structuring of the problem situations rather than the solution of the problem and in the process of encouraging participation from diverse stakeholders (Friend, 2001). An article by Phahlamohlaka and Friend (2004) shows that valuable progress can be made in a one-day facilitated workshop applying SCA to agree on decision areas and uncertainty areas, but that more time is needed for detailed debate to identify criteria for comparing the different decision schemes. SCA, as with many other participatory approaches, is resource-intensive, time-consuming and expensive (Gaudreau & Gibson, 2010; Pidgeon, Demski, Butler, Parkhill & Spence, 2014; Retallack & Schott, 2014), and therefore detailed planning and experienced facilitation are needed when applying any of these methods.

### **1.5.2.3 Strategic options development and analysis**

Developed in the 1980s, SODA is an approach that enables the exploration of problematic situations before decisions are made through the capturing and structuring of different stakeholders' viewpoints in a transparent cognitive map (Eden & Ackermann, 2001). SODA is premised on personal construct theory (Kelly, 1955), which analyses humans' understanding of the world through mental constructs. These constructs exhibit contrasts, or bipolar relationships, of people's

view of the world. The SODA process can be based either on conducting individual interviews with stakeholders and developing different individual cognitive maps, which are then later consolidated in a facilitated workshop, or through collaboratively developing a cognitive map in a facilitated workshop setting (Pidd, 2009). The discussion of the cognitive map and the many interconnections will lead to an understanding of the goals, strategic directions, and issues. The main objective of the SODA approach, according to Eden and Ackermann (2001), is to change people's minds about the nature of the situation through seeing and understanding others' perceptions. Ackermann and Eden (1998) view SODA as an approach designed to support decision-makers in dealing with complexity inherent in many organisational problem situations. Evident in SODA is that it deals with multiple stakeholders and many interrelated issues, but does not explicitly identify uncertainties and risks as part of the process.

#### **1.5.2.4 Robustness analysis**

RA, developed by Gupta and Rosenhead (1968), provides an approach to structure problem situations where uncertainty is high and decisions are sequential. Initially, RA was established as an analyst-dependent 'backroom' methodology, but then changed towards a participative methodology. Participative RA comprises of screening, exploring, structuring, valuing and deciding stages (Rosenhead, 2001). RA aims to maintain rationality in decisions in the face of an unknowable and uncertain future to identify the initial decision with the highest proportion of desirable future scenarios, also known as the most robust initial commitment. All decision options must be plausible, logical and proposed by the stakeholders (and therefore often subjective). This scoring often does not produce a solution, but will eliminate non-contenders (Horlick-Jones & Rosenhead, 2002). RA will not and cannot identify the eventual future outcome, but will guide the decision-makers to more robust initial commitments, which are those commitments that will keep future options open and flexible. RA is useful to facilitate and ensure participation, dialogue, and negotiation. The benefits of RA include the consideration of uncertainty as events unfold. As uncertainties become certainties, the same decision diagram can still be used, as it has many future possibilities. Another benefit of RA is that initially the potential costs of adverse events are mapped, and an attempt can be made to avoid worst-case scenarios. Instead of

attempting to find the best solution, RA can assist in avoiding unacceptable future states (Rosenhead, 1980). RA is a flexible model, which makes budgeting and public accountability for RA projects problematic, as commitment is only to the initial decision. In RA, the robustness of the initial decision is quantified using a robustness score (Rosenhead & Wong, 2000). The robustness score is the sum of all the acceptable options for a given initial commitment and future condition divided by the sum of all the acceptable options in that specific future condition. The higher the robustness score, the more flexibility exists for future decisions when making the initial commitment. Debility is the opposite of robustness. It gives a score of the least flexibility in future decisions when the initial decision is made. It is evident that the RA approach deals with multiple stakeholders with different viewpoints, a complex structure of interconnected factors and uncertainty. The question is, however, whether debility can be used as a form of risk measurement.

### **1.5.3 Other participatory approaches**

The literature on participatory approaches is rich with many different approaches, both qualitative and quantitative. The need was therefore identified to elicit these participatory approaches further using a systematic literature review, as given in Chapter 2. Chapter 2 further describes participatory techniques in general as well as approaches such as multi-criteria decision analysis, systems dynamics modelling, scenario planning and adaptive management.

### **1.5.4 Risk assessment methods**

A literature review on risk assessment methods has been included due to risk being a key characteristic of renewable energy projects (Freudmann, 2011; Gatzert & Kosub, 2016; Ioannou *et al.*, 2017), as mentioned in Section 1.1. In addition, sustainable energy projects or energy innovation projects are characterised by many risks (Mihić, Dodevska, Todorović, Obradović & Petrović, 2018) such as numerous risks from the environment, which are hard to predict, multidisciplinary project teams and multiple stakeholders, difficult decision making and financial risk. In order to plan for a sustainable energy future at a local government level, these risks and uncertainties need to be considered. According to Bowers and Khorakian

(2014), approaches to deal with these risks have not been explicitly examined, and evident from the literature on PSMs, risk is not an explicit focus of these methods.

The concept of risk has a long history, starting with the Greeks, who believed the future is little more than a matter of luck and most of their decisions a matter of instinct (Bernstein, 1996), followed by the mathematicians and scientists of the 15<sup>th</sup> and 16<sup>th</sup> century, who were obsessed with numbers and measurement and who became the first discoverers of the laws of probability (Bernstein, 1996). The quantitative achievements of past researchers, such as Cardano, Fibonacci, Paccioli, Pascal, Fermat, Bernoulli, Von Neumann, Arrow and Markowitz, have transformed the perception of risk from chance of loss into an opportunity for gain; from fate to choice. These heroes shaped the trajectory of progress of risk management over the past 450 years (Bernstein, 1996). Risk assessment and risk management, as a scientific field, became known in the last 30 to 40 years. Risk is viewed as a multidimensional construct with dimensions labelled as dread, lack of familiarity and lack of controllability (Fischhoff, Slovic, Derby & Keeney, 1981). Likewise, it has been found that when considering monetary gambles, losses have a greater impact than gains (Coombs & Lehner, 1984; Kahneman & Tversky, 1979; Yates & Stone, 1992), hence when the perceived risk is too high, a person will choose not to gamble because of the fear of losing what he/she already has. Luce and Weber (1986) propose a theory of risk judgements called 'conjoint expected risk'. Risk perceptions are described as a weighted combination of three probabilities (winning, losing and receiving nothing), expected gains (each gain raised to a power) conditional on winning and expected losses (each loss raised to a different power) conditional on losing. Weber, Anderson and Birnbaum (1992) found that, holding probability constant, the effect of a given outcome on risk judgements decreases as the number of other outcomes in the gamble increases.

While risk assessment and risk management in the past focused mainly on quantitative techniques, a recent innovative approach to risk management and uncertainty was introduced based on the belief that risk exists solely in the conscience of individuals and is therefore a problem of subjective perception (Marczyk, 2010). A variety of risk assessment techniques from multiple disciplines is summarised by the American Society for Safety Engineers and discussed by Luko (2014). In the early stages of project planning, qualitative methods such as

brainstorming, interviews, Delphi analysis, checklists, structured 'what-if' analysis and the consequence/probability matrix are deemed suitable when identifying risk factors (Bowers & Khorakian, 2014). These techniques do not require intensive data demands and are dependent on the subjective opinions of the stakeholders.

## **1.6 Case study: Hessequa Municipality**

According to the Constitution in Section 152, local governments in South Africa must aim to provide democratic and accountable government for local communities, to ensure the provision of services to communities in a sustainable manner, to promote social and economic development, to promote a safe and healthy environment, and to encourage the involvement of communities and community organisations in local government matters (RSA, 1996). Municipalities in South Africa are categorised into three categories, where a Category A municipality has exclusive executive and legislative authority in its area and a Category B shares authority with a Category C municipality. A Category C municipality has "municipal executive and legislative authority in an area that includes more than one municipality" (RSA, 1996: 1331(3)). A Category C municipality is also known as a district municipality.

Hessequa Municipality, situated in the Western Cape province of South Africa, is one of 226 local municipalities in South Africa. Hessequa Municipality shares executive and legislative authority with the Eden District Municipality, making it a Category B municipality. The borders of Hessequa include the inland towns of Heidelberg, Riversdale and Albertinia, and the coastal resorts of Witsand, Jongensfontein, Stilbaai and Gouritsmond, as shown in Figure 1-1.

An estimated 55 559 people reside within Hessequa, which accommodates approximately 17 731 households, or 3.1 residents per household (Hessequa Municipality, 2019a). According to Statistics South Africa (Stats SA) (2011), formal housing is available to 94.2% of residents and 4.6% of the population has access to informal housing. As far as ethnicity is concerned, most of the population (68.5%) describe themselves as coloured, white people constitute 23.2%, and 7.4% identified themselves as black African (Stats SA, 2011). Three formal sectors form the basis of the local economy, namely finance, insurance, real estate and

business services (19.5%); manufacturing (16.3%); and agriculture, forestry and fishing (15.2%) (Hessequa Municipality, 2019a). The unemployment rate of Hessequa in 2011 was an estimated 14.1%, excluding a total number of 1 458 discouraged work-seekers. The youth unemployment rate is estimated at 18.9% and approximately 4.6% of those aged 20 years and older have no form of schooling (Stats SA, 2011). The latest unemployment is estimated at 9.5% (Western Cape Government, 2017). Hessequa Municipality has the lowest and slowest increasing per capita income in the district, with employment showing a negative growth trend (Hessequa Municipality, 2019a).

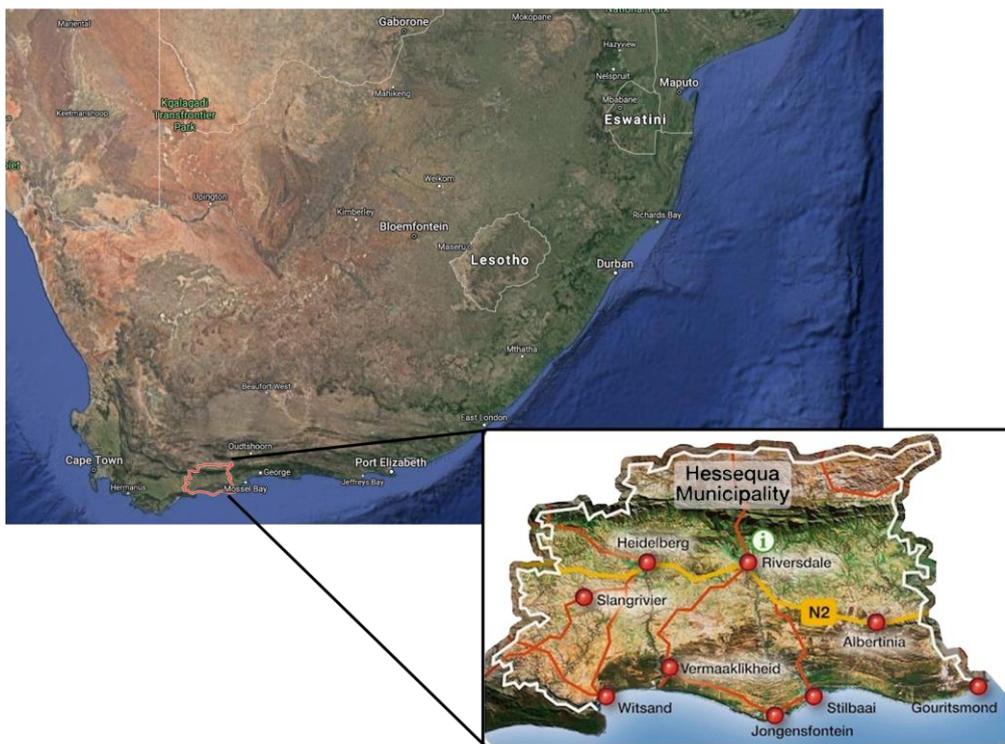


Figure 1-1 Location of Hessequa in the Western Cape province of South Africa

Hessequa is a diverse region with 10 towns or settlements, each with its own unique history, development potential and challenges. Job creation and water security are some of the development priorities evident in most of these towns. The larger towns, namely Riversdale, Heidelberg and Stilbaai, focus more on commercial and industry development. The vast geographic layout of the Hessequa municipal region creates a challenge in terms of service delivery and planning and causes bulk infrastructure, including sewerage processing plants,

water purification plants, electricity substations and reticulation networks, being duplicated for almost every town. Due to the demarcation of the municipal area, the cost of service delivery is a major threat to the sustainability of the municipality (Hessequa Municipality, 2019a).

The governance of Hessequa Municipality is made up of an elected council responsible for decision making and the municipal administration and staff who implement the work of the municipality, as stipulated in the Municipal Structures Act (RSA, 1998). The 17 elected councillors, namely the executive mayor, speaker, Mayoral Committee, nine ward councillors and proportional representative councillors, make decisions in terms of legislation, such as bylaws, as well as in terms of executive functions such as operations, projects and issues of finance. The primary role of the municipal council is to debate issues publicly and to facilitate political debate and discussion (Hessequa Municipality, 2019a). Every year, the council approves a municipal budget and an IDP, which sets out how money will be spent and raised and how development should take place in the area. The council is elected every five years. The municipal administration consists of the municipal manager, who leads the municipal staff, and the five directors responsible for Community Services; Corporate Management; Financial Services; Planning, Development and Environmental Services; and Technical Services. All municipalities in South Africa are responsible for electricity delivery, water for household use, sewage and sanitation, storm-water systems, refuse removal, fire-fighting services, municipal health systems, decisions regarding land use, municipal roads, municipal public transport, street trading, abattoirs and fresh food markets, parks and recreational areas, libraries and local tourism (Education Training Unit, n.d.).

Public participation, as defined in the public participation framework (South African Legislative Sector, 2013), forms an integral part of the role of Hessequa Municipality and involves a variety of activities, including forming democratic representative structures, namely ward committees, assisting those structures to plan at a local level (community-based planning), and implementing and monitoring those plans. The public participation framework was developed to create an opportunity for individuals and groups within selected communities to exchange

views, influence decision making and play an active role in the development and operation of services that affect their lives (Hessequa Municipality, 2019a).

Renewable (or sustainable) energy planning falls under the jurisdiction of the Director: Technical Services. Other responsibilities of the director are repairs and maintenance according to service standards, improved project planning and management, also in terms of the expansion of externally funded programmes, electromechanical services, sanitation and open space management (Hessequa Municipality, 2019a). Hessequa Municipality “promotes sustainable development, [namely] sustainable use of resources, sustainable transport, energy efficiency, recycling, sustainable use of water resources, the use of renewable energy and other environmental friendly practices” (Hessequa Municipality, 2019a: 64). Sustainable development is evident in Hessequa through several successfully implemented projects. Table 1-3 provides a list of some of these projects.

Table 1-3 Sustainable development projects implemented and studies conducted at Hessequa

<b>Timeline</b>	<b>Description of project</b>
<b>2011</b>	Upgrade of the waste-water treatment plant outside Riversdale (solar-driven)
<b>2013</b>	Study done on Riversdale: Unlocking the rooftop photovoltaic (PV) market in South Africa (Reinecke, Leonard, Kritzingler, Bekker, Van Niekerk & Thilo, 2013)
<b>2015</b>	Hessequa Energy Summit held at Stilbaai (Kruyshaar, 2015)
<b>2018</b>	First solar-powered desalination plant launched in South Africa, situated in Witsand (Bulbulia, 2019)
<b>2019</b>	Requirements for SSEG implemented at Hessequa (Hessequa Municipality, 2019b)

Although sustainable energy projects are evident, the planning and implementation of sustainable energy solutions in a municipal management context remain complex, as explained in Section 1.1. The planning of a sustainable energy future necessitates the involvement of different stakeholders. The current approaches applied in other municipal departments, which mainly consist of consultation, will not enable creative thinking and innovation, which are needed when planning for

a sustainable energy future, and therefore the need for a new approach was identified to collectively plan for a sustainable energy future. From discussion with the municipal management it was gauged that the sustainable energy projects implemented are not effectively tracked and monitored, therefore it is difficult to report on the improvement of these projects in terms of carbon emissions and electricity.

The Municipal Systems Act in Chapter 4 clearly stipulates that participation by the local community in the affairs of the municipality should take place either through political structures, mechanisms, processes and procedures as established by the various municipal acts or through other appropriate procedures established by the municipality (RSA, 2000). Consent for conducting research in collaboration with Hessequa Municipality to specifically develop and establish a participatory planning approach for energy sustainability was given at the time of the Hessequa Energy Summit held in July 2015 (see [Appendix A.1](#)). Since then, the researcher was involved in the facilitation of strategy workshops and the attendance of meetings and open discussions with the municipal management and council, during which further support was established to plan for a sustainable energy future. The research was conducted over a period of five years, which provided the researcher with solid knowledge and understanding of a local municipal environment in order to propose the participatory planning approach.

## 1.7 Overview of the dissertation

To summarise, the main activities of each research objective are given in Table 1-4.

Table 1-4 Summary of research objectives and activities

<b>Research objective</b>	<b>Research activity</b>	<b>Journal article / Chapter</b>
1. To review evidence of participatory planning approaches to determine factors necessary for the successful development	<ul style="list-style-type: none"> <li>Conduct a systematic literature review on participatory approaches found in literature to determine factors necessary for the successful development and implementation of such approaches</li> </ul>	A literature review of energy-planning and decision-making approaches in the

and implementation of such approaches		local government sphere <b>Chapter 2</b>
2. To determine whether and how renewable energy options form part of a local government's strategy and long-term plans	<ul style="list-style-type: none"> <li>• Facilitate a workshop to gain an understanding of the internal strategic issues and opportunities of a local government and determine where sustainable energy options fit in (single case study approach; data collection: workshop; data analysis: thematic content analysis)</li> <li>• Conduct a literature review to gain an understanding of the macro environment that is impacting municipalities in South Africa to move to a sustainable energy future (exploratory qualitative literature review)</li> <li>• Identify the opportunities for renewable/sustainable energy at a local government level in South Africa through analysing causal relationships of what has been discussed in the municipality and what is evident in literature (exploratory literature review; analysis using cognitive mapping)</li> </ul>	Journey towards renewable energy for sustainable development at the local government level: The case of Hessequa Municipality in South Africa <b>Chapter 3</b>
3. To investigate how participatory approaches are utilised in the development and communication of a municipal strategy	<ul style="list-style-type: none"> <li>• Observations from being part of the development of a local government's IDP (data collection: research notes; audio recordings)</li> <li>• Observations from facilitating a strategy workshop with a local government (analysis of transcribed data; attendance registers)</li> <li>• Evaluate participation against the factors for the successful design and implementation of a participatory approach</li> </ul>	
4. To develop, apply and evaluate the use of a participatory planning approach for energy sustainability in a local government in South Africa	<ul style="list-style-type: none"> <li>• Develop a conceptual participatory planning approach for local energy sustainability (literature review; inductive reasoning)</li> <li>• Apply the developed approach in a facilitated workshop at Hessequa Municipality (facilitated workshop; group feedback)</li> </ul>	Explore, Design and Act for Sustainability: A participatory planning approach for local energy sustainability <b>Chapter 4</b>

	<ul style="list-style-type: none"> <li>Evaluate the participatory approach based on the participants' perceptions with regard to the use of the approach in a local government context (evaluation form) and based on a process of reflection where the participatory approach had been evaluated against pre-identified requirements</li> </ul>	
5. To critically reflect on the developed approach in order to identify opportunities for future research	<ul style="list-style-type: none"> <li>Reflect on the research process and summarise the key findings, contributions, limitations, and reflections of the research and identify future research opportunities</li> </ul>	N/A <b>Chapter 5</b>

A diagrammatic presentation of the dissertation layout is given in Figure 1-2.

The dissertation is structured around three journal articles published in peer-reviewed journals. The first paper, in Chapter 2, focuses on research objective 1 and consists of a systematic literature review of the participatory planning approaches. The second paper, in Chapter 3, answers research objectives 2 and 3, while building an understanding of a local government context and establishing trust. Article 3, in Chapter 4, focuses on the development, application and evaluation of a participatory planning approach for local energy sustainability (research objective 4). In all three journal articles, the researcher was the lead author and was responsible for conducting the research under the leadership and supervision of the co-author. All three journal articles have been published in peer-reviewed journals. Article 1 has been published in *Publica Administratio*, which is a double-blind peer-reviewed journal accredited with the South African Department of Higher Education and Training and which aims to promote academic scholarship in public administration and management and related fields. Articles 2 and 3 have been published in the journal *Sustainability*, which is a well-recognised, international, open access journal with an impact factor of 2.5 (2018). Research objective 5, to critically reflect on the developed participatory planning approach to find opportunities for future research, forms part of Chapter 5 of the dissertation. Important to note is that due to the nature of the dissertation, which is research by publication, the reader might find duplication in the chapters that represent the original papers in an amended form. Duplication has been avoided as far as

possible, but in some instances the duplication is needed to ensure that the chapter can be read as a stand-alone paper.

A brief synopsis of each chapter is given below.

## **Chapter 2: A literature review of energy-planning and decision-making approaches in the local government sphere**

Chapter 2 argues that the implementation of sustainable energy solutions is one way to ensure the provision of municipal services in a sustainable manner, while promoting social and economic development. In addition, the complex nature of energy systems requires the involvement of municipal stakeholders in the decision-making process towards a sustainable energy future. In a democracy such as South Africa, community participation is not new and forms part of South African and local government policies, yet limited formal methods for public participation that ensure critical and holistic thinking to plan for long-term changes are used in the local government sphere. In order to find participatory approaches suitable for problem structuring and decision making at a local government level, a systematic literature review was conducted. The systematic literature review was qualitative and exploratory and focused on local and international peer-reviewed articles published between 2009 and 2015, which applied approaches inclusive of stakeholder participation for environmental management. The review asked the question how such approaches could be applied specifically to energy-related planning and decision making in the local government sphere. The research provides a synthesis of planning and decision-making literature in order to inform the development of an approach for local government. The main advantages and limitations of each approach, as well as the factors that need to be considered for effective implementation, were elicited and are discussed. A general synthesis of the literature follows and finally, a checklist is presented of the factors necessary for the effective planning and implementation of a participatory approach. The checklist can assist in the design of a participatory planning approach for local governments in South Africa.

## **Chapter 3: Journey towards renewable energy for sustainable development at the local government level: The case of Hessequa Municipality in South Africa**

The case for renewable energy solutions in South Africa is robust when considering the abundance of renewable resources such as solar, wind and biomass. However, the rate of converting to renewable energy technologies at a local government level is much slower than in other countries, such as Germany. It is argued that the implementation of renewable energy solutions at a local government level creates complex problems, especially when considering the public participative nature of local government decision making. When implementing renewable energy technologies, many social, institutional, environmental, technical, and economic factors need to be considered. The purpose of the research conducted, and discussed in Chapter 3, was to determine how renewable energy options form part of a local government's strategy and long-term plans and to investigate how participatory approaches are utilised in the development and communication of a municipal strategy. An action research approach was undertaken, and Hessequa Municipality was selected as the case study. Qualitative data were collected through different methods, including the facilitation of workshops; participation in municipal meetings; open discussions held with the municipal manager, council and the Technical Services manager; observations of IDP and Spatial Development Plan (SDP) meetings held with the nine municipal wards; and the analysis of municipal documentation and other literature. Qualitative content analysis, in combination with cognitive mapping, was used to understand how sustainable energy solutions fit into Hessequa's long-term strategy and vision. The participative nature of Hessequa Municipality was evaluated using the participatory checklist, developed as part of research objective 1. In order to understand the macro environment, namely the barriers to and opportunities for sustainable energy implementation, a literature review was conducted.

#### **Chapter 4: Explore, Design and Act for Sustainable Energy: The case of Hessequa, South Africa**

Local governments in South Africa have been encouraged, especially in the Western Cape province, to start thinking about their electricity landscape, especially in a time characterised by electricity tariff increases, supply constraints, ad hoc load shedding and the need to lower carbon emissions. It is argued that in order to plan for a sustainable energy future, local governments need assistance

and guidance to facilitate and plan a sustainable energy future. Chapter 4 focuses on the development of a participatory planning approach for local energy sustainability. The characteristics of a complex problem were reviewed to establish that the problem of sustainable energy at a local government level is complex. In order to better manage complex problems, the literature shows that soft OR or PSMs need to be applied, and hence these methods were used as a starting point for developing a participatory planning approach. The requirements for a planning approach were elicited, namely that the approach must be participative and inclusive, holistic, simple and transparent. In addition, the approach must include the identification and assessment of risks as part of the deliberation process, the development of a realistic action plan must be attainable at the end of the stakeholder engagement, the approach must be dynamic and it should be formalised with clear institutional arrangements. A novel participatory approach, namely EDAS – to Explore, Design and Act for Sustainability – was subsequently developed, applied, and evaluated as part of a case study with Hessequa, a local municipality in the Western Cape province of South Africa. The insights are relevant not only for local governments, but also for any institution on a journey towards sustainability.

## **Chapter 5: Conclusions**

The final chapter provides a detailed summary of the key findings of the research and discusses theoretical and practical contributions of the research. The novelty of the research lies in the integration of multidisciplinary theories and methods to develop a participatory planning approach for a local government in South Africa. The originality of the research further lies in the geographical application of the developed participatory approach, EDAS, at a local government level in South Africa. Research contributions are made in the fields of public administration, stakeholder participation, soft OR and sustainable energy. The chapter further provides a section on the reflection of the researcher throughout the research period and highlights implications for researchers and practitioners, especially at a local government level, but also in general.

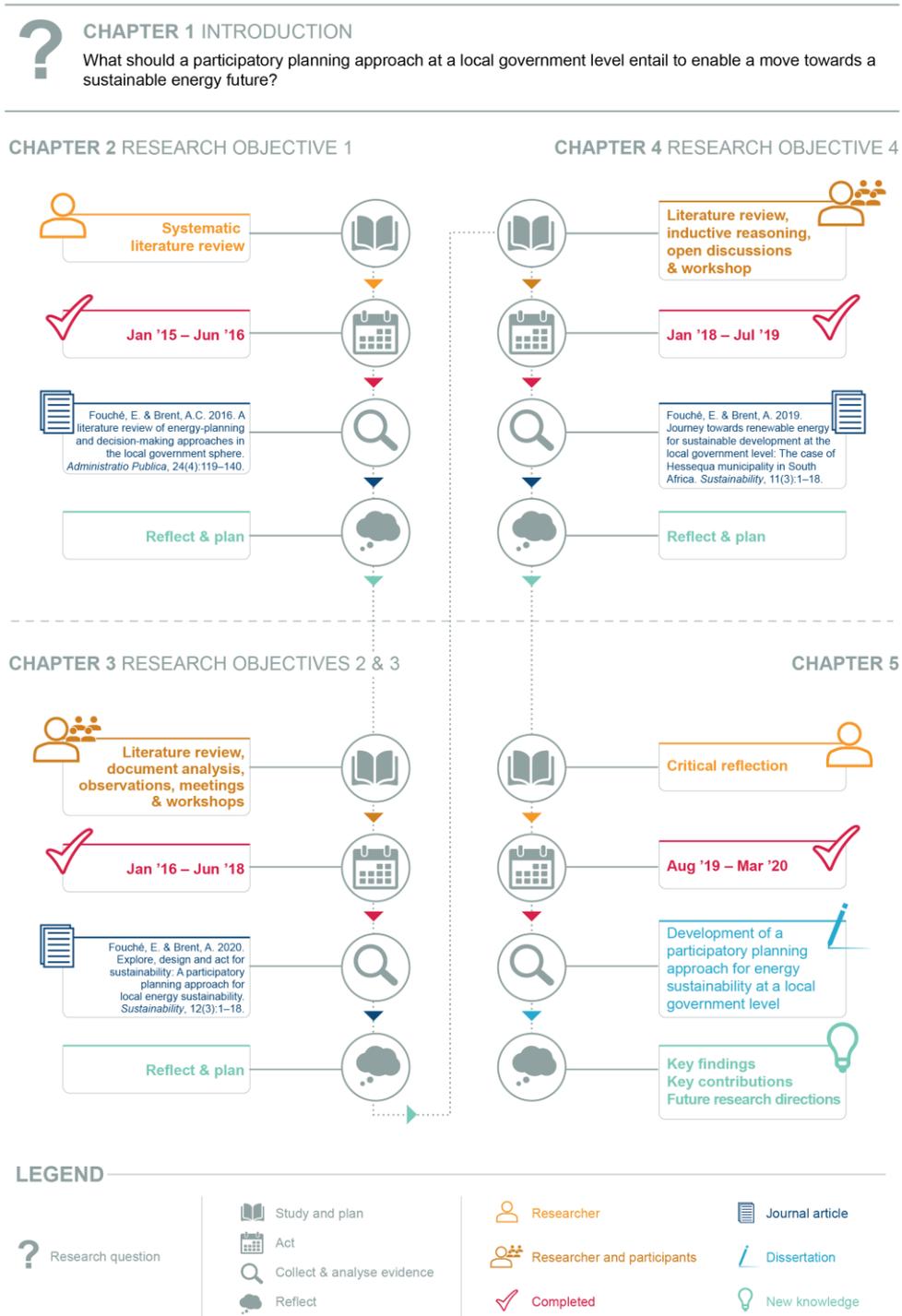


Figure 1-2 Diagrammatic presentation of the research design and dissertation layout

## Chapter 2

# A literature review of energy-planning and decision-making approaches in the local government sphere

### 2.1 Introduction

The mandate of South African local government, as set out in the Constitution of the Republic of South Africa, 1996 in Section 152, is “to ensure the provision of services to communities in a sustainable manner”, “to promote social and economic development” and “to promote a safe and healthy environment” (RSA, 1996: 1331 (2)). One way of providing services to communities sustainably, while promoting economic development and a healthy environment, is to plan for a sustainable energy future.

However, energy systems are complex, as they are interconnected and embedded in social, economic, political, and environmental contexts. Due to the interdependency of the many factors affecting these energy systems, it cannot be resolved in isolation (Head, 2014) and stakeholders need to be part of the process. It is argued that sophisticated and predictive models alone will not ensure a move to a sustainable future (Ravera, Hubacek, Reed & Tarrasón, 2011). This is even more so if public servants are not applying critical thinking for the purposes of energy planning and hence do not fully interpret the results of predictive models. It is important to consider different stakeholders’ perceptions and future visions (Tan, Bowmer & Mackenzie, 2012). The process adopted should ensure “significant shifts in thinking” (Rickards *et al.*, 2014: 642), which require new integrated approaches that should combine a broad range of stakeholders and actors from different societal groups. In a democracy such as South Africa, participation is not new and forms part of South African and local government policies (Sinxadi & Campbell, 2015). Madumo (2014) argues that public participation is an essential element for a democracy and shows the many advantages it could have in the South African setting.

In the literature, the practice of involving stakeholders in an intervention is called a participatory process or approach. For the purposes of this study, the term 'approach' is defined as a way of doing something, which can be a tool, a technique, a method or a combination thereof. A number of reviews have been done on approaches related to energy planning and other environmental issues (Løken, 2007; Mendoza & Martins, 2006; Pohekar & Ramachandran, 2004; Reed, 2008; Wang, Jing, Zhang & Zhao, 2009). While most of these authors focused on a specific approach or decision-making framework, the reviews generally lack consideration of key interaction protocols on stakeholder participation. In order to develop a framework for stakeholder participation and decision making in the local government sphere, an understanding of different participatory approaches had to be elicited. In order to find approaches inclusive of stakeholder participation that could be conducive to planning a sustainable future, a literature review was conducted. The review asked the question how such approaches could be applied specifically to energy-related planning and decision making in the local government sphere. The main advantages and limitations of each approach, as well as the factors that need to be considered for effective implementation, are discussed in this chapter. A general synthesis of the literature follows and finally, factors for the successful development and implementation of a participatory approach are identified and consolidated in a checklist. The checklist can be used as a guideline when developing a participatory planning approach for a local government in South Africa. This chapter stems from the research paper published in the journal *Administratio Publica* (Fouché & Brent, 2016). The original published research paper abstract with the declaration of author contributions is included in [Appendix B.1](#).

## **2.2 Methodology**

### **2.2.1 Research methodology and literature selection**

For this chapter, a literature review of local and international peer-reviewed articles published between 2009 and 2015 was conducted. A selection of approaches inclusive of stakeholder participation applied to environmental management issues was reviewed. A structured and transparent procedure was followed through

defining the research questions, conducting a literature search and screening, synthesising and reporting the results, and finally discussing the research findings.

The review was qualitative and exploratory in nature and answered the following research questions:

- 1) Which approaches inclusive of stakeholder participation have been applied over the period to environmental management issues at a regional, city or community level?
- 2) What are the benefits and limitations of applying these participatory approaches?
- 3) Which factors are necessary for the successful development and implementation of a participatory approach?

A predefined procedure was followed to identify the literature included in the review. The procedure reduced the impact of the review authors' bias, promoted transparency of methods and processes and reduced the potential for duplication, as recommended by the Collaboration for Environmental Evidence (2013). For the initial search, a keyword search was completed in the Scopus and Web of Science Core Collection databases. The extracted studies matched a broad range of keywords, as shown in Table 2-1. The wildcard symbol (\*) was included to search for variations in terminology (e.g. strateg\* found strategy and strategies).

Table 2-1 Keywords used in literature search

<b>Environmental management</b>	<b>Techniques</b>	<b>Stakeholder participation</b>
<b>energy sustainability</b>	<b>Systems science</b>	participat*
<b>low carbon development</b>	systems thinking	stakeholder engagement
<b>sustainable energy</b>	mind map	expert opinion
<b>strateg*</b>	adaptive	public participat*
<b>low carbon strateg*</b>	systems theory	deliberation
<b>sustainable development</b>	soft systems	stakeholder*
<b>plan</b>	SSM	communit*
<b>sustainable energy plan</b>	systems intelligence	<b>Geographical coverage</b>
<b>climate change mitigation</b>	complex problem solving	cit*
<b>climate change adaptation</b>	<b>Other techniques</b>	green cit*

<b>energy policy</b>	scenario planning	town
<b>environmental management</b>	multi-criteria	municipal*
<b>environmental plan</b>	multi-attribute	local government
<b>environmental problem</b>	social multi-criteria	
<b>water management</b>	evaluation	
	analytical hierarchy	
	process	
	value-based	
	structured decision*	
	hypocognition	
	post-normal science	

## 2.2.2 Review procedure and results

The initial keyword search resulted in 591 articles. These 591 articles were reduced based on the exclusion criteria given in Table 2-2. As a result, 200 articles from Scopus and 53 articles from the Web of Science Core Collection were found. These 253 articles were further screened, using a title search, based on the applicability to the study, which specifically focused on approaches inclusive of stakeholder participation applied to environmental management issues. An abstract analysis was then conducted on the remaining 129 articles to include national and international studies that applied approaches inclusive of stakeholder participation to specific sectors, such as the energy sector and the water-management sector, or to the problem of climate change and sustainable development in general. The main reason for including approaches applied in the field of water management was to acknowledge the challenges and opportunities that exist regarding the water energy nexus – a prominent theme in South Africa currently. In addition, the application of approaches in the field of water management has been wide, which has not been the case with other sectors, such as transportation. The review aimed at eliciting the factors necessary for the successful development and implementation of a participatory approach with the end-goal to develop a participatory approach to plan for a sustainable energy future at local government level in South Africa. The literature included then focused specifically on the approaches applied to the fields of energy and climate change, sustainable development and water management and excluded the literature on approaches applied in other sectors, such as flood management, forest

management, land use, sediment management, transport, urban planning and waste management. The abstract analysis resulted in a selection of 38 peer-reviewed articles which were analysed in detail.

Table 2-2 Inclusion and exclusion of criteria used for refinement of search terms

<b>Criteria</b>	<b>Included</b>	<b>Excluded</b>	<b>Number of articles</b>
<b>Matched searched string</b>	Yes	No	591
<b>Selected period</b>	2009–2015 only	Any other periods	253 after refinement
<b>Type</b>	Articles, conference proceedings	Reviews (initially excluded), books, book chapters	
<b>Geographical coverage</b>	Community, town/city, regional	National, global	
<b>Subject area</b>	All other subject areas	Agriculture, arts, computer science, economics, health, business, mathematics, medical, pharmacy, veterinarian	
<b>Language</b>	English	Lithuanian, German, Slovene, Spanish	
<b>Application/sector</b>	Energy, climate change, sustainable development, water management	Flood management, forest management, land use, sediment management, transport, urban planning, waste management	129 after applicability to study and then 38 after abstract analysis. The snowballing technique added 21 relevant papers, resulting in a total sample of 59.
<b>Participatory</b>	Participatory approach followed	N/A	

Through inductive reasoning and the use of codes, six themes emerged from the screening and detailed content analysis. These six themes were used to categorise the articles into six groups of approaches inclusive of stakeholder participation, namely 1) participatory techniques, 2) multi-criteria decision analysis (MCDA), 3) systems approaches, 4) scenario planning, 5) adaptive management and 6) integrated approaches, as shown in Table 2-3.

In order to consequently elicit the limitation and benefits of these approaches, as well as to determine the factors necessary to successfully develop and implement a participatory approach, the snowballing technique was applied, which resulted in a total number of 59 papers included in the systematic review.

Table 2-3 Initial articles selected for review

<b>Categorisation of approaches (number of articles)</b>	<b>References</b>	<b>Sector (number of articles)</b>
<b>Participatory techniques (9)</b>	Alvial-Palavicino <i>et al.</i> (2011), Gaudreau and Gibson (2010), Pidgeon <i>et al.</i> (2014), Retallack and Schott (2014), Sara and Baud (2014), Sherman and Ford (2014), Tan <i>et al.</i> (2012), Wesselink, Paavola, Fritsch and Renn (2011), Westling, Sharp, Rychlewski and Carrozza (2014)	Climate change (1), energy (3), sustainable development (1), water management (4)
<b>MCDA (8)</b>	Buchholz, Rametsteiner, Volk and Luzadis (2009), Chowdhury and Zaman (2009), Kropp and Lein (2013), Magee and Scerri (2012), Mutikanga, Sharma and Vairavamoorthy (2011), Peris, García-Melón, Gómez-Navarro and Calabuig (2013), Sanguanduan and Nititvattananon	Energy (2), sustainable development (3), water management (3)

	(2011), Sánchez-Lozano, Antunes, García-Cascales and Dias (2014)	
<b>Systems approach (4)</b>	Mavrommati, Bithas and Panayiotidis (2013), Sušnik, Molina, Vamvakeridou-Lyroudia, Savic and Kapelan (2013), Sušnik, Vamvakeridou-Lyroudia, Savić and Kapelan (2012), Watkin, Kemp, Williams and Harwood (2012)	Energy (1), water management (3)
<b>Scenario planning (4)</b>	Fünfgeld and McEvoy (2014), Johnson, Dana, Jordan, Draeger, Kapuscinski, Schmitt Olabisi and Reich (2012), Ravera <i>et al.</i> (2011), Rickards <i>et al.</i> (2014)	Climate change (2), sustainable development (2)
<b>Adaptive management (6)</b>	Evans and Karvonen (2014), Fratini, Geldof, Kluck and Mikkelsen (2012), Haasnoot, Kwakkel, Walker and Ter Maat (2013), Head (2014), Serrao-Neumann, Harman and Low Choy (2013), Wise, Fazey, Stafford Smith, Park, Eakin, Archer Van Garderen and Campbell (2014)	Climate change (5), water management (1)
<b>Integrated approaches (7)</b>	Keeler, Wiek, White and Sampson (2015), Madani and Lund (2011), Munaretto, Siciliano and Turvani (2014), Pearson, Coggan, Proctor and Smith (2010), Ribas (2014), Straton, Jackson, Marinoni, Proctor and Woodward (2011), Susskind (2010)	Climate change (1), sustainable development (1), water management (5)

## 2.3 Research findings

### 2.3.1 The what and why of stakeholder participation

In order to plan for a sustainable energy future, it is argued that approaches inclusive of stakeholder participation should be used in the local government sphere. Reed (2008: 2418) defines participation “as a process where individuals, groups and organisations choose to take an active role in making decisions that affect them”. This definition focuses on stakeholder participation. Freeman (1984, cited in Reed, 2008: 2418) states that stakeholders are “those who are affected by or can affect a decision”. Stakeholder participation covers a broad spectrum of interaction, which stems from Arnstein’s (1969) ladder of citizen participation.

The modes or degrees of participation evolved since its first introduction by Arnstein (1969). Tan et al. (2012) describe the modes of participation as information provision, consultation, collaboration and citizen control. Luyet et al. (2012) refined citizen control and use co-decision and empowerment as the next degrees of involvement. Luyet et al. (2012) synthesised a list of participatory techniques into a matrix showing each participatory technique with its degree of involvement. This matrix (as shown in Table 2-4) is an important tool that can be used to select specific interventions when conducting research.

Luyet *et al.*’s (2012) matrix of participatory techniques, in Table 2-4, shows that no single participatory technique covers all degrees of involvement. If it is believed that stakeholder participation is important for the planning process, a combination of these techniques should be chosen. The selection of techniques is specific to a given context and culture. The matrix of Luyet *et al.* (2012) can play an integral part in the selection of specific participatory techniques for a context-specific approach. However, the selection of participatory techniques without a good rationale for why participation is chosen could result in a non-productive, time-consuming and expensive process, leaving stakeholders feeling frustrated and confused.

Table 2-4 Matrix of some participatory techniques with their degree of involvement (Luyet *et al.*, 2012)

<b>Participatory technique</b>	<b>Information</b>	<b>Consultation</b>	<b>Collaboration</b>	<b>Co-decision</b>	<b>Empowerment</b>
Newsletter	X				
Report	X				
Presentation, public hearing	X	X	X		
Internet webpage	X	X			
Interview, questionnaire and survey	X	X	X		
Field visit and interaction	X	X	X		
Workshop		X	X	X	X
Participatory mapping			X	X	X
Focus group discussion			X	X	X
Citizen jury		X	X	X	X
Geospatial/decision-support system	X	X	X	X	
Cognitive map	X	X	X		
Role playing			X	X	X
Multi-criteria analysis			X	X	
Scenario analysis		X	X	X	X
Consensus conference		X	X	X	X

### **2.3.2 The benefits and limitations of applying approaches inclusive of stakeholder participation**

The keyword search revealed a wide range of approaches inclusive of stakeholder participation, which were inductively categorised into the six groups of Table 2-3. A detailed analysis of these approaches revealed many advantages and limitations in their applications. An interesting observation was how some studies combined

different techniques and methods into an integrated approach to overcome some of the limitations of a single approach.

### **2.3.2.1 Application of participatory techniques**

Participatory techniques include interviews, questionnaires, surveys, field visits, focus group discussions, workshops, participatory mapping or a combination of these techniques. As described by Luyet *et al.* (2012), the main rationales for using these participatory techniques are to share information, to consult and, sometimes, to collaborate with the selected stakeholders.

Social learning is one of the main advantages that stem from the application of participatory techniques (Gaudreau & Gibson, 2010; Georgopoulou, Sarafidis & Diakoulaki, 1998; Johnson *et al.*, 2012; Pahl-Wostl, 2009; Tan *et al.*, 2012). The interaction between the decision-maker and the public builds a common understanding of the uncertainty within the project (Ravera *et al.*, 2011). Furthermore, the establishment of two-way communication ensures that stakeholders learn from each other. Stakeholder values (Ravera *et al.*, 2011) and the interconnectedness of factors (Gaudreau & Gibson, 2010) related to the socio-environmental system are better understood.

The use of participatory techniques enables researchers to reveal and analyse the interconnectedness of elements within the operation and the larger ecosystem (Gaudreau & Gibson, 2010). These linkages between the different factors enable the recognition of complexity. A combination of methods is also useful, especially where stakeholder input is needed. Pidgeon *et al.* (2014) regard interviews and workshops as useful for gaining deeper insights into the reasons behind people's choices, which will not always be possible using a questionnaire on its own. Participatory techniques allow the capturing of citizens' values within the decisions made, which produces more "democratic, legitimate and equitable outcomes" (Retallack & Schott, 2014: 361).

Planned participatory techniques can kick-start ongoing collaboration, which is needed for adaptive management. Retallack and Schott (2014) see culture as both an input and an outcome of a value-based approach and view the engagement with the public not as a once-off exercise, but as an ongoing process. This ongoing

engagement is becoming increasingly important in today's times of uncertainty. Sara and Baud (2014) acknowledge that these ongoing engagements enable agreements on collaborative action over time.

The main limitation to be considered with participatory techniques is their comprehensiveness. Participatory techniques are resource-intensive, meaning they are time-consuming and expensive (Gaudreau & Gibson, 2010; Pidgeon *et al.*, 2014; Retallack & Schott, 2014). The time spent on building relationships and establishing trust among stakeholders should not be underestimated. Considerable engagements with stakeholders are needed, especially if one wants stakeholders to become familiar with new technologies, such as renewable energy technologies (Alvial-Palavicino *et al.*, 2011; Ravera *et al.*, 2011).

### **2.3.2.2 Application of multi-criteria decision analysis**

MCDA is a tool that assists the decision-maker in selecting a satisfying alternative from a number of alternatives evaluated against multiple quantitative and qualitative criteria. The reviews done on MCDA methods over the past decade (Løken, 2007; Mardani, Jusoh, Zavadskas, Cavallaro & Khalifah, 2015; Mendoza & Martins, 2006; Wang *et al.*, 2009) concluded that MCDA offers a suitable planning and decision-making framework. Mendoza and Martins (2006) argue that the decision analysis process should be more integrated and transparent through the inclusion of stakeholders as part of the decision process and through a combination of different methods. Løken (2007: 1593) shows that MCDA studies on local energy systems are limited and argues that "planning tools that can evaluate and analyse alternative energy carriers in mutual combination will give some benefits". Wang *et al.* (2009) and Mardani *et al.* (2015) observed that the analytical hierarchy process is the most widely used as a comprehensive method for energy decision making.

The advantages of MCDA include generating a common understanding among stakeholders and decision-makers; the combination of quantitative data and qualitative criteria for decision making (Buchholz *et al.*, 2009; Ribas, 2014); the development of a tractable, audible and transparent process (Kropp & Lein, 2013; Mardani *et al.*, 2015; Peris *et al.*, 2013); and its ease of use and understanding (Sa-nguanduan & Nititvattananon, 2011), especially for non-technical users. A

common understanding among stakeholders leads to the acceptance of decisions taken and builds a strong knowledge base that is useful when future decisions need to be taken (Mutikanga *et al.*, 2011). MCDA approaches have shown potential to guide stakeholders to find and agree on sustainable solutions and to handle the trade-offs between multiple criteria and conflicting values (Giampietro, Mayumi & Munda, 2006; Mutikanga *et al.*, 2011). This approach provides insight into priorities, sensitivities, diverse values and knowledge of the various stakeholders involved (Giampietro *et al.*, 2006). Buchholz *et al.* (2009) suggest that structuring the problem, assisting in the identification of the least robust and/or most uncertain components applicable to the system and integrating stakeholders in the decision-making process could help overcome the implementation barriers of projects.

Some of the main critics of MCDA approaches argue that such approaches may be prone to manipulation, are very technocratic and may provide a false sense of accuracy. Straton *et al.* (2011: 145) see the averaging of criteria weights as one of the main limitations of MCDA, especially when “one is seeking to understand and probe the sources of difference”. The aggregation of each option to a single weighted average value results in important information being invisible. “[O]pportunities for individuals to learn about and discuss the issues and points of difference” (Straton *et al.*, 2011: 145) could be missed, or could lead to a debate on the aggregation procedure with the consequence that the proposed decision is not accepted. Mutikanga *et al.* (2011: 3967) suggest that it is “critical that an appropriate non-compensatory aggregation method is selected for solving such decision problems”.

MCDA takes time, which also results in high costs. The time and costs are related to consensus building and the creation of a common understanding between stakeholders. The synthesis of literature shows that MCDA could be a valuable tool for planning a sustainable energy future in the local government sphere. One of the questions is how to incorporate the complex nature of these future energy systems, and here a systems approach might be beneficial.

### 2.3.2.3 Application of systems approaches

Two specific techniques following a systems approach were distinguished in the review, namely SSM and system dynamics modelling (SDM), referred to as the soft and hard approaches, respectively, in systems science (Maani & Cavana, 2007). These soft and hard approaches are complementary and mutually enforcing.

SSM aims to represent the real world in a conceptual model, which shows interconnected human and organisational factors in the way they are perceived by stakeholders (Checkland, 1981). A three-step approach can be followed: the identification of the problem, the development of conceptual models and the use of these conceptual models to stimulate thinking. Jay Forrester, an American pioneering and systems scientist, was the first to introduce SDM in his book *Industrial dynamics* (Forrester, 1961) in order to develop and simulate a systems structure. The aim of SDM is to study complex feedback-driven systems in which non-linearity usually plays a key role (Sušnik *et al.*, 2012). The model simulates the causal loops in a dynamic way over a specified period. The starting point is always a qualitative conceptual model of the causal processes operating in a given system.

SSM allows stakeholders to discuss perceptions and values, which inform the development of a collaborative problem and its possible solutions (Watkin *et al.*, 2012). The approach can also be used as a conflict management tool in order to develop sustainable solutions. With SDM, the researcher can develop and test scenarios as part of a participatory technique, especially when involving non-specialist stakeholders. The model is easy to use and the aid of graphical development environments adds to the user-friendliness of the model (Sušnik *et al.*, 2012; Sušnik *et al.*, 2013).

The applications of a systems approach, especially for environmental management issues, are limited. The limited applications are attributable to the lack of systematic rigour for practical applications, and it is proposed that a framework for decision making underpinned by systems thinking be used (Davidson & Venning, 2011). Another limitation is that a systems approach does not reflect why or how a decision is made. Further research, or a combination with another approach, is

needed to fully grasp the complexity of the decision-making process (Mavrommati *et al.*, 2013). SDM is not explicitly spatially based. The model mainly “focuses rather on broad-scale system behaviour patterns than on fine-scale accurate physical representation” (Sušnik *et al.*, 2013: 821). This limitation of the time steps of the model asks for the model to be used in conjunction with more detailed energy models.

In order to overcome these limitations, a systems approach or a framework underpinned by systems thinking could provide more benefits when it is combined with or incorporated as part of another method or technique (Davidson & Venning, 2011; Sušnik *et al.*, 2013).

#### **2.3.2.4 Application of scenario planning**

Scenario planning is a method for exploring plausible alternative futures as part of a workshop-style meeting in order to provide assistance in the face of uncertain and volatile futures (Susskind, 2010). The approach is applicable to the complex socio-ecological problems of today. Scenarios are narratives deliberately crafted to describe multiple plausible futures in order to improve understanding and decision making (Johnson *et al.*, 2012). Perhaps what scenarios do best is to help expand the understanding of future risks by systematically exploring plausible futures whose risks have not yet been considered or thought about strategically. Through understanding these risks, appropriate decisions or responses can be made when a given future unfolds. Scenario planning is valued as an appropriate alternative to conventional, predictive decision-making tools, such as cost–benefit analysis, which is recognised as imperfect under uncertainty. Scenario planning is valued as an opportunity to change people’s knowledge, perceptions and subsequent decisions. The process facilitates stakeholders to think through the complexity and uncertainty of the specific context (Fünfgeld & McEvoy, 2014). It can also enable creative thinking among participants, especially with complex problems such as climate change (Ravera *et al.*, 2011; Rickards *et al.*, 2014).

Although it has many benefits, scenario planning also has some limitations, one of which is its time-consuming nature. After establishing a relationship of trust, it remains a timely matter to overcome cognitive challenges, such as combining different forms of knowledge. It is evident that people are struggling to think long-

term, systematically and imaginatively (Rickards *et al.*, 2014). Another major shortcoming of scenario planning is the disconnect between the main objective of the approach and the noticeable impact on subsequent decisions. It is not always evident whether the appropriate decisions are taken when a specific future unfolds. It is reported that scenario planning projects have a weak influence on subsequent adaptation decision making (Rickards *et al.*, 2014). Adaptation plays a prominent role when addressing complex problems, as seen in the application of adaptive management and adaptive governance approaches (Evans & Karvonen, 2014; Fratini *et al.*, 2012; Haasnoot *et al.*, 2013; Head, 2014; Serrao-Neumann *et al.*, 2013; Wise *et al.*, 2014).

### **2.3.2.5 Application of adaptive management**

Adaptive management is seen as a modern way of governance that is needed in today's times of complexity and uncertainty. Where the traditional view of governance was to predict and control, the new way of governing ensures adaptability and the inclusion of stakeholders in identifying problems and opportunities. The main advantage of utilising this approach is that the new paradigm stimulates planners, with other stakeholders, to include adaptation over time in their strategic plans (Evans & Karvonen, 2014; Fratini *et al.*, 2012; Haasnoot *et al.*, 2013). It further provides insight into different possible options, lock-ins and path dependencies. This dynamic adaptive plan can further prepare stakeholders for change and surprise, as it is a constructive way to address the insecurities arising from uncertainty, complexity and divergence (Haasnoot *et al.*, 2013; Head, 2014; Serrao-Neumann *et al.*, 2013). The inclusiveness of the approach further allows for building planning and problem-solving capacity. One of the main limitations of such an adaptive management approach is the practical difficulties. The approach requires careful planning, management and support, which is challenging for local governments due to the lack of necessary skills and resources to manage and plan for sustainable development problems (Serrao-Neumann *et al.*, 2013).

### **2.3.2.6 Application of integrated approaches**

The combination of different approaches, such as participatory techniques, systems thinking, MCDA and scenario planning, is becoming more usual,

especially within social sciences research (Pidgeon *et al.*, 2014). Without going into the detail of each integrated approach within their specific contexts, the main advantages of the integrated approaches can be summarised as social learning and the combination of qualitative and quantitative information within the approach. Straton *et al.* (2011: 161) point out the importance of “community participation and the role such processes can play in providing information to stakeholders, dispelling some unhelpful myths, and coalescing opinion about important criteria and the way forward”. The creation of tension between qualitative and quantitative thinking stimulates more agile, strategic thinking about the future (Olabisi, Kapuscinski, Johnson, Reich, Stenquist & Draeger, 2010). The use of a combination of different approaches, such as citizen jury with MCDA, provides a means to present trade-offs in a transparent and structured way (Straton *et al.*, 2011). Proctor and Drechsler (2006: 169) combine deliberative processes and MCDA in a new technique called “deliberative multi-criteria evaluation” (DMCE). The benefit of DMCE is that the multi-criteria technique provides a transparent and clear structure for the problem, while the deliberative process enables stakeholder learning and deliberation (Stagl, 2007; Wittmer, Rauschmayer & Klauer, 2006). Using scenario planning with a DMCE process is also beneficial because it assists with the settling of long-standing conflicts and ensures that a richer set of information can be captured and that the outputs of the MCDA process are balanced by the narrative (Straton *et al.*, 2011). Although successful in application, the integrated approaches also face many challenges, to a large extent aligned with the challenges of the other approaches discussed in this chapter. The factors that are necessary to overcome these challenges and to ensure successful implementation of the approaches are discussed next.

### **2.3.3 Factors to guide the implementation of an approach inclusive of stakeholder participation**

Thus far, it has been seen that approaches inclusive of stakeholder participation can be beneficial when planning a sustainable energy future within a complex context. The inclusion of stakeholders does not come without difficulties and, for this reason, some factors to guide the successful implementation of these approaches have been elicited from the review.

Systems thinking is a key component of the social learning process, because individuals are better able to adjust their own mental models when they understand the multiple facets of an issue and in the process build an understanding of other's viewpoints (Davidson & Venning, 2011). An important factor to consider is not necessarily the specific methods chosen within the approach, but rather how a holistic approach could be followed. According to Theron (2008), holistic development thinking, planning and implementation entail a 'big picture' understanding of the mutual influences among economic, political, environmental, social, cultural and psychological development contexts. This type of holistic thinking requires an interdisciplinary approach.

It is important to analyse and select the relevant stakeholders that should be included in the process. These selected stakeholders need to be diverse (Johnson *et al.*, 2012), which is sometimes difficult, especially when working with small groups. The inclusion of stakeholders from many disciplines may lead to a trade-off between the depth of analysis and the breadth and inclusiveness of the approach (Ravera *et al.*, 2011). It is cautioned that participatory approaches, if not carried out correctly, may lead to further resistance and mistrust among stakeholders (Ravera *et al.*, 2011). For this reason, careful consideration is needed as to when and how stakeholders should be involved (Luyet *et al.*, 2012; Reed, 2008). The rationale for participation should also be communicated from the start (Wesselink *et al.*, 2011).

Strong mandates and political support are needed for the successful implementation of participatory approaches (Sara & Baud, 2014). If possible, the approach should be part of existing policy development or change processes; otherwise, inclusions are unlikely to be incorporated (Wesselink *et al.*, 2011). Mutikanga *et al.* (2011) point out that mobilising decision-makers for brainstorming sessions away from their work environment could be a difficult task, which might become easier if there is political support.

Good facilitation skills are necessary for the approaches inclusive of stakeholder participation, especially when structured workshops and focus group discussions are conducted. Conflict management (Johnson *et al.*, 2012; Sara & Baud, 2014) and the establishment of rules (Luyet *et al.*, 2012) are key factors to be recognised

and handled effectively. The role of the researcher should also be considered and communicated. The researcher should accept the role of being a participant in the process and proactively guide processes along topics of discussion, and not control processes to get desired information (Ravera *et al.*, 2011).

Participation should include reflexivity and realism (Wesselink *et al.*, 2011; Westling *et al.*, 2014). Reflexivity is a useful lens through which to question stakeholders' understanding of usable knowledge for implementation, the different understanding of collaboration and the extent to which decisions are made (Westling *et al.*, 2014). The methodology of action research provides a solid platform from which such reflection can take place (Ravera *et al.*, 2011; Riel, 2019). For a successful learning experience, the importance of building personal relationships should not be underestimated. Building relationships takes time and a considerable amount of effort (Reed, 2008). "A fair, equal and transparent process that promotes equity, learning, trust and respect" (Luyet *et al.*, 2012: 214) should be a key principle for successful participation.

By following the guidelines stated above, the eight key elements for best practice participatory processes of Reed (2008) and the principles for ideal deliberative procedures (Retallack & Schott, 2014) may result in the successful implementation of a participatory approach. These guidelines, with a good understanding of the specific advantages and limitations of the different approaches, provided a solid knowledge base to compile a checklist to ensure successful implementation of a participatory approach (see Table 2-5). This checklist can also be used to inform the development of a participatory planning approach for local government in a developing country such as South Africa.

Table 2-5 Checklist to ensure successful development and implementation of a participatory approach

No.	What	Possible how
1.	Follow a holistic approach (Davidson & Venning, 2011; Sušnik <i>et al.</i> , 2013).	Inclusion of SSM or other systems thinking method as part of the approach
2.	Select a diverse group of stakeholders to participate from the start (Johnson <i>et al.</i> , 2012; Ravera <i>et al.</i> , 2011; Reed, 2008).	Stakeholder mapping/analyses; personal invitations

3.	Carefully consider how to involve the stakeholders (Luyet <i>et al.</i> , 2012; Ravera <i>et al.</i> , 2011; Reed, 2008; Wesselink <i>et al.</i> , 2011).	Individual interviews/group interviews/stakeholder workshops/focus group discussions
4.	Ensure that a strong mandate and political support are provided (Sara & Baud, 2014; Wesselink <i>et al.</i> , 2011).	Top-down communication of initiative; part of existing policy development or change process
5.	Provide good facilitation skills (Reed, 2008)	Appointment of knowledgeable and experienced facilitator
6.	Communicate the rationale for participation and agree on clear objectives from the start (Reed, 2008; Wesselink <i>et al.</i> , 2011).	Communication strategy
7.	Communicate the role of the researcher (Ravera <i>et al.</i> , 2011).	Communication strategy
8.	Establish rules from the start (Luyet <i>et al.</i> , 2012).	Communication strategy
9.	Ensure that the consequences of the process for decision making are clear to all participants at the start of the deliberation process (Retallack & Schott, 2014).	Communication strategy
10.	Include reflexivity and realism as part of the process (Ravera <i>et al.</i> , 2011; Riel, 2019; Wesselink <i>et al.</i> , 2011; Westling <i>et al.</i> , 2014).	Evaluation form and discussion after each session
11.	Underpin the process by a philosophy that emphasises empowerment, equity, trust and learning (Luyet <i>et al.</i> , 2012; Reed, 2008; Wesselink <i>et al.</i> , 2011).	Clear communication of open and transparent process
12.	Select and tailor methods to the decision-making context, types of participants and level of engagement (Reed, 2008).	Comparison of different methods
13.	Ensure that local and scientific knowledge are integrated (Reed, 2008).	Integrated approach followed
14.	Institutionalise participation (Reed, 2008).	Empowerment of local government management; formalisation of the process
15.	Make participation free and voluntary (consideration of proposals is not constrained by the authority of prior norms or requirements) (Cohen, 1997, cited in Retallack & Schott, 2014: 353).	Rules during intervention (links to 8)

16.	Only exercise force of the better argument (Cohen, 1997, cited in Retallack & Schott, 2014: 353).	Rules during intervention (links to 8)
17.	Ensure that parties are formally and substantively equal in voice and access to the agenda (Cohen, 1997, cited in Retallack & Schott, 2014: 353).	Rules during intervention (links to 8)
18.	Ensure that the approach aims to arrive at a rationally motivated consensus (Cohen, 1997, cited in Retallack & Schott, 2014: 353).	Rules during intervention (links to 8)

## 2.4 Conclusion

Municipalities have a vital role to play in ensuring that problems with regard to a sustainable future are addressed. However, this is not a simple task due to the many interconnected socio-economic, technical, environmental, and political factors that should be simultaneously addressed when planning for a sustainable future. For a local government, it means that on a social level, the community needs to be informed and made aware of the potential changes to the current energy landscape. In addition, an opportunity needs to be given to municipal stakeholders who have an interest in the complex matter to participate in the discussions and decision making. Technically, an understanding needs to be established of the constraints to overcome regarding the current infrastructure and what the costs will entail. On an environmental level, municipalities will have to investigate the impact of different sustainable energy options on the environment and the work will need to be performed within the institutional and political system of a local government. Furthermore, the heterogeneity of local governmental management practices is vast, and consideration of different cultures, contexts and institutional settings is crucial.

When planning for a sustainable energy future at a local government level, stakeholders need to be part of the process. Stakeholders are the people directly affecting or being affected by the problem. The focus of this chapter was therefore on eliciting approaches inclusive of stakeholder involvement using a systematic literature review. The review focused on articles published between 2009 and 2015 that applied a participatory approach to energy planning, climate change, sustainable development, and water management at a regional, city or community level. The approaches found were grouped into six categories: 1) participatory

techniques, 2) MCDA, 3) systems approaches, 4) scenario planning, 5) adaptive management and 6) integrated approaches. Through an analysis of the advantages and limitations of these approaches it became clear that no single approach is perfect and, as a result, many integrated approaches are emerging in literature. The selection of specific techniques within such an integrated approach remains context-specific. However, the factors for the successful development and implementation of a participatory approach, elicited in this review, can provide a solid checklist (as given in Table 2-5) when planning an intervention with a municipality,

The integration of the factors for the successful development and implementation of a participatory approach with the degrees of stakeholder involvement provided the researches with a knowledge base to develop a participatory planning approach for a local government in South Africa. Such an approach needs to take into consideration the heterogeneity of local contexts, ensure effective facilitation of stakeholder participation and needs to ensure that all degrees of stakeholder involvement are addressed. A holistic approach needs to be followed, information needs to be developed and shared, a mutual understanding of the context and problem at hand should be established, critical and creative thinking should be encouraged, decision options should be evaluated against multiple criteria and the implementation plans should be evaluated against a predefined set of objectives.

The next step in the research process was to establish an understanding of the context of a local government in South Africa, to investigate how and whether renewable energy options form part of a local government's long-term plans and to understand how a municipality utilises participatory approaches. Hessequa Municipality, in the Western Cape province of South Africa, was the selected case study, and the start of its journey towards a sustainable energy future is discussed in Chapter 3.

# **Chapter 3**

## **Journey towards renewable energy for sustainable development at the local government level: The case of Hessequa Municipality in South Africa**

### **3.1 Introduction**

The case for renewable energy solutions, such as solar energy, wind energy, hydropower and biomass, is robust in South Africa. The country has the third-largest solar resource in the world, with an average of more than 2 500 hours of sunshine per year and average solar radiation levels ranging between 4.5 and 6.5 kWh/m<sup>2</sup> in one day (DoE, 2015). Wind also shows enormous potential in South Africa, with 6 360 MW of electricity procured through the REIPPPP and 2 078 MW of electricity generation capacity connected to the national grid by March 2019 (South African Wind Energy Association, 2019). According to the Renewable Energy Status Report (DoE, 2015), the cost of solar PV technologies decreased by 83% from the REIPPPP bid window 1 to R0.62/kWh, or USD0.05/kWh. The onshore wind price decreased by 59% over the same period.

The South African policy landscape enables the implementation of renewable energy technologies and promotes ecologically sustainable development and the use of natural resources (RSA, 1996). The White Paper on Energy Policy (Department of Minerals and Energy, 1998), the White Paper on the Renewable Energy Policy of the Republic of South Africa (Department of Minerals and Energy, 2004) and the National Climate Change Response White Paper Policy (Department of Environmental Affairs, 2011) set out the goals and commitment from government to ensure that renewable energy forms a significant part of the South African energy portfolio. The Western Cape province's Green Economy Strategy Framework further highlights that investing in renewable energy technologies is one way of fulfilling the obligation to decrease carbon emissions in South Africa (Western Cape Government, 2013).

The IRP of South Africa is a living plan updated by the DoE, which models different policy scenarios and energy mixes. The IRP 2019 sets a target to produce a total of 26 630 MW of renewable power (solar PV, wind and concentrated solar power) by 2030, while achieving socio-economic and environmentally sustainable growth (DoE, 2019). In addition, the latest IRP caters for the uncapped procurement of distributed generation up to and including 2022. Procurement of distributed generation<sup>1</sup> will be capped at 500 MW per year from 2023 to 2030 (DoE, 2019). Implementing renewable energy solutions at a local government level could potentially hold many social, environmental and economic benefits, such as a reduction of greenhouse gases, electricity security, local job creation and local economic growth. Section 151 of the Constitution (RSA, 1996) gives municipalities the autonomy to govern the local affairs of their communities within the parameters of national and provincial legislation. The three white papers on energy, renewable energy and climate change response contain numerous policy directives in favour of sustainable development and ensuring energy security through a diversified supply mix (Mosdell, 2016). Therefore, municipalities can justify renewable energy implementation initiatives that will drive sustainable development or diversify their supply mix, because these are aligned to national policy directives.

The local municipality of Hessequa saw this potential benefit of energy autarky when a decision was taken to include renewable energy solutions as part of its long-term vision and strategy during an Energy Summit held in June 2015 (Kruyshaar, 2015). However, the implementation of renewable energy solutions at a local government level creates complex problems, especially when considering the public participative nature of local governmental decision making. When implementing renewable energy technologies, many social, institutional, environmental, technical and economic factors need to be considered within the social-cultural context (Barry, Steyn & Brent, 2011). For a local municipality, this complexity can be explained as follows: Socially, people need to be made aware of the potential changes in the electricity supply grid and the municipality needs to understand how people will adopt new technologies, such as SSEG technologies;

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<sup>1</sup> Distributed generation in the IRP 2019 is defined as “small-scale technologies to produce electricity close to the end users of power” (DoE, 2019: 6)

institutionally, municipalities need to review the current electricity cost structures and evaluate the impact of implementing renewable energy technologies on their municipal electricity demand and municipal policies also have to be updated to incorporate the uptake of SSEG; environmentally, municipalities need to understand the impact on the environment of implementing different renewable energy options as well as the impact if these technologies are not adopted; technically, the constraints of the current electricity infrastructure need to be understood; and economically, the effect on the municipal financial cash flow and the impact on the municipal bill of the customer need to be considered. It is therefore clear that the complexity under consideration entails many variables, viewpoints of different stakeholders and uncertainties.

A complex problem is also known as a mess (Ackoff, 1981) or a wicked problem (Rittel & Webber, 1973). Ackoff (1981) defines a mess as a system of interrelated problems with multiple stakeholders. Pidd (2009: 46) quotes Ackoff in stating that a mess is “a set of circumstances in which there is extreme ambiguity and in which there may well be disagreement”. Rittel and Webber (1973) describe a wicked problem as a problem that is difficult or impossible to solve because of its complex interdependencies, where one aspect of the problem being solved causes many other problems. Pidd (2009) proposes soft modelling methods to create a representation of such a complex problem situation, to gain a better understanding, to guide strategic decision making and to effectively manage the mess or wicked problem. Soft modelling methods are of a participatory nature, which means that stakeholders are involved as part of the process. Literature shows many successful applications of these soft modelling methods as well as other participatory processes to better manage the contemporary complex problems of our century (Flacke, 2017; Hukkalainen, Virtanen, Paiho & Airaksinen, 2017; Ouhajjou, Loibl, Fenz & Tjoa, 2017; Reilly, O’Hagan & Dalton, 2016; Watkin *et al.*, 2012; Winkler, Lemke, Ritter & Lewandowski, 2017). However, evidence of the application of these methods at a local government level in South Africa is limited.

Before starting the planning process for sustainable energy projects, the local context should be understood, and it should be determined how sustainable energy fits into local government’s strategy. Strategy is a participatory process of agreeing on priorities and then implementing those priorities (Ackermann & Eden, 2011).

Action research and other participatory research methods play a crucial role in development (Hart, 2008), and therefore this research process provides a platform for becoming part of this journey towards better understanding and agreement on priorities.

Considering the above, this chapter discusses how renewable energy solutions form part of a local government's strategy and elicits the issues that are hampering the implementation of sustainable energy solutions at local government level. A new aspect of the research was an attempt to consider renewable energy options as part of the municipal strategy, and not as a standalone project. Hessequa Municipality, situated in the Western Cape province and one of 226 local municipalities in South Africa, was selected as the case study. The context of the case study was discussed in Chapter 1. The first part of Chapter 3 discusses various opportunities for renewable energy within the Hessequa strategy that could be considered in future planning. The second part focuses on evaluating the participatory approaches utilised in the communication and development of the municipal strategy. A unique application of cognitive mapping was used to elicit the interrelationships between the discussions that took place and the opportunities for renewable energy found in literature. A practical research contribution was the development of a visualised strategy that can be used when discussing the municipal future with municipal stakeholders and the wider public. Chapter 3 is based on an article published in the journal *Sustainability* (Fouché & Brent, 2019). The original published research paper abstract with the declaration of author contributions is included in [Appendix B.2](#).

## **3.2 Research methodology**

The chapter deals with answering two research objectives: firstly, to determine whether and how renewable energy options form part of a local government's strategy and long-term plans, and secondly, to investigate how participatory approaches are utilised in the development and communication of a municipal strategy. An action research approach (Riel, 2019) was used in a single instrumental qualitative case study to understand how renewable energy options form part of a local government strategy and vision as well as to investigate the participatory approaches utilised. According to Yin (Yin, 2009: 13), a case study is

“an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries of phenomenon and context are not clearly evident”. The qualitative nature of the case study allowed for the researcher to be part of the case as an observer and a participant, to explore the potential renewable energy options for Hessequa. Action research involves the researcher and the participants as an integral part of the design to gain understanding of and insight into the worlds of the research participants (Riel, 2019).

The data and information relevant to the case study were collected through different methods, including the facilitation of workshops with the municipal management, ward committees and business owners; participation in several meetings and discussions held with the municipal manager, council and the Technical Services manager; observations of IDP and SDP meetings held with the nine municipal wards; and analysis of municipal documentation. Primary data, such as rich pictures, transcripts, meeting minutes and field notes, as well as secondary documentation were analysed.

Table 3-1 summarises the interactions that formed part of the research and shows the role of the researcher in each of these interactions.

Table 3-1 Municipal interactions that formed part of the research

<b>Interaction name and date</b>	<b>Purpose and outcome of interaction</b>	<b>Number of participants</b>	<b>Role of researcher</b>
<b>Hessequa Energy Summit held in Stilbaai on 23 and 24 July 2015</b>	To establish the possibility of generating and purchasing renewable energy from private producers; the summit concluded a vote of 64 to 36 in favour of pursuing renewable energy opportunities	250–300 participants	Attendant and observer
<b>Community meetings held with communities of Gouritsmond, Stilbaai and Jongensfontein on</b>	To establish unique challenges and development opportunities for Hessequa	30–50 participants	Researcher did not attend, but received meeting notes from sessions

<b>11 and 15 September 2015</b>			
<b>Meeting with the municipal manager held on 30 March 2016</b>	To discuss possible future actions on renewable energy projects; a date was set for a workshop with the municipal management team	4 participants	Attendant; used transcribed data for analysis
<b>Hessequa's True North workshop held on 5 May and 26 May 2016</b>	As part of the social labs driven by the Stellenbosch University SPL, two sessions were facilitated at Hessequa Municipality to determine how the Hessequa Municipality and citizens see their ideal future given the current challenges	52 participants	Facilitator of the session; used transcribed data and rich pictures for analysis
<b>Meeting with the new council after the elections on 30 September 2016</b>	General discussion to meet the new council and to inform them of the research work done to date	20 participants	Attendant; used notes from meeting for analysis
<b>IDP/SDP meetings held during December 2016 to February 2017 with representatives of the different towns</b>	To discuss the town's specific priorities in terms of strategic direction and spatial development	10–20 participants	Participant in some of the meetings; also received meeting notes as secondary data
<b>Renewable Energy Strategy Meeting on 28 January 2018</b>	Open discussion to provide feedback on research and to discuss next steps	9 participants	Presented interim research findings; used meeting notes for analysis

The Hessequa Energy Summit provided an opportunity for subject matter experts, suppliers of renewable energy solutions as well as local citizens (consumers) and politicians to come together to share knowledge and ideas regarding the potential of renewable energy solutions within the Hessequa area. An opportunity was also given for participants to work together in groups and to share their ideas and viewpoints. The summit concluded a vote of 64 to 36 in favour of pursuing

renewable energy opportunities in Hessequa. Meeting notes and the summit report were used for data analysis.

The True North process was an initiative of the municipal council and speaker at the time and it was already in progress when this research was started at Hessequa. The municipal team visited the different towns to get an understanding of how the towns' communities envisage their future. The challenge that surfaced when the towns were visited individually was that each town believed that their issues should receive priority, which is difficult in a municipality such as Hessequa because of the large municipal area and the diversity between the towns. The researcher then proposed the True North workshops in a meeting with the municipal management team and SPL, and a decision was taken to use rich pictures to facilitate the True North sessions and to focus on one True North for Hessequa, instead of different True Norths for each town respectively. The Hessequa True North workshops were then designed and facilitated by the researcher and open questions were asked as to how the participants see their future within Hessequa and what they perceive is currently hampering this ideal future. The people of Hessequa termed this ideal future their 'True North'. Participants worked in groups and were asked to draw a picture of their True North, which was then presented to the other participants. The presentations from the groups were voice-recorded and the data were transcribed for analysis. Ten rich pictures were created during these workshops. Verbal consent was given by the workshop participants to utilise the data and rich pictures as part of the research. The verbal consent form is given in [Appendix A.2](#) and the ten rich pictures are shown in [Appendix C.1](#).

The community and IDP/SDP meetings were held with representatives of the different towns within Hessequa to discuss town-specific challenges and development opportunities. During the IDP/SDP meetings, the participants were asked for their opinion regarding renewable energy solutions and where they see town-specific opportunities for renewable energy. Meeting notes and the formal IDP/SDP report were used for data analysis. All the other meetings as indicated in Table 3-1 were open discussions to determine priorities and next steps. Meeting notes were used for data analysis.

The data collected from the above interactions, together with a literature review to identify sustainable energy opportunities and barriers, were used for qualitative content analysis to determine whether and how renewable energy options form part of a local government's strategy and long-term plans. The researcher then developed a cognitive map to identify causal relationships between the strategic themes that emerged from the True North workshops and IDP meetings, and the barriers and opportunities for sustainable energy evident in the data. The cognitive map was reviewed and approved by the municipal management team and formed the basis for the development of the Hessequa visualised strategy. A cognitive map is a diagram that consists of concepts (nodes) and arrows that link the different concepts together (Pidd, 2009). The main output is a map structured as goals, strategic directions and options (or actions). According to Eden, Ackermann and Cropper (1992), cognitive maps are regarded as a subset of cause maps or causal maps, which is used in the fields of system dynamics (Forrester, 1961; Sterman, 2000) or systems thinking (Senge & Sterman, 1992). System dynamics and systems thinking deal with understanding the behaviour of a human activity system through an understanding of the causal relationships and interdependence of different variables within the system.

The second part of the research was to investigate how participatory approaches are utilised in the development and communication of a municipal strategy. In a South African context, public participation is mainly undertaken by means of ward committees, where the ward committee members should be representative of the wider public. Two main instances were investigated, namely the IDP meetings held with representatives of the different towns and the True North workshops, an initiative of the research process. The factors necessary for the successful development and implementation of a participatory approach, as given in Chapter 2,<sup>2</sup> were used as a guideline in the investigation.

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<sup>2</sup> See Table 2-5 Checklist to ensure successful development and implementation of a participatory approach.

### **3.3 Results**

#### **3.3.1 Five main strategic themes and their causal links to renewable energy options**

Five main strategic themes were determined from analysing the data and developing a cognitive map, as seen in Figure 3-1. Figure 3-1 further shows the options for renewable energy highlighted in green and the current barriers to renewable energy options highlighted in orange. The five main strategic themes are to 1) plan for sustainable infrastructure and innovative service delivery, 2) provide a space for personal and social cohesion, 3) plan for sustainable economic development, 4) plan for environmental conservation and 5) keep municipal tariffs affordable. Five options for renewable energy solutions became evident during the research period (as marked in Figure 3-1), namely a) biomass-to-energy, b) low-carbon local economic development (LED), c) SSEG, d) waste-to-energy and e) feed-in tariffs. Each of the strategic themes, linkages to other themes and opportunities for renewable energy solutions are discussed below.

##### **3.3.1.1 Theme 1: Plan for sustainable infrastructure and innovative service delivery**

The discussions on sustainable infrastructure focused on a need for infrastructure improvement before any new developments can be considered. The sustainable infrastructure mentioned was upgrades to current water reservoirs and dams, sewage systems, the current electricity distribution network and transport systems such as road and rail transport. The load on aging infrastructure, especially during the peak season, posed a problem. In addition, a concern was that the current capacity of the municipal distribution network might not allow for electricity feed into the system, should citizens generate renewable energy from rooftops. What was emphasised was that renewable energy options should be a win-win situation for all role players, namely Eskom (the national utility), the municipality as well as the individuals. The possibility of an integrated energy and water solution emerged, especially in the light of the drought situation facing South Africa (Vogel & Van Zyl, 2016; Van Zyl, 2016).

## Vision & strategic themes

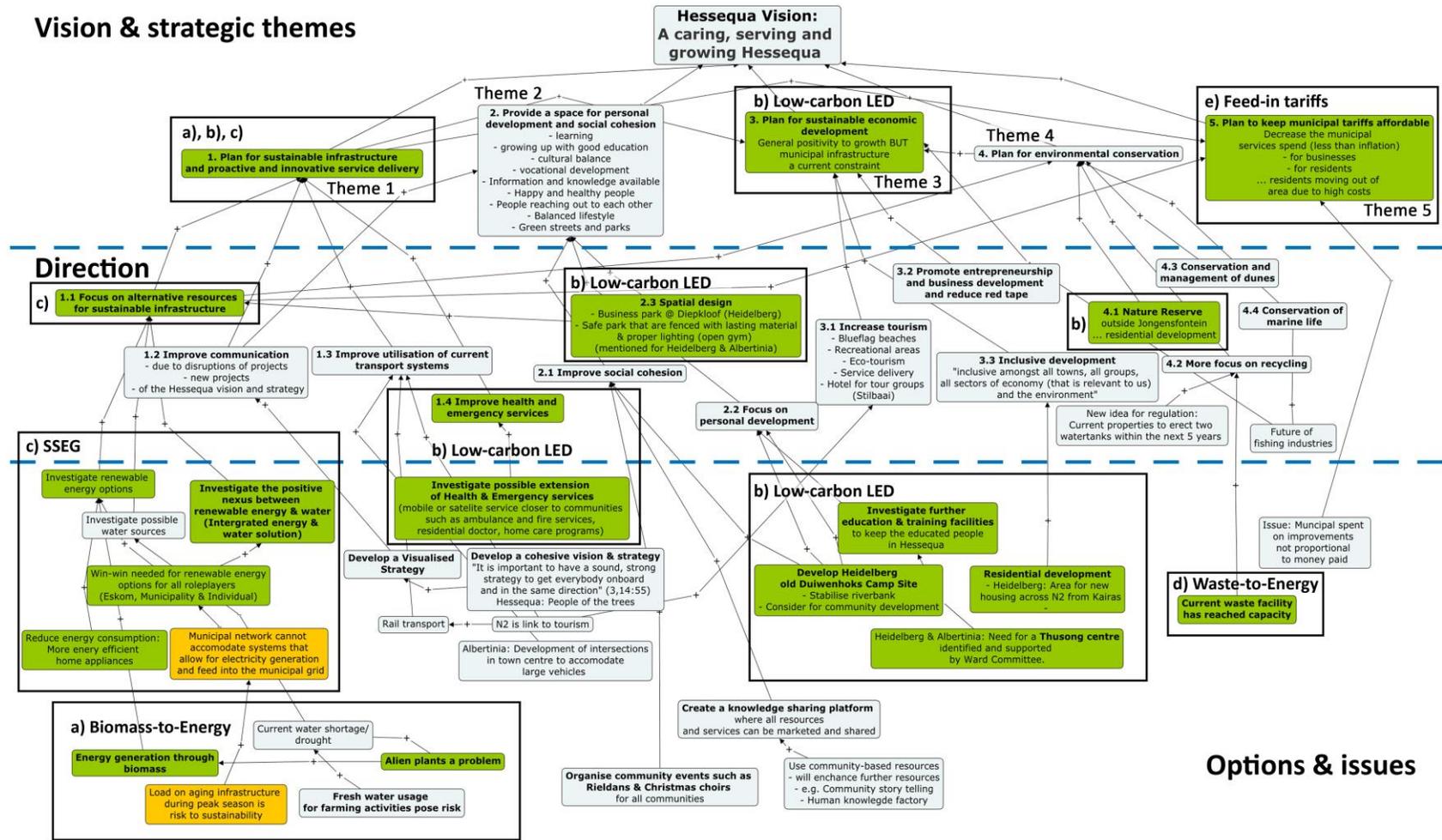


Figure 3-1 Cognitive map of the Hessequa strategic themes with causal links to renewable energy options

No detailed actions were discussed on what this integrated energy and water solutions could entail; however, results from a system dynamics model (Janse van Rensburg, 2018) show that biomass-to-energy in the form of invasive alien plants can contribute towards the nexus of electricity supply and water. Janse van Rensburg's study (2018) further showed that solar energy is the most attractive renewable energy option in terms of operational and capital cost and shows potential when investigating options for SSEG. Although biomass power is more expensive than solar PV power, it shows potential in creating jobs and has a positive environmental impact due to the clearing out of invasive alien plants in the Hessequa area. Biomass power, as a plan for sustainable infrastructure, is interlinked with theme 4, namely to plan for environmental conservation. The plan for sustainable infrastructure and innovative service delivery (Theme 1) also has a positive link with sustainable economic development (Theme 3), which is currently constrained by the municipal infrastructure.

A definite link exists between proactive service delivery and the improvement of current health services in Hessequa, especially in the light of an aging population. One possibility is to extend the current health and emergency services to mobile or satellite services closer to the communities, a residential doctor and home care programmes. These possibilities immediately show a link to entrepreneurial and business opportunities (Theme 1 links with Theme 3) and low-carbon LED. The role of renewable energy is evident as an energy source in the applications needed at healthcare facilities, such as lighting, water heating, medical refrigeration and electricity needed for computers, telephones and medical appliances such as microscopes, nebulisers and centrifuges (Jimenez & Olson, 1998).

Proactive service delivery for the people of Hessequa means better communication, especially when there are major disruptions due to municipal projects in the area. A link to the need for improved communication was clearly seen where the discussions emphasised that it is "important to have a sound, strong strategy to get everybody on board and in the same direction" (Hessequa Municipality, 2018: 4). Currently, the municipality focuses on its financial plan and IDP as Hessequa's strategy. These documents are lengthy and presented in a way that is not always accessible to some citizens. One specific action from the discussions was to create a visualised strategy, which will provide a visual tool for

communicating the Hessequa vision and strategy to the people of Hessequa. The visualised strategy as a communication strategy is discussed in Section 3.3.2.

### **3.3.1.1 Theme 2: Provide a space for personal development and social cohesion**

People choose the Hessequa area as a lifestyle destination. This means that they aim to have a safe, balanced and peaceful stay. It is therefore understandable that social issues, such as youth unemployment; crime-related activities such as drinking, smoking and drug abuse; teenage pregnancies; and children not attending school pose a great risk to the residents. Many novel ideas are proposed on how to solve these social problems. However, the people coming up with these ideas do not necessarily understand the cultural background, as one participant rightly said: “We need to adapt our Western thinking to accommodate the needs of the community in a way that is known to them” (Hessequa Municipality, 2018: 5, translated). According to Stats SA (2011), the total unemployment rate in Hessequa is 14.1% and the youth unemployment rate is 18.9%. The highest level of education reached by most of the population in Hessequa is Grade 12 (Hessequa Municipality, 2017). Hessequa provides limited opportunities for tertiary education, which means that the person with a Grade 12 certificate will either move out of the area for further studies or will not continue tertiary training due to financial constraints. One definite focus of the municipality is to further investigate educational and training facilities, such as training centres and other knowledge-sharing platforms.

Spatial designs and spaces for social cohesion can be beneficial to personal and social development. Here ideas such as business parks, open parks, recreational areas and areas for community development, which can all contribute towards low-carbon LED, need to be considered. The importance of youth development has been reiterated, which can only be done if communities take ownership and responsibility. Community leaders can play an important role to build trust and mobilise communities to build a support structure for youths and their parents. Renewable energy plays a crucial role in the sustainability of these spatial designs and spaces as a source of electricity for lighting, computers and internet connectivity.

### **3.3.1.2 Theme 3: Plan for sustainable economic development**

A portion of the economy of Hessequa is seasonal, with holiday residents owning a large percentage of the properties in Stilbaai. This seasonality can pose a problem for sustainable economic development if not managed. The citizens of Hessequa show a general positivity towards sustainable economic growth in the form of increasing the tourism value chain and the provision of services. Opportunities include tourism infrastructure, transport, signage, basic services, information centres and marketing, developing and improving facilities and human capital (Hessequa Municipality, 2017). A great focus is on social cohesion, where the people of Hessequa aim to be happy and healthy with a balanced lifestyle. Ideas were given in terms of safe recreational parks (with proper lighting), a business park at Diepkloof in the town of Heidelberg, as well as the development of the old Duiwenshok campsite. The development of basic services, businesses as well as spaces for social cohesion creates further opportunities for renewable energy options (positive link between themes 1, 2 and 3) and low-carbon LED. The Western Cape government is committed to low-carbon LED and is willing to assist in exploring opportunities for business and development related to environmentally friendly and resource-efficient manufacturing (Western Cape Government, 2013). GreenCape is another key stakeholder that has been established to facilitate investment in economic growth and support opportunities related to the renewable energy sector (Hessequa Municipality, 2018). Most towns in Hessequa are feeling positive towards balanced development, meaning that development can take place, but not at the cost of natural resources or the disturbance of the towns' character. Due to most towns being a retirement destination, the focus of the residents is on the development of spaces for social cohesion, services and recreational activities. The improvement of health services and the possible extension of health and emergency services are other key objectives for the residents of Hessequa (link between themes 1 and 3).

### **3.3.1.3 Theme 4: Plan for environmental conservation**

Environmental conservation has been a theme throughout all the discussions, and the people indicated that they would like to keep the character of the area intact. Some ideas are to develop a nature reserve on an 86-hectare plot outside

Jongensfontein; to put regulations in place to enforce more recycling; to collaborate with Cape Nature, the Department of Water Affairs and the Department of Environmental Affairs; better management and conservation of the dunes; and the development of a plan to conserve the marine life. Again, many of these options have a link with Theme 3, namely to plan for sustainable economic development. The link with Theme 1, namely to plan for sustainable infrastructure and innovative service delivery, has been discussed in Section 3.3.1.1. A threat for Hessequa is the current landfill facility that has reached its capacity.

When looking at renewable energy solutions, this current threat can become an opportunity when considering waste-to-energy technology. Waste-to-energy is a viable technology for the disposal of municipal solid waste and energy generation and has been proven through successfully implemented and operated facilities in Europe and Japan (World Energy Council, 2016). Drakenstein Municipality in South Africa successfully motivated a waste-to-energy project with the objectives to minimise waste to landfill, to reduce the carbon footprint on municipalities and to support job creation by unlocking value from waste. This project is currently in a planning phase (Hermanus, 2017; Jan Palm Consulting Engineers, 2012).

#### **3.3.1.4 Theme 5: Plan to keep municipal tariffs affordable**

Affordable municipal tariffs are a priority, especially due to the demography of the permanent residents of the area, who are mostly retired and living off a pension fund or citizens earning a low income. In addition, business owners need to keep their businesses running outside of the peak seasons, which is not possible if the municipal tariffs are increasing annually. One concern of residents is that the municipal spend on town improvements is not proportional to the municipal tariffs paid. The municipality aims at keeping the municipal tariff increase below the inflation rate. The municipal tariffs consist of property rates, cost of refuse removal, electricity costs, water costs, and sewage and sanitation costs, of which electricity costs account for 30% of the total municipal bill. Eskom is currently supplying electricity to municipalities, which is then distributed to the properties. The electricity prices have increased by 8% on average annually, which is higher than the current South African Consumer Price Index inflation rate of 4.5% (Stats SA, 2019c). Water penalties due to the drought is putting further pressure on the

municipal bill and it is therefore unrealistic to expect a municipal increase of less than 4.5% under the current circumstances. Renewable energy options in terms of SSEG and feed-in tariffs (see Theme 1) could play an effective role in keeping municipal tariffs affordable. During the time the research was conducted, Hessequa Municipality was in the process of implementing requirements for small scale embedded generation.

### **3.3.2 Investigating the participatory nature of Hessequa**

In order to plan for a sustainable energy future, it is argued that approaches inclusive of stakeholder participation should be used in the local government sphere. Stakeholder or public participation in the South African context is defined as “two-way communication, negotiation and development of mutual understanding, with the ultimate objective of reaching decisions that are supported by the public” (South African Legislative Sector, 2013: 7). The South African Legislative Sector refers to public actors and categorises these public actors as the citizenry, as represented by parties, and interest groups or stakeholders. Stakeholders in this research refer to “any group of people organised, who share a common interest or stake in a particular issue or system” (Grimble & Wellard, 1997: 175–176), of which citizens are also part.

Stakeholder participation can hold many benefits, as indicated in Chapter 2, namely social learning, trust building, knowledge sharing, building a common understanding, changing perceptions and kick-starting ongoing collaboration. A checklist was developed to ensure the successful development and implementation of participatory approaches. The checklist contains 18 guidelines for consideration when planning and implementing a participatory approach. These guidelines are referred to in Table 3-2 as the checklist numbers, and were used to investigate how participatory approaches are utilised in the development and communication of Hessequa’s municipal strategy. Two specific instances were used in the investigation:

- 1) IDP/SDP meetings were held during the period of December 2016 to February 2017 with representatives of the different towns to discuss each town’s specific priorities in terms of strategic direction and spatial

development. The IDP/SDP meetings were organised by the development and planning team of the municipality.

- 2) As part of the social labs driven by Stellenbosch University's SPL, two Hessequa True North workshops were facilitated at Hessequa Municipality to determine how they see their ideal future given the current challenges. The first session was held on 5 May 2016 with the municipal management team, consisting of a total of 15 participants. The second session was held on 26 May 2016 with a broader stakeholder group consisting of 37 participants, inclusive of municipal management representatives, ward committee members, municipal council members, representatives from business and society, and representatives from SPL. The True North workshops were designed by the researcher and the invitations to these workshops were handled by the Manager: Strategic Services.

The checklist of participatory approaches highlights in points 1, 12 and 13 that a holistic and integrated approach needs to be followed when developing and implementing a participatory approach. The approach followed during the IDP/SDP meetings was to discuss the town's possible future development needs by means of cartography or participatory mapping. A printout of the current town area and perimeter was used to draw a possible expansion of the town's perimeter and to make notes of the ideas given by the participants in the session. A holistic approach is an approach followed to understand the total system and the interconnections between the different parts. In municipal terms it means that a total understanding of the interconnections between the economic, political, environmental, social, cultural and psychological factors need to be kept in mind. When considering this description of a holistic approach, it can be argued that the use of participatory mapping on its own is not holistic. In addition, there was no representation of other municipal departments during these IDP/SDP meetings with the specific towns. Participatory mapping is one of the techniques tabled by Luyet *et al.* (2012) and shows that the technique can result in collaboration, co-decision and empowerment, but should be done in combination with systems thinking to ensure that the approach is holistic and integrated.

Table 3-2 Summary of evaluation findings on the participative nature of Hessequa

<b>What</b>	<b>Checklist numbers</b>	<b>Evaluation result for IDP/SDP meetings</b>	<b>Evaluation result for True North workshops</b>
A holistic and integrated approach was followed.	1, 12, 13	No	Yes
A diverse group of stakeholders participated from the start.	2	Yes	No
Careful consideration was given to how to involve the stakeholders.	3	Yes	Yes
A strong mandate and political support were given for the interventions.	4	Yes	Yes
Good facilitation skills were provided through the appointment of a knowledgeable and experienced facilitator.	5	Yes	Yes
A communication strategy was followed.	6–9	Unsure	Unsure
Reflexivity and realism were included as part of the process.	10	No	No
The process was underpinned by a philosophy of empowerment, equity, trust and learning.	11	Yes	Yes
Participation was institutionalised.	14	Yes	Yes

The methodology used during the Hessequa True North sessions was Checkland's (1981) rich pictures, which can timeously show the different structures, process aspects and climate of a given situation. Rich pictures are further beneficial because they can isolate key issues quickly, can represent a whole range of

stakeholders and can be used to better understand the interconnections of different issues. The technique was specifically chosen to ensure that a holistic approach was followed to identify opportunities for the whole of Hessequa, while considering the barriers and constraints. The True North sessions were also specifically planned to ensure that the town representatives attend one workshop to ensure integration between the town's specific priorities to determine strategic themes for Hessequa as a whole.

When considering the participants of the IDP/SDP meetings, the representation was in line with the demography of the specific town where the IDP/SDP meetings were held. It can be argued that accessibility for participants is easier if the meetings or workshops take place within the respective towns. The participants of the Hessequa True North workshops were not representative of the distribution of the population in terms of ethnicity and age. Although 68% of the population described themselves as coloured (Stats SA, 2011), the participants in the room were mostly white men above the age of 40. The voluntary nature of participation makes it difficult for the municipality to involve a more diverse group of stakeholders, yet attention should be given to involving a greater diversity of stakeholders in future discussions.

The means used to involve the stakeholders proved successful. The cartography/participatory mapping used during the IDP/SDP meetings stimulated good discussions in the room on possible future development areas. The facilitator was open to discuss the different ideas and viewpoints of the participants. Positive feedback on using the rich pictures during the True North workshops was received and the rich pictures provided a way to progress to the essence of the discussions at a much faster rate. Although nothing new emerged in terms of the challenges the area faces, the rich pictures provided a visual and transparent view of where the urgent matters are.

Both the Hessequa True North workshops and the IDP/SDP meetings had a strong mandate and political support because participation forms part of the current practices of the municipality. In all cases, the workshops and meetings were facilitated in a professional way.

Points 6 to 9 on the checklist all refer to a communication strategy, which emerged as a major concern throughout most discussions, especially in terms of the development and communication of a shared vision. In order to ensure buy-in into Hessequa's long-term strategy, a formal communication strategy is needed that will ensure continuity. Here a visualised strategy was created, as shown in Figure 3-2, which will not only frame future discussions in the direction of the strategic themes, but can also invoke creative thinking and ideas. The idea of a visualised strategy emerged from using rich pictures when the future intent of Hessequa was discussed during the True North workshops. The objective of using the visualised strategy is to create a conducive environment to more strategic discussions during strategic planning sessions at the local government sphere. The visualised strategy can be used as a tool to structure participated discussions between the municipal administration, the municipal council, the public and other important stakeholders, and to provide a powerful and creative way of eliciting what is important to the people of Hessequa. The feedback received from the workshops and meetings was informal and no evaluation form was used. Participation within Hessequa Municipality is institutionalised; however, more work is needed to formalise and communicate the rules of such participatory processes.

### **3.4 Discussion**

#### **3.4.1 How does renewable energy form part of the Hessequa strategy and what are the current constraints for implementing renewable energy solutions?**

Local small renewable energy projects (<1 MW) in South Africa, such as Bethlehem Hydro, eThekweni Landfill Gas, Darling Wind Farm, PetroSA Biogas Power projects, Hessequa Water Purification and George Airport Solar Plant, have proven that successful renewable energy implementation is possible, but to increase the implementation rate the current barriers must be removed and better support is needed from government. Better coordination among policies and institutions is highlighted as a prerequisite for effective renewable energy implementation (Msimanga & Sebitosi, 2014).

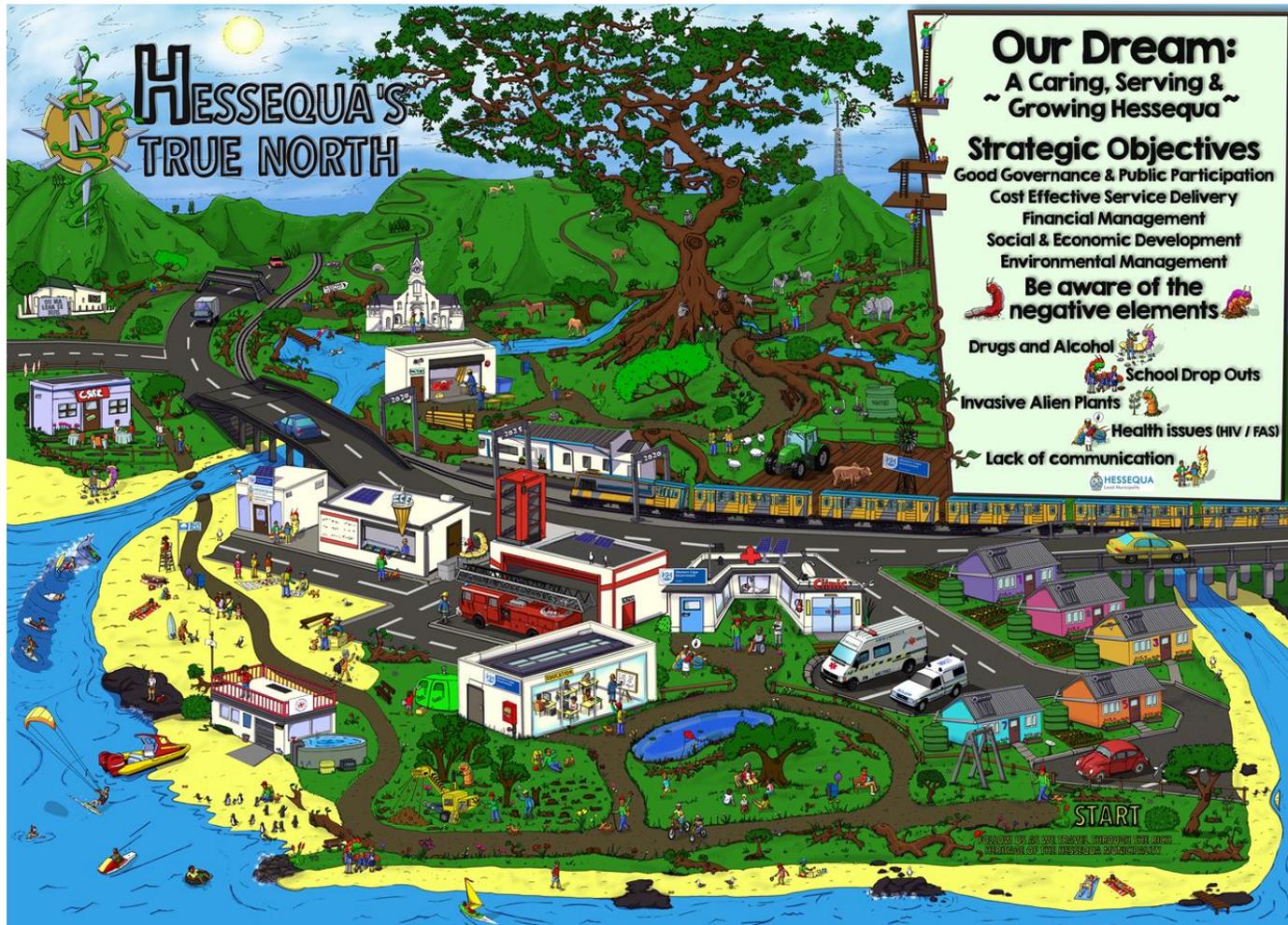


Figure 3-2 Hessequa visualised strategy

Access to modern energy is an important catalyst for economic growth and social equality (Pollet, Staffell & Adamson, 2015). The energy systems that drive our economies should be realigned with the ecological systems that define our planetary boundaries to eradicate poverty, create jobs and sustain growth (Africa Progress Panel, 2015). The consequences if we fail can be catastrophic, and therefore planning for energy security and sustainable energy should form part of the municipal IDP process. As rightly stated in the Hessequa IDP, local authorities should plan for a longer period than the five years that a council is managing (Hessequa Municipality, 2017). This planning process should not be a once-off exercise, but should be incremental to handle the many uncertainties and complexities of our time. Renewable energy projects are long-term investments and should be considered as such.

Hessequa Municipality wants to exercise its constitutional right and is ready to take on the challenge to promote sustainable development using renewable energy, but needs national and provincial government support, practical guidance and funding. Due to the uniqueness of the towns, it was emphasised that the planning of renewable energy projects should be town-specific. The IDP specifically highlights that renewable energy projects should be pursued for the towns of Jongensfontein, Witsand and Stilbaai, with Stilbaai having the greatest potential for economic growth (Hessequa Municipality, 2017). The strategic themes determined from the data analysis show a very good parallel with Hessequa's vision of being caring, serving and growing (Hessequa Municipality, 2017). The discussions did not include details, such as timelines and other specifics, but provided a good idea of what the citizens perceive to be the most important actions and issues in their respective towns. Although renewable energy solutions were mentioned in the discussions, the emphasis was on the socio-economic problems in the area, the citizens' specific needs to maintain and upgrade the current town infrastructure, their concerns about the high municipal tariffs and possible future increases in tariffs and each town's specific challenges.

The cognitive mapping method provided a way of uniquely structuring the coded data to visually show the interrelatedness between the different themes and data. Although renewable energy solutions were not a key focus for the participants, the causal relationships in the cognitive map show many opportunities (highlighted in

green) and barriers (highlighted in orange) in terms of renewable energy solutions. Renewable energy solutions that potentially form part of the Hessequa strategy are as follows (marked a) to e) in Figure 3-1):

- a) Biomass is a potential viable renewable energy source in Hessequa. The possibility of generating renewable energy from the alien plants can offer a solution to the current environmental challenge and has the potential for job creation.
- b) Low-carbon LED is a focus for Hessequa Municipality, as well as the Western Cape government. Future development projects, such as business parks, recreational parks, health and emergency services, and residential developments, create opportunities to incorporate renewable energy technology in the form of solar PV power for applications such as lighting, water heating and electricity generation for small appliances.
- c) SSEG provides a way for home and business owners to generate electricity for own use. The preferred technology is solar PV systems, but technologies such as wind power can also be investigated. To make this a viable option, the constraint of the municipal network and aging infrastructure need to be further investigated in order to accommodate feed into the municipal grid. Hessequa has a linear system, with Eskom supply connecting at the two end points. Feed into the electrical grid will place a constraint on the current system and a more resilient circular distribution system is proposed (Kruyshaar, 2015).
- d) Waste-to-energy technology for the reduction and treatment of municipal solid waste can offer a potential solution for the current landfill capacity problem. This option has further advantages in terms of job creation for the Hessequa area.
- e) To keep municipal tariffs at an affordable level, Hessequa Municipality needs to ensure that its citizens are protected against future electricity price increases. The municipality can either generate and sell its own electricity, which is currently constrained by legislation, or offer citizens a viable solution in terms of a feed-in tariff, which can assist in the payback of SSEG investments.

The current drivers of and barriers to the implementation of small-scale renewable energy projects in South Africa are discussed below.

### **3.4.2 Drivers of and barriers to the implementation of small-scale renewable energy projects in South Africa**

Although renewable energy technologies are becoming more affordable (IRENA, 2019), the transitioning to these technologies remains a challenge due to the initial capital investment and the upfront planning and transactional costs (Fischer, Lopez & Suh, 2011; Msimanga & Sebitosi, 2014). However, in South Africa the trajectory of current electricity prices as well as the question of energy security makes it favourable for consumers, businesses and industries to invest in their own renewable energy generation, such as solar PV power. This places municipalities in a dilemma due to the potential revenue loss from electricity sales (Janse van Rensburg, 2018; Mosdell, 2016). Kritzinger (2016) sees the implementation of feed-in tariffs as a driver for municipalities. Access to renewable energy (or more electricity) does not necessarily reduce the consumer's monthly electricity bill, but could open new opportunities for electricity consumption. The regulatory and legislative environment for renewable energy remains a challenge (DoE, 2015). Local characteristics of public governance, energy regulation, law enforceability and institutional stability, and policy support mechanisms are some of the key barriers found in literature (Comello, Reichelstein & Sahoo, 2018; Fischer *et al.*, 2011). Eskom has the exclusive right to supply electricity (Pegels, 2010) and this restricts access to the national electricity grid for local authorities (De Jongh, 2014). Municipalities are forced to buy electricity from Eskom and to then sell it to their respective consumers. In addition, policies to support renewable projects, especially small-scale projects (<1 MW), are limited and this is hampering growth in the renewable energy industry (Comello *et al.*, 2018; De Jongh, 2014; McDonald, 2009; Nakumuryango & Inglesi-Lotz, 2016; Pegels, 2010; Sebitosi & Pillay, 2008). Fischer *et al.* (2011) argue that renewable energy requires regulation and incentives to be financially viable to compete with cheaper technologies. Local authorities may not disregard national or provincial legislation or pass bylaws in conflict therewith (Mosdell, 2016), yet the regulation of energy needs to be transformed to ensure that local governments do not miss out on opportunities.

McDonald (2009) emphasises the importance of moving away from the current trajectory of business as usual in the energy sector in Africa.

Other possible barriers mentioned in literature are the structure and design of the local energy sector (Fischer *et al.*, 2011); the state and capacity of the current electricity infrastructure (CSIR & CIDB, 2007); the uncertain political and economic environment of South Africa (De Jongh, 2014); the lack of knowledge, skills and expertise of local governments to embark on a renewable energy journey (Winkler *et al.*, 2017); and the lack of consumer awareness of the benefits and opportunities of renewable energy (Department of Minerals and Energy, 2004). Participatory methods are a definite driver to successfully plan and implement renewable energy solutions, especially in closing the knowledge and skills gap of local governments and their citizens. Participation does not only promote transparency, quality and comprehensiveness, but also allows for social learning and trust building between stakeholders, among others, as summarised by Fouché and Brent (2016). Krupa and Burch (2011) list effective communication tools, multi-stakeholder participation and incentives for collaboration as mechanisms that may be integral in the journey towards renewable energy. Local authorities need to ensure that their citizens are not only informed, but that they are also actively involved in the planning of a renewable energy future. The investigation of the participatory processes in Hessequa provided good insights into current practices and generated ideas for improvement, which are discussed in Section 3.4.3.

### **3.4.3 How are participatory processes utilised in the communication and development of the municipal strategy?**

The investigation of how participatory processes was utilised in the development of a municipal strategy showed that Hessequa has practices in place to involve stakeholders, but the voluntary nature of participation sometimes results in a participants group which is not representative of the demography of the area. One way to overcome this challenge is to ensure that matters where specific inputs are required should be identified and then participation for a specific stakeholder group could be planned, as close as possible to the where the stakeholders reside. Another specific shortcoming that was clear from the observations, is that the

Hessequa strategy is not always communicated and accessible in a way that all citizens can understand it. In order to overcome this shortcoming, the development of a visualised strategy emerged during the research period from the idea of using rich pictures (Checkland, 1981) as a participatory technique. The visualised strategy will be beneficial to frame future discussions of local government objectives and will remain the constant when a new municipal council is elected, as discussed as one of the barriers in Section 3.4.2.

#### **3.4.4 Limitations and future research**

The research was conducted following an action research approach, where the researcher acted mainly as an observer and participant in the discussions and municipal meetings as well as a facilitator of the True North workshops. The focus for the municipality was on the Hessequa strategy, its 'True North', and not only on renewable energy solutions. Due to the strategy focus and open questions asked, the depth of the research in terms of the different renewable energy technologies was limited. In addition, the time allowed for the True North workshops did not permit for detailed questions to be asked regarding specific objectives and timelines, and subject matter experts were not always available during these discussions. In order to overcome these limitations, a formal participatory planning approach is proposed in Chapter 4 to plan for sustainable energy solutions.

### **3.5 Conclusions**

Electricity is essential in the drive to develop and grow local municipal areas. The research therefore concluded that renewable energy technology for local authorities, such as Hessequa Municipality, is worth investigating. More sessions with diverse stakeholder groups are needed to develop a plan for implementing sustainable energy solutions that incorporate renewable energy technologies as well as energy efficiency. The following conclusions were drawn based on the research:

- Energy governance, energy planning and climate change are global issues and local authorities have a role to play in this regard. Although municipalities only have authority to regulate within their own areas of jurisdiction, they should exert influence over provincial, national and

international action in the energy and climate change sphere. Ways in which municipalities can exert influence include leading by example, facilitating and encouraging private sector efforts, policy and other forms of advocacy (Mosdell, 2016).

- The research elicited many opportunities and synergies for renewable energy projects as part of the strategy of a local municipality, such as the case of Hessequa Municipality. Potential renewable energy solutions became evident through the discussions of the five strategic themes, namely to 1) plan for sustainable infrastructure and innovative service delivery, 2) provide a space for personal and social cohesion, 3) plan for sustainable economic development, 4) plan for environmental conservation and 5) keep municipal tariffs affordable. The renewable energy opportunities identified were biomass-to-energy, low-carbon LED, SSEG, waste-to-energy and feed-in tariffs. Biomass-to-energy provides a solution for the environmental challenge of alien plants. Through renewable energy, the electricity need, whether for lighting in recreational parks, applications for satellite healthcare clinics, computers and internet connectivity in training centres or for personal electricity use, to reduce the peak electricity demand during high seasons and to keep municipal tariffs affordable can be fulfilled. Renewable energy can further provide opportunities for low-carbon LED and waste-to-energy can provide a viable solution to the current landfill capacity constraint.
- The participatory nature of municipalities provides a conducive environment to future sustainable development. The research showed that the inclusion of different stakeholders and researchers in the strategic planning of a municipality provides opportunities to elicit sustainable solutions not necessarily considered by the municipality on its own. The creation of a unique visualised strategy can further enhance communication of the municipal strategy. Although the research was limited to one case study, the results can be used to mobilise other local authorities to follow a similar journey. Future research should focus on the main limitation of the current participatory approaches of municipalities, namely that a diverse group of participants does not always participate and/or is not always involved in local government decision making. Research could

focus on how and when the wider public should be involved in local government matters to ensure effective public participation.

# Chapter 4

## Explore, Design and Act for Sustainability: A participatory planning approach for local energy sustainability

### 4.1 Introduction

Up to this point, the research focused firstly on determining the factors necessary for the successful development and implementation of a participatory approach and secondly on creating an understanding of a local government context through determining how renewable energy options form part of a local government's strategy and how participatory approaches are being utilised at a local government level.

This chapter focuses on the development, application and evaluation of a participatory planning approach for local energy sustainability, which stems from multidisciplinary theories and problem-solving methods. The development of the approach followed an inductive conceptualisation process. Firstly, a literature review of the characteristics of a complex problem was conducted to evaluate the sustainable energy decisions at a local government level against these characteristics. Secondly, a review of the current PSMs in the field of soft OR, risk assessment methods, participatory techniques and the literature on public participation and collaborative governance informed the conceptual development of the new approach. The decision to focus on soft OR methods, as a starting point, was based on the premises that soft OR methods are suitable to structuring complex problems. The requirements of a participatory planning approach were then elicited using inductive reasoning and working closely with local government over a five-year period.

Finally, to evaluate the developed participatory planning approach, a facilitated workshop, namely the Hessequa Sustainable Energy Journey workshop, was conducted at Hessequa Municipality in the Western Cape province of South Africa. The nature of the workshop was qualitative, using both divergent and convergent

collective thinking. Data collection took place in the form of voice-recorded open discussions, group discussions and group feedback. The workshop was concluded with the completion of an evaluation form to evaluate the approach that was followed. The data of the workshop were analysed and reported to the municipal management team for sign-off and the results of this workshop are reported as part of this chapter. Parts of this chapter were published in a paper in the journal *Sustainability* (Fouché & Brent, 2020), but it should be noted that the chapter was adapted to include lessons learnt from the reflection process. The original published research paper abstract with the declaration of author contributions is included in [Appendix B.3](#).

## **4.2 Review of the characteristics of a complex problem and the problem of local energy sustainability**

In order to determine the characteristics of complex problems, the definitions from literature, shown in Table 4-1, were used. The first characteristic that clearly stands out from the definitions is that a complex problem consists of multiple stakeholders with different views and perceptions of the problem (Pidd, 2009: 46). When there are different views, there will always be multiple objectives, where different stakeholders have diverse opinions on what should be achieved as part of decision making. In addition, a complex problem lacks structure and is seen as a system of problems with many interrelationships. Incomplete, contradictory and changing requirements (Churchman, 1967) show us that a complex problem is characterised by uncertainty and risk. Rittel and Webber (1973) clearly state that the uncertainty and risk when implementing possible solutions to better manage a wicked problem could be high because of unintended consequences, which are difficult to recognise before implementation. According to Pidd (2009), the main difference between uncertainty and risk is that uncertainty cannot be measured, whereas risk can be measured because the probabilities of certain outcomes are known or attainable. Marczyk (2010), on the other hand, argues that risk rating is a redundant, intangible concept, because probability is not something that exists in nature.

Table 4-1 Characteristics of a complex problem

<b>Characteristic of a complex problem</b>	<b>Definitions and statements found in literature</b>
<b>Multiple stakeholders/ stakeholder perspectives and/ or multiple objectives</b>	<p>“A mess is a system of external conditions that produces dissatisfaction” (Ackoff, 1974: 5), meaning a set of circumstances in which there is extreme uncertainty and in which there may well be disagreement.</p> <p>“A mess is a system of problems with multiple stakeholders who may quite hold different views of what is feasible and desirable” (Pidd, 2009: 46).</p> <p>“There is no definitive formulation of a wicked problem”; “The information to understand the problem depends upon one’s idea for solving it” (Rittel &amp; Webber, 1973: 161).</p> <p>“[P]roblems are constructs of the human mind and of people working together” (Pidd, 2009: 56).</p> <p>“The nature of the decision makers will also greatly affect the type of solution needed” and “The major factor of interest here concerns the objectives of the decision makers” (Jackson &amp; Keys, 1984: 476). Jackson and Keys (1984) classify complex problems as pluralistic due to stakeholders having divergent views about goals and objectives.</p>
<b>Interrelated issues/ variables/ factors and complex structure/ system</b>	<p>“In a mess, there are many issues to be faced, they are interrelated, and the interrelationships are often as important as the issues themselves” (Pidd, 2009: 46).</p> <p>“An ill structured problem (ISP) is a residual concept. An ISP is usually defined as a problem [that] lacks structure in some respect” (Simon, 1973: 181).</p> <p>Complex problems cannot be addressed in a piecemeal way or solved in full. Complex problems have to be engaged directly and result from networks of multiple interacting and emerging causes that cannot be individually distinguished (Poli, 2013).</p> <p>Every wicked problem is a symptom of another problem (Rittel &amp; Webber, 1973).</p> <p>“Managers are not confronted with problems that are independent of each other, but with dynamic situations that consist of complex systems of changing problems that interact with each other” (Ackoff, 1979: 99).</p>

<p><b>Uncertainty and risks</b></p>	<p>“[T]he term wicked problem [refers] to that class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing” (Churchman, 1967: B141).</p> <p>Wicked problems, when implemented, “will generate waves of consequences over an extended – virtually an unbounded – period of time” (Rittel &amp; Webber, 1973: 163)</p> <p>“Every solution to a wicked problem is a one-shot operation; because there is no opportunity to learn by trail-and-error, every attempt counts significantly” (Rittel &amp; Webber, 1973: 163)</p>
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As determined, complex problems need holistic approaches to plan and manage them. Marczyk (2010) argues that a complexity-based, holistic approach, focusing on short-term actions, is needed to manage risks. It is clear from the 10 characteristics of a wicked problem (Rittel & Webber, 1973) that every complex or wicked problem is unique and that there is no best practice method to address such a complex problem. Furthermore, complex problems cannot be solved, because every wicked problem is a symptom of another problem. Cilliers (1998) argues that complex systems can be influenced, but not controlled, and that no single model can capture all the properties of a complex system. From these characteristics of complex problems and their non-linear properties it can be concluded that reductionism<sup>1</sup> (Ackoff, 1974), which aims at analysing and finding definite solutions, cannot be used when dealing with complex problems.

The decision to pursue sustainable energy projects at a local government level is complex, as discussed in Chapter 1. The direct stakeholders of a municipal area are the local citizens, business owners, tourists and visitors, the municipal administration team as well as the municipal council.

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<sup>1</sup> Reductionism is based on the belief that problems or experiences can be decomposed into simpler sub-elements or units, with the assumption that if the smaller problems are solved, the whole problem is resolved. Ackoff (1974) states that consistent with reductionism is the belief that cause and effect is a linear relationship, almost like ‘closed-system’ thinking.

In the energy context, other stakeholders are the farmers in the area (who receive their electricity from Eskom directly), the district municipality, local government and other regulatory bodies such as SALGA, NERSA, the Treasury, the DoE and the Department of Environmental Affairs. Each of these stakeholders will have different viewpoints and end goals when discussing the sustainable energy future of a municipality. The research reported on in Chapter 3 shows the interrelatedness of renewable energy in many aspects of the municipality, such as environmental matters, the municipal infrastructure, the financial system of the municipality, future growth and development, social cohesion, people development and services provided by either local government (fire brigade) or district government (healthcare). The implementation of a change in one part of the system can have ripple effects and unintended consequences in other parts of the system. It is therefore important to consider these unintended consequences when planning for sustainable energy.

The energy, economic and political landscapes in South Africa are faced with many risks and uncertainties. Eskom, the national state-owned power utility, which produces and supplies 95% of all electricity in South Africa, is facing problems with increasing debt levels; unstable supply of electricity, resulting in ad hoc load shedding country-wide; and labour unrest (Caldo, 2008; Mjo, 2018; Pollet *et al.*, 2015; SA News, 2019). South Africa's economy did not grow in the months between Quarter 1, 2018 and Quarter 1, 2019 (South African Market Insights, 2019). The first quarter of 2019 disclosed a negative economic growth rate of -3.2% gross domestic product (Stats SA, 2019b) and high levels of unemployment at 29% (Stats SA, 2019a), coupled with political instability (Odendaal, 2017), which contribute to a risky and uncertain environment. Therefore, in general, pursuing sustainable energy projects at a local government level entails many stakeholders, diverse opinions, multiple objectives, a complex structure and many risks and uncertainties. To ensure proper planning and management of this complex problem, a holistic approach is needed for application in a local government context in South Africa.

A detailed literature review of the methods, approaches, and theories that formed the foundation of the developed participatory planning approach was given in Chapter 1. Methods and approaches in the field of soft OR, which have specifically

been developed to deal with complex problems, were reviewed and evaluated against the characteristics of a complex problem. The evaluation pointed out a gap in terms of explicitly identifying risks as part of the approach steps, as shown in Table 4-2. Risk identification should be a key component of a planning approach for local energy sustainability.

The literature on soft OR methods, combined with the research done to date and the literature on risk assessment methods, informed the requirements of the participatory planning approach, as given in the next section. The theories and literature on public participation and collaborative governance were used as the overarching framework in the development of the EDAS approach.

Table 4-2 Evaluation of the characteristics of a complex problem against different PSMs

PSMs	Characteristics of complex problems				
	Multiple stakeholders and perspectives	Multiple objectives	Interrelated variables/ complex structure	Uncertainty	Risk
SSM	YES	YES	YES	NO	NO
SCA	YES	YES	YES	YES	NO
SODA	YES	YES	YES	NO	NO
RA	YES	YES	YES	YES	NO

### 4.3 Requirements of an approach to plan for a local sustainable energy future

When selecting or developing an approach to plan for a sustainable energy future at a local government level, both the literature and the local context should be considered to define the requirements for a planning approach. The requirements for such a planning approach, as elicited from the literature and confirmed with local government management, are as follows:

### **4.3.1 The approach must be participative and inclusive**

In order to include the perceptions and viewpoints (beliefs, interests, values and worldviews) of multiple stakeholders, the approach needs to be participative. Mingers and Rosenhead (2004) emphasise that a PSM has to enable several alternative perspectives to be brought into conjunction with one another, something one can only achieve when all the stakeholders are given an opportunity to share ideas. In addition, the approach needs to be able to make the vast amount of information more accessible, and the problem must be structured in such a way that the richness of information across multiple problem dimensions is not lost. Hector, Christensen and Petrie (2009) give two additional requirements when developing a participative approach. First, the approach needs to be able to make the vast amount of information more accessible and second, the problem must be structured in such a way that the richness of information across multiple problem dimensions is not lost. Mingers and Rosenhead (2004) also highlight that the information shared should be cognitively accessible to actors with different backgrounds and skill levels.

### **4.3.2 The approach must be holistic**

As already discussed in Section 4.2, the non-linear properties of complex problems can only be dealt with using a holistic approach, such as systems thinking (Checkland, 1981; Maani & Cavana, 2007; Maani & Maharaj, 2004; Senge & Sterman, 1992). Maani and Cavana (2007) define systems thinking as a scientific field of knowledge for understanding change and complexity through the study of dynamic cause and effect over time. Checkland (1981) uses the notion of systems thinking in SSM to represent the real world in a conceptual model, which shows interconnected human and organisational factors in the way they are perceived by stakeholders.

### **4.3.3 The approach must be simple and transparent**

The requirement for simplicity and transparency is based on Miller's observations (1955) that the human mind can only retain five to seven units of concentration at any given time, as well as Simon's theory of bounded rationality (1982). The term 'bounded rationality' considers the cognitive limitations of the decision-maker in

terms of both knowledge and computational capacity. Bounded rationality is concerned with the ways in which the actual decision-making process influences the decisions that are reached. Simon (1979) argues that the process of decision making should seek for satisfying decisions, rather than aiming for the most optimal decisions. Transparency can be attained in both visual representation and capturing of an audit trail of the facilitated process. Checkland (1981) uses rich pictures to structure problems in order to help groups and individuals to understand the complex context of a situation. Rosenhead's RA (1980) and Friend's SCA (2001) use a diagrammatic representation of the different strategies discussed during the facilitated process. The advantages and disadvantages of visualisation techniques, such as visual metaphors, conceptual diagrams, mind maps (Buzan & Buzan, 1995) and concept maps (Novak, 1980; Novak & Gowin, 1984), are summarised in Eppler (2006). The advantages of these visualisation techniques for use during a facilitation session include rapid information provision, providing a concise overview of the complex situation, emphasising relationships and connections between concepts, encouraging creativity and self-expression, drawing attention and inspiring curiosity.

#### **4.3.4 The approach must include the identification and assessment of risks as part of the deliberation process**

In order to ensure that all viewpoints and potential options are considered during the participatory approach, divergent thinking followed by deliberation should be an important aspect. Deliberation is the collaborative process of identifying and weighing options in order to establish priorities and action (Gollagher & Hartz-Karp, 2013). It is argued that for the planning of sustainable energy projects, risks should be identified and discussed from the start of collaboration in order to answer the question of whether it is beneficial to pursue sustainable energy projects at a local government level. PSMs provide specific theories that can be used as a base from which one can develop a participatory planning approach for sustainable energy at a local government level, but the identification and assessment of risks need to be made explicit. Risk assessment methods on their own focus more on the implementation and project management phases of projects, which are characterised by considerable data and clearly defined boundaries (Aven, 2017)

and therefore would not be applicable in the planning phase of local sustainable energy. Complexity is a fundamental characteristic of every dynamic system found in nature (Marczyk, 2010). The inclusion of risk, even if it is subjective, as part of the approach for local energy sustainability planning is proposed. The identification and assessment of risks should then form part of the deliberation process.

#### **4.3.5 The development of a realistic action plan must be attainable at the end of a two-day workshop**

The requirement of developing a realistic action plan during a two-day workshop is mainly based on practicality and considering the nature of decision making of a local government in a developing country. There are only a few stakeholders (if any) who would be willing to spend more than two days to work on issues that are not part of their day-to-day work. A local municipality is structured for operational management, where decisions are mainly focused on day-to-day operations and limited long-term planning. Critique found in literature also shows that most problem-structuring techniques are time-consuming (Gaudreau & Gibson, 2010; Pidgeon *et al.*, 2014; Retallack & Schott, 2014). The time available for long-term planning activities on a municipal level is limited, and therefore careful consideration must be given as to who should be involved, what to discuss and the depth of analysis addressed during these workshops. It is clear from the literature on PSMs and soft OR methods that the aim of all these approaches is to have a better understanding of the complex system, but then to commit to next steps and actions, thereby being action-orientated (Seagriff & Lord, 2011). Lewis (1992) describes SSM as a methodology for learning through participative action and Cilliers (1998) points out that any plan of action has to be adapted continuously: “If the plan is too rigid – too much central control – the system will not be able to cope with unpredictable changes” (Cilliers, 1998: 110).

#### **4.3.6 The approach must be dynamic**

When referring to Cilliers’s viewpoint (1998) that the plan of action needs to be adapted continuously, the approach to be used at a local government level needs to be dynamic. This requirement is in line with the PSMs discussed in Chapter 1

and means that the approach, as well as the associated plans, should be adaptable over time.

#### **4.3.7 The approach must be formalised with clear institutional arrangements**

When drawing on the literature on collaborative governance (Ansell & Gash, 2008; Kamara, 2017; Leck & Simon, 2018) maximum effectiveness in the implementation of the EDAS approach can only be achieved if the approach is formalised within a local government; therefore, it should form part of the local government's policies and should include clear roles and responsibilities for all stakeholders, whether private, local, regional or national.

#### **4.3.8 Evaluating the comprehensiveness of the requirements to plan for a local sustainable energy future**

In order to evaluate whether the requirements were comprehensive enough before developing a participative planning approach, they were plotted against the success factors for developing and implementing a participatory approach (Table 3-2) and the characteristics of a complex problem (Table 4-1).

The matrix in Table 4-3 shows that all the success factors of developing and implementing a participatory approach and all the characteristics of complex problems will be dealt with if the requirements to plan for a local sustainable energy future are used in the development of the participatory planning approach for local energy sustainability. An evaluation of the developed planning approach against this matrix is discussed in Section 4.6

### **4.4 Explore, Design and Act for Sustainability**

Based on the requirements, discussed in Section 4.3, a participative planning approach for a sustainable energy future was developed, namely Explore, Design and Act for Sustainability (EDAS). The rationale for this approach is to provide local government with a step-by-step process to facilitate information sharing and discussions on local sustainability, between public and private entities, in order to determine sustainable energy strategies and to drive energy sustainability

		The success factors of developing and implementing a participatory approach								
		A holistic and integrated approach is followed	A diverse group of stakeholders participate from the start	Careful consideration is given on how to involve the stakeholders	A strong mandate and political support are given for the interventions	A knowledgeable and experienced facilitator is facilitating the process	A communication strategy is followed	Reflexivity and realism are included as part of the process	The process is underpinned by a philosophy of empowerment, equity, trust and learning	Participation is institutionalised
		The characteristics of complex problems								
		Multiple objectives Interrelated variables/ complex structure	Multiple stakeholders and perspectives	Multiple stakeholders and perspectives			Multiple objectives agreed	Consideration of uncertainties and risk		
The requirements of an approach to plan for local sustainable energy	The approach must be participative and inclusive		X	X			X		X	
	The approach must be holistic	X					X			
	The approach must be simple and transparent			X		X	X		X	
	The approach must include the identification and assessment of risks as part of the deliberation process								X	
	The development of a realistic action plan must be attainable at the end of a two-day workshop								X	
	The approach must be dynamic							X	X	
	The approach must be formalised with clear institutional arrangements				X					X

Table 4-3 Matrix to evaluate the comprehensiveness of the requirements of a participatory approach to plan for local sustainable energy

The simple and transparent approach consists of three segments, namely Explore, Design and Act. These three segments form a continuous cycle, based on the philosophies that can be tracked back to Galileo Galilei (1564–1642), who believed that conducting designed experiments is the cornerstone of science and the scientific method, and Francis Bacon (1561–1626), who insisted that scientists should proceed through inductive reasoning, from observations to axiom law (Moen, 2010). These philosophies of Galilei and Bacon led to pragmatism and empiricism (Lewis, 1929), which again formed the basis of the Shewhart cycle (1939); the Deming wheel (1950), which later evolved into Deming’s Plan-Do-Study-Act (PDSA) cycle (1993); and the Japanese Plan-Do-Check-Act (PDCA) cycle (1951). All these methods consist of steps that are connected in a circle and represent a “dynamic scientific process of acquiring knowledge” (Shewhart, 1939, cited in Moen, 2010: 3).

The EDAS approach is therefore built on the Explore, Design, Act (EDA) cycle, as seen in Figure 4-1. The approach is unique, because it consists of specific parts of current methods and theories, adaptable for application at a local government level, as shown in Figure 4-2. In literature there is a definite move towards mixing methods, because “this allows the field to stay fresh and vibrant as well as allowing the necessary extensions/adaptations to provide the means for managing a broader range of problems – the call for pragmatism” (Ackermann *et al.*, 2014: 168). Each of the segments within the Explore, Design and Act cycle and detail on the methods and theories used as part of the approach steps, is discussed next.

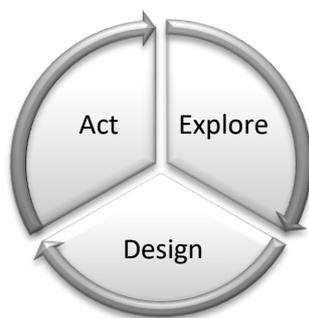


Figure 4-1 Explore, Design and Act cycle

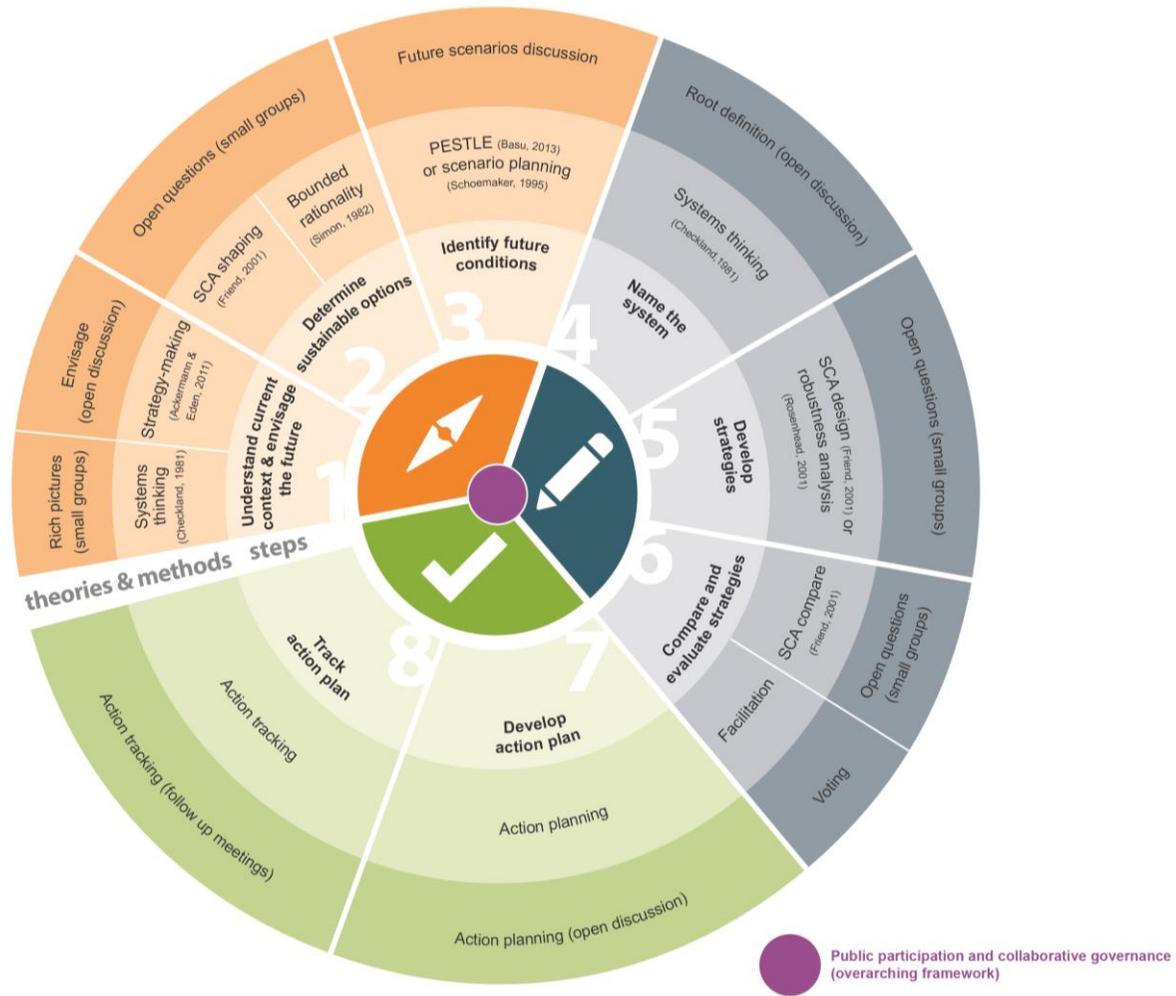


Figure 4-2 Building blocks of the EDAS approach

The EDAS approach should be used in a facilitated workshop with selected stakeholders. It is recommended that, although the EDAS approach uses public participation and collaborative governance as the overarching theory, careful consideration should be given to the stakeholders invited to the workshop. A stakeholder map, as presented in Figure 4-3, is beneficial to gain an understanding of which stakeholders have the power to make or influence decisions and have an interest in sustainable energy.



Figure 4-3 Stakeholder map

In order to ensure that the municipal management and municipal council are clear on the strategic direction taken, the initial workshop should focus on involving the municipal management team, the municipal council, the district government, the provincial government, business forum representatives, the top electricity users in the area as well as subject matter experts and partners. Ward committee members (representing the wider public) should be invited with the aim of creating awareness, but a different cycle of the EDAS approach should be planned for the wider public once agreement has been reached on the initial strategic direction.

#### 4.4.1 **Explore to determine sustainable options and future conditions**

The intent of the *Explore* segment is to creatively think about possible energy futures through firstly, presenting and discussing current trends with regard to sustainable energy and secondly, collecting data on how the participants see their

energy future. The aim is to determine plausible sustainable energy options within a given context through three steps, namely 1) understand the current context and envisage the future, 2) determine sustainable energy options and 3) identify future conditions, which are discussed next.

#### **4.4.1.1 Understand the current context and envisage the future**

In order to understand the current context and to envisage the future, the theories on rich pictures (Checkland, 1981) and strategy making (Ackermann & Eden, 2011) should be used. Rich pictures form part of SSM and are useful aids to assess complex systems using systems thinking. Strategy making is a social and analytical process, and the social process involves changing the minds and behaviours of participants. During a facilitated workshop, participants are grouped together. In the first step, the groups are asked to draw a picture of how they see their energy future in the specific municipal area and to indicate what is currently hampering the realisation of the envisaged future. Each group then has an opportunity to provide feedback. The different aspects of the drawings are discussed and interpreted with the aim of understanding the context of the local environment. The different rich pictures and interpretations could be consolidated into one rich picture or visualised strategy (as discussed in Chapter 3), but it is not a prerequisite to continue the workshop discussions.

After completion of the rich picture discussion, the following question is posed to the participants: How do you foresee the specific local area within 20 to 30 years from now?

The written statements about the future indicate the different mindsets and values of the participants. The discussion of these statements will help to gain consensus on where the municipality and its stakeholders see themselves in the future.

#### **4.4.1.2 Determine sustainable energy options**

After a discussion of the envisaged future, the second step in the *Explore* segment entails questions being asked of the participants to understand what they perceive as plausible sustainable energy options for the future. The step is based on the SCA method (Friend, 2001), specifically the shaping mode, where stakeholders consider different decision areas and options. This step does not only elicit viable

sustainable energy options, based on the knowledge and expertise of subject matter experts (and citizens in the municipal area), but also eliminates non-contenders early in the planning process. Two questions are asked of the participants:

- Question 1: Which sustainable energy options do you perceive as being plausible in the given context when considering the envisaged future?
- Question 2: What are the obstacles (within your control) and barriers (not within your control) to successfully implementing these sustainable energy options?

The sustainable energy options determined during this step will be taken into the second segment of the approach, namely the *Design* segment. All information available on sustainable energy options, such as previous studies done, cost estimates, risks and uncertainties, should be available and discussed when determining the viable sustainable energy options. The data collection of previous information is done during the preparation phase of the workshop. The selection of viable sustainable energy options should be done based on Simon's (1982) bounded rationality theory, where the aim is to opt for satisfying solutions rather than the optimal solution.

#### **4.4.1.3 Identify future conditions**

Finally, as part of the *Explore* segment, potential future conditions are identified (Step 3). Predictions of future conditions, especially with regard to long-term energy development and planning, are challenging due to the changing environment and many uncertainties. Makridakis, Hogarth and Gaba (2010) demonstrated with past examples that accurate forecasting in most areas of business is not possible. Efforts should be channelled towards being prepared for different contingencies, rather than to try to predict. McCrone (2013: 1) states that "we can be certain of only one thing – that all predictions about future energy, like all medium-term economic forecasts, will be wrong". Many factors relating to the economy, politics and the environment fall outside of a local government's control, which brings uncertainties. The literature on PSMs describes these factors as uncertainties about related choices beyond the boundaries of the problem field (Friend, 2001), as the environment that influences but does not control the system

(Checkland, 1981) or as a set of 'futures' representative of possible environments of the system (Rosenhead, 2001). The aim then with the third step in the *Explore* segment is to identify, through a subjective process, a set of futures representative of possible environments of the system that are not within the control of the local government. To keep it simple, three possible future conditions could be determined, namely 1) a positive outlook, 2) a negative outlook and 3) a most likely outlook. The factors used to determine these future conditions should be agreed upfront with subject matter experts and could include factors as given in the PESTLE analysis (Basu, 2013). The PESTLE analysis is a framework used by marketers to analyse and monitor the external environment or macro-environmental factors that can impact the operations of an organisation. PESTLE is an acronym for Political, Economic, Socio-cultural, Technological, Legal and Environmental factors. Another concept that can be used to identify future scenarios is scenario planning, a method originally developed in the 1970s by Royal Dutch Shell.

The details of how the *Explore* segment could be facilitated are described in the case study of Hessequa Municipality in Section 4.5.2.

#### **4.4.2 *Design* desirable sustainable strategies**

The *Design* segment is built on the foundation of Checkland's soft system methodology, where humans are a part of the system. In a system we see things as being connected, interdependent and working together as a complex whole (Checkland, 1981, 1985). Step 4, the first step in the *Design* segment, is to determine what the system should aim to do. In order to define the system, Checkland (1981, 1985) proposes the root definition: a single statement account of the purposeful activity being undertaken by the system. Once the system has been defined, the specific sustainable energy strategies can be developed as part of Step 5. A strategy consists of several sustainable energy options implemented within a given timeline. Rosenhead (2001) refers to configurations and emphasises that special attention should be given when determining the initial commitment. Friend (2001) focuses on decision areas where all possible options within each decision area are identified. Once these possible options have been determined, the compatible options are grouped together and a list of all the plausible strategies

is developed for comparison or evaluation. The creation of possible strategies from first principles can result in a list of more than a hundred possible strategies, which is not only difficult to comprehend without computational assistance, but will also be very time-consuming when evaluating each of these strategies against the identified futures. Based on the principle of Miller (1955), the *Design* segment then proposes to identify a list of no more than five to nine achievable strategies, keeping the definition of the system in mind. The identified sustainable energy strategies then undergo an evaluation against the possible futures to determine the desirable and undesirable strategies (Step 6). The evaluation is based on the associated perceived risks of each strategy within the identified future. The strategies with the least perceived risks are the most desirable. A discussion of how much risk the organisation is willing to take will determine the number of desirable strategies. Voting could also be used to select the strategies that need to be taken to the next step. These desirable strategies will then be used to determine the action steps and way forward to make the desired strategy a reality.

The details of how the *Design* segment could be facilitated are described in the case study of Hessequa Municipality in Section 4.5.3.

#### **4.4.3 Act for sustainability**

*“Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world.” (Joel A Barker)*

The end state of a PSM is reached when consensus has been reached between the stakeholders on the way forward. In SSM Stage 7 (Checkland, 1981), actions to improve the problem situation are discussed and agreed upon. SCA ends with a commitment package that consist of decisions to be taken now, explorations of the identified uncertainties, deferred decisions and contingency plans (Friend, 2001) and in RA (Rosenhead, 2001), an agreement on the initial decision is reached. The *Act* segment then focuses on the development of an action plan (Step 7), consisting of a description of the specific actions or changes that need to occur, agreement on the champions that will drive the action points and commitment as to when the action steps will be completed. To ensure that momentum is kept, and that the implementation of the agreed actions are tracked, Step 8 is proposed, in the form of follow-up meetings.

The details of how the *Act* step could be facilitated are described in the case study of Hessequa Municipality in Section 4.5.4.

## **4.5 Results from the Hessequa Sustainable Energy Journey workshop**

### **4.5.1 Background**

A two-day Sustainable Energy Journey workshop, to establish a sustainable energy plan for Hessequa, was held in July 2019 at the municipal offices of Hessequa in Riversdale, Western Cape, South Africa. In order to plan the workshop, the checklist to ensure successful development and implementation of a participatory approach (from Chapter 2) was used. A strong mandate was given by Hessequa Municipality to organise the workshop, participation was free and voluntary, and careful consideration was given to which stakeholders needed to be involved.

Key outcomes of the workshop were to facilitate knowledge sharing, knowledge transfer and networking, to empower the citizens of Hessequa with the opportunity of SSEG, to develop different energy strategies for possible energy futures, to identify the obstacles and barriers towards sustainable energy implementation and to develop a realistic sustainable energy action plan for Hessequa that addresses the development of the energy strategies and plans to remove the obstacles.

The key stakeholders identified to attend the workshop was the municipal management team, the municipal council, Stellenbosch University, the Western Cape government, Eskom Research, Testing & Development, the Centre for Renewable and Sustainable Energy Studies (CRSES),<sup>1</sup> the Gouritz Cluster Biosphere Reserve (GCBR),<sup>2</sup> GreenCape, Garden Route District Municipality,

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<sup>1</sup> CRSES at Stellenbosch University facilitates and stimulates research and capacity development activities relating to a vibrant and viable renewable and sustainable energy sector in the southern African region (CRSES, 2014).

<sup>2</sup> GCBR is a voluntary citizens' initiative dedicated to the conservation of its region's biodiversity, tied to the socio-economic development for the well-being of its peoples. Governed by members, it is a registered non-profit company with the tax status of a public benefit organisation (GCBR, 2018).

Stilbaai Conservation Trust, the top 20 electricity users in Hessequa as well as electrical engineers and energy consultants as subject matter experts (SMEs). In total, 84 participants were invited to the workshop, of which 28 participants (33%) attended Day 1 of the Hessequa Sustainable Energy Journey workshop and 23 participants (27%) attended Day 2 the Hessequa Sustainable Energy Journey workshop. The participants were categorised into the following stakeholder groups:

- Western Cape government / GreenCape: grouped together due to their close collaboration with regard to the Energy Security Game Changer,<sup>3</sup> an initiative of the Western Cape government
- The municipal management and council: specifically, Hessequa Municipality
- Stellenbosch University and CRSES
- Municipal stakeholders: people living and/or owning businesses in the Hessequa area (including the top 20 electricity users of Hessequa Municipality)
- Subject matter experts: electrical engineers and consultants
- Other: People not living and/or owning businesses in the Hessequa area and not part of any of the other stakeholder groups.

The Hessequa Sustainable Energy Journey workshop representation of these stakeholder groups is shown in Figure 4-4 and Figure 4-5.

Dr Hildegard Fast, head of the Energy Game Changer of the Western Cape government, opened the Hessequa Sustainable Energy Journey workshop with a keynote speech on the energy vision of the Western Cape. Next, representatives of CRSES gave a presentation on the progress and prospects of renewable energy on a local level. The keynote speech and presentation from CRSES set the scene to kick off the participatory planning approach. Verbal consent was given by the

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<sup>3</sup> The Energy Security Game Changer aims to ensure sufficient power to sustain households and grow businesses in the Western Cape province, with a goal to achieve an effective 10% contribution to the electricity needs of the Western Cape by 2020 by reducing the province's demand from Eskom (Western Cape Government, n.d.).

participants that the data from the workshop can be used in the research (see [Appendix A.3](#)). The workshop agenda is shown in [Appendix D.1](#).

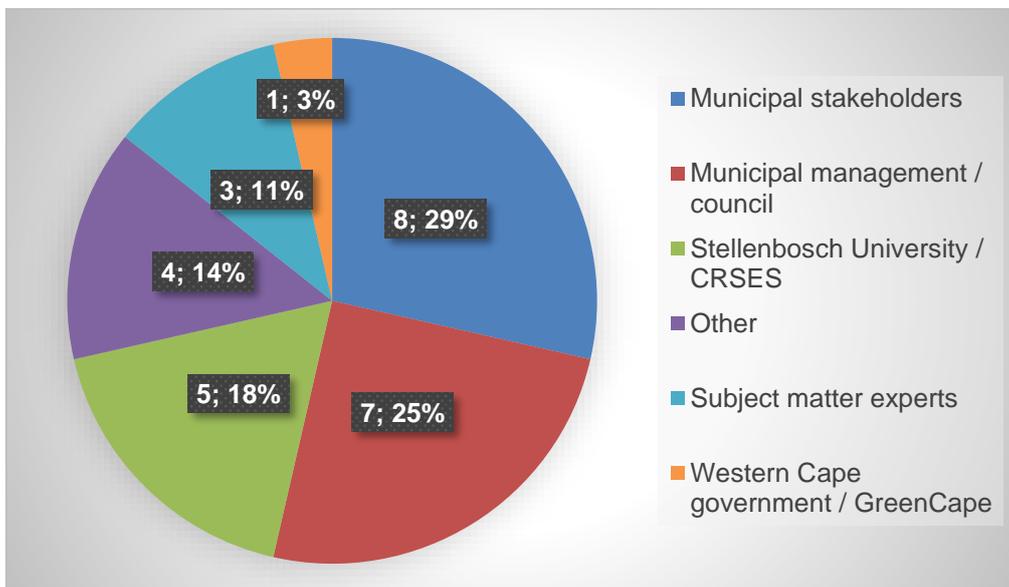


Figure 4-4 Stakeholder representation at Hessequa Sustainable Energy Journey workshop, Day 1

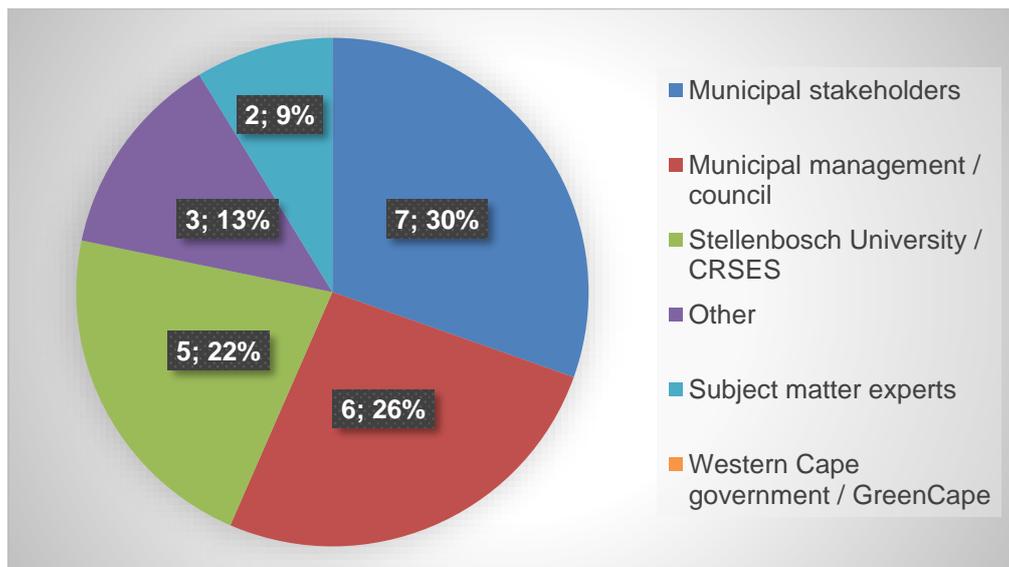


Figure 4-5 Stakeholder representation at Hessequa Sustainable Energy Journey workshop, Day 2

The EDAS approach structured the discussions and debate to explore and envisage the future of Hessequa; to identify sustainable energy options, uncertainties, obstacles and barriers; to name the Hessequa sustainable energy system; to design sustainable energy strategies and evaluate the strategies

against the possible futures; and to lastly develop a sustainable energy action plan for Hessequa. The outcome of each step in the EDAS approach is discussed next.

#### 4.5.2 *Explore to determine sustainable options and future conditions*



The *Explore* segment was already underway before the Hessequa Sustainable Energy Journey workshop took place. *Explore* started the day when the researcher received confirmation that a case study could be conducted at Hessequa Municipality. One of the first collaborations was the Hessequa True North workshops, as described in Chapter 3, where the aim of the researcher was to establish a detailed understanding of the Hessequa context. The True North workshops focused on the development of a long-term vision, Hessequa's True North, while taking into consideration the current obstacles and context. One of the products of the Hessequa True North workshops, namely the Hessequa visualised strategy (see Figure 3-2), was then used as a starting point for the Hessequa Sustainable Energy Journey workshop. The Hessequa Sustainable Energy Journey workshop provided an opportunity to introduce the participants to the visualised strategy, because only 4 of the 28 stakeholders were part of the development of the visualised strategy.

The Hessequa visualised strategy conceptualised many sustainable energy options that are already seen as part of Hessequa's True North, namely sustainable transport (the electric train for public transport), SSEG (roof-mounted solar PV panels), energy efficiency (solar geysers)<sup>4</sup> and sustainable living (water tanks and vegetable gardens). Also evident on the roadmap is the many interrelationship between sustainable energy, sustainable farming and environmental conservation (alien plant removal). When showing the visualised strategy to the participants after the presentation on the energy vision of the Western Cape and the prospects of renewable energy, it became evident that the rate of change of renewable energy technologies is so fast that it is difficult to keep

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<sup>4</sup> Also known as solar water heaters or solar domestic hot-water systems. Solar water heating is the conversion of sunlight into heat for water heating using a solar thermal collector.

up, and therefore the thinking about the future was challenged and expanded to incorporate more innovative and creative ideas regarding sustainable energy.

The *Explore* segment was divided into three steps. First, the participants were asked to envisage the future; second, they were asked to identify sustainable energy options worth pursuing; and third, future conditions were identified.

#### **4.5.2.1 Envisage the future, determine sustainable options and identify barriers and constraints**

The *Explore* segment followed a divergent approach to consider as many alternatives and options as possible at first, without constraining the participants' thinking. With the aim of later ensuring that the options are realistic, a question was asked to consider the obstacles and barriers for successful implementation. After discussing the rate of technological change and showing examples, such as the evolution of the telephone, the changes that occurred in the use of plastic bags over the past decade, the changes in applications of solar panels as well as the development of electric cars, the participants were divided into groups and a series of questions was asked. The groups had to answer and provide feedback on the following questions:

- 1) How do you foresee the specific local area within 30 years from now?
- 2) Which sustainable energy options do you perceive as being plausible in the given context when considering the envisaged future?
- 3) What are the obstacles (within our control) and barriers (not within our control) to successfully implement these sustainable energy options?

The collective answers to questions 1 and 2 are summarised in Table 4-4 and Table 4-5.

Table 4-4 Hessequa's envisaged futures

<b>Question 1: In 30 years Hessequa will ...</b>
be a centre of excellence for sustainable innovations (embracing the 4th Industrial Revolution)
be a financially and resource-sustainable service centre to all communities
have embedded a culture of sustainable living and decision making

have optimised the full lifecycle of manufacturing and production processes in terms of farming, waste handling/reduction, usage of natural resources and supply chains (wisely manage biophysical and socio-economic resources)
have a carbon-neutral energy sector far less dependent on Eskom
remain in the top three performing municipalities in South Africa
remind the world of our shared humanity
have dynamic and sustainable infrastructure that caters for an affordable and quality lifestyle for all
enable innovation through education at all levels / preferred destination for innovative thinkers

Table 4-5 Sustainable energy options worth pursuing

<b>Question 2: Sustainable energy options worth pursuing (prioritised)</b>	<b>Comments / ideas/ collective feedback</b>
<b>SSEG</b>	SSEG policy and feed-in tariff already in place at Hessequa Municipality's role is to promote and facilitate the process to increase the uptake of solar geysers and solar panels
<b>Energy efficiency revitalisation project</b>	Awareness campaign for all Hessequa citizens and businesses with a focus to understand and reduce their carbon footprint
<b>Demand-side management</b>	Demand-side management to be implemented for the top 20 electricity users in Hessequa
<b>Biomass-to-energy</b>	Potential sources have already been identified; a feasibility study must be conducted
<b>Waste-to-energy</b>	Investigate options for anaerobic digestion and the use of landfills/manure to produce energy
<b>Solar and wind</b>	The options of wheeling <sup>5</sup> , IPPs and municipal own generation could be considered (in the medium to longer term)
<b>Wave power</b>	Option, but in the longer term

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<sup>5</sup> Wheeling is the delivery of electricity generated by a private operator in one location to a buyer or off-taker in another location via a third-party network.

<b>Utility-scale batteries</b>	Option, but in the longer term
<b>Smart towns</b>	Option, but in the longer term

### **Question 3: Obstacles and barriers to successfully implement the sustainable energy options**

One of the main internal obstacles mentioned during the Hessequa Sustainable Energy Journey workshop is linked to the organisational structure of the Director: Technical Services. The focus on operational management, such as repairs and maintenance, electromechanical services, sanitation and open-space management, tends to take up most of the department's time and resources, resulting in limited focused time available for energy planning, thereby slowing progress. For municipalities to take on the role of custodian and facilitator of sustainable energy, focused time and resources need to be made available, either by appointing a sustainable energy coordinator in the municipal structure or by establishing a dedicated sustainable energy forum, which is a dual responsibility between the municipality and its stakeholders.

The financial system of the municipality is another obstacle mentioned at Hessequa, especially when implementing feed-in tariffs and the SSEG policy. Currently, the financial system cannot accommodate net billing, resulting in these entries being handled manually by the finance department. For future uptake of SSEG, the financial system will have to be upgraded.

Two key barriers noted during the Hessequa Sustainable Energy Journey workshop that are hampering the implementation of sustainable energy solutions at the local level are the current legal and regulatory environment, which is uncertain and volatile (Comello *et al.*, 2018; Fast, 2019c; Fischer *et al.*, 2011; Nel, 2015), and the cost of renewable energy technologies (Fischer *et al.*, 2011; Mararakanye & Korsten, 2019).

The current energy and political landscapes are coupled with uncertain and inconsistent regulations. In order to overcome the barrier of the regulatory environment, Nel (2015) proposes that policy should focus more on managing the interface between private and public partnerships through increased consensus

building, greater transparency, enhanced stakeholder management, more effective administration and improved decision making. Recently advocated is a more holistic and integrated renewable energy governance effort by firstly recommending a single governmental institution in control of the regulation of renewable energy, secondly proposing an integration of the various policies and pieces of legislation relating to renewable energy and thirdly building this new renewable energy framework law through a wide public participation process (Mauger & Barnard, 2018).

The other barrier mentioned is the current capital cost (initial investment) of sustainable energy technologies. The International Renewable Energy Agency, an intergovernmental organisation that supports countries in their transition to a sustainable energy future, shows a decline in 2018 in the weighted average cost of electricity from renewables and forecasts these declining electricity cost from renewables to continue beyond 2020 (IRENA, 2019). While the cost of renewable energy is decreasing, the Eskom rates are increasing year on year and surpassed 90c/kWh in 2018. The question is therefore, why do we not see more people in South Africa moving to renewable energy? The complexity of the situation needs to be taken into consideration. The process of giving up what one already has (current Eskom electricity) and spending money on converting one's electricity system into a renewable energy system is not that simple, especially in a time where economic growth in South Africa is slow. Echoing Fischer *et al.* (2011), Msimanga and Sebitosi (2014) state that it is not only a matter of initial capital investment, but also of high upfront planning and transactional costs. Return on investment carries the greatest weight in the decision-making process. The current commercial tariff structures (maximum demand tariff)<sup>6</sup> are further constraining businesses' investment in SSEG. In addition, local governments are constrained in terms of their annual budgets and are reluctant to invest large amounts of capital

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<sup>6</sup> Maximum demand tariff has a charge for the total amount of electricity used (energy charge in kWh), plus a demand charge (kW) for the relevant billing period. The demand is a measure of the maximum amount of electricity used at any one time. The chargeable demand in any month is the maximum demand recorded in that month.

for which they will only see the benefits beyond the five-year term in which a council is in control, especially within an uncertain legal and regulatory environment.

The generation license of Hessequa is perceived as a positive and an opportunity for when the municipality is ready to invest in IPPs. In addition, it was interesting that the current position of state-owned utility Eskom, with the possibility of future load shedding and aging infrastructure, is not seen as a barrier, but rather an opportunity for Hessequa to change its energy landscape. What was clear from the discussions is that the reliability of the supply of electricity from Eskom is one of the main factors that will drive decisions and electricity consumers' behaviour.

#### **4.5.2.2 Identify future conditions**

Prior to the Hessequa Sustainable Energy Journey workshop, a PESTLE analysis was used to consider political, economic, socio-cultural, technological, legal and environmental trends, such as the potential unbundling of Eskom, the economic growth rate in South Africa, unemployment rates, cost of technologies, carbon tax and future climatic conditions such as droughts. When discussing these trends with a workshop participant (and citizen of Hessequa), prior to the workshop, a decision was taken to keep the Hessequa workshop focused. In order to do so, two main uncertainties were identified that will drive decision making and behaviour at a local government level, namely 1) the future reliability and cost of electricity supply from Eskom and 2) the future affordability of substitute electricity technologies (including storage options). These two drivers were then used in a scenario-planning matrix to build a set of assumptions on the different behaviours that electricity users might follow if these different futures realise. The matrix made it possible for Hessequa to position itself in terms of the future, which made the next step, the development and prioritisation of energy strategies in the *Design* segment, much easier. The future conditions are visualised in Figure 4-6.

Dark Ages describes a future where long-term load shedding is a reality. Even the possibility for a total blackout is high. Fear is driving consumer behaviour, which is resulting in an increased investment in alternative electricity and off-grid solutions, even though the cost of substitute solutions is high. The municipality is affected by lower demand due to consumers moving off the grid, which has a direct impact on the municipal revenue. The cost and impact of load shedding put further

constraints on the municipality in terms of service delivery and customer satisfaction. The movie *Lord of the Rings* was used as metaphor to illustrate this future.

Green Flavour describes a future where the electricity supply from Eskom is highly reliable (minimum to zero load shedding) and the cost of alternative electricity options is high. In this future, some consumers are investing in substitute electricity technologies due to a belief that living green is the right thing to do. For these consumers, cost is not an obstacle, but the potential future increased cost of electricity from Eskom might influence their decisions. In addition, electricity demand could be impacted by being more efficient by upgrading appliances that have lower electricity consumption levels. The municipality is affected by lower demand, energy efficiency and the updating of substitute electricity technologies. This has an impact on the electricity load per household or business, which is influencing the demand for electricity from the municipality and municipal revenue. The movie *The Greatest Showman* was used as a metaphor to illustrate this future.



★ Hessequa's positioning

Figure 4-6 Future conditions and positioning of Hessequa

The New World future describes a scenario where load shedding is the new normal and Eskom prices are increasing, while the cost of alternative electricity technologies, including storage options, is decreasing and these alternative technologies are becoming cost-effective. The municipality has decided to take an

active lead to develop an alternative electricity supply for Hessequa and believes that, like in the movie *Field of Dreams*, the players will come when the field is built. The municipality is proactive through developing and updating policies and implementing enabling electricity tariffs as well as through championing initiatives for installing an alternative electricity supply and driving energy efficiency. The municipality becomes resilient and manages to keep electricity tariffs well below inflation in future years to come. Jobs are created in the municipal area to maintain the area's own generating capacity. The essential services of the municipality will not be affected when a total blackout occurs.

Smart Investor focuses on a future where the reliability of supply from Eskom is high and the cost of alternative electricity solutions is low. In this scenario, the municipality is not forced, due to high grid reliability, to take an active lead in developing an alternative electricity supply. A few informed consumers make the decision to install alternative electricity (without storage) and take advantage of the municipal feed-in tariffs to pay off their investment. These consumers are impacting the municipal load profile by supplying electricity during off-peak and standard times, but become electricity users during peak times. This anomaly in the load pattern forces Eskom to charge significant high tariffs during peak times. The municipality has difficulty in explaining the relative high tariffs to consumers who are not taking advantage of the feed-in tariff to offset their electricity cost. The movie used as a metaphor in this scenario was *The Secret of my Success*.

The discussion that followed the presentation on these future conditions and potential scenarios clearly indicated that Hessequa Municipality and the electricity consumers position themselves in the New World scenario, where the municipality plays the role of custodian and facilitator to guide decisions on alternative electricity supply options in order to be in a resilient future position, should Eskom continue with load shedding or if the cost of electricity becomes unaffordable. This positioning also ties in with the future statements of Hessequa, namely to be a preferred destination for innovative thinkers and to have a carbon-neutral energy sector that is far less dependent on Eskom, with dynamic and sustainable infrastructure that caters for an affordable and quality lifestyle for all.

### 4.5.3 Design desirable sustainable strategies



The *Design* segment started with explaining to the participants what systems thinking is and then asking them to follow a systems perspective and to describe the energy system they would like to design. The structure of Checkland's (1981) root definition was used to develop the system name. Checkland's root definition should include what the system does, how the system does it as well as the system's long-term objectives. During the discussion of possible system names, one participant mentioned that the White Paper on the Renewable Energy Policy of the Republic of South Africa (Department of Minerals and Energy, 2004) should be used to align the Hessequa system name with the vision of the South African government. The White Paper on the Renewable Energy Policy of the Republic of South Africa states that government's overall vision for the role of renewable energy in its energy economy is "an energy economy in which modern renewable energy increases its share of energy consumed and provides affordable access to energy throughout South Africa, thereby contributing to sustainable development and environmental conservation" (Department of Minerals and Energy, 2004: 1). Table 4-6 shows the naming options for the Hessequa energy system.

Table 4-6 Hessequa energy system naming options

<b>Option 1</b>	A system that facilitates innovative, alternative energy solutions through the integration of energy generation, storage, distribution and energy management in order to obtain energy security and enable sustainable living
<b>Option 2</b>	A system that provides a resilient energy matrix through the integration of energy generation, storage, distribution and energy management in order to obtain energy security and enable sustainable living
<b>Option 3</b>	A system that uses available resources by exhausting materials in a full lifecycle to obtain energy security
<b>Option 4</b>	A system that facilitates the implementation of modern energy solutions through the integration of energy generation, storage, distribution and energy management in order to obtain energy security and enable sustainable living

The discussion of these different energy system name options focused on the meaning of the words used in the system name. 'Innovative' (in Option 1) refers to flexible and dynamic solutions that are changing at the same rate as technology is changing. A debate on energy versus electricity further ensured clarification that the municipality's role is to focus on energy, which entails electricity, transport and heating. 'Obtain energy security' means that the system should not be dependent on Eskom alone, but should incorporate alternative energy solutions. 'Energy management' refers to the supply and demand of energy. 'Sustainable living' was described as living that is not destructive, yet affordable, and incorporates sustainable development and environmental conservation, as stated in the White Paper on the Renewable Energy Policy of the Republic of South Africa (Department of Minerals and Energy, 2004). 'Modern' (in Option 4) entails flexible, dynamic, innovative and alternative energy solutions (solutions that are changing with technology). The workshop participants did not conclude with a final consensus on the system name, but the exercise ensured focus and structure for the next step, namely to develop energy strategies over a specified timeline. It was made clear to the participants that a strategy can be a combination of different energy options implemented over time.

The group discussions on sustainable energy strategies, in the time available, focused mainly on short- to medium-term actions. Participants felt that in order to gain momentum in moving towards a sustainable energy future it is important to focus on a few selected projects within the longer-term strategy. This philosophy is aligned with the system description that the solutions should be flexible and dynamic. The proposed actions from all participant groups were then grouped into specific decision areas. These decision areas are shown in Table 4-7 and were then used to develop the potential sustainable energy strategies, and then to evaluate the risk of each of the developed strategies against the future conditions, as identified in Section 4.5.2.

Strategy 1 aims to continue as per the status quo, where the municipality is focusing on SSEG only. Strategy 2 focuses on the enablement of SSEG, on prioritising the communication and awareness of sustainable energy and on driving education from a municipal level. Strategy 3 incorporates the enablement of SSEG, driving energy efficiency and focusing on communication and awareness. Strategy

4 aims to focus on all four decision areas in parallel, thereby focusing on the quick wins of energy efficiency and SSEG, while collaborating with stakeholders such as GCBR and CRSES to conduct feasibility studies on potential future sustainable energy solutions as well as driving communication, awareness and education on sustainable energy.

From the discussions on each of these strategies and decision areas it became clear that Strategy 4 is the preferred strategy for Hessequa. By focusing on all four decision areas, Hessequa can be proactive in finding future solutions that will ensure energy security and sustainable living. The time available within the workshop did not allow for a detailed discussion of the risks associated with these strategies.

Table 4-7 Decision areas identified during the Hessequa Sustainable Energy Journey workshop

Decision area	Actions	Timeline
<b>1. Enabling of SSEG (rooftop PV panels with storage as an option)</b> 	Implement SSEG policy	Done
	Implement feed-in tariffs	Done
	Communication and awareness campaign to promote rooftop PV systems	Short term
	Upgrade the current financial system to accommodate for net billing	Short term
	Develop an SSEG case study	Short term
	Build renewable energy capacity within municipality (e.g. solar PV Green Card)	Short term
<b>2. Energy efficiency revitalisation project</b> 	Implement at least one project (e.g. light-emitting diode streetlights) to build momentum	Short term
	Communication and awareness of energy efficiency projects and guidelines (e.g. gas geyser vs. conventional)	Short term
	Energy demand-side management project for top 20 electricity users	Short term
	Develop 'green planning elements' and update policies and building regulations	Short term
	Measure, track and report successes	Short term

<p><b>3. Conducting of feasibility studies to develop future options</b></p> 	Biomass-to-energy feasibility study to be conducted by GCBR	Short term
	CRSES to conduct feasibility studies (e.g. waste-to-energy options, possible IPPs for solar and wind, alternative fuel strategies)	Short to medium term
	Utility-scale energy storage solutions: investigate options and identify potential co-investors	Medium term
	Start to think about smart town planning (the use of information and communication technology to collect data and then use the data to effectively manage assets and resources.	Medium term
<p><b>4. Communication, awareness and education</b></p> 	Run a communication and awareness campaign on how to be carbon-neutral, energy efficiency options and promoting the uptake of solar PV panels	Short term
	Implement a system to measure and track the transitioning to green dependence	Short term
	Interactive visitors' centre on renewable energy and environmental conservation (our impact on the environment)	Medium term
	Development and sharing of best practices for full lifecycle farming/manufacturing operations	Medium term
	Forestation of parks in towns	Medium term

#### 4.5.4 Act for sustainability



The aim with the third segment, namely act for sustainability, is to agree on an action plan and way forward. Since the start of the Hessequa Sustainable Energy Journey, it was strongly advocated that a workshop is not worth much if it does not lead to some action. The strategy followed during this segment of the approach was to get verbal commitment on each action item as to who will be responsible for that specific action. The commitment from the Director: Technical Services and the municipal manager was noticeable, and they were comfortable to take on the role of enabling and

facilitating the Hessequa Sustainable Energy Journey. The workshop further established willingness from many outside stakeholders to take part in the journey through contributing and committing to the identified actions. One of the most important next steps agreed during the workshop was to establish an Energy Forum to continue the discussion and collaboration, not only on sustainable energy, but also on the sustainability of Hessequa in general. The agreed short-term actions (to be implemented within five years) and medium-term actions (implemented over five to ten years) are shown in tables 4-8 and 4-9.

Table 4-8 Agreed action items to be implemented within five years

	<b>Description of action item</b>	<b>Responsibility</b>
<b>1.</b>	Develop an Integrated Energy Plan for Hessequa (including the top 20 electricity users) and incorporate energy guidelines.	Director: Technical Services
<b>2.</b>	Build momentum by implementing at least one new green energy project (excluding LED streetlights).	Director: Technical Services
<b>3.</b>	Establish an energy forum with quarterly meetings for ongoing collaboration between the municipality and stakeholders.	Director: Technical Services
<b>4.</b>	Develop 'green planning elements' and update municipal SDPs, IDPs, policies and building regulations (also incentives such as gas geysers in new and existing buildings).	Municipal management with council
<b>5.</b>	Conduct an Energy Demand Side Management Project (usage audit of top 20 electricity users; identify initiatives; measure and track).	Director: Technical Services
<b>6.</b>	Upgrade the current financial system to accommodate net billing for SSEG.	Financial Services
<b>7.</b>	SSEG: Set up a case study with Spar.	Municipality and Spar
<b>8.</b>	Run a communication and awareness campaign on how to be carbon-neutral, energy efficiency options and promoting the update of solar panels (PV).	Director: Technical Services
<b>9.</b>	Build renewable energy competency in the municipality (e.g. solar PV green card).	Director: Technical Services

10.	Develop a strategy for biomass-to-energy and conduct feasibility studies (including the development of a local wood-making industry such as pellets, furniture and firewood).	GCBR
11.	Collaborate with CRSES to conduct feasibility studies (e.g. waste-to-energy options and possible IPPs [solar and wind]).	Municipality and CRSES
12.	Implement a system to measure and track the transitioning to green dependence.	Director: Technical Services

Table 4-9 Agreed action items to consider in five to ten years

	Description of action item
1.	Investigate possibilities for solar panel manufacturing, assembly, etc. for LED with the private sector.
2.	Investigate options for utility-scale energy storage solutions and identify potential co-investors.
3.	Develop and share best practices for full lifecycle farming and manufacturing operations.
4.	Investigate the forestation of parks in towns.
5.	Investigate the potential for an interactive visitor's centre on renewable energy and environmental conservation (our impact on the environment).
6.	Start to think about smart town planning (smart energy, waste, water integration).

## 4.6 Evaluation of the EDAS approach

### 4.6.1 Feedback from the workshop participants

The researcher was in the position to facilitate the EDAS approach at Hessequa, which provided the opportunity to assess the approach in terms of practicality and feasibility. The approach starts with divergent thinking, opening the minds of participants to many possibilities without analysing or judging the ideas, followed by a systems perspective to understand the system as a whole and to gain an understanding of unintended consequences if projects are implemented in isolation, and ending with convergent thinking, leading to a realistic action plan and

way forward. The expectations identified by the participants, namely 1) to develop an action plan consisting of simple, adaptable and resilient actions that are realistic in terms of current regulations, 2) to establish ongoing collaboration and 3) to create awareness of energy and environmental sustainability, have been met. In addition, the requirements of the approach as identified in Section 4.3, namely to be participative, holistic, simple, transparent and dynamic, have been successfully met.

An evaluation form (see [Appendix D.2](#)), completed by the participants of the Hessequa Sustainable Energy Journey workshop, were used to assess the overall feeling of the participants towards the planning approach followed. The evaluation form consisted an overall rating of the workshop as well as detailed feedback on each step of the EDAS approach, namely Explore, Design and Act. The overall rating was based on the amount of new information acquired, expectations met, materials presented, facilitator and presenter skills, and the participatory decision making of Hessequa. In total, 57% of the participants rated the workshop as excellent, 33% as above average and 10% as average, as seen in Figure 4-7 .

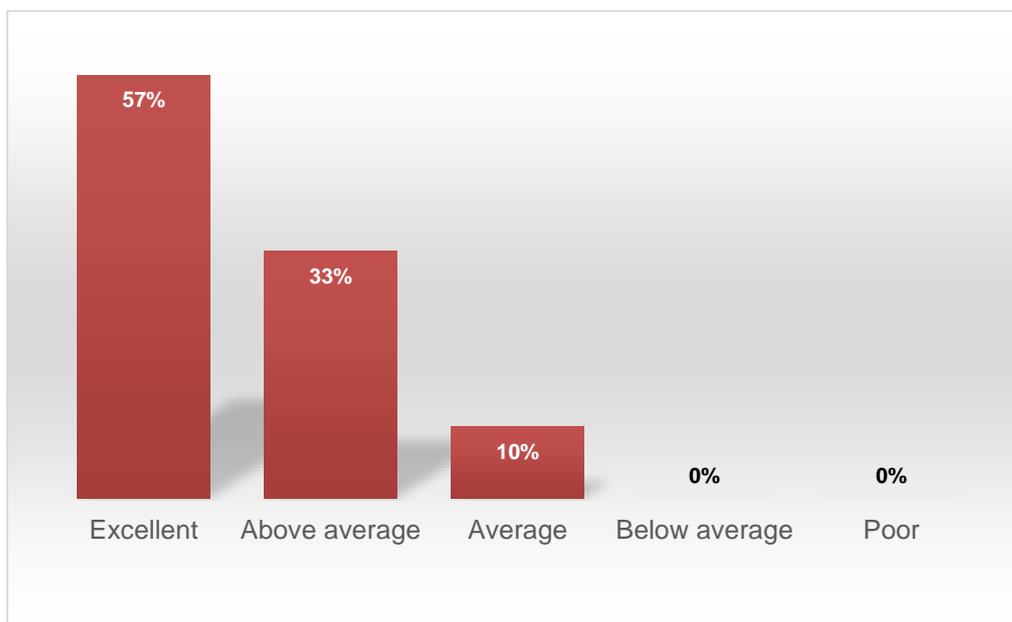


Figure 4-7 Overall rating of the Hessequa Sustainable Energy Journey workshop held

For 90% of the participants, the outcome of the workshop was satisfactory in terms of what was achieved in the available two days. The participants felt that all aspects were covered, and responsibilities were identified and addressed, and that it had

been a good start in formulating a strategy, with an experience of shared learning and shared visioning with focused discussions. Ten per cent of the participants felt that more time was required, especially when keeping in mind that some information was new to many participants. Participants commented that EDAS provided a structured approach that stimulated thinking and facilitated valuable discussions. The approach keeps focus on the subject and cultivates participation towards a desired outcome. A few participants mentioned that the approach needs some refinement and is not necessarily comprehensive enough to reach a detailed plan of action. In total, 76% of the participants felt that the *Explore* segment of EDAS was the most valuable, 18% commended the *Act* segment and 6% viewed the *Design* segment as the most important. For most participants, exploring the many possible energy options, understanding the advantages and disadvantages of various alternatives and discussing diverse perspectives in understanding the problems were stimulating and valuable.

The participants felt that the EDAS approach or similar workshops are a way forward to improve local government participatory decision making. However, care should be taken to ensure that the relevant stakeholders are identified and given an opportunity to participate meaningfully. The role of the facilitator is crucial in such a workshop to ensure that discussions are not side-tracked and that all participants give their input. Other options mentioned to improve local government participatory decision making were better communication and awareness from the municipality as well as the establishment of community forums, such as an energy forum.

#### **4.6.2 Reflection on the EDAS approach**

The researcher undertook a further evaluation in the research period of reflection. The EDAS approach was critically analysed and reflected on against each aspect of the matrix (see Table 4-3). The table shows a combination of the success factors for developing and implementing a participatory approach and the characteristics of a complex problem. The following questions were asked and answered: What worked well? What did not work? What limitations in the research does the researcher foresee?

The following can be concluded based on the prior requirements to plan for local sustainable energy:

- **The approach must be participative and inclusive**

When complex matters, such as a local sustainable energy future, need to be discussed and planned, it will be difficult, in a South African context, to implement one approach or one intervention that is participative and all-inclusive. Firstly, the widespread levels of knowledge, literacy and education of citizens, and even members of the council, make it difficult. What might seem as a simple concept for one participant might be regarded as extremely complicated for another participant, and having a joined conversation with too large a group of participants will create frustration at the one end and loss of people's interests at the other end. Secondly, the participative nature of municipalities is to either invite participants to the intervention or to make a public announcement of the affair. Either way, the process remains voluntary and the municipality has limited control as to who will and who will not attend. An observation made during the research period was that the municipality operates in departmental silos, so even though meeting requests are sent to all municipal administration managers, participation from other municipal departments was limited. Of the total structure of municipal administration staff, which comprises of five directors and the municipal manager, only the municipal manager and the Director: Technical Services (with one colleague) attended the Hessequa Sustainable Energy Journey workshop. The departments Planning, Development and Environmental Services; Community Services; Corporate Management; and Financial Services were not present during the duration of the workshop. In addition, of the seventeen council members, who comprise of nine ward council members and eight proportional representative councillors, only three council members attended the workshop. This shows that in order to make the approach truly participative and all-inclusive, many more iterations are needed, and innovative ways need to be investigated on how to ensure a wider representation and participation. The EDAS approach ensures that the iteration takes place and is represented in the cyclic design, as shown in Figure 4-1 and Figure 4-2.

- **The approach must be holistic**

Two specific steps in the EDAS approach have been included to ensure that the approach is holistic, namely Step 1, of the *Explore* segment, to understand the current context and envisage the future, and Step 4, of the *Design* segment, to name the system.

In Step 1, rich pictures were used, stemming from systems thinking (Checkland, 1981). According to Bell and Morse (2013), rich pictures can help groups to gain an understanding of their own connection or disconnection with a complex matter and can help to explore the dominance or priority of that specific issue. In Hessequa's case, the rich pictures ensured an understanding of the underlying issues, constraints and opportunities within a Hessequa context in terms of the environment, service delivery, social cohesion, political aspects, cultural aspects and the local economy. This understanding was then used in agreeing on multiple objectives in terms of how the participants envisage their future. Although the participant group that developed the initial rich pictures was different from the participants of the Hessequa Sustainable Energy Journey workshop, there was close alignment in the strategic themes that were discussed.

Step 4 also stems from Checkland's SSM (1981), namely the root definition. The rationale for this step is to determine the participants' definition of the system under consideration, in this case their future energy system. The technique assisted to elevate thinking about what an ideal system would entail and ensured that differences in understanding could be identified and discussed. For example, a good discussion took place in terms of what should be included in the Hessequa energy system, if it should only entail electricity or if transport and other energy forms must also be included. These discussions ensured that a holistic approach was followed, which helped in identifying the boundaries of the system as well as the system's connections with other variables outside of these boundaries.

- **The approach must be simple and transparent**

Simplifying the approach is difficult due to the different participants' perspectives. Careful consideration needs to be given to which methods and tools should be included in the EDAS steps and how to effectively involve the stakeholders. The

facilitator plays an important role in ensuring the simplicity of the approach, so when complicated matters or concepts are discussed, the facilitator's role is to simplify these terms and to encourage a discussion for better understanding. As stated in earlier discussions, the aim of the discussions should firstly be to agree on the strategic direction of the municipality on the complex matter before the wider public is approached. The methods and tools designed specifically for the Sustainable Energy Journey workshop was for participation at this strategic level, which poses a research limitation. It is believed that when the EDAS approach is taken to the community level, different methods and tools are needed to ensure that the approach is kept simple and transparent. Further research is needed to understand which methods and theories could be applied in a workshop or intervention with the wider community and other stakeholder groups, and when this participation is needed.

The transparency of the approach was a result of a good communication strategy that was followed. Many prior discussions took place with some of the stakeholders and municipal management to establish the rationale for participation, the rules and the objectives of the workshop. E-mail communication was sent out with the invitation to the workshop and a report on the workshop results was distributed to all invitees. The researcher cannot comment on how these workshop results were further distributed and communicated within the municipality. The reality that stood out with regard to the process of decision making is that final decisions will be taken by the council, when it comes to that point, so even though a detailed list of actions was agreed upon, no one can be held accountable, because these actions or decisions were not made in a council meeting. A future research opportunity would be to investigate whether any progress has been made on the agreed actions.

- **The approach must include the identification and assessment of risks as part of the deliberation process**

The Hessequa Sustainable Energy Journey workshop was a first iteration of the EDAS approach, and much time was spent on the first segment, namely *Explore*. The exploratory discussions were necessary to ensure that the relevant information is being shared and that everyone has a mutual understanding of what a sustainable energy future could entail. Due to the rich and detailed discussions,

limited time was available for discussions of the perceived risks. Further research is therefore needed to investigate how the identification and assessment of risks could assist in selecting a preferred strategy.

- **The development of a realistic action plan must be attainable at the end of a two-day workshop**

The development of a realistic action plan at the end of a two-day workshop was a practical requirement, but also stems from prior discussions with stakeholders, who are becoming frustrated with multiple meetings and discussions held with the municipality that are not resulting in any action. In the matrix given in Table 4-3, the researcher linked this requirement to the success factor that entails that the process needs to be underpinned by a philosophy of empowerment, equity, trust and learning. If no action plan exists and no action is visible after such a workshop, participants will lose trust in the process, but after some reflection, the existence of an action plan, on its own, not necessarily results in action being taken. More research is needed to fully understand which factors will result in visible action with regard to complex issues, such as energy security and climate change, at a local government level. If the cyclic design of EDAS was implemented, namely a continuation of the discussions on a regular basis, the specific duration of the workshop does not have to be a prerequisite. The two-day workshop was chosen to ensure that the researcher could progress as far as possible with applying the approach in real terms in the time available to complete the research. It is therefore proposed that this specific requirement be changed to: The development of a realistic action plan must be attainable at the end of each workshop. The emphasis therefore shifts to action being taken and not on the duration of the workshop.

- **The approach must be dynamic**

The cyclic design of the EDAS approach allows for the approach to be dynamic. With each cycle, new risks and uncertainties can be identified due to changes that will occur between the cycles. This will allow for discussions, reflection and deliberation to adapt the action plans as and when required. The adaptation of plans and the discussions that take place could then also ensure that empowerment, trust and learning are outcomes of the process. The researcher was not able to investigate whether a dynamic approach is followed at Hessequa,

as only one iteration of EDAS was applied. More iterations are needed to truly understand the dynamic nature of the EDAS approach.

- **The approach must be formalised with clear institutional arrangements**

For any approach to be sustainable, it is believed that it must be institutionalised. The research to develop a participatory planning approach, namely EDAS, was supported by Hessequa Municipality and the researcher was given a mandate to conduct the research and to facilitate workshops at Hessequa. What was difficult during the research period was to keep the momentum, because the research period stretched over an election period. The second part of the research was conducted with a new selected council, therefore any support and trust established during the first half of the research had to be regained with the new council. The EDAS approach has not been institutionalised at Hessequa Municipality and the reason for this, as mentioned before, is that more iterations are needed, and more research needs to be conducted to formalise the EDAS approach. However, it is believed that the approach is a step in the right direction to improve participation and decision making in complex matters, such as a sustainable energy future, at a local government level.

## **4.7 Conclusion**

The main aim of the research on which this chapter reports was to develop, apply and evaluate a participatory planning approach for local governments in South Africa that can be used during stakeholder workshops concerning long-term sustainability issues such as energy. Due to the complex nature of local energy sustainability, it has been determined that the participatory planning approach must incorporate the characteristics of a complex problem. Complex problems consist of a system of problems with multiple stakeholders and perspectives. The complex structure of these problems, with many interrelated issues, tends to lead to unintended consequences, where a solution to one part of the problem could influence other parts of the system. This also means that complex problems are characterised by uncertainty and risk. Complex problems can never be understood

or solved in full, therefore great care should be taken when addressing these problems.

Building on recognised methodologies and theories, while taking into consideration the context of local governments in South Africa, a new approach, EDAS, was developed to Explore, Design and Act for Sustainability. The EDAS approach was successfully applied and evaluated in a workshop with Hessequa Municipality, a local government in the Western Cape province of South Africa, to determine sustainable energy strategies and a way forward. The developed approach is novel due to its holistic, dynamic and transparent features, it provides structure for focused discussions and it is a first for a local municipality in South Africa, as far as could be ascertained.

The results from the Hessequa Sustainable Energy Journey workshop show that sustainable energy strategies can be identified in a short period if a diverse group of stakeholders participates and a knowledgeable facilitator ensures that the discussions taking place are structured and focused. The discussions allowed subject matter experts to share knowledge and information with the other stakeholders, which ensured awareness creation of sustainability issues and their impact on the future environment. The *Explore* segment followed a divergent approach to consider as many alternatives and options as possible at first, without constraining the participants' thinking, followed by convergent thinking in considering the obstacles and barriers to successful implementation of the identified options. The *Design* segment started with explaining to the participants what systems thinking is and then asking them to describe the energy system they would like to design from a systems perspective. Different energy system definitions were identified without a final consensus reached or the selection of a specific system name, but the exercise ensured focus and structure for the next step, namely to develop energy strategies over a specified timeline. It was made clear to the participants that a strategy can be a combination of different energy options implemented over time. The group discussions on sustainable energy strategies, in the time available, focused mainly on short- to medium-term actions. Participants felt that in order to gain momentum in moving towards a sustainable energy future, it is important to focus on a few selected projects instead of coming up with long-term plans. The proposed actions from all participant groups were

then grouped into specific decision areas, which were further used to develop an energy strategy. The aim with the final segment, namely Act for sustainability, is to agree on an action plan and a way forward. Since the start of the Hessequa Sustainable Energy Journey workshop, it was strongly advocated that a workshop is not worth much if it does not lead to some action. The commitment from the municipal director of technical services and the municipal manager was noticeable, and they were comfortable with taking on the role of enabling and facilitating the Hessequa Sustainable Energy Journey. The workshop further established willingness from many outside stakeholders (non-state holders) to take part in the journey through contributing and committing to the identified actions. One of the most important next steps agreed during the workshop was to establish an energy forum to continue the discussion and collaboration every quarter, not only on sustainable energy, but also on the sustainability of Hessequa in general.

In order to improve the approach, EDAS needs to be applied in other local government contexts as well as in public enterprises. More cycles of the approach are needed to improve and refine the approach in terms of developing more detailed sustainable energy strategies, identifying and assessing risks and comparing the strategies against these identified risks, and also to ensure that the approach is dynamic and that it can be formalised and institutionalised as part of a local government. It is also recommended that the EDAS approach be adapted and applied to more stakeholders representing the wider public with the focus to create awareness and understanding of what a sustainable energy future entails and why it is important. Chapter 5 provides a detailed discussion of the main findings, contributions and future research directions.

## Chapter 5 Conclusions

### 5.1 Introduction

Climate change research and the current role of local governments to mitigate the impact of climate change were the starting point for this research journey. The impact of climate change is evident in South Africa. Mean annual temperatures have increased and a decline in the number of rain days in almost all regions is apparent (McSweeney & Timperley, 2018). However, at this point in time, the South African problem is more focused on electricity security than on lowering the carbon footprint. South Africa had the worst year of loadshedding on record in 2019 and according to the CSIR, loadshedding is expected to continue for another two to three years (Wright & Calitz, 2020). The problem of electricity security is due to the financial position and current management of state-owned utility Eskom. Fortunately, when understanding the interconnectedness of complex problems, the management of one of the problem aspects, whether it is electricity security or climate change mitigation, will impact the other problem aspect.

The Western Cape government has been proactive in implementing the Energy Security Game Changer, which aims to achieve an effective 10% contribution to the electricity needs of the Western Cape by 2020 by reducing the demand from Eskom. The mandate from provincial government is that local governments need to respond proactively to move towards cleaner and more renewable forms of energy (Fast, 2019c), but from an observer's perspective, some local governments are slow in implementing changes to enable a move towards a sustainable energy future. In order to deal with complex problems at a local government level, such as a sustainable energy future, the research argues that stakeholder involvement is crucial. In South Africa, the term 'public participation' forms part of national, provincial and local government legislation and is used for any form of interaction with civil society and stakeholders. In the South African context, civil society is described as those who have a presence in public life, while stakeholders are people who have a specific interest in what is undertaken and its institutional outcome (South African Legislative Sector, 2013). Internationally, the literature on public participation and stakeholder participation does not provide a universal

definition of these terms, which can cause confusion. Public participation is seen as a democratic right of all South African citizens, as stipulated in the Constitution of South Africa, yet limited evidence could be found in literature of how public participation is being applied to complex local government matters and its effectiveness. For this research, the need was identified to develop a participatory planning approach for local energy sustainability and the stance was taken that in order to develop such an approach, the process needs to start with the municipal management team, the council, ward committee members (who represent civil society) and key stakeholders before the wider public is involved. Planning for a sustainable energy future is a new concept for a local municipality in South Africa, and therefore strategic direction needs to be established before involving the wider public.

Through a case study and action research approach, the focus of the research was to understand what local governments, especially in the Western Cape province of South Africa, are doing to enable sustainable energy in municipal areas and the role of public participation in this regard, and then to support local governments in developing and applying a participatory planning approach for energy sustainability. Public participation involves two-way communication, negotiation and development of mutual understanding, with the ultimate objective of reaching decisions that are supported by the public (Creighton, 2005; South African Legislative Sector, 2013). However, improper planning and application of participatory approaches can lead to non-productive, time-consuming and expensive processes, which may leave people feeling frustrated and confused. The importance of developing a participatory planning approach is therefore apparent. In order to develop a participatory planning approach for energy sustainability at a local government level, the following research question was asked: What should a participatory planning approach at a local government level entail to enable a move towards a sustainable energy future?

To answer the research question, the following research objectives were established:

1. To review evidence of participatory planning approaches to determine factors necessary for the successful development and implementation of such approaches
2. To determine whether and how renewable energy options form part of a local government's strategy and long-term plans
3. To investigate how participatory approaches are utilised in the development and communication of a municipal strategy
4. To develop, apply and evaluate the use of a participatory planning approach for energy sustainability in a local government in South Africa.

The researcher took part in several municipal meetings and workshops at Hessequa Municipality from 2015 to 2019. Hessequa Municipality is a local government situated between the inland towns of Heidelberg, Riversdale and Albertinia and the coastal resorts of Witsand, Jongensfontein, Stilbaai and Gouritsmond in the Western Cape province of South Africa. Hessequa was selected due to an already established collaboration with Stellenbosch University and an openness to be part of the development of a participatory planning approach for energy sustainability. The qualitative data used for this research were meeting and workshop notes, transcribed data from workshops, observations, an evaluation form, municipal documentation and literature available in the public domain. Research methodologies such as qualitative analysis, exploratory research and inductive reasoning were used.

The key findings from these research objectives are discussed next, followed by a summary of the research contributions, the research limitations, future research opportunities, a personal reflection of the researcher and concluding remarks.

## **5.2 Summary and discussion of key findings**

### **5.2.1 Objective 1: To review evidence of participatory planning approaches to determine factors necessary for the successful development and implementation of such approaches**

In this research, a participatory planning approach is defined as using a combination of different theories, tools, techniques and methods in a participatory process of involving a selected group of stakeholders with the objective to firstly create a mutual awareness and understanding of a specific matter in order to plan for the future, secondly to ensure that collaborative decision making takes place and thirdly to ensure joint effort in the implementation, monitoring and tracking of projects. In order to review participatory planning approaches, a systematic literature review was conducted to find approaches inclusive of stakeholder participation that have been applied to environmental management issues at a regional, city or community level. Local and international peer-reviewed articles, published between 2009 and 2015, were used as data. The articles were categorised into six groups of approaches inclusive of stakeholder participation, namely 1) participatory techniques, 2) MCDA, 3) systems approaches, 4) scenario planning, 5) adaptive management and 6) integrated approaches.

The main advantages and limitations of these participatory approaches were elicited, and it became evident that in order to overcome some of these limitations, many researchers are moving towards integrated approaches where different methods are mixed or combined. According to Mingers and Rosenhead (2004), the combination of different methods is a common occurrence. The added advantage of combining hard (quantitative) and soft (qualitative) models is the richness of qualitative and quantitative information, which can stimulate more agile, strategic thinking about the future. Mingers and Rosenhead (2004) further comment that the choice of methods is a function of the knowledge, experience and skills of the practitioner. To some extent, the problem context is kept in mind when choosing an approach.

The systematic literature review also produced collective success factors for planning and implementing a participatory approach. These factors were summarised in a checklist (tables 2-5 and 3-2), which comprises of the following:

- The inclusion of a holistic or systemic thinking approach, such as SSM or systems thinking, is recommended.
- A diverse group of stakeholders needs to form part of the participation process. These stakeholders can be determined through stakeholder analysis or stakeholder mapping.
- Careful consideration should be given to how to involve the stakeholders and when to involve the different groups of stakeholders.
- The participation will only be successful if a strong mandate and political support are provided; therefore, the initiative should form part of an existing policy development or change process.
- The appointment of a knowledgeable and experienced facilitator is key to ensuring that the opinions of all participants are taken into consideration (all parties need to be substantively equal in voice and conflict must be handled effectively).
- A solid communication strategy must be in place to ensure that:
  - the rationale for participation is communicated;
  - the objectives of participation are clear;
  - the role of the researcher (if applicable) is discussed;
  - participation rules are agreed; and
  - the consequences of the process for decision making are clear.
- Reflexivity and realism should be included as part of the process. Reflexivity is the process by which the researcher reflects on the data collection and interpretation process, taking into consideration one's own beliefs and background. Realism is a representation of how things really are or refers to being practical and facing the facts.
- The participation process should be underpinned by a philosophy that emphasises empowerment, equity, trust and learning.
- Methods used during the participation process should be selected and tailored based on the decision-making context, the types of participants and the level of engagement.

- Local and scientific knowledge needs to be integrated.
- Participation should be institutionalised.
- Participation/intervention rules should be established and need to include the following:
  - Participation must be free and voluntary.
  - Force of the better argument needs to be exercised.
  - The approach should aim at arriving at a rationally motivated consensus.

The success factors for planning and implementing a participatory approach were used to investigate how participatory approaches are utilised in the development and communication of a municipal strategy and the municipal IDP, as discussed in Section 5.2.3. These factors were further utilised when the requirements for an approach to plan for a local sustainable energy future were identified, as discussed in Chapter 4. A matrix of how these requirements overlap was presented in Table 4-3.

### **5.2.2 Objective 2: To determine whether and how renewable energy options form part of a local government strategy and long-term plans**

A single instrumental qualitative case study was conducted at Hessequa Municipality in the Western Cape province of South Africa to understand how renewable energy options form part of a local government's strategy and long-term plans. The researcher acted as participant and observer during multiple municipal interactions and facilitated multiple strategy workshops during the research period. The data collected during this research period were used to determine whether renewable energy options form part of the municipal strategy. A literature review was then conducted to identify sustainable energy opportunities that could form part of a municipal strategy and further elicited opportunities and barriers for implementing these sustainable energy solutions. A cognitive map was used to analyse the data and to determine causal links between what had been discussed during municipal interactions and strategy workshops and what are evident as renewable energy opportunities in the literature.

The research concluded the following:

- Renewable energy solutions are not currently a key focus for Hessequa Municipality, mainly due to other more pressing strategic matters, such as social issues due to youth unemployment, crime-related activities, alcohol and drug abuse, school drop-outs and teenage pregnancies, current aging infrastructure, environmental conservation, landfill capacity reached, slow economic growth and increasing municipal tariffs.
- However, the causal relationships of the municipal strategic themes and sustainable energy explicitly show that many opportunities for renewable energy solutions exist in the form of biomass-to-energy, low-carbon LED, SSEG with feed-in tariffs and waste-to-energy to treat and reduce municipal solid waste.
- Renewable energy can therefore play a role in the strategic themes of Hessequa Municipality, namely sustainable infrastructure and service delivery, personal development and social cohesion, sustainable economic development, environmental conservation and keeping municipal tariffs affordable.
- The main opportunity to move to a sustainable energy future is the potential of renewable energy in South Africa, especially solar energy. The current position of Eskom, where loadshedding is unavoidable, is seen as an opportunity for local governments to change the energy landscape of the supply and distribution of electricity. Two key barriers hampering the implementation of sustainable energy solutions at the local level are the current legal and regulatory environment and the cost of renewable energy technologies with storage options. The barriers, obstacles, opportunities and strengths were discussed in chapters 3 and 4, and a summary is given in [Appendix E.1](#).

The legislation of public participation at a local government level provides a conducive environment to have fruitful discussions on complex matters with the interested stakeholders at a local level. In order to investigate the plausibility of the renewable energy options, evident in literature, the research concluded that a participatory workshop could be beneficial for local governments to develop a sustainable energy plan.

### **5.2.3 Objective 3: To investigate how participatory approaches are utilised in the development and communication of a municipal strategy**

Literature shows that participatory processes in South Africa miss the true objective of public participation, namely to encourage the involvement of communities and community organisations in decision making on local government matters (RSA, 1996) and to develop a culture of participation by building the capacity of local communities, councillors and officials to participate in municipal affairs (Cooperative Governance & Traditional Affairs, 1998). South African municipalities mainly use consultative processes for public participation, where information is discussed and inputs are received, but the decision-making authority still resides with the municipal council (Slutsky *et al.*, 2016). According to Piper (2011), the relative weakness of civil society hinders effective public participation. The stance taken in this study is that for complex matters, such as sustainable energy planning, selected stakeholder groups first need to be engaged to agree on the strategic direction of the municipality before the community or wider public can be involved. The rationale for not involving the wider public before strategic direction is attained is to avoid confusion or the creation of expectations that cannot be fulfilled.

The checklist to ensure the successful development and implementation of participatory approaches was developed and discussed in Chapter 2, and used to evaluate the participatory nature of Hessequa Municipality in the development and communication of its strategy. The checklist was developed with a specific purpose to move higher up on Arnstein's (1969) ladder of citizen participation, namely involvement (collaboration and co-decision) and empowerment, and not only information sharing and consultation. The participatory approaches used for the investigation were 1) IDP/SDP meetings held with town representatives and 2) the Hessequa True North workshops. The main difference between these interactions were that the IDP/SDP meetings were planned and facilitated by the Manager: Strategic Services, whereas the True North workshops were planned (in collaboration with the municipal management team) and facilitated by the researcher.

The Municipal Structures Act of 1998, the Municipal Systems Act of 2000, the Municipal Finance Management Act of 2003 and the Municipal Property Rates Act of 2004 (RSA, 1998, 2000, 2003, 2004) clearly show that participation in local government matters is institutionalised, which provides a favourable environment for participation. Although participation is institutionalised, an investigation of how these participatory processes takes place, specifically considering the development of the municipal IDP, pointed out the following limitations:

- A holistic, integrated approach was not followed for the IDP/SDP meetings. The current discussions on the IDPs are organised to be held per town in the municipal area. Each town discusses matters that are deemed a priority without considering the strategic priorities of the municipality (as a whole). This could result in unintended consequences, where unrealistic expectations are created, which later result in unsatisfied citizens.
- A diverse group of stakeholders does not participate from the start. The people attending these types of discussions and interventions are not always representative of the demography of the area, and therefore more attention should be given as to how a wider representation of participants could be involved in the discussions and debates.
- It is unclear whether a communication strategy was followed during the IDP/SDP meetings to discuss the rationale and objectives for participation, the participation rules, the role of the researcher/facilitator and the consequences of the process for decision making.
- Reflexivity and realism do not explicitly form part of the participatory approaches of a municipality. More research is needed to understand how reflexivity and realism can effectively contribute towards the participations process.
- In order to improve the participatory processes in terms of empowerment, equity, trust and learning, the outcome of participation should be made available in a format that is accessible to all. Currently, the final IDP is available in electronic format on the municipal website. Citizens without an internet connection or with relatively low literacy levels will not have access to the information, and therefore might be left

out of getting feedback on the decisions taken. A report on the outcome of the True North workshops and the consolidated visual strategy was delivered to the Manager: Strategic Services. The researcher is unsure how the workshop report and visual strategy were rolled out to the wider community. It is the researcher's opinion that a communication feedback loop is important for the establishment of empowerment, equity, trust and learning, but such a feedback loop is not always in place or, if in place, not effective.

Although participation is institutionalised from a legislative perspective, more formal participatory approaches and facilitation techniques, which form part of municipal procedures, could be implemented. In the case of complex matters such as a total redesign of the local energy landscape, different approaches than the participatory processes currently applied at a local government level are needed and careful consideration should be given as to why stakeholders need to participate, in which phase the wider public should be involved, and to how these participants (both stakeholders and the wider public) should be involved.

#### **5.2.4 Objective 4: To develop, apply and evaluate the use of a participatory planning approach for energy sustainability in a local government in South Africa**

In order to develop the conceptual participatory planning approach, the main literature on participatory approaches, PSMs (also known as soft OR) and complex problems was used, and a methodology of inductive reasoning was followed. The context of Hessequa Municipality also significantly contributed to the development of the approach, as the researcher found that a complicated mathematical or reductionist approach would not be beneficial within the municipal area and that the inclusion of stakeholders is crucial. From a better understanding of the context it was also found that the focus of the approach should be on creating awareness, building trust and collectively learning and adapting over time. Therefore, the requirements of a participatory planning approach were elicited, namely that the approach must be participative and inclusive, holistic, simple and transparent. In addition, the approach must include the identification and assessment of risks as part of the deliberation process and the development of a realistic action plan must

be attainable at the end of each workshop to ensure traction and momentum building. The assessment of risks was deemed important to establish an understanding of the related risks, should local governments not react to the problems of climate change and energy security. To ensure that the action plan is adapted continuously as technology and knowledge change, the participatory planning approach needs to be dynamic. Finally, for the approach to be sustainable, it needs to be formalised with clear institutional arrangements.

Building on these requirements, the EDAS approach was developed, namely to Explore, Design and Act for Sustainability. The novelty of the approach lies in the flexibility of using different methods within each segment, suitable for and adaptable to the given context (see Figure 4-2). The approach is general enough so that it can be used not only for the development of sustainable energy strategies, but also in terms of all aspects of sustainability. Furthermore, the approach is seen as a dynamic process of acquiring knowledge and consists of a continuous cycle of exploring, designing and acting.

The first segment of the EDAS approach, *Explore*, aims at opening the minds of participants to think creatively about the future and all its possibilities in order to determine plausible sustainable options. In addition, as part of the *Explore* segment, possible future conditions are determined, such as a positive outlook, a negative outlook and a most likely outlook (as perceived by the participants). These future conditions are then used in the next segment to *Design* desirable sustainable strategies. The *Design* segment applies a systems perspective to ensure that the problems dealt with are not considered in isolation, but are seen as interdependent and working together as a complex whole. A part of the *Design* segment is to define the system dealt with using Checkland's (1981, 1985) root definition. The system's name is used to develop specific strategies over a period. These identified strategies are then prioritised based on risk evaluation. The final segment of EDAS, but also the start of future collaborations, is the *Act* segment, where consensus is reached on the way forward in terms of those action items that will improve the problem situation.

As already discussed, the research process was based on an action research and a case study design. In action research, the participants and researchers are key

components in the research findings, and in this case were part of the design and development of the participatory planning approach. The EDAS approach was applied during a two-day workshop with Hessequa Municipality to develop a sustainable energy plan. Expectations of the participants were met, namely to 1) develop an action plan consisting of simple, adaptable and resilient actions that are realistic in terms of current regulations, 2) establish ongoing collaboration and 3) create awareness of energy and environmental sustainability. The EDAS approach resulted in consensus on the Hessequa envisaged futures, the sustainable energy options worth pursuing, different options of an energy system's name and decision areas combined in the different possible sustainable energy strategies.

In order to evaluate the EDAS approach, the participants were asked at the end of the second day of the Hessequa Sustainable Energy Journey workshop to complete an evaluation form and to verbally comment on how they experienced the approach used during the workshop. In general, all participants were comfortable with and excited about the outcome of the workshop and commended the EDAS approach. The evaluation results can be summarised as follows:

- In total, 90% of the participants felt that the outcome of the workshop was satisfactory for what is achievable in two days. Ten per cent of the participants felt that more time is needed for participants to become comfortable with the new information shared.
- The participants believed that the EDAS approach stimulates thinking and provides a structure for facilitating valuable discussions. The approach ensures focus on the subject and cultivates participation towards a desired outcome.
- The *Explore* segment was deemed the most valuable due the exploration of many possible options, creating an understanding of complex problems and diverse perspectives.
- The EDAS approach is a way forward for public participation, especially at a local government level, to ensure that discussions are structured and valuable.

- The identification of the stakeholders that should take part in these types of participatory workshops was deemed vital.
- The selection of the right facilitator is crucial to ensure that all participants give their inputs and that discussions are not side-tracked.

It is therefore evident that the municipal stakeholders believe that focused participatory workshops are important for participatory decision making at a local government level. This ensures better communication, creates awareness of public matters and establishes collaboration to drive actions and implement decisions.

A further critical reflection was done by the researcher to evaluate and reflect on how the initial requirements of an approach to plan for a local sustainable energy future were applied during the EDAS workshop. The main conclusions are as follows:

- The EDAS approach can make a difference in moving towards a sustainable energy future in South Africa and other developing countries. More structured discussions between public agencies and non-state holders can ensure a better understanding of the problem of energy sustainability, not only in terms of energy security, but also in terms of climate change.
- Local governments still have a long journey ahead in improving participation in complex matters, such as a sustainable energy future, and it is recommended that these discussions need to take place in a structured way using a participatory planning approach.
- Discussions of complex matters need to take place on a strategic level before the wider public is involved, mainly to allow time for the municipal management team, council and key stakeholders to first gain a mutual understanding of the complex issue and to agree on the strategic direction. The rationale for involving the wider public needs to be carefully considered and it is believed that the focus for involving the wider public should be on creating awareness and understanding of the complex issues and the reasons why certain decisions are needed.
- Internal participation and collaboration within the municipality can also improve and enhance planning of complex matters, such as sustainable

energy. More interdepartmental discussions are needed to effectively tackle these complex issues and if necessary, changes to the municipal organisational structure need to be considered to ensure that these discussions take place and are effective.

- The identification and assessment of risks are deemed important to compare different sustainable energy strategies, but more research is needed to investigate how the identification and assessment of risks can assist in this regard.
- A realistic action plan is important as an outcome of the EDAS approach to ensure that momentum is gained. The EDAS approach has been designed to be a cyclic approach to ensure that the discussions continue and that the action plans are adapted over time, as and when needed. Factors to ensure that action is taken at a local government level need to be investigated as part of future research.
- In order to overcome the barriers in terms of legislation, municipalities should continue to exert influence over provincial and national government by taking the lead in enabling and encouraging private sectors to implement sustainable solutions.
- The EDAS approach can only be successful and sustainable if it is formalised and institutionalised as part of government policies. The identification of roles and responsibilities, not only for government bodies, but also for non-state holders, is of utmost importance.

### **5.3 Summary of key contributions**

The research effort has made the following key contributions:

- 1) In the field of public engagement, Rowe and Frewer (2005) argue for the need for theories or models that predict or describe how to enable effective involvement. Bayley and French (2008) highlight that there is limited literature on the design of participatory processes that deal with the management of particular concerns. In addition, according to Luyet *et al.* (2012), there is no standardised approach related to the evaluation of public participation. Based on these research needs and building on the best practice stakeholder participation guidelines of Reed (2008) and practical

findings elicited from several studies applying participatory approaches (Davidson & Venning, 2011; Johnson *et al.*, 2012; Luyet *et al.*, 2012; Ravera *et al.*, 2011; Retallack & Schott, 2014; Sara & Baud, 2014; Sušnik *et al.*, 2012; Wesselink *et al.*, 2011; Westling *et al.*, 2014), the factors necessary for the successful development and implementation of a participatory approach were elicited and summarised in a checklist. The contribution of the checklist is to provide 18 guidelines to ensure the successful development and implementation of a participatory approach. The checklist has been applied during a case study with Hessequa Municipality in the Western Cape province of South Africa and can be used as a guideline for any local government or other institution to plan and implement a participatory process. The checklist deals specifically with where information is exchanged between members of the public and the sponsors and where the act of dialogue and negotiation serves to transform opinions of all stakeholders. These participatory approaches then cover all the degrees of involvement from information sharing to empowerment. Another contribution of the developed checklist is that it can be used to evaluate participatory approaches in terms of effectiveness. Summarising the factors for the successful development and implementation of a participatory planning approach is an empirical contribution and the checklist, an output of the research done as part of Chapter 2, is a practical contribution that was successfully used by the researcher in the planning of the participatory workshops with Hessequa Municipality and the development of the participatory planning approach for sustainability.

- 2) A practical contribution is made through showing how renewable energy options form part of a local government's plans in using a cognitive map as an analysis tool to elicit causal links between what has been discussed during strategy workshops and what is found in literature. Cognitive mapping as an analysis tool to elicit the viewpoints from many workshop participants can contribute to the application of such mapping in the field of energy sustainability, energy security and adaptation to climate change.
- 3) A practical contribution has been made in using the theoretical concept of rich pictures to visualise the strategy of a local government in South Africa. Checkland (1981, 1985) recommends the use of rich pictures to

contextualise and understand current problems and issues dealt with, and the use of rich pictures is evident in content analysis (Bell *et al.*, 2016). Recently, the people of Taranaki, New Zealand, created a visual 2050 roadmap towards lower greenhouse gas emissions through a co-design and participatory process (New Plymouth District Council, 2019). The use of visual aids, such as rich pictures, is beneficial for creating awareness, communication and stakeholder buy-in.

- 4) The EDAS approach is a conceptual contribution in the fields of renewable energy and sustainability, as well as that of soft OR, public administration and policymaking. The uniqueness of the developed approach lies in the theoretical grounding and its flexibility in terms of using multidisciplinary theories, techniques or parts of methods in the fields of soft OR, systems thinking, decision analysis, strategy and facilitation. The *Explore* segment incorporates the use of rich pictures to visualise the future to be created, with the use of divergent facilitation techniques and a PESTLE analysis or scenario planning to identify possible future conditions. The *Design* segment uses the root definition of SSM (Checkland, 1981), convergent facilitation techniques and risk identification to prioritise the developed strategies. The *Act* segment uses a project planning approach to determine the action steps and roles of participants. The advantage of the EDAS approach is that certain limitations of using other participatory approaches solely can be minimised. The participatory planning approach can be applied to any local government or other institution and can be used for sustainability in general. Uittenbroek, Mees, Hegger and Driessen (2019) indicate a gap in literature in terms of the way in which participation processes are designed and the objectives in mind, and emphasise the need for more research in this regard.
- 5) A practical contribution has been made in applying the EDAS approach in a facilitated workshop with Hessequa Municipality. EDAS provides a hands-on approach for public participation and collective governance. The lessons learnt and sustainable energy solutions that emerged can be of practical consideration when similar workshops are planned. The novelty lies in the application to a specific geographic location and the flexibility of

adapting the methods and tools used as required by the context and the facilitator.

- 6) The EDAS approach is not only applicable to sustainable energy and local government, but can also be applied to other sustainability challenges, regional and national governments as well as other organisations.
- 7) The development of the participatory planning approach from first principles of how to deal with complex problems, and incorporating the uncertainty context of a local government, provides a good case study on how to design participatory approaches for a certain objective.

Policy implications also emerged from applying the participatory planning approach to a local government in South Africa. The need for participatory approaches that facilitate structured discussions of complex matters became evident. The main objective with participation, at this stage of the debate on climate change and energy security, should be to create awareness, build trust, establish collaboration with the public and empower those individuals or groups that are willing and able to make a difference. It is therefore encouraged that a participatory planning approach, specifically for complex matters, be institutionalised at local governments and that time and resources are dedicated for long-term planning.

#### **5.4 Limitations of the study and future research directions**

The main limitation of the study is that the research was conducted only at one local municipality in South Africa. The developed participatory approach should therefore be applied and evaluated in other local government contexts to prove its generalisability and to investigate the appropriateness in enabling a sustainable energy future locally. The EDAS approach consists of a continuous cycle of Explore, Design and Act. In order to refine the approach in terms of added detail on the energy strategies and how risk is used to determine a preferred strategy, additional cycles over a period need to be facilitated. An EDAS facilitation guide is included in [Appendix F.1](#) for this purpose.

The participatory planning approach needs refinement in terms of the identification and assessment of risk, which are done to prioritise the designed strategies. None of the current PSMs explicitly identify and assess risks. In addition, risk assessment

methods are more widely used during project implementation and many authors (Aven, 2017; Ioannou *et al.*, 2017; Mihić *et al.*, 2018) propose that risk management in energy planning, but also in general, should become a focal point for future research. Ioannou *et al.* (2017) state that non-statistical risks, such as policy instability, economic instability, lack of public acceptance and restrictions of land availability, are frequently the drivers of failures. Qualitative risk assessment methods (Bowers & Khorakian, 2014) that do not require intensive data demands and are dependent on the subjective opinions of the stakeholders are proposed.

The application of the participatory planning approach at Hessequa Municipality focused specifically on energy sustainability, where energy was defined as electricity, transport and heating. The discussions clearly indicated the interrelationships between energy, water and the economy, or the energy-water-food nexus, but these interrelationships were not explored in detail. A system dynamics model, or similar, is proposed to better understand the energy complexity and their interrelationships at the local level.

The framing of a complex problem is an important aspect that needs consideration when planning a participatory planning approach. The Hessequa Sustainable Energy Journey workshop was specifically framed around the current Eskom crisis of intermittent electricity supply and Eskom's financial position. This framing has established an immediate need for change to ensure energy security. The reduction of greenhouse gas emissions will be a consequence of actions to secure electricity. The discussions that took place during the workshop clearly indicated that short-term financial gains (return on investments) are the primary driver for decision making. The framing of capital investments is mostly based on financial terms such as net present value and payback. However, when it comes to capital investments for sustainability, the point of view must move away from financial gain and should rather consider risk. For sustainability, an insurance mindset is therefore needed. People should not ask what there is to gain, but rather what could be potentially lost if the investment towards a sustainable energy future is not made. Mihić *et al.* (2018) note that social and behavioural aspects are becoming increasingly important for the success of renewable energy projects, and therefore a potential future research question could focus on how people's behaviour can be influenced and mindsets changed to prioritise long-term benefits

and risk aversion, instead of immediate gains towards mitigating climate change. This research question could provide future research directions in the fields of psychology and social sciences.

Future (practical) research studies, specifically for Hessequa, have been proposed as next steps during the Hessequa Sustainable Energy Journey workshop. These studies include the development of a biomass-to-energy strategy for Hessequa, the identification and evaluation of waste-to-energy options, the investigation of possible solar or wind IPPs, determining alternative fuel strategies as well as an investigation of utility-scale energy storage solutions. Smart town planning was also identified as a research opportunity.

Considering the limitations, as discussed above, future research directions should then focus on applying the EDAS approach to more local government contexts as well as public enterprises. Another research focus is to determine how risk factors are being identified in the decision making of sustainable solutions and how these risk factors are used in the deliberation process to influence the decisions, especially in terms of prioritising the different strategies. In terms of moving towards a sustainable energy future, further research could focus on the human behaviour elements regarding sustainable energy decisions, especially on how mindsets can be influenced to focus more on longer-term environmental benefits than on short-term financial gains. In addition, an investigation of which factors will ensure that action is taken at a local government level could form part of future research.

Focusing on public participation at a local government level, a distinction needs to be made between public participation for business-as-usual activities and public participation for complex matters. An investigation should focus on the rationale for participation and consider when the wider public should be involved and how these participants (both stakeholders and the wider public) should be involved.

## **5.5 Personal reflection**

Embarking on the journey to complete a doctoral degree is like opening a can of worms; you think you have a clear idea of what the research will entail, but when starting the research process, you soon realise that there is more to consider than originally thought, and the process soon becomes very complicated and confusing.

The systematic literature review of different participatory planning approaches taught me that there is no one-size-fits-all approach and that detailed consideration should be given to the context in which one would like to develop a participatory approach. The original thinking of the participatory approach was biased towards MCDA, but after conducting the literature review, I came to the conclusion that there are many other suitable approaches that need to be considered, some of which I did not have knowledge of at the time. The combination of different approaches became a viable option. I decided I had to start with a clean sheet and for some time I did not have any idea of what the end product would be. Fortunately, during the time of conducting the research and focusing on understanding the context of local governments in South Africa, I was a part-time lecturer at the University of Stellenbosch Business School in Contemporary Decision-making. The part of the module on which I focused was soft OR, or problem-solving methods, so I could familiarise myself with the subject.

During the same time period I was also working as a management consultant, which taught me how difficult change management is when implementing new systems in an organisation. I realised that change management should not be ignored in the research process and thereby the idea of involving diverse stakeholders in the research process became stronger. My role as a management consultant at the time was to conduct baseline risk assessments for Safety, Health and Environment. Operational risk management in Safety, Health and Environment has become a popular approach in the mining industry since the 1970s when the Australian mining industry suffered many major disasters. Since then, operational risk management has evolved from complying with mining regulations to preventing single fatality events in the first decade of the 21<sup>st</sup> century, and moving towards a control-based approach in the second decade of the 21<sup>st</sup> century (Joy, 2018). I realised that in order to proactively manage future possible natural disasters, impacted by climate change (McAdam, 2014; Sauerborn & Ebi, 2012), risks and control measures need to be incorporated as part of the research as well.

Keeping these ideas at the back of my mind, I continued with the next cycle in the research approach, namely to create an understanding of the problem within a given local government context. Working closely with Hessequa Municipality and having the opportunity to facilitate the True North workshops gave me the

opportunity to understand the inner workings of the municipality and to familiarise myself with the Hessequa area and its people. What stood out during these collaborations was the openness and willingness of Hessequa to implement sustainable energy projects in the municipal area. However, with regard to planning and implementing these sustainable, long-term projects, the municipality is constrained in terms of resources, budget and time. The dependence on external funding and support is key to the success of Hessequa moving to a sustainable energy future.

It is evident from the research that the development of a participatory approach for local energy sustainability was an emerging process, starting with the systematic literature review in Chapter 2 and considering all the possible methodologies, but then converging to soft OR approaches. Soft OR, also named PSMs, was developed from the beliefs of Ackoff (1961, 1979, 1981), Rosenhead (1989, 1996) and Mingers and Rosenhead (2004), to name a few members of the Operational Research Society. The mandate given in Ackermann *et al.* (2014) to mix and combine methods gave me the confidence to develop EDAS, an approach to Explore, Design and Act for Sustainability. Because one is always critical of one's own work, I do see many limitations in the approach, especially with regard to the level of detail delved into when the approach is applied. In addition, I am not entirely comfortable with the step of risk identification and have many questions regarding the similarities and differences between the terms 'risk' and 'uncertainty'. I do, however, believe that the approach is more than sufficient within the context of local governments in South Africa to start the discussions on energy sustainability. The success of the approach lies in the continuation of the discussions and in the cyclic nature of Explore, Design and Act. EDAS is unique due to the flexibility of the approach. It is not a cast-in-stone scientific methodology, but a framework to structure discussions. Different parts of different tools and methods can be used during the steps within each of the segments of EDAS. For example, the step to identify future conditions as part of the *Explore* segment evolved when conducting the case study at Hessequa into using future scenarios, a concept from scenario planning. The nature of EDAS is participative, action-orientated and therefore adaptable dependent on the participants and subject matter experts in the room. With the development of EDAS, I realised that the rigour and scientific design of

the participatory process are important; however, the power of the discussions taking place is even more important. The structure of the participatory approach should be flexible to accommodate the direction of the discussions, but the facilitator should be experienced enough to ensure that the discussions are not side-tracked to a point that the objectives of the workshop are not being realised.

## 5.6 Final word

The South African context of energy sustainability clearly shows that climate change is not one of the main drivers for decision making at a local government level. The current situation of the state-owned utility Eskom provides an opportunity for local governments to move away from electricity generated from fossil fuels and lessen their dependence on Eskom. The implications of the identified barriers and opportunities for local governments in South Africa emphasise that it is important for municipalities in South Africa to be proactive, rather than reactive. High-income citizens, who are also the high-electricity consumers, will move to solar PV power over the next decade. This will have a direct impact on the municipal revenue stream, which means that municipalities should think creatively, in collaboration with municipal stakeholders, on how to deal with this phenomenon. Unfortunately, according to Fast (2019b), the scope for municipalities in improving their diversity of electricity supply is limited in the current uncertain and fluid regulatory environment. The researcher believes that the regulatory environment should not stall local governments to start and continue discussions on how to move to a sustainable energy future, even if the only outcome is to create more awareness.

The research dealt with involving stakeholders in the structuring and understanding of complex problems, such as energy sustainability, at a local government level. As argued by Reed (2008), stakeholder participation needs to be underpinned by a philosophy that emphasises empowerment, equity, trust and learning:

Where relevant, participation should be considered as early as possible and throughout the process, representing relevant stakeholders systematically. The process needs to have clear objectives from the outset and should not overlook the need for highly skilled facilitation. Local and scientific knowledges can be integrated to provide a more comprehensive

understanding of complex and dynamic socio-ecological systems and processes (Reed, 2008: 2417).

A key learning from the research is that we, as humanity, have incredible power in terms of creativity and being innovative. When involving stakeholders in structured discussions about the complex problems we are faced with in the 21<sup>st</sup> century, the output was astonishing. Stakeholders did not only put the issues on the table, but also came up with innovative ideas to better manage these complexities. The willingness to collaborate with local governments further showed that people care and want to make a difference.

I believe that the EDAS approach can make a difference in moving towards a sustainable energy future in South Africa. The more structured discussions researchers and practitioners can facilitate, the closer we can get to understanding the problem of energy sustainability, not only in terms of energy security, but also in terms of climate change. Furthermore, in order to overcome the barriers in terms of legislation, municipalities should continue to exert influence over provincial and national government by taking the lead in enabling and encouraging private sectors to implement sustainable solutions.

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# **Appendix A**

## **Proof of informed consent**

Informed consent in this context means explaining the study's purpose to research participants and obtaining a signed or verbal affirmation that the participants understand the procedures to be used and to consent to participate in the study.

## A.1 Consent from Hessequa Municipality

**HESSEQUA**  
Munisipaliteit / Municipality / U Masipala



*Rig alle korrespondensie aan die Munisipale Bestuurder  
Address all correspondence to the Municipal Manager*

Tel: (028) 713 8000  
Faks / Fax: 086 4015 118  
Posbus / P.O. Box 29, RIVERSDAL(E), 6670  
E-pos / E-mail: [info@hessequa.gov.za](mailto:info@hessequa.gov.za)  
[www.hessequa.gov.za](http://www.hessequa.gov.za) Van den Bergstraat  
RIVERSDAL(E)

Verw./Ref: 16/2/1

Navrae/Enquiries: Mnr J Smit

11 Augustus 2015

Me Elaine Fouche  
Epos: [foucheelaine@sun.ac.za](mailto:foucheelaine@sun.ac.za)

### WIE DIT MAG AANGAAN

### HESSEQUA VOLHOUBARE ENERGIE

Hiermee word bevestig dat Me Elaine Fouche toegang verkry tot Hessequa Munisipaliteit se inligting met betrekking tot volhoubare energie.

Dat Me E Fouche mag deel wees van die proses om data in te samel vir die beplanning van volhoubare energie vir Hessequa.

Ek vertrou dat u bogenoemde in orde vind.

Die uwe

  
**J. JACOBS**  
**MUNISIPALE BESTUURDER**

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#### STREEKKANTORE / REGIONAL OFFICES

ALBERTINIA  
Tel: (028) 713 7858

STILBAAI  
Tel: (028) 713 7831

SLANGRIVIER  
Tel: (028) 713 7892

JONGENSFONTEIN  
Tel: (028) 713 7850

HEIDELBERG  
Tel: (028) 713 8019

GOURITSMOND  
Tel: (028) 713 7855

WITSAND  
Tel: (028) 713 7868

## A.2 Consent from participants of the Hessequa True North workshops



UNIVERSITEIT • STELLENBOSCH • UNIVERSITY  
jou kennisvenoot • your knowledge partner

### STELLENBOSCH UNIVERSITY INFORMATION & CONSENT TO PARTICIPATE IN RESEARCH

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**TITLE OF THE RESEARCH PROJECT:** Development of a participatory planning approach for energy sustainability at a local governmental level.

**RESEARCHER:** Elaine Fouche (foucheelaine@gmail.com)

**ADDRESS:** Faculty of Engineering, Stellenbosch University

**CONTACT NUMBER:** 0836090116

**SUPERVISOR:** Prof Alan Brent (acb@sun.ac.za)

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Dear Participant,

My name is Elaine Fouche and I would like to invite you to participate in a research project entitled the development of a participatory planning approach for energy sustainability at a local governmental level.

Please feel free to ask any questions you might have pertaining to the study, or your proposed participation in the study. This study (SU-HSD-000895) has been approved by the Research Ethics Committee (REC) at Stellenbosch University and will be conducted according to accepted and applicable national and international ethical guidelines and principles.

The research objective of the True North workshops is to gain an understanding of the Hessequa environment and to understand the main strategic priorities of the municipality and what the current constraints are in implementing these strategic priorities. During the workshop, participants will be asked to draw a picture of their 'True North' meaning how they see their future within the municipal area, but then also to note the current issues that the municipality and the community face. Important information for workshop participants:

- The researcher needs input from the participants during the workshop.
- Data will be collected in a workshop setting and represented collectively and not per individual.
- No potential risks or discomforts are foreseen for taking part in the research study.
- Participants will benefit from the research in the form of knowledge transfer, shared learning and networking.
- The researcher will make use of voice recordings during the workshop that will be anonymised and coded.
- All data collected during the workshop will be save guarded in a password protected Dropbox folder.
- The outcome of the workshop will be distributed to municipal management team for further distribution.

If you choose to participate in the workshop, it will be taken to include that you declare the following:

- I have read the above information and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- All issues related to privacy and the confidentiality and use of the information I provide have been explained to my satisfaction.

**RIGHTS OF RESEARCH PARTICIPANTS:** You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché (mfouche@sun.ac.za / 021 808 4622) at the Division for Research Development. You have the right to receive a copy of this consent form.

## A.3 Consent from participants of the Hessequa Sustainable Energy Journey workshop



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### STELLENBOSCH UNIVERSITY INFORMATION & CONSENT TO PARTICIPATE IN RESEARCH

---

**TITLE OF THE RESEARCH PROJECT:** Development of a participatory planning approach for energy sustainability at a local governmental level.

**RESEARCHER:** Elaine Fouche (foucheelaine@gmail.com)

**ADDRESS:** Faculty of Engineering, Stellenbosch University

**CONTACT NUMBER:** 0836090116

**SUPERVISOR:** Prof Alan Brent (alan.brent@vuw.ac.nz)

---

Dear Participant,

My name is Elaine Fouche and I would like to invite you to participate in a research project entitled the development of a participatory planning approach for energy sustainability at a local governmental level.

Please feel free to ask any questions you might have pertaining to the study, or your proposed participation in the study. This study (SU-HSD-000895) has been approved by the Research Ethics Committee (REC) at Stellenbosch University and will be conducted according to accepted and applicable national and international ethical guidelines and principles.

The research aims to support local government through the development of a participatory planning approach for energy sustainability. The study is framed around the understanding of how people make decisions under uncertainty and how they deal with complexity. Participatory Action Research (PAR), in a case study of Hessequa Municipality, is used to involve research participants in the design, the development and the testing (verification) of a participatory planning approach for energy sustainability. Important information for workshop participants:

- A workshop will be held over a 2-day period, where the researcher needs input from the participants.
- Data will be collected in a workshop setting and represented collectively and not per individual.
- No potential risks or discomforts are foreseen for taking part in the research study.
- Participants will benefit from the research in the form of knowledge transfer, shared learning and networking.
- The researcher will make use of voice recordings during the workshop that will be anonymised and coded.
- All data collected during the workshop will be save guarded in a password protected Dropbox folder.
- The outcome of the workshop will be distributed to all participants.

If you choose to participate in the workshop, it will be taken to include that you declare the following:

- I have read the above information and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- All issues related to privacy and the confidentiality and use of the information I provide have been explained to my satisfaction.

**RIGHTS OF RESEARCH PARTICIPANTS:** You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché (mfouche@sun.ac.za / 021 808 4622) at the Division for Research Development. You have the right to receive a copy of this consent form.

## **Appendix B**

### **Original published research papers and declaration of author contributions**

This appendix contains page one of the original published research papers (research abstract) as well as the formal declaration of the scope and nature of the contribution of each author to each publication, in the prescribed format as set out in the requirements for publications that are included in dissertations by Stellenbosch University. As per the Stellenbosch University guidelines, these declarations are not signed in order to keep the signatures of the individuals out of the public domain, however a copy of the signed declarations are in the possession of both the candidate and the primary supervisor, Prof Alan Colin Brent.

## B.1 Research paper 1 abstract and Chapter 2 declaration

Research paper 1 abstract: *Administratio Publica*, 24(4):119–140

# A Literature Review of Energy-planning and Decision-making Approaches in the Local Government Sphere

E Fouché

School of Public Leadership and the Department of Industrial Engineering  
Centre for Renewable and Sustainable Energy Studies  
University of Stellenbosch

A C Brent

School of Public Leadership and the Department of Industrial Engineering  
Centre for Renewable and Sustainable Energy Studies  
University of Stellenbosch

### ABSTRACT

Planning for energy sustainability should be a top priority for local governments, especially in a time when the South African electricity public utility, Eskom, is struggling to ensure supply and climate change is an unavoidable concern. This article provides a synthesis of planning and decision-making literature in order to inform the development of a framework for local government to facilitate decision-making regarding sustainable energy futures. For effective planning and decision-making it is argued that the involvement of all stakeholders is vital, mainly due to the complexity of today's sustainability problems, which are embedded in social, economic, political and environmental contexts. Hence, a detailed analysis of current approaches inclusive of stakeholder participation elicited the current advantages, limitations and factors regarding the successful implementation of participatory approaches. From the review, a checklist of the factors necessary for the successful development and implementation of a participatory approach was compiled. The authors suggest that the checklist can inform the development of an energy-planning and decision-making framework for local government to facilitate mutual understanding of the problem, incorporate all stakeholders' values and, ultimately, provide better trust and acceptance of future energy decisions.

**Declaration by the candidate:**

The candidate's contribution, with regard to the original research paper on which [Chapter 2](#) (pages 40–60) is based, is as follows:

Nature of contribution	Extent of contribution (%)
The candidate conceptualised and executed the research, wrote the research paper, incorporated periodic feedback from her supervisor/co-author, and improved the research paper in response to feedback received during the journal's peer-review process.	90%

The following co-authors contributed to the article presented in Chapter 2 (pages 40–60):

**Prof Alan Colin Brent (Email: [acb@sun.ac.za](mailto:acb@sun.ac.za))**

Nature of contribution	Extent of contribution (%)
Prof Brent provided overall supervision during the research period. He offered alternative perspectives during the conceptualisation phase, gave periodic feedback during the writing of the research paper and reviewed the final paper before submission to the academic journal. Prof Brent further assisted with the decision-making process when feedback was received during the journal's peer-review process.	10%

Date and signature of candidate: *Declaration with signature in possession of candidate and supervisor.*

**Declaration by co-authors:**

The undersigned hereby confirm that

1. the declaration above accurately reflects the nature and extent of the contributions of the candidate and the co-authors to the research paper included as part of Chapter 2 (pages 40–60),

2. no other authors contributed to the research paper besides those specified above, and
3. potential conflicts of interest have been revealed to all interested parties and that the necessary arrangements have been made to use the material in Chapter 2 (pages 40–60) of this dissertation.

Name	Signature	Institutional affiliation	Date
<b>Prof Alan Colin Brent</b>	<i>Declaration with signature in possession of candidate and supervisor</i>	Stellenbosch University	

## B.2 Research paper 2 abstract and Chapter 3 declaration

Research paper 2 abstract: *Sustainability*, 11(3):1–18




Article

### Journey towards Renewable Energy for Sustainable Development at the Local Government Level: The Case of Hessequa Municipality in South Africa

Elaine Fouché <sup>1,\*</sup> and Alan Brent <sup>1,2</sup> 

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<sup>2</sup> Sustainable Energy Systems, School of Engineering and Computer Science, Victoria University of Wellington, Wellington 6012, New Zealand; alan.brent@vuw.ac.nz

\* Correspondence: fouchelaine@gmail.com or fouchelaine@sun.ac.za; Tel.: +27-83-609-0116

Received: 12 December 2018; Accepted: 26 January 2019; Published: 31 January 2019 

**Abstract:** The purpose of the research on which this article reports was to investigate how renewable energy forms part of the strategy of a local government, and to evaluate how participatory processes are utilised in the development and communication of this municipal strategy. The research was conducted with Hessequa Municipality, a local authority situated in the Western Cape Province of South Africa. A new aspect of the research was an attempt to consider renewable energy options as part of the municipal strategy, and not as a standalone project. Action research was undertaken and the resulting qualitative data were analysed using thematic analysis. Cognitive mapping was used to display the data and to analyse the causal relationships between different strategic themes. The causal relationships explicitly show that many opportunities for renewable energy solutions are evident in the form of: biomass-to-energy, low-carbon local economic development, small-scale embedded generation, waste-to-energy, and feed-in tariffs. The barriers for implementation are aging infrastructure and financial and legislative constraints. Participatory processes formed an integral part of the strategy formulation, and a unique visualised strategy was developed for communication with local citizens—a first for a local municipality in South Africa.

**Keywords:** participatory processes; renewable energy; strategy; municipality; cognitive map; action research; qualitative; energy autarky; South Africa

---

#### 1. Introduction

The case for renewable energy solutions, such as solar energy, wind energy, hydropower and biomass, is robust in South Africa. The country has the third largest solar resource in the world, with an average of more than 2500 h of sunshine per year and average solar radiation levels ranging between 4.5 and 6.5 kWh/m<sup>2</sup> in one day [1]. Wind also shows enormous potential in South Africa, with 6422 MW of electricity procured through the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and 3776 MW of electricity generation capacity connected to the national grid by June 2018 [2]. According to the Renewable Energy Status Report [1], the cost of solar photovoltaic (PV) technologies decreased by 83% from the REIPPPP Bid Window 1 to R 0.62/kWh, or USD 0.05/kWh. The onshore wind price decreased by 59% over the same period.

South Africa is a signatory of the Kyoto Protocol and the United Nations Framework Convention on Climate Change and, as such, has an obligation to mitigate climate change. The policy landscape enables the implementation of renewable energy technologies and promotes ecologically sustainable development and the use of natural resources [3]. The 1998 White Paper on Energy Policy [4], the 2003

*Sustainability* **2019**, *11*, 755; doi:10.3390/su11030755
[www.mdpi.com/journal/sustainability](http://www.mdpi.com/journal/sustainability)

**Declaration by the candidate:**

The candidate's contribution, with regard to the original research paper on which [Chapter 3](#) (pages 61–87) is based, is as follows:

Nature of contribution	Extent of contribution (%)
The candidate conceptualised and executed the research, wrote the research paper, incorporated periodic feedback from her supervisor/co-author, and improved the research paper in response to feedback received during the journal's peer-review process.	90%

The following co-authors contributed to the article presented in Chapter 3 (pages 61–87):

**Prof Alan Colin Brent (Email: [acb@sun.ac.za](mailto:acb@sun.ac.za))**

Nature of contribution	Extent of contribution (%)
Prof Brent offered support throughout the study and provided suggestions and comments on the article. He offered alternative perspectives during the conceptualisation phase, gave periodic feedback during the writing of the research paper and reviewed the final paper before submission to the academic journal. Prof Brent further assisted with the decision-making process when feedback was received during the journal's peer-review process.	10%

Date and signature of candidate: *Declaration with signature in possession of candidate and supervisor.*

**Declaration by co-authors:**

The undersigned hereby confirm that

1. the declaration above accurately reflects the nature and extent of the contributions of the candidate and the co-authors to the research paper included as part of Chapter 3 (pages 61–87),

2. no other authors contributed to the research paper besides those specified above, and
3. potential conflicts of interest have been revealed to all interested parties and that the necessary arrangements have been made to use the material in Chapter 3 (pages 61–87) of this dissertation.

Name	Signature	Institutional affiliation	Date
<b>Prof Alan Colin Brent</b>	<i>Declaration with signature in possession of candidate and supervisor</i>	Stellenbosch University	

## B.3 Research paper 3 abstract and Chapter 4 declaration

Research paper 3 abstract: *Sustainability*, 12(3):1–18


*sustainability*


Article

### Explore, Design and Act for Sustainability: A Participatory Planning Approach for Local Energy Sustainability

Elaine Fouché <sup>1,\*</sup>  and Alan Brent <sup>2</sup>

<sup>1</sup> Department of Industrial Engineering and the Centre for Renewable and Sustainable Energy Studies, Stellenbosch University, Stellenbosch 7602, South Africa

<sup>2</sup> Department of Industrial Engineering, Stellenbosch University, and Sustainable Energy Systems, School of Engineering and Computer Science, Victoria University of Wellington, Wellington 6140, New Zealand; alan.brent@vuw.ac.nz

\* Correspondence: fouchelaine@gmail.com

Received: 19 December 2019; Accepted: 16 January 2020; Published: 23 January 2020 

**Abstract:** This paper focuses on the development of a participatory planning approach for local energy sustainability. The characteristics of a complex problem were reviewed to establish that the problem of sustainable energy at a local government level is complex. In order to better manage complex problems, the literature shows that soft operational research or problem-structuring methods need to be applied, and hence these methods were used as a starting point for developing a participatory planning approach. The requirements for a planning approach were elicited, namely that the approach must be participative and inclusive, holistic, simple and transparent. In addition, the approach must include the identification and assessment of risks as part of the deliberation process, the development of a realistic action plan must be attainable at the end of the stakeholder engagement, the approach must be dynamic, and should be formalised with clear institutional arrangements. A novel participatory approach, namely EDAS—to Explore, Design and Act for Sustainability—was then developed, applied, and evaluated as part of a case study with a local municipality in the Western Cape Province of South Africa. The insights are relevant not only for local governments, but for any institution on a journey towards sustainability.

**Keywords:** energy sustainability; local government; problem structuring; stakeholder involvement; climate change; group decision support; action research; collaborative governance; deliberation

---

#### 1. Introduction

Moving to a low-carbon energy economy requires changing the current energy landscape. This is a complex problem encompassing a broad set of aspects, such as changes in technologies, energy networks and infrastructure, social practices, public attitudes, policies and regulations, to name a few [1–4]. Consistently providing affordable energy services, achieving security of energy supplies and reducing carbon emissions require the deployment of low-carbon technologies and energy-efficiency measures, of which the costs and benefits are often uncertain [2].

Sustainable energy is a principle in which the use of energy “meets the needs of the present without compromising the ability of future generations to meet their own needs”, and has two key components, namely: renewable energy, and energy efficiency [5] (p. 10). Renewable energy is generated by resources that are self-replenished, such as wind, solar, biomass and hydro power [6]. Energy efficiency, on the other hand, includes using less energy (kWh) to achieve the same benefits [5].

In order to deal with the uncertainties and complexities in the transitioning to a sustainable energy system, it is argued that diverse stakeholders must be involved from the start of the process [7–9].

*Sustainability* 2020, 12, 862; doi:10.3390/su12030862
[www.mdpi.com/journal/sustainability](http://www.mdpi.com/journal/sustainability)

**Declaration by the candidate:**

The candidate's contribution, with regard to the original research paper on which [Chapter 4](#) (pages 88–131) is based, is as follows:

Nature of contribution	Extent of contribution (%)
The candidate was responsible for the conceptualisation, formal analysis and execution of the research. She wrote the research paper, incorporated periodic feedback from her supervisor/co-author, and improved the research paper in response to feedback received during the journal's peer-review process.	90%

The following co-authors contributed to the article presented in Chapter 4 (pages 88–131):

**Prof Alan Colin Brent (Email: [acb@sun.ac.za](mailto:acb@sun.ac.za))**

Nature of contribution	Extent of contribution (%)
Prof Brent offered supervision throughout the research period. He supported the candidate during the conceptualisation phase, gave periodic feedback during the writing of the research paper and reviewed the final paper before submission to the academic journal. Prof Brent further assisted with the decision-making process when feedback was received during the journal's peer-review process.	10%

Date and signature of candidate: *Declaration with signature in possession of candidate and supervisor.*

**Declaration by co-authors:**

The undersigned hereby confirm that

1. the declaration above accurately reflects the nature and extent of the contributions of the candidate and the co-authors to the research paper included as part of Chapter 4 (pages 88–131),

2. no other authors contributed to the research paper besides those specified above, and
3. potential conflicts of interest have been revealed to all interested parties and that the necessary arrangements have been made to use the material in Chapter 4 (pages 88–131) of this dissertation.

Name	Signature	Institutional affiliation	Date
<b>Prof Alan Colin Brent</b>	<i>Declaration with signature in possession of candidate and supervisor</i>	Stellenbosch University	

## Appendix C

### C.1 Ten rich pictures developed during the Hessequa True North workshops

**Session: 5 May 2016**  
**1. Kaleidoscope**



Hessequa, with their people in the center, is like a rough diamond. The beauty lies in the different fractions when the diamond is formed... as shown in the picture (See numbers).

1. A more caring society: The picture shows the importance of life and the clock that is ticking... we need to care for each other... be conscious and mindful of each other. Also needs to improve Health Care.
2. Healthy economy: Group told the story of uniqueness of Hessequa where their Gini-coefficient over the past 10 – 15 years.... The objective is not to become the richest of the richest. The scale represent the balance. The tree and the fruit represent an economy from which people can live, provide, grow and develop . (Quality of life)
3. The jewel of Hessequa: The jewel within Hessequa needs to be protected and developed. To do this the diverse community needs to take hands and do it together.
4. Telling the world about Hessequa through a website and social media. Have a revolving door policy. People can come and go any time to visit or to stay long-term.

**Session: 5 May 2016**  
**2. Turning threats into opportunities**



This group focused on more specific issues and how these issues (threats) can be turned into opportunities:

1. Reduce current waste problem through recycling
2. Happy People – Promote tourism, educate people, providing jobs, healthy lifestyle etc.
3. Environmental management – get rid of alien plants, protect the environment.
4. Infrastructure development such as health care, alternative energy and water security.
5. Change informal settlements to providing formal housing.
6. Grow the economy through making it easier for businesses to employ people and do business (reducing red tape) – also provide education opportunities through the business sector.
7. Use the current structures - N2 to promote Hessequa's revolving door and the railway for transporting people to their workplace.

## Session: 5 May 2016

### 3. Pathway to the True North



The True North should aim at creating a place which is attractive for people to live in and to grow and develop. It should comprise of the following:

- Happy people
- Sustainable infrastructure and economy
- Crime-free
- Recreational activities
- Formal housing
- Protecting the environment
- Educated people

We need to know which road will take us to the True North and need to be aware of the different detours (distractions that can lead us away from the right pathway).

Factors that can influence the True North are:

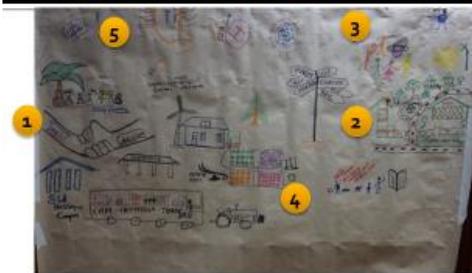
- Climate change which is causing droughts that leads to hunger.
- Political instability
- Natural disasters such as floods, fires, droughts
- Crime
- Health Care
- Infrastructure such as power, water and housing
- The environment
- Unrealistic expectations of stakeholders (Communities; Municipal Management; Business Owners; Tourists, etc.)

We will be able to see the warnings signs through:

- Good municipal management
- Stable political situation in area
- Constitution, law, compliance
- Clear mission and vision ("GDP")
- Spatial development plan
- Solid financial plan

## Session: 5 May 2016

### 4. World-class Hessequa



Hessequa should be a world-class destination where tourists from all over the world would like to come and visit. The following themes were mentioned:

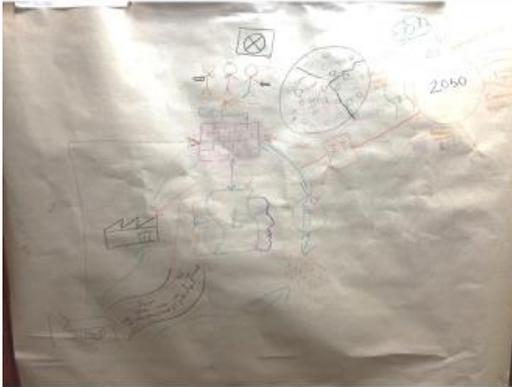
- 1) Ethical: integrity
- 2) Esthetics: Spatial development for a sustainable future. Happy people, good infrastructure, education opportunities
- 3) Government & politics: Venn diagram – commit to the things that we agree on and acknowledge and accept the things we do not agree on. Ensure that we have aligned goals.
- 4) Economy – People need to be willing to work. Start with educating and developing the children (our future workforce).
- 5) Build on the current successes: Blue flag beaches; Railway; Social forums etc.

All of these things are interconnected.



## Session: 26 May 2016

### 7. Key to unlock the True North



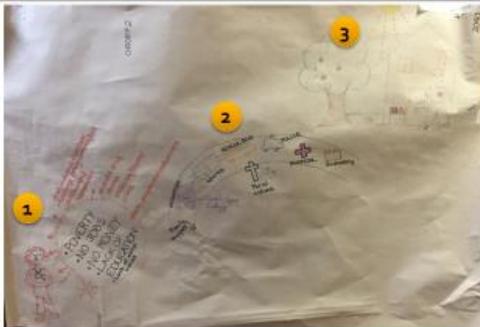
**The Ideal Future:** A built, supported and sustainable environment. Find opportunities, which will require and provide the opportunity for community members to development skills. Current artificial Communities – but people have choice to stay where they want.

**The inputs towards die Ware Noord include:**

- Create opportunities for the promotion of an equal diverse community.
- How do we give them the key to take their opportunities?
- Promote the spirit cooperation between residents in the community.
- Depict a circle of different cultures working together towards one goal.
- Create platforms where people see more of each in other spaces than at Spar.
- Move towards integrated spatial planning and create safe, healthy communities.
- If we can move in the right direction and feel safe amongst each other we would have progress.

## Session: 26 May 2016

### 8. Bridge to the future



1. Current situation:
  - Many children at all grades are leaving school. The circle shows the influences which make children leave school. This needs to be stopped.
  - Elderly on pension are forced to work for their grandchildren and probably get the young children to work too in order support their families.
2. Bridge to the future includes:
  - Inclusiveness; a negotiated standard of living between the people of Hessequa
  - The future is a happy healthy family with work and (self-realisation)
  - Need family support to break the circle of poverty (and lost education)
  - An Education system that provides for skills training
  - The need of health and security for people to thrive
  - Industry (illustrated) to increase the number of businesses and employed residents
3. The True North are represented by
  - A person in the future who has books, health and nature around him with green energy and healthy food.
  - Sustainable energy from the sun that shines on everyone.
  - "Self-sustainable life": People are looking at being less dependent on people and able to grow their own food etc.
  - Just do it – Nike tekkies show agility and movement.

## Session: 26 May 2016 9. Building on the past



Introduced dysfunctional society but here are books that can be used.

Build some bridges to give people access to the "True North"

Develop a philosophy around skills, love and cooperation

What can we use and have access to at the moment to work towards die Ware Noord:

- the land for agriculture
  - N2 as corridor to three of the towns to boost and promote tourism in the area
  - Train & railway
  - Further education and training facilities
- To keep the knowledge in Hessequa
- Tourism (Umbrellas)
  - Energy (renewables) – wind energy – solar energy
  - Invasive trees which can be used to help the petrol issue
  - Use the resources currently available to empower people, for example, Libraries/ gov dept etc.

## Session: 26 May 2016 10. Pathway to the True North



In order to move towards the True North Hessequa needs to reposition itself. Currently there are different factors that prevent a move towards the True North

### Inputs towards die Ware Noord includes:

- Need to identify activities which will be employed in the interests of Hessequa
- Working together = "Saam vorentoe" towards a community that solves its own needs.
- Political stability
- Infrastructure (water electricity etc)
- Everyone working with nature that is sustainable
- Economic sustainability with new opportunities
- The sun shines on everyone

# Appendix D

## D.1 Hessequa Sustainable Energy Journey workshop agenda



**Aim: To establish a holistic sustainable energy plan for the next 30 years**

**DAY 1: Wednesday, 10 July 2019**



Agenda Item	Who	Time
Registration		8h30
Opening and welcoming	Hessequa Executive Mayor: Grant Riddles	9h00
Keynote: Energy vision of the Western Cape	Dr Hildegard Fast	9h30
Progress and prospects of renewable energy (SA vs World)	Centre for Renewable and Sustainable Energy Studies (CRSES): Ndamulelo Mararakanye	10h15
<b>Tea Break</b>		<b>10h45</b>
Aim of the workshop and expectations	Facilitator: Elaine Fouche	11h15
 Worksession 1: <b>EXPLORE</b> and envisage the future	Group sessions	12h00
<b>Lunch</b>		<b>12h30</b>
 Worksession 1: <b>EXPLORE</b> and envisage the future (cont.)	Feedback	13h30
 Worksession 2: <b>EXPLORE</b> renewable energy options	Group sessions and feedback	14h00
<b>Comfort Break</b>		<b>15h00</b>
Worksession 3: Uncertainties	Group sessions and feedback	15h15
Closing	Municipal Manager: Johann Jacobs	16h00
<b>Gin Tasting and Dinner</b>		<b>18h00</b>

Hessequa Municipality in collaboration with University Stellenbosch invites you to be part of

**A SUSTAINABLE ENERGY JOURNEY**

**10 – 11 July 2019**  
09h00 – 16h00  
Town Hall, Municipal Offices, Van den Berg Street, Riversdale

**AGENDA**

DAY 2: Thursday, 11 July 2019



Agenda Item	Who	Time
Registration		8h30
Opening	Municipal Manager: Johann Jacobs	9h00
A system's perspective	Facilitator: Elaine Fouche	9h30
<b>EXPLORE:</b> Possible future scenarios	Johannes van Zyl	10h00
Worksession 4: <b>DESIGN:</b> Name the Hessequa Sustainable Energy System	Facilitator: Elaine Fouche	10h15
<b>Tea Break</b>		10h45
Worksession 5: <b>DESIGN</b> sustainable energy strategies	Group sessions and feedback	11h15
Worksession 6: Evaluate the sustainable energy strategies	Group sessions	12h00
<b>Lunch</b>		12h30
Worksession 6: Evaluate the sustainable energy strategies (cont.)	Feedback	13h30
Worksession 7: <b>ACT</b>	Facilitator: Elaine Fouche	14h00
<b>Comfort Break</b>		15h00
Evaluation of workshop		15h15
Closing of Workshop	Hessequa Executive Mayor: Grant Riddles	15h30

## D.2 Hessequa Sustainable Energy Journey workshop evaluation form



### Hessequa Sustainable Energy Workshop Evaluation

Please rate the workshop by marking the box that most accurately reflects your opinion:

	Excellent	Above Average	Average	Below Average	Poor
1) How would you rate the amount of new information learned?					
2) How would you rate the workshop in terms of meeting your expectations?					
3) How would you rate the materials/slides presented?					
4) How would you rate the facilitation skills?					
5) How would you rate the speakers?					
6) How would you rate participatory decision-making of Hessequa?					

Kindly answer the following questions regarding the workshop:

7) What was the most valuable information you learned during the workshop?

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8) In your opinion, do you think the outcome of the workshop was sufficient for what could be achieved within the 2-days available for the workshop? Please explain.

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9) In your opinion, how can local governments improve participatory decision-making?

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10) What is your opinion about the **EDAS** process (Explore, Design and Act for Sustainability), followed during the workshop?

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### Hessequa Sustainable Energy Workshop Evaluation

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11) Which part of the **EDAS** process (Explore, Design and Act for Sustainability), was the most valuable to you? Why?

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12) Do you think that the **EDAS** process (Explore, Design and Act for Sustainability) could work in other local government settings within South Africa? Please explain

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13) Any other comments?

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**Thank you for your participation and feedback**

## Appendix E

### **E.1 The barriers, obstacles, opportunities and strengths of implementing sustainable energy solutions at a local government level in South Africa**

To understand the local South African energy landscape, the researcher identified the current barriers hampering and the opportunities driving the implementation of sustainable energy at a local government level in South Africa. These barriers and opportunities have been identified in literature as well as through the discussions held with the municipal stakeholders during informal interactions as well as formal workshops.

To summarise the barriers and opportunities, a differentiation is made between external factors (those things not within control of the municipality), in this case barriers (also known as threats) and opportunities, and internal factors, namely obstacles (or weaknesses) and strengths. The discussion of the barriers and opportunities is general to all local governments in South Africa. The key obstacles and strengths that are discussed here are specific to Hessequa Municipality and might or might not be relevant to other local governments in South Africa.

#### **Barriers**

Two key barriers that are hampering the implementation of sustainable energy solutions at the local level are the current legal and regulatory environment, which is uncertain and volatile (*Comello et al.*, 2018; Fast, 2019c; Fischer *et al.*, 2011; Nel, 2015), and the cost of renewable energy technologies (Fischer *et al.*, 2011; Mararakanye & Korsten, 2019).

The International Renewable Energy Agency (IRENA), an intergovernmental organisation that supports countries in their transition to a sustainable energy future, shows a decline in 2018 in the weighted average cost of electricity from renewables and is forecasting these declining electricity cost from renewables to continue beyond 2020 (IRENA, 2019). While the cost of renewable energy is decreasing, the Eskom rates are increasing year on year and surpassed 90c/kWh in 2018. The question is therefore, why do we not see more people in South Africa

moving to renewable energy? The complexity of the situation needs to be taken into consideration. The process of giving up what one already has (current Eskom electricity) and spending money on converting one's electricity system into a renewable energy system is not that simple, especially in a time where economic growth in South Africa is slow. Echoing Fischer *et al.* (2011), Msimanga and Sebitosi (2014) state that it is not only a matter of initial capital investment, but also of high upfront planning and transactional costs. Return on investment carries the greatest weight when it comes to a transition to sustainable energy. In addition, local governments are constrained in terms of their annual budgets and are reluctant to invest large amounts of capital for which they will only see the benefits beyond the five-year term in which a council is in control, especially within an uncertain legal and regulatory environment. In order to overcome the barrier of the regulatory environment, Nel (2015) proposes that policy should focus more on managing the interface between private and public partnerships through increased consensus building, greater transparency, enhanced stakeholder management, more effective administration and improved decision making. Recently advocated is a more holistic and integrated renewable energy governance effort by firstly recommending a single governmental institution in control of the regulation of renewable energy, secondly proposing an integration of the various policies and pieces of legislation relating to renewable energy and thirdly building this new renewable energy framework law through a wide public participation process (Mauger & Barnard, 2018).

## **Obstacles**

One of the main internal obstacles mentioned during the Hessequa Sustainable Energy Journey workshop is linked to the organisational structure of the Director: Technical Services. The focus on operational management such as repairs and maintenance, electromechanical services, sanitation and open space management tends to take up most of the department's time and resources, resulting in limited focused time available for renewable energy planning, and therefore slow progress. The financial system of the municipality is another obstacle, especially when implementing a feed-in tariff and SSEG policy. The financial system currently cannot accommodate net billing and needs to be upgraded. Finally, the current commercial tariff structures, especially the maximum

demand tariff, are constraining businesses to invest in SSEG. For municipalities to take on the role of custodian and facilitator of sustainable energy, focused time and resources need to be made available either by appointing a sustainable energy coordinator in the municipal structure or by establishing a dedicated sustainable energy forum, which is a dual responsibility between the municipality and its stakeholders.

## **Opportunities**

One of the main opportunities for moving to a sustainable energy future in South Africa is the solar potential, with an average of more than 2 500 hours of sunshine per year. South Africa's Northern Cape is one of the most attractive resource areas in the world (Get.invest, n.d.). It is of interest to note that Germany, with a solar potential of approximately 1 600 hours of sunshine per year, has already installed a total of 25 000 MWp of PV power (60% of the country's capacity). According to CRSES, South Africa's current installed capacity is 700 MWp (Mararakanye & Korsten, 2019). Other forms of renewable energy, such as wind, hydropower and biomass, also show potential. Although perceived as a current barrier, the researcher strongly believes that the current downward trend of the cost of renewable energy technologies is an opportunity for investment. An interesting finding during the Hessequa Sustainable Energy Journey workshop was that the current position of state-owned utility Eskom, with the possibility of future load shedding and aging infrastructure, is perceived by stakeholders as an opportunity to change their current energy landscape, and not as a threat. Evident is the role the reliability of electricity supply plays in electricity consumers' decision making and behaviour. These findings are in line with findings from a household solar energy survey conducted by CRSES, which concluded that social and financial factors are the most important for decision making (Mararakanye & Korsten, 2019).

## **Strengths**

A strength unique to Hessequa Municipality is that it has a generation license. This is perceived as a strength for when the municipality is ready to invest in IPPs. Currently, the amendment of Section 1 of the Electricity Regulation Act 4 of 2006 (RSA, 2008) is aimed at encouraging municipal electricity generation. Small-scale projects of generating up to 1 MW will be exempted from NERSA licencing. This

allows businesses and the municipality to install PV infrastructure to reduce their carbon footprint, while saving on electricity costs. The trading of electricity still has to be registered at NERSA in terms of Sections 8 and 9 of the Electricity Regulation Act 4 of 2006 (RSA, 2006). Unfortunately, when it comes to buying electricity directly from IPPs, Eskom is the single buyer, which means that municipalities cannot purchase electricity directly from IPPs. The City of Cape Town is currently in a court case to implement a Section 34 determination, in accordance with the New Generation Capacity Regulations in the Electricity Generation Act, to allow municipalities to procure up to 400 MW of renewable energy directly from IPPs (Sicetsha, 2019; Somdyala, 2019).

### **Concluding remarks**

The South African context of energy sustainability clearly shows that climate change is not one of the main drivers for decision making at a local government level. The current situation of the state-owned utility Eskom provides an opportunity for local governments to move away from electricity generated from fossil fuels and lessen their dependence on Eskom. The implications of the identified barriers and opportunities for local governments in South Africa emphasise that it is importance for municipalities in South Africa to be proactive, rather than reactive. High-income citizens, who are also the high-electricity consumers, will move to solar PV power over the next decade. This will have a direct impact on the municipal revenue stream, which means that municipalities should think creatively, in collaboration with municipal stakeholders, on how to deal with this phenomenon. Unfortunately, according to Fast (2019b), the scope for municipalities in improving their diversity of electricity supply is limited in the current uncertain and fluid regulatory environment. The researcher believes that the regulatory environment should not stall local governments to start and continue discussions on how to move to a sustainable energy future, even if the only outcome is to create more awareness.

## **Appendix F**

### **F.1 EDAS Facilitation Guide**



**FACILITATOR  
GUIDE**

**EDAS**  
EXPLORE, DESIGN AND ACT FOR SUSTAINABILITY



CENTRE FOR RENEWABLE AND SUSTAINABLE ENERGY STUDIES





# TABLE OF CONTENTS

BACKGROUND	2
AIM	2
WHAT IS EDAS?	3
ROLE OF THE FACILITATOR	6
HOW TO FACILITATE EDAS	
1. EXPLORE to determine sustainable options and future conditions	8
2. DESIGN desirable sustainable strategies	12
3. ACT for sustainability	14
CONCLUSION	15
REFERENCES	16

## BACKGROUND

Local governments in South Africa faces a challenging time in dealing with many complex problems, such as energy security and climate change, water security, local economic development and poverty, to name a few. In order to deal with these complex problems at a local government level, stakeholder involvement is crucial. Participation of stakeholders should be underpinned by a philosophy of empowerment, equity, trust and learning. Public participation is a democratic right of all South African citizens, and although this is stipulated in the Constitution of South Africa, limited evidence could be found in literature on how public participation is being facilitated as well as of its effectiveness.

To address this knowlegde gap, a participatory planning approach for local sustainability was developed, namely Explore, Design and Act for Sustainability (EDAS). The rationale for the approach is to provide a step-by-step process to facilitate information sharing and discussions on local sustainability. The EDAS approach has been initially developed for energy sustainability, but can be applied to any sustainability problem. The EDAS approach is participative and inclusive, holistic, simple, transparent, dynamic and include the identification and assessment of risks. The output of the approach is a realistic action plan for sustainability.

### AIM

This document aims to provide the facilitator of the EDAS approach with a practical step-by-step guideline to effectively lead the discussions on sustainability. It is recommended that the chosen facilitator have a good understanding of complex problems and problem-structuring methods in the field of soft operational research.



## WHAT IS EDAS?

The approach, Explore, Design and Act for Sustainability (in short EDAS) is a participatory planning approach that stems from multidisciplinary theories, techniques or parts of methods in the fields of soft operational research, systems thinking, decision analysis, strategy, and facilitation. EDAS involves stakeholders and integrates local and scientific knowledge to provide a comprehensive understanding of complex and socio-ecological systems and processes. The issues that could be dealt with using the EDAS approach are specifically focused on sustainability, such as the Sustainable Development Goals of the United Nations. EDAS structures the discussions and debate to explore and envisage the future; to identify sustainable options, uncertainties, obstacles and barriers; to name the envisaged system; to design sustainable strategies; and to evaluate the strategies against the possible futures. The EDAS approach is participative, inclusive, holistic, simple, transparent and dynamic. The main outputs of the EDAS approach are a realistic action plan and the establishment of ongoing stakeholder collaboration.

The EDAS approach consists of the following three segments:

- 1 **Explore** to determine sustainable options and future conditions
- 2 **Design** desirable sustainable strategies
- 3 **Act** for sustainability

The three segments of the EDAS approach, namely Explore, Design and Act, form a continuous cycle that represents a dynamic process of acquiring knowledge continuously and then acting based on the acquired knowledge. The theoretical grounding and the different steps in the approach is shown in the EDAS cycle presented in Figure 1. The EDAS approach was developed as part of a doctoral dissertation (Fouché, 2020).

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<sup>1</sup>Seventeen Sustainable Development Goals (SDGs) have been adopted by all United Nations member states in 2015. Broad ownership of the SDGs must translate into a strong commitment by all stakeholders to implement these goals. For more information on the SDGs, see <https://sustainabledevelopment.un.org/sdgs>

Figure 1





## ROLE OF THE FACILITATOR

The facilitator's role in EDAS approach is as follows:

- To understand the context and develop objectives, for the approach as well as the workshop
- To assist with the planning
- To remain neutral and objective throughout the process
- To keep discussions during the workshop focused and energised
- To create an environment for all to have a chance to participate
- To be the gatekeeper
- To ensure that the workshop's objectives and expectations are met.

The role of the facilitator needs to be explained at the start of the intervention to all participants.

### HOW TO SUCCESSFULLY PLAN THE EDAS WORKSHOP

Prior to starting with the EDAS workshop, the facilitator should have a good understanding of the context in which the approach is being applied. An understanding of the context and the local environment can be established through interactions with the stakeholders living and doing business within the area. Techniques such as interviews, observations, rich pictures, cognitive mapping or other visualisation tools can be used to establish an understanding of the context. The aim is to gain the trust of the sponsors of the workshop and to ensure that clear workshop objectives are established. In addition, it is important to plan and consider the stakeholders that need to be part of a workshop on sustainability issues. The facilitator should ensure that a diverse group of stakeholders is engaged, inclusive of subject matter experts, the decision-makers as well as representatives of the wider community.

It is advised that the facilitator be part of the workshop planning. The facilitator will have to assist with developing the workshop agenda and finalising the participant list, provide assistance in sending out workshop invitations to the participants and assist in the detail organisation of the workshop (such as what is needed in terms of room layout, guest speakers, stationery, technology, meals and refreshments).

The checklist provided in Table 1 is useful when planning the EDAS workshop.



Table 1 Checklist to successfully plan and implement a participatory approach

No.	What	Possible how
1.	Follow a holistic and integrated approach.	EDAS has been developed for this purpose
2.	Select a diverse group of stakeholders to participate from the start.	Stakeholder mapping/analysis; personal invitations
3.	Carefully consider how to involve the stakeholders.	Open discussions / group discussions / individual interviews
4.	Ensure that a strong mandate and political support are provided for the workshop.	Top-down communication of initiative; part of existing policy development or change process
5.	Ensure sound facilitation skills.	Appointment of knowledgeable and experienced facilitator
6.	Communicate the rationale for participation and agree on clear objectives from the start.	Communication strategy
7.	Communicate the role of the researcher/facilitator.	Communication strategy
8.	Establish rules from the start.	Communication strategy
9.	Ensure that the consequences of the process for decision making are clear to all participants.	Communication strategy
10.	Include reflexivity and realism as part of the process.	Evaluation form and discussion after each session
11.	Underpin the process by a philosophy of empowerment, equity, trust and learning.	Clear communication of open and transparent process
12.	Select and tailor methods to the decision-making context, types of participants and level of engagement.	Comparison and inclusion of different methods
13.	Ensure that local and scientific knowledge are integrated.	Integrated approach followed
14.	Institutionalise participation.	Empowerment of local government management; formalisation of the process
15.	Make participation free and voluntary.	Rules during intervention (links to 8)
16.	Only exercise force of the better argument.	Rules during intervention (links to 8)
17.	Ensure that all parties are formally and substantively equal in voice.	Rules during intervention (links to 8)
18.	Ensure that the approach aims to arrive at a rationally motivated consensus.	Rules during intervention (links to 8)

# HOW TO FACILITATE EDAS: EXPLORE



## 1. Explore to determine sustainable options and future conditions

The first segment in the EDAS approach, Explore, aims to determine plausible sustainable options within a given context. The Explore segment consists of three steps, namely a) envisage the future, b) determine sustainable options and c) identify future conditions. These three steps take place during a stakeholder workshop. The participants are divided into groups and three questions are asked. An analysis of potential future conditions is also conducted.

*Table 2 Steps of the Explore segment*

<b>a) Envisage the future</b>	Q1: How do you foresee the specific local area within 30 years from now?
<b>b) Determine sustainability options</b>	Q2: Which sustainable (energy/water/other) options do you perceive as being plausible in the given context when considering the envisaged future? Q3: What are the obstacles (within our control) and barriers (not within our control) to successfully implement these sustainable (energy/water/other) options?
<b>c) Identify future conditions</b>	PESTLE analysis, scenario planning or similar technique

### a) Envisage the future

The stakeholder workshop should aim at opening the minds of the participants through showing, presenting and discussing the current trends regarding sustainability. Presentations by guest speakers knowledgeable in the field under consideration could also help in setting the scene of the workshop.

After setting the scene, the facilitator briefly discusses the EDAS approach with the participants and starts with the first question:

**Q1: How do you foresee the specific local area within 30 years from now?**

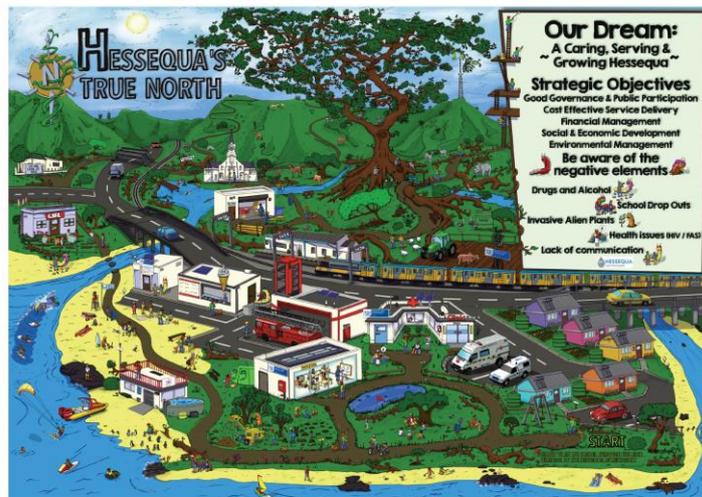
The written statements about the future indicate the different mindsets and values of the participants. The discussion of these statements will help to gain consensus on where the stakeholders see themselves in the future. Here are some examples of future statements:

- **In 30 years, our area will be a centre of excellence for sustainable innovations (embracing the 4<sup>th</sup> Industrial Revolution).**
- **In 30 years, our area will have embedded a culture of sustainable living and decision making.**
- **In 30 years, our area will have dynamic and sustainable infrastructure that caters for an affordable and quality lifestyle for all.**

Additional to asking the question on the envisaged future, the facilitator can ask the stakeholder groups to draw a picture of how they see the future within the specific context. The groups can be prompted to include sustainable energy or sustainable options, but the process should not be limited to these topics. Each group then has an opportunity to provide feedback on the drawings.

Drawing the pictures on the envisages futures might mean that an additional workshop session needs to be scheduled, because the facilitator will need time to analyse, interpret and consolidate the different aspects of the drawings into one rich picture or visualised strategy (see Figure 1 as an example). This visualised strategy can then be used as the starting point for future planning. The visualised strategy provides a holistic picture of the different aspects and the connections between these different parts. When focusing on one specific aspect, it should be done within the frame of the big picture. The development of the visual strategy could also be part of the preparation phase and used by the facilitator to understand the context of the local environment.

Figure 2 Example of a visualised strategy



## HOW TO FACILITATE EDAS: EXPLORE



### b) Determine sustainability options

The next step as part of the Explore segment is to determine sustainability options. The visualised strategy and/or future statements can be used as a starting point. Two questions are asked to the participants:

**Q2: Which sustainable (energy/water/other) options do you perceive as being plausible in the given context when considering the envisaged future?**

**Q3: What are the obstacles (those things within our control) and barriers (those things not within our control) to successfully implement these sustainable (energy/water/other) options?**

The second step in the Explore segment not only elicits viable sustainable options, based on the knowledge and expertise of subject matter experts, but also eliminates non-contenders early in the planning process. The sustainable options determined during this step will be taken into the second segment of the approach, namely the Design segment. All information available on the sustainable options, such as previous studies done, cost estimates, risks and uncertainties, should be made available and discussed when determining the viable sustainable options. The data collection of previous information is done during the preparation phase of the workshop. The aim when selecting viable sustainable options is to opt for satisfying solutions rather than optimal solutions. Table 3 provides an example of possible sustainable options with identified obstacles and barriers.

*Table 3 Sustainable options with obstacles and barriers as identified by stakeholders*

Q2: Sustainable options	Q3: Obstacles and barriers
Small-scale embedded generation	Obstacle: Municipal financial system to accommodate net billing Obstacle: Maximum demand tariff structure
Municipality to generate and use/sell own electricity	Barrier: Return on investment Barrier: Current legislation
Water tanks installed at all households over the next five years	Obstacle: Current policies to be updated

**c) Identify future conditions**

The aim with the third step in the Explore segment is to identify, through a subjective process, a set of futures, representative of possible environments of the system that are not within the control of the stakeholders. To keep it simple, three possible future conditions could be determined, namely 1) a positive outlook, 2) a negative outlook and 3) a most likely outlook. The factors used to determine these future conditions should be agreed upfront with subject matter experts and could include factors as given in the PESTLE analysis.

**PESTLE**

PESTLE is an acronym for Political, Economic, Socio-cultural, Technological, Legal and Environmental factors.

Another option to determine possible futures is to use a scenario-planning approach. In scenario planning, a specific set of uncertainties is identified and used to develop potential future scenarios. The discussion is then focused on what should be done if that specific future scenario realises. In Figure 2 an example is shown where grid supply reliability and the cost of substitute electricity are used to determine four potential future scenarios. Each of these scenarios needs to be explained to the workshop participants. These future scenarios are used during the Design segment where the different sustainable strategies are evaluated within each of these potential future scenarios.

Figure 3 Future conditions identified



# HOW TO FACILITATE EDAS: DESIGN



## 2. Design desirable sustainable strategies

The Design segment uses a systems perspective, where we see things as being interconnected. The first step in the Design segment is to determine what the system should aim to do by developing a root definition. It is important that participants understand the concept of systems thinking before developing the system's root definition. Many powerful videos are available on YouTube that explain the concept of systems thinking. In short, a system is a set of connected things or parts forming a complex whole. As seen in Figure 3, the basic structure of the system's root definition has three specific parts, namely it should describe what the system does (X), how the system does it (Y) and what the system's long-term objective is (Z).

Root definition:  
a single statement  
account of the  
purposeful activity  
being undertaken  
by the system

Figure 4 Layout of the system's root definition

A SYSTEM		
TO DO X	BY Y	IN ORDER TO Z
what the system does	how the system does it	system's long-term objective

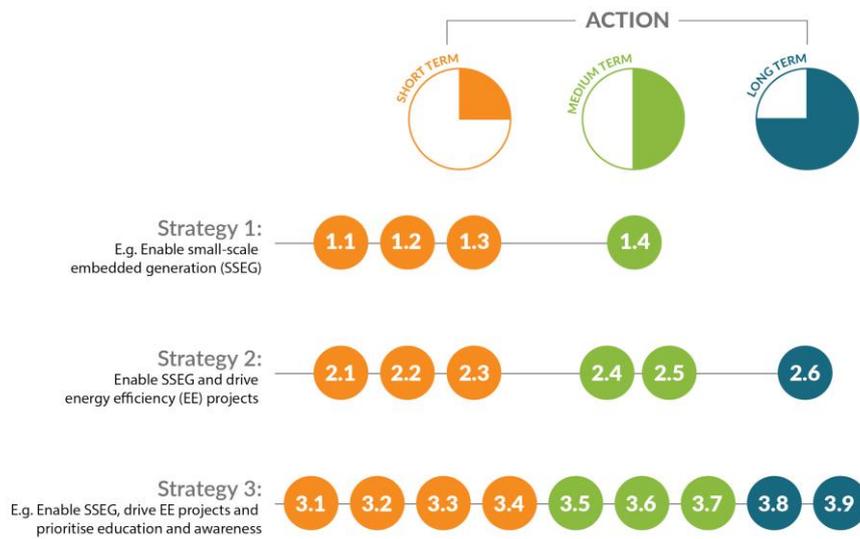
More detail can be added to the basic structure of the root definition, but for the purpose of EDAS, the basic structure is adequate. Once the system has been defined, the specific sustainability strategies can be developed.

The aim is to develop no more than five to nine achievable strategies, keeping the definition of the system in mind. The identified sustainability strategies then undergo an evaluation against the possible futures to determine the desirable and undesirable strategies. The evaluation is based on the associated perceived risks of each strategy within the identified futures.

The strategies with the **least perceived risks are most desirable**. A discussion of how much risk the stakeholders are willing to take will determine the number of desirable strategies. These desirable strategies will then be used to determine the action steps and way forward to make the desired strategy a reality.



Figure 5 Examples of sustainability strategies



## HOW TO FACILITATE EDAS: ACT



### 3. Act for sustainability

The end state of EDAS is reached when consensus has been reached between the stakeholders on the way forward. The Act segment focuses on the development of an action plan, consisting of a description of the specific actions or changes that need to occur, agreement on the champions that will drive the action points and commitment as to when the action steps will be completed. An example of an action plan is given in Table 5.

"Vision without action is merely a dream. Action without vision just passes the time.  
Vision with action can change the world"  
(Joel A Barker).

## CONCLUSION

The EDAS approach is a flexible approach that should be adapted according to the facilitator's knowledge and understanding of the given context. Once the first workshop has been completed, it is important that the findings and discussions that took place are summarised and feedback given to all participants.

To move towards a sustainable future, the cycled approach of EDAS necessitates further discussions to take place (more cycles), during which agreed actions are followed up, new actions are agreed, new options are considered, and new challenges are discussed. The more structured discussions can be facilitated, the closer stakeholders can get to understanding and better managing the sustainability issues under consideration.

The EDAS approach, if facilitated effectively, can make a difference in moving towards a sustainable future in South Africa. The more structured discussions researchers and practitioners can facilitate, the closer they can get to understanding the complexities of sustainability matters. Local governments should exert influence over provincial and national government by taking the lead in enabling and encouraging private sectors to implement sustainable solutions.

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