Development of an ISO 50001 Energy Management System: Barriers, Drivers, and Enablers in a Local Government of Western Australia

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DECLARATION

I declare that the work carried out and presented in this thesis are my own and has been produced by me as a result of my original research. No part of the work has been submitted previously to qualify for any other academic degree. The content of this thesis has been carried out following the date of approval of the research project.

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16/07/2021

ABSTRACT

Background: ISO 50001 is the international standard for Energy Management Systems (EnMS), following the same Plan-Do-Check-Act framework as other highly successful ISO standards such as ISO 14001 Environmental Management and ISO 9001 Quality. The opportunity for efficient integration with these standards along with the well understood and academically agreed benefits for emissions reduction and cost savings have facilitated a growth in ISO 50001 implementation. Previous literature has identified that this implementation has predominantly occurred in the energy intensive industry sectors such as manufacturing. An 'efficiency gap' or 'energy paradox' has been identified to be hindering the implementation of compliant EnMSs, particularly in the service and commercial sectors.

Purpose: The aim of this study is to identify the influencing factors; barriers, motivators, opportunities, and enablers which may influence the implementation of ISO 50001 in the service sector, such as that of a Western Australian (WA) Local Government (LG).

Methods: The researcher was embedded within the City of Melville (CoM) LG in which a literature synthesis, document review and case study observations were collected. The literature synthesis was conducted to provide a theoretical underpinning of the potential influencing factors of ISO 50001 implementation within a LG. The literature included ISO 50001 case studies from several energy intensive disciplines and other sustainable energy initiatives more commonly implemented beyond the industry sector. In parallel the CoM document analysis and case study observations were conducted weekly over the duration of the work experience.

Results: The literature synthesis identified the key theoretical barriers as Resources, System Structure, Information and Behaviour of stakeholders. Several key positive influencing factors were also identified to potentially alleviate the effects or overcome these barriers. The

overarching positive influencing factors included the WA institutional values and context, Top Management Support and Additional Grant Funding. When these were considered individually as drivers or enablers the additional positive influencing aspects are Emission Reduction and Public Interest (Drivers) and existing ISO Certifications, Staff Support and External Relationships (Enablers). Based on these results the two key barriers that are specific for a LG were System/Structure and Time Resources. However, the key influencing factor that could override these barriers is the established External Relationships that provide the technical capacity not typically available within LGs. In the CoM context the Addition of Funding was observed to have significant benefits to enabling ISO 50001 implementation.

Conclusions: The results discussed were unique to the LG context with the influencing factors of Time Resources and External Relationships for capacity building as findings unique within the case study. This is a foundational study which is recommended to be built upon to increase the understanding of both the qualitative and quantitative results of an ISO 50001 compliant EnMS in the LG context. With increased awareness in these outcomes, it is concluded that the benefits of the ISO 50001 standard can reach beyond the industrial sector and into the LG context.

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CHAPTER 1. INTRODUCTION

Energy

Energy is an essential resource in the operation of the Developed World, its organisations, and the progress to equitable standards of living of the its citizens (International Organization of Standardization, 2011). The reduction in poverty and improvements in quality of life have been accredited to the industrial developments that the consumption and use of energy has allowed (F. Mohamad, Abdullah, Kamaruddin, & Mohammad, 2014). However, the sustainability of energy and its influence on social, environmental, and economic indicators, has become a topic of discussion among world leaders and political parties globally, as energy consumption continues to rise (Singh & Lalk, 2016). The International Energy Agency (IEA) estimates a growth of 45% in primary energy needs from 2006 to 2030, with 80% continuing to rely on fossil fuel as the source of primary energy (Ashok Sarkar, 2010). The growing trend in energy consumption is an increasing concern as the resource consumption and emissions production associated with traditional combustion energy production is understood to be unsustainable for the functions of our planet, according to the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2018).

The increase in industrial activities and the production of goods and services are influencing a rise in anthropogenic emissions such as carbon dioxide (CO_2) with an estimate of nearly 40% of the global Greenhouse Gas (GHG) emissions a result of the industrial and commercial/service sectors (McKane et al., 2017). With rising GHG emissions the planet will experience an increased Greenhouse effect, a change in the planets energy balance, which in turn will alter the climatic and ecological systems which rely on this balance. This shifting climate is understood to result in increasing occurrences of natural disasters, changing weather patterns, droughts and sea level rise, impacts of Climate Change (CC) concerning the globe and of great concern to Australia (CSIRO and Bureau of Meteorology, 2020).

Currently, the IEA estimates a global increase of Carbon Dioxide Equivalent (CO2-e) emissions from 28Gt in 2006 to 41Gt in 2030 (Ashok Sarkar, 2010). The current emission levels are already at an unprecedented level in the Earth's atmosphere and a swift change in human energy-use practices such as improved Energy Efficiency (EE), Renewable Energy (RE) technology uptake, energy storage and fuel switching, must occur to mitigate emission production for the remainder of this century and beyond (IPCC, 2018). Without intervention the United Nations Framework Convention of Climate Change (UNFCCCs) IPCC's 5th assessment report predicts significant environmental and social disturbance costs (IPCC, 2014).

The aggregate of individual organisations improving these energy-use practices is already understood to have a significant influence on reducing the global CO2-e atmospheric concentration. With this understanding, many sustainable energy initiatives have developed over time, ranging from organisational best practices to National or Industry wide initiatives (F. Mohamad et al., 2014). However, without standardisation these initiatives are limited on the potential energy savings and emissions abatement they can achieve and therefore inhibit the positive economic, environmental and social outcomes (AIRMIC, 2018).

The globalisation of our markets with highly interconnected commerce, supply chains, and goods and services trading, has altered our behaviour away from the sustainable use of resources due to a lack of coordination and cooperation of independent enterprises (Soriani, 2020). In 2015, Australia along with 194 other Signatories of the United Nations (UN) conference on Climate Change Paris Agreement (United Nation, 2021), committed to GHG reduction targets and solidified the requirement for international coordination and effective policy implementation (McKane et al., 2017).

Energy Standards

Standards provide the opportunity to establish agreements for organisations and individuals to adhere to the best practices in that field. Best practices are established through the sharing and collaboration of knowledge and wisdom demonstrated by stakeholders involved in the subject matter, including; field experts, practitioners, users, manufacturers, distributors, academics, regulators and consumers (AIRMIC, 2018). For example, standards aid in overcoming the issues and barriers independent organisations experience while working towards common goals and outcomes. They provide a platform for expert knowledge sharing and consensus, establish best practices and systems, streamline working systems and procedures, improve public image by demonstrating an organisations commitment in these areas of improvement, and ultimately improved performance of the organisation (Soriani, 2020). By complying to a standard, an organisation commits to adhering to these established best practices (AIRMIC, 2018).

International Standards

A worldwide federation of national standard bodies has formed and established the International Organization of standardization (ISO), to structure International Standard preparation through the collaboration of ISO technical committees and international, governmental and non-governmental organisations (International Organization of Standardization, 2018b). Over the last 50 years, ISO has created standards with the aim to provide the benefits of international consensus and collaboration to positively contribute to the world we live in. International Standards provide processes and strategies to drive improvements in quality, effectiveness and performance, in almost all global sectors (International Organization of Standardization, 2011). An ISO Management System standard (MSS) specifically provides support and procedures for the governance and leadership functions across economic sectors, organisations, and diverse geographical, cultural and social conditions (International Organization of Standardization, 2021). The ISO MMS are

also beneficial in providing significant advantages when utilised by policy makers due to the shared core principles; “openness, transparency, effectiveness, relevance, stakeholder engagement and consensus” (ISO/IEC, 2015, p. 3).

ISO50001 Energy Management System Standard

Since 2019, there are 12 Type A: Management System ISO standards, which have been implemented globally (International Organization of Standardization, 2021). The International Organization of Standardization has declared that it only develops standards where they can determine a clear market requirement (International Organization of Standardization, 2011). The opportunities in continual improvements in energy performance of organisations globally was recognised by ISO and in 2011 the first ISO 50001 Energy Management System (EnMS) standard was created (International Organization of Standardization, 2018b). Energy Management (EnM) has been defined as "measurement, monitoring, control, and improvement activities for energy and carbon performance to support the achievement of a company's overall goal" (Böttcher & Müller, 2016). The standard does not guide an organisation on energy management strategies or impose energy auditing requirements for compliance, but instead allows organisations to establish the practices that best suits its context by providing a structure for monitoring and acting on energy performance improvements.

By utilising the ISO structure for energy management, it is acknowledged that this standard can significantly contribute to meeting the emission and energy consumption targets established by individual Countries, and how they can contribute to international targets (Brem, Cusack, Adrita, O'Sullivan, & Bruton, 2020). The second edition, ISO 50001:2018 has been technically revised and replaces, in full, the 2011 first edition (International Organization of Standardization, 2018b).

Plan Do Check Act (P-D-C-A) Framework

The Plan-Do-Check-Act (PDCA) framework (Figure 1) is a highly successful ISO MSS structure used by other standards such as, ISO 9001 Quality Management System and ISO 14001 Environmental Management Systems (EMS). This structure has also been adapted in the ISO 50001 standard to achieve the same fully accountable management system as realised in these other successful standards. It facilitates the implementation of a transparent and accurate energy monitoring system required to achieve continual improvement in energy performance (Marimon & Casadesús, 2017). The PDCA framework is based on a cyclic approach to enable organisations to evaluate their own performance by reflecting on their targets and achieved outcomes (see Figure 2 below) in an accurate quantitative format against baseline measurements (International Organization of Standardization, 2018b). This allows organisations to take proactive approaches to identify areas of success, and the nonconformities and barriers hindering the success in meeting energy targets (Marimon & Casadesús, 2017).

Figure 1 Plan-Do-Check-Act ISO MSS approach (International Organization of Standardization, 2018b)

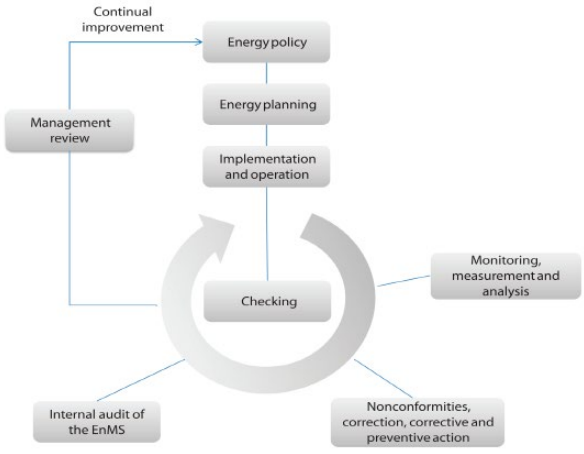

Figure 2 Cyclic Management System (PDCA) for Continual Improvement (Marimon & Casadesús, 2017)

In summary of Figure 1, as presented in the standard (International Organization of Standardization, 2018b), and Figure 2 (Marimon & Casadesús, 2017) the key elements of an ISO 50001 compliant EnMS comprise of the four Plan-Do-Check-Act phases. The "Plan" phase determines the context of the organisation through establishing an Energy Policy, formulating an Energy Management Team (EnMT) and completing an Energy Review to determine significant energy users (SEUs), energy consumption baselines (EnBs), and identify Energy Performance Indicators (EnPI) across the organisation's scope. The planning phase also uses this information to set energy targets and consider actions for energy performance improvement opportunities, and create action plans (International Organization of Standardization, 2018b). The "Do" phase involves implementing the action plans determined to achieve energy performance improvements and developing the controls for appropriate operation, maintenance, and communication procedures and ensure energy performance is considered throughout design and procurement practices. The "Check" phase employs a system to measure, analyse, evaluate, and document energy performance for the use of management reviews (International Organization of Standardization, 2018b). The "Act" phase allows for continual improvement of this system, achieved through checking and acting on the performance of the EnMS and addressing nonconformities as identified (Figure 2) (International Organization of Standardization, 2018b).

The ISO 50001 standard is structured in a way to promote universal utilisation across all international sectors and organisations, to optimise the energy performance benefits, and reduce the associated impacts of energy use globally (McKane et al., 2017). The ISO 50001 standard is voluntary for organisations to implement, although it allows compliance auditing and certification to be attained at the discretion of the organisation. ISO 50001 can be integrated into a management system of any size, so organisations can meet the objectives and targets of the EnMS, solely based on their baseline energy data to meet the unique

requirements and characteristics within their operations (International Organization of Standardization, 2018b).

In order to make significant changes to sustainable energy practices, further work is required beyond energy generation and supply alterations (Singh & Lalk, 2016). Therefore, the emphasis of the ISO 50001 EnMS is that it can promote a cultural change in current business practices to holistically evaluate an organisations energy performance, improve the support of Top Management towards energy performance improvements, and promote improvements in decision making related to energy efficiency projects and technology adoption (McKane et al., 2017). The ISO 50001 standard ensures an EnMS applies industry best practices and strives for continual energy performance improvements.

Quantifiable Impacts

The systematic management of energy, through a well-designed ISO 50001 compliant EnMS, is viewed by policy makers to be a cost-effective tool to mitigate CC, as it can reduce GHG emissions while also reducing the energy costs associated with organisations operations (Böttcher & Müller, 2016; F. Mohamad et al., 2014). For example, ISO 50001 implementation in medium to large industrial organisations can result in fourfold savings in energy, compared to the business as usual (BAU) scenario, as this investment only requires a 1.5 year payback period (Therkelsen et al, 2015). At the time of ISO 50001 inception, a review of the potential energy use reductions was undertaken by ISO and it was estimated that, with a broad application across all economic sectors, 60% of the world's energy use could be influenced (International Organization of Standardization, 2011).

The Clean Energy Ministerial (CEM) utilised the methods established by McKane et al. (2017) to estimate the annual primary energy savings that ISO 50001 implementation will achieve by 2030, under the assumption that 50% of projected energy consuming industry and service sector organisations were under ISO 50001 management (International Organization

of Standardization, 2017a; McKane et al., 2017). A 6% annual decrease was calculated in the organisations' projected global energy consumption which would accumulate to an energy savings of 105EJ between 2011 and 2030 (McKane et al., 2017). When analysed at organisational level, it was estimated that the potential energy savings following ISO 50001 implementation ranged from 10-40% and the cost savings from energy use, by implementing energy efficiency improvements, ranged from 25-70% in the service sector (McKane et al., 2017).

ISO 50001 EnMS Uptake

Many organisations are recognising the importance of integrating energy management into their overall business strategies, organisational structures, and daily operations as the push for sustainable practices, reduced consumption and energy performance improvements continues to gain momentum (Böttcher & Müller, 2016). This was observed through the initial growth of ISO 50001 certification from its inception in 2011 until 2017. For example, a growth of 332% was experienced between 2011 and 2012 with certification numbers of 459 and 1,981 achieved respectively (Figure 3) (Marimon & Casadesús, 2017). The total valid certification of ISO 50001 reached a maximum in 2017 at 21,501, before falling to 18,059 and 18, 227 in 2018 and 2019 respectively (Figure 3) (International Organization of Standardization, 2020).

Figure 3 Global ISO 50001 EnMS Certification trend (International Organization of Standardization, 2014, 2015, 2017b, 2018a, 2020; Marimon & Casadesús, 2017)

Prior to the observed plateau in Figure 3, McKane et al. (2017) recognised the need for accelerated uptake of ISO 50001 certifications to reach the projected energy reduction potential and to significantly impact global GHG emissions. The literature is clear and in complete consensus that energy consumption must be reduced to mitigate GHG emissions, and that ISO 50001 is an effective and economically viable means to do so, and even receives favourable support from industries (Brem et al., 2020). Despite these benefits, the ISO 50001 certification has plateaued in recent years (Figure 3) and many companies and organisations are hesitant to adopt this standard (F. Mohamad et al., 2014). This hesitance to adopt such standards has been described as an "energy paradox" or "efficiency gap" (Singh & Lalk, 2016) and further investigation is necessary to identify the barriers that organisations experience in implementing energy management and sustainability strategies, particularly the ISO 50001 standard.

To date, the organisations which have implemented an EnMS have primarily been in the industrial sector (Dzene, Polikarpova, Zogla, & Rosa, 2015) such as Mining, Food production, Pulp and Paper, and Manufacturing of chemicals, plastics, metals, machinery and electrical equipment (ISO, 2019). This can be easily understood due to the high energy intensity involved in these sectors, and clear opportunities for improved energy performance, cost savings and reputational improvements. However, the causes of CC are embedded across a all sectors (Oseland, 2019), with the service sector accounting for 7% of the global GHG emissions (McKane et al., 2017), and therefore the solutions must be applied cross-sectorally.

The majority of the service (commercial) sector emissions come from the consumption of electricity in buildings (McKane et al., 2017). This aligns with the energy consumption behaviour of a Local Government (LG) council. As energy demand continues to grow in the

service sector, it has become increasingly apparent that the efficiency gap in this sector must be addressed, energy performance improved, and GHG emissions significantly reduced (McKane et al., 2017).

The Context of Cities

The industrial revolution of the late 18th century is described by Rees and Wackernagel (1996) as having "stimulated the greatest human migration in history". The industrial revolution promoted a mass movement of people from rural farms and villages into the modern urban environment of Cities (Rees & Wackernagel, 1996) because of the increase in wealth and jobs this manufacturing boom created. The UN reported that, from 2016, 54% of the world's population lived in urban areas, with the proportion of urban distribution projected to increase to two-thirds by 2050 (Ritchie, 2018). As urbanization increases so does the economic growth and standard of living of a city's residents (Ritchie, 2018), which when coupled with population growth, creates a concerning picture for projections of global energy and resource consumption (Rees & Wackernagel, 1996).

In the 1990s, Rees and Wackernagel (1996) suggested further work was needed to inform urban policies to minimise ecological system degradation, reduce resource and energy consumption associated with cities, and identify unique problems and opportunities to within these social structures. The gap in this area of research has continued into the 21st century, however facilitating implementation and assessing the opportunities of ISO 50001 is one area where research can help address these areas of concern.

Local Governments (LGs) are unique to other organisations in that they provide services, enact local legislation, and are the foundation of a community and its activities (Oseland, 2019). They not only have the ability to mitigate the emissions from their own operations but can influence the behaviour and values of their local community. The everyday lives of people are shaped by the availability and performance of offered services and infrastructure

within their local communities (Oseland, 2019). The political commitment to emission reduction is critical to transform into a more sustainable and low-emission society and this commitment from a LG will allow for action to be taken through a bottom-up approach.

Project Aim

The aim of this research are:

1. To identify the various and unique barriers, opportunities, motivators, and enablers, hereby referred to as influencing factors, involved in the implementation of an ISO 50001 compliant EnMS within the LG context.
2. That this study can be applied to other service/commercial organisations of similar size and function, to aid in the successful implementation the ISO 50001 standard.
3. That this project will contribute to this growing body of academic research and by identifying these influencing factors the application, of the ISO 50001 standard may be stimulated across various sectors.

The project is broken down into two stages, first the literature synthesis and then an embedded single case study in ISO 50001 implementation.

Literature Review: The potential influencing factors of ISO 50001 EnMSs and other sustainable energy initiatives throughout industrial and service sectors were identified and discussed in the literature review. Particular attention was paid to the sector in which the literature was focused and how this factor may disproportionately facilitate or inhibit a sustainable energy initiatives success, to develop an understanding within a LG context. Case Study: These findings were assessed to determine aptness within the context of the City of Melville (CoM) in Western Australia. Non-participant observations were made throughout the initial design and implementation of an ISO 50001 compliant EnMS.

CHAPTER 2. SYNTHESIS OF CURRENT LITERATURE

Procedure

The methods of the literature synthesis are covered in the following section. The focus of this section is to outline the procedures taken to search for relevant and appropriate literature and the selection process for the literature used to bridge the gap between ISO 50001 implementation and the influencing factors within the unique context of a LG (Figure 4).

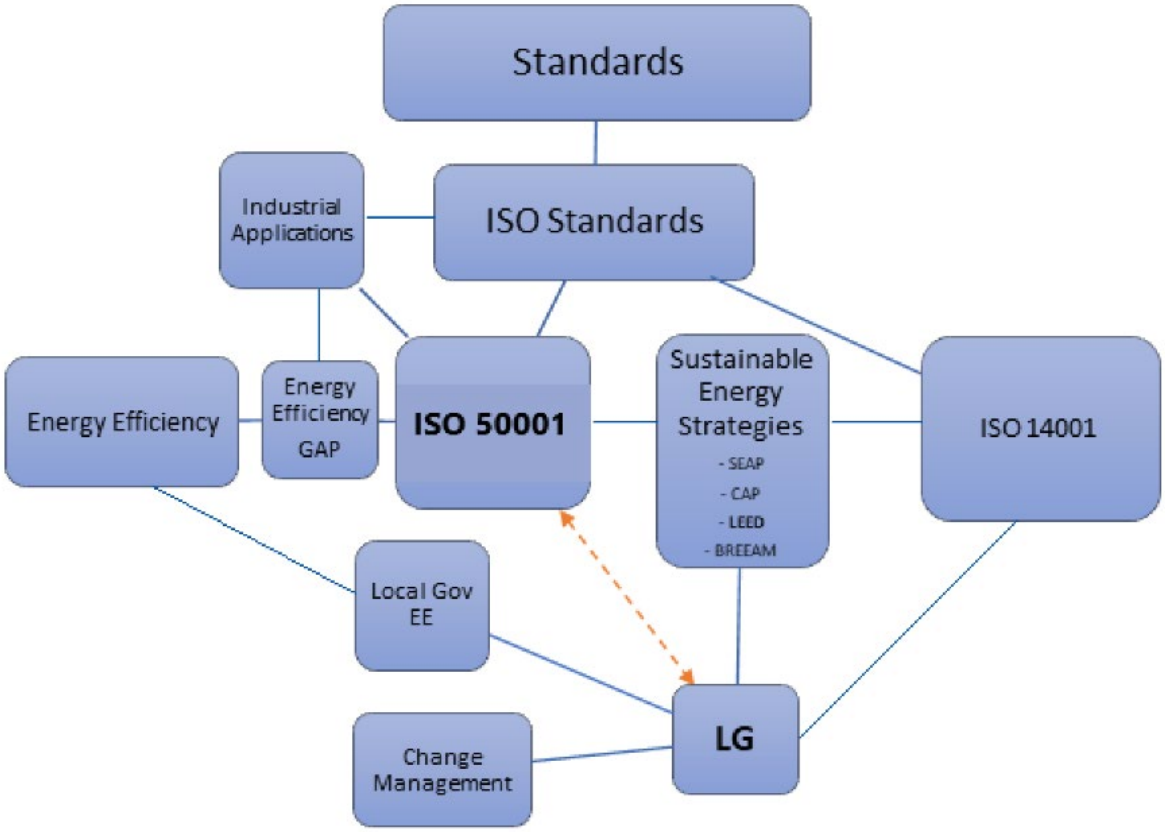

Figure 4 Literature Synthesis mind map. Dotted line indicates the gap in literature and the purpose of this research paper.

The literature available on the implementation of an ISO 50001 EnMS is currently scarce and, although some case studies regarding the implementations of ISO 50001 are available, they are not applicable within the LG context. The literature that is available, predominantly focuses on the industrial application of this standard, investigating the benefits, barriers and

challenges experienced through improving energy performance in highly energy intensive operations. There is, however, an increasing awareness from scholars on the importance of local climate and energy governance and policies, recognised through the numerous sustainable energy initiatives observed.

A keyword search was undertaken using the Murdoch University Library search engine. To ensure the most appropriate literature was included within the literature synthesis this search strategy occurred in three phases. The initial keywords in the literature search included a combination of; *ISO 50001, Implementation, Barriers, ISO 14001, ISO 9001, Change Management,* and *LG*. Following this initial search and the identification of various initiatives the keywords were expanded to include *Climate and Energy Action Plans, LEED, BREEM, Energy Efficiency,* and *Energy Efficiency Gap.* These key words were coupled with *LG, Municipality* and *Service industry* to refine the search results, as suitable initiatives are often applied across sectors. For the purpose of these searches, *municipality* and *LG* were used interchangeably. Lastly to elaborate on the findings made throughout the literature reviewed the key words; *Silos, Public Choice Theory, Rational Choice Theory, Complex Joint Action Theory, Green IT, Climate Change adaptation* and *mitigation* were incorporated.

Through this initial keyword search it was established that a small but growing pool of publications exist for the various energy management and sustainable energy initiatives, which investigate the experiences of LGs and municipalities. The initiatives which were deemed to share the objective of the ISO 50001 standard in; facilitating energy performance improvements, improving energy efficiency, and reducing emission production were selected. The authors' findings were utilised to compile a comprehensive list of the potential influencing factors to ISO 50001 compliant EnMS implementation in the LG context (Figure 4).

The selection process, to determine which initiatives were appropriate to use in place of an ISO 50001 equivalent study, was completed through a critical analysis of the topic initiative. For example, Sustainable Development Initiatives are defined by Saha and Paterson (2008) to promote the three main pillars of sustainability, the "Three E's"; environment, economy, and equity dimensions, in which energy consumption is one of eight sustainability efforts addressed. The remaining seven include air quality, water quality and consumption, solid waste production and recycling, green buildings, open space, brownfield redevelopment and equity initiatives (Saha & Paterson, 2008) and demonstrates a significantly broader target than energy consumption, in which the ISO 50001 standard focuses (International Organization of Standardization, 2018b). The work of Saha and Paterson (2008) was a valuable resource however, as it evaluated the experiences of LGs to promote Sustainable Development and established the critical role in which cities play in working towards a solution in resource depletion, pollution and emission production by upholding the 1972 Rio Summit adage of "Think Global, Act Local".

The other initiatives included in the literature synthesis also align with sustainability efforts under the theme of sustainable development. Sustainable development is described as a "paradigm shift" (Saha & Paterson, 2008), as cities are beginning to take responsibility and action towards sustainability through various sustainable energy initiatives; internal standards, industry/internationally recognised management systems, and best practices (Figure 4). These Initiatives include the implementation of sustainable energy best practices (SEBP) (Brem et al., 2020), energy efficiency and sustainable development systems and certifications such as: Leadership in Energy and Environmental Design (LEED) (Cease, Kim, Kim, Ko, & Cappel, 2019) and Building Research Establishment's Environmental Assessment Method (BREEAM) (Brem et al., 2020); Green IT (Molla, Pittayachawan, Corbitt, & Deng, 2009)

and Energy Efficient IT (Pollard, 2013); and Sustainable Energy Action Plans (Dzene et al., 2015).

Where possible, the initiatives which had literature available for both its implementation by LGs or municipalities, and literature which compared its experiences to that of ISO 50001 standard implementation were preferred (Figure 4). For example, Brem et al. (2020) eloquently assessed how companies compliant with ISO 50001 and ISO 14001 performed in LEED and BREEAM valuations, determining that mature companies, with these certifications well established, would achieve gold or platinum LEED and 4-star BREEAM ratings. The appreciation of the relationship between both these ISO standards and the LEED and BREEAM assessment criteria justified the inclusion of the related literature to reinforce the experiences of municipalities in their sustainable development and energy management actions. This relationship is also significant as BREEAM (1990) is the longest standing environmental assessment method in which most subsequent rating schemes have been based on (Brem et al., 2020). The work of Cease et al. (2019) and Joerke, Waters, and Gavito (2012), on implementing LEED in sustainable urban developments and facilities of LGs, was analysed to understand the barriers, motivators, opportunities, and enablers in the LG context.

Literature expressing the work of energy efficiency improvements for “Green” logistics and “Green” IT were included in this literature synthesis (Figure 4). The importance and contribution of logistics and IT within a City’s operations is well understood as a significant part of a City’s functioning (Molla et al., 2009). These resources provide valuable insight into the importance of a Local Government’s involvement in energy efficiency throughout its supply chain (Pollard, 2013) and the drivers and barriers faced by LG to implement green IT initiatives (Molla et al., 2009).

The results from implementation and integration of other Plan-Do-Check-Act (PDCA) ISO standards such as ISO 14001 Environmental MS and ISO 9001 Quality MS (Bansal & Bogner, 2002) (Fadzilah Mohamad, Abdulllah, Mohammad, & Kamaruddin, 2013) (Brem et al., 2020), were included in this study as the literature was relevant in terms of policy implementation and change management within the public service sector (Figure 4).

The motivators, agenda setting, and constraints experienced by LGs in addressing CC policies were synthesised as the literature looked to understand the influence of a LG's systems and structures on such a boundary-spanning and complex issue as CC (Figure 4) (Musah-Surugu, Ahenkan, & Bawole, 2019). The study by Musah-Surugu et al. (2019) is in the scope of CC adaptation policy, in contrast to the mitigative scope of an ISO 50001 EnMS and associated policies. However, this work was valuable in identifying the opportunities and enablers which are engrained in local and national government structure. It provided insight into the limitations experienced in the context of a newly decentralised governmental structure within a developing country such as Ghana, and enlightens the advantages experienced by a country such as Australia.

The results of the literature synthesis are presented in the following section explaining the potential barriers, drivers and enabling factors identified throughout the current literature which can potentially influence the implementation of an ISO 50001 compliant EnMS. It was also considered how these influencing factors shifted based on the sector on which the literature was focused. As the literature does not currently provide a standardised classification of the barriers associated with ISO 50001, these barriers were categorised in Table 1.

Influencing Factors relating to Sustainable Energy Initiatives

Barriers

Barriers are defined as circumstances which prevent progress (Lexico, 2021). The efficiency gap in meeting the energy saving potential of organisations, recognised throughout the literature, gives reason to conclude that there are inhibiting mechanisms or barriers at play. These barriers are recognised in the context of EE opportunities, energy performance improvements and sustainable development initiatives. Like the other influencing factors of ISO 50001 and other sustainable energy initiatives, not all barriers are the same as they affect the characteristic of each organisation differently. The literature presents a significant number of barriers which were categorised by researchers based on the major themes established in the context of their implementation. For example, Ashok Sarkar (2010) identified; Institutional, Technical, Financial, Informational and Behavioural concerns as the key barriers across stakeholders for EE improvements. Cease et al. (2019) identified the key barriers for LEED-ND (neighbourhood development) adoption in LGs as Economic, Policy, Public Awareness and Organizational. Marimon and Casadesús (2017) identified the barriers in ISO 50001 implementation as Operational and Organizational. Singh and Lalk (2016) classified the barriers identified for EE improvements within manufacturing firms into; Economic, Organisational, and Behavioural. The conclusion of the work of Dzene et al. (2015) identified the critical issues of ISO 50001 implementation in municipalities as limited availability of energy data, lack of measurable indicators, and difficulty applying the standard procedures within municipalities.

The categorisation of barriers into these identified key groups, were assessed with relevance to an ISO 50001 implementation within a LG context and synthesised as: Resources, System Structure, Information, and Behaviour as the major barriers. Within these categories

subgroups of barriers were identified (Table 1) and a comprehensive analysis of the potential barriers is presented in this report.

Table 1 Potential barriers associated with ISO 50001, categorises and subcategories as synthesised from the current literature.

Resources	Financial Employees Technical
System Structure	Institutional Values Organisation Complexity Internal Policies
Information	Knowledge Communication
Behaviour	Internal Stakeholders External Stakeholders

As the literature reviewed involved general sustainable energy initiatives as well as literature discussing the direct experiences of ISO 50001 implementation, there will be a distinction made between barriers related in general to successful sustainable energy initiatives and those experienced specifically in the development and implementation of an ISO 50001 EnMS.

Resources

The availability and access to resources, and changes to resource requirements and allocation within an organisation following the implementation of sustainable energy initiatives, were identified throughout the literature reviewed. Within this category for resource barriers the subcategories; Financial, Employees (skills and knowledge), and Technical Resources were found to be prevalent throughout the literature and potentially relevant within the LG context.

Financial

The literature that was directly concerning the LG context consistently identified budgetary constraints and access to funds, due to fiscal allocations, as a barrier to implementing

sustainable energy initiatives, ISO 50001 EnMSs and related strategies (Cease et al., 2019). Local governments are complex organisations with highly department dependent values and responsibilities, which in terms of financial resources can create a barrier due to competing priorities (Musah-Surugu et al., 2019; Pollard, 2013). The split incentive between the people responsible for allocating capital resources to energy performance improving investments and those responsible for paying energy bills can be a barrier for organisations due to the disconnection between the potential return on capital within these departmentalised firms (Böttcher & Müller, 2016).

These considerations, coupled with the presumed high cost of project development, are identified as the most common and significant barrier within the literature reviewed. These economic factors remain inhibitors despite the growing evidence that the reduction of costs often exceeds the costs of project implementation. Bansal and Bogner (2002) describe the implementation of a fellow ISO standard, 14001 Environmental management, as a "win-win" in terms of the return on investment and improvement on environmental aspects. In the context of energy reduction, Ashok Sarkar (2010) stated energy efficient projects are "no-regret" policies due to the negative net financial costs expected for the life of the project.

However, hidden costs (Joerke et al., 2012) such as annual document maintenance (Bansal & Bogner, 2002), staff training and procurement adjustments (Dzene et al., 2015) and the delay in economic returns (Böttcher & Müller, 2016; Molla et al., 2009) can be an inhibiting factor when organisations are assessing the economics of sustainable energy project implementation. The prioritisation of short-term returns over the potential long-term pay-off of sustainable energy investments is a particular barrier for organisations with considerable budgetary constraints, such as LGs (Cease et al., 2019). An additional financial barrier identified in the literature regarding an ISO 50001 compliant EnMS, is the additional cost of certification related to ISO standards (Marimon & Casadesús, 2017)

There is also a perception of risk to the investment in EE projects (Ashok Sarkar, 2010; Cease et al., 2019; Singh & Lalk, 2016), which in the risk adverse environment of a LG can be a significant barrier. With increased implementation of ISO 50001 and information sharing through studies such as these, the currently unclear business value, and long-term payoffs of these projects become clearer and the cost-benefit analysis towards these projects can be more accurately undertaken.

Singh and Lalk (2016) identified that energy efficiency projects implemented at a small-scale, such as for small or low energy consuming organisations, could be a potential barrier. The economy of scale for the capital of equipment and skilled staff, and the compounding returns from multiple or large-scale efficiency retrofits, equipment replacements or renewable energy installations can make the decision to implement these projects much clearer for large energy intensive organisations. Also, the market structure around the technologies and equipment, that would be involved in improving energy performance within a firm undertaking a sustainable energy initiative, can be inhibiting to their utilisation (Singh & Lalk, 2016). Often these technologies are new to market or still developing which means they are not placed at a viable price, especially if the cost of energy is respectively low. The motivation for implementing such strategies will be hindered as the financial incentive is lost in the unfavourable market (Singh & Lalk, 2016).

Employee Competencies

The implementation of sustainable energy initiatives can be highly technical (McKane et al., 2017) requiring a high degree of staff competency in energy management (Karcher & Jochem, 2015), or the resources to compensate for such a gap in competency (Dzene et al., 2015). The IPCC working group III, for the fifth Assessment report, identifies the lack of human and institutional capacity a primary barrier towards meeting the sustainable energy and EE mitigation potential within the industrial sector (McKane et al., 2017). An industry heavy in

operations is likely to have a greater technical capacity of employees than that of the service sector, which are already recognised as experiencing limitations in internal technical, business and risk management skills (Singh & Lalk, 2016). These 'gaps' will place further pressure on the economics of the projects with the training of staff, alterations to staff time availability and workloads, and/or the use of external consultants to fill these internal skill and knowledge shortfalls, having a notable impact on the cost of implementation (Karcher & Jochem, 2015).

The ISO 50001 and related ISO standards credit themselves for being applicable to organisations throughout a complete range of size and complexity (International Organization of Standardization, 2018b). Karcher and Jochem (2015) however, acknowledges this as a potential barrier specific to ISO 50001, as the size of the Energy Management team will have to correspond to the requirements of the organisations. With increasing complexity, the staff resources may be strained as the volume of staff and their allocation of time away from BAU job roles can impact the performance of the EnMS or the operations of the organisation itself (Karcher & Jochem, 2015).

Technical

The technical resources that will be required to collect energy usage data with accuracy and within the scope of an organisation's sustainable energy initiative, can be highly sophisticated, complex and time consuming to acquire (Bansal & Bogner, 2002; Marimon & Casadesús, 2017). McKane et al. (2017) found the lack of accurate and comprehensive historic energy data, and the means for achieving accurate data collection, was a barrier in implementing an ISO 50001 compliant EnMS due to the quantitative focus on energy performance within this standard. In the case study on Italian public housing, the large stock of property with varying construction years was an extreme challenge to completing an energy review and implementing ISO 50001 (Dall'O, Ferrari, Bruni, & Bramonti, 2020). In this case the only

consumption data available was from energy bills which were the aggregate of several services (Dall'O et al., 2020). Having the appropriate energy data to create baseline energy consumption levels, energy targets and objectives is crucial to ISO 50001 implementation and determining action plans towards continual improvement (Dzene et al., 2015).

The literature recognises the implementation of sustainable energy initiatives require the installation and use of highly sophisticated monitoring systems and may require the contribution of other resources such as a significant initial capital for technical monitoring equipment (Böttcher & Müller, 2016), the involvement of external experts for installation, training the internal energy monitoring staff (Karcher & Jochem, 2015; McKane et al., 2017), and the time required to collect the energy usage data at the appropriate standard (Dzene et al., 2015). The Information Technology (IT) services within the organisation will also have to be at a standard appropriate for the data storage, analysis, and communication of results throughout complex organisations, such as a LG (Molla et al., 2009).

System/Structure

Institutional Values

Institutions are defined by Bansal and Bogner (2002) as “structures and activities that provide stability and meaning to social behaviour”. Based on the literature reviewed, the institutional factors which influence these behaviours in the context of energy management and sustainability in LGs are particularly the other levels of government and the political climate in which they exist (Musah-Surugu et al., 2019). The values held by the government in power at federal and state levels will influence the motivations of the public and private organisations operating within their jurisdiction. A lack of support by government in terms of policies, regulations and financial incentives is understood to hinder the realization of ISO

management systems (F. Mohamad et al., 2014; Fadzilah Mohamad et al., 2013) and other sustainable energy initiatives (Molla et al., 2009; Singh & Lalk, 2016).

Climate change projections, emissions reduction targets, and the emerging technologies to improve energy efficiencies and lower emissions in energy generation is a swiftly changing environment in which regulators and policy setters find it difficult to keep pace (Fadzilah Mohamad et al., 2013). The lack of appropriately set and enforceable regulations can be a barrier for successful energy management (Molla et al., 2009). One example would be the absence of market regulations to support energy efficiency investments by organisations (Singh & Lalk, 2016). Without a regulated market or incentives in place to overcome the numerous obstacles for investment, a deceleration of the use of emerging and developing technologies could ensue (Singh & Lalk, 2016).

The political interests and intentions of the various levels of government will have an overwhelming influence on the behaviour of actors and their ability to implement change. In the Ghana case-study for CC adaptation measures, Musah-Surugu et al. (2019) identified these political interests as overwhelming negative influences on the implementation of these measures. The short-term political interests that occur in an elected government structure are recognised to often be considered over the interests of the public (Musah-Surugu et al., 2019). In this same study Musah-Surugu et al. (2019) noted the institutional structure surrounding policy implementation and management systems could severely hinder the execution of such changes. The silos of interest which occur in decentralised government structures work horizontally between departments and vertically throughout the different levels of government (Musah-Surugu et al., 2019). The division of responsibilities, resources, outcomes, and internal cultures between departments lead to these silos which can diminish efficiency and cooperation required to achieve best practices in sustainable energy management and meeting the potential outcomes for emission reduction (Oseland, 2019).

Organisation Complexity

Silos of interest can occur throughout all levels of institutions, organisations, and departments and is viewed within the literature as a general trait of local, regional, and federal governance (Oseland, 2019). The cross-sectoral nature of energy consumption, emission reduction actions and CC, means that the siloism common within LGs has the potential to be a significant barrier in the implementations of energy management systems such as ISO 50001 (McKane et al., 2017). This barrier of siloism is recognised in the literature involving management systems (Fadzilah Mohamad et al., 2013), sustainability initiatives (Cease et al., 2019) and energy action plans (Brem et al., 2020; Dzene et al., 2015).

The complex structure of organisations, such as a LG ultimately results in the involvement of a large number of concerned and logical actors to complete sustainable energy activities and can result in the Collective Action Problem (Böttcher & Müller, 2016; Musah-Surugu et al., 2019). Those involved may have the best intention to accomplish the activity and achieve its outcomes, yet no actors take the measures to fulfill the requirements of the activity as the rational is that others will act instead (Musah-Surugu et al., 2019). These multiple actors may also have differing, siloed and personal interests which may result in the lack of cooperation, delays in policy action or policy deadlocks resulting from the Complexity of Joint Action theory (CJAT) as presented by Pressman and Wildavski in 1984 (Musah-Surugu et al., 2019). CJAT can result in the failure of the most promising of policies due to the involvement of too many parties (Musah-Surugu et al., 2019). In the context of sustainable energy initiatives and energy management the act of monitoring, collecting, and analysing energy usage data will involve multiple actors from different departments. The ISO 50001 standard specifically requires a level of accuracy for the organisation's EnMS energy review, requiring members of the organisation to follow a consistent methodology and collaborate efficiently to complete the review and develop a successful energy policy (Dzene et al., 2015). The ISO 50001

standard addresses this with development of the EnMT to standardize and manage the practices, however with increased complexity of the organisation comes an increase in the number of team members, enhancing the risks of CJAT (Dzene et al., 2015).

The existing internal structure of an organisation will have an impact on the success of an EnMS implementation. In complex organisations, it is understood that a single regime is necessary for public issues to be dealt with appropriately (Musah-Surugu et al., 2019), a lack of which is a barrier to sustainable energy initiative implementation, particularly ISO 50001 (International Organization of Standardization, 2018b). For a single regime to succeed strong leadership must exist with a commitment and prioritization of the issue from top management (Marimon & Casadesús, 2017; Fadzilah Mohamad et al., 2013). A lack of this leadership is recognised throughout the literature as a barrier to ISO 50001 and sustainable energy project implementation (Molla et al., 2009) throughout industry applications (McKane et al., 2017), in LG sustainable decision-making (Cease et al., 2019) and in CC adaptation within the LG context (Musah-Surugu et al., 2019). The ISO 50001 standard emphasises the involvement and commitment of top management and implementation of a single management system to address this common barrier (International Organization of Standardization, 2018b).

The commitment of top management within the organisation must be conveyed throughout all levels of the organisational structure to be effective. Brem et al. (2020) recognised the potential for a large divide between the intentions of top management and the actions of other team members within complex, departmentalised organisations due to the existing bureaucratic structures. This detachment between horizontally and vertically distinct members of an organisation can inhibit the cultural change necessary for successful sustainable energy initiatives (Brem et al., 2020). This can be the direct result of an organisation's lack of internal policies related to energy and climate (Singh & Lalk, 2016), or simply enhanced by a lack of internal structure (Fadzilah Mohamad et al., 2013) required to

promote internal policies. For example, the existence of a communication system or policy is increasingly important for policy implementation and cultural change (Marimon & Casadesús, 2017), especially as the size and complexity of organisations increase.

This increasing complexity of an organisational structure can also inhibit the development and implementation of a sustainable energy initiative due to the increasing complexity of energy consumption information and the need for multiple Energy Performance Indicators (EnPIs) (Dzene et al., 2015). This level of complexity can also influence the process and success of integrating an energy initiative with the organisation's current policies (Karcher & Jochem, 2015).

A lack of planning regarding the structural breakdown of energy consumption responsibility and the outsourcing of operational control can have a significant inhibiting influence on an organisation's ability to adjust consumption behaviours (Böttcher & Müller, 2016; Dall'O et al., 2020). For example, as de Sousa Jabbour et al. (2017) recognise, in their work towards greener supply chains through ISO 50001 implementation, the outsourcing of logistics processes is common amongst manufacturing companies and significantly impacts the potential improvements in energy performance.

The literature related directly to ISO 50001 implementation recognises organisational and system design errors as a potential barrier to a successful EnMS (F. Mohamad et al., 2014). The post hoc approach to energy and carbon policy can be extremely costly, financially and in terms of time and potential for abatement (Dall'O et al., 2020). Retrofitting EE equipment is notably more expensive than implementing these actions at initial design stages (Dall'O et al., 2020).

Internal Policies

There are several barriers related to the policies existing within the structure of an organisation, as noted in the related literature. As mentioned above, the lack of suitable energy and carbon related policies would likely contribute to complications in implementing sustainable energy initiatives. This also rings true for underdeveloped, unclear, outdated and poorly enforced internal policies (Singh & Lalk, 2016). Clarity in a policy's purpose and a well-defined structure are the foundations for successful policy implementation and integration within an organisation, without which the symptoms of siloism, Collective Action Problem and particularly the CJAT will overwhelm it's potential (Singh & Lalk, 2016). The presence of outdated policies not only negatively influences the success of an initiative's implementation but can itself be a symptom of poor implementation and management. The evolving nature of energy efficiency technologies can outrun a poorly designed sustainable energy policy if the appropriate frequency of revision is not established (Singh & Lalk, 2016).

The operation of a complex organisation, such as a LG, will likely involve several policies running concurrently. The established policies of an organisation may have been developed under a former value system in which energy performance did not take precedence over other considerations. Policies designed or altered for the purpose of sustainable energy initiatives may conflict with these other deep-rooted policies and inhibit the potential energy savings the initiative can achieve (Singh & Lalk, 2016). An organisations traditional procurement policy will favour the lowest cost options (often strictly capital costs) (Singh & Lalk, 2016), while the ISO 50001 standard requires procurement to incorporate evident energy performance considerations to meet compliance (International Organization of Standardization, 2018b).

Meeting the requirements of the standard and initiative certification will certainly involve additional measures and an input of the organisation's resources (Cease et al., 2019). The process and requirements for achieving certification are viewed by some to add bureaucracy

and not value to an organisation's operation (AIRMIC, 2018). ISO 50001 is not immune to the additional requirements for certification, however ISO recognised this barrier and with a standard framework, shared with other successful ISO standards, the additional efforts towards implementation and certification are minimised through integrated audits, minimisation of documentation, improved resource utilisation and less bureaucracy (Fadzilah Mohamad et al., 2013). Sustainable energy initiatives lacking this flexibility in their framework may find its rigidity a barrier in its implementation.

The ISO 50001 standard has addressed some internal policy barriers however, the literature around the standard has recognised some barriers related to the flexibility the standard provides. ISO 50001 was developed with the ability to be tailored to fit the unique requirements of individual organisations, no matter the size or complexity (International Organization of Standardization, 2018b). However, this accommodation to all organisations can result in highly complex policy development, implementation challenges, and complicated energy measurements, analysis and results management, and result in operational difficulties (Marimon & Casadesús, 2017). As the size of an organisation increases, so too does the potential to experience these difficulties.

Information

Clarity and consensus on the information shared amongst stakeholders and access to an appropriate means to communicate between all interested parties is vital for sustainable energy initiative implementation. The lack of which is a barrier towards the essential global paradigm shift required for sustainability and improved energy performance best practices (Saha & Paterson, 2008).

Knowledge

Climate change is a 'Wicked Problem' as it is highly-complex, has multiple causes and requires multiple solutions, the efforts of one solution may cause another problem, causes and solutions involve long-term lock-ins, and ultimately there may be no solution (Oseland, 2019). The projected emissions levels and impacts of CC are offered through various pathway scenarios in global and local circulation models, with outcomes ranging from a 1.5 to 4 degrees Celsius increase from pre-industrial temperatures (IPCC, 2014). This wicked problem can create contestation and scepticism for reform within the public and for policymakers due to the uncertainty surrounding the nature of the problem and the best practices to tackle it (Musah-Surugu et al., 2019). The call for sustainable energy initiatives and the global value of their implementation are therefore embedded in confusion and misunderstanding (Musah-Surugu et al., 2019).

A lack of understanding in an initiative's influence on the global issue of CC and emissions mitigation is a significant barrier which is further influenced by the lack of awareness and knowledge surrounding evolving EE technologies and their potential (Ashok Sarkar, 2010). A lack of awareness and the technical skills required to identify EE opportunities are competencies lacking in many organisations, particularly those with less technical operations (McKane et al., 2017). This knowledge gap means opportunities for energy performance improvements can be missed and the potential outcomes of sustainable energy initiatives not met (Ashok Sarkar, 2010; Bansal & Bogner, 2002; Marimon & Casadesús, 2017).

An information barrier within ISO 50001 EnMS implementation, mentioned previously in this report, is the lack of credible historic consumption data on which the EnMS relies in its planning phase (Dzene et al., 2015). A clear understanding of the projects opportunities and outcomes therefore cannot be clearly determined (Dzene et al., 2015) which can further emphasise the misunderstanding and scepticism surrounding sustainable energy initiatives

and what they can contribute to emission abatement, and ultimately to the wicked problem of CC.

The planning phase of ISO 50001 also includes the development of an EnM team, in which members of the organisation are selected and provided an induction into the topics of energy performance and energy efficiency (Karcher & Jochem, 2015) to facilitate their role in the development, implementation, maintenance and continual improvement of the EnMS (International Organization of Standardization, 2018b). The benefits of internal job rotation are not employed when this framework is followed, and the risks of siloism and business myopia can threaten the EnMS's success (Karcher & Jochem, 2015). As energy performance improvements are identified and their benefits reaped the business myopia of the EnMT may mistakenly assume all energy potential is met and result in opportunities being missed (Karcher & Jochem, 2015). Opening the communication amongst internal and external stakeholders, and across all levels and departments of an organisation will allow for knowledge sharing and fresh perspectives to contribute to energy performance improvements.

Communication

A lack of communication procedures can magnify the risks of inadequate knowledge sharing at all levels of an organisation (F. Mohamad et al., 2014). Energy consumption is a cross-departmental issue within organisations as consumption data is collected from different departments and forwarded to those responsible for energy accounting (Dzene et al., 2015). The cooperation of all levels of an organisation is required for successful sustainable energy initiatives. The lack of a clear and well established communication procedure will inhibit this cooperation and cultural change to penetrate beyond the executive and management team and throughout the horizontal department levels (Dzene et al., 2015).

Communication beyond the organisation must also be established. Climate change is a cross-sectoral issue however, the sectoral breakdown of institutions and initiatives will inhibit the identification and collaboration of strategies whether for CC adaptation (Oseland, 2019) or for CC mitigation. Organisations within the service sector such as LGs have the unique ability to bring together the interests of the public, local community, the private sector, and those of the LG council themselves and provide a platform for dialogue (Cease et al., 2019). Having procedures in place to encourage this interaction and communication is necessary to engage with these stakeholders to share knowledge, encourage participation, and promote acceptance and behavioural changes towards sustainable energy practices (Cease et al., 2019).

Behaviour

The behaviour of stakeholders influencing or impacted by the outcomes of sustainable energy initiatives must be considered, particularly in the LG context. The literature has identified several characteristics within the behaviour of internal and external stakeholders, such as employees and the public respectively, that can act as barriers towards successful implementation and in meeting prospective outcomes.

Employees

Employees are the backbone of change management towards sustainable energy initiatives (de Sousa Jabbour et al., 2017). However, employees and their behaviour are susceptible to several psychological phenomena; Rational Choice Theory, Public Choice Theory, Behavioural biases, Complexity Joint Action Theory (CJAT), Silos of interest, resistance to change, and apathy.

The Rational Choice Theory postulates that individuals will determine their social behaviour and economic choices through their own cost-benefit analysis to assure their best possible outcome (Musah-Surugu et al., 2019). This behaviour is however altered in the political

context and often referred to in the literature as the Public Choice Theory (Cease et al., 2019; Oseland, 2019). Elected officials are susceptible to the influence of the elector and are likely to respond to highly vocal and organised platforms, such as community groups, due to the additional motivation of re-election and political legitimacy (Musah-Surugu et al., 2019). This phenomenon is of particular interest in the LG context, for change management and energy policy implementation, due to the significant role of elected officials and the value that LGs place on the wants and needs of their local community. Without a supportive public choice towards sustainable energy practices these initiatives can be removed from the agenda of the political actors and fail to be implemented (Musah-Surugu et al., 2019).

The behavioural biases of particular actors and roles within an organisation can also influence an initiative's implementation and success. For example, management may have a bias towards production outcomes over those of energy performance (McKane et al., 2017), public managers may be risk adverse to new and innovative programs (Deslatte & Stokan, 2020) and political council members may favour a "realistic" approach to sustainable energy outcomes which results in short-term goals being lowered for achievability (Oseland, 2019). The influence of these biases can aggregate to form a significant barrier towards initiative success.

The risk of silos and CJAT were previously identified due to the internal structure of an organisation, with strong departmentalisation, division of responsibilities and authority, and multiple actors with their own self-interests, priorities, overlapping goals or a lack of clarity in the final outcome (Musah-Surugu et al., 2019). These phenomena work in conjunction with human nature to behave within the Rational Choice and Public Choice Theories. Silos can develop due to the division of responsibilities through a structural layout, however as the interactions between departments is limited and the responsibilities and authority of individuals is narrowed, so too is the willingness to share information and knowledge (Saha

& Paterson, 2008). Rational choice may influence an actor to weight the sharing of their specialised knowledge as a cost and threat to their position of responsibility and authority, over the potential benefit that this knowledge sharing may provide.

The apathy of employees can be a significant barrier to sustainable energy initiatives as the lack of interest, enthusiasm, or concern of the team towards energy performance can halt an initiative in its tracks. Employee involvement and support is essential to achieve the cultural change involved of ISO 50001 (International Organization of Standardization, 2018b), required for success (Dall'O et al., 2020). Apathy can stem from a lack of managerial commitment (F. Mohamad et al., 2014), as this leadership is necessary for clear goal setting and the allocation of appropriate resources, without which employees can become disgruntled, discouraged and indifferent to the initiatives success. Apathy can also be the result of a lack of understanding of the potential benefits (McKane et al., 2017; F. Mohamad et al., 2014) or the misunderstanding of costs involved, such as the impression that costs will increase and standard practices and productivity will change (Saha & Paterson, 2008). This apathic behaviour can make staff resistant to change (Fadzilah Mohamad et al., 2013), particularly in terms of EnM team members within the ISO 50001 EnMS (Karcher & Jochem, 2015). A survey amongst German ISO 50001 certified companies identified that for 82% of the respondents, 1 or 2 employees are required for EnM tasks for more than 50% of their working time (Karcher & Jochem, 2015), a significant adjustment to these member's job roles and responsibilities.

Public

The service sector's connection with the public, and the immediacy in which change will be felt beyond the organisations boundary, can be an inhibitor of sustainable energy initiatives. The public can hold strongly resistant views toward change to the status quo due to a number of factors; a limited knowledge and understanding of the benefits of change, the perceived

costs associated with the change and an unwillingness to pay for these costs (Cease et al., 2019). These beliefs can be caused by limited public awareness related to EE opportunities (Singh & Lalk, 2016), a misconception of energy reduction side effects such as reduced safety and quality (Marimon & Casadesús, 2017), scepticism and cynicism of the carbon and climate sciences (Musah-Surugu et al., 2019), and can ultimately result in apathy towards sustainable energy use and the associated initiatives.

It must be noted that engaging in an ISO standard, such as ISO 50001, can both challenge these barriers, while also creating barriers due to the identification and communication of poor energy performance processes involved in an organisation's BAU (Bansal & Bogner, 2002). Identifying these SEUs will likely create pressure from various stakeholders to tackle these areas with haste. This barrier was identified specifically in relation to the Environmental Management standard ISO 14001 (Bansal & Bogner, 2002) in which environmental 'clean-ups' do not as clearly result in a monetary benefit as in energy performance improvements due to fuel and energy procurement reductions, an important distinction to mention.

Drivers

Motivators

Motivation is defined as the reasons for acting, behaving and making decisions in a particular way (Lexico, 2021). The three pillars of sustainability; equity/social responsibility, the environment, and economics (Elkington, 1998) form the basis for the overarching motivations in which companies and public service providers may approach standards such as the ISO 50001. This was reflected in the work of Marimon and Casadesús (2017) in which the key motivators for adopting ISO 50001 systems were identified as; social requirements, ecological drivers and competitive advantage.

These motivators suggest why organisations have acted to implement sustainable energy initiatives, and more specifically the ISO 50001 standard. In the work of Musah-Surugu et al. (2019) on CC adaptation policy it was found that the motivation to act on CC policies were quite "heterogeneous and jurisdictionally sensitive". Unique motivators were identified for each organisation with many of the overarching motivators influencing behaviour towards initiatives to varying degrees based on their parameters, such as size, location and sector.

Social Responsibility

Social requirements represent the motivation of the public administration and other professional institutes in organisations implementing an ISO 50001 EnMS. Meeting the expectations of society as a whole is noted to improve an organisation's public image (Dzene et al., 2015; Soriani, 2020), its social licence to operate and the business's bottom line (Saha & Paterson, 2008). The general certification of a MS is acknowledged to improve public images (Soriani, 2020), however more specifically Dzene et al. (2015) identified the associated positive public image towards municipalities undertaking implementation of an ISO 50001 EnMS. Meeting social requirements involves the awareness of current emissions (Molla et al., 2009) and population (Joerke et al., 2012) trends, which in themselves are motivators of sustainable energy initiatives and ISO 50001 implementation in organisations throughout all sectors.

LGs experience the influence of the horizontal and vertical institutional bureaucracy that may not impact the operations of other sectors so heavily. There is the added influence of the rational choice theory of the many political actors within LGs (Musah-Surugu et al., 2019). This can be significant as elected officials, and the decision bias they may have towards re-election, can be swayed heavily by the value the community place on issues (Dzene et al., 2015) . This can be viewed as a motivation for actors to improve energy performance if the public interests are aligned. Musah-Surugu et al. (2019) found that cities whose employees

were attending and actively involved in sustainability development conferences experience an incremental alteration of resource allocations favouring these values. By improving a LG employee's understanding of the global community's social responsibility to the issue of energy and emissions reduction their decision bias towards initiative implementation can be positively influenced. This can be a motivation and an opportunity to the implementation of sustainable energy initiatives.

In the LG context, both staff and public health and wellbeing weigh heavily on the decisions to implement such initiatives. Böttcher and Müller (2016) reported that improving office energy efficiency contributes "relatively little" in terms of the overall operations process improvements when compared to improvements made in production processes of the same organisation. Therefore, some literature identifies these improvements as weak motivators of sustainable energy initiatives in this context (Böttcher & Müller, 2016). However, operational benefits span beyond cost and emissions savings (Dzene et al., 2015). Implementation of a sustainable energy initiative can also result in greater staff performance and moral (Marimon & Casadesús, 2017), improved worker safety, and a higher quality of product (Pye & McKane, 2000) due to improved indoor climate and working conditions.

A consideration to the public health within a city's boundary is also a unique motivator, particularly to large, densely populated and more build up regions (Rees & Wackernagel, 1996). Rees and Wackernagel (1996) discuss the potential of pollution accumulation within cities due to the proximity of residents to emission sources and impact on dilution of toxic chemicals compared to those produced in less built-up areas.

Some motivators were identified for ISO 50001 implementation specifically, and include improved corporate environmental performance (Böttcher & Müller, 2016) and improving the legitimacy within the wider social context (Molla et al., 2009). The corporate

environmental performance of an organisation is measured with the use of key performance indicators and considers a range of environmental aspects, including GHG emissions (Böttcher & Müller, 2016). Establishing EnPIs throughout an organisations operational scope is a significant component of the ISO 50001 planning phase and when utilised in the cyclic PDCA approach of ISO standards will facilitate continuous improvements (Marimon & Casadesús, 2017). With this reasoning, it is justifiable why improvements in corporate environmental performance are a unique motivator for implementing an ISO 50001 EnMS over other sustainable energy initiatives. In addition, the ISO 50001 standard is internationally recognised and associated to the highly credible ISO family of standards. Therefore, it is understood that establishing legitimacy of an organisation's energy performance is a motivator for ISO 50001 implementation specifically, as other initiatives is do not have such a level of recognised legitimacy.

Environment

The environmental motivators, such as the ecological responsibilities held by organisations (Marimon & Casadesús, 2017) and the recognised need for; energy and emissions reductions (Böttcher & Müller, 2016; Dzene et al., 2015; McKane et al., 2017; Saha & Paterson, 2008), climatic stabilization, and a sustainable environment, are significant motivators recognised throughout the literature. From this literature synthesis it is concluded that, as a motivator, the ecological and environmental impacts of an organisation's operations span across the industry and service sectors and can positively influence a range of sustainable energy initiative practices, including implementing an ISO 50001 EnMS.

Economic

Economic aspects such as operation efficiencies and productivity improvements (Fadzilah Mohamad et al., 2013) and cost reduction related to energy procurement (Dzene et al., 2015;

Marimon & Casadesús, 2017; Molla et al., 2009; Singh & Lalk, 2016) are positive motivators identified in the literature. The improvement in an organisation's productivity and efficiencies was a motivator specifically identified for the implementation of ISO 50001 EnMSs (Fadzilah Mohamad et al., 2013) and not identified in the literature of the other sustainable energy initiatives. The structure of the ISO 50001 standard specifically encourages improving efficiencies, and in turn productivity, through the required identification of SEUs and the formation of baseline consumption values in the planning phase (International Organization of Standardization, 2018b). Utilising these quantitative values allows the organisation to identify areas of efficiency improvement and recognise when efficiency activities are not functioning as they should.

The economic motivators were identified to have a greater weighing, in terms of influence, on industrial organisations, which have a much stronger capital-based approach to business decisions (Singh & Lalk, 2016) than the service sector. Direct monetary benefits can result from the improved energy performance of operations however, there are a number of secondary economic benefits that can motivate, such as competitive advantage amongst other firms (Böttcher & Müller, 2016; Marimon & Casadesús, 2017; Singh & Lalk, 2016), involvement in the Carbon finance market (Ashok Sarkar, 2010) and protection against emission regulation changes (Molla et al., 2009).

Competition is the foundation of a functional free market. Institutions must ensure their top performance in the social context to ensure customers purchase their products, employees perform, the local community accepts their presence and government regulations do not constrict or hinder their operations (Bansal & Bogner, 2002). The public context and pressures of conformity within an industry is referred to as the "Bandwagon effect" by Bansal & Bogner (2002) and though they exist in the public service sector, weigh much heavier and have a quicker influence on these highly competitive industrial organisations. It is expected

that performance in the economic context will increasingly involve the compliance with emissions regulations (Karcher & Jochem, 2015), such as a carbon cap-and-trade or carbon taxing. Implementing a sustainable energy initiative to reduce energy, and in turn reduce emissions, will forestall these regulation changes and reduce the economic impacts on the organisation (Molla et al., 2009) and may potentially facilitate a positive involvement in the carbon finance market (Ashok Sarkar, 2010).

Although each of these three pillars of sustainability can stand alone as motivators, they are highly interconnected and influence the outcomes of one another. The weighting that a specific organisation places on each pillar will also alter based on its parameters. These motivators were recognised across sectors however, a LG for example, may be influenced more heavily by the social requirements of its community while being less motivated by energy and emission reduction, to positively influence the environmental and economic pillars, when compared to an energy intensive industrial company. Due to the different context in which organisations exist some may be motivated by one aspect while others have no bearing the organisation's performance.

Opportunities

Opportunities are defined as a set of circumstances that makes something possible (Lexico, 2021). The opportunities identified, are the potential positive outcomes of ISO 50001 implementation. As the ISO 50001 EnMS grows in the level of implementation across all sectors and the experiences of organisations are reviewed with more intention, it is expected the opportunities presented from these initiatives will become better understood (McKane et al., 2017). With a more definitive expectation regarding the opportunities that can be achieved, these factors may transition from opportunities to motivating factors for policy makers. As this motivates more sustainable energy initiative uptake, the barriers preventing implementation may be identified and better understood and may facilitate a positive

feedback loop of understanding, knowledge sharing and application. This feedback loop itself is recognised as an opportunity within the literature (Ashok Sarkar, 2010; Brem et al., 2020).

Social, Environment & Economic Opportunities

The Social, Environmental and Economic factors which were identified as motivators for sustainable energy initiative implementation are acknowledged here to also be an opportunity associated specifically with ISO 50001.

Energy performance improvements is the specific outcome pursued through implementing an ISO 5001 EnMS. F. Mohamad et al. (2014) stated in their work, regarding ISO 50001 implementation for a Malaysian Copper manufacturer, that the "protection of the climate is done globally through a sum of local contributions". With increased implementation across all sectors this chance to aggregate to a considerable global emission reduction is a significant opportunity of ISO 50001.

The plan-do-check-act (PDCA) structure of ISO 50001 has the overarching goal of continual improvement (Brem et al., 2020), which will provide ongoing opportunities for emissions and cost savings. Dall'O et al. (2020) recognised that this continual improvement can be further stimulated by the reinvestment of the funds, that would have otherwise been spent on energy procurement during BAU, back into the EnMS projects and training.

Improved Internal Structure

To appreciate the opportunities that ISO 50001 can provide in terms of improving the internal organisation and policy structure, the unique structural, information transmission, communication and interpersonal issues that decentralised organisations experience, through both vertical and horizontal streams, needs to be understood. These institutional concerns were initially identified in the work of Oseland (2019) on the institutional barriers of climate policy planning of cities however, many examples of these barriers were identified

throughout the literature for various sectors and initiatives. These institutional structure issues were identified as potentially impeding project development and financing (Ashok Sarkar, 2010) due to many internal issues. These issue include; split incentives, lack of culture towards energy efficiency, collective action problems (Böttcher & Müller, 2016), silos of interest (Saha & Paterson, 2008), strongly segmented departments and the influence of the CJAT (Musah-Surugu et al., 2019). The literature recognises the opportunity for improving internal structures from implementing the ISO 50001 standard through the collaboration of departments, enhanced communication and sharing of resources and information (Oseland, 2019). This is achieved through the Standards requirement of the EnMT and with it; the cross department involvement of staff, addressing energy management responsibilities and a commitment from top management (International Organization of Standardization, 2018b).

Regulation Change Resistance

Considering the current global climate and emissions situation, significant GHG reduction regulatory changes are increasingly being implemented around the globe. In this context Australia, it is currently ranked globally as the highest in per capita emission production, sitting around 21.5 tCO_2-e per person (Department of the Environment and Energy, 2019). It can therefore be expected that emissions reduction regulatory changes will inevitably occur, whether in the form of command-and-control or market-based mechanisms or incentives. Implementing sustainable energy initiatives will allow organisations to proactively mitigate their emissions to protect against fluctuating carbon emission prices (Karcher & Jochem, 2015), reduce the cost burden of carbon taxes (Böttcher & Müller, 2016), benefit from incentive-based regulations (Molla et al., 2009) and respond to emerging knowledge and technology (Bansal & Bogner, 2002). An ISO 50001 EnMS specifically requires a regular review of the organisation's energy context and will allow it to remain flexible and adaptable to these on-going regulatory changes. Protection against regulation change is already

recognised in the literature as a motivator in the industrial sector but is an opportunity throughout all sectors.

Shift in Normative Expectations

Demonstrating sustainable energy practices through initiatives such as ISO 50001 can provide the competitive advantage that many organisations strive for. There appears to be a positive feedback effect for competition of this form within the industrial sector. The needs and values of third-parties such as stakeholders, customers, environmental NGOs, and government emissions targets (Marimon & Casadesús, 2017) influence the behaviour of organisations to deliver the desired outcomes and build legitimacy amongst external stakeholders (Molla et al., 2009). Through relational-motivation effects competing organisations will alter their energy management behaviour to remain competitive, which will set the precedence and the normative expectations within the societal context (Molla et al., 2009) and shift the market on a sustainable basis (Ashok Sarkar, 2010).

These normative expectations, in terms of energy consumption, can also be encouraged by public awareness as the end users/consumers become more informed through this competition and promotion of sustainable energy practices (Karcher & Jochem, 2015; McKane et al., 2017; Molla et al., 2009). The service sector, particularly LGs, are in a unique position to directly interact with their communities in a relationship beyond buyer and seller and, instead, in the way of direct support, services, and communication. LGs can therefore play a significant role in facilitating the shift in normative expectations as they bring stakeholders together and present a platform for dialogue between public and private interest groups (Cease et al., 2019). Rees & Wackernagle (1996) describe cities as “urban sustainability multipliers” because of the complex system linkages of LG operations and the opportunities this presents to stimulate change amongst related aspects. Addressing a single sustainability issue can influence the outcome of many factors (Rees & Wackernagel, 1996).

Culture change

The approach of the ISO standard in implementing change across global sectors has been recognised in the literature through the identification of specific opportunities in ISO 50001 implementation. McKane et al. (2017) states that "the heart of ISO 50001 is a non-tangible culture-changing business practice". The change in culture towards energy management allows for improved decision making regarding EE activities (McKane et al., 2017) and improved employee acceptance (Karcher & Jochem, 2015). A cultural change which is occurring as a global effort is known to encourage employees to accept additional work efforts as a contribution to these global efforts, and as it is perceived that the change is coming from an external source, resistance within the organisation is minimised (Bansal & Bogner, 2002). The international and sector spanning implementation of ISO 50001 has the potential to tap into these cultural and behavioural opportunities to stimulate change.

Knowledge sharing

Through the internationally coordinated implementation of ISO 50001 there is an enormous potential to tap the energy efficiency, energy reduction and fuel switching opportunities globally (Ashok Sarkar, 2010). Using this standard may facilitate the sharing and penetration of best practices, policies and developing technologies across international, sectoral and institutional boundaries (Ashok Sarkar, 2010) and in particular the untapped potential of Local Governments.

ISO Standard Integration

As ISO has designed many successful MS standards with the shared PDCA structure, ISO 50001 also can be efficiently integrated amongst these other ISO standards, requiring only marginal disruption and resources (Marimon & Casadesús, 2017). This integration has been acknowledged within the industrial sector to promote the opportunities of improved

operational benefits (Böttcher & Müller, 2016; de Sousa Jabbour et al., 2017) through both improved energy performance and improved management of inter-related areas of business (AIRMIC, 2018).

These standards also build on one another to create trust from the market (Molla et al., 2009; Soriani, 2020), stakeholders (Bansal & Bogner, 2002), and insurance companies (AIRMIC, 2018) that best practices are being conformed to, stakeholder expectations are being met, and that risks are kept within an acceptable level.

Enablers

An enabler is defined as a thing or circumstance that makes something possible (Lexico, 2021). Despite the barriers that medium and large organisations face in implementing policy change and management systems, the internal and external factors which have influence on a firm can encourage them to make these changes. The enablers experienced by organisations have been broken down into three categories based on the literature assessed: the presence of other ISO standards already in place, the institutional structure, and political context.

ISO Standards

The structure of the ISO 50001 standard itself is an enabler for its implementation as it is suitable for organisations of all sizes and scopes and the requirements and procedures are more flexible than other energy related standards investigated (Karcher & Jochem, 2015).

The shared PDCA structure of ISO standards, is identified as the greatest enabler to promoting, simplifying, eliminating redundancies, and saving time and cost on ISO 50001 implementation and certification (Brem et al., 2020; Mohd Yusuff et al., 2013). It is found that 85% of organisations adopting ISO 50001 have adopted other ISO standards (Marimon

& Casadesús, 2017). The barriers many organisations experience in internal policy and procedures are less likely to occur if ISO 14001 is already established as this standard focuses on the management processes rather than the particular environmental outcome (Bansal & Bogner, 2002). Singh and Lalk (2016) identify that the presence of the ISO 14001 Environmental Management System (EMS) is the single greatest enabler for ISO 50001. This is extremely encouraging as ISO 14001 has the widest geographical and industry coverage of all environmental management certification systems worldwide (Bansal & Bogner, 2002).

Top management's commitment for change and to meet set targets is crucial for the success of an EnMS (Fadzilah Mohamad et al., 2013), as too is the willingness and enthusiasm of staff (Marimon & Casadesús, 2017). The culture for change would have been established through a previous ISO implementation and experiencing the benefits from such a structured change will encourage those involved to continue improvements through other management systems.

ISO management systems are internationally recognised because of their robust guidelines (Soriani, 2020). The recognition of following an internationally respected and endorsed standard will encourage its implementation through the top managements' desire for the associated reputation of competence and achieving best practices (AIRMIC, 2018) and will encourage staff to accept and embrace the additional efforts required by them (Bansal & Bogner, 2002).

Organisational Structure

As addressed previously, having a strong internal management system structure allows organisations to work faster, more efficiently and with a higher standard of product, therefore achieving greater operational and ecological benefits (Marimon & Casadesús,

2017). Saha and Paterson (2008) acknowledge the value that a devoted Sustainability Department will have on the efficiency and performance of administration, information, organisational and leadership resources and if this department is present, it is a significant enabler to implementing a successful ISO 50001 EnMS.

Institutional and Political Context

The parameters and context of the organisation implementing ISO 50001 can also be an enabler to its success. Based on the rate of respondents from large US cities, populations greater than 75,000, which participated in a survey regarding sustainability development, Saha and Paterson (2008) concluded that the characteristics that contributed to those cities responding are parallel to those most likely to pursue sustainability-related activities. The results describe cities with larger populations, higher rate of population growth, lower poverty levels, higher median family income, and a greater percentage of the population having completed a bachelors' degree, as more likely to carry out these activities (Saha & Paterson, 2008), such as implementing an ISO 50001 compliant EnMS.

The political context in which the organisation exists will have a significant impact on what encourages sustainable energy initiatives and internal system changes to succeed. For example, an organisation's position within a 'Developed country' can enable organisations, such as LGs, to implement and advance such management systems as the ISO 50001 due to greater likelihood of financial, skills and technical resources than their developing country counterparts. For example, Musah-Surugu et al. (2019) investigate the CC policy implementation in Ghana, a developing country in which these policies until recently were largely dealt with in a centralised government. The implementation of these policies remains in contest with others for investment within LGs due to deficiencies in resources,

inefficient sectorization and competing priorities (Musah-Surugu et al., 2019). In contrast, Australia holds a mature and efficient decentralised governmental structure, in which the local level of government can exercise political decision-making, address societal issues, and allocate resources and responsibilities highly effectively.

Developed countries also have a larger market and a greater ability to regulate and enforce policies and standards (Ashok Sarkar, 2010). A strong national political stance on energy consumption and emissions reduction can be a substantial enabler towards ISO 50001 implementation due to the influence these factors place on stakeholder expectations, normative values, the competitive value of certification and the economic situation of carbon and potential for mandatory emissions capping. Germany holds robust national energy policies in support of emission reductions, such as, the 1999 Eco tax cap for complying companies, equalizer schemes for tax relief for those energy intensive industries that implement ISO 50001, and technical and financial support for EnMS implementations for eligible companies (McKane et al., 2017). Germany was found in the literature to be the consistent case study for national policies and their success in enabling certification as evident in the disproportionately high number of certifications (Figure 5) (Dall'O et al., 2020). Germany held 3,402 ISO 50001 certifications, approximately 50% of the global total in 2014 (McKane et al., 2017) and has held this lead through global ISO 50001 implementation trends with 5,786 certifications (Figure 5), 32% of the 2019 global total according to the ISO 2019 Survey (Figure 3) (ISO, 2019). Australian organisations held 8 certificates for ISO 50001 in 2019 (ISO, 2019).

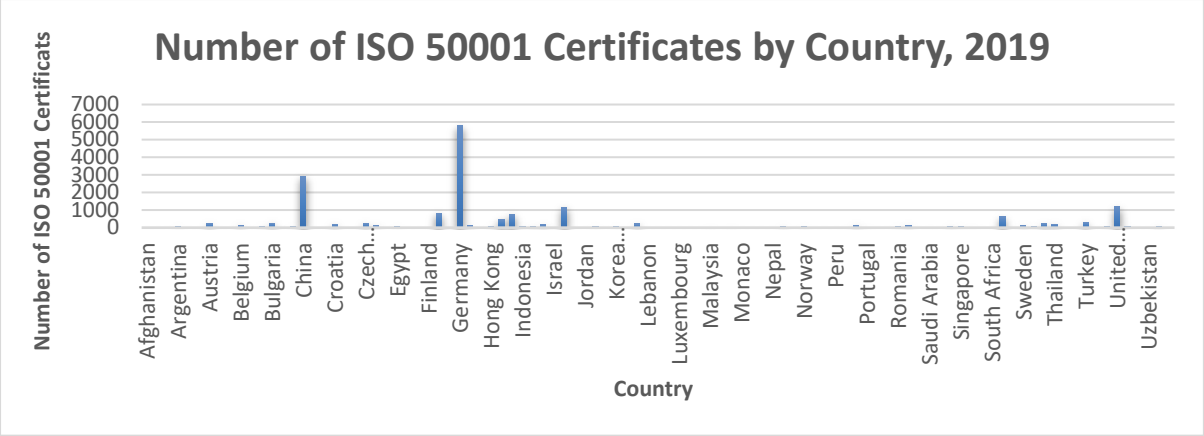

Figure 5 Number of ISO 50001 certifications by country, based on ISO 2019 MS survey results (ISO, 2019)

Australian Context

Australia is one of the highest emitters of GHGs per capita, globally (Carbon Dioxide Information Analysis Center, 2016). As the threats of CC increase throughout Australian sectors, there has been an increasing urgency to commit to emission reduction. Australia is expecting an annual population growth rate of 1.5 per cent through to 2030, significantly higher than the Organisation of Economic Co-operation and Development (OECD) average of 0.4 per cent (Australian Government, 2015). Australia has also experienced its 25th consecutive year of economic growth (Australian Government, 2015) and, without action, risks following the trend towards becoming more affluent, yet less efficient (Ashok Sarkar, 2010). Reducing the energy and emission intensity of the Australian economy is essential to meet the global emissions targets.

In the 2015 commitment to the Paris CC conference agreement, to limit the global average temperature rise to less than 2◦C above pre-industrial levels, Australia established the target of a 26-28% reduction in emissions below 2005 levels by 2030 (Australian Government, 2015). To meet their commitment, the Australia Government is developing an emissions budget for the period 2021-2030 (Australian Government, 2021) and has established various emission reduction strategies such as; low emission technology roadmaps, the Emission

Reduction Fund (ERF), National Greenhouse and Energy Reporting (NGER), Renewable Energy Target (RET), and other regulatory schemes (Department of Industry, 2021). The NGER scheme, for GHG emissions measuring and reporting, was legislated by the Australian Government in the *National Greenhouse and Energy Reporting Act, 2007* (Australian Government, 2021). The Australian Government has also developed various agencies and organisations working to mitigate CC; the Australian Renewable Energy Agency (ARENA), Commonwealth Scientific Industrial Research Organisation (CSIRO), Clean Energy Finance Corporation (CEFC) and the Clean Energy Regulator (CER) (Department of Industry, 2021).

The Climate Active Carbon Neutral Standard is an initiative being implemented by Australian organisations and businesses, through a partnership with the Australian Government, to encourage nation-wide voluntary climate action (Department of Industry, 2021). Similar to the initiatives discussed in the Literature Review, the Climate Active standard works to facilitate positive action on CC, certify on a voluntary basis, and connect organisations to facilitate the sharing of knowledge and best practices. With these schemes, regulations, and standards it is clear that there is significant governance around energy and emission reduction in Australia.

The National Inventory of Australia's GHG emissions states that the total net emissions were 518.9 Mt C02-e in 2019, a 15.2 per cent reduction in emissions compared to 2005 levels (Australian Government, 2021). This is progress in the right direction in terms of reaching the Paris Agreement targets, however it is understood that much more must be done to meet Australia's 2030 goal. In the 2019 "King Review" an expert panel reported on their inquiry into the untapped low-cost abatement potential across the Australian economy. Improving EE was a particular focus of this review when recommending the allocation of the Governments $2 billion Climate Solutions Fund (G. King et al., 2020). The final recommendations were made around the three core themes; enhanced participation in the ERF, voluntary emissions

reduction incentivisation, and unlocking low emission technologies (G. King et al., 2020). The expert panel concluded, incentivising voluntary emissions reductions will place Australia on track to exceed its 2030 Paris target, while maintaining economic growth (G. King et al., 2020)

CHAPTER 3. STUDY DESIGN AND METHODOLOGY

Procedures

This study used a qualitative research, case study approach. A case study approach was selected for the purpose of providing a preliminary investigation into ISO 50001 implementation within the context of a LG, which is an Australian first initiative in this sector. The CoM was selected as a single embedded case for this study to further understand the synthesis of the reviewed literature. This was completed using two approaches, the document review, and the case study observations.

City of Melville Context

The CoM is located in Perth Western Australia (WA) and is 20 minutes south from the central business district. It has a land area of 53km^2 and runs along 18 km of the Swan River (City of Melville, 2017a). Based on the 2019 census, CoM has an estimated population of 102,307 residences with a projected 17.74% growth to 126,754 by 2036 (City of Melville, 2020). Following the classification of organisation size, as defined by Böttcher and Müller (2016), the CoM is classified as a small company with less than 500 employees as it has approximately 460 Full-time Equivalent (FTE) employees (City of Melville, 2019). The CoM footprint contains a mix of residential, retail, business and industrial precincts and includes a number of retail and commercial hubs (City of Melville, 2017a).

The total annual community emissions of the CoM's local geographic boundary was reported as 1,181 ktCO^2-e for the baseline year of 2015 to 2016 (City of Melville, 2021d). The City's operational GHG emissions were reported as 11,796 tCO^2e- and 10,145 tCO^2e- for the years 2015/16 and 2019/20 respectively (City of Melville, 2021a). The breakdown of the CoM's 2019-20 emission source and energy consumption is provided on the Community Outcome

Reporting website and available to all stakeholders, the results of which are summarised in Table 1 and Table 2.

Table 2 CoM operations 2019-20 emission source breakdown (City of Melville, 2021a)

Emissions Source	Emissions (tCo2-e)	Percentage
Stationary Energy	563,825	48%
Transportation	352,558	30%

Table 3 CoM operations 2019-20 energy source/ fuel type breakdown (City of Melville, 2021a)

Energy Source/Fuel Type	Energy Consumption	Units	% of Total Energy Source
Electricity	52,560	GJ	58.26 %
Petrol	29,279	GJ	32.46 %
Gas	8,373	GJ	9.28 %

The values held within the CoM council, staff and community are ideal to implement an ISO 50001 compliant EnMS. The CoM's recently implemented Quality Policy describes its loyalty to the wellbeing of its community, stakeholder satisfaction, appropriate leadership within the organisation and the compliance to statutory and regulatory requirements (Silcox, 2018). The values of the community and the goals of the CoM are outlined in the city's documents; the Corporate Environmental Strategic Plan (CESP) 2016 to 2025 and the Corporate Business Plan 2020 to 2024. Community Priority Survey results are taken in high regard when determining the CoM's strategic direction over a four year period, informing the Corporate Business Plan, annual budget, long term financial planning and workforce and issue specific planning (City of Melville, 2020). The 2020 community surveys identified "Clean and Green" as their number one priority and from these considerations the CoM have

determined the top three CESP priorities as ‘Greening the City’, ‘Reduce Carbon Emissions’, and achieve ‘Sustainable Energy Management’ (City of Melville, 2016).

The CoM is also involved in the Global Covenant of Mayors for Climate and Energy (GCoM) initiative and is working with the Climate Council through the Cities Power Partnership (CPP) program to reduce the city’s energy consumption and ultimately create a low-emission community (City of Melville, 2017b). In its Corporate Environmental Strategic Plan (City of Melville, 2016), the CoM has publicly committed to the emission reduction target of a 48% reduction from 2005-06 levels by 2025 within their facilities and operations (City of Melville, 2019). A recent Net Zero Emission commitment, by the year 2030, has been made following the Ordinary Meeting of the Council on 15 June, 2021 (City of Melville, 2021b, p. 22).

To address the emission reduction targets, the CoM partnered with Murdoch University and applied for funding under the Commonwealth Government Smart Cities and Suburbs Program for its “Local Government Facilities as a Grid Paralleled-Mode Microgrid” project, hereby referred to as the Smart City Project. The Commonwealth Government’s $50 million program aims to support the delivery of innovative technology-based projects which would improve the productivity and sustainability of Australian cities and towns (Australian Government, 2020). The project was awarded $546,724 of matching funding, in 2018, to put towards it’s smart grid system (Australian Government, 2020). The Smart Grid Project included the completion of a Level 2 Australian Standard compliant (AS3598:2000) Energy Audit and the instalment of 218 electrical meters across 12 key facilities, which represents 75% of the CoM’s electricity use and is representative of all CoM facility types (Lund, 2021). This funding was a one-off payment through a grant approval process and is not applicable across Australian LGs.

Data Collection

For the project the researcher assumed the role of the ISO 50001 EnMS consultant and worked with the CoM formally through their Work Experience Program. The data was collected through unstructured case study observations while the researcher was directly involved in EnMS design, MS integration, and staff and Executive Management Team (EMT) liaison. EnMS activities commenced Nov-2020 and was completed April-2021. The researcher visited the CoM approximately once a week to undertake EnMS development activities. The researcher worked under the supervision of the CoM Sustainability Coordinator and was granted 'Work Experience' clearance to access the CoM's Business Management System (BMS) documentation.

The data collected through the document review and case study observations occurred in parallel during the six-month period.

Document Review and Gap Analysis

The researcher completed the tasks of a systematic document review and a gap analysis of the current CoM BMS documentation and ISO 50001 requirements. The document review was completed using a top-down approach starting at the highest-level (tier one) documentation. Through this process a total of 26 internal CoM documents were reviewed (Appendix B).

The Tier one level, strategic operational documents; Council Policies (CP), Objectives, Frameworks and Plans, were first reviewed to gather an understanding and context of the CoM and its operations. Tier two documents included the 'Business Management System (BMS) Manual' and Corporate Dictionary. The BMS manual outlines the structure of CoM documentation and interprets the principles of the compliant standards. The BMS also contains the 'Integrated Compliance Matrix' in which the documents concerning ISO standard integration are mapped out. Tier three System Procedures (SP) are the procedures

determining what, when and who, are required for the success of the organisation and to meet the ISO and AS/NZS Standards in which the CoM is compliant. Tier four documents contain Work Instructions which provide the guidance or instruction for specific processes and steps. Tier five contained supporting documents and templates to ensure the creation of corporate documents were achieved in a manner appropriate for CoM use.

Following the review of the internal documentation the CP and SP for the CoM's ISO 50001 compliant EnMS were drafted by the researcher (Appendices C and D).

Observations

Unstructured case study observations were made throughout the researchers embedded work within the CoM. These observations reflected all activities undertaken within the CoM; document review and gap analysis, document access and troubleshooting, email correspondence, questionnaire distributions, personal interactions, formal Management and ETM meetings, and CoM and Murdoch project and smart grid project meetings.

Observations were captured during a six-month period, where weekly informal journaling was written documenting; the date, events, context, and individuals involved noting personal communication and non-verbal cues (emotive and expressive responses). These observations were taken after each visit, providing a quarter-to-full page of observational results.

The cases study observations and journaling were guided with the following questions:

- What drivers (motivators and opportunities) are in place?
- What barriers are in place?
- What barriers are overcome with the CoM's current BMS and clearly defined SPs?
- How would ISO 50001 implementation influence the drivers and overcome the barriers?
- What barriers would remain?

- What recommendations can be made to overcome these remaining barriers?

This research ran concurrently to the final stages of the smart grid project. The outcomes and observations made throughout the smart grid project contributed to the data collection of this project.

Questionnaire – Design and evaluation

A pilot EnM questionnaire was developed by the researcher to informally interact with CoM employees and to gain an understanding of the internal CoM culture around EnM, identify who may be responsible for making decision regarding energy, identify any energy performance improvement opportunities as observed by staff, and document recommendations made by these actors. The questionnaire was intended to be distributed to any relevant facility managers to facilitate a more structured approach to observational data collection. The desired level of distribution was not achieved, and a suitable level of structured results was not collected for analysis. The questionnaire was instead distributed in a preliminary manner and the initial results and feedback were utilised were possible for informal observational case study results and analysis of the Literature Synthesis.

The pilot EnM questionnaire was validated by two topic experts (Professor Chris Lund, Murdoch Lecturer & Jagpreet Walia, CoM Sustainability Coordinator) and items were refined and reviewed based on the feedback they provided. Questions were presented as guided questions asking for specific examples of energy matters (Appendix E). Permission to undertake the research using the questionnaires and analyse the results was given by the City as part of its operational processes and guidelines.

Data Analysis

Inductive Analysis

The document review and case study observations were assessed through a theoretically driven inductive analysis based on the literature synthesis. These observations were categorised into themes and then compared to the literature synthesis to determine the extent of these influencing factors and the relevance to the LG context.

This inductive approach provided a structure for identifying the CoM's barriers and a system to establish the relationship between the observed barriers in the LG context and the cross-sectoral findings of the literature synthesis (Figure 6). This inductive analysis was also applied to the positive influencing factors (drivers and enablers) to determine the relationship between these positive influencing factors and the barriers overcome in this case study's LG context (Figure 7).

Document Review and Gap Analysis

The BMS documents associated with the ISO standards; ISO 14001 and IS0 9001, with the shared PDCA framework, were systematically reviewed against the ISO 50001 requirements to determine what EnMS compliant documentation needed to be developed, what documentation currently existed in the BMS, and if any additions or alterations were necessary for these documents.

The BMS manual (Appendix A), was used to map out the relevant documentation against the ISO 50001 standard to correlate the 'System Elements' of the standard, and the relevant Standard section numbers, with the 'City of Melville Compliance Approach Documentation No./Title'. Additional information was added to the 'Integrated Compliance Matrix' to outline the specific ISO 50001 standard requirements and identify where and what additional CoM documents are required to meet the needs of the ISO 50001 (blue text). The documents

requiring review and details of the requirements, as stated in the ISO 50001 standard, were also added (red text). If these specific requirements were not found within the relevant documentation it was noted in the 'Gap Analysis Report' tables with the document ID, Document Location of the required alteration, and the Recommendation or Action to be taken to ensure ISO 50001 compliance (Appendix B). This process was completed for all levels of documentation.

Twenty-six documents were initially reviewed of which 6 were excluded because no alterations were required for these documents. Of the remaining, 13 were excluded from the results as no influencing factors were identified to contribute to the success of the ISO 50001 implementation. The final 7 documents were analysed against the supporting literature synthesis to determine the key barriers (Figure 6) and drivers and enablers (Figure 7) influencing the CoM towards its ISO 50001 implementation.

Next, additional supporting documentation were developed specifically for the CoM to address the gaps in the ISO 50001 compliant EnMS. Following the guidance of the Sustainability Coordinator and the CoM's System Procedure for Document Control (SP-007), documents were drafted to meet the ISO 50001 requirements which were not met through the current BMS documentation. Due to the paralleled nature of the ISO 50001 EnMS requirements to those covered in the ISO 14001 EMS, the EMS CP-030 and EMS SP-010 documents were used as templates to ensure the draft EnMS documents were aligned with the CoM specifications. The documents developed included the Energy Management CP (Appendix C) and Energy Management SP (Appendix D), which will now act as the ISO 50001 and BMS bridging documents for the CoM. These documents were noted (blue text) in the Compliance Integration Matrix where their addition is required (Appendix A).

Lastly, recommendations for the development of additional documentation and information that was beyond the scope of the researcher's involvement to meet all requirements of the ISO 50001 standard were also noted in the Gap Analysis Report along with recommendations made towards successful EnMS development.

CHAPTER 4. RESULTS

Overview of Results

These results were guided by the influencing factors identified within the literature synthesis. The results have been presented in two sections. Section one discusses the key barriers identified in the CoM case study. The second section discusses the positive influencing factors; drivers (motivators and opportunities) and enablers identified from the CoM case study.

Barriers

The barriers were categorised from the literature synthesis, document review and case study observations into the key headings of Resources, System/Structure, Information, and Behaviour of stakeholders. These factors are outlined as they impact the success of sustainable energy initiatives and are observed to be altered depending on the context of the organisation. Figure 6 depicts the clear distinction between the literature, CoM observations and the overlapping barriers. Further discussion of the remaining barriers identified by the literature have not been discussed in the results as the CoM's unique drivers and enablers in ISO 50001 implementation have contributed to overcoming these barriers.

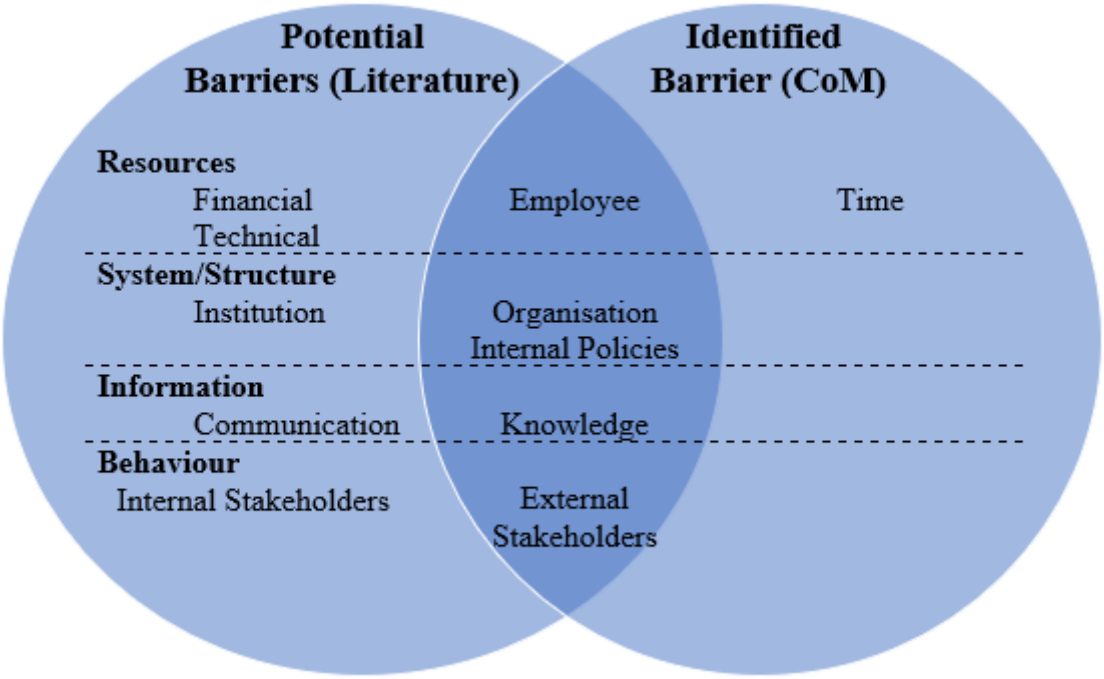

Figure 6 Potential barriers in ISO 50001 implementation as identified within the CoM and identified as overarching barrier between CoM and literature synthesis results. Those barriers observed exclusively under the literature synthesis were overcome due to the positive influencing factors unique to the CoM.

Resources

Time (Identified in CoM)

From the case study observations conducted by the researcher a key barrier was identified that has not been discussed in the literature. The high demand for time resources were observed as a barrier through the process of project and document approvals, due to the complexity of protocols and procedures and external factors causing delays. For example, the length of time to receive approval of the project took approximately twice as long as anticipated due a number of factors such as difficulty in the coordination of multiple parties, workload demands of all participants, and external events such as the Covid-19 global pandemic and the ensuing disruptions.

The document review results also support this key finding, that excessive time resource requirements can be a barrier to implementation, as the Procurement Policy (CP-023)

indicated a complex approval process due to four sets of Purchase Value Thresholds: under $5,000, $5,000 to $50,000, $50,000 to $250,000 and over $250,000. These require authorisation based on the monetary value and procurement procedures defined within the thresholds. For example, it is CoM council policy that purchases above $50,000 must obtain three written quotes from suppliers and those above $250,000 are to be put through a public Request for Tender in accordance with Part 4 of the *Local Government (Functions and General) Regulations 1996.* Procurement supporting energy efficient products and services to improve energy performance is a requirement of the ISO 50001 standard which can be delayed by navigating CoM protocols and can slow down active EnM projects.

Employee Resources

Employee resources were identified both from the literature and in the context of CoM to be a barrier to successful ISO 50001 implementation. In an EMT meeting the executives expressed their concern regarding the lack of internal capacity. Specifically asking who within the city will implement the technical aspects of the EnMS, who has the knowledge required to make technical energy related decisions, and what are the job role requirements to meet these capacity needs. Observations were made as consideration was given by the EMT for job role creation to increase internal technical capacity or to maintain a working relationship with external organizations which can provide this capacity.

System/Structure

Organisation

Barriers within the CoM organisation include the identified risk of siloism, split incentives and CJAT due to the complexity of; the organisation, its BMS and protocols. Energy performance considerations span across departments and appropriate management can be

hindered by siloism which was identified as a “medium risk” in the CoM’s Operational Risk Register.

The barrier to ISO 50001 implementation caused by silosim and split incentives were identified in the case study observations, as facilitated by the pilot questionnaire. When asked “who on/off site is formally assigned the responsibility for managing energy consumption?” (Appendix E) the respondents identified the branch team leaders as responsible. However, they also stated that the current power bills were managed by a separate department, Building Services, and never viewed or handled by the team leader directly.

The complexity of the organisation was also observed directly by the researcher through the process of the document review and in drafting the CoM’s EnM CP and SP. To undertake actions such as document creation it is required that the party follows the defined procedural steps within the related SPs. Often these involve approvals obtained through a particular sequence of actions and involve multiple parties across departments and of various hierarchy levels. For example, the Document Control procedure (SP-007) states all relevant stakeholders must contribute to the document’s development, the document must be approved, document ID is obtained from the Corporate Services Administration Coordinator, and all relevant officers are to be informed.

The outsourcing of operations such as the organisation’s heating, ventilation, and air-conditioning (HVAC) system is a potential barrier to achieving a successful ISO 50001 compliant EnMS. It was found through the smart grid project, and associated energy audit, that the sub-metering for individual units could not be installed due to this outsourced arrangement and therefore, energy consumption information not be effectively collected for management purposes (Lund, 2021). Also, the control of the HVAC system remains statically

controlled external to the CoM which will inhibit the energy saving potential of a dynamically controlled internal system (Lund, 2021).

Internal Policies

Through the document analysis it was identified that the implementation of ISO 50001 and its requirements would clash with the CoM's current BMS internal policies. For example, the ISO 50001 standard requires the procurement of equipment and services to consider their specifications to ensure energy performance (International Organization of Standardization, 2018b). However, there is an order of priority for procurement sources within the CoM's procurement SP:

1. "Existing City contracts
2. Aboriginal Businesses or ADEs
3. WA Local Government Association (WALGA) preferred supplier arrangements
4. State Government Common Use Arrangements (CUAs)
5. Open Market" (Procurement & Contracts Coordinator, 2020)

This current policy and priority for procurement is not conducive with the requirements of the ISO 50001 standard and may be a barrier to efficient and successful EnMS implementation.

Information

Knowledge

Observational case study data was collected during the energy audit conducted for the smart grid project. A lack of staff knowledge and understanding about RE generating capacity, economics of electricity consumption, and energy inefficiencies were observed (Lund, 2021). For example, service windows of the Operations Centre store office were observed to be left

open all day while the air-conditioning was operating and set to 18 degrees Celsius (Lund, 2021). When discussions were undertaken with staff a team member stated:

> *"There was no need to undertake energy efficiency as all of the electricity for the facility was now generated by the photovoltaic system"* (Lund, 2021).

Behaviour

External Stakeholders

Although no observational data was collected in regards to external stakeholders barriers, the document review of the CoM Corporate Business Plan stated that the key community priorities for 2020 were a "Clean and Green" city where the previous year's Community Wellbeing Survey (2018/19) results indicated "Safe and Secure" as most importance for the community (City of Melville, 2020). This shows a short-term shift of values by the community that may not meet the CoM's ISO 50001 EnMS core principles in the long-term.

Positive Influencing Factors

Drivers and enablers are positive factors that helped to overcome some of the barriers for the CoM that were identified in the literature synthesis. The document review and case study observations are discussed interchangeably to highlight the key positive influencing factors for the ISO 50001 implementation within the CoM. Top Management support and available Funding were considered influencing factors both as drivers and enablers (Figure 7). Without these two factors it is understood that the barriers facing the ISO 50001 EnMS may not be overcome for successful implementation. The significant role of the Institutional context and values as positive influencing factors are also recognised as both drivers and enablers (Figure 7).

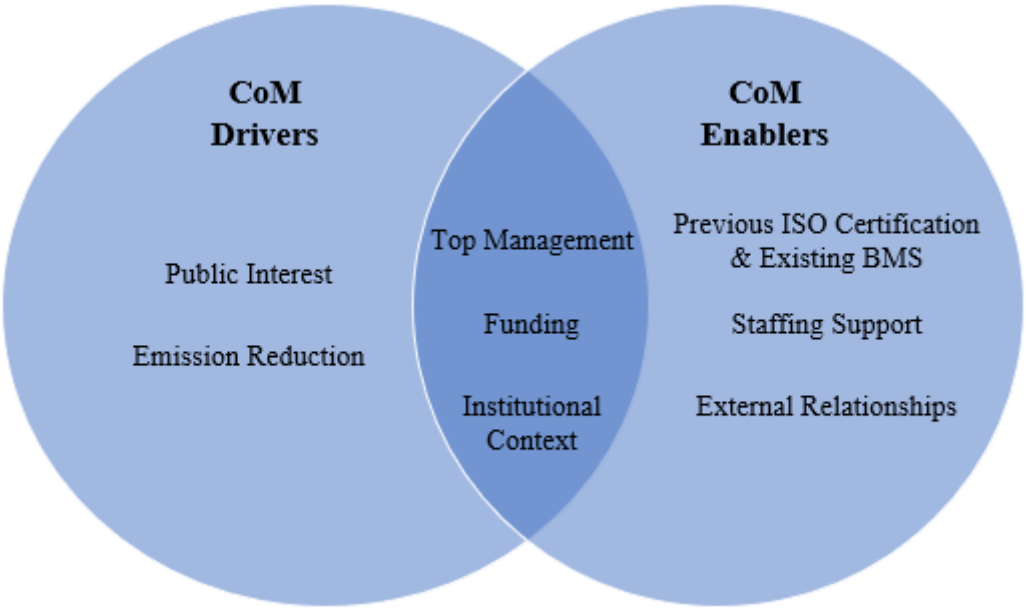

Figure 7 The positive influencing factors collected through the case study observations within the CoM. Influencing factors can occur as drivers and enablers independently or work to both drive the initiatives implementation and enable its success.

Top Management

The values of top management were observed to strongly favour the sustainable performance of the CoM in terms of EnM and emission reduction. For example, observations made during the proceedings of the EMT meeting, regarding the smart grid project and progress towards EnMS implementation, showed overwhelming executive support to reach the Net Zero emissions target for CoM operations by 2030.

This observation was validated in the 2021 Ordinary Meeting of the Council in which the minutes state:

> *"[CoM] Commits to: ... the reduction of the carbon emissions caused by the operations of the City of Melville to net zero by December 2030; and working with the State and Federal Governments, the community and local businesses to ensure that the carbon*

emissions within the geographical area of the City of Melville reach net zero by 2050" (City of Melville, 2021b).

When presented with the smart grid project results, the suggested EnM activities and the monetary payback periods for the project capital investment, the CEO requested it be remodelled in terms of requirements in reaching the Net Zero Emissions goal. This request demonstrated the EMT core values towards emission reduction over the impact on the CoM budget.

Funding

Funding is a valuable driver and enabler of the ISO 50001 EnMS in the LG context as it allows additional resourcing, otherwise not available in the LG context.

The Commonwealth funding grant received as part of the smart grid project was put into the instalment of 218 electrical metering sensors and the interactive monitoring system and dashboard. These outcomes led to a positive reaction within the EMT towards the user-friendly program and its use for energy data collection, analysis, and interpretation. This data collection will be used to facilitate the ISO 50001 energy review requirements.

Institutional Context

The CoM is located in WA and its activities governed by the legislative requirements of the WA *Local Government Act (1995).* The *WA Local Government Act (1995)* recognises that the LG and State Government relationship has no defined scope as they "may perform function of a like nature" (Government of Western Australian, 2021). The governing values of the State and Federal Government will likely influence the legislative and executive actions performed by the LG.

The CoM's purpose is set by the *Local Government Act (1995)* (City of Melville, 2020) in which it aims to best meet the needs of current and future generations (Government of

Western Australian, 2021) and the CoM endeavours to integrate the three pillars of sustainability; environmental protection, social progress and economic prosperity (City of Melville, 2020). The WA governing context and values will drive sustainable energy initiatives such as an ISO 50001 compliant EnMS. In the CoM case study this initiative was enabled by the greater Australian values, which provided funding opportunities to overcome urban challenges, such as sustainability, through the Smart Cities and Suburbs Program.

Drivers

Drivers were identified as supporting factors for ISO 50001 implementation in the CoM because they promoted positive reinforcement for the LG to engage in an EnMS. The independent drivers identified were Emission Reduction, and Public Interests (Figure 7).

Emission Reduction

The key drivers identified below are indicative of the global trend to address anthropogenic GHG emissions. Emission reduction within the CoM was observed as a high priority as stated in the CESP emission reduction targets of 48% on 2005-06 levels by 2025 (City of Melville, 2016) and more recently the 2030 Net Zero emissions target for CoM operations (City of Melville, 2021b). Initiatives for increasing sustainable energy management, such as; reducing energy consumption with improvement in fleet efficiency, improving EE of city lighting and cooling systems, and employing more RE generation at CoM assets, are driving the CoM to achieve ISO 50001 EnMS certification (City of Melville, 2016).

The pilot questionnaire revealed several opportunities and motivators to ISO 50001 implementation as observed by the Facility managers and their employees. In a discussion with the Civic Square Library team (Dec 2020) the opportunity for significant energy consumption reduction was noted by the manager. Inefficient air-conditioning at the Civic Square Library, lack of natural lighting and excessive/ineffective artificial lighting at the

Bullcreek Library and the single glazed windows of the Canning Bridge Library were inefficiencies identified by staff.

Public Interest

As discussed at the Ordinary Meeting of the Council, a petition was signed by 1,179 residents and 85 non-residents of the CoM expressing concerns for CC trends and impacts to life and ecosystems (City of Melville, 2021b). This petition requested the CoM to declare a climate emergency. This is noted to be a powerful signal from the public (City of Melville, 2021b). The CoM will join approximately 100 Australian local councils in their Climate Emergency stance, 8 of which are located in WA (City of Melville, 2021b).

Community support and public interests contributed as one of the main driving factors for the ISO 50001 EnMS implementation because of the increased awareness and acceptance by the community who live within a city which values and supports Global emission reduction targets. The CoM's Code of Conduct expresses the 'Primacy of Public Interest' as a core requirement of staff and management.

Enablers

The successful implementation of the ISO 50001 EnMS will be facilitated by the identified enablers. These include the pervious ISO Certification undertaken by the CoM, and Staffing Support (Figure 7). One unique aspect of the CoM was the External Relationship established with the University sector, specifically with Murdoch University (Figure 7).

ISO Certification

The existence of the mature and well maintained BMS, facilitated by the previous certification in ISO 14001 and ISO 90001, is a significant enabler to a successful ISO 50001 EnMS because of the shared framework structure, the existence of vital compliance documents, and the systems in place to facilitate new document creation.

Several documents within the BMS, related to these other standards, were identified in the document review as enabling the EnMS implementation by addressing barriers recognised during previous ISO certification. For example, the Information Framework document acknowledges siloism within the CoM and provides policies and procedures to ensure "information and knowledge is shared and disseminated through cross functional work groups" (Manager Information Technology and Support, 2015).

Staffing Support

Through observations made while conducting the pilot questionnaire, the willingness to discuss energy matters and the insightful contribution to ideas on energy performance improvement opportunities from staff members were encouraging interactions. This demonstrated the positive value these internal stakeholders held towards EnM and the acceptance to the suggestion of policy implementation and change.

The success of recent environmental policy implementation also demonstrates staffing support. For example, the CoM recently implemented a three-bin Food Organics, Garden Organics (FOGO) system throughout its community and within its operations. The staff (and community's) willingness to make behavioural changes with this policy implementation was recognised as an enabler to move forward with other sustainability initiatives.

External Relationships

The relationship that the CoM has established with Murdoch University was identified as a very significant enabler to facilitate an ISO 50001 compliant EnMS. Observations made of the EMT and other staff members were of concern in the handover of responsibility following completion of Murdoch University project involvement. Discussion of job role creation and the skills these individual(s) should possess to increase internal technical capacity were undertaken between the EMT and Murdoch staff and the researcher.

The academic knowledge and technical expertise provided by this multidisciplinary relationship with Murdoch University, particularly in the smart grid system implementation, is unique within the CoM context. Yet, it should be noted that this relationship is a particularly important influencing factor which overcame the LG's employee capacity gaps at the time of this study.

The importance of this relationship was acknowledged within the CoM as the researcher observed discussions between the two parties regarding the establishment of a Memorandum of Understanding (MoU) to continue the mutually beneficial collaborations.

CHAPTER 5. DISCUSSION

In the case study observations, barriers that may potentially inhibit a successful implementation of the ISO 50001 compliant EnMS in the CoM were identified from all the main categories established in the literature synthesis; Resources, System/Structure, Information and Behaviour. Some barriers were observed to be overcome due to the positive influencing factors unique to the CoM (Figure 7). The three key barriers remaining fell into the subcategories: Time, Organisation structure and External stakeholders (Figure 6). Time was a barrier not identified through the literature synthesis but identified through the case study observations by the researcher.

Barriers Remaining in LG context

The key finding regarding the CoM's potential barriers are that the complexity of the LG's organisation structure and the associated internal policies can be inhibiting factors of efficient ISO 50001 EnMS implementation and, due to this complexity, significant time resources are required.

Resources

The complexity of the CoM's BMS, observed by the researcher, and the protocols and procedures in place to move forward with policy implementation was a significant barrier. For example, the scope of this project was altered due to the time required to meet CoM policy approval requirements. Time resources were also influenced by several external factors, such as Covid-19, which influenced the operations of organisations across all sectors. The requirement of unanticipated time resources is a potential barrier, not identified in the literature synthesis, that should be acknowledged in future studies. As time resources are increasingly allocated towards implementation of sustainable energy projects this may place further pressure on the other resources such as employees and finances.

The capacity of employees to complete the ISO 50001 EnMS implementation is a greater challenge for the service sector due its less technical operations as compared with other industrial heavy organisations and sectors (Singh & Lalk, 2016). As a LG's BAU operations require less technical capacity, it is appropriate to expect the available internal employee capacity will be less steered towards technical skills and knowledge (Karcher & Jochem, 2015). The CoM's EMT confirmed this as a barrier through their expressed concern in finding staff to take on the EnM responsibilities.

Financial resources were overcome as a barrier for the CoM through the organisation's identified positive influencing factors such as funding, however, as the EnMS progresses through the stages of implementation it has the potential to emerge as an inhibiting factor. Excessive time and employee resources can place additional strain on an initiative's economics. Financial resources has been identified as the greatest barrier in sustainable energy initiatives (Cease et al., 2019; Dall'O et al., 2020; Dzene et al., 2015), particularly in the LG context (Musah-Surugu et al., 2019; Saha & Paterson, 2008) and is a factor which must be observed carefully moving forward.

System/Structure

The significant complexity of LGs is due to their decentralised structure and the separation of leadership, responsibilities, control, resources, and administration between departments (Oseland, 2019). When addressing a cross-departmental issue such as energy performance this organisational structure can be an inhibiting factor in implementing the associated initiatives (McKane et al., 2017; Musah-Surugu et al., 2019). The resultant silos of interest and complex action problems (Böttcher & Müller, 2016), which can develop from these internal organisation structures require further research as they are a sector-spanning and internationally recognised challenge. Similarly, the CoM has acknowledged siloism within

their organisation, which may be a barrier that must remain well managed as it cannot be eliminated.

Due to the complexity of the CoMs operations and the composition of employee capacities some operations were outsourced. The findings of the smart grid project are that the HVAC outsourcing may inhibit the energy performance improvements of the ISO 50001 EnMS, as the benefits of having an internal dynamically controlled system are not achieve due to outsourced responsibilities (Lund, 2021). Outsourcing is a common practice and an observed barrier for organisations throughout all sectors, such as logistics in the industrial sector (Böttcher & Müller, 2016). Overcoming outsourced operations may create added pressure on the resources of the CoM as internalising these responsibilities will be met with more internal capacity requirements.

The CoM requires multiple internal policies to run concurrently for its functional operation. For example the CoM has a total of 50 Council Policies, 31 Local Planning Policies, 26 Operations Policies and one Public Relations Policy (City of Melville, 2021c). Through the document review of the 26 related internal documents, internal policy clashes were identified and require amendment to achieve ISO 50001 compliance (Appendix B). These clashes can also occur as technologies and knowledge shift and policies are not kept up to date (Singh & Lalk, 2016) or if the policy lacks clarity and a clear goal (Musah-Surugu et al., 2019). Within a complex organisation such as the CoM, frequent revision of policies is necessary (Singh & Lalk, 2016) as is laid out in the city's Document Control Procedures (SP-007).

Information

Climate change is a wicked problem which, by definition, does not have a single or simple solution to overcome its causes and impacts (Oseland, 2019) and determining the correct approach an organisation must take may not be possible. Due to this, CC will remain to have

the potential to inhibit mitigative responses such as ISO 50001 implementation. Also, the quickly evolving technologies to improve EE and provide RE generation capabilities require highly technical skills to make the most informed and appropriate decision for the organisation and its operations (Ashok Sarkar, 2010) often not within the internal capacity of a LG organisation. Although, adapting these approaches (EE and RE) may be one way for LGs to manage CC.

Behaviour

The LGs ongoing link with the public can directly influence the actions and decisions made within the organisation. In the context of the CoM, the external stakeholders' values currently align with the values and aim of the ISO 50001 standard. It may appear that this should be considered a motivator or enabler to ISO 50001 implementation however, it was observed in the most recent community priority surveys that there is volatility in the local community's priorities between one year to the next. This is considered a potential barrier by the researcher as it has the potential to influence a negative Public Choice Theory (Cease et al., 2019) regarding the CoM's EnMS.

Barriers Overcome in LG context

The key findings for LGs to overcome barriers are in the importance of grant Funding opportunities and the External Relationships to assist in fulfilling knowledge and capacity gaps. The institutional context of Australia is recognised to have enabled the opportunity of grant funding from the Commonwealth for the City of Melville, but this was from a one-off fund and would not be available to other councils going forward. The relationship between these key findings and their influence on overcoming barriers within the CoM are discussed below (Table 4).

Table 4 Relationship: Barriers overcome in ISO 50001 implementation and the CoM's unique Positive Influencing Factors

Barriers Overcome		Positive influencing factors
Resources	Financial	Funding Top Management Institutional Context
	Technical	Funding Top Management External Relationships
Structure/ System	Institution	Institutional Context Public Interest Emissions Reduction
Information	Communication	ISO and BMS
Behaviour	Internal	Top Management Staff support Public Interest

Resources

The financial barriers for implementing sustainable energy initiatives were noted throughout the literature to be the most significant barrier within the LG context (Cease et al., 2019). The technical and financial barriers observed from the literature synthesis were overcome in the CoM with aid from the $546,724 commonwealth funding granted. This funding allowed for the purchase of the technical monitoring and analysis equipment to be used throughout the ISO 50001 EnMS implementation and operation, as well as Level 2 Energy Audits of all key facilities to identify energy reduction options. Without this funding, the allocation of financial resources within the CoM required for the appropriate level of energy data collection, a lack of technical resources would have been a barrier shared with the case studies reviewed in the

literature. For example, Dall'O et al. (2020) found the complexity of energy data throughout public housing and the lack of means to collect data appropriately was a significant barrier.

Moving forward, financial resources will be required to provide increased technical capacity of internal staff and/or the engagement of external consultants. In the context of the CoM, this will no longer be funded by the original grant and could potentially develop into a barrier if the values and support of top management were to shift away from emission reduction. It was observed that the support of top management can overcome such barriers as financial and technical resources (McKane et al., 2017) through the decisions made by top management to appropriately allocate resources in favour of EnM. This allocation of finances will not only support the capital investment required for energy performance improvements but can also support the capacity building required to overcome technical barriers.

The CoM has built a working relationship with Murdoch University in which this external entity offers academic and technical expertise in return for access to CoM operations and information for the purpose of academic research. The shared resources between these cross-sectoral organisations were observed to have overcome the limitation of technical knowledge and the misunderstanding of risks related to EE projects (Ashok Sarkar, 2010; Cease et al., 2019; Singh & Lalk, 2016). It was found this expert guidance addressed the risk adverse nature of LGs, which influences the decision making of involved parties, such as staff and management (Deslatte & Stokan, 2020). The value of external relationships is a unique finding within the case study and not found within the literature reviewed. It was observed to be a positive influencing factor which, when coupled with the financial grant, overcame the resource barriers, which were found in the literature to hinder ISO 50001 implementation, particularly in the LG context (Cease et al., 2019).

System/Structure

The institutional values of the Australian Commonwealth towards emission reduction, environmental sustainability and in enabling growth and change in this space (Department of Industry, 2021) is noted by the researcher to be a contextual enabler unique to the CoM's setting. Without these shared values by the public and throughout all levels of the Australian government, opportunities such as the Smart Cities and Suburbs Program funding may not have been available. The energy intensity of the Australian sectors and the per capital GHG emission rates are some of the highest in the world (Carbon Dioxide Information Analysis Center, 2016), which has been observed alongside a quarter century of continued economic growth (Australian Government, 2015). Understanding the Australian context is an important distinction to be made when considering the success of ISO 50001 implementation in LGs internationally. The drivers for Australian LGs, to reduce emissions and the financial opportunities available within the nation, are likely applicable to a very small portion of countries around the globe. This aligns with the finding of Ashok Sarkar (2010) were it was concluded that developed countries have a greater ability to regulate and enforce these sustainable energy policies and standards.

The values held by the Australian government, both at state and federal levels, are significant positive influencing factors in the implementation of ISO 50001. The institutional barriers experience by other organisations due to the lack of supportive policies, regulations, and financial incentives (F. Mohamad et al., 2014; Fadzilah Mohamad et al., 2013) were not observed to be present in the CoM case study. There is in fact a significant amount of supportive governance around energy and emission reduction in Australia, such as CC mitigation agencies (ARENA, CSIRO, CEFC and CER), emission reduction strategies (ERF, NGER, RET), and standards for carbon neutrality (Department of Industry, 2021). The literature found that the presence of robust government policies and standards towards

emission reduction significantly impact the rate of ISO 50001 implementation. For example, the accelerated rate of certification of ISO 50001 in German organisations (Figure 5) is agreed upon by academia to be the result of this supportive governance (Dall'O et al., 2020; McKane et al., 2017).

This focus on emissions reduction throughout all levels of the Australian government and within organisations, as they take on voluntary commitments (Department of Industry, 2021), is also observed in the values of the public's interests. The CoM's community signing of the petition requesting the city declare a climate emergency is a strong public signal of the significant value the Australian public places on energy and emission reduction. The interests of the public take more precedence as a valuable motivator for LGs, when compared to other sectors and organisations, as LGs place public interests higher on their decision-making hierarchy (Musah-Surugu et al., 2019). This is noted in the CoM's Code of Conduct that "employees are required to make decisions solely in terms of the public interests" (Code of Conduct) which is important due to the role of a LG and the direct and immediate influence of its activities and actions on the community's wellbeing (Cease et al., 2019). The CoM's community priority towards a 'Clean and Green' city and the recent call for a climate emergency have been observed to encourage the actions of the CoM staff and council through the recent engagement from top management to move forward with the ISO 50001 EnMS.

Information

The information barrier related to communication was observed to be overcome for the CoM by the highly developed and functional BMS and associated communication systems and procedures. A lack of the clear communication throughout an organisation is noted by Dzene et al. (2015) to potentially inhibit ISO 50001 implementation as the corporate and cultural change cannot penetrate beyond the top management. Staff willingness is crucial for the success of an EnMS (Marimon & Casadesús, 2017; Fadzilah Mohamad et al., 2013) and

therefore, the communication of EnMS policy and system procedures must be effectively diffused throughout all levels of the organisation. Due to the previous implementation of ISO standards the CoM has addressed communication barriers prior to the planning of the ISO 50001 implementation.

The CoM's communication system procedures in place also address the need for communication beyond the organisations boundary and to external stakeholders, across sectors (Oseland, 2019) and into the community (Cease et al., 2019). Engagement with these stakeholders is important for knowledge sharing, to encourage participation and promote acceptance to change (Cease et al., 2019) involved in ISO 50001 implementation.

Behaviour

The behaviour of internal stakeholders was noted in the literature synthesis to be a potential barrier to successful sustainable energy initiative implementation (Musah-Surugu et al., 2019) as an organisations employees are the backbone to change management (de Sousa Jabbour et al., 2017). Unsupportive behaviour of staff and management can stem from opposing values of the community and the initiative in question. This can result in the Public Choice Theory of these internal actors being overwhelmingly influenced by the public values and result in the sustainable energy initiative losing momentum and potentially failing (Musah-Surugu et al., 2019).

In the CoM case study, the public values are encouraging of the internal stakeholder behaviour towards ISO 50001 implementation, which is further enforced by the top management values and clear commitment to energy and emissions reduction. The apathy or disgruntled nature of staff that can occur due to unclear managerial commitment (F. Mohamad et al., 2014) was not observed in the CoM due to the clear goals set by the EMT

and the appropriate allocation of resources to support staff in energy performance activities to date.

Barriers Overcome because of ISO 50001

The literature synthesis identified that in implementing an ISO 50001 EnMS some barriers to its success can be reduced or overcome due to the standard requirements themselves. The key ISO 50001 requirements identified to address the barriers related to the standard's success include; the formation of the EnMT and internal training/capacity building, the information gained through the energy review, top management commitments, communication requirements, the shared ISO PDCA framework, and legitimacy of ISO standards.

Energy Management Team

The formation of the EnMT is a requirement under the Leadership section of the ISO 50001 Standard and its purpose is to establish the person(s) to hold the responsibility of the EnMS (International Organization of Standardization, 2018b). By establishing an EnMT using staff from different departments the risks of developing silosim, split incentives, and CJAT may be reduced.

Competency

The competency requirements of the organisation's involved parties are recommended to be appropriate for the role of the person doing the work (International Organization of Standardization, 2018b). To achieve these competency levels training is recommended, particularly for EnMT members who are encouraged to continually develop and improve their skills and knowledge (International Organization of Standardization, 2018b). This recommendation within the ISO 50001 standard will address the recognised potential barrier of limited employee resources due to the lack of internal specialised skills and expertise (Karcher & Jochem, 2015).

Energy Review

The increased awareness and understanding of an organisation's energy performance will be facilitated by the required Energy Review (International Organization of Standardization, 2018b). By establishing a baseline of energy efficiency, use, and consumption, the SEUs and opportunities for energy performance improvements can be identified (International Organization of Standardization, 2018b). This can inform employees and increase awareness within the organisation, which can reduce staff apathy towards the implementation of the EnMS (McKane et al., 2017; F. Mohamad et al., 2014).

Beyond the internal barriers, the qualitative results of the energy review can facilitate the growth in knowledge and understanding of LG energy reduction potentials and provide a platform for knowledge sharing within this sector, further addressing the knowledge barrier associated with an ISO 50001 compliant EnMS.

Top Management

A clear commitment from the person(s) who directs and controls the organisation at the highest level is required by the ISO 50001 standard (International Organization of Standardization, 2018b). The importance of a top management commitment was acknowledged by Musah-Surugu et al. (2019) as critical in creating a clear and effective system and addressed in the standard through energy policy establishment, formal commitments, and communication by top management (International Organization of Standardization, 2018b).

Communication

The standard states a requirement that the organisation shall establish an internal and external communication procedure (International Organization of Standardization, 2018b) to ensure all relevant stakeholders are included and that the information communicated is consistent

and dependable. These aspects of the standards communication requirements will address the barriers that may arise due to ineffective communication, such as; inadequate knowledge sharing required for the cooperation of energy matters (F. Mohamad et al., 2014), inhibited cultural changes (Dzene et al., 2015), lack of participation, and a change in community behaviour and value systems reducing acceptance of EnMS implementation (Cease et al., 2019).

ISO PDCA Framework

The shared structure of the PDCA framework with other ISO MS standards can help overcome the resource and institutional barriers found through the literature synthesis. The implementation of an ISO 50001 EnMS within a large and complex organisation can require significant time and financial resources and threaten to add bureaucracy, complexity and ultimately cause operational difficulties (Marimon & Casadesús, 2017). The benefits of ISO integration are comprehensively discussed by Fadzilah Mohamad et al. (2013). The key aspects of integration are cost savings, integrated audits, minimisation of documents and records and better resource utilisation. This integration provides a holistic view of the organisation and how MSs relate to the priorities of other standards (Fadzilah Mohamad et al., 2013). These benefits can reduce the draw on time and financial resources and simplify the organisations BMS.

Legitimacy of ISO Standards

The legitimacy of ISO standards and their implementation into an organisation's procedures can improve their standing within the wider social context (Molla et al., 2009) and improve behavioural outcomes of internal and external stakeholders.

Strengths and Limitations

Several strengths and limitations were experienced in reaching the outcomes of this research and the associated CoM case study work, such as the adjustments made to time, scope and output.

The global pandemic and the residual impacts placed on the timeline of foundation projects and approvals was a significant limitation of the original project design and outcomes. The time delays experienced by these foundation projects resulted in the CoM's EnMS approval not being finalised and the smart grid project running concurrently for the duration of this project. The requirement to make changes to this project's scope provided the opportunity to review the CoM's BMS and documentation to produce a gap analysis report. This gap analysis formed the foundation for ISO 50001 compliant implementation and will be valuable for the efficient integration of the EnMS into the current systems, upon approval.

The outcomes of this project can contribute to the future work of academia in the field of ISO 50001 implementation through the identification of potential barriers and positive influencing factors in the LG and service sector context.

Within the research design a pilot questionnaire was developed and validated to aid in the formation of an EnMS. The questionnaire's aim was to establish a working knowledge of the organisation's energy context and facilitate the communication, knowledge sharing and involvement of internal staff. The stage of the EnMS approval resulted in a lack of awareness and communication regarding the researcher's involvement within the CoM which limited the distribution of the questionnaire at this time. However, this questionnaire can be used within the CoM when final EnMS approvals have been granted to assist in EnMS design and implementation.

The literature synthesis and the theoretical categorisation of positive influencing factors were limited as related literature is scarcely available. A definitive classification of these factors could not be established due to a limited number of case studies in the context of ISO 50001 and in the LG space. This report has created a foundation study which can be built upon by continued identification of influencing factors in various organisation contexts to accelerate efficient and successful ISO 50001 implementation across all sectors.

CHAPTER 6. CONCLUSION

The barriers identified within the literature synthesis for successful ISO 50001 implementation were classified into the categories: Resources, System/Structure, Information and Behaviour. Following the case study observations within the CoM it was concluded that particular barriers may be overcome based on the unique positive influencing factors present for that organisation. The key factors which will aid in overcoming the barriers experience by a LG are the access to external resources such as funding and the expert technical capacity of an external partner or entity. The institutional context in which the organisation exists is also a key positive influencing factor identified in the Australian case study.

Based on these results the two key barriers that are specific for a LG were organisation's system and structure and time resources. Time was a unique barrier identified in the case study for the context of a LG and it is recommended that this be considered in more depth in future studies. The complex organisational structure was observed to create multiple challenges for the organisation, also influencing the required time resources.

Recommendations

This thesis identified the barriers, drivers, and enablers through the early stages of the EnMS planning phase. It is recommended that work is continued within the CoM to see through the Planning, Implementing, Checking and continual improvement of the ISO 50001 compliant EnMS. This work will be facilitated by the Gap Analysis Report (Appendix B) and the Pilot Questionnaire (Appendix E). At the time of this study the CoM was highly motivated to complete the items identified in the Gap Analysis Report to meet ISO 50001 compliance and assist in reaching the City's net zero carbon emissions target of 2030. It is the understanding of the researcher that this work is highly likely to be completed by the CoM upon formal project approval.

Continuing the identification of inhibiting and enabling factors will contribute greatly to the growing body of work for ISO 50001 implementation, specifically in terms of a WA LG. It would also be a significant addition to the understanding of ISO 50001 performance within LGs if the monitoring of the CoM's energy performance were continued and the results analysed and published in an academic space. This can help identify areas in which the LG benefits from a standard such as ISO 50001 in terms of cost and emissions reductions. Quantitative results such as these may assist in overcoming the information and behaviour barriers experienced across sectors through an improved understanding of the business value and long-term payoff of ISO 50001 EnMS implementation.

It is highly recommended that the working relationship continues between the CoM and Murdoch University to maintain the mutual benefits which this relationship provides.

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APPENDICES

Appendix A BMS Manual Additions

7. System Procedures and their linkages with the Standards:
ISO 50001: Energy Management System

Energy Management
This procedure details the process of designing, implementing and maintaining an Energy Management System to establish energy performance improvements to operations under the City of Melville's control. Energy performance is a concept which is related to energy efficiency, energy use and energy consumption.

The Energy Management System to which these system procedures relate is established in compliance to the ISO 50001:2018 Energy Management System. This procedure outlines the process of developing and implementing Energy policy, objectives, energy targets and action plans for energy performance improvements, while meeting applicable legal requirements and other requirements.

System Procedure SP- Energy Management applies to all of the City of Melville business functions, operations and facilities and seeks to identify significant energy users (SEUs), their contribution to energy consumption and operational risks, and opportunities for improvement. These energy performance improvements will pertain to the design and procurement of facilities, equipment, systems or energy-using processes within the City's operations, functions and facilities.

The Energy Management Team will be responsible for the EnMS, hold authority for effective implementation of the EnMS and is accountable for delivering energy performance improvements.

Integrated Compliance Matrix

	System Elements	ISO 9001:2015	ISO 14001:2015	ISO 50001:2018	AS/NZS 4801:2001	City of Melville Compliance Approach Document No./Title Documented Information
Context of the Organization	Understanding the organization and its context	4.1	4.1	4.1	-	Corporate Planning & Strategy Framework, SP-022 Strategic Planning, SP-001 Business Planning
	Understanding the needs and expectations of interested parties	4.2	4.2	4.2	-	Customer Framework, Stakeholder Relationship Framework, SP-022 Strategic Planning, SP-001 Business Planning, SP-013 Legal and Compliance Requirements (Interested parties of energy performance and EnMS, requirements of parties,
	Determining the scope of the management system	4.3	4.3	4.3	4.1	Process Management Framework, BMS Manual, Safety Management Manual and Continuous Improvement Implementation Plan, SP-010 Environmental Management, SP Energy Management
	Management system and its processes	4.4	4.4	4.4	4.1	BMS Manual, SP-010 Environmental Management, Safety Management Manual and Continuous Improvement Implementation Plan, SP Energy Management
Leadership	Leadership and commitment	5.1	5.1	5.1	4.4.1.2	Leadership Framework – (Commitment to EnMS; policy, targets and objectives established. Energy Management Team established)
	Policy	5.2	5.2	5.2	4.2	CP-039 Quality Policy, OP-005 Occupational Safety and Health Policy, CP-030 Environmental Policy, CP Energy Policy (targets and objectives, legal requirements, supports procurement of Energy efficient products services)
	Organizational roles, responsibilities and authorities	5.3	5.3	5.3	4.4.1	BMS Manual – SP – Energy Management
Planning	Actions to address risks and opportunities	6.1	6.1	6.1	4.3.1 & 4.4.6	Risk Management Framework, SP-021 Risk Management (Risks and opportunities to be addressed in terms of EnMS)
	Compliance Obligations	-	6.1.3	-	4.3.2	SP-013 Legal and other compliance requirements
	Planning action	-	6.1.4	6.1.2	4.3	SP-021 Risk Management (Actions to address risk in terms of EnMS)
	Objectives and planning to achieve them	6.2	6.2	6.2	4.3.3	SP-001 Business Planning, SP-022 Strategic Planning, SP-010 Environmental Management Safety Management Manual and Continuous Improvement Implementation Plan
	Planning of changes	6.3	-	-	-	SP-002 Change Management
	Energy Review	-	-	6.3	-	SP Energy Management, Corporate Environmental Strategic Plan

	Energy Performance Indicators	-	-	6.4	-	SP Energy Management, Corporate Environmental Strategic Plan
	Energy Baseline	-	-	6.5	-	SP Energy Management, Corporate Environmental Strategic Plan
	Planning for Collection of Energy Data	-	-	6.6	-	Smart Grid Dashboard Work Instruction, Corporate Environmental Strategic Plan, SP-015 Measurement and Monitoring Procedure
Support	Resources	7.1	7.1	7.1	4.4.1.1	People Framework, Asset Management Framework, Information & Knowledge Framework, SP-018 Project Management, SP-015 Measurement and Monitoring, SP Energy Management (resources for implementation, maintenance, and continual improvements)
	Competence	7.2	7.2	7.2	4.4.2	SP-009 Learning and Development (Competence of persons that affect energy performance and EnMS)
	Awareness	7.3	7.3	7.3	4.4.2	SP-009 Learning and Development (aware of Energy Policy, effectiveness of EnMS, energy objectives and targets and benefits)
	Communication	7.4	7.4	7.4	4.4.3	Marketing and Communications Framework, Customer Framework, Stakeholder Relationship Framework, SP-003 Communication (Communication in terms of EnMS, what, when, who, how.
	Documented Information	7.5	7.5	7.5	4.4.4, 4.4.5 & 4.5.3	SP-007 Document Control, SP-020 Records Management
Operation	Operational planning and control	8.1	8.1	8.1	4.4.6	Project Management Framework, Community Safety and Crime Prevention Framework, SP-018 Project Management, SP-001 Business Planning, SP-002 Change Management, SP-004 Contract Management Procedure SP – Energy Management
	Emergency Preparedness and response	-	8.2	-	4.4.7	SP-008 Emergency Preparedness & Response, SP-010 Environmental
	Requirements for products and services	8.2	6.2	8.3	4.3.3	SP-018 Project Management
	Design and development of products and services (Planning, inputs, controls, outputs and changes)	8.3	4.3.3, 4.3.1	8.2	4.3.3, 4.4.6	SP-006 Design Management
	Control of externally provided processes, products and services	8.4	-	8.3	-	Contract and Tenders Framework, SP-004 Contract Management, SP-019 Purchasing and Procurement (Energy performance is one of the evaluation criteria for procurement equipment and services that can have an impact on SEU)
	Production and service provision	8.5	-		-	SP-018 Project Management
	Control of production and service provision	8.5.1	-	-	-	SP-018 Project Management
	Identification and traceability	8.5.2	-	-	-	SP-018 Project Management

	Property belonging to customers or external providers	8.5.3	-	-	-	SP-018 Project Management
	Preservation	8.5.4	-	-	-	SP-018 Project Management
	Post-delivery activities	8.5.5	-	-	-	SP-018 Project Management
	Control of changes	8.5.6	-	-	-	SP-002 Change Management
	Release of products and services	8.6	-	-	-	SP-018 Project Management
	Control of nonconforming outputs	8.7	-	-	-	SP-017 Non conforming product or service
Performance evaluation	Monitoring, measurement, analysis and evaluation	9.1	9.1	9.1	4.5.1	SP-015 Monitoring and measurement (What needs to be monitored and measured, energy targets and objectives, EnPIs, Operation of SEUs – How, When)
	Customer satisfaction	9.1.2	-	-	-	Customer Service Framework, SP-005 Measurement of Customer Satisfaction
	Evaluation of compliance	-	9.1.2	9.1.2	4.5.4	SP-013 Legal and other compliance requirements (In terms of EnMS)
	Analysis and evaluation	9.1.3	9.1.2	9.1.1	4.5.4	Continuous Improvement Framework, SP-015 Monitoring and measurement (EnPI vs EnB), SP-005 Measurement of Customer Satisfaction,
	Internal audit	9.2	9.2	9.2	4.5.4	SP-012 Internal Audit (in terms of Energy Management)
	Management review	9.3	9.3	9.3	4.6	SP-014 Management Review review EnMS, time frame, extent to which targets have been met
Improvement	Nonconformity and Corrective Action	10.2	10.2	10.1	4.5.2	SP-017 Non conforming product or service, SP-016 Corrective & preventative action, SP-011 Incident Reporting and Investigation
	Continual Improvement	10.3	10.3	10.2	4.4.1.2	Continuous Improvement Framework (in terms of Energy Management and

Appendix B Document Gap Analysis Report: for ISO 50001 compliance in CoM

Check List to completion

- CP and SP ID numbers
- Create work instructions
    - Smart Grid Dashboard (Energy monitoring and analysis)
- Establish Document
    - "Energy data collection plan" (ISO pg12)
- Establish EnM Team
    - Define job role
    - Establish staff competency gaps
- Review and Finalise Energy CP and SP
- Implement changes from Gap Analysis to identified BMS documents
- Implement Energy Reduction action plans

ISO 50001 requirements:

To be covered by Dashboard or related "Energy data collection plan"

6.3 Energy Review

Platform to document:

- current energy types
- evaluate past and current energy uses and consumptions
- identify SEUs
    - determine relevant variables
    - determine current energy performance
    - identify persons doing work under its control that influence or affect SEUs
- determine and prioritise opportunities for improving energy performance
- estimate future energy use(s) and energy consumption

6.6 Planning

"The organisation shall define and implement an "Energy data collection plan" appropriate to its size, its complexity, its resources and its measurement and monitoring equipment" (ISO pg 12)

Data shall include:

- relevant variables for SEUs
- energy consumption related to SEUs
- operational criteria related to SEUs
- static factors
- data specified in action plans

9.1 Monitoring, measurement, analysis and evaluation of energy performance and the EnMS

- What needs to be monitored and measured
- Method to monitoring, measuring, analysis and evaluation

- When to be performed

A.6.3 Energy Review

"Retain documented information on measurement, monitoring and other means of establishing accuracy and repeatability" (ISO pg22)

To be covered by EnM Team

5.3 Organization roles, responsibilities and authorities

- EnMS established, implemented, maintained, and continually improved
- Conforms to ISO 50001
- Implementing action plans
    - What will be done
    - Resources required
    - Who will be responsible
    - When it will be completed
    - How results are evaluated, including method(s) used to verify energy performance improvement
- Reporting on performance of EnMS and energy performance improvements
- Established criterial and methods to ensure the operation and control of the EnMS are effective
    - EPIs appropriate for measuring and monitoring energy performance
    - Enable the organisation to demonstrate energy performance improvements
    - Relevant variable significantly affecting energy performance
        - Normalisation of EnPI and EnB values
- Establish objectives at relevant functions and levels

Document Review

BMS

Document ID	Document Location	Recommendation/Action
CP- Energy		Drafted
SP- Energy		Drafted
BMS Manual		Drafted
	1. Introduction	Making reference to the system procedures: ISO 50001:2018 Energy management System The objectives of the BMS are: To achieve continual improvement in all areas of the City's operation?
	4. Hierarchy	Teir 2: Add ISO 50001:2018 Energy Management System
	7. System Procedures and their linkages with the standards:	ISO 50001: Energy Management

	System Procedures ID Number required (Corporate Administration Team to allocate)	Energy Management procedure SP-
	EnM Procedure	Drafted
Integrated Compliance Matrix		Drafted

Plans/ Frameworks

Document ID	Document Location	Recommendation/Action	Pg
Safety Management Manual and Continuous Improvement Implementation Plan	Legislative Requirements	ISO 50001:2018 Energy Management Systems	2
Corporate Environmental Strategic Plan	Planning	Energy competency training "Education, training, skills and experience"	
Corporate Business Plan	Figure 1	Update with Energy reduction strategies Add ISO 50001 standard to list under Internal Business Management System	7
	1.4 Risks	Add Energy as a risk	9
	4. Data Analysis	Smart Grid system - dashboard Adjustments to 2025 roadmap Figure 4 update	

System Procedures

Document ID	Document Location	Recommendation/Action
SP-010 Environmental Management	Supporting Documents (External)	*ISO 50001:2018*
	1. Purpose	Supports… *Energy Management System (ISO 50001)*
SP-021 Risk Management	Supporting documents external	*ISO 50001:2018*
	Attachment 2 – Consequence Criteria	Define energy as a risk Add energy to "Consequence criteria"
SP-002 Change Management	NA	NA
SP-012 Internal Audit	Supporting Document (external)	*ISO 50001:2018 Energy Management*
	2. Scope	Compliance to *AS/NZS ISO 50001*
	5. Process Links	**Controls** *ISO 50001:2018 EnMS* **Outputs**

		Ongoing compliance with *ISO 50001*
	6. Stakeholders	6.3 Customers/receivers of outputs • *EnMT* 6.4 Control owners/Regulators • *External Auditors of AS/NZS ISO 50001*
	7. Key Performance Indicators	Retains compliance with *AS/NZS ISO 50001*
SP-007 Document Control Procedure	5. Process Links	**Controls** Internal and external audits for ISO 9001, 14001, *50001* and AS/NZ 4801
SP-015 Measurement and Monitoring	Supporting Documents (external)	*ISO 50001: Energy Management Systems*
	1.0 Purpose	• Continuous improvement through identification of gaps in service delivery and *operations;* • *Ensures equipment used for measurements provide data which is accurate and repeatable;* • *Opportunities for new technology implementation*
SP-014 Management Review	Supporting Documents (external)	*ISO 50001:2018 EnMS*
	3. Process	Outputs – *Actions to improve EnM Systems*
	4.1 Objectives	*To confirm that the COM is continuing to conform to the EnM Standards (ISO50001:2018)*
	4.3 BMS Management Review Meetings	• *Energy management system, their objectives and performance against baselines and targets*
	4.6 Team Principles	• *Share information with… EnMT so they can plan appropriately* • Implement policies and principles of all SHEQ and *Energy requirements*
	4.8 Team Outcomes	City's SHEQ, *Energy* and Business Excellence journey Maintain compliance/accreditation • *ISO 50001:2018 EnMS*
	5. Process Links	Controls

		ISO 50001 Enablers *EnMT*
	7. Key Performance Indicators	Retain certification/compliance to … and *Energy standard (ISO 50001)*
SP-009 Learning and Development	Add ISO requirement ->	"Determine competence of person(s) who affect energy performance and EnMS" Add competence through "Education, training, skills and experience"
	Suggestion	Develop Online Workplace Learning (OWL) training content for Energy Management (suggestion)
SP-001 Business Planning	NA	NA
SP-018 Project Management	5. Process Links – Enablers	*EnM Team*
	7. Key Performance Indicators	*Performance of energy management*
SP-003 Communication	Add ISO requirement ->	"Any person(s) doing work under the organisation's control can make or suggest improvements to the EnMS" (ISO 7.4)
SP-020 Record Management	NA	NA
SP-019 Procurement	3.2 Purchase Value Threshold	If "better value" can be obtained.. See Procurement CP-023 Value for Money
	CP-023 3. Value for Money	Value for money is achieved… environmental, social, economic and *energy performance*… factors
	Add ISO requirement -> (8.2 Design)	"Where applicable, the results of the energy performance consideration shall be incorporated into … procurement activities"
	Add ISO requirement -> (8.3 Procurement)	"The organization shall establish and implement criteria for evaluating energy performance over the planned or expected operating lifetime, when procuring energy using products, equipment and services which are expected to have a significant impact on the organization's energy performance." "When procuring energy using products, equipment and services

		that have, or can have, an impact on SEUs, the organization shall inform suppliers that energy performance is one of the evaluation criteria for procurement."
SP-016 Corrective and Preventive Action	Supporting documents (external)	*ISO 50001: Energy Management System*
	5. Process Links	**Controls** *ISO 50001*
	Stakeholders 6.4 Control owners/ Regulators	External auditors for accreditation to *ISO 50001*
	7. Key Performance Indicators	Accreditation to *ISO 50001*
SP-017 Control of Non-Conformity Product or Services	NA	NA
SP-006 Design Management (superseded) Directorate Procedure - Design Management	4.1.6 Design Development	• *Energy performance improvement opportunities*
	Add ISO requirement -> (8.2 Design)	"Organisation shall consider energy performance improvement opportunities and operational control in the design of new, modified and renovated facilities, equipment, systems and energy-using processes that can have significant impact on its energy performance over the planned or expected operating lifetime." "Where applicable, the results of the energy performance consideration shall be incorporated into specification, design and procurement activities."
SP-013 Legal and Compliance Requirements	Other references Plan/Policy/Framework	*CP- Energy Policy*
	Supporting Documents (external)	*ISO 50001 Energy Management System clause 4.2*
	5. Process Links	**Controls** *AS/NZS ISO 50001 Energy Management System clause 4.2*

Policy

Document ID	Section	Suggestions	Standard requirements
CP- 023 Procurement	Policy Objectives	add "ensure that products and services support energy performance"	"supports the procurement of energy efficient products and services that impact energy performance" (ISO 5.2)
	3. Value for money 3.1 Policy	"Value for money is achieve through critical assessment of… energy performance"	
	6. Sustainable procurement and Corporate Social responsibility		"When procuring energy using products, equipment and services that have, or can have, an impact on SEUs, the organisation shall inform suppliers that energy performance is one of the evaluation criteria for procurement" (ISO 8.3)
	4. Procurement Requirements 4.2 Policy	Policy states "All officers with procurement authority will undertake procurement training" Suggest that training contains Energy performance considerations	
CP- 039 Quality	NA		
CP-030 Environmental Management	NA		

Other Documents

Document ID	Location in EnM SP	Suggestion/Action
Competency Survey and Organisational Competency Checklist	4.7 Competency Training and Awareness	Ensure Personnel aware of energy policy, EnMS objectives and targets and benefits of improving energy performance, implications of not conforming with EnMS requirements
		Determine an EnM competency standard for this checklist
Induction Procedure and Contractor Induction	4.7 Competency Training and Awareness	Includes information about energy responsibilities an importance of conforming to the Energy policy and EnMS

Corporate Dictionary Additions

Abbreviations

EnBs	Energy Baselines
EnMS	Energy Management System
EnMT	Energy Management Team
EPIs	Energy Performance Indicators
SEU	Significant Energy User

Audit

a) ISO 50001:2018 Energy Management System

Continual Improvement

Recurring activity to enhance performance

Energy

Electricity, fuel, steam, heat, compressed air and other similar media.

Energy Review

Analysis of energy efficiency, energy use and energy consumption based on data and other information, leading to the identification of SEUs and opportunities for energy performance improvements.

- **Energy Consumption**
  Quantity of energy applied to a process
- **Energy Use**
  Application of energy eg. Lighting, heating, transportation
- **Energy Efficiency**
- Ratio or other quantitative relationship between an output of performance, service, goods, commodities, or energy, and an input of energy.
- **Significant Energy Use (SEU)**
  Energy use accounting for substantial energy consumption and/or offering considerable potential for energy performance improvement. Significance criteria are determined by the City of Melville.

Energy Baseline

Quantitative reference(s) providing a basis for comparison of energy performance, based on data from a specified period of time and/or conditions. A reference to before and after, or with and without implementation of energy performance improvement actions.

Energy Management Team (EnMT)

Those person(s) with the responsibility and authority for effective implementation of an Energy Management System and for delivering energy performance improvements.

Energy Performance

Measurable results (quantitative or qualitative) related to energy efficiency, energy use and energy consumption. Energy performance can be measured against the City of Melville's objectives, energy targets and other energy performance requirements. Energy performance can be influenced by the management of activities, processes, products, systems or organisations.

Energy Performance Improvements

Improvement in measurable results of energy efficiency or energy consumptions related to energy use. Energy performance is compared to the energy baseline (EnB)

Energy Performance Indicators (EnPI)

A measure or unit of energy performance as defined by the Energy Management Team, depending on the nature of the activity being measured. Useful to demonstrate energy performance improvements. (see KPI)

Monitoring

Determining the status of a system, process or activity.

Objective

Results to be achieved such as, intended outcome, purpose, aim or goal. Can relate to different disciplines; financial, health and safety, and environmental goals, and different levels; strategic, City-wide, project, product and process.

Top Management

Those (Person or group of people) who directs and controls the Council at the highest level through delegating authority and resources.

KPIs

The measures of the City of Melville's energy performance are as follows:

Organisations total energy consumption

Performance comparison made against baseline measurements

Performance indicators within SEUs and service areas

Appendix C Council Policy

City of Melville

ENERGY POLICY

Policy Type: Council Policy **Policy Owner: Executive Manager Organisational Development**	**Policy No. CP-** **Last Review Date:**

POLICY OBJECTIVES

The objectives of this policy are to provide guidance and direction for the City of Melville (City) to continually improve energy performance, including energy efficiency, energy use and energy consumption.

POLICY SCOPE

The City is responsible for providing a broad range of services to residents and businesses, including parks and reserves, recreation and leisure facilities, libraries and community education, collection and disposal of waste, planning and building approvals, environmental health and civil construction.

This policy relates to all City operations, assets, staff and contractors providing services on behalf of and under the control of the City. This policy also applies to the design and procurement of facilities, equipment, systems or energy-using processes within the City's operations.

DEFINITIONS/ ABBREVIATIONS

POLICY STATEMENT

The City aims to minimise the continually improve upon the energy performance associated with its activities, while maintaining the operations of the City of Melville

The City recognises that the global climate is changing as a result of an increase in the concentration of greenhouse gas emissions in the atmosphere and that human activities, in part, continue to contribute to increased greenhouse gas emissions along with other naturally occurring factors. The City recognises its role in promoting mitigation of greenhouse gas emissions from its operations and assets and leading the way for the community to reduce the emissions within the geographic boundaries of City of Melville.

The City will incorporate the principles of sustainable development and energy performance improvement within its decision making, design and procurement processes. Energy performance is a concept which relates to energy efficiency, energy use and energy consumption.

The City will establish Energy Performance Indicators (EPIs) and energy baselines (EnBs), throughout its operations, to ensure effective and measurable energy performance improvements over time.

The City will:

- Maintain the Corporate Environmental Strategic Plan with respect to Energy goals, objective, targets, actions and Energy performance indicators and the progress in Energy performance improvements;
- Incorporate the Energy Management Process into its Business Management System to enhance awareness and the priority given to energy performance improvements;
- Implement and use management systems to plan, document, measure, monitor and analyse energy performance including setting, assessing and reviewing objectives and targets;
- Identify and manage significant energy users (SEUs) and the associated risks, including climate change risks, within operations and apply best practice principles to ensure Sustainability;
- Continually improve energy performance through training, management review, research, development and consultation with the community;
- Require employees and contractors to comply with all relevant legislation, regulations and standards that impact energy performance;
- Support energy performance improvements in the procurement of products and services, and design activities that improve energy efficiency, energy use and energy consumption by the City of Melville and its activities;
- Communicate this policy to all staff, contractors and other stakeholders as well as making this policy available to the general public.

References that may be applicable to this Policy

Legislative Requirements:	N/A
Procedure, Process Maps, Work Instructions:	To Establish; *Smart Grid Dashboard Work Instruction*
Other Plans, Frameworks, Documents Applicable to Policy:	ISO 50001:2018 Energy Management System ISO 14001:2015 Environmental Management System AS/NZS 4801:2001 Occupational Health and Safety Management System ISO 9001:2015 Quality Management System ICSS 2014-17: International Customer Service Standard – Customer Service Institute of Australia (CSIA) The Australian Business Framework (ABEF) 2011 – SAI Global City of Melville Corporate Environmental Strategic Plan, Corporate Environmental Management framework, Safety, Health, Environment and Quality Risk and Legal Register, Continuous Improvement Framework
Delegated Authority No:	N/A

ORIGIN/AUTHORITY **ITEM NO.**

REVIEWS

Appendix D System Procedure

City of Melville

System Procedure
Energy Management

No. SP-

Latest Revision Details (Earlier revision History is listed at end of document)

Date amended	Description of Change	Revised by (Procedure Owner)	Reviewed by MLT (Date)	Endorsed by ELT for Approval (Date)

Authorisation
Procedure Owner –Sustainability Coordinator
Directorate – Management Services
Reviewer – MLT
Approver – ELT

Other References that may be applicable to this Procedure

Legislative Requirements:	Refer to the legislative listing in the Safety, Health and Environment Risk and Legal Register
Delegated Authority:	
Plan / Policy / Framework:	BMS Manual CP- Energy Policy* Corporate Environmental Framework Corporate Environmental Strategic Plan
Procedures:	SP- 012 Internal Audit Procedure SP- 014 Management Review Procedure SP- 007 Document Control Procedure SP- 015 Measurement and Monitoring Procedure SP- 021 Risk Management Procedure SP- 002 Change Management Procedure SP- 001 Business Planning Procedure SP- 018 Project Management Procedure SP- 019 Procurement Procedure SP- 016 Corrective and Preventive Action Procedure
Work Instruction / Process Maps:	Smart Grid Dashboard Work Instruction Environmental Monitoring and Measurement
Forms / Supporting Documents (internal):	City of Melville Corporate Dictionary Safety, Health, Environmental and Quality Risk and Legal Register Identifying Organisational Environmental Aspects Procedure Work Instruction
Supporting Documents (external):	ISO 50001:2018 Energy Management System AS3598:2000 Australian Standard Energy Audit

City of Melville

* Please Note this is a Draft Document for the purpose of a Dissertation Thesis investigation on the process for implementing an ISO 50001 compliant Energy Management System and its integration into the City of Melville's BMS. This document is yet to be approved, enacted, and released within the City of Melville. Please refer to the external 'Document Gap Analysis' report for all items marked in Orange. These identified documents require the recommended action, as listed in the document gap analysis, to be complaint with ISO 50001 requirements.

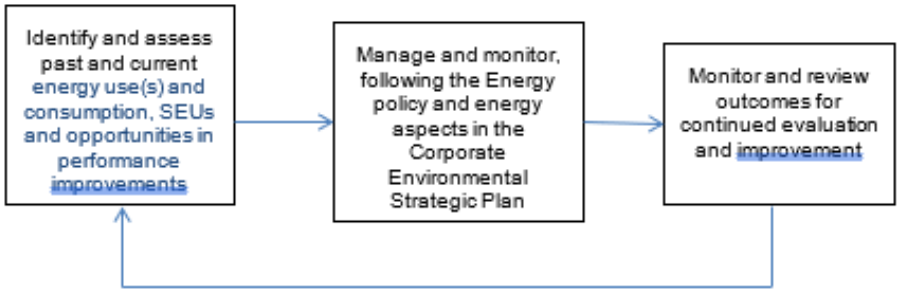
1. Purpose

This procedure details the process of maintaining an Energy Management System (EnMS) to the ISO 50001:2018 standard. It supports the integrated management system, specifically the Quality Management System (ISO 9001), Environmental Management System (ISO 14001) and the Occupational Health and Safety Management System (AS/NZS4801:2001). It provides an overview of the key elements of the EnMS at the City of Melville which supports a culture of energy performance improvements from all levels of the organisation.

2. Scope

This procedure applies to all City of Melville business operations, functions and assets. This includes the design and procurement of facilities, equipment, systems or energy-using processes within the City's operations. The consumption of all energy types (electricity, gas, fuel) are within the scope of this procedure.

3. Process



4. Procedure

4.1 Energy Policy

The City of Melville has established an Energy Policy (CP-) which provides guidance and direction for the City to improve the energy performance related to its operations and include energy management considerations in decision making. This policy is available on the Business Management System on the intranet and externally on the City of Melville website.

The policy has been written in consultation with stakeholders and discussed, reviewed and approved by Council before being distributed and communicated to all staff, contractors and interested parties. The policy shall undergo reviews in accordance with the Document Control Procedure and Management Review Procedure as part of the continual improvement process.

4.2 Identifying Significant Energy Users: Associated Aspects and Risks

The Identifying of Organisational Significant Energy Users (SEUs) is completed through the initial Energy Review and initial Energy Audit.

The Identifying Organisational Environmental Aspects Procedure Work Instruction outlines the process for identifying significant aspects within the business and will apply to Energy Aspects.

For further information refer to –
Safety, Health, Environment and Quality Risk and Legal Register
Risk Management Procedure SP-021
Smart Grid Dashboard Work Instructions
Identifying Organisational Environmental Aspects Procedure Work Instruction

4.3 Legal and Other Requirements

The EnMS provides a means to identify, explain and communicate all energy legal requirements and voluntary undertakings to all employees, on-site service providers and contractors, whose work could affect the City's ability to meet those requirements and undertakings. Energy requirements include statutes, regulations, permits and enforceable agreements such as the Environment Protection Act 1986 (WA) and Clean Energy Legislation (Carbon Tax Repeal) Act 2014. These statutes, regulations, permits and agreements will be included in relevant Work Instructions and supporting documents where appropriate and applicable.

The Legal and Other Requirements Procedure (SP-013) ensures that the City of Melville is aware of these energy requirements and voluntary undertakings. This procedure specifies the means for anticipating changes to energy requirements, including new requirements that may apply as a result of changes in operations and incorporating these changes into the EnMS. The Safety, Health and Environmental Risk and Legal Register links environmental risks with associated Legal and Other Requirements.

For further information refer to: Legal and Other Requirements Procedure SP-013

4.4 Objectives and Targets (Corporate Environmental Strategic Plan (CESP))

Objectives and targets are set to assist in managing environmental risk and improve performance and efficiency of resource consumption within the City. The CESP documents the energy consumption objectives and targets at relevant functions and levels within the City.

The CESP is formulated using input from a variety of sources including the Safety, Health and Environmental Risk and Legal Register, Wellbeing Surveys, Perception Surveys, and international benchmarks. The CESP designates responsibility for achieving objectives and targets and the time frame by which they are to be achieved.

The objectives and targets from the CESP will be included in the business planning process and Operational Managers from each service area will ensure that energy targets and objectives are included in the setting of KPI's and seeking the allocation of appropriate funding levels to enable the achievement of energy objectives. Progress against the Corporate Energy Strategic Plan will be reviewed at least annually at the BMS Management Review meeting.

For further information refer to: The Corporate Environmental Strategic Plan (CESP)

4.5 Energy Management Team (EnMT)

The Energy Management Team is appointed by the Chief Executive Officer and Department Management. The COE holds the overall responsibility for the City of Melville operations and Energy needs.

The amount of staff resources required in the EnM team will be proportional to the size of operations and energy requirements and aspects. The relevant EnM team members will consult with relevant internal stakeholders to determine the energy aspects concerning the City's operations and develop action plans. The EnMT will either report directly to the CEO or the Executive Management Team (EMT).

4.6 Resources, Roles, Responsibility and Authority

4.6.1 Defining Roles and Responsibilities of City of Melville Personnel

The EnMS requires the coordination, cooperation and understanding of the Council and all staff of the City and specifically a number of different officers in order for the City to maximise the opportunities of energy efficiency and performance and include climate change considerations in decision making. Position Descriptions are established for all employees. The following provides an overview of these positions and responsibilities:

Council
- Adoption of Energy policy; and
- Allocation of budget funding to enable the stated commitments in the Energy Policy to be achieved.

Senior Management - CEO, ELT
- Endorse Energy Policy;
- Review the EnMS at planned intervals of no less than 12 monthly through the BMS Management Review Meeting to ensure the continuing suitability, adequacy, and effectiveness of the EnMS; and
- Provide resources and support in order to implement and maintain the EnMS.

Executive Manager Organisational Development (Management Representative)
- Ensure the EnMS is established, implemented, and maintained in accordance with the requirements of the ISO 50001.

Sustainability Coordinator - EnMT
- Develop, implement, and maintain the EnMS.
- Report energy performance as per the Corporate Environmental Strategic Plan.
- Develop Programs under Corporate Environmental Strategic Plan and drive their implementation.
- Manage regulatory interactions;
- Assist in establishing energy KPIs, objectives and targets; and
- Provide subject matter energy efficiency and performance advice.

Procedure Owners – MLT & OLT
- Comply with the Energy Policy, environmental and energy legislation and implement procedures in own areas of responsibility.

- Report Non-Conformances and identify Opportunities for Improvement (OFI's);
- Establish and maintain a process for ensuring relevant staff are adequately trained;
- Ensure the allocation of sufficient resource for actions detailed in the CESP;
- Achieving energy objectives and targets;
- Incorporating energy KPI's, objectives and targets into Business Plans;
- Identify and report energy improvement opportunities;

All Staff Including Contractors

- Comply with the Energy Policy, environmental and energy legislation and all energy procedures;
- Report Non-Conformances and identify Opportunities for Improvement (OFI's);
- Possess working level knowledge of the EnMS;
- Support achieving EnMS objectives and targets;
- Attend all identified energy efficiency and performance training;
- Identify and report energy improvement opportunities.

4.6.2 Accountability

The officers responsible for achieving and maintaining EnMS compliance will be held accountable for their responsibilities and tasks throughout the year. Responsible officers are in charge of updating their progress against the energy KPI's on a monthly basis.

The Monitoring and Measurement Procedure SP-015 details the process for receiving and addressing concerns raised by all personnel regarding energy performance and compliance.

4.7 Competence Training and Awareness

Senior Management (ELT) is committed to ensure that all personnel, (including employees, on-site service providers, and contractors) whose job responsibilities affect the ability to achieve the EnMS objectives and targets, have been trained and are capable of carrying out these responsibilities.

The City of Melville has initiated a Competency Survey and Organisational Competency Checklist the results of which are recorded in the Aurion Human Resource system. In addition the induction procedure and contractor inductions include information about environmental responsibilities and the importance of conforming to the Energy Policy and the EnMS.

Energy competencies and requirements are also included in individual contracts and performance contracts for all employees working for or on behalf of the City.

An energy clause is included in all Tenders to ensure Contractors are aware of their responsibility in relation to energy management.

For further information refer to:
Purchasing and Procurement Procedure SP–019

Communication Procedure SP-003

4.8 Communication

The City of Melville Communication Procedure details the process for internal and external communication with regards to its EnMS.

The Customer Service procedure documents communication and recording of comments from interested parties.

4.9 Documentation

The EnMS documentation is contained within the Business Management System (BMS) utilising the ECM data storage system.

Documentation includes but is not limited to the Energy Policy, Objectives and Targets (CESP), supporting documents and records necessary for effective planning, operation and control of processes that relate to significant energy users.

This procedure describes the scope of the EnMS and the main elements of the system and their interaction with reference to related or supporting documents.

4.10 Control of Documents

All documents relating to the EnMS are maintained and controlled in accordance with the Document Control Procedure. This includes the EnMS policy, objectives, targets and relevant records required for subsequent evaluation and improvement of the operation of the EnMS.

Documents on the City's compliance with energy requirements as well as energy performance relating to non-regulated aspects are recorded and maintained in accordance with document retention and disposal schedules.

For further information refer to:
Document Control Procedure SP–007
Records Management Procedure SP–020

4.11 Operational Control

The EnMS identifies and provides for the planning and management of all the City's operations and activities to assist in meeting the commitments established in the Energy Policy.
Operations/activities with significant energy uses (SEU) have been identified and various controls have been implemented to ensure energy performance and efficiency is optimal and consumption minimised. These controls are detailed in the Safety, Health and Environmental Risk and Legal Register. These documents are stored in the BMS in the document management system, ECM, and are listed in the Master Document list for the EnMS. The implementation of controls to manage energy aspects is an ongoing process.

The ELT is responsible for authorising process changes (System Improvements) and all other authorised changes occur through the Executive Manager Organisational Development or Director of the relevant Service Area making changes. The Sustainability Coordinator is responsible for reporting on the effectiveness of the outcomes of the operational control mechanisms and provide advise for improvements

as required. The EnMT will advice the Sustainability Coordinator on energy performance matters.

The documents to be included in the operational control planning and auditing process are derived from the Safety, Health and Environmental Risk and Legal Register in the "controls" column. Individual responsible officers are responsible for ensuring the documents are relevant and up to date and that any changes to those documents are reviewed by the Sustainability Coordinator and the Director of the relevant Service Area. The responsible officers are also responsible for ensuring that any changes made to documents or procedures are communicated to all relevant staff.

4.12 Monitoring and Measurement

The Monitoring and Measurement Procedure (SP-015) details the general guidelines for monitoring of the EnMS.

For further information refer to Monitoring and Measurement Procedure SP-015.

4.13 Non-Conformity, Corrective and Preventive Action

The EnMS establishes and maintains documented procedures for preventing, detecting, investigating, promptly initiating corrective action, and reporting (both internally and externally, in accordance with the legal requirements) any occurrence that may affect the City's ability to meet its commitments as outlined in its Energy Policy, EnMS objectives and targets. Such measures pay particular attention to incidents that may have an effect on compliance with energy requirements as well as on energy performance in regulated and non-regulated areas. Non-conformances are tracked and reported (eg External and Internal audits through Pathway tasks, as are non-conformances and suggestions from customers and suggestions from staff lodged as OFI Pathway tasks).

For further information refer to Corrective and Preventative Action Procedure SP-016

4.14 Records

The Records Management Procedure (SP-020) details the system for establishing and maintaining records as necessary to demonstrate conformity to the requirements of the EnMS and the ISO 50001.

For further information refer to Records Management Procedure SP-020.

4.15 Audit

The City's performance in adhering to the Energy Policy, objectives, targets and plans and on how well the EnMS assists the City in achieving those objectives, targets and plans, will be audited annually by the internal and external auditors. These audit findings and other OFI's will be submitted to the BMS Continuous Improvement Team meetings for consultation and approval prior to any changes or implementation being made.

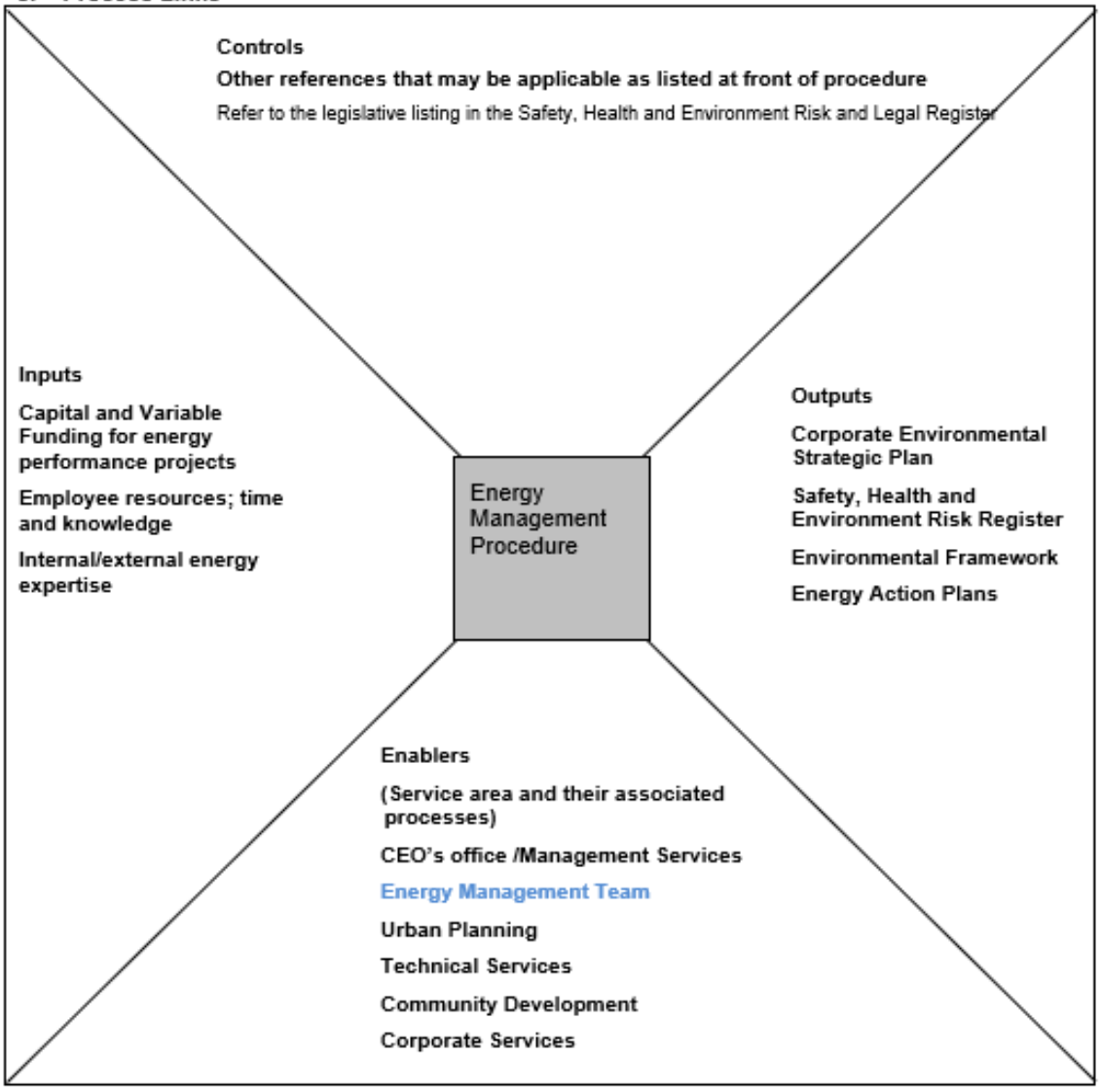
For further information refer to Internal Audit Procedure SP- 012.

4.16 Management Review

The Management Review Procedure (SP-014) details the City's review of the EnMS in accordance with the BMS schedule.

For further information refer to Management Review Procedure SP-014.

5. Process Links



6 Stakeholders

6.1 Suppliers of inputs
City of Melville
Energy Management Team
Capital equipment suppliers / contractors
Consultants and subject matter experts

6.2 Process performers
City of Melville employees
Consultants
Suppliers / contractors

6.3 Customers / receivers of outputs
City of Melville employees
City of Melville community

6.4 Control owners / Regulators
City of Melville employees
Sustainability Officer - EnMT

7. Key Performance Indicators
Energy KPI's, objectives and targets as per 4.6

Revision History

Date procedure amended	Description of Change	Revised by (Procedure Owner)	Reviewed by OLT (Date)	Approved by ELT (Date)
	Document creation			

***** End of Document *****

Appendix E Questionnaire

This is not an Audit or a critical analysis, but instead to gain an understanding of the current energy management process across the City of Melville (CoM). This information will be used to assist in developing an ISO compliant EnMS. Comments will remain confidential.

Facility/Service Area:

Management Contact Details:

1. How many people work in this facility?

Aspects

2. What are the energy needs of the facility/service area? (Examples; Comfort services, activities in the building, use of utilities (lighting, computers, pumps, lifts)
3. List of Energy consuming activities at the site:
4. List of Energy producing activities at the site:

Responsibilities

5. Who on/off site is formally assigned the responsibility for managing energy consumption?
6. What are they currently responsible for?
7. Do their responsibilities include;
    - Managing Operational Energy?
    - Equipment purchasing and design decisions to reduce energy consumption?
    - Equipment Maintenance?
    - Training/education of staff in energy reduction activities and behaviours?
    - Liaison with Top Management about energy consumption?
8. If no one on site yet holds these responsibilities, who would be most appropriate to hold this responsibility? Why?

Targets

9. Are you familiar with any policies and targets related to energy efficiency and GHG emissions reduction in which the CoM has in place? What are they?
10. Are there energy targets established for this service area?

- What are they?
- What support do management & staff get from the CoM to meet these targets?
- What happens if you don't meet these targets?
- What do you need to meet/establish these targets?

KPIs/monitoring/review

11. What are the formal Energy Performance Indicators (EnPIs) and energy expectations, if any? *(Examples; units/kWh, $/kWh, hrs operation/kWh)*
12. Is the monitoring of KPIs specified in the job description for the relevant person?
13. Is there a schedule for KPI monitoring and energy review currently in place?

14. Do you have any recommendations on a time frame to undertake these monitoring/review procedures? And why?

Measures in Place/recommendations

15. What energy efficiency (EE) or renewable energy (RE) measures have been undertaken at the site?
16. Who initiated/drove these measures?
17. What barriers do you and staff recognise to slow down or prevent the site from improving EE and RE improvements?
18. What recommendations does the facility management have on the site's energy expectations and EnPIs?