How useful are renewable energy toolkits for developing countries? A framework for evaluation

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Livia Paggi
Tracy Lane
Robert Gross (robert.gross@imperial.ac.uk)
Phil Greenacre (philip.greenacre06@imperial.ac.uk)
Jack Nicholls (jack.nicholls09@imperial.ac.uk)
Rebecca Mawhood (rebecca.mawhood11@imperial.ac.uk)

Imperial College Centre for Energy Policy and Technology

CONTENTS:

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EXECUTIVE SUMMARY

OECD governments, internationals organisations such as the UN and World Bank, and NGOs view themselves as playing a catalytic role in assisting developing countries achieve their low carbon goals. From 1998 to 2000, the international community provided over USD 3 billion in development assistance to developing countries to promote renewables (Martinot, 2002). Funds are intended to help developing countries overcome existing barriers to deployment and be used to finance and distribute different renewable energy technologies and advise individual countries on institutional and regulatory reform. As part of the international community's efforts, a large number of renewable energy toolkits have also been produced over the past decade. The World Bank, UN, USAID, and the IEA are some of main sponsors of such toolkits.

The underlying concept of a renewable energy toolkit is that when raw information on the technological, economic, social, and financial dimensions of renewables is packaged and distributed effectively, the knowledge base of all the key stakeholders is improved, and thereby the entire process of deploying RETs. However, how this process happens in practice is not so self-evident and despite the large number of existing toolkits (over 65 were identified), evaluations of them are sparse.

As such, a framework was developed to evaluate to what extent the existence of renewable energy toolkits advances the agenda of promoting renewables in developing countries. Toolkits were evaluated for 1) accuracy and completeness, meaning whether they adequately address the technological, institutional, economic and cultural barriers to deployments; and 2) as learning tools, meaning whether the format/concept of a toolkit is an effective learning device.

We argue that although toolkits provide a great deal of information on various aspects RET deployment they are not unequivocally helpful. Existing toolkits tend to address the barriers to renewables at a theoretical or high level. For instance toolkits provide extensive information on different economic and financial policy mechanisms, and technology options. However, case studies of renewables in developing countries demonstrate that when projects fail, it is not for lack of available information, but rather poor decision-making and analysis of information.

Existing toolkits rarely provide a mechanism to adapt general information to specific situations. Furthermore, toolkit users may often not know what kind of information is relevant or applicable to their specific circumstance. Only a select few toolkits have incorporated a 'self-diagnostic' function to help sift through what are often copious amounts of information, of which may not be relevant to certain users. Because users can find it challenging to adapt the information, existing toolkits are considered to be poor in overcoming social and cultural barriers to renewables. Moreover, given the amount of information and toolkits already in existence, the marginal gains from developing a more accurate and complete toolkit may be relatively small.

Nonetheless, there is significant scope for revisiting the concept of a toolkit as learning tools. By examining the format, language, audiences and sources of information of the toolkits their conceptual strengths and weaknesses can be extrapolated. Existing toolkits predominantly rely on the use of ICT to deliver information. This tends to promote a one-way transfer of information that does not equate with the transfer of knowledge in a form required by users in different regions and countries. Furthermore, the reliance of ICT to deliver information eliminates the human dimension in the acquisition of

knowledge. We do however wish to highlight that a select few toolkits have incorporated a function whereby users can ask experts questions. The issue is exacerbated by the fact that the toolkits are predominantly in English language (REEGLE toolkit does have a French & Spanish option), and therefore they are assuming that all users are fluent in English. This not only can potentially exclude large bases of users, but it also signifies there is little capacity for local stakeholders to direct their input, engage and challenge the content of the toolkits.

The 'on-the-ground' impact of toolkits is potentially limited by the fact that their audiences are often poorly defined. Often there is not distinction being made whether the toolkit is for local beneficiaries, or staff working at developing organizations. However, it is evident that different audiences have very different needs. Finally we wish to highlight that many of the toolkits have taken on the function of acting as an electronic library for other resources and existing toolkits. Thus the result is that often they recycle other toolkits or similar materials produced by international organisations. Therefore, the marginal value of such a contribution is open to question.

A key recommendation emerging from this research that future knowledge management activities (whether they are toolkits or other activities) be developed with full engagement of the beneficiaries of the toolkit to meet specific requirements of the country or region, rather than products of broad development efforts made by the international community. Toolkits constructed for a specific context can help ensure that the format, language, and content are accessible for the intended user.

Moreover, the acquisition of knowledge not only requires the transfer of information, but it requires a receiver, who is seeking specific knowledge, and is then choosing to use it in a certain way. Before developing additional renewable energy toolkits further research is required to establish to what extent existing toolkits may have influenced local policy makers in their thinking and whether any links can be made between the use of toolkits and renewable energy policy outcome.

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

IEA	International Energy Agency
IO	International Organisation
IRENA	International Renewable Energy Agency
KM	Knowledge Management
MCDA	Multi Criteria Decision Analyses
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Cooperation and Development
RET	Renewable Energy Technology
UKERC	UK Energy Research Centre

INTRODUCTION

Research question

This Working Paper seeks to address whether the existence of renewable energy toolkits advances the agenda of promoting renewable energy deployment in developing countries[1]. In the context of deploying renewable energy in developing countries, toolkit is a term that has primarily been adopted by the international community[2]. There is no single definition of a toolkit and ultimately it is whatever the producer wants it to be. For this research, a toolkit has been broadly defined as a resource (or set of resources) that is made publicly available to help developing countries achieve their renewable energy goals.

In the mid-1990s, the international community began producing toolkits on a wide array of topics in development, including renewable energy for developing countries. The underlying concept of a toolkit is that when raw information on the economic, social and financial dimensions of renewable energy is packaged and distributed effectively, the knowledge base of all the key stakeholders is improved, and thereby the entire process of deploying renewable energy.

Over the last decade, a plethora of studies have emerged in the development field that emphasise the direct link between access to knowledge and economic growth. For instance the Word Bank, in a seminal report published in 1998, stated: "the need for developing countries to increase their capacity to use knowledge cannot be overstated" (World Bank, 1998). Developing countries, whatever their institutional disadvantages are, have access to one great asset--the technological knowledge accumulated in industrial countries (World Bank, 1998). Not only the World Bank, but also IRENA, and other international organisations now promote themselves now as "platforms for exchange and development of knowledge" (IRENA, 2012). Renewable energy toolkits are attempts made by vested stakeholders to assist developing countries tap into the global technical knowledge.

Development assistance for renewables has steadily increased over the last decade and is likely to continue to do so in the near future (See below Figure 2). Although some scholars have referred to the use of 'knowledge management' for development purposes as a 'fad' (Wilson, 2002) international organisations are setting up dedicated departments to oversee knowledge management strategies and activities (IRENA, 2012). Therefore, it is likely that the production of renewable energy toolkits, as an output of an organisation's knowledge management strategy, is a trend that is likely to continue.

In theory renewable energy toolkits are a mechanism for diffusing the 'know-how' that can enrich communities in developing countries. However, how this process takes place in practice is not so self-evident. Development practices are often controversial, and the interactions between developing countries and the international community are highly complex and political. Therefore, addressing what kind of information the international community has selected to include in renewable energy toolkits and examining how these toolkits are being packaged and disseminated is invaluable to inform and potentially improve the way in which international organisations can influence the spread of renewable energy in developing countries in the future.

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[1] There is much debate surrounding the term "developing country" and there is no consensus on what kinds of indicators, such as GDP or potential growth, should be used to determine the status of a country. The World Bank, for instance, defines developing countries as: "countries with low or middle levels of GNP per capita as well as five high-income developing economies -Hong Kong (China), Israel, Kuwait, Singapore, and the United Arab Emirates". For the purpose of this research the term developing country refers to all non-OECD countries.

[2] The term 'international community' refers to the various actors involved in implementing renewable energy technologies and polices in developing countries. This includes: International organizations devoted to energy such as IRENA and the IEA; international development agencies such as the World Bank; local and international NGOs; and government departments of developing countries relevant to implementing renewable energy.

This research considers whether the existence of renewable energy toolkits advances the agenda of promoting renewable energy deployment in developing countries. To answer this question, we establish what renewable energy toolkits exist, and develop a framework for evaluating them. By evaluating renewable energy toolkits produced by the international community, we hope to provide insight into the impact of knowledge management in the development and renewable energy sectors—an area of research where to the best of our knowledge, few studies have been done.

Methodology

The methodology for this research borrows heavily from the Technology and Policy Assessment (TPA) approach developed by UKERC. The aim of the TPA function is to review the evidence regarding important and controversial issues in energy and climate policy. In doing so, it seeks to draw upon the tools and techniques of so-called Evidence Based Policy and Practice (EBPP), but is not tied to any rigidly defined methodology (Solesbury 2001; Sorrell 2007).

The research process undertook three major phases (See Figure 1):

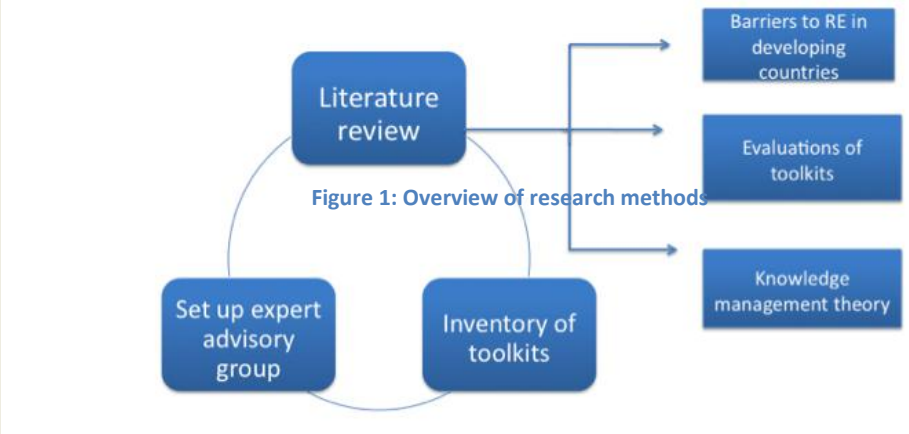


Figure 1: Overview of research methods

Firstly, a comprehensive review was conducted of existing tools available to help implement renewable energy policies and technologies in emerging and developing countries. An inventory was compiled of existing renewable energy toolkits. Using data from the set of available toolkits, we documented what topics are covered by toolkits, who developed them, what formats they come in, and crucially, who is meant to use them (See Annex 1 for inventory of toolkits identified).

A total of 67 toolkits were identified for the inventory. The inventory does not purport to be comprehensive. The primary reason being is that there is no single definition or consensus on what the term 'toolkit' means or how it should be interpreted. Moreover, by conducting research only in English language, the inventory is limiting itself to materials that are predominantly produced by western institutions and international organisations.

In order to establish a theoretical framework to evaluate renewable energy toolkits, a systematic review of the academic literature addressing renewable energy policy and tools to support their deployment was also conducted. Specifically, the research focused on three areas: 1) Studies on the barriers to renewable energy deployment 2) Evaluations of existing renewable energy tools and 3) Knowledge management theory in the development context.

Structure of the paper

Following this introductory section, the paper is structured as follows: **Section 2** provides a brief history on the origins of toolkits, which we believe, is indispensable for addressing how best to evaluate them. **Section 3** classifies the existing toolkits according to producer, format and targeted audience. **Section 4** presents a two-step approach framework for evaluating the toolkits. **Section 5** applies the evaluation

framework and evaluates a sample of toolkits for accuracy and completeness, and as learning tools. **Section 6** presents our conclusions, avenues for further research, and recommendations.

ORIGINS OF RENEWABLE ENERGY TOOLKITS

The history of renewable energy toolkits provides invaluable insight into what the toolkits are trying to achieve, and what kind of analytical framework can be devised to evaluate them.

The role of the international community

Since the late 1990's, following the international adoption of the Kyoto Protocol, a series of global initiatives have emerged that are dedicated to promoting sustainable energy. Promoting renewable energy in developing countries has reached the agenda of international policy processes, as it has become widely accepted that developing countries have a key responsibility and stake in partaking in the global efforts made to reduce greenhouse gas emissions.

Thus, the speed and ability of developing countries to deploy renewables, has become a topic of global concern. Furthermore, the international community, which is predominantly driven by OECD governments, international organisations such as the UN and the World Bank and NGOs, envision themselves as playing a catalytic role in the process. As articulated by the OECD's environment directorate in 1998, OECD countries play an invaluable role in assisting developing countries to establish sound policy environments, invest in human capital, and set up robust institutions and governance systems to promote environmental sustainability (OECD, 1998).

Consequently, international financial institutions, such as the World Bank, and government development agencies such as USAID, CIDA and DFID have financed a number of activities in the renewable energy sector. From 1980 to 2000, official development assistance for renewable energy in developing countries totalled USD 3 billion (Martinot, 2002). This trend is likely to continue in the future given the commitment of the international community to address both issues surrounding climate change and poverty alleviation.

As illustrated in Figure 2, over the last decade (since the adoption of the Kyoto Protocol) the amount of aid committed by OECD countries for renewable energy increased significantly, which also led to an increase in the creation of renewable energy toolkits. It is likely that toolkits will continue to be an activity undertaken by the international community.

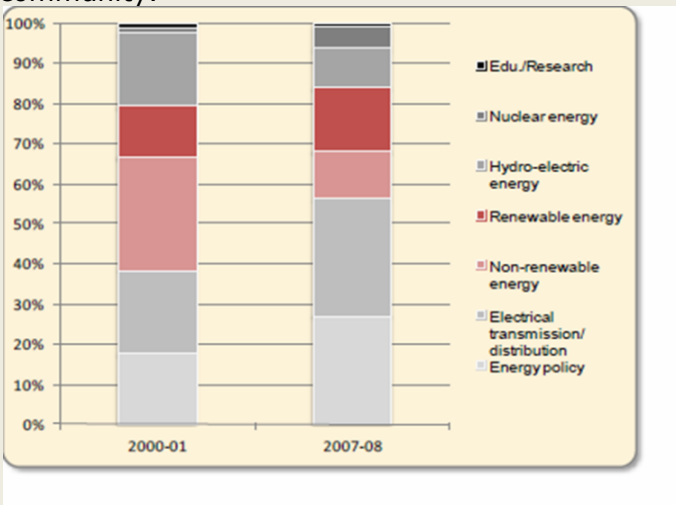


Figure 2: Sub-sectoral breakdown of aid committed by OECD countries to energy (Source: OECD, 2010).

'Failed' donor-driven projects

The flurry of renewable energy toolkits also coincided with the fact that 'donor-driven' renewable energy projects completed in the 80's drew significant criticisms from both within the international community, as well as amongst donor-recipient countries. Expert in renewable energy and former World Bank consultant, Eric Martinot, described the donor-funded renewable energy projects as having been plagued by the "equipment installation mentality"—meaning that the objective of the project was simply to install a certain number of systems. Although there were some exceptions, the projects predominantly failed to promote commercial sustainability and replication (Martinot, 2001).

In line with Martinot's observations, another study published by Gerard Foley in 1992 described several of the renewable energy projects implemented throughout the 80's as a 'catalogue of disappointments' whereby only a few survived the departure of the foreign project staff that installed them. Foley also emphasised the point that donors relied on NGOs to implement the projects, who may have been enthusiastic about the projects, but whose staff were often technically underqualified to work on renewable energy (Foley, 1992).

Thus the renewable energy toolkits were developed as a way to help address not only many of the existing barriers to diffusing renewable energy in developing countries, but were also perceived as a management instrument to help train international staff in the technical and economic dimensions of renewable energy projects.

International organisations as platforms of knowledge

Renewable energy toolkits also emerged at a time when international development organisations started to recognise that the impact of aid could no longer be measured solely by economic criteria, but should also be assessed according to people's capacity to access, generate and use specialised knowledge. Subsequently, international organisations such as the World Bank started to rebrand themselves as 'collectives of knowledge users and producers" (Ferguson et al, 2010). International organisations did not just want to be providers of development assistance through projects loans. Instead they wanted to start emphasising their role as disseminators of research and knowledge. This transformation process can be witnessed by the World Bank who in 1998, under the then president James Wolfensohn rebranded the organisation as the "Knowledge Bank".

Renewable energy toolkits emerged when international development organisations started to market themselves as knowledge brokers. Toolkits became one of the mechanisms through which international development organisations' could package, commoditise, and disseminate institutional knowledge. A number of international organisations working in the field of energy appropriated the image of being knowledge brokers.

TOOLKIT INVENTORY—WHAT TOOLKITS EXIST?

This section presents a categorisation of the findings from the inventory research. The renewable energy toolkits are classified in order to extract key information on the producer, content, and format of the toolkits. This section aims to provide an overview of existing toolkits. Salient issues will be explored in more detail in the analyses conducted in Section 5.

The process

In order to evaluate the notion of a renewable energy toolkit, an inventory was compiled of existing toolkits. To the best of our knowledge, few attempts have been made to compile such information. The World Bank did the most comprehensive inventory in 2005 as part of their efforts to develop a new toolkit on renewable energy, which was then released in 2008. The World Bank inventory initially identified 90 toolkits that focused on either rural energy and/or just renewable energy. The toolkits were in turn categorised as follows: 1) academic papers/theoretical analyses 2) technical handbooks that focus on RE technologies 3) step-by-step guidelines for project development and implementation 4) training manuals and 5) best practice and case studies (World Bank, 2005).

Although the inventory produced by the World Bank included academic studies, our toolkit inventory only focused on identifying materials from the grey literature. The reason for this is two-fold: Firstly, by narrowing the toolkit inventory to the grey literature we are de facto identifying the toolkits that are readily available to the key stakeholders and decisions makers in the renewable energy sector that may not have access to academic studies, which tend to be only available through subscription proprietary databases. Secondly, the toolkits identified through the grey literature, tend to have an ex-ante focus by providing practical and actionable advice to inform future decision-making processes. By contrast, the academic studies tend to focus on developing theoretical frameworks in order to obtain insights into the existing barriers to deploying renewable energy.

The toolkits were subsequently classified to understand what kind of information is being selected and disseminated via toolkits. Specifically, our toolkit inventory seeks to answer:

- How is the concept of a toolkit being used and interpreted?
- Who is producing the toolkits and what region or stakeholder are they for?
- What issues and/or barriers to implementation are the toolkits seeking to address?
- What kinds of delivery formats are being used for the toolkits?

The numerical findings based on the inventory are meant to be more illustrative than a robust statistical analysis of the key trends in existing toolkits. We emphasise again that issues surrounding the format, audience, and content of the toolkits are analysed in Section 5.

Toolkit producers

Based on the inventory, five major actor types have been identified as having contributed to creating toolkits focused on renewable energy for developing countries. Figure 3 illustrates a breakdown of the toolkit producers, and what follows is a brief overview of the institutional landscape and how the actor types have been defined for the purpose of analysing and categorising the toolkits.

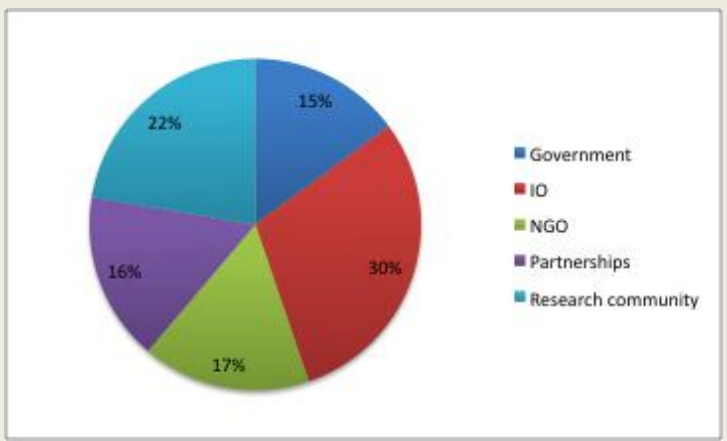


Figure 3: Toolkit Producers (Source: authors' analysis – see Annex 1)

International Organisations, as illustrated above, produced the majority of toolkits identified. For the purpose of this research, international organisations are intergovernmental organisations whose primary activity is energy related such as the IEA; it also includes the various UN agencies, the World Bank and other regional development banks that have programs on renewable energy.

Non-Governmental Organisations are a distinct actor from international organisations for the purpose of categorising the toolkit inventory. This is because the two groups focus on different kinds of activities. Although NGOs are often funded by IOs, NGOs are born out of civil society initiatives and are private entities that are entitled to have independent policies from states. NGOs in the renewable energy sector focus on a range of projects that include capacity building efforts, providing legal assistance, and engaging communities to promote awareness and understanding of renewables. NGOs that have been particularly active in developing energy toolkits have been CARE, Christian Aid and Practical Action.

OECD governments (predominantly through government development agencies and energy departments) have also been major producers of renewable energy toolkits with DFID, USAID, CIDA and the EU being some of the most prominent examples. As Figure 2 illustrates, OECD governments have diverted some of their assistance from the traditional energy sector to developing renewables over the past decade. The high level of involvement of OECD governments reflects the view that their assistance plays an indispensable catalytic role in deploying renewable energy in developing countries (OECD, 1998).

The *research community* includes toolkits produced by universities and institutes focused on research and development of renewables. Toolkits created by research institutes such as the National Renewable Energy Lab (NREL), the renewables research arm of the US Department of Energy, are also included since the NREL is a body solely dedicated to research and promotion of energy technology and efficiency.

The research community has played a particularly important role in developing software programs to map out countries' (and rural areas/villages) energy needs and potential energy solutions. Furthermore, the research community has been the primary driver in developing resource assessment tools—and although they are not the main focus of this research—they are a tool of major importance for developing countries since they are crucial for the initial phase of the transition when the country needs to identify what kinds of technologies are most appropriate for the specific environment.

Individual companies such as major utilities or those operating in the financial sectors produced none of the toolkits identified. This can in part can be explained by the fact that private companies who may be producing investment support tools are likely to keep it them as proprietary information. Nonetheless, a number of *partnerships* amongst different actors have started to emerge in the renewable energy industry. The partnerships are voluntary, multi-stakeholder initiatives aimed at promoting renewable energy. Partnerships started emerging in the mid to late 2000's as they were considered to be an innovative approach to overcoming deficits in global governance and regulations, as well as a way to tackle transnational border issues effectively (Parthan et al, 2010). Major partnerships that have included key private and public sectors actors include the Get FIT program created by Deutsche Bank in conjunction with the UN; REEEP, which includes various NGOs and businesses and is led by the UK government; and CDKN a partnership led by PWC. Partnerships tend to focus on areas such as energy access, efficiency, renewables, and transport. Many of the activities include publications, training programmes, and barrier removal activities.

Format

Figure 4 illustrates the different formats that toolkits appear in.

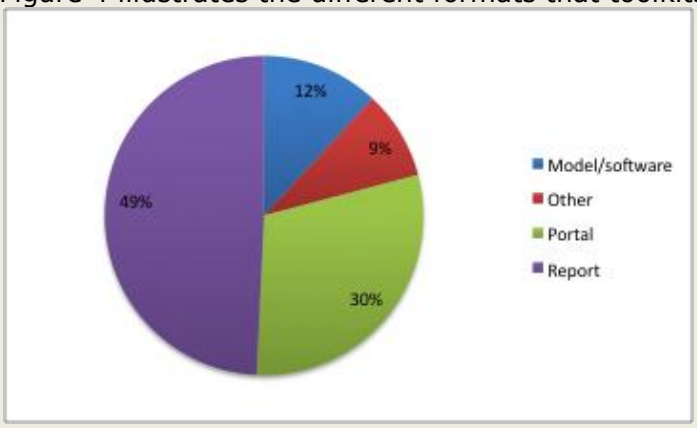


Figure 4: Toolkit Formats (Source: authors' analysis – see Annex 1)

All of the toolkits are available on the Internet. However the toolkits were presented in different formats, the majority of which appeared as reports that were then published on the sponsoring organisations' websites. In the mid to late 2000's web portals started to emerge. These were created for the purpose of compiling and providing materials on renewable energy and energy in developing countries. Some of these portals, such as the World Bank Group's, serve the function of an electronic library which provides a number of resources including publications on various topics and training modules. Several of the toolkits originally produced in the format of a report were then stored on such portals. Other portals such as a website produced by the World Energy Council are interactive sites that enable users to carry out diagnostics on the various policies that exist for renewable energy. Software and modelling tools have been developed to assist countries with energy planning and these are primarily quantitative in nature. The category 'other' refers to the toolkits that come in the format of training manuals or bibliographies of resources.

Audience

The toolkits were categorised in order to establish what regions and which stakeholders they are targeting.

1.1.1 Regions

Figure 5 illustrates the breakdown of what region or regions the toolkits are aimed at assisting:

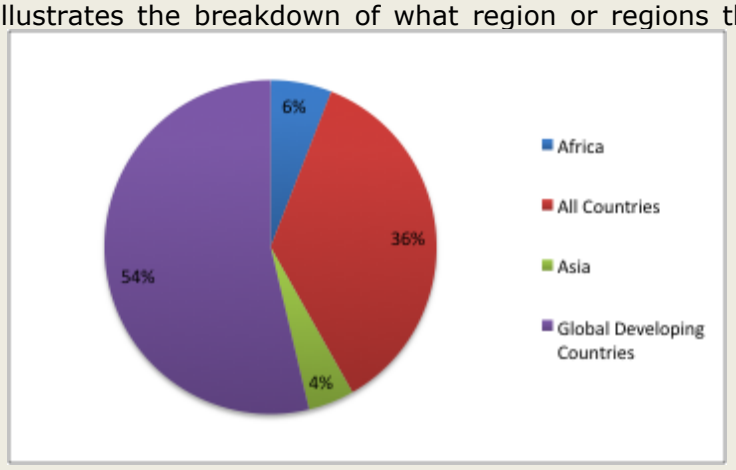


Figure 5: Toolkits according to region (Source: authors' analysis – see Annex 1)

From the outset of this project, questions emerged on which regions the work should focus on. However, during the research it became apparent that the toolkits themselves tended not to focus on a particular region. Over half of the toolkits were targeted at non-

OECD countries, and several of them were drawing best practices and case studies globally. There has been a slight bias towards toolkits developed for Africa and Asia.

Stakeholders

Attempts were also made to categorise the toolkits according to targeted stakeholder. The following chart illustrates that often the toolkits do not specify who the toolkit is for or they simply indicate that it is for all practitioners.

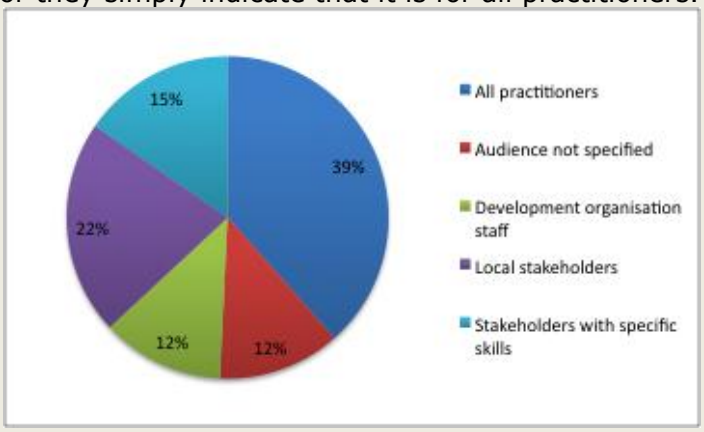
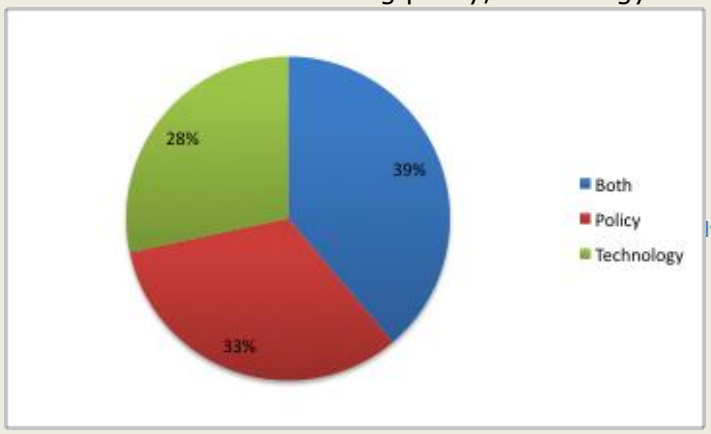


Figure 6: Toolkits by audience type (Source: authors' analysis – see Annex 1)

Some of the toolkits, especially the software modelling tools require quantitative skills. We also wish to highlight that several of the toolkits were not developed specifically for local stakeholders—rather they were made by international organisations to help provide guidance for their own staff working in developing countries on renewable energy projects.

Technology or Policy Focus

The topics addressed in the toolkits predominantly focus on policy-level issues or on technology-issues, or both. As demonstrated in Figure 5 there is a relatively even distribution of those covering policy, technology or both technology and policy together.



lysis –

Specifically, policy-focused toolkits include coverage of issues such as how to obtain financing for RET development, relevant economic and market arrangements for enabling RET growth, appropriate legal and policy frameworks, and institutional arrangements and capacity. For the purpose of the inventory, the policy toolkits have been grouped as either Economic/Financial or Institutional/Capacity or Neutral. Neutral means the toolkit covers a broad range of policy topics and cannot be placed in one of the more specific categories. However it does not mean that equal coverage is provided to all policies and policy types. Figure 8 illustrates the general breakdown of the types of policies covered in the toolkits.

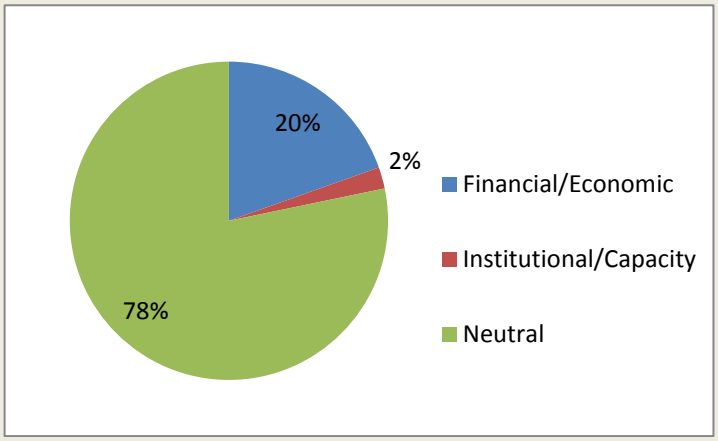


Figure 8: Policies addressed by toolkits (Source: authors' analysis – see Annex 1)

Most of the toolkits identified attempts to cover a broad range of policy issues rather than focusing on one single policy or type of policy. Figure 9 below illustrates the types of technologies generally covered in the toolkits. Similar to the policy toolkits, most of the technology focused toolkits attempt to provide high-level coverage of a range of relevant technologies rather than focusing on single technologies. This may be due to who produces the toolkit. A solar technology association would likely produce a toolkit on solar technologies and relevant policies, whereas development organisations are more likely to cover a broader set of issues.

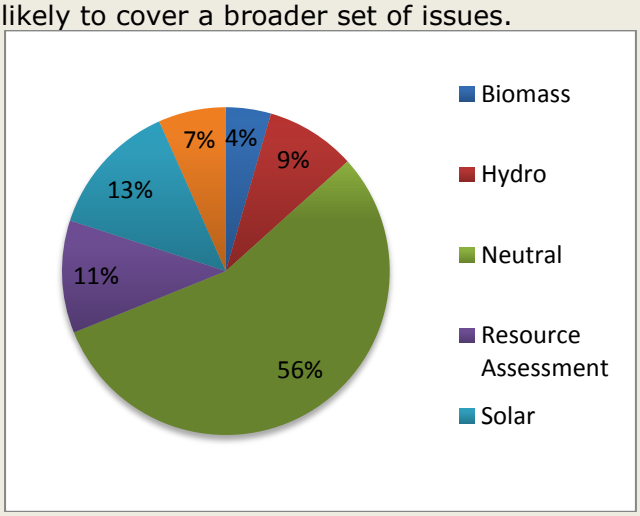


Figure 9: Technologies addressed by toolkits (Source: authors' analysis – see Annex 1)

It should be noted that technology toolkits are typically not in-depth 'how to' manuals for specific machinery. Equipment manufacturers or installation services providers more appropriately provide such materials, and as such were not included in our analysis. Several of The technology-focused toolkits that are inventoried are computer models/software programs designed to be used for assessing scenarios using real or estimated values and in a decision support manner.

EVALUATING TOOLKITS—DEVELOPING A FRAMEWORK

Section 3 demonstrates there is a wide range of toolkits that seek to address a variety of issues. They come in different formats, have various objectives, and very often the audiences are not defined. However, in various ways they all seek to promote renewable energy development. Therefore, ultimately they must be judged on the extent to which they succeed. However, even if a country has successfully deployed renewable energy projects, it is almost impossible to attribute that success to a particular toolkit. Therefore, a framework for evaluation is necessary to determine the extent to which toolkits themselves are effective at driving the deployment of renewable energy in developing countries.

A systematic review of both grey literature and academic studies was conducted to establish whether evaluations of renewable energy toolkits have been previously conducted, and if so whether the frameworks and criteria used are adequate to address the full range of the toolkits' strengths and weaknesses. Building on the literature findings, we propose a two-step framework that entails evaluating toolkits:

1. For accuracy and completeness; and
2. As learning tools

The first part of the framework draws heavily on existing studies on renewable energy in developing countries and critiques of energy models. The second part of the framework is informed by theories of knowledge management within the context of the development sector.

Existing evaluations

To the best of our knowledge, despite the quantity and variety of renewable energy toolkits produced by the international community over the past decade, the number of evaluations of renewable energy toolkits publicly available is sparse.

The review uncovered a handful of evaluations of energy and climate models—software tools (a form of toolkit) developed to inform key stakeholders on the renewable energy planning process. The systematic review of the literature also revealed a number of assessments of the impact of renewable energy policies in developing country contexts as well as frameworks developed for evaluating individual renewable energy projects (See for instance, Wiser, 2002; Blechinger and Shah, 2011). However, as these assessments evaluate renewable energy policy design, but fail to evaluate how far that policy design is influenced by toolkits, these kinds of evaluations have not been considered in further depth.

Energy & climate models

Energy models developed for the renewable energy sector, and their critiques, are widely referred to in academic studies as Multi-Criteria Decision Analyses (MCDA). These software models incorporate qualitative and quantitative criteria, to help policymakers and other stakeholders involved in implementation assess the tradeoffs between numerous constraints and objectives in renewable energy planning. The tools have been used extensively in both industrialised and developing countries to help stakeholders untangle what are the often conflicting political, technical, economic and social objectives of renewable energy projects (Polatidis et al, 2006). Such tools are meant to better inform the decision-making process and identify the most viable and sustainable renewable energy solutions for individual communities (Haralmbopolous and Polatidis, 2006).

The debate surrounding MCDA methods is focused on what kind of criteria should be included in such models. Until recently MCDA studies were primarily concerned with the viability of the models in industrialised countries and they were primarily quantitative and technical in nature (See for instance Pohekar and Ramachandran, 2004 or Konidari and Mavrakis, 2006). In 2007 the Sure DSS tool, and later in 2009, the ESTEEM tool were developed which started to include more qualitative criteria and modulated the interconnection between technologies and their social context.

Authors	***Energy model evaluation***

Cherni et al (2007)	Tools do not take into consideration local population
Cherni and Kalas (2011)	Tools do not incorporate any participatory methods
Alvial Palavicino et al (2011)	Specific cultural contexts need to be accounted for otherwise renewable energy projects are bound to fail
Van Ruijven et al (2008)	Models do not account for informal economies; use of traditional fuels; income distribution
Brent and Kruger (2009)	Evaluated the SURE-DSS tool and a manual produced by ITDG group. Authors concluded that the information in the toolkits is useful, however little analysis was done on toolkit uptake or impact on RE deployment.

Table 1: Key points of energy model evaluation by author/source

Scholars also started to assess the applicability of energy models in developing countries (See Table 1 for a summary of the key points made in evaluations identified).
Cherni and Kalas (2011), for instance, provide a comprehensive review of existing single- and multi-criteria models and highlight their limitations within the context of rural energy planning in developing countries. Fifteen tools including HOMER, MARKAL, ared and contrasted.
Cherni points out that the traditional energy models are too heavily focused on technical criteria such as emphasising the cost of the technology, and the cost of power output. Many of the existing models allow the local population to participate only after experts have taken many of the technical decisions (Cherni et al, 2007). The tools do not adequately consider the long-term sustainability of the infrastructure development and there is hardly any criteria incorporated in the models that reflect the needs of local communities (Cherni and Kalas, 2011).
In line with Cherni's viewpoint, a group of scholars based in Chile have also emphasised the importance of incorporating social criteria in energy planning. They argue that all research and modelling tools should rely on methodologies that incorporate the interaction that communities have with the technology. If public attitudes towards the technology are not appropriately addressed, unexpected conflicts surrounding ownership, trust, and locality can emerge ultimately hindering the success of the project (Alvial-Palavicino et al, 2011).
Other criticisms have also been voiced in the literature on the limitations of energy models in the developing country context. Van Ruijven et al, 2008 argue that few energy models at present account for the political, economic and social dimensions specific to developing countries (Van Ruijven et al, 2008). They comment on the more general use of energy models rather than those that are specifically related to renewable energy, but nonetheless they provide invaluable insight.
Van Ruijven focuses on the energy models used by the IPCC, which are then used in order to develop future scenarios on global use of energy and the potential impact of climate changes. Van Ruijven argues that the models only incorporate dynamics pertinent to developed countries and they do not include the range of socio-economic issues in developing countries. For example, income distribution is not incorporated into the models when forecasting energy demand, which underestimates the energy behaviour that is typically associated with either low- or high-income groups. Energy planning models use GDP per capita as a driver for the energy intensity of activities. However, given that developing countries have such a large informal sector, using the GPD is not a sufficiently adequate criterion to reflect the complexities of the economy. The informal activity includes a whole range of activities that take place in the real world but that are then not absorbed into the model (Van Ruijven et al, 2008).

Evaluating for accuracy and completeness

Existing evaluations argue that the modelling tools do not adequately take into consideration the range of issues affecting developing countries. The authors are in broad agreement that the tools tend to overemphasise the technological, economic, and

environmental dimension to energy planning. They argue that by many of the tools overlook the importance of participatory involvement of local communities.
The evaluations focus on whether or not the tool itself is accurate and comprehensive and reflects the potential barriers that exist in deploying renewable energy in developing countries. The evaluations point out specific areas where the tools fail on these counts. However, none of the evaluations identified assess whether renewable energy toolkits, as decision-making tools, are useful for developing countries to achieve their renewable energy aims. The evaluations do not question whether local practitioners use them or find them useful. In essence the evaluations don't entirely consider the ways in which the tool (and information) is distributed, accessed, received, read, understood and used. Yet these practical issues influence the extent to which toolkits can actually drive renewable energy deployment.
The exception to this criticism is a study that compares the use of two renewable energy tools in South Africa. Brent and Kruger (2009) compared the SURE-DSS tool to a manual produced by the Intermediate Technology Development Group, which is also focused rural energy in developing countries and assessed their impact in South Africa. Interviews were conducted with various renewable energy stakeholders in South Africa. The results from the research indicate that the two tools/frameworks were relatively comprehensive and were widely accepted as addressing many of the key issues addressed in authoritative studies on rural energy development. However, what emerged is that many of the responses of the people interviewed were very closely in line with what was being propagated in the literature. Whether the people interviewed were representative of the people the toolkit were trying to influence needs to be questioned; the people who were being interviewed typically worked in international agencies (and were also likely to be developing such tools or to be familiar with such concepts) but there may not have been many other local stakeholders whose views were not canvassed.
In sum, the existing evaluations of models (where they exist at all) give us a reasonable basis for evaluating renewable energy toolkits for accuracy and completeness i.e. whether they sufficiently address the technological, institutional, economic, and cultural barriers to deploying renewable energy. As such, this approach constitutes the first step of our framework.

Evaluating toolkits as learning tools

However, existing evaluations typically omit a robust assessment of whether toolkits are useful learning tools. To fill in this gap, we turn to knowledge management (KM) theory in order to identify a framework for evaluating toolkits as learning tools. A brief overview of the field is provided, followed by the role of KM in the international development sector, and finally the criteria we have selected for which to evaluate them against.

Knowledge Management

A myriad of definitions exist for knowledge management (KM), which have evolved over time from the early 1990s (Dalkir, 2005). For the purpose of this research, KM is defined as the 'organisational practices that facilitate and structure knowledge sharing and learning' (Ferguson et al, 2010). Through various strategies and activities, KM seeks to leverage the collective knowledge within an organisation to enhance its competitiveness and performance (Alavi & Leidner, 2001). The study of KM seeks to take a very abstract concept of knowledge and attach a business and social value to it. We argue that renewable energy toolkits are a KM strategy deployed by the key actors (See Figure 3) in the industry. Developing toolkits is a mechanism through which the organisations collect knowledge and insight from previous experiences in the field, and make it readily available in a format so that it can be distributed both within the organisation and without.
As a discipline, KM emerged from business studies and the corporate sector in the early 1990s (Hovland, 2003). The emphasis, in much of the early KM literature, is on corporate competitive advantage. Quinn (1992, as quoted in Nonaka and Takeuchi,

1995) notes that the economic power of the modern firm is in its intellectual capabilities rather than the more traditional economic inputs of labour and capital. KM, therefore, places value on the knowledge of its workers, and seeks to extract that knowledge, store it, and ensure it is not lost through staff turnover. The underlying concept of KM is that if a mechanism is established to retain knowledge of the staff, performance of the firm will be improved, and additional or innovative new knowledge will be created.

However, the task of sharing knowledge and appropriating is not as straightforward as it appears. How do we define knowledge? Without wanting to delve into a philosophical debate, it is however useful to briefly turn to early writers on KM such as Nonaka and Takeuchi (1995) who make a fundamental distinction between two types of knowledge: explicit and tacit. Explicit knowledge is that which can be written down, codified, and repeated. It is more associated with data or information. Tacit knowledge, on the other hand, is much more intangible. It is knowledge that is not visible or expressible, and is difficult to share or communicate with others (Nonaka & Takeuchi, 1995). Elaborating on this, tacit knowledge is our personal know-how based on the experience, values, and ideals of the individual.

Firms started to strategise on how best to archive, package and share the intellectual assets of their staff and find ways to convert their tacit knowledge into an accessible and concrete format. Early writers on KM, such as Nevo and Chan (among others) attribute the ICT and technology boom with ushering KM towards a more mainstream corporate strategy and product (Nevo and Chan, 2007). It was in the context of ICT that many of today's definitions of KM were created, emphasising the collection, storage and sharing of knowledge in an ICT-based system.

However, as McDermott notes, despite the opportunities that ICT created for KM, ICT alone cannot deliver knowledge management (McDermott, 1999). McDermott emphasises that the human element of KM is indispensable. McDermott writes, sharing knowledge, "involves guiding someone through our thinking or using our insights to help them see their own situation better. To do this we need to know something about those who will use our insights. " This assertion highlights a key issue that is often neglected in KM strategies – to have any impact, knowledge must not only be provided, there must also be someone on the receiving end who chooses to seek out knowledge, and subsequently make a decision on whether, and how, to use it. Taking this further, a lack of clarity about who the user(s) will be and what their needs are could result in KM products that are not used, or not effective.

Extensive theoretical studies have been produced on the role of KM in the corporate sector and how to most effectively promote organisational learning. The studies have tended to focus on the business dimension of KM, meaning developing strategies that can convert the intellectual assets into profit for the organisation (Gray 1996, as quoted in Dalkir, 2005); and the technology dimension of KM which is focused on identifying the most effective format, meaning a focus on information and technology systems.

While the studies on KM in the corporate sector can provide some insight into organisational learning, they do not take into account how KM is used in the public and non-profit sectors. Given that the production of renewable energy toolkits for developing countries is an activity undertaken by the international community, which is predominantly driven by the OECD governments and international organisations, we will further examine them in the context of KM and international development.

Knowledge management in international development

In government and international development, KM differs from business. The use of KM in international development is not purely an internal effort designed to bring about an improved competitive position. International development organisations embrace knowledge management to strengthen the skills and knowledge of their beneficiaries as well as their own knowledge (Ferguson et al, 2010). Thus KM in the context of international development seeks to enhance the knowledge both internally within the organisation and the knowledge based of external actors.

As noted in Section 3, KM as a focus for the international development community started to take hold in 1998 when the World Bank released the annual development

report "Knowledge for Development" (World Bank, 1998). According to the World Bank, the developing countries have suffered from information problems, which in part, were hindering their ability to develop economically. With this document, the World Bank sought to position itself as an entity to help alleviate these information problems.
However, the literature on KM in development recognises there are a number of complications in the ideology underlying the tools and strategies used to transfer knowledge to the beneficiaries of the aid and there remains significant uncertainty on the impact of KM strategies on policy processes and decision making (Hoveland, 2003). In fact, extensive knowledge exists on renewable energy technologies and relevant policies to enable or promote them. However, that information has not been fully acquired by all the relevant players in developing countries, adapted to the local circumstances, and accepted and used by the local population. This highlights a fundamental weakness of KM which is that collecting and distributing knowledge –including toolkits—does not necessarily mean that knowledge is distributed and taken up.

Criteria

Drawing on an extensive body of studies on the impact of KM on development practices, we utilise a number of the critiques that have emerged in the literature that will enable us to evaluate toolkits as learning tools. Based on the studies, we develop four criteria to evaluate a sample of existing renewable energy toolkits. The four criteria not only enable us to make concrete observations but they also help extrapolate several conceptual strengths and weaknesses in the toolkits. The toolkits are evaluated using the following criteria:

- Format
- Language
- Audience
- Information source

Each of the above is now discussed in turn.

Format

The format of the toolkit, meaning the way in which the information in the toolkit is organised, distributed, and made accessible, is crucial in determining the uptake of the toolkit. If the information cannot be found and used by the individual, or community of practice, or designated organisation, then the KM strategy has failed (Dalkir, 2005).
As illustrated in Figure 4 the majority of toolkits are made available using an ICT system (i.e. The information is stored and distributed electronically through the use of internet). However, acquiring knowledge is also linked to experience, values, beliefs and cultural practices. Thus, a key question is whether existing renewable energy toolkits, which are reliant on ICT systems, are able to capture and foster the 'tacit knowledge', or are only distributing raw information and data. If only the latter, it is questionable as to the extent to which that kind of information can be adapted and converted to country specific situations. As one expert on KM in development warned, "without human participation, even the latest technology will become redundant". Therefore we assess the extent to which the toolkits are interactive and provide for human interaction.
In addition, our evaluation of formats considers: the ability of users to respond and whether the toolkit can adapt to their changing needs; how exactly the content is structured i.e. can the items be easily found and retrieved; whether there is a standard for admitting new content into the system which ensures operational relevance and high value; and finally whether the toolkit, software model or report can be easily integrated and adapted to the targeted users' existing system (Dennon, 2006).
Finally, McDermott, amongst several other KM experts, warns development organisations to not create 'information junkyards' by over relying on ICT systems to distribute information (McDermott, 1999).

Language

Several studies on KM in development emphasise the power relations that exist in development organisations. The major criticisms directed at KM are often referred to as

the "dark side" of knowledge management. These criticisms range from highlighting the naivety of trying to collect and distribute knowledge for the betterment of individual and organisational improvement (Alter, 2006) to assertions that the sheer act of managing knowledge by its very nature entails promoting some knowledge and suppressing other knowledge (Gherardi and Nicolini, 2003). In practice, the so-called dark side of KM can mean that some knowledge may be purposefully suppressed, distorted, or misappropriated in pursuit of a specific agenda or outcome (Alter, 2006).

The use of language in the toolkits is a huge factor in determining both the content and accessibility to the users. The language that is used or not used may also be seen as an attempt by international organisation to impose their will and vision of best practices, regardless of whether they are appropriate or wanted by developing countries (Powell, 2006; Ferguson et al, 2010). Powell, a critic of the use of KM in the development sector observed: "language is not simply an instrument of speech but is, for most of us, also the main medium of thought—it represents a social process".

English is often not everyone's first language and the use of language encompasses a structure of thought and share understanding that may not be simply translatable. Countries often have very different discourses on development compared to on energy planning which may be difficult to reconcile. Thus we assess to what extent toolkits are made available in other languages, and the issues that may arise from only having English toolkits.

Audience

Different actors in the renewable energy arena have different needs and require different kinds of information. The World Bank has stated: "one of the key lessons learned from the previously developed toolkits and handbooks is that the audience found them not useful because they were not tailored to and did not fully address the needs of the audience" (World Bank, 2005). Furthermore, understanding who the intended beneficiaries are of the knowledge is essential in order to evaluate their direct impact on the specific stakeholder.

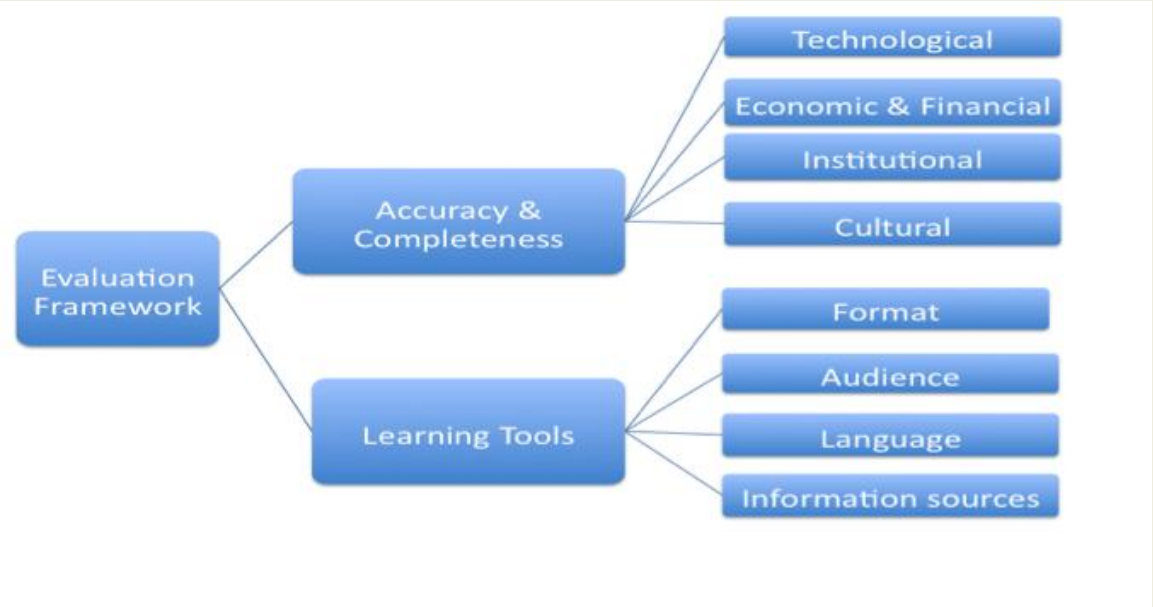
Sources of information

Toolkits purport to be the gatekeepers of the knowledge that can help deploy renewable energy in developing countries. Thus it is essential to assess what kind of information is included in the toolkits, and identify its sources.

The discussion on sources of information can be evaluated within the context of several critiques of country development. Specifically, the development community tends to run along favoured or accepted discourses, often called conventional wisdom, that drive the work of the development agencies. As these discourses are accepted and repeated, researchers have noted a tendency to follow a "blueprint development" (Roe, 1991). In these situations, success stories (or even cases that were not successful) are adopted as the dominant discourse of the agency or community of practice, and are then promoted as the accepted or right way to do things – regardless of whether they have been tested, or are appropriate in the context in which they are ultimately used (Roe, 1991). Thus KM efforts and toolkits run the risk of taking these blueprints and branding them as the correct approach to international development – irrespective of whether they are proven successes, or if they are appropriate to local circumstances.

Evaluation Framework

It is evident that in order to evaluate toolkits, both the content and the concept need to be addressed. We therefore propose a two-step framework that first evaluates the toolkits according to accuracy and completeness, and then as learning tools. Figure 10 illustrates the evaluation framework and criteria selected to apply to existing renewable energy toolkits.



Sample of Toolkits

The framework and criteria have been applied to a selection of 9 toolkits. The aim in selecting the pool of nine toolkits was two-fold: first, to identify toolkits that were produced by major actors that fund renewable energy activities; second, to select a sample of toolkits that represented a wide variety in format, producer, and content.
Furthermore, a focus was placed on selecting toolkits that are interactive and in a format that allows for the information provided to be continuously updated (i.e. portals or online databases). As such, static reports that have become or could be easily be outdated have been automatically excluded from the toolkit sample.
What follows is a table listing the toolkits that have been selected for analysis, and their sponsoring organisations:

Sponsoring Organisation	**Toolkit title**
World Bank	World Bank Renewable Energy Toolkits
IEA & IRENA	Renewable energy policies database
USAID & NREL	LEDS
Clean Energy Solutions	Clean Energy Ministerial
World Future Council	Future Policy FITS toolkit
USAID	Energy toolbox
Household Energy Network	HEDON
REEEP (Renewable Energy and Efficiency Partnership) & REN 21	REEGLE
CDKN (PWC, Fundacion Futuro Latinoamericano, INTRAC, LEAD International, ODI, and SouthSouthNorth)	CDKN Network

Table 2: Sample of toolkits for evaluation (Source: authors' analysis)

Accuracy and completeness

As articulated in section four, the toolkit pool is initially evaluated for accuracy and completeness i.e. assessing to what extent toolkits are sufficiently complete and accurate to address the barriers (and the mechanisms for overcoming them) to deploying renewable energy in developing countries. Drawing from a range of existing case studies of renewable energy projects deployed in developing countries, we classify the existing barriers into four main categories and observe how they manifest themselves in practice. We then go on to discuss to what extent the sample of toolkits (See Table 2) address the existing obstacles to deployment.

Barriers to deploying renewable energy

A barrier, for the purpose of this research, is defined as a negative condition related to the marketing and use of renewable energy technologies and prevents their widespread use (Jarach, 1989). Barriers put renewables at an economic, regulatory, and institutional disadvantage compared to traditional forms of energy (Martinot and Beck, 2004).

A plethora of academic analyses exist documenting the obstacles to expanding renewables (See for instance: Martinot and Beck, 2004; Painuly, 2001; Martinot and McDoom, 2000). The issues discussed include, imperfect capital markets; weak regulatory governance structures; poor market acceptance of the technology; financing risks; and lack of skilled personnel (Painuly, 2001).

How these barriers manifest themselves "on-the-ground" varies greatly by country, region, technology, or whether it is on-grid RET versus an off-grid rural electrification project. Nevertheless, it is useful to classify the barriers to analyse what extent the toolkits address their different elements.

Some authors (see for instance Jarach, 1989) make a distinction between the macro-barriers and micro-barriers to RET uptake. Macro-barriers are obstacles that exist at a national level and pertain to the costs of conventional energy, and to government policy measures (or lack thereof) whereas micro-barriers are the potential issues associated with the daily management, operation and maintenance of the renewable energy plants. A more recent study on renewable energy projects in North Africa emphasises that geopolitical issues should now be considered a category of barrier in itself, as risks associated with civil strife and political instability have become a major deterrent for foreign investors in the region (Komendantova et al, 2009).

We further categorise obstacles as follows: i) Economic and financial; ii) Technological; iii) Institutional; iv) Social, cultural and behavioural. Table 3 provides an overview of this classification and the salient issues associated with each type of barrier (Adapted from: Stapleton, 2008; Beck and Martinot, 2004; Painuly, 2007; Wong, 2012).

BARRIER CATEGORY	ISSUES
Economic and financial	• High capital costs • Lack of financing • Lack of access to credit for the consumer • High discount rates • Lack of policy instruments to support RETs • Dependency on donors (e.g. World Bank) for financing
Technological	• Lack of skilled personnel and training facilities • Unreliable products • Lack of scientific data
Institutional	• Lack of institutions/mechanisms to disseminate information • Lack of legal/regulatory frameworks • Difficulties in realising financial incentives due to

	corruption • Unstable macro-economic environment • Donor dependency

Toolkit/Sponsoring organisation	**Barrier**			
	Economic	Technological	Institutional	Cultural
World Bank RE toolkit	√	√	√	
IEA/IRENA policy database	√		√	
LEDS	√	√	√	√
Clean Energy Solutions	√	√	√	
Future policy.org - FITs	√		√	√
USAID toolbox	√	√	√	
HEDON		√		
REEGLE	√		√	√
CDKN	√		√	

Social, cultural and behavioural	• Lack of consumer acceptance of RETs • Unaware of the benefits of RE • RET doesn't fit in with lifestyle

Table 3: Barriers to renewable energy deployment

How do the toolkits perform?

The sample of toolkits was systematically reviewed to establish to what extent they address four major categories of barriers. The following chart illustrates the key findings:

i). Economic and financial barriers

Figure 11: Barriers addressed by toolkits (Sources: authors' analysis)

Scholars and experts on renewable energy for developing countries are largely in agreement that the remedies to financial and economic barriers include government intervention (at both the national or local level) and that a range of policies need to be implemented that focus on issues such as emissions reduction, restructuring the power sector, and rural electrification (See Table 3).

However, a case study on two solar home projects funded by the World Bank in rural villages in Bangladesh and in West India demonstrates that the difficulty is not merely implementing a set of policies to overcome financial and economic barriers. Rather the problem is how to choose the most appropriate policy mix (Wong, 2012). The high cost of solar lighting systems hampered households from obtaining them. In both projects, World Bank consultants adjusted the prices to make the technology more affordable.

Different models for costing the technologies were developed to help meet the needs of the different consumers in the villages. For instance, a universal subsidy policy was implemented to reduce the actual costs of the systems; in some instances the battery chargers were distributed for free; user-pay principles were adopted to generate a sense of ownership over the equipment.

Despite these incentives and financing policies, difficulties in the projects persisted. The subsidies for solar lantern systems were not high enough for each installation and only covered 60%; the only people who benefited from the subsidies were already well to-do and therefore the solar lighting systems did not achieve the end goal of providing energy to alleviate poverty. Furthermore, NGOs, acting as intermediaries, were offered USD 80 for each successful installation to help promote the projects and ensure their sustainability. However, the result was that NGOs would often only target customers who were able to afford the system, and they were less interested in helping the poor gain access to solar lighting (Wong, 2012). Thus it is evident there are a range of policies that have the potential to address the financial and economic barriers but they can also suffer from a series of unintended consequences if the policy impact within the specific setting is not thought through.

Returning to our sample, Figure 11 demonstrates that eight of the nine toolkits provide copious amounts of information on the policy measures that can be used to overcome economic and institutional barriers. The World Bank, REEGLE, and Clean Energy Solutions toolkits have compiled an extensive number of case studies that demonstrate the different strengths and weakness of the various credit and financing models that countries can use. These three toolkits are best described as 'virtual libraries' whereby information on the different regulatory and policy processes can be obtained. Links can also be found to manuals on how to design and implement tariffs for renewable energy. The IEA/IRENA database strives to be the most comprehensive database on existing renewable energy policies, which can be searched according to policy type, technology, or country. The other toolkits provide information on more select policies, for example the Future Policy FiTs toolkits only provide support on feed-in-tariff design and implementation.

Given how much the toolkits emphasise the importance of implementing economic and financial policies, further research was conducted to establish which ones are covered i.e. are they just focused on renewable energy, or are the toolkits including other groups of policies that are required for countries to achieve their low carbon goals?

The following table illustrates the major groups of policies established to promote renewable energy.

Policy area	**Specific actions**
Renewable energy promotion policies	• Price-setting policies • Quantity-forcing policies (Renewables Targets) • Cost reduction policies • Public investments and market facilitation activities • Power grid access policies
Emissions Reduction Policies	• Renewable energy set-asides • Emissions cap and trade policies • Greenhouse gas mitigation policies
Power Sector Restructuring Policies	• Competitive wholesale power markets • Self-generation by end users • Privatisation and/or commercialisation of utilities • Unbundling of generation, transmission and distribution • Competitive retail power markets
Distributed Generation Policies	• Net metering • Real-time pricing • Capacity credit

	• Interconnection regulations
Rural Electrification Policies	• Rural electrification policy and energy services concessions • Rural business development and microcredit • Comparative line extension analyses
Non-Energy Sector Policies (Trade, Planning and Industrial Policies)	• Tariff and non-tariff policies restricting import/export of RETs (Painuly, 2001) • Local content requirements (Lane) • Local planning policies

Table 4: Low carbon policies (Source: Martinot and Beck, 2004; Painuly, 2001)

According to our review, the toolkits addressed the following groups of policies:

	RE Promotion Policies	Emissions Reduction Policies	Power Sector Restructuring Policies	Distributed Generation Policies	Rural Electrification Policies	Non-Energy Sector Policies
World Bank RE toolkit	√		√	√	√	√
IEA/IRENA policy database	√	√	√	√	√	√
LEDS	√					
Clean Energy Solutions	√			√	√	√
Future policy.org - FITs	√					
USAID toolbox	√		√	√	√	√
HEDON						
REEGLE	√	√				
CDKN	√					

Table 5: Low carbon energy policies addressed by toolkits (Source: authors' analysis)

It is evident that the USAID, World Bank, and REEGLE toolkits take a very broad approach to policies by covering most of the relevant policy categories – albeit at far less detail than the FuturePolicy.org FIT toolkit. While these toolkits do make note of many types of relevant policies, they do not go into extensive detail about how certain policies may be relevant to a specific case. The LEDS toolkit is focused on providing links to relevant policies rather than providing their own materials on the individual issues.

This analysis illustrates that the toolkits do provide extensive amounts of information on a range of policy categories. However, the toolkits do not provide or prescribe a mechanism for knowing how to select what kinds of policies or technologies in order to address/overcome the cultural barriers a country may face in promoting renewables.

Yet the prospects for policy success are very specific to the cultural, legal and financial factors in each country. For instance, World Bank renewable energy expert Eric Martinot points out that a microcredit model worked in Sri Lanka because the country had a history of providing micro financing, already established institutions in rural areas, and a well-developed commercial banking system (Martinot et al, 2002). This credit model is unlikely to work under different circumstances. Moreover, given how broadly the toolkits cover policy issues, the toolkits are likely to be of more use for raising awareness, rather than detailed information on implementation of policies.

ii). Technological barriers

Most developing countries are well endowed with potential renewable energy sources, and unlike the majority of industrialised countries, there remains vast areas of unused land that can be used to build infrastructure. Nevertheless several technological barriers still exist for developing countries. The issues primarily have to do with selection, use, and maintenance of the renewable energy technology.

Frequently there is a lack of reliable scientific data on the potential for specific countries, which has resulted in the wrong technology being selected for the country or region. Furthermore, developing countries often do not have the capacity, skills, and data availability to conduct resource assessments. The dearth of technical knowledge and capacity has led to the distribution of poor quality technologies, and/or several of them going out of operation shortly after installation. For instance, worldwide, it is estimated that 10-20% of solar homes systems are no longer operational because they were installed without charge controllers and inadequate battery system (Laumanns & Reiche, 2004).

A number of practitioners working in developing countries have emphasised the importance of the quality of technology products—all planned renewable energy projects should specify the minimum standards for the equipment and tests/monitoring should be undertaken to confirm that the equipment meets these standards (Stapleton, 2009). Without a standard of codes and certification the product quality and acceptability is affected. Low quality products increase the purchase and commercial risks associated with renewables (Painuly, 2001).

However, the quality of the renewable energy equipment alone does not ensure that the system will not fail. Engineers and technicians are required to be trained on the ground to design, install, and maintain the systems (Stapleton, 2009).

The aforementioned case study of the World Bank project in Bangladesh showed that the poor performance of the solar lantern system was in part due to inefficient technical support. However, the problem did not lie in poor communications between the entrepreneurs (who are responsible for distributing the technology) and the manufacturers. The entrepreneurs were able to report the faults rapidly to the technicians. But the technicians could not offer immediate help because the company was not based near the community. This 'support gap' reduced the confidence of the customers and the profitability of the business (Wong, 2012). Without local technicians it is not possible to build a support system. Furthermore, the skills gap is not just amongst local technicians. Development staff also often lacks the technical skills to administer renewable energy projects (Martinot, 2001; World Bank; 2005). It is evident that toolkits not only need to provide overviews of the different technologies, but also how to develop on the ground technical capacity to ensure the projects are sustainable.

Table 4 illustrates that some of the major toolkits, including the World Bank, LEDS, USAID toolbox, and Hedon Toolkits provide how-to guides on implementing specific technologies. The World Bank toolkit has a designated technology section providing overviews of the major renewable energy technologies, including wind, village hydro, photovoltaics, and biomass. The toolkit also provides guidelines and technical and safety requirements for different technologies, which as mentioned above has been documented as a key barrier. The toolkits provide documents or links to data on renewable energy for different countries as well.

However none of the above toolkits provide advice on how to obtain data on potential renewable energy resources in specific countries. To the best of our knowledge the most comprehensive step-by-step toolkit that enables countries to conduct resource assessments is the Geospatial Toolkit, which is an NREL-developed, map-based software application that incorporates resource data and other geographic information systems date for integrated resource assessment. The NREL has specifically developed individual biomass, wind and solar resource assessments tools and thus far has conducted resource assessments for several developing countries, including Bhutan, Pakistan, and India (NREL, 2012).

Two toolkits, LEDS and REEGLE, can help guide individual countries on what technologies have worked, or what information exists on the country, as they are organised in such a way that information can be retrieved according to country/region.
Several of the toolkits provide high level overviews of the different renewable energy technologies to help inform policy makers and other stakeholders on the basics of how they function. Nevertheless, they do not resolve a key issue that developing countries face: the lack of trained staff with the capacity to maintain the equipment. Thus, the toolkits are not focused on delivering step-by-step guidance on developing on the ground technicians, and to the best of our knowledge, the toolkits do not provide any assistance on how to develop this kind of capacity.

iii). Institutional barriers

Institutional barriers include weak (or lack of) legal frameworks for independent power producers and an absence of credible regulatory and monitoring structures. Robust institutions are invaluable for providing clear and predictable signals to customers and industry to generate confidence in renewables (World Bank, as cited in Wong, 2012).
Institutional barriers manifest themselves at both the national and local and municipal levels. Without institutions at the local/regional level, deploying decentralised (off-grid) renewables is particularly difficult. Local/regional policy frameworks help stimulate NGOs to maintain and service the technologies, and encourage activity by small and medium enterprises. At the national level, strong institutions are required to set prices, plans, and established regulatory agendas. Regulatory bodies are essential to give confidence to investors that the rules will be enforced (German Federal Ministry for Economic Cooperation and Development, 2004). Unwieldy regulations lead to difficulties in realising financial incentives, as well as corruption in the system.
For example, a case study on renewables in North Africa indicated that the greatest deterrent for foreign investors was their perception of regulatory risks in the region. Investors were concerned by the lack of liberalisation and corruption in the system, and by inefficient bureaucratic processes. According to the study, the poor governance of energy institutions was due to a lack of technical capacity amongst the civil service, as well as a lack of ambition at the policy-making level (Komendantova et al, 2009).
As illustrated in Figure 11, nearly all of the toolkits address to some extent the institutional barriers. For instance the USAID Toolbox has a dedicated section on implementing electricity sector reforms. However, when looked at in depth, it is merely a presentation on the topic that outlines some of the key components of the process. Similarly, the World Bank and REEGLE toolkits provide access to documents that touch on institutional reform, however there is no ranking system of the documents or guidance to know where to begin. The LEDS tool is unique in that it allows for the user to walk themselves through the various steps of implementing the process of transition to a low carbon energy system and to evaluate private and public sector capacity to implement a low-carbon strategy. Links to reports on how other countries have implemented capacity assessments are provided. However, whilst the toolkits can provide some information on the processes, they are unlikely to provide sufficient support for strengthening the institutional capacity in practice.

iv). Social cultural and behavioural barriers

The impact that social, cultural and behavioural barriers have on renewables cannot be underestimated. The risk of overlooking the cultural barriers is especially high in developing countries given that it is the international community that is leading the transition (see section 3), which in practice is led by OECD countries.
Cultural barriers include a lack of social acceptance for certain RETs - a technology can be seen as alien and not to have any potential benefits. Often there is a preference for traditional forms of energy and thus resistance to change. Referring back to the case study on the distribution of solar lanterns in the community in Bangladesh—there is no doubt that the solar lanterns provide better quality of lighting than kerosene, the traditional fuel used for lighting in town. However, the case study illustrates that the use of kerosene provided the villagers with a much greater sense of security. Solar lanterns provided four to five hours of hours of lighting per day and households had to pay the rent whether they used the light or not. Unlike liquid kerosene, there was no way for a

household to save solar lighting for future use if they did not require the full use of the lantern one day. Furthermore, because of its liquid format, kerosene could be easily shared amongst villagers and traded. As result, the community was very resistant to transitioning to solar lanterns (Wong, 2012). Another case study pointed out that the dissemination of solar cookers has often been unsuccessful because the cookers worked only during day-light hours, whereas households were accustomed to prepare meals after dark and indoors (Laumanns & Reiche, 2004).

According to our classification, only LEDS, REEGLE and the FIT toolkit are structured in such a way as to potentially address the cultural barriers that exist to deploying renewable energy because they allow for some interaction and a mechanism to adapt information to specific contexts and situations. LEDS and the FIT toolkit allow local policy makers to carry out self-diagnostics to identify the kinds of policies and areas of reform required. They help the user identify what kind of information and assistance is required for their specific circumstances. REEGLE organizes information according to country and enables policy makers to assess what kind of work and information on their specific country exists already. Cultural barriers to renewables are the result of an inappropriate policy and technology mix being selected that is not compatible with the social nuances of a society.

We acknowledge that no toolkit will be able to provide a solution that is universally applicable. However, the toolkits could benefit from a mechanism that enables a country to conduct a self-diagnostic to assess what kind of technologies and policies could be applicable. The LEDS toolkit is the most comprehensive diagnostic toolkit that walks local policy makers through the entire process of developing a 'Low Emissions Development Strategy'. It was developed to help countries organise the process, assess the current situations, analyse different options, and prioritise actions. The toolkit is organised in such a way that it compiles the various resources and existing renewable energy tools, and organises them according to what phase of the 'LEDS Process' the country is in. Similarly the FIT tool, albeit limited to focusing on the design of a feed-in tariff, supports the country through the process, starting with assessing applicability to the country's existing situation. REEGLE, although it does not explicitly provide a self-diagnostic, organises information in such a way that it is accessible by country and region. This enables stakeholders to assess what policies and frameworks already exist in their country, look at what neighbouring or comparable countries have established, and access resources on topics of interest.

Conclusion

A large variety of renewable energy toolkits exist that provide extensive information on the economic and financial, institutional and technological dimensions to renewable energy. Specifically, copious amounts of information exist on the various policy measures associated with deploying renewables. However, as illustrated by the case studies, the barriers to renewables in developing countries are not a result of the lack of available policy and technology options. Rather it is about knowing which ones to select, and predicting how they will interact with other existing policies, and social and cultural factors. Furthermore, although the toolkits provide a broad coverage of technology issues, they do not address how to develop on the ground technical capacity which is essential to maintain the RET systems. It appears that, with the exception of the LEDS and the Future FITs policy toolkits, the other tools do not provide any interactive capacity that is essential to address cultural barriers that are country/region specific.

Existing toolkits contain a substantial amount of information. Some of the toolkits are more up to date than others—for instance REEGLE is a comprehensive platform that is up-to-date, whereas much of the information on the World Bank toolkit was last updated in 2005. Thus, there may be marginal gains in trying to develop another comprehensive and accurate toolkit that seeks to address in further detail economic, financial, and technological dimensions.

The issue, we believe, is not more information. Rather it is the way in which it is organised, and the way in which others can adapt this information to specific circumstances. The cultural barriers are rarely addressed by the toolkits. This is not because the toolkits are not providing accurate information but because cultural barriers

are not addressed and the format is not adaptable to country-specific situations. In order for cultural barriers to be addressed, toolkits may need to be reframed as learning tools. Evaluating them as such will provide insight into how toolkits can address the barriers as they manifest themselves on the ground, and not just in theory.

Learning tools

We now move on to evaluating toolkits as learning tools, the second part of the framework. The evaluation seeks to challenge the underlying concept of a toolkit as a learning device, rather than challenging the specific content and materials included. Four criteria will be applied to the sample of nine toolkits (See Figure 6 for table of toolkits). The evaluating criteria are: format, language use, targeted audience and source of information (See section 4.3.3 for a description of the criteria).

Format

The format of toolkits refers to the way in which the information on renewable energy is organised and the mode through which it is distributed. Toolkit formats not only determine who can access the information, but also the extent to which a user can find the information needed, engage with it, and adapt it to the circumstances specific to their country or region.

All nine of the toolkits selected are web portals accessed through the internet. The web portal format has several benefits—it allows for broad access and the sponsoring organisation is able to update information continuously. However, with the exception of the LEDS and Future Policy toolkits, the portals are rarely organised in such a way that the user can easily identify what kind of information they should be looking for. Thus more progressive toolkits incorporate a self-diagnostic element to the tool. With the exception of the toolkit done by REEEP and the one produced by the Clean Energy Ministerial, none of the selected toolkits enable the user to interact and ask questions. REEEP and the Clean Energy Ministerial provide an option of contacting an expert who can provide tailored advice specific topics.

As illustrated in Figure 4, most of the toolkits identified were reports that were then published on web portals. Thus the toolkits are acting as a library rather than an advisory service. Reports are easily outdated, and their length and unwieldiness makes it difficult for users to identify what the need. This exacerbates the problem that policy makers and other vested stakeholders often may not know what kind information they should be looking for.

The overreliance on ICT to deliver renewable energy toolkits touches on a number of issues raised in studies on knowledge management for development. Although in theory ICT provides access to a huge number of people, in developing countries ICT can have several limitations. There can be digital illiteracy, a high cost of access to telecommunications, and either low-level or no access at all to internet services. For instance, in Africa there are 4.2 million Internet users (excluding South Africa) with a population of about 850 million (Jain, 2006). This means that 99.99% of the people have no Internet connection. Moreover, Internet growth is held back by a range of constraints including poor telephone infrastructure, and low international bandwidth (Jain, 2006).

Whilst using ICT to drive knowledge management does enable large amounts of information to be distributed, it does not acknowledge the 'relationship' aspect to managing and acquiring knowledge. The toolkits simply become 'repository systems' for information and what remains absent is the ability to share and to learn tacit knowledge (the knowledge acquired through personal experience) (Ferguson et al, 2010). Moreover, by just depending on ICT, organisations are taking an approach to knowledge management whereby the knowledge becomes divorced from its users. The result is that the production of the toolkit becomes the end in itself with little consideration for the potential audience (Fahey and Prusak, 1998).

Language

Similar to format, the use of language also influences who is able to use it. Toolkits produced by the international community are predominantly in English, with the exception of REEGLE. This toolkit has created a function whereby users can search for documents that have been produced in French and Spanish. Additionally, it creates an added difficulty for non-English speakers to *contribute* their input and perspectives – further exacerbating potential bias and lack of local context in international development KM tools.

Audience

As illustrated in Figure 5, the majority of toolkits either do not specify who exactly it is for, or they explicitly state that it is for a wide range of stakeholders. For instance the World Bank Renewable Energy Toolkit states that it has been developed to 'assist bank staff and country counterparts' to improve the design and implementation of renewable energy projects. REEGLE, a clean energy information portal, sponsored by the REEEP partnership, states that it is targeting a range of stakeholders, including governments, project developers, businesses, financiers, NGOS, academia, international organisations and civil society. Similarly, Practical Action, who developed a toolkit for Oxfam and Christian Aid, states that it is a toolkit developed to build the "skills and knowledge of their staff and partners to deliver energy access projects for poverty reduction worldwide'. By contrast, the interactive FiT website is not specifically targeting development staff, rather it is targeting "users around the world looking to introduce or improve FIT laws in their country or region" (FuturePolicy, 2012). The software models developed for energy planning such as HOMER require users that are numerate and have quantitative skills in order to input data accurately and interpret results. It is evident that the toolkits tend to have broad audiences and rarely target specific stakeholders. Several of the toolkits produced by development organisations do not specify whether they have been produced for development staff or explicitly for policy makers of the targeted country.

Knowledge management in international development can be divided into two sub-areas: knowledge management internal to the international organisation to improve organisational performance; and knowledge management external to the organisation to improve knowledge in developing countries and/or to impact policy or development outcomes. Often, KM products in international development organisations are aimed at achieving both goals (internal and external), where perhaps they would be better able to achieve their goals if they were distinctly developed for each relevant audience. Ferguson et al (2010) highlight a similar conclusion in their study of KM in international development organisations noting that "Bilateral Agency Knowledge Management interventions were geared toward supporting and satisfying higher management layers, rather than local considerations." Similarly, renewable energy toolkits, by not defining their audience group and trying to target the needs of both internal staff, as well as external stakeholders, result in formats and solutions that risk being of little use to everyone.

Sources of Information

The objective of a toolkit is to provide information that is not only useful, but also provides the 'solutions' to deploying renewables. To some extent toolkits may claim to have the 'universal truth' regarding the problem (Ferguson et al, 2010). In attempting to collect and codify a person or group's knowledge, the manager is branding that particular knowledge as the right one. In the context of renewable energy toolkits, this could have the effect of crowding out many good ideas and solutions, in particular more localised solutions, because they have not been explicitly codified.

Several of the toolkits are libraries that collate information from other sources. For instance, the REEGLE toolkit states on its website that it collects information from over 100 sources including IEA, World Energy Council and so forth. However, most of the sources are other international organisations or agencies. Similarly, the World Bank is

taking information from its own internal projects as well as other development agencies such as the UN. Many of the toolkits, such as Hedon, put links to other toolkits that have been produced. In other words several of the toolkits act as electronic libraries which contain toolkits produced by other international organisations.

CONCLUSIONS AND RECOMMENDATIONS

There are a substantial number of renewable energy toolkits whose aim is to help promote renewables in developing countries. They cover a wide range of topics—including the different technology options; various financing and policy instruments; and legal and regulatory guidance for specific kinds of renewable energy projects. Materials include manuals, best practices from other countries and case studies. The international community has produced the majority of existing renewable energy toolkits, and they are predominantly products of wider development efforts made by international organisations and OECD governments. The aim of this Working Paper was to assess whether the existence of renewable energy toolkits advances the agenda of promoting renewable energy deployment in developing countries. This is a particularly important question given the number of toolkits that exist, and that evaluations of them are sparse.

Although toolkits provide a great deal of information on various aspects of renewables development, they are not unequivocally helpful. Toolkits address the barriers to deploying renewables but typically only at a high or theoretical level. For example, toolkits tend to provide details of different regulatory and economic policies. However, the literature suggests that where projects fail, it is not for lack of information, but rather poor decision-making and analysis of information. The toolkits reviewed rarely provide a mechanism to adapt general information to specific situations.

Other obstacles to the development of RETs that have been identified include weak institutions and a lack of on-the-ground technical capacity. Once again, toolkits have been found to rarely address this capacity or institutional support structures, and do not nurture the decision-making skills that would most successfully enable countries to become independent from development assistance.

Renewable energy toolkits have their merits but suffer from some important limitations. Existing toolkits tend to promote a one-way transfer of information, and that does not necessarily equate with the transfer of knowledge in a form required by users in different regions and countries. Toolkits are over-reliant on the use of ICT to deliver information. The result is that the toolkit producer is able to disseminate large amounts of information, however it eliminates almost entirely the human dimension to acquiring knowledge. Toolkits that only use ICT to deliver information are rarely able to develop a format that is interactive with the user. Because users can find it challenging to adapt the information, existing toolkits are considered to be poor in overcoming social and cultural barriers to renewables. Further, the majority of toolkits provide little capacity for local stakeholders to direct their input and engage and challenge the content.

These weaknesses are exacerbated when audiences for the toolkits are poorly defined. It is evident that different audiences have very different needs. In addition, toolkits also need to be evaluated in light of existing information. However, this research finds that information in toolkits is often, although not always, recycled from other toolkits or similar materials produced by international organisations. Therefore, the marginal value of such a contribution is open to question.

Moreover, an extensive review of the literature on knowledge management and the development sector revealed that there are few studies (and none specifically in the renewables sector) documenting whether knowledge management activities increase the ability of institutions to take the information into account in their policy models.

Based on the results from evaluating toolkits for accuracy and completeness, and as learning tools, we come to the following conclusions:

- Given the amount of information already in existence, the marginal gains from developing a more accurate and complete toolkit may be relatively small.

- In any case, the concept of using toolkits as learning tools does need to be revisited.
- A progressive approach should consider focusing on two-way engagement rather than a one-way transfer of knowledge.
- Toolkits or learning tools developed with a poorly defined audience are unlikely to achieve this two-way engagement.
- There is little empirical evidence on whether KM activities such as the production of renewable energy toolkits influence policy making and implementation.

As such, we suggest the following recommendations:

- Toolkits could be better constructed with due regard to a specific context and embedded within a particular social and geographic environment, rather than deriving solely or largely from more generic global development efforts.
- Toolkits should be developed and used within a national framework that covers different environmental management tools, legislation and decision-making process. The toolkit should provide information and a system to extract information that can be integrated with existing environmental management tools, and policy frameworks used in a given country. Toolkits are unlikely to be as effective if they are used as a single stand-alone tool.
- Further research into measures taken to promote capacity building (both institutional capacity and technical training) would be valuable in order to identify what kind of tool or assistance has had a positive impact in these areas, and whether it could be applicable to the renewables sector.
- Develop a case study in a specific region/country to assess to what extent donor-funded projects in the realm of knowledge management & renewable energy have influenced practitioners to take specific policies into account in their everyday work.

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2. ANNEX 1: TOOLKIT INVENTORY

No.	Main Sponsoring Organization	Toolkit Title	Produced By	Regional Focus	Format	Technology or Policy Focus?	What Technology?	What Policy?
1	RESURL & DFID (with Judith Cherni)	SUREDSS	Research community	Global Developing Countries	Model/software	Both	Neutral	Neutral
2	Authors: Miguel Mendonca, Jacobs David, Sovacool Benjamin	Powering the Green Economy	Research community	All Countries	Other	Policy		Financial/Economic
3	CARE	Toolkits for integrating climate change into development projects	NGO	Global Developing Countries	Report	Both	Neutral	Neutral
4	Clean Energy Ministerial	Clean Energy Solutions Centre	IO	All Countries	Portal	Both	Neutral	Neutral
5	Christian Aid /UNFCC	Renewable energy to reduce poverty: planning decentralized renewable energy projects	NGO	Global Developing Countries	Report	Both	Neutral	Financial/Economic
6	DFID	Best Practices for Sustainable Development of Micro Hydro Power in Developing Countries	Government	Global Developing Countries	Report	Both	Hydro	Financial/Economic

No.	Main Sponsoring Organization	Toolkit Title	Produced By	Regional Focus	Format	Technology or Policy Focus?	What Technology?	What Policy?
7	Eric Martinot	Eric Martinot (Ex-World Bank Consultant and RE specialists) personal website	Research community	Global Developing Countries	Portal	Policy		Neutral
8	Eric Martinot et al. , 2001	World Bank/GEF solar home system projects: experiences and lessons learned 1993-2000	Research community	Global Developing Countries	Report	Both	Solar	Neutral
9	ESMAP/BNWPP	Stakeholder Involvement in Options assessment: promoting dialogue in meeting water and energy needs.	IO	Global Developing Countries	Report	Both	Hydro	Neutral
10	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	Renewable Energy and the Clean Development Mechanism: Potential, Barriers and Ways Forward - A Guide for Policy Makers	Government	Global Developing Countries	Report	Policy		Financial/Economic
11	REN 21	Capacity Development, Education & Training: Integrated and sustained action is the key	IO	Global Developing Countries	Report	Policy		Institutional/Capacity
12	HEDON	Various toolkits under the publication sections of the portal	NGO	Global Developing Countries	Portal	Both	Neutral	Neutral

No.	Main Sponsoring Organization	Toolkit Title	Produced By	Regional Focus	Format	Technology or Policy Focus?	What Technology?	What Policy?
13	IEA	Global Renewable Energy: Policies and Measures	IO	All Countries	Portal	Policy		Neutral
14	IEA	IEA PV system programmes	IO	Global Developing Countries	Portal	Both	Solar	Neutral
15	IEA	Renewable Energy Services for Developing Countries: Reccomended Practice & Key lessons	IO	Global Developing Countries	Portal	Both	Solar	Neutral
16	IEA /RETD	Strategies to Finance Large Scale Deployment of Renewable Energy Projects: An Economic Development and Infrastructure Approach	IO	All Countries	Report	Policy		Financial/Economic
17	Intelligent energy (EU)	Reinforcing provision of sustainable Energy services in Bangladesh and Indonesia for Poverty Alleviation and Sustainable Development	IO	Asia	Report	Both	Neutral	Neutral

No.	Main Sponsoring Organization	Toolkit Title	Produced By	Regional Focus	Format	Technology or Policy Focus?	What Technology?	What Policy?
18	Intelligent energy (EU organizations)	Promotion of the efficient use of renewable energies in developing countries: Financing tools scan in Cambodia	Government	Asia	Report	Technology	Biomass	
19	International Solar Energy Society	Renewable Energy Future for the Developing World	NGO	Global Developing Countries	Report	Policy		Neutral
20	IPCC/SRREN	Renewable energy sources and climate change mitigation	IO	All Countries	Report	Both	Neutral	Neutral
21	NREL	The Geospatial Toolkit	Research community	All Countries	Portal	Technology	Resource Assessment	
22	National Rural Electric Cooperation (Published on: Reseau International d'Acces aux Energies Durables.)	Mini Grid Design Manual	Research community	Global Developing Countries	Report	Technology	Neutral	
23	Natural Resources Canada	RET Screen Clean Energy Project Analysis Sofware	Research community	All Countries	Model/software	Technology	Neutral	
24	NREL	HOMER	Research community	All Countries	Model/software	Technology	Neutral	

No.	Main Sponsoring Organization	Toolkit Title	Produced By	Regional Focus	Format	Technology or Policy Focus?	What Technology?	What Policy?
25	Open Energy Info (funded by USAID & NREL)	Low Emissions Development Strategies Toolkit (LEDS)	Research community	All Countries	Portal	Policy		Neutral
26	Practical Action produced the toolkit for Christian Aid and OXFAM	Interactive RE toolkit	NGO	Global Developing Countries	Portal	Both	Neutral	Financial/Economic
27	REN 21	A series of thematic background papers such as Traditional Biomass Energy:Improving its use and moving to modern energy use	IO	Global Developing Countries	Report	Policy	Biomass	Neutral
28	Renewable Energy & Energy Efficiency partnership (REEEP)	Geospatial Toolkit for Renewable Energy Planning and Policy	IO	All Countries	Model/software	Technology	Neutral	
29	Renewable Energy & Energy Efficiency Partnership (REEEP)	REEEP digital library	IO	All Countries	Portal	Both	Neutral	Neutral
30	Renewable Energy & Energy Efficiency Partnership (REEEP) / UNIDO	Sustainable Energy Regulation and Policymaking for Africa	IO	Africa	Portal	Policy		Neutral
31	UN	Energy for Sustainable Development in Africa	IO	Africa	Report	Policy		Neutral

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32	UNDP	Gender and Energy for Sustainable Development	IO	Global Developing Countries	Report	Policy		Neutral
33	UNDP	Bioenergy primer: modernised biomass energy for sustainable development	IO	Global Developing Countries	Report	Technology	Biomass	
34	UNEP	Implementation of Renewable Energy Technologies: Project Opportunities and Barriers Summary of Country Studies	IO	Africa	Report	Policy		Neutral
35	UNEP	Wind Power Projects in the CDM: Methodologies and Tools for Baselines and Carbon Financing and Sustainability Analysis	IO	Global Developing Countries	Report	Both	Wind	Financial/Economic
36	UNEP	Experience with PV systems in Africa: Summaries of selected cases	IO	Africa	Report	Both	Solar	Neutral
37	UNEP	Private financing of renewable energy : A guide for policy makers	IO	Global Developing Countries	Report	Policy		Financial/Economic
38	UNESCO	Solar Photovoltaic Systems Technical Training Manual	IO	Global Developing Countries	Report	Technology	Solar	

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39	United States Energy Association	Handbook on Best Practices for the Successful Deployment of Energy, Grid-Connected Renewable Energy, Distributed Generation, and Combined Heat and Power in India	Government	Asia	Report	Policy		Neutral
40	US Geological Survey	Hydroelectric Power: How It Works	Government	All Countries	Portal	Technology	Hydro	
41	USAID	Grid Connected Renewable Energy Toolkit: Annotated Bibliography	Government	Global Developing Countries	Other	Both	Neutral	Neutral
42	USAID	USAID Renewable energy toolkit: Report on grid-connected RE; one on stoves programmes in DC.	Government	Global Developing Countries	Portal	Both	Neutral	Neutral
43	World Future Council & Climate Parliament	Feed-In Tarrifs: A policy solution for FiTs	IO	All Countries	Portal	Policy		Financial/Economic
44	World Alliance for Decentralized Energy (WADE)	Guide to Decentralized Energy Technologies	NGO	All Countries	Report	Technology	Neutral	
45	World Bank	Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices	IO	Global Developing Countries	Report	Policy		Neutral

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46	World Bank	Renewable Energy Toolkit Needs Assessment	IO	Global Developing Countries	Report	Both	Neutral	Neutral
47	World Bank (Independent Evaluation Group)	Evaluation of World Bank's assistance for RE project	IO	Global Developing Countries	Report	Both	Neutral	Neutral
48	World Bank RE tool kit	World Bank RE toolkit	IO	Global Developing Countries	Report	Both	Neutral	Neutral
49	World Bank/ESMAP	Hands-On Energy Adaptation Toolkit (HEAT)	IO	Global Developing Countries	Portal	Policy		Neutral
50	World Bank/ESMAP	Tool for Rapid Assessment of City Energy (TRACE)	IO	Global Developing Countries	Portal	Both	Neutral	Neutral
51	World Energy Council	Assessment of Energy Policy and Practices	IO	All Countries	Report	Policy		Neutral
52	World Energy Council	Renewable Energy Projects Handbook	IO	All Countries	Report	Both	Neutral	Neutral
53	World Energy Council	Policies for the Future 2011: Assessment of Country Energy and Climate Policies	IO	All Countries	Report	Policy		Neutral

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54	REN 21	National Policy Instruments: Policy Lessons for the Advancement & Diffusion of Renewable Energy Technologies Around the World	IO	All Countries	Report	Policy		Neutral
55	Barlow et al.	Wind Pumps: A Guide for Development Workers	Research community	Global Developing Countries	Other	Technology	Wind	
56	Khennas et al.	Small Wind Systems For Rural Energy Services	Research community	Global Developing Countries	Other	Technology	Wind	
57	GTZ	New Prospects in Solar Cooking-The GTZ Manual	Government	Global Developing Countries	Other	Technology	Solar	
58	Harvey and Brown	Micro-hydro design manual: a guide to small scale water power schemes	Research community	Global Developing Countries	Other	Technology	Hydro	
59	NREL	Hybrid 2	Research community	All Countries	Model/software	Technology	Resource Assessment	
60	NREL	Vipor	Research community	All Countries	Model/software	Technology	Resource Assessment	
61	NREL	Energy10	Research community	All Countries	Model/software	Technology	Resource Assessment	
62	NREL	LEAP	Research community	All Countries	Model/software	Technology	Resource Assessment	

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63	Clean Energy First	Resource Library	NGO	All Countries	Portal	Technology	Neutral	
64	Deutsche Bank/UN	Get FiT	Partnerships	Global Developing Countries	Report	Policy		Financial/Economic
65	RenDEV	Multiple toolkits	IO	All Countries	Portal	Both	Neutral	Neutral
66	REEEP	REEGLE	Partnerships	Global Developing Countries	Portal	Both	Neutral	Neutral
67	CDKN	CDKN Network	Partnerships	Global Developing Countries	Portal	Both	Neutral	Neutral