

TAX INCENTIVES FOR THE PRODUCTION AND USE OF SUSTAINABLE ENERGY – A COMPARISON BETWEEN SOUTH AFRICA AND BRAZIL

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It is with great pleasure that I conclude:

It is done.

ABSTRACT

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Sustainability has become an emphasised universal topic in recent years, especially just after the turn of the second millennium. Leaders from a wide range of disciplines and geographic locations have congregated to discuss their very real energy concerns and the potential solutions available to address them. Various notable conferences have been held from the World Summit on Sustainable Development in Johannesburg, South Africa in August 2002 to the more recent annual World Future Energy Summit held in Abu Dhabi, United Arab Emirates in January 2013.

South Africa and Brazil form part of the BRICS group of nations which is characterised by emerging and rapidly-growing economies. South Africa and Brazil both are favoured by sustainable energy environments with an abundance of sustainable energy resources. Both countries also have various tax incentives that are aimed at encouraging the production and use of sustainable energy. Despite these facts, a large disparity still exists between South Africa and Brazil pertaining to their sustainable energy usage as a percentage of their total primary energy usage. South Africa's sustainable energy usage is extremely small compared to that of Brazil, and therefore this study aims to determine improvements for South Africa. Brazil's tax related policies and legislation are instructive in this regard.

The benefits of sustainable energy as opposed to energy generated from fossil fuels are evident from an analysis of their economic, environmental and social impacts. Tax incentives can take on various forms and although not the only factor, they would appear to be an important consideration in encouraging investments in sustainable energy.

Numerous barriers are identified that directly affect both the ability and desirability of the production and use of sustainable energy. Some of the more significant barriers include high initial capital costs, regulatory frameworks and intellectual rights, the long term nature and payback period of sustainable energy projects and the availability of alternative fossil fuels. Tax incentives are one of the measures that, if appropriately used, could significantly reduce many sustainable energy related barriers.

The study concludes that South Africa can learn from Brazil and implement improvements to its tax incentives and related policies and legislation. This would assist in addressing some of its key sustainable energy related barriers. Possible improvements noted include regulatory policies in which South Africa could consider implementing a sustainable energy obligation and mandate; improved certainty regarding South Africa's research and development incentives; and improved benefits resulting from the research and development incentives.

KEY WORDS:

Tax incentive

Sustainable energy

Renewable energy

South Africa

Brazil

BRICS

OPSOMMING

BELASTINGAANSPORINGS VIR DIE OPWEKKING EN GEBRUIK VAN VOLHOUBARE ENERGIE - 'N VERGELYKING TUSSEN SUID-AFRIKA EN BRASILIE

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Volhoubaarheid het 'n beklemtoonde universele tema geword gedurende die afgelope jare, veral net na die draai van die tweede millennium. Leiers uit 'n groot verskeidenheid van dissiplines en geografiese plekke het byeengekom om wesenlike energie-bekommernisse en die moontlike beskikbare oplossings daarvoor, te bespreek. Verskeie belangrike konferensies het plaasgevind, insluitend die Wêreldberaad oor Volhoubare Ontwikkeling in Johannesburg, Suid-Afrika in Augustus 2002, en die meer onlangse jaarlikse Wêreld Toekoms Energie Beraad wat in Abu Dhabi, Verenigde Arabiese Emirate in Januarie 2013 gehou is.

Suid-Afrika en Brasilië is deel van die BRICS groepering van nasies wat deur opkomende en vinniggroeiende ekonomieë gekenmerk word. Suid-Afrika en Brasilië het albei gunstige volhoubare energie omgewings met 'n oorvloed van volhoubare energiebronne. Beide lande het ook verskeie belastingaansporings wat op die bevordering van die produksie en gebruik van volhoubare energie gemik is. Ten spyte hiervan, bestaan daar steeds 'n groot verskil tussen Suid-Afrika en Brasilië met betrekking tot volhoubare energie verbruik uitgedruk as 'n persentasie van hul totale primêre energie verbruik. Suid-Afrika se volhoubare energie verbruik is baie klein in vergelyking met dié van Brasilië, en daarom poog hierdie studie om verbeterings vir Suid-Afrika te bepaal. Brasilië se belasting-verwante beleide en wetgewing is insiggewend in hierdie verband.

Die voordele van volhoubare energie in teenstelling met energie verkry van fossielbrandstowwe word duidelik uitgewys deur 'n ontleding van die onderskeie ekonomiese, omgewings en sosiale impakte. Belastingaansporings kan verskeie vorms aanneem en hoewel dit nie die enigste faktor is nie, wil dit voorkom of dit 'n belangrike oorweging in die bevordering van volhoubare energie verwante beleggings is.

Talle struikelblokke wat beide die vermoë en wenslikheid van die produksie en verbruik van volhoubare energie direk beïnvloed is geïdentifiseer. Sommige van die meer beduidende hindernisse sluit hoë aanvanklike kapitale koste, regulatoriese raamwerke en intellektuele regte, die langtermyn aard en terugbetaal tydperk van volhoubare energie projekte, en die beskikbaarheid van alternatiewe fossielbrandstowwe in. Belastingaansporings is een van die maatreëls wat, indien reg toegepas, baie volhoubare energie-verwante hindernisse kan verminder.

Die studie het bevind dat Suid-Afrika by Brasilië kan leer en sodoende verbeterings aan sy belastingaansporings en verwante beleide en wetgewing kan aanbring. Hierdie verbeterings sal help met die hantering van sommige van die belangrikste volhoubare energie-verwante hindernisse. Moontlike verbeterings wat voorgestel word sluit regulerende beleid waarin Suid-Afrika kan oorweeg om 'n volhoubare energie verpligting en mandaat te implementeer; verbeterde sekerheid oor Suid-Afrika se navorsing en ontwikkelingsaansporings; en verbeterde voordele wat voortspruit uit die navorsing en ontwikkelingsaansporings in.

SLEUTELWOORDE:

Belastingaansporingskema

Volhoubare energie

Hernubare energie

Suid-Afrika

Brasilië

BRICS

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TAX INCENTIVES FOR THE PRODUCTION AND USE OF SUSTAINABLE ENERGY – A COMPARISON BETWEEN SOUTH AFRICA AND BRAZIL

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

Every economically active entity manages resources, whether they are financial, capital, social or environmental in nature. Most resources are however finite, and therein lies one of the biggest challenges today – to increase claim to such resources without compromising the ability of future generations to meet their needs. Corporate social responsibility has become an increasingly important agenda item in many board room discussions, and entities are encouraged to integrate responsibility and accountability into their profit making activities.

Natural resources in particular are being depleted at alarming rates, and this has focussed attention on the important concept of sustainable energy. The fact is illustrated in the case of Mbanga (2008:21), where a delegate's closing remark was: "the question is not whether we can afford to implement renewable energy and energy efficiency initiatives; the question is whether we can afford not to".

The consumption of natural resources in order to generate energy results in two distinctly negative consequences. The first relates to the consumption of a finite resource. Increasing populations bring with them an increased demand for energy and therefore as consumption of these appropriately termed 'fossil fuels' increases, both their scarcity and resulting cost increases. (Blackman & Baumol, 2007.) The second consequence is the adverse environmental impact that results from these energy generation processes (Krupa & Burch, 2011:6254). Harmful greenhouse gasses such as carbon dioxide are emitted into

the atmosphere, and this increases global warming and climate change (Karrappan, 2011:15).

Energy and the consumption thereof is a basic human need, and therefore sustainable energy is relevant to every person (Cleveland & Najam, 2008). It follows that corporate governance frameworks such as the King III report have consequently increased the focus on sustainability in an entity's financial reporting (KPMG, 2009:2).

A country's government and leadership structure have an important role to play in influencing and facilitating the development and implementation of sustainable energy through tax related policies and legislation (Akanle, 2009:1). It would therefore be useful to analyse such tax related policies and legislation in countries that have contrasting degrees of implementation and use of sustainable energy. Such an analysis will also highlight what South Africa can learn from other countries so as to stimulate its own production and use of sustainable energy sources.

Previous research in South Africa has addressed several tax incentive aspects pertaining to sustainable energy. These include the use of accelerated capital allowances (Parker, 2009:48; Van Eeden & Wichmann, 2011:6) and cash incentives (Van Eeden & Wichmann, 2011:6). Studies have also investigated the effectiveness and significance of tax incentives in attracting investments (Febriana, 2011; Van Parys & James, 2010). Furthermore the sustainable energy tax incentives of developed countries like the United States and the United Kingdom have been compared (Menaker, Kershaw, Letherman, Scoon & Ng, 2012).

As initial capital expenditure is considerable for sustainable energy technologies (Mbanga, 2008:17), attracting investment in sustainable energy through the use of tax incentives is vitally important. Research has shown that the decisions taken by multinational organisations regarding the location for conducting research and development activities are closely connected to the tax incentives for such research and development in the countries under consideration (Congressional Documents and Publications, 2011).

1.2 PROBLEM STATEMENT

Both South Africa and Brazil form part of the BRICS (Brazil, Russia, India, China and South Africa) group of nations which is characterised by emerging and rapidly-growing economies. This common economic grouping, which is analysed further in chapter 4.2.1, is the basis on which the comparable country, Brazil, was selected.

Brazil is a country where significant growth in sustainable energy is prompted by its considerable energy requirements as a rapidly developing nation. When it comes to the size of investments made in sustainable energy, Brazil is ranked sixth of all the countries in the world. The majority of all sugar-derived ethanol is produced in Brazil, and further investments include wind power and biomass plants. (KPMG, 2011:1-3.)

At the end of 2011, Brazil was ranked third for its total renewable energy capacity (including hydro power). At the same time, it was also ranked second in the world for both its biomass energy and hydropower capacities after the United States and China respectively. (REN21, 2012:19.)

Almost half (43,9%) of Brazil's internal energy supply is sustainable, compared to an average of only 6% in developed countries and an average of 14% for the world (The Ministry of Mines and Energy in KPMG, 2011:10). This would suggest that, in relative terms, developing countries have a higher production and use of sustainable energy compared to developed countries. South Africa, however, is at the lower end of the scale with its sustainable energy development still in its initial stages (Van Eeden & Wichmann, 2011:6). Chapter 4.2.1 provides a more detailed comparison in this regard. South Africa does however have extensive sustainable energy resources including a coast line that largely supports the use of wind power, and solar radiation which is amongst the highest levels in the world (Parker, 2009:48).

South Africa's current energy production and supply is not sustainable due to the fact that it is extremely carbon intensive (Mbanga, 2008:17). This is costly as Eskom, a South African state owned enterprise, reported that higher coal and diesel costs increased their year on year primary energy costs by around 40% in 2008 (Wilhelm, 2008:3).

Approximately 95% of South Africa's electricity usage is supplied by Eskom (Eskom, 2013). Furthermore, Worthington, (in Mbanga, 2008:18) notes that Eskom's 2025 target for sustainable energy is only about 1% of primary energy production. This means that the development and investment in sustainable energy will have to originate from alternative entities.

Tax breaks and incentives are used increasingly by governments around the world to encourage the production and utilization of sustainable energy (Menaker *et al.*, 2012). An extensive database search indicated that few studies have been performed that critically analyse and compare the tax incentives for the production of sustainable energy in South Africa to that of a country with a similar economic climate, but with a superior level of sustainable energy production and usage. A comparison will therefore be made between tax incentives contained in policies and legislation in the South African and Brazilian sustainable energy arenas. This will be useful in determining an effective means to increase the scale of development and investment in, as well as the use of, sustainable energy in South Africa.

1.3 PURPOSE STATEMENT

The aim of this study is to address the aforementioned knowledge gap through investigating the use of tax incentives in the production and use of sustainable energy as well as examining the barriers relating to sustainable energy. A critical analysis of tax incentives with regard to sustainable energy in South African and Brazilian tax policies and legislation will be performed. These findings will be used to evaluate and compare sustainable energy tax incentives within the context of South Africa and Brazil. Furthermore, this study will provide insight into possible improvements to current policies and legislation in order to encourage increased sustainable energy development, implementation and usage in South Africa.

1.4 RESEARCH OBJECTIVES

- To provide a contextual overview of tax incentives for the production and use of sustainable energy as well as sustainable energy barriers.
- To critically analyse and compare sustainable energy tax incentives specific in the context of South Africa and Brazil.
- To determine suggestions and improvements that can be made to South African tax incentives contained in policies and legislation through interpreting the abovementioned objectives in a South African context and noting what South Africa can learn from Brazil in this regard.

1.5 DELIMITATIONS

In interpreting the findings of the study undertaken, a number of delimitations need to be taken into consideration. These are as follows:

- The study is performed with specific reference to the geographic context of South Africa and Brazil respectively. Although other countries are also mentioned in the discussion and analysis, their specific attributes are considered in isolation and therefore at no point does the intention exist to apply the findings of the study to the context of these additional countries.
- The study is undertaken with explicit reference to the sustainable energy sector. The findings and interpretations are therefore intended to relate solely to this sector.
- Lastly, the study focuses on tax incentives as opposed to taxes that are imposed. The study therefore limits its scope to exclude any related taxes that are imposed on a taxpayer thereby resulting in an increased tax liability.

1.6 ASSUMPTIONS

This study is based on a number of specific assumptions. The assumptions relevant to the study are as follows:

- A direct relationship exists between the tax related policies and legislation of a country and the progress in the production and use of sustainable energy in such a country.
- Taxpayers respond to tax incentives when conducting their business or personal activities. They are assumed to be rational in their decision making and they attempt to achieve the highest profitability and lowest related tax liability while going about their business.
- The analysis and comparison of sustainable energy related tax incentives within South Africa and Brazil, although not exhaustive, is representative of the influence that tax incentives have on the current state of sustainable energy production and use in these countries.

1.7 DEFINITION OF KEY TERMS

The meanings ascribed to key terms used throughout the study are as follows:

Biodiesel is "... a fuel made from vegetable and animal fat oils that have been processed to remove glycerin, sometimes combined with petroleum-based diesel (labeled a biodiesel blend) and for use in most diesel engines without modifications" (Your Dictionary, Not dated (a)).

Biofuel is a "fuel produced from renewable resources, especially plant biomass, vegetable oils, and treated municipal and industrial wastes. Biofuels are considered neutral with respect to the emission of carbon dioxide because the carbon dioxide given off by burning them is balanced by the carbon dioxide absorbed by the plants that are grown to produce them." (Your Dictionary, Not dated (b).)

Biomass is a term that encompasses “renewable organic materials, such as wood, agricultural crops or wastes, and municipal wastes, especially when used as a source of fuel or energy. Biomass can be burned directly or processed into biofuels such as ethanol and methane.” (Your Dictionary, Not dated (c).)

CFA Franc zone is a grouping of 14 member countries consisting of Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo (collectively known as the West African Economic and Monetary Union (WAEMU)) as well as Cameroun, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea and Gabon (collectively known as the Communauté Economique et Monétaire de l'Afrique Central (CEMAC) – directly translated as the Economic and Monetary Community of Central Africa). These countries are all former French colonies and, culturally, they all speak French. Together the countries are considered to be a monetary union sharing the CFA Franc as a common currency. (Van Parys & James, 2010:406.)

Feed-in tariff is a “payment made to households or businesses generating their own electricity through the use of methods that do not contribute to the depletion of natural resources, proportional to the amount of power generated” (Oxford Dictionaries, Not dated (a).) Feed-in tariffs are used to assist in the formation of an industry. This is achieved by setting a higher tariff payable for something like sustainable energy in comparison to energy that comes from a non-renewable source. (Mbanga, 2008:18.)

Fossil fuel is “a hydrocarbon deposit, such as petroleum, coal, or natural gas, derived from the accumulated remains of ancient plants and animals and used as fuel. Carbon dioxide and other greenhouse gases generated by burning fossil fuels are considered to be one of the principal causes of global warming.” (Your Dictionary, Not dated (d).)

Shale is a “fine-grained sedimentary rock consisting of compacted and hardened clay, silt, or mud. Shale forms in many distinct layers and splits easily into thin sheets or slabs.” (Your Dictionary, Not dated (e).)

Shale gas is a “natural gas occurring within or extracted from shale” (Oxford Dictionaries, Not dated (c)).

Sustainable is used within an environmental impact context and is defined as “conserving an ecological balance by avoiding depletion of natural resources” (Oxford Dictionaries, Not dated (d)). For the purposes of this study, the term ‘sustainable energy’ is synonymous with renewable, alternative or green energy.

Tax break is defined as “a special tax benefit given to promote specific economic or social objectives. For example, the U.S. government, having decided that individual home ownership is a boon to the economy, allows interest on a home mortgage to be subtracted, in whole or in part, from one's taxable income. The resulting lower taxation for homeowners constitutes a tax break.” (Your Dictionary, Not dated (f).)

Tax incentive as discussed in chapter 2.3.1 is defined as a tax related payment or concession offered in order to encourage targeted activities or stimulate greater output or investment (Oxford Dictionaries, Not dated (b); Your Dictionary, Not dated (g)).

1.8 ABBREVIATIONS USED

For ease of reference, Table 1 below summarises all abbreviations used in this document:

Table 1: Abbreviations used in this document

Abbreviation	Meaning
BRICS	Brazil, Russia, India, China and South Africa
CCL	Climate Change Levy
CEMAC	Communaute Economique et Monetaire de l'Afrique Central (Economic and Monetary Community of Central Africa)
CIP	Critical Infrastructure Programme
CO ₂	Carbon Dioxide
FIG	Foreign Investor Grant
FIT	Feed-in Tariff
ITC	Investment Tax Credit
kWh	Kilowatt Hour
MIP	Manufacturing Investment Programme
MW	Megawatt
OECD	Organisation for Economic Co-operation and Development
PPA	Power Purchase Agreement
PPP	Purchasing Power Parity
PTC	Production Tax Credit
R	Rand
REC	Renewable Energy Credit
REFIT	Renewable Energy Feed-in Tariff
REIPPP	Renewable Energy Independent Power Producer Programme
RPS	Renewable Portfolio Standards
SARS	South African Revenue Service
UK	United Kingdom
US	United States
USD	United States Dollar
VAT	Value Added Tax
WAEMU	West African Economic and Monetary Union

1.9 RESEARCH DESIGN AND METHODS

This study is comprised exclusively of an extended literature review of the tax incentives available in South Africa and Brazil that intend to encourage the production and use of sustainable energy. Non-empirical research is therefore conducted in this study and it involves critically analysing and comparing secondary data.

Non-empirical research is the most appropriate inquiry strategy as the purpose of this study is to provide a meaningful analysis of the current state of tax incentives in South Africa and Brazil. Furthermore, the objective is to provide an interpretation of the tax incentives that encourage the production and use of sustainable energy within that context. Ultimately the study aims to provide suggested improvements to current South African tax policies and legislation.

An inherent limitation of performing a non-empirical literature review is that no new empirical evidence is obtained, and therefore the source data is limited to existing empirical research. A qualitative approach is however supported by the fact that, to meet its objectives, the study is neither required to create new nor validate existing empirical evidence. Performing a literature review is supported further by the fact that similar investigations in a related context use the same methodology (Nel, 2010:13; Terhoeven, 2012:9).

The sources that are used for the literature review encompass relevant legislation and policies as well as academic literature that provide insight into tax incentives in the sustainable energy contexts of South Africa or Brazil.

1.10 OVERVIEW OF THE CHAPTERS

This study consists of six core chapters. As a continuation of the information presented in the introduction, chapter 2 discusses the reasons for the increased production and use of sustainable energy and how tax incentives influence the attraction of investment. Chapter 2 concludes with a general overview of sustainable energy tax incentives within the context of a tax incentive definition.

Significant barriers that generally affect the development and use of sustainable energy are addressed in chapter 3. Chapter 4 starts by examining South Africa and Brazil's sustainable energy environment, and goes on to discuss, within this context, the tax incentives for sustainable energy related investments and usage that are available.

The purpose of chapter 5 is to critically analyse and compare the South African tax incentives, identified in chapter 4, to those of Brazil. Suggestions that would overcome the barriers noted in chapter 3 as well as encourage an increased sustainable energy sector within South Africa are consequently identified. Lastly, chapter 6 of the study concludes with an assessment of how the study has achieved its research objectives, and considers possibilities for future research.

CHAPTER 2

TAX INCENTIVES IN THE CONTEXT OF SUSTAINABLE ENERGY: AN OVERVIEW

2.1 INTRODUCTION

Carbon intensive economies such as South Africa's have seen a significant increase in electricity costs over the past few years. This is in addition to increasing gasoline and diesel prices. Energy from non-sustainable sources is therefore becoming increasingly expensive due to its limited nature, and consequently it is important that sustainable energy be used instead of fossil fuels. This fact was highlighted by the US government during their recent budget reviews in which they increased rather than reduced renewable energy tax incentives. The reviews occurred as a result of the need for increased tax revenue during the economic recession. (Garrison, 2013:27.)

This chapter sets out to explore the reasons behind the need to increase the production and use of sustainable energy, and the importance of tax incentives in achieving this. Furthermore, the concept of a tax incentive is clearly defined. In conclusion, the chapter offers an overview of sustainable energy enabling tax incentives.

2.2 JUSTIFICATION FOR INCREASING THE PRODUCTION AND USE OF SUSTAINABLE ENERGY

Sustainable development, within the context of sustainable energy, consists of three fundamental elements, namely economic, environmental and social (Krupa & Burch, 2011:6254). Each of these elements (examined in chapter 2.2.1 to 2.2.3 below) form an integral part of understanding the need to increase the production and use of sustainable energy, specifically in South Africa.

2.2.1 Economic impact

During 2007/2008 South Africa faced a crisis in its energy sector. The demand for electricity began exceeding the available supply due to the country's strong economic growth. Although coal based electricity generation was on the increase, the rate of increase was insufficient to meet the growing economy's immediate needs. This resulted in load shedding, a term synonymous with power outages. (Krupa & Burch, 2011:6254.)

The power outages may not have stemmed directly from insufficient fossil fuel resources but rather, amongst other reasons, resulted from inadequate maximum load planning (Krupa & Burch, 2011:6254). An energy supply that is insufficient in meeting an economy's demands will affect the economic stability of that country (Economics Online, Not dated). Therefore, because fossil fuels are finite in nature, sustainable energy is an important consideration for the future.

As noted in chapter 2.1 above, the cost of energy associated with fossil fuels is increasing (Garrison, 2013:27). In order for an economy to stay competitive globally, both the cost of energy as well as its availability should be considered (Deloitte, 2013). Chapter 3.2.1 identifies the high initial capital costs associated with sustainable energy as a barrier to using sustainable energy. However if this barrier can be overcome through solutions such as tax incentives, the availability of sustainable energy will make it a preferred source of energy from an economic perspective. (Obata, Not dated.)

The production and use of sustainable energy can also strengthen the self-sufficiency of an economy by minimising its reliance on foreign energy supplies. The attainment of sustainable energy self-sufficiency therefore reduces the challenges associated with a country's electricity, heat and fuel requirements. (Kaphengst, 2011.)

2.2.2 Environmental impact

The almost exclusive use of fossil fuels as an energy source, makes South Africa's economy extremely carbon intensive (Karrappan, 2011:6). Chapter 4.2.1 analyses some of South Africa's energy related statistics in more detail and indicates that the use of coal alone accounts for 72,5% of South Africa's primary energy consumption (BP, 2013:41).

South Africa's mining and industrial sector accounts for half of the national primary energy consumption, which illustrates the importance of and dependence on mining and industrial activities in the South African economy. As a result, the carbon intensity of the South African economy is among the highest in the world. (Du Plooy, 2008.)

Coal is used for 90% of South Africa's electricity generation. Furthermore, the Sasol coal-to-liquid process, which accounts for a quarter of South Africa's liquid fuel production, results in substantially higher greenhouse gas emissions than conventional oil refining. (Du Plooy, 2008.)

The concern with using fossil fuels, such as coal, as an energy source is that it causes severe environmental pollution. It also results in environmental decay due to increased greenhouse gas emissions, a loss of biodiversity and increased air borne pollution. (Krupa & Burch, 2011:6254.) In contrast, sustainable energy has a negligible (if any) impact on the environment (Parker, 2009:48).

2.2.3 Social impact

Sustainable energy can have a direct positive influence on an economy's underprivileged population. An example of this is solar photovoltaics technology, which helped reduce energy poverty in northern KwaZulu-Natal, South Africa, when it was installed in 33 400 houses. This technology uses the energy from sunlight to produce a flow of current, which is then conducted to the necessary external sources requiring power. (Mbanga, 2008:17.)

Job creation is another social benefit associated with the sustainable energy sector. Sustainable energy related job creation opportunities are higher than those provided by existing coal-fired power stations. (Gets, 2013:18-20.) Almost 40 people are required to be employed for the erection and commissioning of a 1-2 megawatt photovoltaic project, and each additional 1 megawatt capacity increases this staffing requirement by 15 people (Singh, 2013).

Research and development investments are likely to vary depending on whether the tax incentives relating to their funding incorporate a grant or whether the tax incentives do not offer a grant. This is because an entity is generally primarily concerned with undertaking projects that have a high positive expected rate of return, and not necessarily projects that will provide the best social return. Grants can therefore be used to encourage the investment in projects delivering higher social returns. (Congressional Documents and Publications, 2011.)

2.3 THE IMPORTANCE OF TAX INCENTIVES IN ATTRACTING INVESTMENTS

2.3.1 Tax incentive definition

An incentive is defined as “a payment or concession to stimulate greater output or investment” (Oxford Dictionaries, Not dated (b)). A tax incentive is defined as “a tax benefit offered in order to encourage or discourage targeted activities” (Your Dictionary, Not dated (g)). Tax incentives include, amongst others, tax credits, grants, tax holidays, accelerated depreciation (KPMG, 2011:1), and tax exclusions or exemptions. In combining the above definitions, a tax incentive for the purposes of this study is therefore defined as a tax related payment or concession offered in order to encourage targeted activities or stimulate greater output or investment.

2.3.2 The ability of tax incentives to attract investments

Before considering investment in the specific context of sustainable energy, it would be worthwhile to obtain an understanding of the ability of tax incentives as a whole to attract investments.

A study performed in the CFA Franc zone (consisting of 14 sub-Saharan African countries) concludes that tax exemptions and investment do not share an overt positive relationship. This does however not preclude the existence of a positive relationship entirely. It was found that the less complex a tax system is and the more guarantees a government provides, the higher the investments that it attracts. (Van Parys & James, 2010:400.)

A different study that analysed the effect that tax incentives have on attracting foreign investment concludes that foreign investments in the Canadian Oil Sands Project, which is based on the Canadian petroleum industry, were not significantly attracted by tax incentives. The study does however add that the impact of tax incentives is significant when other positive investment factors exist. (Febriana, 2011:3.)

The abovementioned studies, although relevant because they encompass numerous Sub-Saharan African countries and the petroleum energy sector respectively, do not specifically address the sustainable energy environment and as such cannot be regarded as conclusive in this area. This is important to note as there is little empirical evidence that either supports or contradicts the notion that sustainable energy production is increased as a direct result of sustainable energy policies. (Song, 2011:195.)

In contrast to the above, it has been noted that progress in the furtherance of sustainable energy development requires a country's government to facilitate the necessary market conditions through policy and legislation (Mbanga, 2008:21; Song, 2011:195). The growth in the development and use of sustainable energy is therefore largely dependent on the existence of supportive sustainable energy policy frameworks (Martins & Pereira, 2011:4383).

Tax breaks are important incentives that encourage the advancement of sustainable energy and both the US and UK governments intend to continue using them (Menaker *et al.*, 2012).

Tax-related incentives such as tax exemptions and allowances are more advantageous to governments than incentives such as grants. This is due to the fact that they do not require upfront cash flows, but are rather incorporated through the reduction of a taxpayer's tax liability. (Febriana, 2011:1.)

2.4 OVERVIEW OF TAX INCENTIVES

Where the preceding section considered the relationship between tax incentives and investment in sustainable energy, this section defines a tax incentive and provides an overview of frequently used sustainable energy enabling tax incentives.

2.4.1 Research and development

As noted in chapter 1.1, multinational businesses conduct higher levels of research and development activities in countries where tax related incentives exist. Other factors that are considered by these businesses include: market access, the current level of knowledge within the country regarding the research and development that is to be undertaken, and the availability of competent researchers. (Congressional Documents and Publications, 2011.) This confirms the notion that factors such as the length of historic involvement and the maturity of technology within a country affect the country's sustainable energy investment and production (Song, 2011:196).

Because research and development spurs innovation, research and development tax incentives are expected to increase private investment, and therefore increase growth, in the targeted sustainable energy sector. Small and medium sized businesses are often eligible for more beneficial research and development incentives than other larger entities. More generous incentives for specific energy related research and development are also available in some countries such as the US. (Congressional Documents and Publications, 2011.)

Research and development tax incentives include, amongst others, tax credits and tax allowances. Currently both South Africa and Brazil provide tax incentives for research and development. (Congressional Documents and Publications, 2011.)

2.4.2 Feed-in tariffs

Feed-in tariffs (FITs) are used to assist in the formation of an industry. This is achieved by setting a higher tariff payable for something like sustainable energy in comparison to energy that comes from a non-renewable source. (Mbanga, 2008:18.) Professor Dieter Holm (in Mbanga, 2008:18) explains that in a South African context, most of these tariffs fall under a 20 year contract which assists in providing revenue security to the developer. A learning curve is generally an integral part of such contracts, and this is encouraged through set decrements in the tariff over the contract period which ensures that the sustainable energy output becomes cheaper over time. (Mbanga, 2008:18.)

During 2011 South Africa saw the introduction of a public procurement programme known as the Renewable Energy Independent Power Producer Programme (REIPPP). This programme replaced the Renewable Energy Feed-in Tariff (REFIT) and, in contrast, defines a ceiling tariff for auctions in the various qualifying sustainable energy classes. A power purchase agreement (PPA), which is guaranteed for 20 years, is then signed by the winning bidder. (International Energy Agency, 2013.)

FITs are considered equitable in the sense that higher tariffs can be made available for locations that have fewer resources. Internationally it has also been considered the most cost efficient way to encourage the development of the sustainable energy industry (Mbanga, 2008:18).

Countries like the UK use FITs, where fixed payments are made to entities for the generation of sustainable energy, together with further payments for any supply of this energy to the national grid. These payments are not subject to income tax, for example when they are generated for personal use by households. (Menaker *et al.*, 2012.) FITs have therefore been noted to have a positive effect on sustainable energy production, particularly in the hydro energy sector (Song, 2011:196).

2.4.3 Tax incentives in countries other than South Africa and Brazil

In the US, tax incentives encouraging the development and use of sustainable energy take the form of corporate and personal tax incentives, property tax incentives, sales tax incentives and other incentives such as rebates and production incentives. These can be implemented in a variety of ways such as tax deductions or exclusions, tax exemptions or tax credits. Examples of where these have been applied are in the purchasing of energy efficient equipment and in the construction of energy efficient buildings. (Garrison, 2013:28.)

Some specific US sustainable energy tax incentives include: the investment tax credit (ITC), which is calculated as a percentage of the sustainable energy asset's value; the production tax credit (PTC), which is based on the units of sustainable energy produced – for example per kWh of electricity produced; and progress expenditure credits for expenditure incurred on projects which are expected to take in excess of two years to construct (Menaker *et al.*, 2012).

In the UK a climate change levy (CCL) is charged, and the related tax incentive for energy supplied from sustainable sources is a reduction in the rate of such a levy if energy efficiency or carbon emission targets are met (Menaker *et al.*, 2012).

Both the US and the UK allow for accelerated capital allowances. These result in higher depreciation percentages (tax allowances) on qualifying assets, which are usually machinery and equipment used in the development or production of sustainable energy, and consequently there is a much faster realisation of tax benefit through a reduced tax liability. (Menaker *et al.*, 2012.)

2.5 CONCLUSION

The benefits of sustainable energy as opposed to energy generated from fossil fuels are evident from an analysis of their economic, environmental and social impacts. Although, economically, the cost of sustainable energy is higher than its fossil fuel alternatives, tax incentives can assist to alleviate this. Furthermore, sustainable energy offers economic benefits such as energy self-sufficiency, which is an important consideration for the future.

The environmental benefits associated with sustainable energy far outshine those of carbon intensive energy resources. The adverse environmental impact associated with the use of fossil fuels leaves a country with little choice but to consider the production and use of sustainable energy. The alleviation of energy poverty as well as increased job creation further supports sustainable energy from a social perspective.

Tax incentives can take on various forms and although not the only factor, they would appear to be an important consideration in encouraging sustainable energy related investments.

CHAPTER 3

BARRIERS TO THE PRODUCTION AND USE OF SUSTAINABLE ENERGY: AN OVERVIEW

3.1 INTRODUCTION

One of the primary reasons for sustainable energy related tax incentives is to overcome the barriers that would otherwise restrict or inhibit the growth of, or interest in, sustainable energy. Chapter 2 discussed the three fundamental elements that impact the justification of the production and use of sustainable energy. There are the economic, environmental and social impacts respectively. It also dealt with the importance of tax incentives in attracting investments and provided an overview of sustainable energy tax incentives within the context of a tax incentive definition. This chapter sets out to identify and discuss the barriers applicable to the production and use of sustainable energy.

3.2 SUSTAINABLE ENERGY BARRIERS

3.2.1 Initial capital cost

The considerably high initial capital costs associated with sustainable energy production is one of the most common barriers mentioned in the sustainable energy literature reviewed (Parker, 2009:48; Mbanga, 2008:16-21; Menaker *et al.*, 2012; Martins & Pereira, 2011:4378-4390).

Tax allowances, such as those discussed in chapters 4.3 and 4.4 below, seek to ease the burden of the high initial capital costs associated with sustainable energy technologies. The high upfront cost can be illustrated in the example of wind turbines, where down payments are necessary before a project has even commenced. In this example, the key question is therefore whether the net cost of capital, after taking related tax incentives into account, will allow for the production of electricity below the feed-in tariff rates. (Parker, 2009:48.)

The cost associated with sustainable energy related technologies has improved in recent years, with the past two years evidencing a 31% reduction in the average cost of solar power systems. Although there has been a decline in wind and solar power costs in recent years, this has not been sufficient to outperform the cost of electricity generated from fossil fuels. (Fahey, 2013.)

It appears that the largest sustainable energy related costs are to be incurred upon initial adoption of the new technology, while the effort and cost of further developing the already existing sustainable energy technology is expected to be easier and cheaper in future years. (Fahey, 2013.)

Although the initial capital costs of sustainable energy related assets are higher than their fossil fuel counterparts, it is expected that this may not always be the case. The reason for this is that the cost of fossil fuels is constantly rising while sustainable energy related prices are expected to reduce over time (Mbanga, 2008:17). Carbon taxes are one of the significant influences increasing fossil fuel costs (Parker & Gilder, 2013).

3.2.2 Lack of local manufacturing and installation capacity

The previous section (Chapter 3.2.1) highlights a major challenge associated with sustainable energy development, namely the availability of funding. However, even if funding is obtained, sufficient local manufacturing and installation capacity can still pose a challenge (Mbanga, 2008:20). This can result from numerous factors including the lack of an appropriate level of technical expertise being available in the workforce (Garratt, 2011).

Infrastructure is another important consideration that is key to the progress of the development and implementation of renewable energy within a country. The extent of infrastructure reliance differs between sustainable energy sources, with some sources requiring significantly better infrastructures than others. The infrastructure required for biomass is a good example, as biomass is one of the key sustainable energy sources to be used in place of fossil fuels. (Lam, Varbanov & Klemeš, 2010:545.)

Biomass requires vast land areas, and would therefore usually include areas such as farms or forests. Transportation facilities are also imperative as both field and road transportation of the biomass resource is required. Depending on the transportation method, a carbon footprint could result which is then to be associated with the biomass energy resource. The transportation infrastructure is therefore an essential consideration for the development and implementation of renewable energy both in terms of profitability as well as sustainability. (Lam *et al.*, 2010:545.)

3.2.3 Regulatory framework and intellectual rights

A regulatory framework provides certainty and consistency in application. In the South African context Mbanga (2008:20) states that the current solar industry legislative and regulatory framework is not sufficient due to its lack of clarity. Appropriate leadership is required to encourage and facilitate the furtherance of sustainable energy, and an improved regulatory framework is vital. (Mbanga, 2008:20.)

Another concern for entities investing in sustainable energy is that of other entities being able to take advantage of knowledge that becomes available as a direct result of the original entity's investment, thereby obtaining a benefit without having had to incur any substantial cost to obtain that benefit. Policies that protect intellectual property rights are therefore crucial in facilitating investment in sustainable energy. (Congressional Documents and Publications, 2011.)

3.2.4 Insufficient technological advancement

It is apparent that yet another barrier exists because sustainable energy technology has not reached an appropriate level of advancement such that the technology is efficient and reliable, and therefore trusted. Examples of this include the challenges in connecting solar and wind related energy systems to the Brazilian distribution grid (Martins & Pereira, 2011:4383) and challenges that are experienced with electric car batteries (Menaker *et al.*, 2012).

3.2.5 Seasonal, time of day, and related reliability of sustainable sources

Although seasonality is not always an issue as the use of varying sustainable sources can in fact be complementary to one another (refer to the discussion in chapter 4.2.4), the reliability of sustainable energy sources is still a real concern. This barrier could however also stem from a lack of reliable information on the variability of sustainable energy sources. (Martins & Pereira, 2011:4383.)

3.2.6 Long term nature and payback period

Notwithstanding each of the aforementioned barriers to the development and implementation of sustainable energy, a defining characteristic of a sustainable energy project is its long term nature and extended payback period (Hamilton, 2009).

Chapter 4.2.4 points out that wind energy auctions held in Brazil attracted a 20 year grant period (Martins & Pereira, 2011:4379-4380). Furthermore chapter 2.4.2 notes that previously South African feed-in tariffs envisioned a contract period of 20 years, and now power purchase agreements are guaranteed for 20 years (International Energy Agency, 2013; Mbanga, 2008:18). Projects of a longer term nature, of for instance 20 years, that have extended payback periods, have a higher degree of uncertainty. This uncertainty is evident in the difficulty associated with determining the project's realistic costs and benefits. (Indiasolar.com, Not dated.)

The prediction of future energy costs is problematic as social, political and economic circumstances could change over the duration of the sustainable energy project. Given the risks, financing institutions may also require guarantees for the funding that they provide (International Finance Corporation, 2011:9). As a result of all the uncertainties and the extended payback period influencing profitability, the motivation for a sustainable energy project can be difficult to provide (Ghoshal, 2011).

3.2.7 Alternative fossil fuels

Jaffe (2010) is convinced, after 30 years of analysing the energy markets, that the future of the energy industry will be transformed by the use of shale gas, and that the move to sustainable energy will lose momentum as a result. The use of shale gas, a fuel producing only half the carbon footprint compared to its coal equivalent, could increase as a short term energy resource. (Jaffe, 2010.)

Apart from the reduced carbon footprint, reasons supporting the shale gas revolution include the development of new technology that is able to unlock the potential of the gas confined between shale formations at a low enough cost, as well as an abundance of the resource around the world. It is estimated that North America has sufficient shale gas resources to support its natural-gas needs for the next 45 years. (Jaffe, 2010.)

Shale gas, much like wind and solar energy, is found in many countries. Western and Chinese users will therefore have local access to it and this will assist in preventing the development of a natural-gas cartel. There is however a real environmental concern that ground water may be contaminated if drilling fluids seep into aquifers or if they are disposed of in an inappropriate manner. (Jaffe, 2010.)

The top 10 countries with technically recoverable shale gas resources include South Africa, which is ranked eighth (with 390 trillion cubic feet of shale gas – 5,3% of the world total), and Brazil, which is ranked tenth (with 245 trillion cubic feet of shale gas – 3,4% of the world total). China is ranked first with 1 115 trillion cubic feet of shale gas – 15,3% of the world total. This illustrates the diverse distribution of shale gas in numerous geographic locations. (U.S. Energy Information Administration, 2013:10.)

Much like other fossil fuels, shale gas resources are finite, which means that even if they are used in the short term, eventually the need will once again arise for a cleaner more sustainable source of energy. The use of shale gas in the short term will provide an opportunity for extended research and development in the sustainable energy arena, without the immediate need for it to be competitively priced. (Jaffe, 2010.)

Without being exorbitantly expensive, reasonable mandates for energy usage to include a fixed percentage of energy from sustainable energy sources will continue encouraging companies to contribute to the sustainable energy market, thereby reducing future costs. (Jaffe, 2010.)

3.3 CONCLUSION

Numerous barriers that directly affect both the ability and desirability of the production and use of sustainable energy are identified. It is important to understand these barriers properly as this allows for the identification of appropriate measures needed to address them. Tax incentives are one of the measures that, if appropriately used, could significantly reduce the impediment many of the barriers pose. Consequently the following chapters identify and assess the suitability of tax incentives, particularly within a South African context.

CHAPTER 4

ANALYSIS OF SUSTAINABLE ENERGY TAX INCENTIVES IN THE CONTEXT OF SOUTH AFRICA AND BRAZIL

4.1 INTRODUCTION

The preceding chapter discussed the barriers that exist in the production and use of sustainable energy, and highlighted the fact that tax incentives could assist in mitigating these barriers. In order to place tax incentives in context, this chapter first analyses the sustainable energy environments of South Africa and Brazil. Thereafter the specific tax incentives made available by each of these countries are examined.

4.2 SOUTH AFRICA AND BRAZIL'S SUSTAINABLE ENERGY ENVIRONMENT

4.2.1 Statistical comparison

As the context of this study entails analysing and comparing South Africa to Brazil, it is worthwhile to consider a few relevant statistics pertaining to these two countries. An extract from the 2013 OECD country statistical profiles for South Africa and Brazil can be found in Table 2 below:

Table 2: Extract from 2013 OECD country statistical profiles for South Africa and Brazil

	South Africa (2010)	Brazil (2010)
Renewables' contribution to total primary energy supply (%)	[1,1]	43,9
CO₂ emissions from fuel combustion (Million tonnes)	347	388
Total population ('000 persons)	50 133	193 253
GDP per capita (USD current PPPs)	10 498	11 239

Source: OECD (2013a & 2013b)

The aim was to use 2013 data, but the most recent data available in the 2013 OECD country statistical profiles relate to 2011. However, the year of 2011 did not have data for each of the four respective fields noted in Table 2. The most recent year with corresponding data in each of the four fields was 2010. Therefore for purpose of comparison, the data of 2010 is used.

South Africa's renewables' contribution to total primary energy supply in Table 2 was corrected for the purposes of this study from 10,7% to 1,1%. This correction is the average of the data obtained from BP (2013:41) in

Table 3 and the Renewables 2012 Global Status Report (2012:107) discussed later in this section.

From analysing Table 2, it is evident that sustainable energy contribution to total primary energy supply is almost 40 times higher in Brazil than what it is in South Africa. It is also worth noting that Brazil's population is almost four times larger than that of South Africa, yet the CO₂ emissions from fuel combustion in real terms are very much the same as South Africa's. This disparity is emphasised even further by the fact that Brazil has a slightly larger GDP per capita than South Africa.

Alternative sources were consulted in addition to Table 2 in an attempt to obtain a more recent overview of the information. On an annual basis BP publishes a world energy review. "For 62 years, the *BP Statistical Review of World Energy* has provided high-quality objective and globally consistent data on world energy markets. The review is one of the most widely respected and authoritative publications in the field of energy economics, used for reference by the media, academia, world governments and energy companies" (BP, 2013:2).

Table 3 details the million tonnes oil equivalent per fuel type for South Africa, Brazil as well as the total for the entire world. The table is followed by Figure 1 which provides a graphical representation of the percentage that each fuel type comprises of the total primary energy for that geographic location. Figure 1 therefore allows for comparisons to be drawn between South Africa, Brazil and the entire world.

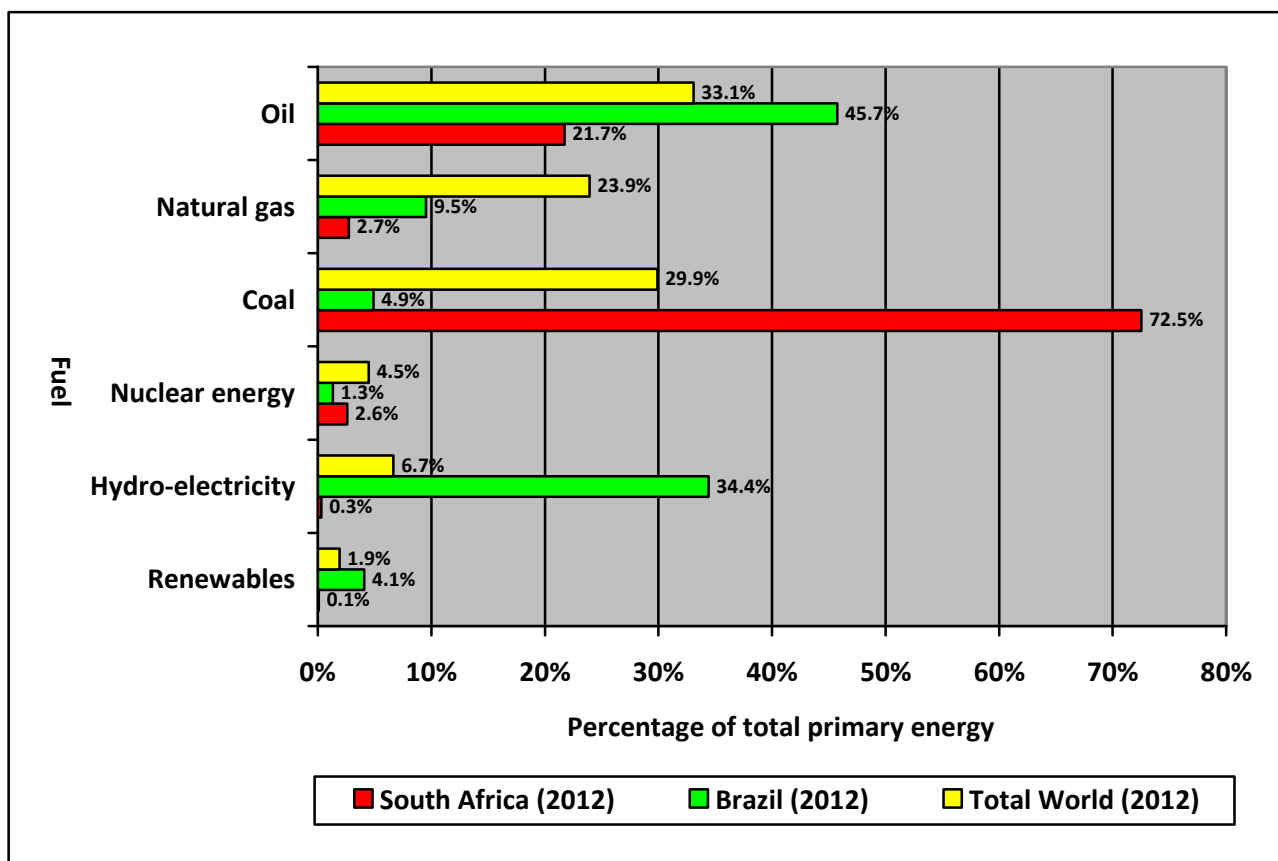
Table 3: Extract of country primary energy consumption by fuel

Fuel	South Africa (2012) Million tonnes oil equivalent	Brazil (2012) Million tonnes oil equivalent	Total World (2012) Million tonnes oil equivalent
Oil	26,9	125,6	4 130,5
Natural gas	3,4	26,2	2 987,1
Coal	89,8	13,5	3 730,1
Nuclear energy	3,2	3,6	560,4
Hydro-electricity*	0,4	94,5	831,1
Renewables*	0,1	11,2	237,4
Total	123,8	274,6	12 476,6

Source: BP (2013:41)

* Total renewable energy consists of the hydro-electricity and renewables categories.

Figure 1: Percentage of country total primary energy consumption by fuel



Source: Adapted from BP (2013:41)

Four important facts are clear from Figure 1:

- As a source of energy, oil accounts for just under half of Brazil's total primary energy consumption.
- South Africa's use of coal to provide energy, as a percentage of its total primary energy, is more than double the equivalent average for the world. South Africa's coal usage in generating energy therefore appears to be excessively high.
- When compared with the total world average, natural gas in South Africa and Brazil is not as dominant a source of energy. Chapter 3.2.7 highlighted the fact that the use of natural gas to generate energy, such as the gas obtained from shale rock formations, could potentially increase within the next few decades. South Africa and Brazil's natural gas consumption may therefore increase in the next few years as both countries were included on the list of top 10 countries with technically recoverable shale gas resources (see chapter 3.2.7).
- Renewable energy (consisting of the hydro-electricity and renewables categories in Figure 1) as a percentage of total primary energy for 2012 is noted to be 38,5% for Brazil and a mere 0,4% for South Africa.

The Renewables 2012 Global Status Report states that the primary energy generated from renewables for Brazil in 2009/2010 was 47,5% (REN21, 2012:107). The renewable's share of electricity production in South Africa in 2010 was 1,8% (REN21, 2012:109). This information differs from the information presented in Figure 1, in the fourth factual statement above. It also differs from the data from the OECD statistical profiles presented in Table 2. Although differences in the information from the three alternative sources are evident, each source consistently expresses the fact that the extent of production and use of sustainable energy in Brazil significantly exceeds that of South Africa.

The above-mentioned statistics highlight the reason for the study's comparison between South Africa and Brazil, as it would appear that South Africa can learn a lot from Brazil's more advanced sustainable energy sector.

4.2.2 Sources of sustainable energy

As discussed in chapter 1.2, although very different, both South Africa and Brazil have vast sustainable energy resources at their disposal. Two of South Africa's prime examples are wind and solar related energy and they are supported by a highly favourable coast line and high radiation levels respectively. However, in spite of this, the majority of these sources are still largely unused. (Parker, 2009:48.)

Brazil is one of the world's top three producers of sustainable energy, behind China and the European Union, largely due to the fact that it has extensive water resources (Martins & Pereira, 2011:4379). Brazil's main sustainable energy resources that are currently utilised include hydro, sugar-derived ethanol and biomass sources (KPMG, 2011:41). Although Brazil has sustainable energy that contributes to such a significant portion of its total primary energy supply, less than 0,3% of this total primary energy supply results from solar or wind related sources (Martins & Pereira, 2011:4378).

The advantages of wind and solar resources lie in the fact that they are free, and their use in the production of sustainable energy has a negligible (if any) impact on the environment (Parker, 2009:48).

4.2.3 Comparison between South Africa and Brazil's sustainable energy resources

The preceding section (Chapter 4.2.2) indicates that South Africa and Brazil's sustainable energy resources are inherently different from one another. Their comparison should therefore be contextually interpreted to provide a meaningful analysis. South Africa's primary sustainable energy resources consist of wind and solar, contrasted with Brazil's primary sustainable energy resources of hydro and biomass. (Parker, 2009:48; KPMG, 2011:41.)

Consistent with the discussion in chapter 4.4, solar energy is generally applied to smaller systems and as such will involve numerous smaller projects, whereas wind, hydro and biomass projects take place on a much larger scale (Entrepreneur's Toolkit, 2011). Brazil,

having hydro and biomass resources, would therefore primarily be involved in large scale projects, whereas South Africa would also be involved in numerous small scale projects pertaining to solar energy resources. Numerous small scale projects are more challenging to regulate than a reduced number of larger scale projects, as the same requirements exist for all projects irrespective of size, and therefore larger projects are able to take advantage of economies of scale (McGuckin, 2013). As a result, South Africa's projects would be more challenging to regulate than those of Brazil.

A country's ability to incorporate the production and use of sustainable energy into its energy activities is affected by the availability of land (Kaphengst, 2011). Solar panels require large areas of land to generate a meaningful amount of energy, which has resulted in locations such as the desert and even rooftops being considered (Marquit, 2009). Wind turbines face the same dilemma as tens or hundreds of them are required to power a town. Correctly spacing the wind turbines requires a great stretch of land as it is important that the turbines receive sufficient wind and that they are also not affected by the other turbines' turbulence. (Guims, 2011.)

A further important consideration in assessing the possibility of improved production and use of sustainable energy is the competing requirements pertaining to land and water resources. Biofuels could also affect the supply of existing food crops, if they are not restricted to crop and forest residues. (Ölz, Sims & Kirchner, 2007.)

Brazil's extensive water resources are extremely beneficial as hydroelectric power is one of the most cost-efficient means of generating sustainable energy (Marquit, 2009; Martins & Pereira, 2011:4379). South Africa, by contrast, is a water scarce country (Republic of South Africa Department of Water Affairs, 2012).

In summary, South Africa and Brazil's sustainable energy statistics cannot be viewed in isolation, but rather need to be interpreted within the abovementioned context. Brazil's abundance of cost efficient water resources differs from South Africa's need to trade-off sustainable energy with its mining economy and land areas used in the production of food. South Africa can learn from Brazil; however it must be borne in mind that the two countries' economic drivers are inherently different from one another.

4.2.4 Solar and wind technology in Brazil

Even though Brazil is located in a tropical region, having solar energy resources available and relatively constant throughout the year, its utilisation of solar technology is far behind that of other sustainable energy resources. Solar water heating remains the most common use of such energy, with studies indicating that solar technology could be cost effective across Brazil. (Martins & Pereira, 2011:4380.)

The growth in Brazil's wind energy production has been exponential, and has increased from 22MW in 2003 to 921 MW in 2011. This increase is supported by wind energy auctions which allowed for an additional 71 projects in 2009 and 50 in 2010. Over a 20 year grant period, it will add up to a total increase of 1 800MW and 1 519MW respectively. The underutilisation of wind as a source of sustainable energy is clearly evident in the Brazilian Wind Atlas which estimated in 2001 that wind power in excess of 145 000MW exists inland of Brazil. (Martins & Pereira, 2011:4379-4380.)

Seasonal wind and hydro regimes were found to be complementary. This supports the increased use of wind energy to overcome the decline in hydro power during Brazil's dry season. The same correlation can also be attributed to solar radiation due to its expected reduction with cloudiness during the rainy season, when hydro power can be used. (Martins & Pereira, 2011:4383.)

Research conducted by Martins and Pereira (2011:4386) found the following three factors to be of critical importance in the expansion of solar and wind energy:

- incentives and related actions in the local market
- improved government regulations
- government fiscal policies and public awareness

4.3 SOUTH AFRICAN TAX INCENTIVES

The definition of a tax incentive is detailed in Chapter 2.3.1, and the nature thereof is to provide tax relief to a taxpayer (Oxford Dictionaries, Not dated (b); Your Dictionary, Not dated (g)). Chapters 4.3.1 to 4.3.4 below detail the South African tax incentives that are available according to the Income Tax Act (58/1962) (hereafter referred to as the Income Tax Act).

The owner of the asset is typically entitled to claim allowances on their cost incurred, however in some instances the South African Revenue Service (SARS) may base the allowance on an arm's length price if this is lower than the taxpayer's cost (Parker, 2009:48).

4.3.1 Section 11D: Scientific or technological research and development

Section 11D of the Income Tax Act provides an allowance of either 100% or 150% of expenditure incurred on research and development and it is also applicable to capital expenditure. This section was changed in October 2012. Although no amendment was made to the deduction percentage that is made available for the expenditure incurred for scientific or technological research and development, the scope of qualifying for the additional 50% deduction has become more tightly controlled and somewhat subjective in nature as it now requires approval from the Minister of Science and Technology. (Income Tax Act; PwC, 2012:10-11.)

The practical implementation of this requirement means that the related approval will be considered by a specific committee, which is appointed according to legislation, for carrying out this task. The increased subjective nature is evident in the fact that the innovative nature and the specialised skills required for carrying out the scientific or technological research and development must be taken into consideration by the committee in approving the additional 50% deduction. (PwC, 2012:10-11.)

The section 11D allowance contained in the Income Tax Act applies to

- discovering non-obvious scientific or technological knowledge or
- creating, developing or significantly improving any invention, design, computer program or related essential knowledge.

4.3.2 Section 12B: Deductions in the production of renewable energy

Section 12B of the Income Tax Act allows for accelerated capital allowances. The allowance rate in the first, second and third years is 50%, 30% and 20% respectively. This allowance is granted based on assets that are used in the generation of electricity from wind, sunlight, gravitational water forces producing less than 30 megawatts, and biomass. (Income Tax Act.) A similar allowance is provided with regard to the production of biofuels (Parker, 2009:48).

4.3.3 Section 12D: Deductions for transmission lines

Section 12D of the Income Tax Act grants a 5% allowance per year on the cost of line or cable used for the transmission of electricity.

4.3.4 Section 12I: Industrial policy projects

Section 12I of the Income Tax Act allows in addition to the normal S12C manufacturing allowance, an allowance in the first year of either 35% or 55% of the cost of an asset used in an industrial policy project. These percentages can be increased further should they relate to an industrial development zone (Income Tax Act). Industrial policy projects are characterised by their components of job creation and pioneering energy efficiency (Van Eeden & Wichmann, 2011:6).

4.3.5 Cash based tax grants

The following cash based tax grant incentives that encourage the use of sustainable energy are explicated by Van Eeden and Wichmann (2011:6):

- *Critical Infrastructure Programme (CIP)*. R17.3 million was granted in 2010 to support the generation of electricity from the conversion of household waste related gas.
- *Manufacturing Investment Programme (MIP)*. This is a 15% to 30% incentive based on the investment value of qualifying assets that are less than R200 million.
- *Foreign Investor Grant (FIG)*. This grant allows for a maximum of R10 million for the movement of qualifying assets to South Africa from abroad.

4.4 BRAZILIAN TAX INCENTIVES

The Brazilian government announced that it has a target of generating 75% of its electricity supply from sustainable sources by 2030 (KPMG, 2011:3). Therefore an analysis of the related tax incentives and programmes that are currently in place and which are intended to assist in achieving this target will provide a valuable insight into how the production and use of sustainable energy can be encouraged.

An incentive program known as the *Programa de Incentivo àd Fontes Alternativas de Energia Eléctrica* (Incentive Programme for Alternative Sources of Electric Energy) was introduced in Brazil in 2002. This program primarily supports the production of electricity from three sustainable resources (KPMG, 2011:10):

- wind
- biomass
- small hydroelectric

Solar energy was not included in the abovementioned programme due to the fact that solar energy is generally applied to smaller systems, whereas the programme's focus is on maintaining larger units of energy production arising from more established technologies so that the sources can be integrated into the Brazilian national power grid (Entrepreneur's

Toolkit, 2011). Chapter 4.2.3 further illustrates how this fact assists to differentiate the sustainable energy landscapes of South Africa and Brazil.

The positive effects of this program are illustrated by the fact that at the end of 2009, 2010 and 2011, Brazil's biomass power capacity was the second largest in the world (KPMG, 2011:41; KPMG, 2012:46; REN21, 2012:19). At the end of 2011, Brazil was also ranked second in the world, after China, for its total hydropower capacity (REN21, 2012:19).

4.4.1 Technological innovation activities

Brazilian research and development related tax incentives are contained in the *Lei do Bem* (Tax Benefits Act). This legislation grants specific tax incentives for the performance of technological innovation activities, which are defined so as to include both the formation of new products or processes, as well as the enhancement of existing products or processes by means of additional functionality. (PwC, 2012:2.)

The purpose of this legislation, amongst others, is to increase competitiveness, and therefore the tax incentives are available for technological innovation activities which improve a product or process's quality or productivity. Innovation in this context is taxpayer specific, which allows a taxpayer to utilise the related tax incentives if the development is new for the taxpayer but not necessarily for the industry. (PwC, 2012:2.)

Tax incentives for technological innovation activities allow taxpayers an additional deduction in computing both their

- corporate income tax liability and
- calculation base of the social contribution on net profits (PwC, 2012:3).

New assets acquired for use in research and development activities qualify for an initial deduction from taxable income in the year of their acquisition equal to 100% of their cost. Furthermore three mutually exclusive additional deduction alternatives exist for qualifying expenses (which include new capital assets acquired for use in research and development activities) incurred during the year of assessment in respect of technological innovation activities. (PwC, 2012:3.) These are detailed in Table 4:

Table 4: Additional deduction for technological innovation activities in Brazil

Condition required for alternative to apply	Additional deduction percentage	Total deduction for qualifying expenses
Standard deduction on qualifying expenses incurred	60%	160%
Deduction on qualifying expenses incurred where the taxpayer's total research amount increased by up to 5% in a given year	70%	170%
Deduction on qualifying expenses incurred where the taxpayer's total research amount increased in excess of 5% in a given year	80%	180%

Source: Adapted from PwC (2012:3)

Patented innovations attract a further 20% deduction on the qualifying expenses incurred. This deduction can only be claimed once the related patent is issued, however it is on top of the additional deductions noted in Table 4. This potentially allows the taxpayer a total deduction equivalent to 200% of the qualifying expenses incurred. (PwC, 2012:3.)

The only limitation regarding the deduction for technological innovation activities is that any excess deductions may not be carried over to future tax years if insufficient profits exist against which to fully utilise the research and development deduction in the year that the expenses were incurred (PwC, 2012:3).

4.4.2 Research and development related intangible assets

An accelerated allowance provides for the full amortization of expenditure incurred to purchase an intangible asset during a year of assessment, if that intangible asset is used exclusively for the purpose of research and development (PwC, 2012:3).

4.4.3 Excise tax

Machinery, equipment, instruments, accessories, parts and tools qualify for a 50% direct deduction of excise tax when they are to be used for research and development purposes. This supports a taxpayer's cash flow as the deduction occurs directly when the above-mentioned item is purchased. (PwC, 2012:3.)

4.5 CONCLUSION

Both South Africa and Brazil have favourable sustainable energy environments where there is an abundance of sustainable energy resources. South Africa and Brazil's sustainable energy environments are however inherently different and cannot be viewed in isolation. Brazil's abundance of cost efficient water resources differs from South Africa's need to trade-off sustainable energy with its mining economy and land areas used in the production of food. South Africa can learn from Brazil; however it must be borne in mind that the two countries' economic drivers are inherently different from one another.

Both countries have various tax incentives that are aimed at encouraging the production and use of sustainable energy. Despite these facts, a large disparity still exists between South Africa and Brazil pertaining to their sustainable energy usage as a percentage of their total primary energy usage. South Africa's sustainable energy production and usage is extremely small compared to that of Brazil.

CHAPTER 5

COMPARISON AND EVALUATION OF SUSTAINABLE ENERGY TAX INCENTIVES IN THE CONTEXT OF SOUTH AFRICA AND BRAZIL

5.1 INTRODUCTION

As mentioned in Chapter 4, although South Africa and Brazil have favourable sustainable energy environments and both countries have tax incentives aimed at encouraging the production and use of sustainable energy, South Africa has a relatively small percentage of sustainable energy usage compared to Brazil. South Africa and Brazil's sustainable energy environments are however inherently different and cannot be viewed in isolation. This chapter analyses the disparity identified between South Africa and Brazil's sustainable energy usage within the context of these inherent differences. Furthermore despite the differences, suggestions based upon a contextual understanding of what can be learnt from Brazil, specifically for South Africa, are provided in order to improve South Africa's investment in and use of sustainable energy.

5.2 COMPARISON BETWEEN SOUTH AFRICA AND BRAZIL

Using the context described in chapter 4.1 together with chapters 4.3 and 4.4 above, this section sets out to analyse and compare the sustainable energy tax incentives available in South Africa and Brazil.

5.2.1 Overview

Table 5 summarises the sustainable energy promotion policies that are applicable to South Africa and Brazil in relation to a comprehensive list of sustainable energy promotion policies:

Table 5: Summary of sustainable energy promotion policies in South Africa and Brazil

Sustainable energy promotion policy	South Africa	Brazil
Regulatory policies:		
Feed-in tariff (including premium payment)	n/a	n/a
Electric utility quota obligation/RPS	n/a	n/a
Net metering	n/a	n/a
Biofuels obligation/mandate	n/a	national level policy
Heat obligation/mandate	n/a	state/provincial level policy
Tradable REC	n/a	n/a
Fiscal incentives:		
Capital subsidy, grant, or rebate	national level policy	n/a
Investment or production tax credits	n/a	national level policy
Reductions in sales, energy, CO ₂ , VAT, or other taxes	n/a	national level policy
Energy production payment	n/a	n/a
Public financing:		
Public investment, loans, or grants	n/a	national level policy
Public competitive bidding	national level policy	national level policy

Source: Adapted from REN21 (2012:71)

The table indicates that sustainable energy promotion policies are more extensively used and applied in Brazil than in South Africa.

5.2.2 Regulatory policies

According to the OECD (2010:10):

“The objective of regulatory policy is to ensure that regulations are in the public interest. It addresses the permanent need to ensure that regulations and regulatory frameworks are justified, of good quality and ‘fit for purpose’. An effective regulatory policy supports economic development and the rule of law, helping policy makers to reach informed decisions about what to regulate, whom to regulate, and how to regulate.”

In comparing South Africa to Brazil, it is evident that South Africa has no regulatory policies to promote sustainable energy, whereas Brazil has two – for biofuels and heat. Both of Brazil's regulatory policies contain an obligation or mandate.

The Brazilian Federal Law compels the production and use of biodiesel through requiring diesel composition to include at least 5% biodiesel (KPMG, 2011:10). A requirement of this nature would appear to serve multiple purposes, namely:

- It requires the continuous production of biodiesel in the ordinary course of business.
- It integrates the production and use of sustainable energy into current business processes, which serves to embed the required technology into a business's infrastructure.
- The relatively low mix percentage is not overly burdensome to the taxpayer.
- All taxpayers in the same industry are affected equally by the requirement, and therefore it does not hinder competitiveness, it rather encourages taxpayers to find efficient solutions to reduce the cost of biodiesel as a sustainable energy source.
- A taxpayer may be more open and willing to investigate and use sustainable energy sources as a result of the familiarity that is created by the constant exposure and required use of the sustainable energy source.

A sustainable energy obligation or mandate will therefore assist in the development of the local sustainable energy industry (American Coal Council, 2006).

Through using the example of biodiesel as a biofuel obligation or mandate, the analysis above supports the fact that regulatory policies can have a positive impact on the production and use of sustainable energy.

5.2.3 Fiscal incentives

The scientific or technological research and development incentive in South Africa (see chapter 4.3.1) is similar to the technological innovation activities incentive that is available in Brazil (see chapter 4.4.1). The fact that these incentives are focused on research and development and as such do not specifically relate to sustainable energy needs mention, however, they can relate indirectly to research and development in the field of sustainable energy.

In addition to the research and development incentive, South Africa has specific provisions relating to incentives for sustainable energy (see chapter 4.3.2). This appears to be the reason for the inclusion of South Africa but exclusion of Brazil in

Table 5 in the field for *capital subsidy, grant, or rebate* under fiscal incentives.

From the research and development incentive chapters (see chapter 4.3.1 and chapter 4.4.1) it becomes clear that the maximum Brazilian additional allowance can be double that of what is available in South Africa. The South African incentive is more troublesome for the taxpayer as approval needs to be sought from the relevant committee. This creates a degree of uncertainty as there is no guarantee that the additional deduction will be obtained. (PwC, 2012:2-11.)

The Brazilian additional allowance rewards and specifically takes into account the taxpayer's yearly growth in research and development undertakings, through making an increased allowance available if investment in research and development is increased. No comparable allowance exists in the South African research and development context. (PwC, 2012:2-11.)

5.3 SUGGESTIONS TO INCREASE THE UPTAKE OF SUSTAINABLE ENERGY TECHNOLOGY

5.3.1 Overview

This section looks at suggestions about how to increase the uptake of sustainable energy technologies. As seen in the preceding analysis, tax incentives play an important role in the growth of the sustainable energy industry within economies. An example of a method to increase the use of available technology like solar water heaters is the provision of tax rebates for homeowners that have and use such technology (Mbanga, 2008:20).

Regulatory and policy frameworks should also be shaped to overcome the barriers discussed in chapter 3.2. The stability and permanence of research and development tax incentives within policies was found to positively influence related research and development investments, by Guellec and van Pottelsberghe de la Potterie (in Congressional Documents and Publications, 2011). This could therefore apply to the sustainable energy sector too.

Research indicates that the innovation and production of sustainable energy can be stimulated by stricter policies. It was also found that the use of quantity requirements which call for the supply of a minimum quota, which carries a fine if not met, has superior results in comparison to price based policies for the generation of sustainable energy. (Song, 2011:196.)

Other suggestions to increase the uptake of sustainable energy and related technologies according to Martins and Pereira (2011:4384) include:

- municipal tax discounts
- mandatory technology usage in new buildings
- regular sustainable energy auctions
- tax reductions on sustainable energy related imports
- a national fund supporting sustainable energy research and development

5.3.2 Suggestions specific to South Africa

South Africa can gain a lot of useful information by examining the advanced sustainable energy environment in Brazil. Based on a detailed literature review, the following improvements are suggested to increase the current level of production and use of sustainable energy in South Africa:

- *Regulatory policy.*

As described in chapter 5.2.2, South Africa should consider implementing a regulatory policy that sets a sustainable energy obligation and mandate. It is important that this policy takes into consideration which sustainable resources are sufficiently available and reliable, so that economic activity is not hindered by such a policy.

Brazil is a good example where this has been successfully implemented. Much can be learnt from their biofuel policy and process. Brazil has illustrated that a country should focus on using sustainable sources that are inherently available and supported by their geographic landscape and climate. This is evident from chapter 4.4. South Africa should therefore consider a solar or wind energy obligation or mandate as chapter 4.2.2 draws attention to the abundance of these two sustainable energy sources.

Chapter 3.2.7 detailed the concern of fossil fuel alternatives hindering the advancement of the production and use of sustainable energy. A sustainable energy obligation and mandate may assist in ensuring that even if a fossil fuel such as shale gas is used there will still be investment in and innovation pertaining to sustainable energy. This will promote future competitive production and use of sustainable energy. (Jaffe, 2010.)

- *Improved certainty regarding research and development incentives.*

A major point of criticism against the research and development tax incentives in South Africa is that there is no guarantee that a taxpayer will obtain results that are worthwhile, and therefore investing in South Africa can be an expensive risk (PwC, 2012:11).

Taxpayers prefer certainty when it comes to their tax affairs (Phillips, 2012). South Africa should therefore create an environment that supports this. Continuing the discussion of chapter 5.2.3, the subjectivity of providing a research and development incentive that is subject to committee approval (chapter 4.3.1) needs to be reconsidered. If the purpose of the committee is to monitor and prevent unauthorised deductions, an alternative mechanism that addresses this concern should be found.

Chapter 3.2.6 noted the long term nature and payback period associated with sustainable energy related projects. One of the key concerns associated with this barrier is the uncertainty it brings, which makes the motivation for a sustainable energy project difficult to provide (Ghoshal, 2011). Additional uncertainty pertaining to research and development incentives would worsen the concern. Simplicity and the reduction of ambiguous, complex legislation assist in delivering certainty (Pennsylvania Institute of Certified Public Accountants, Not dated). Therefore the suggestion to provide certainty to taxpayers regarding South African research and development incentives is made.

- *Improved benefit regarding research and development incentives.*

Chapter 5 highlights that South African research and development incentives are lower than those of Brazil and that they do not acknowledge a taxpayer's yearly growth in research and development activities.

It is therefore proposed that the additional tax allowances for scientific or technological research and development in South Africa be increased to be more in line with those of Brazil. This suggestion is incorporated for the purpose of encouraging growth in the production of sustainable energy.

The proposed South African incentive model could therefore replicate Brazil's model by starting from a base allowance, and incorporating a sliding scale guaranteed additional allowance based on the taxpayer's growth in research and development investment year on year. Brazil's further deduction for qualifying expenses incurred once a patent is issued should also be replicated. This will assist in addressing the sustainable energy barrier pertaining to high initial capital costs associated with sustainable energy projects (see chapter 3.2.1).

5.4 CONCLUSION

Although South Africa and Brazil have vastly different sustainable energy environments, South Africa can learn from Brazil and implement improvements to its tax incentives and related policies and legislation that would assist in addressing its key sustainable energy related barriers.

Sustainable energy promotion policies are more extensively used and applied in Brazil than in South Africa., The suggested improvements identified therefore include improvements to South Africa's regulatory policy, with a particular suggestion to establish a wind or solar energy obligation and mandate. Further suggestions included improved certainty regarding research and development incentives as well as improved benefits from the research and development incentives.

CHAPTER 6

CONCLUSION

6.1 INTRODUCTION

The study provides taxpayers with a comprehensive understanding of the current sustainable energy contexts in South Africa and Brazil. The BRICS economic grouping allows for a meaningful analysis of Brazil's tax incentive programmes that are currently in place, with the purpose of understanding how these principles compare with and can benefit and be applied in South Africa.

This chapter aims to assess the results of the study against the research objectives which originally defined the study's purpose. The chapter then concludes with commentary on the value of the study, together with proposals for future research.

6.2 ACHIEVEMENT OF RESEARCH OBJECTIVES

Three research objectives were listed in chapter 1.4 as integral to the study. The achievement of each of these objectives is assessed below:

- *To provide a contextual overview of tax incentives for the production and use of sustainable energy as well as sustainable energy barriers.*

Chapter 2 first recognises the economic, environmental and social justification for increasing the production and use of sustainable energy, after which it discusses the importance of tax incentives in attracting investments as well as provides an overview of sustainable energy tax incentives within the context of a tax incentive definition.

It was found that economically, the production and use of sustainable energy can strengthen the self-sufficiency of an economy, reducing the challenges associated with a country's electricity, heat and fuel requirements such as the availability of the

energy supply. Environmentally, fossil fuels are extremely carbon intensive and their use causes severe environmental pollution, whereas sustainable energy has a negligible (if any) impact on the environment. Socially, sustainable energy can have a direct positive influence on an economy's underprivileged population through reducing energy poverty as well as providing job creation opportunities.

Regarding the importance of tax incentives in attracting investments, it was found that little empirical evidence either supports or contradicts the notion that sustainable energy production is increased as a direct result of sustainable energy policies. However the growth in the development and use of sustainable energy is largely dependent on the existence of supportive sustainable energy policy frameworks. Frequently used sustainable energy enabling tax incentives include research and development tax incentives as well as feed in tariffs.

Chapter 3 identifies and discusses seven barriers to sustainable energy. These include: (1) The initial capital cost; (2) The lack of local manufacturing and installation capacity; (3) The regulatory framework and intellectual rights; (4) Insufficient technological advancement; (5) The seasonal, time of day, and related reliability of sustainable sources; (6) The long term nature and payback period and (7) Alternative fossil fuels.

The suggested improvements to South Africa's tax policies and legislation, as discussed in chapter 5, also indicate how some of these sustainable energy barriers can be addressed. A key finding is that although sustainable energy barriers exist, effective tax policies and legislation can assist in significantly reducing many of the impediments created by the barriers.

- *To critically analyse and compare sustainable energy tax incentives specific in the context of South Africa and Brazil.*

Chapter 4 details the sustainable energy tax incentives currently available in South Africa and Brazil. These incentives are analysed within the context of the sustainable energy environments to which they relate as Brazil's abundance of cost efficient water resources differs from South Africa's need to trade-off sustainable energy with its mining economy and land areas used in the production of food. South Africa can learn from Brazil; however it must be borne in mind that the two countries' economic drivers are inherently different from one another.

In comparing South Africa to Brazil, South Africa has no regulatory policies to promote sustainable energy, whereas Brazil has two – for biofuels and heat. Both of Brazil's regulatory policies contain an obligation or mandate.

The scientific or technological research and development incentive in South Africa is similar in nature to the technological innovation activities incentive that is available in Brazil. It was however found that the maximum Brazilian additional allowance can be double that of what is available in South Africa. The South African incentive is also more troublesome for the taxpayer as approval needs to be sought from the relevant committee. This creates a degree of uncertainty as there is no guarantee that the additional deduction will be obtained.

A comparison is drawn between South Africa and Brazil's tax incentives in chapter 5.2. A key finding resulting from this is that Brazil has a substantially higher number of sustainable energy promotion policies in place than South Africa; however South Africa and Brazil's sustainable energy policies cannot be viewed in isolation, and rather need to be interpreted within the context of the country's sustainable energy environments. Furthermore where South Africa and Brazil have similar policies in place, it was generally found that the benefits associated with Brazil's policies exceeded those offered by South Africa.

- *To determine suggestions and improvements that can be made to South African tax incentives contained in policies and legislation through interpreting the abovementioned objectives in a South African context and noting what South Africa can learn from Brazil in this regard.*

Chapter 5.3 explicates, with reference to Brazil's tax policies and legislation, suggested improvements that can be made to South African tax policies and legislation. An important conclusion is that South Africa can learn from Brazil and implement improvements to its tax incentives and related policies and legislation that would assist in addressing its sustainable energy related barriers.

The suggested improvements identified include improvements to South Africa's regulatory policy, with a particular suggestion to establish a wind or solar energy obligation and mandate. Further suggestions included improved certainty regarding research and development incentives as well as improved benefits from the research and development incentives.

6.3 OVERALL CONCLUSION

The literature review performed summarises the main elements regarding the investment in and use of sustainable energy within the context of South Africa and Brazil. In achieving this, the different sustainable energy tax incentives were examined, and related barriers were identified. The reasons supporting the move to sustainable energy were also considered within the specific context of South Africa and Brazil. The literature review concludes with suggestions on how the uptake of sustainable technology can be increased in South Africa, based upon a contextual understanding of what can be learnt from Brazil.

Factors that make this study useful include the insight provided on sustainable energy related tax incentives and potential barriers within a South African and Brazilian context. The comparison and interpretation offered in the study can assist in increasing South Africa's investment in and use of sustainable energy.

The proposed improvements to the South African sustainable energy tax policies and legislation may assist in the implementation of solutions that can encourage the development, implementation and use of sustainable energy in South Africa.

6.4 FUTURE RESEARCH

This study focused specifically on South Africa and Brazil. At the end of 2011, China was considered as having the highest renewable power capacity in the world for the categories including hydro-power and excluding hydro-power. China also had the highest new sustainable energy capacity investment in 2011. (REN21, 2012:19.) A similar study between South Africa and the remaining BRICS countries, in particular China, would provide valuable additional insight into the improvements that South Africa can make with regard to its tax incentives for the production and use of sustainable energy.

An analysis to ascertain the current focus of the South African government, and the importance of improved utilisation of sustainable energy relative to other economic, environmental and social challenges would be insightful. This could incorporate analysing the allocated budget expenditure in each of the respective sectors and determining the reasons for the specific focus or lack thereof on the sustainable energy sector.

Furthermore, it is necessary to mention that from a current 1,8% renewable energy share of electricity production in 2010, South Africa's target for renewable energy share of electricity production is 13% by 2020 (REN21, 2012:109). It would therefore be worthwhile to research and investigate the South African government's proposed plans for reaching this target, with reference to comparable countries that have experience regarding the implementation of such plans and the consequent effects thereof.

Lastly, this study analysed the tax incentives currently in effect as well as the current levels of sustainable energy usage. A time series analysis providing details as to what these incentives were and how they have changed over time, relative to the country's sustainable energy production and consumption profile at those points in time, will provide valuable insight into the effects of sustainable energy related policies and legislation.

LIST OF REFERENCES

- Akanle, T. 2009. *Promoting renewable energy and energy efficiency*. [Online] Available from: www.iucnael.org/en/documents/doc_download/71--akanle-promoting-renewable-energy-and-energy-efficiency-.html [Downloaded: 2013-09-18].
- American Coal Council. 2006. *Renewable portfolio standards*. [Online] Available from: <http://www.americancoalcouncil.org/?page=rps> [Accessed: 2013-09-21].
- Blackman, S.A.B. & Baumol, W.J. 2007. Natural resources. In: Henderson, D.R. (ed.) *The Concise Encyclopaedia of Economics*. [Online] Available from: <http://www.econlib.org/library/Enc/NaturalResources.html> [Accessed: 2013-09-16].
- BP. 2013. *BP statistical review of world energy*. [Online] Available from: http://www.bp.com/content/dam/bp/pdf/statistical-review/statistical_review_of_world_energy_2013.pdf [Downloaded: 2013-08-17].
- Cleveland, C.J. & Najam, A. 2008. *Energy and sustainable development at global environmental summits*. [Online] Available from: <http://www.eoearth.org/view/article/152457/> [Accessed: 2013-09-18].
- Congressional Documents and Publications. 2011. *Senate finance committee hearing: "tax reform options: incentives for innovation."*[5]. Lanham, US: Federal Information & News Dispatch. [Online] Available from: <http://0-search.proquest.com.innopac.up.ac.za/docview/893744889/fulltext?accountid=14717> [Accessed: 2013-02-23].
- Republic of South Africa Department of Water Affairs. 2012. *Key messages*. [Online] Available from: <http://www.dwaf.gov.za/events/waterweek/2012/key.aspx> [Accessed: 2013-09-16].

Deloitte. 2013. *Energy costs and policies: 2013 global manufacturing competitiveness index*. [Online] Available from: http://www.deloitte.com/view/en_US/us/Industries/Process-Industrial-Products/manufacturing-competitiveness/mfg-competitiveness-index/f47523e46ba0b310VgnVCM3000003456f70aRCRD.htm [Accessed: 2013-09-21].

Du Plooy, P. 2008. SA's carbon emissions a cause for concern. *Engineering News*. [Online] Available from: <http://www.engineeringnews.co.za/article/sa039s-carbon-emissions-a-cause-for-concern-2008-01-25> [Accessed: 2013-09-14].

Economics Online. Not dated. *Economic growth*. [Online] Available from: http://www.economicsonline.co.uk/Competitive_markets/Economic_growth.html [Accessed: 2013-09-14].

Entrepreneur's Toolkit. 2011. *PROINFA - incentive program for alternative sources of energy in Brazil*. [Online] Available from: http://www.entrepreneurstoolkit.org/index.php?title=PROINFA_-_Programa_de_Incentivo_%C3%A0s_Fontes_Alternativas_de_Energia_El%C3%A9trica_no_Brasil [Accessed: 2013-08-21].

Eskom. 2013. *Company information*. [Online] Available from: <http://www.eskom.co.za/c/40/company-information/> [Accessed: 2013-02-25].

Fahey, J. 2013. *New technology propels "old energy" boom*. [Online] Available from: <http://www.rdmag.com/news/2013/05/new-technology-propels-%E2%80%99Cold-energy%E2%80%9D-boom> [Accessed: 2013-09-16].

Febriana, R. 2011. *The significance of tax incentives in attracting foreign investment: lessons from the Canadian Oil Sands Project*. Unpublished master's thesis. Canada: University of Manitoba. [Online] Available from: <http://0-search.proquest.com.innopac.up.a.c.za/docview/1222049726/fulltextPDF/13C6E6B9E60618B0D46/9?accountid=14717> [Downloaded: 2013-02-23].

Garratt, K. 2011. *Renewables industry faces skills shortage*. [Online] Available from: <http://www.renewableenergyworld.com/rea/blog/post/2011/05/renewables-industry-faces-skills-shortage> [Accessed: 2013-09-21].

Garrison, L.R. 2013. Going "green": state tax incentives and alternative energy – an update. *Journal of State Taxation*, 31(2):27-54. [Online] Available from: <http://0-web.ebscohost.com.innopac.up.ac.za/ehost/pdfviewer/pdfviewer?sid=13c16c88-4173-42af-aea9-67ba924c9c7b%40sessionmgr111&vid=2&hid=103> [Downloaded: 2013-02-23].

Gets, A. 2013. *Powering the future: renewable energy roll-out in South Africa*. [Online] Available from: http://www.greenpeace.org/africa/Global/africa/publications/climate/RenewableEnergyReport_PoweringTheFuture.pdf [Downloaded: 2013-09-14].

Ghoshal, K. 2011. The reality of renewables (part 1): why the regulator-developer-investor confluence remains an elusive target. *Electric Energy T&D Magazine*, January-February. [Online] Available from: http://www.electricenergyonline.com/?page=show_article&mag=68&article=549 [Accessed: 2013-09-21].

Guims, P. 2011. *Ten major disadvantages of wind energy*. [Online] Available from: <http://energyscience.knoji.com/ten-major-disadvantages-of-wind-energy/> [Accessed: 2013-09-14].

Hamilton, K. 2009. Unlocking finance for clean energy: the need for 'investment grade' policy. *Energy Environment and Resource Governance Briefing Paper*, 2009(6):1-8. [Online] Available from: <http://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/bp1209cleanenergy.pdf> [Downloaded: 2013-09-21].

Indiasolar.com. Not dated. *Barriers to renewable energy development in India*. [Online] Available from: <http://www.indiasolar.com/barriers.htm> [Accessed: 2013-09-21].

International Energy Agency. 2013. *Renewable energy independent power producer programme (REIPPP)*. [Online] Available from: <http://www.iea.org/policiesandmeasures/pams/southafrica/name,38785,en.php> [Accessed: 2013-08-24].

International Finance Corporation. 2011. *Assessment of the Peruvian market for sustainable energy finance*. [Online] Available from: <http://www.ifc.org/wps/wcm/connect/78f59b00493a76e18cc0ac849537832d/SEF-Market+Assessment+Peru-Final+Report.pdf?MOD=AJPERES> [Downloaded: 2013-09-21].

Jaffe, A.M. 2010. Shale gas will rock the world. *The Wall Street Journal*. [Online] Available from: <http://online.wsj.com/article/SB10001424052702303491304575187880596301668.html> [Accessed: 2013-08-10].

Kaphengst, T. 2011. *Fundamental questions of renewable energy self-sufficiency (RESS)*. [Online] Available from: <http://www.ecologic.eu/4284> [Accessed: 2013-09-14].

Karrappan, A. 2011. *A carbon emissions tax as a mitigating strategy for reducing greenhouse gas emissions in South Africa*. Unpublished master's thesis. Pretoria: University of Pretoria. [Online] Available from: <http://upetd.up.ac.za/thesis/available/etd-03052012-165638/> [Downloaded: 2013-04-12].

KPMG. 2009. *Corporate governance & King 3*. [Online] Available from: <http://www.kpmg.com/ZA/en/IssuesAndInsights/ArticlesPublications/Tax-and-Legal-Publications/Documents/Corporate%20Governance%20and%20King%203.pdf> [Downloaded: 2013-02-23].

KPMG. 2011. *Taxes and incentives for renewable energy*. [Online] Available from: <http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/Taxes-Incentives-Renewable-Energy-2011.pdf> [Downloaded: 2013-02-23].

KPMG. 2012. *Taxes and incentives for renewable energy*. [Online] Available from: <http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/taxes-incentives-renewable-energy-2012.pdf> [Downloaded: 2013-05-11].

Krupa, J. & Burch, S. 2011. A new energy future for South Africa: the political ecology of South African renewable energy. In: Greening, L.A. & Jefferson, M. (eds.) *Energy Policy*, 39(10):6254-6261. [Online] Available from: http://0-ac.els-cdn.com.innopac.up.ac.za/S0301421511005489/1-s2.0-S0301421511005489-main.pdf?_tid=09968944-071a-11e3-8e5d-00000aab0f26&acdnat=1376729596_5f67d88385c9ecff4f943358fdf5caf2 [Downloaded: 2013-08-17].

Lam, H.R., Varbanov, P.S. & Klemeš, J.J. 2010. Regional renewable energy and resource planning. In: Lund, H., Østergaard, P.A. & Stadler, I. (eds.) *Applied Energy*, 88(2):545-550. [Online] Available from: http://0-ac.els-cdn.com.innopac.up.ac.za/S0306261910002047/1-s2.0-S0306261910002047-main.pdf?_tid=de5910f6-071b-11e3-9d2d-00000aab0f27&acdnat=1376730384_9cb20bc64665dcb26bf156d968b96724 [Downloaded: 2013-08-17].

Marquit, M. 2009. *5 feasible renewable energy sources*. [Online] Available from: <http://phys.org/news161024861.html> [Accessed: 2013-09-14].

Martins, F.R. & Pereira, E.B. 2011. Enhancing information for solar and wind energy technology deployment in Brazil. In: Greening, L.A. & Jefferson, M. (eds.) *Energy Policy*, 39(7):4378-4390. [Online] Available from: http://0-ac.els-cdn.com.innopac.up.ac.za/S0301421511003417/1-s2.0-S0301421511003417-main.pdf?_tid=8cccf7aa-7e15-11e2-95f6-00000aacb35e&acdnat=1361664359_5193ddb24ad94bd61306b3dc5f734c23 [Downloaded: 2013-02-23].

Mbanga, S. 2008. Cities network - renewable energy summit. *IMFO: Official Journal of the Institute of Municipal Finance Officers*, 8(4):16-21. [Online] Available from: http://0-search.sabinet.co.za.innopac.up.ac.za/WebZ/images/ejour/imfo/imfo_v8_n4_a9.pdf?sessionid=01-54242-1906995824&format=F [Downloaded: 2013-02-23].

McGuckin, R. 2013. *Using financial mechanisms to overcome barriers for small renewable energy projects*. [Online] Available from: <http://www.mwhglobal.com/thought-leadership/using-financial-mechanisms-to-overcome-barriers-for-small-renewable-energy-projects/#.Uj4IEz-158E> [Accessed: 2013-09-21].

Menaker, M., Kershaw, D., Letherman, S., Scoon, I. & Ng, G. 2012. Clean energy sector tax incentives in the US and UK. *International Tax Review*, 23(3). [Online] Available from: <http://0-web.ebscohost.com.innopac.up.ac.za/ehost/detail?sid=37ec34ba-3617-44ab-96ea-45554095ee0c%40sessionmgr113&vid=3&hid=103&bdata=JnNpdGU9ZWWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=buh&AN=74976460> [Accessed: 2013-02-23].

Nel, R. 2010. *Proposed vehicle green taxes in South Africa: what are the prospects of it achieving its purpose?* Unpublished master's thesis. Pretoria: University of Pretoria. [Online] Available from: <http://upetd.up.ac.za/thesis/available/etd-05052010-163524/> [Downloaded: 2013-04-12].

Obata, O. Not dated. *Wind energy as an alternative to fossil fuel*. [Online] Available from: http://www.academia.edu/203625/Wind_Energy_as_an_Alternative_to_Fossil_Fuel [Accessed: 2013-09-21].

OECD. 2010. *Regulatory policy and the road to sustainable growth*. [Online] Available from: <http://www.oecd.org/regreform/policyconference/46270065.pdf> [Downloaded: 2013-08-21].

OECD. 2013a. *Country statistical profile: Brazil 2013*. [Online] Available from: http://www.oecd-ilibrary.org/economics/country-statistical-profile-brazil_csp-bra-table-en [Accessed: 2013-04-12].

OECD. 2013b. *Country statistical profile: South Africa 2013*. [Online] Available from: http://www.oecd-ilibrary.org/economics/country-statistical-profile-south-africa_csp-zaf-table-en [Accessed: 2013-04-12].

Oxford Dictionaries. Not dated (a). *Feed-in tariff*. [Online] Available from: <http://oxforddictionaries.com/definition/english/feed-in-tariff?q=feed-in+tariff> [Accessed: 2013-09-14].

Oxford Dictionaries. Not dated (b). *Incentive*. [Online] Available from: <http://oxforddictionaries.com/definition/english/incentive?q=incentive> [Accessed: 2013-04-15].

Oxford Dictionaries. Not dated (c). *Shale gas*. [Online] Available from: <http://oxforddictionaries.com/definition/english/shale-gas> [Accessed: 2013-09-14].

Oxford Dictionaries. Not dated (d). *Sustainable*. [Online] Available from: <http://oxforddictionaries.com/definition/english/sustainable?q=sustainable> [Accessed: 2013-04-15].

Ölz, S., Sims, R. & Kirchner, N. 2007. *Contribution of renewables to energy security*. [Online] Available from: http://www.iea.org/publications/freepublications/publication/so_contribution.pdf [Downloaded: 2013-09-14].

Parker, M. 2009. Financing renewable energy projects. *Without Prejudice*, 9(8):48. [Online] Available from: http://0-search.sabinet.co.za/innopac.up.ac.za/WebZ/images/ejour/jb_prej/jb_prej_v9_n8_a24.pdf?sessionid=01-54211-2010626673&format=F [Downloaded: 2013-02-23].

Parker, M. & Gilder, A. 2013. Is your business ready for the carbon tax? *Ensignt*, May. [Online] Available from: http://www.ens.co.za/news/news_article.aspx?iID=1030&iType=4 [Accessed: 2013-09-16].

Pennsylvania Institute of Certified Public Accountants. Not dated. *Guiding principles of good tax policy: a framework for evaluating tax proposals*. [Online] Available from: <http://www.picpa.org/Content/Files/Documents/Advocacy/6292-Guiding%20Principles%20for%20Good%20Tax%20Policy.pdf> [Downloaded: 2013-09-21].

Phillips, B. 2012. A general guide to the proposed GAAR. *Tax Journal*. [Online] Available from: <http://www.taxjournal.com/tj/articles/special-focus-proposed-gaar-48711> [Accessed: 2013-09-21].

PwC. 2012. *Research and development in the BRICS*. [Online] Available from: http://www.pwc.com/en_GX/gx/tax/newsletters/global-tax-news-research-development/assets/pwc-research-development-brics.pdf [Downloaded: 2013-05-06].

REN21. 2012. *Renewables 2012: global status report*. [Online] Available from: http://www.ren21.net/Portals/0/documents/Resources/GSR2012_low%20res_FINAL.pdf [Downloaded: 2013-05-11].

Singh, N. 2013. Over 50,000 jobs created by renewable energy sector in last three years. *The Times of India*, 6 March. [Online] Available from: <http://timesofindia.indiatimes.com/business/india-business/Over-50000-jobs-created-by-renewable-energy-sector-in-last-three-years/articleshow/18834676.cms> [Accessed: 2013-09-14].

Song, Y.W. 2011. The effect of renewable energy policies on renewable energy production. *Atlantic Economic Journal*, 39(2):195-196. [Online] Available from: <http://0-web.ebscohost.com/innopac.up.ac.za/ehost/pdfviewer/pdfviewer?sid=0b339a81-3760-4244-b3eb-bb4a706ff250%40sessionmgr110&vid=2&hid=103> [Downloaded: 2013-02-23].

South Africa. Income Tax Act, No. 58 of 1962. In: SAICA Legislation Handbook. 2012. Johannesburg: LexisNexis.

Terhoeven, J. 2012. *The role of taxation in attracting foreign direct investments to South Africa: a BRICS comparison*. Unpublished master's thesis. Pretoria: University of Pretoria. [Online] Available from: <http://upetd.up.ac.za/thesis/available/etd-03092012-122234/> [Downloaded: 2013-04-12].

U.S. Energy Information Administration. 2013. *Technically recoverable shale oil and shale gas resources: an assessment of 137 shale formations in 41 countries outside the United States*. [Online] Available from: <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf?zscb=92395576> [Downloaded: 2013-08-17].

Van Eeden, R. & Wichmann, M. 2011. Making the most of tax incentives encouraging the use of renewable energy. *Tax Breaks Newsletter*, 306:6. [Online] Available from: http://0-search.sabinet.co.za/innopac.up.ac.za/WebZ/images/ejour/montb/montb_n306_a5.pdf?sessionid=01-54211-2010626673&format=F [Downloaded: 2013-02-23].

Van Parys, S. & James, S. 2010. The effectiveness of tax incentives in attracting investment: panel data evidence from the CFA Franc zone. *International Tax and Public Finance*, 17(4):400-429. [Online] Available from: <http://0-search.proquest.com/innopac.up.ac.za/docview/746600096/fulltextPDF/13C6E6B9E60618B0D46/5?accountid=14717> [Downloaded: 2013-02-23].

Wilhelm, A. 2008. Hauling South Africa over the coals. *Inside Mining*, 1(2):3. [Online] Available from: http://0-search.sabinet.co.za/innopac.up.ac.za/WebZ/images/ejour/sh_mining/sh_mining_v1_n2_a2.pdf?sessionid=01-54242-1906995824&format=F [Downloaded: 2013-02-23].

Your Dictionary. Not dated (a). *Biodiesel*. [Online] Available from: <http://www.yourdictionary.com/biodiesel> [Accessed: 2013-08-21].

Your Dictionary. Not dated (b). *Biofuel*. [Online] Available from: <http://www.yourdictionary.com/biofuel#science> [Accessed: 2013-08-21].

Your Dictionary. Not dated (c). *Biomass*. [Online] Available from: <http://www.yourdictionary.com/biomass#science> [Accessed: 2013-08-21].

Your Dictionary. Not dated (d). *Fossil fuel*. [Online] Available from: <http://www.yourdictionary.com/fossil-fuel#science> [Accessed: 2013-08-21].

Your Dictionary. Not dated (e). *Shale*. [Online] Available from: <http://www.yourdictionary.com/shale#science> [Accessed: 2013-09-14].

Your Dictionary. Not dated (f). *Tax break*. [Online] Available from: <http://www.yourdictionary.com/tax-break#culture> [Accessed: 2013-08-21].

Your Dictionary. Not dated (g). *Tax incentive*. [Online] Available from:
<http://business.yourdictionary.com/tax-incentive> [Accessed: 2013-04-15].