Chapter for the Book "A co-evolutionary framework for analysing business contributions to climate change governance in areas of limited statehood",
edited by Ralph Hamann and Tanja Börzel
Revised Version, 28 March 2012

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Governance of Renewable Energy Incentives Across Varying Levels of Statehood

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Abstract

There is an urgent need to move away from the traditional reliance on fossil fuel based electricity generation if we are to maintain a stable climate. To do so, effective incentive mechanisms are needed to promote renewable energy in emerging economies and developing countries where future demand is strongest. A co-evolutionary framework is used to explore the governance of climate change mitigation by analysing the role and motivating factors of both the public sector and the private sector in the promotion of renewable energy. A comparative analysis of South Africa and Germany wind energy projects is presented, highlighting how varying levels of statehood impact market incentives for renewable energy development. The focus of the analysis is on how the risk profile of a developing country increases the cost of capital for renewable energy projects, which in turn increases the required tariff and widens the price differential between electricity from renewable sources and fossil fuels. This results in greater challenges for designing effective market incentives in emerging and developing countries.

1. Introduction

Climate change governance includes contributing toward mitigating GHG emissions in order to "maintain a stable climate as an essential public good" (Chapter 1, p2). This chapter explores the mitigation aspect of climate change governance by assessing market based incentives (MBIs) that promote renewable energy. The focus is on how the temporal and spatial issues influencing renewable energy deployment impact public and private sector stakeholders across countries with varying levels of statehood. Specifically, the enabling environment required within local, national or international structures to generate sufficient incentive to engage independent power producers (IPPs) is explored. The objective of this analysis is to assist in identifying innovative approaches to incentivise both the state and the private sector in order to increase deployment of renewable energy in developing countries.

The research method used is theory building from case studies (Eisenhardt & Graebner 2007; Eisenhardt 1989). In order to purposefully build the theory, case studies based on hypothetical South Africa and Germany wind energy projects were drawn from non-random theoretical sample. The basis for this analysis is hypothetical wind energy projects in South Africa and Germany. The two countries differ significantly with regard to their degree of statehood and level of socio-economic development. South Africa is an emerging economy with a nascent wind energy sector (lower level of statehood), while Germany is a developed country with an advanced wind industry (higher level of statehood). Data has been collected through in-depth literature and document analysis, direct participation in the South African wind sector, and interviews with renewable energy sector stakeholders in Germany and South Africa.

In the remainder of this chapter, the relevance of MBIs to climate change governance is discussed, followed by a brief background of MBIs within the context of limited statehood. The co-evolutionary framework is then applied to the public sector and business organisation interaction to explore how MBIs are developed. The framework is then grounded in practical experience through a comparative analysis of wind energy projects in South Africa and Germany. The cost of capital resulting from variance in host country level of statehood is emphasised. Lastly, policies to link MBI design to the host country level of statehood are recommended.

2. Climate Change Governance and MBIs

Leading scientists of the International Panel on Climate Change (IPCC) concluded in the 2007 Fourth Assessment Report that "warming of the climate system is unequivocal" and "most of the global average warming over the past 50 years is very likely due to anthropogenic greenhouse gas increases" (Pachauri & Reisinger 2007). The implications of this are far reaching and a prudent course of action is to immediately reduce greenhouse gas (GHG) increases wherever possible and cost effective. The worldwide provision of electricity is an important sector to engage because it is a leading contributor to global CO_2 emissions due to high reliance on coal, oil and natural gas (IEA 2011; Henderson & Newell 2010).

Limiting the long-term average temperature increase to two degrees Celsius, commonly correlated with CO_2 parts per million (ppm) of 450, has been established as the consensus mitigation target to maintain a stable climate (Pachauri & Reisinger 2007; IEA 2008; IEA 2011). Unfortunately, by not fully accounting for the negative externalities to the environment and atmosphere, traditional carbon intensive electricity generation has been able to prolong artificially low tariff prices that in part help to create a cost advantage over renewable based electricity generation (Philippe Menanteau et al. 2003; Dinica 2006). As a result, the planet is rapidly being locked into an emissions scenario that is estimated to go well beyond the target 450 Scenario. The World Energy Outlook 2011 sounds an alarm with the following prediction:

> "Four-fifths of the total energy-related CO_2 emissions permissible by 2035 in the 450 Scenario are already 'locked-in' by our existing stock (power plants, buildings, factories, etc.). If stringent new action is not forthcoming by 2017, the energy-related infrastructure in place will generate all the CO_2 emissions allowed in the 450 Scenario up to 2035, leaving no room for additional power plants, factories, and other infrastructure unless they are zero-carbon, which would be extremely costly". (IEA 2011)

This elucidates the urgent need to increase renewable energy in the overall electricity supply or risk locking in an outcome assured to be beyond the 450 Scenario. However this is easier said than done because a main cause of the looming lock-in situation is that renewables are intermittent and historically not perceived to be cost competitive when compared with fossil fuel based electricity generation (Arent et al. 2011; Haas et al. 2004). To overcome these historic challenges to renewable energy, a policy shift supported by effective incentive mechanisms is needed to catalyse a rapid transition toward energy sources without negative environmental externalities (Christensen et al. 2006).

Recently there has been progress towards increasing renewable energy from its modest contribution to the overall global energy supply. The Renewables 2011 Global Status Report highlights that in 2010 an estimated 19.4% (16.1% hydro & 3.3 other renewables) of electricity consumption was supplied by renewable energy with nearly half the added electricity capacity of approximately 194 gigawatts (39 GW Wind, 30 GW Hydro, 17 GW Solar PV) coming from renewable sources (Janet & Martinot 2011). The contribution of renewables toward added capacity is particularly important because worldwide demand for energy continues to increase, particularly from emerging economies such as China, India and South Africa.

In order to avoid locking-in traditional fossil fuel systems, alternative energy sources must become a major contributor to meet future energy demand of developing economies. The 21st century global centres of growth have also shifted, which has important implications for the geographical focus of renewable energy incentives. The Organisation for Economic Co-operation and Development (OECD) countries[1] are no longer the drivers as "non-OECD countries account for 90% of population growth, 70% of the increase in economic output and 90% of the energy demand growth over the period from 2010-2035" (IEA 2011). Such growth trends highlight the need for effective MBIs tailored to the developing country context. While the potential of MBIs to deliver cost-effective environmental policies has been widely recognised by policymakers, the focus of MBI theory has largely been placed on OECD countries (Stavins 2002; Sandor et al. 2002). As a consequence, limited research exists on the applicability of MBIs in areas of limited statehood, particularly developing countries where the ability to fully implement and enforce policy mandates is often lacking (Börzel & Risse 2010).

Governance in areas of limited statehood is a useful conceptual framework for making sense of how MBIs "travel" across different spatial and temporal levels to the developing country context (Risse 2010). According to Risse and Börzel (2010),

[1] 34 member organisation representing the world's "developed" country grouping. Full listing of countries is found at http://www.oecd.org. Of note, current membership does not include Brazil, Russia, India, China or South Africa.

emerging economies and developing countries can often be termed as "areas of limited statehood" due to their limited ability to effectively implement and enforce policy. As pointed out by Börzel et al (2010), even in South Africa where legal standards and regulation are quite advanced, capacity for implementation and compliance is often lacking. This chapter attempts to contribute to the emerging study of climate change governance and limited statehood by comparing MBIs in emerging South Africa and developed Germany.

3. MBI Background – Price versus Demand Driven Strategies

A number of strategies have been implemented to promote renewable energy. The ongoing debate over what approach is the most successful and effective focuses on price driven versus demand driven strategies (Haas et al. 2004). Price driven strategies are characterised by the state setting a price that is intended to reduce uncertainty and attract IPPs. The most well known mechanism is the feed in tariff (FIT), whereby "utilities must purchase all renewable power for sale and in return receive a premium—the government sets prices (tariffs) through long-term contracts" (Huang & Wu 2011 page 1). FITs have been successfully used to exceed renewable energy targets in Germany (Janet & Martinot 2011) and were initially planned for South Africa (NERSA 2009) prior to a switch to a competitive bidding system. FITs have been successful to deploy renewable capacity, particularly in the German experience, however they have been criticised on the basis that such price driven strategies reduce competition and are not cost effective (Frondel et al. 2010; Butler & Neuhoff 2008; Krewitt & Nitsch 2003).

On the other side of the debate is the demand driven approach. Within this strategy the state sets an objective to be reached and organises a competitive bidding process, or impose quotas on electricity suppliers through a system of tradable green certificates (Philippe Menanteau et al. 2003). Advocates of the approach claim it allows for better control over consumer costs and retains the market incentive (Finon & Perez 2007), while concerns cite increased transaction costs from setting up and managing a trading scheme (Haas et al. 2004).

The competitive bidding approach has been opted for in South Africa whereby a defined amount of renewable energy has been mandated and IPPs are eligible to bid through specified phases. While this approach holds potential, it increases the level of

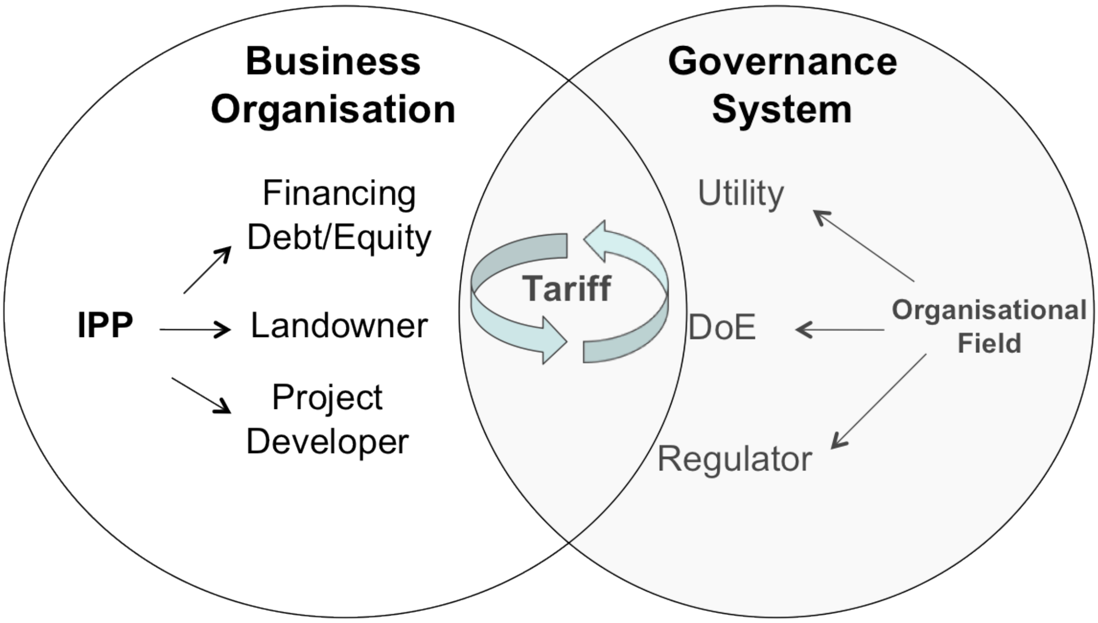
IPP risk that is subsequently reflected in the cost of capital, thereby potentially eliminating any cost savings and deterring capable IPPs from engaging. Also, just as with price driven approaches, the additional cost incurred for renewable energy must be financed by the governance structure, which is typically passed on to the consumer via a special levy or cross subsidisation among all consumers of electricity (Philippe Menanteau et al. 2003)

4. Renewable Energy Incentives and the Co-Evolutionary Framework

To develop a renewable energy sector led by IPPs, an enabling environment must be created within local, national or international structures that can generate sufficient incentive for IPPs to engage at a project level (Dunkerley 1995). Such incentives for promoting renewable energy should "offer a reasonable risk-return ratio to investors and … minimize the total costs for society" (von Flotow & Friebe 2011, p.9). To effectively address both these requirements, MBIs develop in a manner analogous to the co-evolutionary framework described in Chapter 1. The IPPs need for financial incentive and the state's willingness and ability to subsidise is what makes possible the co-evolutionary relationship. The desired outcome is a well-designed MBI emerging through "co-evolutionary interactions between business organisations and their governance context" which culminate in incentives set to entice private sector participation at the lowest feasible cost to society (Chapter 1, p17).

The actors comprising the governance system and those referred to as business organisations vary by country. The players within the governance system are primarily within the state or public sector and will at a minimum include the national government department dealing with energy (i.e. Department or Ministry of Energy), the government energy regulator, the utility that supplies and/or distributes the electricity via the power grid (or multiple utility companies if the country has been deregulated) and the local municipality government. In the case of developing countries, the United Nations Framework Convention on Climate Change (UNFCCC) is also involved in the governance because renewable energy projects are eligible to receive carbon credits under the Clean Development Mechanism (CDM) of the Kyoto Protocol. On the other side, the business organisation within the renewable energy field refers to all the entities that come together to form an IPP. Illustratively this includes, but is not limited to, the project developer, equipment manufacturer, debt and equity providers and the landowners. Figure 1 below is a high-level illustration of the key actors in the co-evolutionary framework.

Figure 1: Co-Evolution of Renewable Energy Incentive



The business organisation is dependent on the state to ensure a sufficient return on investment for their renewable energy projects, and the state is dependent on the business organisation to deliver clean energy to the country's electricity supply. This inter-dependence takes the form of what can be classified as a performance based public private partnership (PPP)[2]. Successful partnerships involve an optimal allocation of risks, and all major investment projects such as renewable energy projects, present a multitude of risks that both the public and private sectors recognise and assume. Typical considerations include demand risk, payment risk, performance risk, political risk, regulatory risk, foreign exchange risk and project specific risk. The state, with input from key business organisations can allocate the project risks to the party most able to manage and mitigate them. This is a critical success factor in the sustainability of any PPP because allocation of risk to the party most able to manage it is the hallmark of an efficient incentive structure. Conversely, inefficient structures unnecessarily raise the overall project and/or incentive cost (Pellerin & Bauer 2008).

[2] The PPP discussion is in part adapted from the *Millennium Challenge Corporation Private Sector Initiative Toolkit*

Furthermore, the business organisation and the governance system evaluate opportunities and risks in different ways. The governance system, which in this case is the public sector, typically focuses on overall economic viability of projects and evaluates the tradeoffs inherent to supporting renewable energy over other national priorities. Generally, one of the motivations for the governance system to promote renewable energy is climate change mitigation and preventing the lock-in of fossil fuel based energy systems. Due to limited resources in developing countries, the additional costs associated with promoting renewable energy must be fully understood and evaluated within the context of all other immediate development challenges facing the host country.

Access to reliable and affordable energy is known to be a pillar of economic growth and poverty alleviation (Inglesi-Lotz & Blignaut 2011). Fortunately mitigation through inclusion of renewable energy and addressing development objectives does not always have to be mutually exclusive. However, in order for the two objectives to support one another, an optimisation of monies allocated is crucial. To do so, effective MBIs are necessary that specifically address the local opportunities and challenges of the host country.

It is recognised that in order to deploy renewables at the scale required to achieve the 450 Scenario, then private sector capacity is needed to fully exploit the potential of renewable energy. Engaging the private sector can increase effectiveness and scale by transferring risk unsuitable for the public sector to the private sector while also making use of its financial investments and capabilities. However, as opposed to the governance structure, the private sector is more narrowly concerned with meeting the required rate of return for the project, which is based on the underlying risk profile of the venture. The explicit intention of renewable energy as a public good is therefore led by the state, not the business organisation. However an underlying assumption of this research is that by engaging in renewable energy development, business organisations will be contributing to the 'public good' regardless if this is their underlying motivation.

It has also been acknowledged that non-economic factors (i.e. administrative hurdles, grid access procedures, non-transparency) influence decision making by project developers (Lüthi & Prässler 2011). However, assuming sufficient natural resources exist and authorisation feasible, the main concern of the business organisation is an acceptable financial return. As a result the IPP is motivated by the business opportunity established by the governance structure, and is incentivised to actively engage with defining the rules and regulation which result in an attractive MBI. This is driven by the IPPs need for financial incentives to make renewable energy projects financial viable, and made possible by the state providing such subsidy (Toke 2007; Dinica 2006). To sum, the co-evolution relationship between the IPP and the state is predicated upon the importance of financial subsidy for renewable energy deployment.

5. Time and Space Considerations of Renewable Energy Promotion

Effective MBIs in developing countries must be cognisant of the host country level of statehood and corresponding temporal and spatial issues. The key challenge is to determine a price per kilowatt hour (kwh) that can be financed through tariffs and the subsequent subsidy that will provide an appropriate private sector return on investment. The desired outcome is a tariff price that represents the lowest possible cost of renewable energy (cost-effective) but is still attractive to IPPs (efficient and feasible). Since motivation differs amongst the governance structure and the business organisation, incentives are required to bridge the gap and enable a mutually beneficial structure to emerge.

The public sector's primary concern is providing reliable, affordable and increasingly clean energy to the end-consumer, represented by the citizens to whom the state is ultimately accountable. As a result, the governance system's main challenge is viewed by this analysis as a temporal issue, caused by the current day *tariff price differential* between fossil fuel based power generation and renewable energy. Key considerations include: What is the differential cost between renewable energy cost and the current tariff rate? Who will pay the differential between the existing electricity price and the cost of renewable energy? What is the price sensitivity of the end electricity consumer? These questions result in different answers depending on the country's context. Within South Africa, even though climate change threatens to have a disproportionally negative impact on Africa (Stern 2007; Parry 2009), paying incrementally higher costs for electricity is often viewed as unacceptable considering the numerous and more pressing development challenges facing the country (Fay et al. 2011; Vorster et al. 2011). As a result, the overall increase in electricity cost when adding renewables to the overall energy supply emerges as a key issue for the end consumer and the state.

Increasing the complexity of this situation, but also providing an opportunity for renewables to contribute a larger percentage of energy in the future, is the fact that the energy sector is dynamic and constantly changing. For example, renewables are desirable for reducing the overall volatility of energy pricing structure because they offer stable pricing. Wind energy investors have relatively certain knowledge of the lifetime cost of the plant from the outset because installed costs and mean wind speed are known, and there are low variable costs, zero fuel cost, and no carbon emission costs (P. Schwabe et al. 2011). Furthermore, renewables continue to show promise for future deployment because the overall costing trend for installing renewable capacity has been decreasing each year as technology improves and greater scale is achieved.

On the other hand, underlying fuel costs of traditional energy sources (i.e. coal, oil, gas, nuclear) are highly variable and increasing because they are subject to the world market and the increasing demand for energy. The cost differential between renewables and fossil fuel based electricity is also highly country specific because both renewable energy potential and availability of fossil fuels differ from country to country. Furthermore, developing countries are often characterised by dominant state-owned utilities that are "rarely exposed to market costs of capital" (Eberhard & Gratwick 2011, p.5542). This manifests in widely varying price differentials between the current electricity tariff offered by incumbent national utilities and the price required by IPPs to profitably provide electricity from renewable sources. In summation, this dynamic situation characterised by renewables trending toward cost competitiveness, is a timing issue representing both a current day challenge and a future opportunity.

Alternatively, the business organisation has an entirely different set of drivers as compared to the governance system. Classic risk versus reward analysis is invoked, with a focus on 'spatial' implications because location (i.e. host country) is a key determinant of risk. The viability of the IPP is determined by its ability to achieve a financial return in excess of the perceived risk associated with the project. IPPs evaluate projects based on their potential to achieve an internal rate of return[3] (IRR)

[3] IRR is a measure that can be used to rank several prospective projects under consideration for investment. It is the discount rate that brings the net present value of all cash flows from the project equal to zero.

on equity that is determined by the risk profile of the project and host country. Moving from developed to developing countries has significant overall cost implications because investors perceive areas with a lower level of statehood to be higher risk due to a confluence of factors, which requires an increased IRR to compensate. If investors do not find an attractive IRR from renewable energy projects, they will invest in other opportunities to seek their remuneration. In today's global economy, renewable energy projects compete for investment with all firms, particularly utilities and infrastructure related firms. Global capital has become a potential resource for developing countries and power projects are often dependent on global financing for investment. Investors prefer investing in countries with manageable country and political risks. They will only invest in higher risk projects and countries if they get a higher IRR compared to lower risk investment options in developed countries.

Renewable energy projects are highly dependent on financing terms, with the required IRR in large part determined by the structure of the project and the risk associated with anticipated cash flows (Wiser & Pickle 1998). Unfortunately, the investment structure of large-scale energy projects is a cause of higher risk within developing countries because they require substantial up-front investments that are recouped over a long period of time through the sale of electricity at a preset price. Renewable energy is perceived to include even greater risk because an incentive mechanism is often necessary to bridge the gap between the costs of renewables as compared to traditional generation. This means that the private sector IPPs must have confidence that the host country government will honour contractual obligations and continually fund the subsidy over the long term. The risk associated with such long-term contractual relationships in developing countries required a financial return that increases as one travels spatially outside the OECD countries.

A recent survey exploring investor's preferences for different framework conditions for investments in wind parks in emerging and developing countries concluded that:

> "Investors want to reduce political investment risks (framework conditions) as much as possible. An increased risk in comparison to an ideal scenario can cause investors to hold back their investment or at least raise their return expectations correspondingly in order to compensate for the increased risk."
> (von Flotow & Friebe 2011)

This situation runs counter to the need for the governance system to minimise the overall cost of electricity. As a result, it becomes more difficult to make a compelling financial case for promoting renewable energy in developing countries and underscores the importance of effective MBI design.

To sum up, the above analysis outlines two key considerations faced by the governance system and business organisation: time and space. From this discussion, it is apparent that for effective renewable energy incentives to be developed, the temporal and spatial considerations must be addressed within the host country context.

6. Germany and South Africa Wind Energy Projects Comparative Analysis

There are wide variations in the cost of wind energy projects within a country and internationally (P. Schwabe et al. 2011). In an effort to elucidate these profound differences, a comparative analysis of wind energy in Germany and South Africa is provided. Wind is chosen because it is an advanced technology that under the correct circumstances can be cost competitive with fossil fuel based electricity. First, the expected IRR benchmark is estimated for grid connected wind energy projects in South Africa and Germany. Then using the estimated IRR benchmarks, the tariff price to meet this investment hurdle is modelled using hypothetical wind farms in both countries. The comparison between developed country Germany and developing country South Africa is presented to highlight how perceived level of statehood impacts the financing of renewable projects.

Estimating the cost of capital for renewable energy projects is subjective and highly dependent on the underlying variables and assumptions. For the purpose of this analysis, the market based model proposed by Fay and Kumar (forthcoming) is selected because it provides an estimated discount rate using financial markets observation. This is a capital asset pricing model (CAPM) approach that is designed to incorporate the risk attributes specific to the country, project and industry. Yield to maturity on a long term government bond and the equity risk premium are used as approximate measures of statehood and the new industry risk premium to measure wind sector maturity.

The approach to estimate the expected return on equity investment is as follows:

Expected Return on Equity $E(R_e)$ *= Yield to Maturity (YTM) on a Long Term Government Bond + Equity Risk Premium + New Industry Risk Premium*

Applying the model to South Africa as of January 2012 yields an expected rate of return of 20.04%. The underlying variables mirror the approach used by Fay and Kumar (forthcoming).

South African $E(R_e)$ *= 8.45% + 7.29% + 4.30%*

= 20.04%

The YTM on the Long Term Government Bond rate of 8.45% is reported from the Johannesburg Stock Exchange's GOVI Index as of January 3, 2012. The 10-year Equity Risk Premium of 7.29% is taken from Hassan and Van Biljon's analysis (2010). The new industry premium of 4.30% is calculated using the Ibbotson Associates full-information beta estimation process[4]. The new industry risk premium is included because wind farms are new to South Africa. The first ever round of negotiations regarding PPAs for wind project IPPs was announced in December 2011 as part of a competitive bidding process. Over time, as South Africa gains experience with wind energy, the new industry variable will decrease to zero.

By comparison, Germany with a higher perceived level of statehood and a more advanced wind sector than South Africa benefits from a much lower expected rate of return at 7.30%.

Germany $E(R_e)$ *= 1.90% + 5.40% + 0%*

= 7.30%

The YTM on the Long Term Government Bond rate of 1.90% is from January 3, 2012 and based on the German government backed 10-year bond (Bloomberg 2012). The equity risk premium of 5.40% is estimated via an in-depth survey approach performed by Fernandez, Aguirreamalloa and Corres (2011). Germany has one of the most developed renewable energy sectors in the world; it is a leader in the manufacture of wind turbines and had over 27.2 GW of wind operating at the end of 2010 (Janet & Martinot 2011, p.20). Due to the advanced state of the wind sector in Germany, the new industry risk premium of zero is applied.

The IRR benchmarks demonstrate a significant difference between cost of capital in developed Germany and developing South Africa. Germany, with a high

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[4] *IRPi = (RIi x ERP) – ERP;* where *IRPi* indicates the expected industry risk premium for industry *i*; *RIi* is the risk index (full -information industry *i* beta); and *ERP* represents the expected equity risk premium.

level of statehood and an advanced wind energy sector, benefits from a low cost of capital for the wind projects. Conversely, South Africa has a lower level of statehood that is combined with a nascent wind energy sector, resulting in a higher perceived risk that in turn demands a higher cost of capital.

Next, the affect of higher cost of capital on the tariff price needed to meet the required IRR is explored in Germany and South Africa. This is important to MBI design because it is a measure of the tariff price required to attract IPP interest. A high-level financial analysis of hypothetical German and South African wind farms, each with a 20-year lifespan, is presented to illustrate the overall variation in the price of renewable electricity generation. Indicative quotes from actual operating and maintenance (O&M) service providers and insurance brokers are used uniformly across both projects. All other uniform assumptions are wind industry norms or estimates from best available data. The key variable inputs are capital expenditure per MW wind installed, capacity factor, consumer price index (CPI) and the interest rate for debt financing.

Table 1 provides a summary of the key variables and the required tariff rate of €9.5c[5] per kwh to meet the expected return on equity of 20.04% in South Africa. The Standard Bank benchmark of $2,000,000 USD per MW installed is used for estimating the cost of building wind farms in South Africa (Standard Bank 2011). The 9% interest rate used is the South African Prime rate as of January 2012, and the CPI is the 2011 average of 5% (Statistics SA 2012). The average capacity factor of 27.17 is estimated by a 2011 capacity credit study that relates to the first 2000 MW of installed wind capacity in South Africa (Werner et al. 2011).

Table 1: Hypothetical 100 MW South Africa Wind Farm

Technical	Value	Unit
Turbine Capacity	2.5	MW
# of Turbines	40	Nos
Total Capacity	100	MW
PLF	27.17%	Eskom 2011
Estimated net generation	238,009	MWh / year
Inflation	5.00%	CPI
Capital Expenditure	142,857,143 €	Euro
Interest Rate	9.00%	Prime
Equity IRR	20.04%	CAPM Estimate
Required Tariff	€ 0.095	Euro Cents

5 Exchange rate of 10 to 1 is utilised to convert from Rand to Euro

Table 2 provides a summary of the key variables and the required tariff rate of €6.3c per kwh to meet the expected return on equity of 7.30% in Germany. While capital expenditure outlays have varied over the years by project, an average German specific benchmark of €1,373,000 Euro per MW installed determined by the International Energy Agency is used (P. Schwabe et al. 2011). The interest rate of 3.58% is sourced from Bundesbank, using the rate that the domestic banks in Germany charge on euro-denominated loans to non-financial corporations domiciled in the euro area as of November 2011. The inflation rate used is Germany's 2011 average CPI of 2.32% (CPI 2011). The estimated average capacity factor for Germany is 25.8%, based on 2008 results (P. Schwabe et al. 2011).

Table 2: Hypothetical 100 MW Germany Wind Farm

Technical	Value	Unit
Turbine Capacity	2.5	MW
# of Turbines	40	Nos
Total Capacity	100	MW
PLF	25.80%	EIA
Estimated net generation	226,008	MWh / year
Inflation	2.32%	CPI
Capital Expenditure	137,300,000 €	EIA
Interest Rate	3.58%	Bundesbank
Equity IRR	7.30%	CAPM Estimate
Required Tariff	€ 0.063	Euro Cents

The above analysis translates the investment cost necessary for renewable energy in South Africa and Germany into an inflation indexed tariff rate over a 20-year period, providing a rough estimation of the tariff price necessary for IPPs to engage in each country. The comparison indicates a €3.2c difference between the required tariff pricing for wind energy, representing a 51% higher tariff needed in order to attract IPPs in South Africa. Such a profound tariff price differential, even with the better-anticipated wind resource in South Africa, underscores the implications of the host country risk on financing. As previously discussed, renewable energy projects further compound the difficulties because of the substantial up-front capital needed and the long-term repayment based on the PPA. As a result, cost of capital plays an increasingly larger role in the viability of renewable energy projects in countries that suffer from problems of limited statehood, and any incentive mechanism must understand and address each country's specific cost of capital situation.

Table 3: Tariff Pricing – euro cents denominated

Country	Estimated Wind Generation Cost	Household Tariff kwh	Wind Energy Pricing
Germany	6.2c	26.7c *	5c – 9c ***
South Africa	9.2c	5.23c **	11.5c ****

* June 2011 retail household end-user with consumption of 3,500 kwh/year, Source: http://www.energy.eu/
** 2011/2012 standard average price, Source: http://www.eskom.co.za/c/53/tariffs-and-charges/
*** Estimated German FIT pricing 2011, Source: http://www.energy.eu/#Feedin
**** Maximum bid allowed under REBID for on-shore wind energy is 115c ZAR

From the perspective of the governance system, it is important to understand the incremental cost between renewable energy and the current tariff price. Even though direct comparisons of IPP generation costs and existing tariffs from national utilities are difficult to fully discern (Eberhard & Gratwick 2011), they are useful for providing a basic understanding of the price differential when including new energy sources to an incumbent system. Table 3 compares the hypothetical tariff rate required by wind energy IPPs, the current retail household kwh tariff rate and the on-shore wind tariff rate offered in both countries. What emerges from the German case is that the retail price of €26.7c is significantly higher than the estimated cost of €6.3c for wind energy generation. This is not a straight comparison because the overall tariffs in Germany are comprised of numerous taxes and charges; therefore exact cost of generation can only be estimated. For example, an analysis of the 2005 electricity tariff in Germany found that 60% of the tariff contributed to electricity generation, transmission and marketing; 10% to a concession charge and the remaining 30% toward taxes, of which only 3% contributed to the Renewable Energy Sources Act (Wenzel 2006).

To estimate the actual cost of electricity generation for Germany, the average base price for electricity on the European Power Exchange Spot market for Germany/Austria was €51.12 per MWh in 2011, which corresponds to approximately €5.1c per kwh (EPEX Spot 2012). The FIT pricing used in Germany shows that the estimated generation cost for 2011 electricity in the German grid network is only slightly above the hypothetical cost for wind power and at the low end of the German FIT. This implies that wind energy in Germany is getting close to being cost competitive versus traditional generation.

In direct contrast, the South African state has fewer options available to promote renewable energy because the gap in price differential between wind and the retail electricity price is significant. ESKOM, the monopolistic South African utility, currently provides electricity to households at a retail price of approximately €5.23c. The tariff rate is scheduled to increase by approximately 16% in 2012 for the third consecutive year of significant increases (NERSA 2012, ESKOM 2011). However even with the increase the cost of generating coal-based power using South Africa's legacy infrastructure is still comparatively inexpensive (Pegels 2010), especially when compared to the €9.5c estimated to generate wind energy. This presents a challenge in the short term to fund the differential between current pricing and the required wind tariff.

Another important consideration that underpins this analysis is the willingness and ability of the end electricity consumer to absorb higher costs of electricity. As is the case with most emerging and developing countries, South Africa has high levels of poverty and inequality, resulting in substantial price sensitivity for a large part of the population to tariff price increases. Compounding the problem is that the government has limited resources and must prioritise the most immediate needs such as jobs, health and education, to name a few. Subsidy funding for renewable energy, as a result, is secondary because the country faces a host of developmental challenges that are perceived as more important and immediate than climate change, which is often perceived as an intellectual emergency (Winkler & Marquand 2009). On the other hand, Germany has a much higher electricity price and a populace less sensitive to price increases. There has also been a consistent willingness to buy renewable energy at a higher price by the German consumer (Wüstenhagen & Bilharz 2006), providing much more flexibility and support for renewables in Germany.

7. Recommendations for MBI Policy in Areas of Limited Statehood

For renewable energy in developing countries to reach the scale required to meet the 450 Scenario, MBI design must carefully consider cost of capital and the potential role of incentives in decreasing project risk. By doing so, MBIs will increase their effectiveness and shorten the timeframe till renewable electricity generation reaches parity with traditional energy systems. This will require innovative approaches to incentivise both the state and the business organisations.

Recognising the importance of promoting renewables and the potential long term outstanding liability from the price differential necessary for incentivising renewables, the government of South Africa has set up an initiative called South African Renewables Initiative (SARI) in collaboration with global donors and foreign governments to explore innovative funding mechanisms to lower the cost of renewable energy deployment (Creamer 2011). Another interesting initiative is an international program led by Deutche Bank called GET FiT, which supports policy structures in middle and low-income countries that address specific national contexts and provide private investors with confidence. GET FiT attempts to maximum incentive capture in the least cost manner to the funding partners through "a combination of public money for renewable energy incentives, risk mitigation strategies such as international guarantees and insurance, and coordinated technical assistance to address non-financial barriers and create an enabling environment for project development" (Fulton 2010). SARI, GET FiT and other emerging incentive mechanisms will be important additions to renewable energy promotion, and specifically to finding ways to reduce the overall risk profile of renewable projects.

Recommendations include supporting incentives from the international climate regime and national governments for below market rate loans and loan guarantees to the IPP in order to reduce perceived risk and drive down the cost of capital. The German government has successfully provided below market rate loans to support its renewable energy sector. As early as the 1990's, wind energy plants and PV roof systems were eligible for soft loans with an interest rate reduction of 4.5% as compared to standard loans (Paolo 2006; Rosaria Di Nucci et al. 2007). In 1999, Germany introduced the Market Incentive Programme (MAP) for smaller scale renewable energy systems that provided direct investment subsidies and soft loans with long term repayment conditions and partial debt forgiveness if certain conditions were met (Bechberger & Reiche 2004). KFW, the promotional bank of the Federal Republic of Germany, has even established a special facility for renewable energies and energy efficiency that provides loans with subsidised interest rates and favourable repayment terms to developing countries if a government guarantee is provided (Holtkotte 2005). These are excellent examples of incentive mechanisms that mitigate risk in an effort to reduce the overall cost of renewable electricity.

Another recommendation is to address the tariff price differential through incentives specifically designed to leverage the stable cost of wind energy versus the increasingly volatile fossil fuel based electricity costs. Theoretically, the international climate change regime could engage with the South African state (as opposed to the international MBI opportunity available through the CDM) to play an active role in providing immediate support to meet the incremental tariff price difference for wind energy. The business as usual tariff price could be marked to the predominant fuel source used in the host country, for example coal in South Africa. Designed properly, opportunity may exist for funds to be repaid if and when wind energy becomes cheaper than coal based electricity generation. Operationally, the same entity that receives the initial subsidy to cover the negative tariff price differential may be reimbursed for that initial subsidy by a future positive tariff price differential. The global coal price could be used as the benchmark to assess the traditional cost of power. This approach could allow developing countries to immediately benefit from inclusion of renewable energy without having to absorb the short-term incremental cost. This is a reverse lock-in strategy because South Africa would secure renewable energy at the business as usual cost of coal-based generation.

As demonstrated by table 3, there likely remains a high differential between the cost of wind and that of coal-based electricity generation in South Africa. Therefore, this proposed incentive mechanism would be a long-term, speculative proposition dependent on the increasing cost of fossil fuel based electricity. While risky from a straight financial perspective, such an approach could be an efficient and cost effective way for the international climate change regime to promote the global public good of reducing carbon emissions. Such an incentive mechanism offers a sustainable alternative to fossil fuel based electricity generation while at the same time supporting climate smart development because it does not requiring the host country state to divert their limited resources to finance the more expensive current day cost of renewable energy.

There are many potential MBIs to address the time and space issues affecting developing countries in the quest to promote cleaner energy. More research is necessary to better understand possible incentive design and implementation to shift the present electricity generation paradigm in developing countries.

8. Conclusion

In order to meet the challenge posed by climate change, the current dependence on fossil fuel based electricity generation needs to undergo dramatic transformation in the immediate future or risk locking in carbon intensive power installations that will push the world past the 450 Scenario threshold. This calls for bold climate change governance, whereby both the public and private sector must effectively work together through a co-evolutionary framework to establish and implement effective incentives for renewable energy.

Global climate change governance needs to place special focus on developing countries, which are the future demand centres for electricity. To do so, challenges that are inherent to areas of limited statehood need to be better understood and addressed. Transporting MBI approaches from the developed world does not always travel well because underlying host country contexts are different. The host country level of statehood is a key determinant of any renewable energy project's risk profile. This in turn influences the cost of capital. The result is renewable energy, as demonstrated by this chapter's analysis, which is more expensive in the developing world than in OECD countries, hindering the state's ability to prioritise the large-scale promotion of renewables. To overcome this challenge, innovative approaches that incentivise both the state and the private sector are necessary. This requires incentives that simultaneously address the cost of capital by reducing project risk and decrease the tariff price differential.

References

Arent, D.J., Wise, A. & Gelman, R., 2011. The status and prospects of renewable energy for combating global warming. *Energy Economics*, 33(4), pp.584-593.

Bechberger, M. & Reiche, D., 2004. Renewable energy policy in Germany: pioneering and exemplary regulations. *Energy for Sustainable Development*, 8(1), pp.47-57.

Bloomberg, 2012. Germany Government Bond Yield & Interest Rates. 7 January 2012.

Börzel, T., Héritier, A., Kranz, N., Thauer, C., 2010. *Racing to the Top? In Governance Without a State.* New York: Columbia University Press.

Börzel, T.A. & Risse, T., 2010. Governance without a state: Can it work? *Regulation & Governance*, 4, pp.113-134.

Butler, L. & Neuhoff, K., 2008. Comparison of feed-in tariff, quota and auction mechanisms to support wind power development. *Renewable Energy*, 33(8), pp.1854-1867.

Christensen, J., Denton, F., Garg, A., Kamel, S., Pacudan, R., Usher, E., 2006. *Changing Climates: The Role of Renewable Energy in a Carbon-Constrained World*, New York: United Nations Environment Programme.

CPI, 2011. Inflation Germany 2011. Available at: http://www.inflation.eu/inflation-rates/germany/historic-inflation/cpi-inflation-germany-2011.aspx.

Creamer, T., 2011. Renewables Procurement Process May Be Extended Beyond the First Phase. *Engineering News*. 16 December 2011.

Dinica, V., 2006. Support systems for the diffusion of renewable energy technologies —an investor perspective. *Energy Policy*, 34(4), pp.461-480.

Dunkerley, J., 1995. Financing the energy sector in developing countries: Context and overview. *Energy policy*, 23(11), pp.929–939.

Eberhard, A. & Gratwick, K.N., 2011. IPPs in Sub-Saharan Africa: Determinants of success. *Energy Policy*, 39(9), pp.5541–5549.

Eisenhardt, K.M., 1989. Building Theories from Case Study Research. *The Academy of Management Review*, 14(4), pp.532-550.

Eisenhardt, K.M. & Graebner, M.E., 2007. Theory Building from Cases: Opportunities and Challenges. *Academy of Management Journal*, 50(1), pp.25-32.

EPEX Spot, 2012. EPEX Spot. *European Power Exchange*. 01 February 2012.

Eskom, 2011. ESKOM RETAIL TARIFF ADJUSTMENT FOR 2011/12. Eskom.

Fay, J., Kapfudzaruwa, F., Na, L., Matheson, S., 2011. A comparative policy analysis of the Clean Development Mechanism in South Africa and China. *Climate and Development*, pp.1-19.

Fay, J. & Kumar, U., Forthcoming 2012. A Market Based Model for Determining the Investment Benchmark of Renewable Energy Projects in South Africa

Fernandez, P., Aguirreamalloa, J. & Corres, L., 2011. Market Risk Premium used in 56 countries in 2011: a survey with 6,014 answers. IESE Business School.

Finon, D. & Perez, Y., 2007. The social efficiency of instruments of promotion of renewable energies: A transaction-cost perspective. *Ecological Economics*, 62(1), pp.77-92.

von Flotow, P. & Friebe, C., 2011. Framework conditions for Investments in Wind Parks in Emerging and Developing Markets the Investors' Perspective, Oestrich-Winkel: Sustainable Business Institute.

Frondel, M., Ritter, N., Schmidt, C.M., Vance, C., 2010. Economic impacts from the promotion of renewable energy technologies: The German experience. *Energy Policy*, 38(8), pp.4048-4056.

Fulton, M., 2010. GET FiT Plus: De-Risking Clean Energy Business Models in a Developing Country Context. Deutsche Bank Climate Change Advisors.

Haas, R., Eichhammer, W., Huber, C., Langniss, O., Lorenzoni, A., Madlener, R., Menanteau, P., Morthorst, P.-E., Martins, A., Oniszk, A., Schleich, J., Smith, A., Vass, Z., Verbruggen, A., 2004. How to promote renewable energy systems successfully and effectively. *Energy Policy*, 32(6), pp.833-839.

Hassan, S. & Van Biljon, A., 2010. The Equity Premium and Risk-Free Rate Puzzles in Turbulent Economy: Evidence from the 105 year of data from South Africa. *South African Journal of Economics*, 78(1), pp.23–39.

Henderson, R. & Newell, R., 2010. Accelerating Innovation In Energy: Insights from Multiple Sectors. *Harvard Business School*, 10(067), pp.1-24.

Holtkotte, A., 2005. KFW: Attractive Loan Conditions for Renewable Energy Projects.

Huang, Y.H. & Wu, J.H., 2011. Assessment of the feed-in tariff mechanism for renewable energies in Taiwan. *Energy Policy*, (0).

IEA, 2008. World Energy Outlook 2008, Paris: International Energy Agency.

IEA, 2011. World Energy Outlook 2011, Paris: International Energy Agency.

Inglesi-Lotz, R. & Blignaut, J., 2011. Estimating the price elasticity for demand for electricity by sector in South Africa. *South African Journal of Economic and Management Sciences*, 14(4), pp.449-465.

Janet, S. & Martinot, E., 2011. Renewables 2011: Global Status Report, Paris: *REN21*.

Krewitt, W. & Nitsch, J., 2003. The German Renewable Energy Sources Act—an investment into the future pays off already today. *Renewable Energy*, 28(4), pp.533-542.

Lüthi, S. & Prässler, T., 2011. Analyzing policy support instruments and regulatory risk factors for wind energy deployment–A developers' perspective. *Energy Policy*, 39, pp.4876–4892.

Menanteau, P., Finon, D. & Lamy, M.L., 2003. Prices versus quantities: choosing policies for promoting the development of renewable energy. *Energy Policy*, 31(8), pp.799-812.

NERSA, 2009. Renewable Energy Feed In Tariff. National Energy Regulator of South Africa.

NERSA, 2012. NERSA Review Eskom's Tariffs For The Period 01 April 2012 TO 31 March 2013. National Energy Regulator of South Africa. 09 March 2012.

Pachauri, R.K. & Reisinger, A. eds., 2007. Climate Change 2007: Synthesis Report, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC.

Paolo, A., 2006. Use of economic instruments in the German renewable electricity policy. *Energy Policy*, 34(18), pp.3538-3548.

Parry, M., 2009. Climate change is a development issue, and only sustainable development can confront the challenge. *Climate and Development*, 1(1), pp.5–9.

Pegels, A., 2010. Renewable energy in South Africa: Potentials, barriers and options for support. *Energy Policy*, 38(9), pp.4945-4954.

Pellerin, T. & Bauer, J., eds., 2008. Private Sector Initiatives Toolkit. Millennium Challenge Corporation.

Risse, T. ed., 2010. *Governance without a State? Policies and Politics in Areas of Limited Statehood*, Columbia University Press: New York.

Rosaria Di Nucci, M., Mez, L., Reiche, D., Bechberger, M., 2007. Intelligent Energy Europe: Country Report Germany, (Workpackage 3 No. 2), Freie Universitat Berlin: Environmental Policy Research Centre-FFU, Berlin.

Sandor, R.L., Bettelheim, E.C. & Swingland, I.R., 2002. An overview of a free-market approach to climate change and conservation. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 360(1797), pp.1607-1620.

Schwabe, P., Schwabe, S. & Hand, M., 2011. IEA Wind Task 26: Multi-national Case Study of the Financial Cost of Wind Energy, Work Package 1 Final Report.

Standard Bank, 2011. The IPPPP RFP. Standard Bank.

Statistics SA, 2012. *Consumer Price Index (CPI), Past CPI Releases: January 2012*, South Africa: Statistics South Africa.

Stavins, R.N., 2002. Lessons from the American Experiment with Market-Based Environmental Policies. *SSRN Electronic Journal*, 22.2002, pp.01-032.

Stern, N., 2007. *The Economics of Climate Change: The Stern Review*, Cambridge UK: Cambridge University Press.

Toke, D., 2007. Renewable financial support systems and cost-effectiveness. *Journal of Cleaner Production*, 15(3), pp.280-287.

Vorster, S., Winkler, H. & Jooste, M., 2011. Mitigating climate change through carbon pricing: An emerging policy debate in South Africa. *Climate and Development*, 3, pp.242-258.

Wenzel, B., 2006. What Electricity from Renewable Energies Costs. Germany Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Werner, D. Aphane, O., Otto, A., Leask, K., 2011. Capacity Credit of Wind Generation in South Africa, Pretoria, South Africa: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Department of Energy, Eskom, Pretoria, South Africa.

Winkler, H. & Marquand, A., 2009. Changing development paths: From an energy-intensive to low-carbon economy in South Africa. *Climate and Development*, 1(1), pp.47-65.

Wiser, R.H. & Pickle, S.J., 1998. Financing investments in renewable energy: the impacts of policy design. *Renewable and Sustainable Energy Reviews*, 2(4), pp.361–386.

Wüstenhagen, R. & Bilharz, M., 2006. Green energy market development in Germany: effective public policy and emerging customer demand. *Energy Policy*, 34(13), pp.1681-1696.