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1 Can the Green Economy deliver it all? Experiences of 2 renewable energy policies with socio-economic objectives

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9 **Abstract:** The Green Economy (GE) paradigm aims to reconcile environmental and socio-economic
10 objectives. Policies to deploy renewable energy (RE) are widely perceived as a way to tap the
11 potential synergies of these objectives. It is, however, still largely unclear whether the potential of
12 simultaneously achieving both environmental and socio-economic objectives can be fully realized,
13 and whether and how multiple objectives influence policy design, implementation, and evaluation.
14 We aim to contribute to this aspect of GE research by looking at selected country experiences of
15 renewable energy deployment with respect to the socio-economic goals of job creation or energy
16 access. Across the cases examined, we find the following implications of relevance for the GE
17 framework: First, we confirm the important role of governmental action for GE, with the specific
18 need to state objectives clearly and build monitoring capacity. Second, consistent with the “strong”
19 green growth variant of GE, some of the cases suggest that while renewable deployment may indeed
20 lead to short-term socio-economic benefits, these benefits may not last. Third, we underline the
21 urgent need for new methodologies to analyze and better understand multiple-objective policies,
22 which are at the heart of the GE paradigm.

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27 Kennedy School’s Belfer Center for Science and International Affairs.

1. Introduction

One of the main premises of the “Green Economy” (GE) concept is that low-carbon energy technologies have considerable potential to achieve socio-economic objectives alongside environmental ones. In essence, the GE paradigm promises a new holistic model of societal well-being. This is evident from UNEP’s definition of the concept: A green economy “results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities” (UNEP 2011). However, GE is a relatively vague concept that builds on a number of implicit assumptions, which have been scrutinized in scientific literature. In this regard, Bowen & Hepburn (2014), largely based on Jacobs (2013), identify two forms of green growth (GG), which can be seen as more specific versions of a GE. “Standard” green growth concepts postulate that green (i.e. environmental) policies will reduce economic growth in the short run, but increase it in the long run. In contrast, “strong” green growth asserts that green policies can also increase economic growth in the short run. Bowen & Hepburn (2014) further claim that from a theoretical point of view, strong green growth may only hold under one of the following conditions: (a) if, during an economic downturn, green policies provide an important stimulus for economic recovery (“green Keynesianism”); (b) if green policies explicitly address existing market failures, for example an inadequate provision of infrastructure; or (c) if green policies incentivize entrepreneurs to establish competitive advantage in green technologies and services through associated innovation.

Apart from its dependence on specific assumptions, the concept of GG is also questioned on fundamental grounds. First, critics of the so called “growth imperative” like Daly (2013) question whether growth – green or otherwise – can actually increase wealth, or at least increase it faster than illth. Jakob & Edenhofer (2014) question whether growth in general, as well as de-growth as an alternative, are useful approaches at all. They reason that growth as an approach fails to explicitly identify the objectives that should ultimately be achieved *via* economic growth. In other words, they see growth as a means, rather than as an end, to achieve societal welfare. One implication of this stance for the GG and GE concepts is the necessity to specify policy objectives, so as to evaluate the performance of green policies in achieving them. The most important reference here is certainly the Sustainable Development Goals (SDGs), not least because it has been explicitly argued that a GE is essential for sustainable economic development (Barbier & Markandya 2013). We therefore depart from a focus on growth as a metric to assess the relevance of the GE concept in policy-making and look at the interlinkages between renewable energy policies and jobs as well as energy access.

The above GE literature raises several important questions that motivate this paper and are addressed in four exploratory case studies. First, to what extent do green policies explicitly target socio-economic objectives or are even driven by these objectives? For instance, empirical evidence suggests that RE deployments, particularly in developing countries, are often implemented as socio-economic policies; see for example Recalde (2015) on Latin America and Steinbacher (2015) on Morocco. This is important because formulated or intended objectives obviously determine how policies are designed and evaluated, and are also likely to affect how they perform in achieving multiple objectives. In fact, this issue of multi-objective policies is as yet largely unexplored in the literature. A second relevant aspect with a view to the “strong” green growth concept outlined above is to explore whether green policies are able to bring about socio-economic benefits in the short to mid term – and not only in the long term. Against this background, we aim to look at several countries’ experiences along these two lines of inquiry – the role of multiple objectives in policy design and stated short-term benefits in terms of outcomes – and reflect upon their implications for

1 GE and GE research. We aim to add value to the GE debate by covering heterogeneous cases – South
2 Africa, Germany, Morocco, and Kenya - and derive lessons learned from these countries. Our aim is
3 exploratory in nature and we do not strive to judge or evaluate policy effects in particular cases.

4 Specifically, we focus on policies for the deployment of renewable energy and two socio-economic
5 objectives identified by SDG 7 and 8, namely the provision of energy access and job creation.
6 According to UNEP (2011), low-carbon technologies – particularly renewable energies in the
7 electricity sector (RE) – bear considerable potential for making progress towards these and other
8 objectives, such as public health and energy security. The IEA (2013) emphasizes the role of RE in
9 achieving universal access to modern energy sources by 2030, while IRENA (2016) underlines their
10 potential for job creation. The socio-economic dimension of RE is also acknowledged in climate
11 change science and global policy debates. In particular, the recent IPCC AR5 (2014) finds that
12 measures to deploy RE are often associated with other societal goals – and a positive interaction is
13 believed to create the possibility of “co-benefits.”

14 Existing research on analyzing the potential of job creation or energy access through RE policies are
15 largely model-based *ex-ante* assessments. A number of existing studies cover the potential of job
16 creation through clean energy policies, both in developing and in developed countries; see for
17 example Dai et al. (2016), Bowen & Kuralbayeva (2015) and the studies cited in IPCC (2012), OECD
18 (2010), and GIZ (2015). Most of these studies focus on gross employment and suggest that an
19 expansion of RE has positive effects. A smaller number of studies, using more sophisticated models,
20 analyze net employment impacts, and the results of these also suggest that effects are positive. A
21 notable exception, contrasting policy targets with outcomes, is Rathmann et al. (2012), who look at
22 the Brazilian biodiesel program and find that the “promised land” has not been reached. From a
23 theoretical point of view, Fankhauser et al. (2008) point out that gross employment can indeed be
24 positive for two reasons: First, sectors immediately related to RE production are likely to expand.
25 Second, these sectors are, in general, more labor intensive than traditional industries. The authors,
26 however, also underline that direct employment gains are likely to diminish when technologies
27 become mature. Long-term employment can, however, be sustained when RE expansion is successful
28 as a green industrial policy, i.e. in building up an industry that is globally competitive (e.g. Rodrik
29 2014).

30 Concerning energy access, several studies point to the large potential of decentralized RE for
31 electrification, especially in rural areas (IPCC 2012, REN21 2014). However, initiatives for distributed
32 renewable energy face a distinctive set of technical, policy, financial, institutional, and regulatory
33 challenges (Palit 2013; WRI 2015). Several studies have identified the main barriers to the
34 deployment and uptake of small-scale renewables; see for example Chaurey & Kandpal (2010),
35 Sovacool et al. (2011), IOB (2014) and Urpelainen (2016) specifically for solar home systems (SHS).
36 For these reasons it is widely assumed that grid connection is generally preferred as an option where
37 it is feasible (van der Vleuten et al. 2007). Intermittency and capacity constraints of RE systems can
38 also limit the extent to which they can satisfy commercial and productive needs, or increasing
39 demands associated with growing appliance use. Even in areas where renewables-based options are
40 competitive, they may still be unaffordable for poor rural households. Innovative business models or
41 financing may be needed to make these affordable. While off-grid renewables are becoming
42 increasingly competitive with grid-based systems, particularly in remote rural regions, the fraction of
43 population whose demand will be met through such systems remains open to debate (Deichmann et

1 al. 2011; Zeyringer et al. 2015), and evidence on impacts is still insufficient (Azimoh et al. 2015;
2 Jürisoo et al. 2014; Rao et al. 2016).

3 In summary, there are gaps in the literature regarding the realization of the seemingly high potential
4 and respective expectations of RE's contribution to socio-economic objectives. Studies in this
5 direction are so far relatively sparse in the literature; this is particularly the case for large-scale RE
6 deployment policies that are still a relatively new development.

7 The remainder of this paper is structured as follows: Section 2 describes the methodology used.
8 Section 3 covers the case studies on RE policies and job creation in Germany and South Africa, while
9 section 4 covers the Moroccan and Kenyan case studies on the deployment of renewables for energy
10 access. Section 5 discusses the key findings from the case studies for the GE paradigm and Section 6
11 concludes.

12 **2. Methodology**

13 Given the lack of empirical studies that specifically look at the links between renewable energy
14 policies and socio-economic objectives, our aim in this paper is to cover a diverse range of cases in an
15 exploratory manner and thereby help prepare the ground for more in-depth studies. In other words,
16 our overarching aim is to grasp and present country experiences with the design and implementation
17 of policies at the intersection of renewable energy promotion and socio-economic objectives. By
18 doing so, we also strive to identify common patterns across these diverse cases and to link them back
19 to the theoretical green economy debate. Importantly, we do not conduct original evaluation of any
20 specific policy, which would be beyond the scope of this paper.

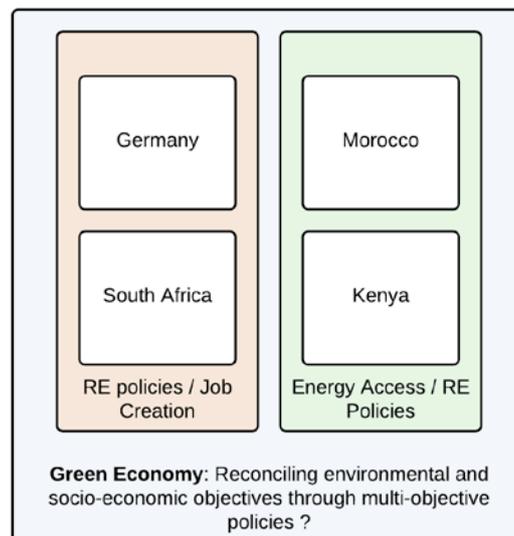
21 Methodologically, we approach the question of interlinkages between RE policies and socio-
22 economic objectives by adopting a “multiple-case” design (Yin 2009: 48). In this design, several
23 processes and events are taken into account within each case study. Cases are looked at separately
24 in a first step and are then compared in a second step. Case studies are described by Gerring (2004)
25 as “an intensive study of a single unit with an aim to generalize across a larger set of units.” Of
26 course, the confines of this paper and our decision to address four diverse cases limit the depth to
27 which each case can be studied, as well as generalization of respective findings. Within each case
28 study, we mainly rely on a review of secondary sources (e.g. policy documents, statements,
29 evaluations, analysis from in-country experts regarding the programs). In South Africa, primary data
30 from sixty interviews carried out with stakeholders and decision-makers in late 2014 was also used
31 (Steinbacher forthcoming). Not relying on original research and making use mostly of gray literature
32 of course limits the validity of results somewhat. Accordingly, we only claim indicative evidence in
33 each case, which requires further peer-reviewed scientific research to be confirmed and better
34 understood.

35 Case selection in this paper is based on a set of criteria that make Germany, South Africa, Morocco,
36 and Kenya important cases for further hypothesis generation and theory building in the GE literature
37 (on case studies and inference see George & Bennett 2005 and Levy 2008). First, initial case-
38 knowledge suggests multiple policy objectives are likely to have played a role in policy formulation in
39 the four cases. Furthermore, the selected cases are salient – and sometimes even emblematic – and
40 are often referred to as examples; see for example Le Cordeur (2015) on South Africa and Morgan &
41 Weischer (2013) on Germany. A second point considered in selecting the cases was to ensure that

1 the policies or programs examined were large enough in scope and ambition to demonstrate
2 discernible effects, which also ensures that data on policies is available. That said, the latter is an
3 issue for further research and mentioned again in section 5 of this paper.

4 The in-case analysis is structured along the lines of a strongly simplified model of the policy process,
5 i.e. the policy cycle (Dunn 2012). Despite numerous critiques (Fischer et al. 2007: 55), the policy cycle
6 is a useful tool/framework, enabling us to discuss the role of multiple objectives in the agenda-
7 setting, policy formulation, and implementation phases. The policy process implies the following four
8 questions guiding the structure of our exploratory, short case studies: (1) Are multiple objectives
9 pursued with the adoption of the policy? (2) Exactly how are these objectives reflected in policy
10 design? (3) What results are visible and how are these appraised? (4) Are tradeoffs or synergies
11 visible and do they appear to influence policy redesign or the stability of policies, or possibly even
12 termination?

13 Figure 1 provides an overview of the structure of our case studies:



14

15 **Figure 1: Case studies and focus within cases**

16 **3. RE deployment and job creation**

17 **3.1. South Africa: Job creation as a core driver of RE deployment**

18 **Job creation as a key driver for the design of RE policy**

19 South Africa's electricity system relies on coal for well over 90% of its generation, leading to pressure
20 to diversify in the direction of cleaner sources of energy (Alton et al. 2014). The main policy for
21 deploying RE in South Africa is the Renewable Energy Independent Power Producer Procurement
22 Program (REIPPPP) launched in 2011 to replace previous feed-in tariffs that were never effectively
23 implemented (Pegels 2011). Interviewees from the public and private sector with an energy
24 background in South Africa were asked to rank the objectives of the RE policy (for methods, see also
25 Joas et al. in press, Steinbacher 2015). The main underlying drivers identified for the REIPPPP were

1 energy security as well as job creation and industrial policy. Improving security of supply – in light of
2 the growing incapacity of South Africa’s state-owned utility Eskom to finance and manage the
3 addition of much-needed electricity capacity – was seen as a top driver for the program (average
4 rank of 2.4 out of 15 objectives proposed). Only job creation was seen as an even more important
5 policy objective (average rank of 2.2), and it was often mentioned together with the objective of
6 industrial policy (2.5). The very strong interlinkages between socio-economic objectives and the
7 REIPPPP were recently underlined by South African Energy Minister Tina Joemat-Pettersson, who
8 stated that the program is designed to “contribute to economic growth and job creation, in addition
9 to the contribution it makes to security of electricity supply” (Joemat-Pettersson 2015).

10 The REIPPPP is not the only reflection of socio-economic objectives in clean energy and climate policy
11 debates in South Africa. The government’s New Growth Path sets a goal of “300,000 additional direct
12 jobs by 2020 to green the economy,” with “renewable energy construction and manufactur[ing] of
13 inputs” as main contributors (Department of Economic Development 2010). Estimates of the number
14 of jobs created through the deployment of renewable energy in South Africa range from roughly
15 36,000 direct additional jobs to well over 400,000. The maximum figure depends on how many
16 indirect jobs are taken into account (Department of Energy 2015b: 135). The objective of creating
17 local jobs should be viewed in the context of South Africa’s 52.6% youth unemployment rate in 2014
18 (increased from 50.1% in 2011) and a total unemployment rate of about one quarter of the
19 population (World Bank 2016).

20 **The South African Renewable Energy Independent Power Producer Procurement Program** 21 **(REIPPPP)**

22 The REIPPPP is a tender-based renewable energy procurement program, where power purchasing
23 agreements (PPAs) for defined volumes of capacity for each technology are tendered in a two-stage
24 process in yearly rounds (Eberhard et al. 2014). The program is notable for the important place it
25 grants to socio-economic objectives, which are directly reflected in policy design. A particular feature
26 of the evaluation of bids in the REIPPPP is that only 70% of points are allocated based on price, while
27 30% is based on other criteria targeted at achieving socio-economic policy objectives in line with
28 development priorities and the requirements of the Broad Based Black Economic Empowerment Act
29 (Eberhard et al. 2014, 13). One quarter of the 30 “economic development” points that bidders can
30 earn relates to direct job creation requirements (Stands 2015, 55). Other socio-economic objectives
31 include local content requirements, black ownership, and local economic development, which are
32 defined in specific ways in the context of the REIPPPP (WWF South Africa: 16). The diversity and
33 scope of economic development criteria and the direct involvement of local communities set this
34 program apart (WWF South Africa 2015).

35 **Evaluations of the achievement of the job creation target**

36 The South African Department of Energy estimates that 25,526 direct jobs (one job being defined as
37 one person-year) were created by the 1,417 MW of successful projects in bidding round three (7,813
38 jobs were available during the construction phase). This more than doubled the number of jobs
39 created by projects from round two (Department of Energy 2015b: 135). For the fourth REIPPPP
40 bidding round, which closed in 2015, successful projects are expected to create 27,365 person-years
41 of direct employment over a 20 year period, of which 7,071 will be available during construction;
42 95.9% of jobs are committed to be held by South African citizens (Department of Energy 2015b).

1 Given the poor quality of electricity supply in South Africa and frequent blackouts that constrain
2 economic development, the indirect effects of the REIPPPP on job creation are also expected to be
3 positive. By adding much-needed electricity capacity within a short time-frame, solar and wind
4 projects are expected to generate net financial benefits of 4bn ZAR in the first half of 2015 (Calitz et
5 al. 2015).

6 In addition to direct job creation by REIPPPP projects, large and increasing proportions of local
7 content in successful projects are likely to have positive effects on job creation in South Africa. Local
8 content in PV projects in round four exceeded 64% (up from 38.4% in round 1), and the equivalent of
9 wind is 44.6%, up from 27.4% in round one (Department of Energy 2015a). The associated decrease
10 in prices of the tenders indicates that – in the South African case – local content requirements and
11 increasing economic efficiency can go together. The special features of the South African market
12 (size, availability of finance, excellent resources) need to be borne in mind for the transferability of
13 lessons to other developing countries. The question has been raised, however, as to whether the
14 current design of REIPPPP leverages the full potential of economic development throughout the
15 program. As pointed out by Eberhard et al. (2014: 28), the focus on value-based assessments of local
16 content could limit the potential for job creation given that higher-value components tend to be less
17 labor-intensive.

18 Beyond the official government numbers, recent studies (Eberhard et al. 2014; Stands 2015; Tait et
19 al. 2013, WWF South Africa 2015) assess the developmental achievements of the REIPPPP. Findings
20 from Stands' comprehensive survey on job creation in the REIPPPP (Stands 2015: 84) – the first of its
21 kind in the South African context – indicate that the “program has exceeded all thresholds and
22 targets set out in the bid document scorecard. Results communicated by the Department of Energy
23 might thus underrepresent actual job creation, “leaving room for speculation and rumors about this
24 new industry to emerge” (WWF South Africa 2015: 20). The uncertainty surrounding official job
25 creation figures in South Africa underlines the tremendous need for further independent
26 assessments of job creation through the REIPPPP, with continuous evaluation and monitoring.
27 Furthermore, project companies are found to be “taking the [economic development] requirements
28 seriously” (Stands 2015: 90; WWF South Africa 2015:2), and to be genuinely interested in delivering
29 the developmental aspect of their projects, given the political priority attached to job creation and
30 local development (Stands 2015: 84).

31 Despite the generally positive assessment of the REIPPPP, including on dimensions other than job
32 creation, a lack of transparent communication and consistent monitoring has led to uncertainty
33 surrounding the achievements of the REIPPPP in the past. There has been anecdotal evidence
34 concerning foreign renewable energy companies flying in their workforce, even for truck driver jobs.
35 With the success of foreign utilities in bidding round three (with more than half of PV capacity won
36 by Italian utility company Enel), this has strengthened the voice of renewable energy skeptics.
37 Nuclear and coal activists readily point out the jobs potential in their respective industries.

38 “Improving lives through wind energy” reflects the industry’s concern of being seen as contributing
39 to socio-economic development through its projects. Industry stakeholders interviewed stressed that
40 any sign of fabricated job creation expectations would put into question the future of the REIPPPP.
41 Underlining that any policy in South Africa had to be a jobs policy above all, project developers
42 worried about unrealistic expectations of substantial job creation and local content. At the same time
43 auction results were expected to decrease round after round and RE projects to come online within

1 short timelines. Concerns over the REIPPPP's track record seem to have waned and recent ministerial
2 announcements point to an extension of the REIPPPP (Joemat-Pettersson 2015). The South African
3 case nevertheless illustrates the importance of managing job creation expectations and transparent
4 communication of achievements, both in terms of the quantity and quality of jobs (Stands 2015;
5 WWF South Africa 2015). The limited size of the overall program and a complete lack of visibility
6 beyond 2020 create highly challenging conditions for RE companies expected to contribute to
7 economic development. A stronger focus on transparency, capacity development (including among
8 project developers), and communication between stakeholders involved appears necessary to
9 safeguard acceptance and future expansion of a renewable energy program that is expected to excel
10 in several dimensions. Even more importantly, the lack of independent and thorough monitoring of
11 the REIPPPP, particularly concerning the very sensitive political issue of job creation, makes an
12 evaluation of the promise of GE challenging.

13 **3.2. Germany: Two stories of creating competitive advantages in RE** 14 **industries**

15 **The role of jobs for renewable energy promotion**

16 The promotion of renewable energy (RE) in Germany was primarily driven by environmental
17 concerns, but prospective job creation has been a welcome side effect and important political
18 motivation. The feed-in tariff scheme (Renewable Energy Act, EEG) was set up in 2000 as the main
19 policy for deploying RE. The main intention of it was to develop different technologies for
20 environmental reasons¹, but there was also the promise of creating new jobs. A particular concern
21 was that the 1998 electricity market liberalization would lead to a long-term decline of RE
22 deployment in this sector. Moreover, it was feared that decreasing energy prices would put jobs in
23 the newly created wind industry at risk (Lauber & Mez 2004; Jacobsson & Lauber 2006).
24 Employment, however, has never been an official objective in the underlying EEG Act. This was
25 recently reemphasized by the German Government (Bundesregierung 2015), which stated that it is
26 only a welcome side effect.

27 Job creation as an argument and reason for RE deployment has continued to be of political
28 relevance, even though the evidence for it is primarily implicit. The ministries in control of RE
29 deployment have continuously commissioned studies to analyze the impact on job creation,
30 suggesting that they view it as a politically relevant indicator. Moreover, the number of jobs created
31 was also highlighted in the recent Energiewende monitoring report (BMW 2015b). Finally, a survey
32 of policy experts on the goals of the Energiewende (Joas et al. in press) suggests that jobs, together
33 with acquiring technology and market leadership in RE technologies, still play a crucial role in the
34 political debate. This is also because they are of use in gaining political support for RE promotion
35 from the employed and their associations.

36 **Policy design & complementary measures**

37 The fact that job creation is not an official objective is also reflected in the design of the policies. In
38 particular, unlike the case of South Africa and many other countries (see Kuntze & Moerenhout 2013)
39 the EEG does not contain any explicit local content provisions that require a certain proportion of the
40 installed plant to be produced domestically. The only action that had been taken in this regard were

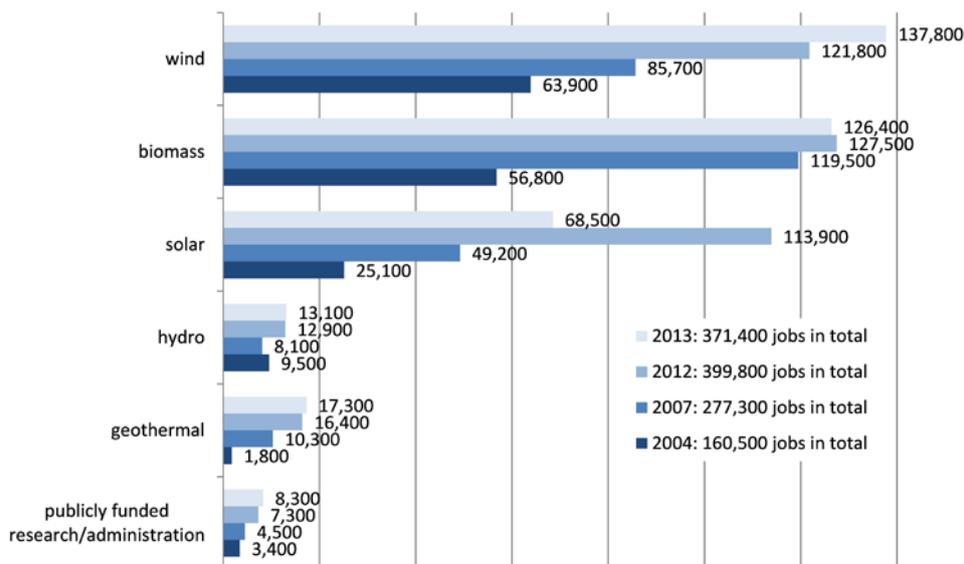
¹ Since then other measures have been introduced, but the EEG definitely remained the most important one.

1 trade sanctions imposed at the EU level in 2013 to keep at bay the “dumped and subsidized imports
2 of solar panels from China” (EC 2015) which were backed by the German government.

3 There have, however, been a number of complementary measures of economic promotion – explicit
4 and implicit – from both the federal and state governments to foster job creation and industry
5 development through the deployment of renewables. These measures comprise financial tax
6 incentives, favorable custom duties, export credit assistance, quality certification, and different
7 forms of loans; see Lewis & Wiser (2007) and Kuntze & Moerenhout (2013). Data on such measures
8 is, however, sparse and unsystematic except for the official funds provided for energy R&D by the
9 federal and state governments (see BMWi 2015a). The total financial volume of all measures
10 together is unclear, but it is very likely dwarfed by the 16 billion EUR in EEG expenditures in the same
11 year (BDEW 2015).

12 Impacts of RE expansion on jobs

13 Figure 2, based on Lehr et al. (2015), shows gross employment through the deployment of RE for
14 selected years in the period from 2004 through 2013. Jobs include both direct and indirect jobs: the
15 former are jobs in companies that provide goods and services directly related to RE, for example
16 wind turbine manufacturing, while the latter are jobs lower down the supply chain, for example
17 production of silicon wafers (also see GIZ 2015). Estimates of net employment, i.e. the overall
18 balance of jobs created and lost, can, however, be either positive or negative: according to Lutz et al.
19 (2014) net job creation turned negative in the power sector, which uses by far the most RE, but this
20 is positive in other studies (e.g. Blazejczak et al. 2013). From a societal perspective, net effects are
21 the more relevant indicator, but they are methodologically very difficult to estimate and thus figures
22 are relatively uncertain. Moreover, gross job effects are useful in analyzing the long-term structural
23 effects of job creation (see Section 1). This is why we concentrate on them in the following
24 paragraphs, focusing on the most insightful cases of wind and solar PV.



25

26 **Figure 2: Estimated gross employment effects through RE in Germany (based on Lehr et al. 2015)**

27 With regard to wind energy, the majority of jobs are related to investment, including exports (86%).
28 More specifically, (onshore) wind turbine manufacturing is characterized by a high proportion of

1 exports (61%) and, at the same time, a very low proportion of imports (1%); two German companies
2 (Siemens and enercon) have been in the global top ten for years (see Pegels & Lütkenhorst 2014).
3 Wind energy thus more or less resembles the prototypical case of a globally competitive industry as
4 aspired to by (green) industrial policies.

5 The emblematic example of the German solar industry appears to be a more salient case, especially
6 since it is alleged worldwide as providing evidence of failure to build up an industry. In fact, the
7 development of employment in solar cell and module production leaves no doubt about the rise and
8 fall of this industry. According to federal labor market statistics (see Figure 3) jobs in the field of
9 module and cell production rose from around 2,000 at the beginning of 2009 to more than 12,000 in
10 late 2011, only to plunge back down to around 2,000 in the middle of 2014. Two related explanations
11 are often given for this (see for example BMWi 2012; Lehr et al. 2015): (a) The surge of PV
12 deployment made companies too optimistic regarding the future demand and considerable
13 production overcapacities were built. Many of these capacities had to be shut down when demand
14 for German modules and cells proved lower than expected. (b) Many new players, particularly in
15 China, entered the world market in the late 2000s and increased competition led to an industry
16 shake-out, which particularly affected German companies due to their cost disadvantages. This is
17 underlined by looking at the proportion of German products installed in the German market, which
18 fell from around 60% in 2008 to 15% in 2011. The proportion of Chinese producers, however, rose
19 from 21% in 2008 to 60% in 2011 (BMW 2012).



20

21 **Figure 3: Jobs in solar module and cell production (Source: Destatis)**

22 This development does not hold true for all solar industries though, as other industries higher up the
23 value chain have fared considerably better. According to data provided by VDMA (2015) PV
24 equipment producers as a whole provided more than 50% of the world market share in 2015 and are
25 thus still well positioned; for a list of companies and number of employees see GTAI (2013). This
26 confirms earlier assessments, for example by Claudy et al. (2010), according to which the prospects
27 are particularly good in sectors where German companies are already established and have strong
28 comparative advantages, such as manufacturing (also see wind industry above). Hence, the
29 widespread notion that job creation has completely failed in the solar industries must be put into
30 perspective.

31 **Lessons and feedback of achieved effects on policy stability & design**

1 In summary, Germany’s record in creating and sustaining new industries and jobs through RE
2 deployment is so far mixed. Developments in the solar cell and module production have shown that
3 the new industries were eroded by world market competition. The more successful cases of wind
4 energy – and in terms of absolute jobs to a lesser extent also bioenergy and other parts of the solar
5 industry value chain – suggests that existing comparative advantages may be a decisive factor. Of
6 course, the question of how such comparative advantages can be sustained in the long term also
7 remains open. In particular the negative outcome in the solar industry has so far had no visible
8 impact on RE policy design and deployment targets. The reason is presumed to be that Germany’s
9 Energiewende was never primarily a job policy and environmental concerns prevailed.

10 **4. Energy access policies and RE technologies**

11 **4.1. Kenya: Slow grid extension as a driver for market-based off-grid PV**

12 **Genesis and evolution of rural electrification plans and policies**

13 In 1974, the first Rural Electrification Programme (REP) was launched to increase access to electricity
14 in rural areas in Kenya. Early progress was slow, as estimates from a 1993 survey suggest that
15 household electricity access among rural households was about 3% (see Table 1) (NCPD et al. 1994).
16 In 1997, the first Rural Electrification Masterplan was developed to plan, prioritize, and accelerate
17 rural electrification in Kenya. However, progress continued at a very slow pace. Estimates from a
18 2003 national survey suggest that rural household access to electricity had crept up to only 4.6% (CBS
19 et al. 2004). Other national sources suggest that rural electrification stood at about 2% at the turn of
20 the millennium (Karekezi & Kithyoma 2002). The Rural Electrification Masterplan was updated in
21 2009 and envisaged rapid expansion of on-grid capacity. However, household electrification rates in
22 rural areas remain very low; the most recent estimates suggest that it was less than 13% in 2013
23 (KNBS 2014).

24 As part of Kenya’s vision 2030, the Rural Electrification Authority (REA), which is mandated to
25 accelerate the pace of rural electrification, has now set a target of increasing connectivity to 100% by
26 2030 with an interim goal of over 50% by 2022 (Government of Kenya 2012). This means the pace of
27 providing new connections each year needs to increase significantly. With on-grid connection costs
28 remaining out of reach for most poor rural customers, how this will be achieved remains unclear.

29 **Evolution and drivers of residential solar home systems (SHS) in rural electrification plans and 30 policies**

31 Initial interest in renewables emerged after the oil crises of the 1970s and was motivated by a desire
32 to reduce the cost of national oil imports and increase national energy sovereignty and resilience
33 (Karekezi & Kithyoma 2002). However, while these incentives still underlie the government’s new
34 plans to rapidly expand on-grid (primarily geothermal-based) renewable electric capacity, the off-grid
35 solar PV sector is largely excluded from recent policies and plans.

36 The development of the solar PV sector in rural Kenya was initiated in 1984 by two ex-U.S. Peace
37 Corps volunteers. They were instrumental in attracting interest from donors and the Kenyan
38 government by organizing a number of demonstration projects showcasing PV systems in Kenya,
39 (Byrne 2009). At the time, the government strategy for the off-grid SHS sector was one of no policy,

1 i.e. to leave it largely unregulated. In 1986, indirect policy measures in the form of exemption from
2 value-added tax (VAT) and duties on imported PV products and components were implemented.
3 Since then, however, taxes and duties have been applied and removed many times and at different
4 rates, and on different parts of PV systems (Byrne et al. 2014). More recently, since 2012, regulations
5 for the PV sector have also come into force in the form of licensing and technical standards. On the
6 whole, while government documents have continued to refer to solar energy, there have been few
7 incentives and no specific targets or legislations designed to increase its uptake.

8 Climate change or environmental considerations appear to have neither explicitly nor implicitly
9 motivated the SHS market development in Kenya. According to several scholars, solar PV market
10 growth in rural areas was tied to the slow pace of grid extension and lack of confidence in the
11 government's ability to honor its rural electrification targets (Bawakyillenuo 2012; Jacobson 2007;
12 Acker & Kammen 1996). The dramatic drop in PV prices together with increasing demand for
13 electricity from better-off rural plantation workers and a growing rural middle class have also
14 contributed. The availability of batteries manufactured locally has also been credited as having a
15 positive impact.

16 While much of the literature on SHS in Kenya points to the private market-driven nature of the
17 sector, recent analysis challenges this view and asserts that indirect public policy support and donor
18 support were vital to building markets, absorbing risks, and developing actor networks that were key
19 to the growth of the sector in Kenya (Byrne et al. 2014; Newell et al. 2014; Bawakyillenuo 2012).
20 Donor support in the form of the photovoltaic market transformation initiative (PVMTI) implemented
21 by the World Bank between 1998 and 2008, with a total budget of US\$ 5 million, was particularly
22 important for the development of the sector. The funds were used to provide technical assistance,
23 particularly in the areas of training and quality assurance (Hansen et al. 2014). In addition, bilateral
24 donors such as GIZ also contributed by providing direct financial resources and by creating the
25 supporting industry and supply-side conditions to promote market development (Bawakyillenuo
26 2012).

27 **Targets and achievements: SHS and rural household electrification**

28 Data on progress with rural electrification and SHS installations in Kenya over the last couple of
29 decades is provided in Table 1 below. The REA has set specific targets for rural electrification in its
30 strategic plan. The plan includes three phases: Phase I from 2008-2012, with targets for connecting
31 all public facilities and one million rural customers and increase connectivity to 22%; Phase II from
32 2013-2022 aiming to increase connectivity to 65%; and Phase III for 2022-2030 aiming to increase
33 connectivity to 100%. As can be seen from the table, the targets for rural customer connectivity have
34 not been achieved for Phase I.

35 Monitoring and evaluation activities providing insights on experiences with PV for household uses or
36 reliability and quality of grid-connected power supply in Kenya remain extremely limited. However,
37 some studies indicate that between a fifth and a quarter of installed SHS in Kenya in the past were
38 not functional or only partially functioning (Acker & Kammen 1996). Erratic equipment quality and
39 installation and maintenance standards have been cited as some of the reasons for this. The
40 popularity of the new fee-for-service and pay-as-you-go business models in the SHS market shift the
41 responsibility for maintenance and quality assurance to the service providers, which might be of

1 benefit to customers. However, the systems have not been in place long enough or deployed at a
 2 scale sufficient to allow a more systematic evaluation of their merits and impacts.

3 **Table 1: Rural electricity connections and SHS deployment in Kenya**

Year	Grid-connected rural consumers (numbers) ¹⁾	Estimated total* installed SHS (numbers) ²⁾	Rural household electricity access (%) ³⁾
1993	n.a.	20,000	3.4
1998	48,949	66,500	4.3
2003	87,175	150,000	4.6
2008	205,287	260,000	8.1.
2013	528,552	350,000	12.6

4 Sources: 1) Kenya Power (various); 2) Estimated from Ondraczek 2013; 3) NCPD et al. 1994, CBS et al. 2004, KNBS 2014;
 5 Note * includes rural, urban and institutional.

6 **Changes to plans and policies and future outlook**

7 Kenya’s new energy policy does not define any goals for further promoting SHS. Even support for on-
 8 grid solar appears to be lacking as the most recent Least Cost Power Development Plan (LCPDP)
 9 assumes that it is not cost competitive with other generation technologies. The most specific
 10 intentions for PV, concerning rural access goals, relate to the program for rural institutions and the
 11 conversion of a number of large remote diesel installations to diesel-PV hybrid systems (Byrne et al.
 12 2014). More recent developments in energy policy-making in Kenya thus appear to have reversed
 13 even the few indirect policies aimed at supporting the SHS market. Economic considerations and the
 14 need to raise government revenues has led to the abolition of the tax and duty exemptions on PV
 15 products and components and even given rise to new taxes on some components (Byrne et al. 2014).

16 **4.2. Morocco: A utility-led effort to electrify remote villages off the grid**

17 **Genesis and evolution of rural electrification plans and policies**

18 Starting with the creation of a special energy fund in 1975, rural electrification in Morocco was
 19 carried out through the National Rural Electrification Program (Programme National d’Electrification
 20 Rurale: PNER). The first two phases of the PNER from 1982–1986 and 1991–2000, show very slow
 21 progress (Karekezi & Kithyoma 2002). A national survey from 1992 suggests that access to electricity
 22 among rural households was 15.6% (Ministère de la Santé Publique & Macro International 1993). The
 23 low financial capacity of the regional autonomous bodies, who were supposed to finance the
 24 program, was considered a shortcoming (Nygaard & Dafrallah 2015).

25 To overcome this situation and accelerate rural electrification, in July 1995 the Global Rural
 26 Electrification Program (Programme d’Electrification Rurale Globale: PERG) was established. At the
 27 time when the PERG was launched in 1996, official sources indicated that Morocco’s rural
 28 electrification rate was 18% and that the country aimed to bring the rate of rural electrification to
 29 80% by 2010. Since objectives were exceeded in the early years of activity, they were revised to

1 electrify all the rural areas by the year 2007. The pace of electrification was also accelerated to target
2 1,500 to 2,000 villages per year with an estimated annual budget of 150 million dollars.

3 The PERG is widely considered an example of a successful rural electrification program, though many
4 authors studying the case have had to rely on the National Office of Water and Electricity's (Office
5 Nationale de L'Electricité et de l'Eau potable, ONEE's)² own evaluations and data on performance
6 and impacts (Nygaard & Dafrallah 2015). Nevertheless, the program is responsible for increasing the
7 rural electrification rate from 18% in 1996 to over 90% by 2013. Building an extensive national village
8 database for efficient prioritization of actions, detailed grid planning, and clear contractual
9 arrangements with local governments are all cited as being factors responsible for the success of this
10 program. A participative financing scheme in which those who benefited contributed 25% of the cost
11 of electrification, local governments contributed 20%, and ONEE picked up the remaining 55% of the
12 cost (part of which was financed from a 2.25% solidarity tax on electricity sales) was also considered
13 an important aspect of the program (Karekezi et al. 2005). A significant part (estimated at close to
14 half) of ONEE's contribution to the program was mobilized from international lenders (AFD, IDB, JBIC,
15 EIB, FADES, Kuwait Fund, KfW) as concessional loans guaranteed by the Moroccan government
16 (Massé 2010).

17 **Evolution and drivers of residential SHS in rural electrification plans and policies**

18 During the early years of the PERG, the national village database assessment suggested that about 8
19 to 10% of rural villages were too remote and, therefore, it was too expensive to electrify them
20 through an extension of the grid. Thus, it was foreseen that these villages would be served by
21 decentralized PV solar home systems. In 1998, the first major PV SHS initiative, funded by the GEF
22 and IFC, was initiated (Mostert 2008). Concerns regarding the coverage and speed of SHS
23 dissemination, as well as adequate repairs and maintenance of the systems, led ONEE to decide to
24 outsource the off-grid component of its rural electrification program to private contractors. Through
25 an international bidding process, enterprises were selected for ten-year concessions and contracted
26 to supply and maintain a fixed number of PV systems in certain specified remote regions (Christensen
27 et al. 2015). The systems were supplied on a fee-for-service basis with households having to
28 contribute about 10% of the cost as a connection fee and a regular monthly maintenance fee. The
29 fee amount was determined by the type of service (size of the system) and was to be paid for over a
30 period of 10 years (Allali 2011; Nygaard & Dafrallah 2015). After awarding the first concession in
31 2002, four other concessionaires were included in successive bidding rounds. In total, contracts were
32 signed to distribute 105,000 SHS installations of an initial estimated 150,000 SHS envisaged when
33 PERG was launched in 1997. International donor funding was also very instrumental in supporting
34 the SHS deployment that became part of the PERG to provide access in remote areas (Nygaard &
35 Dafrallah 2015).

36 The primary motivation of the Moroccan government in including off-grid SHS as part of its rural
37 electrification strategy was economic (Amegroud 2015). SHS dissemination was limited to very
38 remote rural regions where extension of the grid was considered too expensive. However,
39 subsequently, realizing the climate benefits of the SHS, the program was proposed for funding under
40 the Clean Development Mechanism and was registered as one of the first programmatic CDM

² ONEE (formerly: Office national de l'électricité, ONE) is a vertically integrated, state-owned utility and the only buyer of electricity in Morocco. Moreover, it also supplies 41% of all electricity from its own plants and is thus said to dominate the power sector in Morocco (IEA 2014).

1 projects (Nygaard & Dafrallah 2015). For most of the rural population, however, electricity access has
 2 been achieved through connection to the grid (see Table 2).

3 **Targets and achievements: SHS and rural household electrification**

4 Data on outcomes, achievements, and impacts of the rural electrification program (PEERG) and its
 5 SHS component are exclusively available from official ONEE reports. Nygaard & Dafrallah (2015)
 6 suggest that the estimates of the rate of rural electrification are likely to be based on coverage rather
 7 than on an estimate of actual household connections. Even so, they suggest that rural household
 8 access in 2013 is likely to be in the order of 89% (compared to the 98% suggested by ONEE's
 9 estimates of coverage).

10 **Table 2: Rural electricity connections and SHS installations in Morocco**

Year	Grid-connected rural consumers (numbers) ¹⁾	Estimated total installed SHS (numbers) ¹⁾	Rural electrification coverage (%) ¹⁾	Rural household electricity access (%) ²⁾
1993	n.a.	n.a.	18%	15.6%
1998	286,899	1885	32%	n.a.
2003	979,489	10,457	62%	51.3%
2008	1,815,047	51,509	95.4%	n.a.
2013	2,027,120	51,559	98.5%	~89% ³⁾

11 Sources: 1) Reproduced from Nygaard & Dafrallah (2015) based on official ONEE's statistics; 2) Ministère de la Santé
 12 Publique & Macro International (1993); 3) Ministère de la Santé et al. (2003). 4) Best estimate from Nygaard & Dafrallah
 13 (2015).

14 Independent evaluations of the SHS component of PERG are also missing. It remains unclear why
 15 only half of the 105,000 SHS installations targeted through the concessions have been implemented,
 16 especially considering that this represents an even smaller fraction of the 150,000 originally
 17 estimated as being required. Nygaard & Dafrallah (2015) speculate that consumers might have
 18 considered the SHS a second-best option, providing poorer service at too high a cost. This appears to
 19 be borne out by the fact that as of 2010, ONEE has embarked on a program to connect households to
 20 the grid in areas already provided with SHS (Christensen et al. 2015) and ceased the deployment of
 21 SHS in 2009. Unfortunately, no information or evaluations exist regarding the quality and
 22 performance of the SHS installed.

23 **Changes to plans and policies and future outlook**

24 The Moroccan government has set ambitious targets to diversify its electricity mix and reduce
 25 dependence on imports. In its 2009 National Energy Strategy, renewable energy targets were set to
 26 achieve two GW each for solar, wind, and hydropower respectively by 2020 (42% of the total
 27 electricity capacity in 2020). However, these targets have been set for the construction of medium-
 28 to large-scale power plants; decentralized energy supply is not considered a core element in the
 29 Moroccan Solar Plan or the Moroccan Integrated Wind Energy Programme (Vidican 2015). The key
 30 incentive for this emphasis on large-scale renewables appears to be a desire to increase energy
 31 independence. However, it also aims to attract investments, build technical expertise, and improve

1 industrial competitiveness (Steinbacher 2015; Vidican 2015; Marquardt et al. 2015). After years of
2 debate and increasing pressure from Moroccan companies, the government adopted a PV roadmap
3 at the end of 2014. In December 2015, a law (Loi 58-15) was eventually passed that will open the
4 low-voltage grid level and thereby enable the connection of smaller scale RE installations. This is also
5 expected to make a significant contribution to other socio-economic objectives such as job creation.

6 **5. Discussion**

7 In this section we reflect upon and discuss the implications of the findings of each case study for the
8 GE conceptual framework. In Kenya and Morocco, renewable energy policies targeted the expansion
9 of energy access arising from a failure to provide infrastructure. Both cases emphasize that
10 governments have an important role in the implementation of a GE. In the Kenyan case, where the
11 development of SHS was more market driven, existing assessments suggest that indirect government
12 policies and donor finance had an important role to play. This case particularly highlights the need to
13 put in place an effective regulatory framework with long-term targets. Without such a framework,
14 deployment could subside over time or certainly not keep pace with targets or requirements. Related
15 to this is the necessity to build up capacity both for policy-making and monitoring. The availability
16 and reliability of policy reports and data for Kenya was relatively scarce. This, of course, makes
17 assessing policies, including the socio-economic effects, very challenging, and highlights the need to
18 strengthen national monitoring and evaluation capacities.

19 The case of Morocco is interesting in comparison because a relatively strong policy framework, with
20 especially clear long-term targets, was put in place and the rural electrification program has been
21 widely considered a success. Importantly, renewable deployment was largely inspired by economic,
22 rather than environmental (green), considerations. The aim was to provide access to very remote
23 villages that were considered too expensive to connect to the grid. Nevertheless, , the fact that SHS
24 led to an increase in access underlines that renewable deployment can indeed create short-term
25 socio-economic benefits and thus supports the main assertion of strong green growth (see above).
26 This is specifically the case when important infrastructure such as grid connections is underprovided
27 (see Introduction). Recent plans of the utility to connect regions originally covered by the SHS
28 concessions to the central grid, suggest, however, that these are increasingly being viewed as a
29 transitional technology. Accordingly, the socio-economic benefits from the initial renewable
30 deployment are not likely to be sustained in the long run. However, the experience with off-grid solar
31 may have been one factor prompting plans for more large-scale solar development that are part of
32 current policies in Morocco. In other words, this might have helped develop “green” technologies
33 from a niche to a more encompassing, national-level project.

34 The South African REIPPPP illustrates how socio-economic objectives can be strongly reflected in the
35 design of policies for the deployment of renewables. Job creation is a particularly pressing problem in
36 South Africa, which makes it a prototypical case for GE. Political expectations for job creation through
37 the REIPPPP were very high and even though first reports point to a fulfillment or even over-
38 fulfillment of the creation of jobs promised by the developer, there is great uncertainty surrounding
39 actual effects as estimated in official figures. Negative policy feedback, due to high expectations,
40 unclear estimates of impacts, and a lack of available data and independent evaluation, are particular
41 challenges for the assessment of South African GE concepts. These challenges seem to be typical for
42 multi-objective policies interlinking environmental and socio-economic objectives, but have hardly

1 been addressed in the GE literature. New approaches are only beginning to emerge, such as the
2 framework developed by Sreenivas et al. (2015).

3 The case of Germany is interesting in comparison because employment objectives also played an
4 important role in renewable energy policy, but only unofficially. Job creation was not reflected in
5 policy design and no local content provisions were included. Nevertheless, expectations were high,
6 particularly regarding the creation of technology leadership and respective jobs in the solar PV
7 industry. Deployment of renewables was conceived, at least implicitly, as a green industrial policy.
8 Accordingly, the German experience constitutes a test case for the strong green growth assertion,
9 which upholds that the creation of competitive advantages in green technologies is one way to
10 create both short- and long-term economic benefits, such as jobs. However, while the solar module
11 and cell manufacturing industry indeed rose to global market leadership from 2009, it experienced a
12 considerable fall only two years later, with a corresponding decline in the number of jobs. This was
13 the result of a global industry shake-out following increased competition in combination with little
14 pre-existing comparative advantages; in fact, this was predicted as a possible outcome by earlier
15 theoretical literature on job market effects. Accordingly, the case of the German solar industry
16 questions this aspect of the possibility of (strong) green growth. This must be put somewhat into
17 perspective, though, because in comparison the wind industry has fared considerably better.
18 Moreover, it is also possible that a dedicated multiple-objective design might have prevented this
19 outcome.

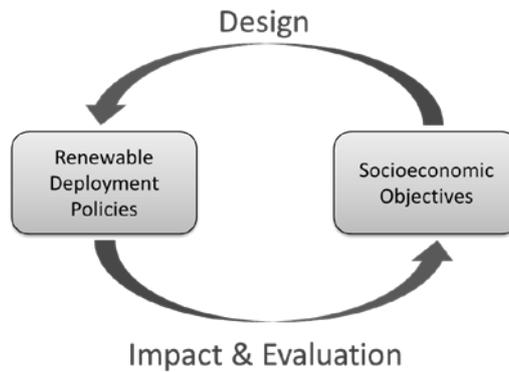
20 **6. Conclusion**

21 This multiple-case study produced several findings suggesting that the GE conceptual framework
22 needs to be reconsidered. First, in support of earlier findings we can confirm that the role of
23 governments in implementing a long-term GE regulatory framework is of utmost importance. This
24 may be particularly challenging in countries like Kenya, where capacity for policy making, monitoring
25 and evaluation of complex policy frameworks needs to be strengthened. Accordingly, capacity
26 building is an important enabling condition to leverage the potential for GE policies and GG and
27 should to be addressed head on.

28 Second, some cases suggest that renewable deployment can generate short-term socio-economic
29 benefits, which supports the assertion of strong green growth. They also suggest, however, that
30 these benefits may not be sustained; energy access through SHS may eventually be superseded by
31 grid access as in Morocco, and jobs created might be lost with the rise of international competition
32 as in Germany. Whether the benefits could – or should – become more permanent through different
33 policy designs remains an open question. It also needs to be acknowledged, however, that the
34 expectation of socio-economic benefits seems to have created political momentum to implement the
35 respective “green” policies in the first place. In Germany, green policies persist despite ambiguous
36 job creation results in some segments, while experience with SHS in Morocco has facilitated national
37 RE policy developments.

38 Finally, and probably most importantly and novel, this work suggests that designing – and analyzing –
39 policies aiming to achieve multiple objectives differs considerably from the traditional ideal-type
40 view of policies as being targeted at single objectives. This is particularly relevant for the GE, as – at
41 least in our understanding – it ultimately entails a “paradigmatic shift” towards such multi-objective
42 settings. More precisely, as this paper has underlined, there is a direct interplay between renewable

1 deployment and socio-economic objectives that works in two directions (Figure 4); renewable
2 deployment policies have impacts on socio-economic objectives, but these objectives also influence
3 the design and evaluation of these policies, which in turn also influences impacts throughout the
4 policy cycle.



5

6 **Figure 4: Inter-linkage between renewable deployment policies and socio-economic objectives**

7 This second aspect has received little attention so far. We agree with Sreenivas et al. (2015) that
8 there has been much rhetoric while the development of practical methodologies has lagged behind.
9 Adding to the approach they propose, our findings suggest some additional elements that could be
10 important, namely the explicit identification of objectives, clear communication and management of
11 expectations, and a broad and transparent set of indicators for monitoring and evaluation. The
12 availability of sound and comprehensive data is crucial not only for further GE research, but also to
13 ensure regulatory stability and sustainable policies. Tremendous opportunities for further research
14 exist in order to advance our understanding of the extent to which the GE can actually achieve its
15 promise.

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