



STUDY

Achieving 100 % Renewable Energy for all

Lessons learned from the development of
Renewable Energy roadmaps in the Global South

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1. Introduction

What will Planet Earth look like in 2050? According to the United Nations 2030 Agenda for Sustainable Development, the new paradigm for governments should be to “leave no one behind” and ensure economic and social prosperity within planetary boundaries. Mitigating the worst impacts of climate change will therefore require the large-scale, rapid deployment of Renewable Energy (RE) and fossil fuels to be declared an obsolete technology by 2050.

This process will undoubtedly allow the manifold socio-economic benefits of RE to be unleashed, benefiting the poor, women and the young alike. Thanks to their modularity and flexibility, renewable energies can transform an energy system into one that is decentralised and owned by the people. As RE systems would be installed where energy is needed most, we would subsequently achieve 100 % energy access, creating millions of new jobs in the sector. Specially designed capacity building programmes could also ensure a just transition for every country with a skilled labour force. The sheer number of jobs would also increase opportunities for women in the Global South to become advocates for RE, for instance as entrepreneurs. This would not only increase economic activity and improve incomes around the world, it would also mean a shift from fossil fuel to electric mobility and from traditional cooking with biomass, charcoal or wood to electric, renewable cooking. This could significantly improve the air quality in cities and reduce smoke from cooking indoors. In any case, it could reduce the number of deaths currently associated with poor air quality both in- and outdoors.

The energy system of the future would thus be a driver for sustainable development. Such an energy system could enable leapfrogging and improve livelihoods, especially in the Global South. This is why 100 % Renewable Energy needs to become a reality. However, this will require nothing short of a paradigm shift from “energy for development” towards “Renewable Energy for sustainable development”.

And there is reason to hope that this will become reality: in 2018, 169 countries had set some kind of Renewable Energy target (GSR 2019), and a number of countries continue to integrate high shares of variable Renewable Energy into their energy mix. Solar and wind generation grew at double-digit pace in 2018, with solar alone increasing by 31 % (IEA 2019). In sum, renewables provided around a quarter of global electricity generation by the end of 2018 (GSR 2019).

However, efforts need to be ramped up if this vision, which is based on international agreements, is to be met. Political action lags behind political will as decision-makers have taken measures nowhere near adequate to meet this challenge. This can have tremendous consequences, especially in countries of the Global South where energy demand is rising rapidly due to a growing population and rapid economic development. By planning and constructing new coal fired power plants in many parts of the Global South, there is a risk that we might end up locked into a fossil energy system instead of leapfrogging into a renewable world. In addition, almost one billion people around the world are still deprived of access to basic electricity – most of them in sub-Saharan Africa and developing Africa (61 % and 35 % respectively). Without access to electricity, many people do not have the means for socio-economic development, and consequently face poverty and limited opportunities for self-development and education. What is more, 2.7 billion people had no access to clean cooking in 2017; 97 % of them were living in countries of the Global South (IEA 2018). The WHO estimates that every year four million people die prematurely from illnesses attributable to indoor air pollution as a result of traditional cooking. More than 50 % of premature deaths due to pneumonia among children under five are caused by inhaling toxic particles from indoor air pollution (WHO 2016).

That is why projects have been set up in Tanzania, Bangladesh and Costa Rica to develop integrated 100 % Renewable Energy (RE) roadmaps aiming to eradicate poverty in Tanzania, achieve stable energy access in Bangladesh and full decarbonisation in Costa Rica. A well-designed framework for 100 % RE achieves the Paris climate targets and supports implementation of Agenda 2030. As such, 100 % RE roadmaps are an obligation rather than an option for countries who signed both agreements. 100 % RE can offer opportunities to identify synergies and complementarities between energy security, socio-economic development and climate change mitigation. Country-specific, long-term 100 % RE roadmaps, backed by opinion leaders, can provide a positive vision and thus be a tool to develop the urgently needed political leaders in post-Paris times.

Governments must take a leading role in this effort. They must set up frameworks enabling such integrated policy-making. These should consider national development plans and SDG implementation, but also adopt technology standards and establish financial



All scenarios show that transitioning to 100 % RE can reduce GHG emissions to the levels necessary to limit global warming to 1.5° C, as agreed in Paris in 2015.

mechanisms to fund the transition to 100 % RE. Only then can governments prevent fossil fuel-based path dependencies and enable leapfrogging.

Case studies around the world show that, in the longer run, fossil energy systems are economically less viable than RE systems. A shift towards 100 % RE is thus not only a means to achieve NDCs, but to raise their ambitions through country-driven processes, which promote long-term climate action, build capacity and align poverty eradication and climate change whilst supporting in-depth multi-stakeholder engagement in all project phases.

Target setting plays a central role in developing and implementing integrated 100 % RE roadmaps. 100 % RE targets can demonstrate political commitment and provide both stakeholders and the population with a clearer view of the region’s long-term vision – it “catalyses change by providing an official mandate for action” (WFC 2014). To date, 65 countries have set 100 % renewable electricity targets and 169 countries have adopted RE targets at the state or provincial level (GSR 2019). Identifying and communicating a 100 % Renewable Energy target has several additional advantages: it can guide deployment of technological and human resources; streamline resources; provide policy guidance for all stakeholders; and increase investment certainty.

However, 100 % RE targets can vary substantially and therefore require adaptation to the jurisdiction’s political conditions: this can include 100 % renewable electricity, such as in Cape Verde; 100 % targets that are implemented alongside 100 % carbon neutral strategies, such as in Frankfurt am Main; 100 % targets for Renewable Energy in rural electrification, such as in Bangladesh; and finally, there are more comprehensive targets that aim to cover 100 % of total energy needs with Renewable Energy sources, such as in Denmark (WFC 2014).

This report aims to distil the lessons learned from science-based Renewable Energy roadmap development with the aim of achieving 100 % Renewable Energy access for all by 2050 in line with the Paris Agreement’s 1.5° C target. Its findings are based on the processes of projects that have been set up in Tanzania, Bangladesh and Costa Rica over the past years.

These three inherently distinct countries are at very different stages of RE development, be it in terms of the share of RE in their energy mix, technology deployment, implementation of a coherent policy framework, energy access, business models, or linkages with climate change mitigation or economic development. They can thus provide a glimpse of roadmap development in different Global South regions and offer guidance. Although the projects all share the same aim, the processes can differ from country to country since there is no ‘one-sizes-fits-all’ approach; rather, actions need to be tailored to local circumstances.

Policy-makers, civil society organisations, development organisations and funders who are engaged in similar processes may obtain advice and key takeaways. The following chapter provides an overview of the processes set up in three countries – Tanzania, Bangladesh and Costa Rica – which will be followed by a short introduction of the energy status quo in the respective countries. Chapter 3 presents the lessons learned from the three projects and contextualises results for similar, future projects. Here, an analysis of national contexts and country-specific issues is provided, before the report concludes with a future development trajectory.

2. Establishing a process for multi-actor partnerships for 100 % Renewable Energy

Achieving 100 % RE for all is one of the greatest transformations humanity has to undertake. It is therefore essential to create the conditions necessary to build confidence and trust between different actors. Multi-actor partnerships (MAPs) can serve as a mechanism for making this process happen alongside developing mutually acceptable solutions and win-win situations. The inclusive and participatory nature of the processes promotes a greater sense of ownership over its outcomes and, consequently, strengthens its sustainability. MAPs also stimulate transparent and inclusive decision-making, and strengthen stakeholder networks, accountability and a sense of empowerment.

Further, 100 % RE can imply many different development pathways. It is up to the people involved to develop a joint vision that is relevant for the stakeholders and that places the 100 % RE narrative within the respective social and economic context. In Tanzania, this was done by envisioning how renewables could support the nation's aim to become a middle-income country; in Costa Rica, integration with the Decarbonization Plan

provided the answer. In contrast, already starting a process with a concrete, preset narrative – that has been created without input from stakeholders – can have negative effects on building ownership among stakeholders and peer-to-peer dialogues. It can impose certain views on other individuals or groups that might not align with their priorities and realities. Therefore, a dialogue among stakeholders that kicks off the process of developing a joint energy vision for the country might be more suitable to frame a relevant, and appropriate, narrative. This might entail initial questions regarding the future energy mix, or the development vision for the country and how society and the economy should evolve over the coming decades.

“100 % renewables is not a project, it’s a commitment to solutions: universal access to clean and affordable energy for all and climate change mitigation.”

Jahangir Masum, Executive Director, Coastal Development Partnership Bangladesh

The projects in the three countries examined in this paper have shown that developing a shared vision helps to realise and evaluate the feasibility of a sustainable and fair transition towards 100 % RE that is applicable across jurisdictions. It further provides guidance for policy-makers and governments to develop an inclusive policy development process. Jointly cultivating a development vision for a country and thinking about how to achieve the stipulated targets establishes a project process that makes its outcomes relevant and tangible for national and sub-national stakeholders. It thereby increases the appeal of continuously participating in the process through activities such as workshops and publications. Developing a shared vision is thus the first step to creating a multi-actor partnership.

Another advantage of jointly developing a vision through peer-to-peer dialogue is the improvement of the policy-science interface: dialogues help to overcome the policy preferences of policy-makers by demonstrating that alternatives exist. But they also help to foster science-based advocacy by explaining the scientific basis behind a certain aspect of the energy transition and ensuring credibility of the science by jointly feeding into it.

The importance of inclusive decision-making becomes especially prevalent in light of RE's inherent modularity and distributed nature, which is well suited for decentralised energy systems. It recognises that individuals and communities play an important role in the energy transition through increased citizen participation and local ownership of Renewable Energy projects, and are thus more likely to accept the energy transition, as was the case in Germany. Empirical studies have shown that local acceptance of the deployment of renewable energies can be improved by community ownership of the project (Musall/Kuik 2011). Creating awareness of environmental issues and of (energy) consumption patterns, decreasing emissions and climate damaging GHGs and promoting and creating innovative solutions and new approaches to scaling up RE can be some of the advantages of such an approach (Sádián 2014). Given that a shift to a fully 100 % RE powered system cannot be tackled by a single stakeholder or a particular sector alone, but rather by a range of stakeholders across all sectors and governance levels, a multi-stakeholder approach for roadmap development becomes increasingly relevant. A structural shift to 100 % RE needs to build and utilise alliances of, and between, stakeholders from all departments and sectors. Cooperation and synergies

across parties and governance levels will therefore be crucial and can only be achieved through continuous exchange.

To get this process started, stakeholders and opinion leaders need to be identified and mapped. During this stage, it is important to strike a balance between stakeholder groups. Consequently, civil society organisations, ministries, universities working on RE, utilities, women and faith groups, as well as banks and RE businesses, need to be encouraged to participate. In addition, multipliers such as journalists and community organisations should be considered. Representatives from these sectors are brought together to discuss how 100 % RE could be turned into a reality, and in what time frame. In most cases, these initial discussions will already reveal some of the barriers an energy transition might face, but also opportunities and narratives needed to make the topic relevant for the broader public.

The successful facilitation of such a deep peer-to-peer policy dialogue requires well-connected partners on the ground to identify the change agents who can kick-start a dialogue and ensure necessary buy-in from others. It is important to note that change agents can be classified as either **a)** champions of the energy transition in their country, **b)** individuals/groups that have the decision-making or implementing power to make the transition happen, or **c)** groups/organisations that have strong collective interest and knowledge in the pursuit of the energy transition, e.g. due to the negative environmental impacts of the current energy production. To do so, partners on the ground need to be well established and connected, to be able to engage the various sectors, and also to have an open line of communication with relevant decision-making bodies. Such an exchange must be kept alive at all times through follow-ups and joint activities; otherwise there is a risk that stakeholders may lose interest in pursuing the energy transition further. Eventually, such an engagement process and the resulting collaborations and partnerships should be institutionalised to ensure the effectiveness of decisions made and appropriate implementation. Chapter 4 highlights issues that might arise during such a process and how some of these could be tackled.

In a next step, the development of the 100 % RE model itself needs to be discussed, priorities such as energy access and job creation determined, and data (e.g. GDP and population growth) collected. The model used in our projects has been developed by the Institute for Sustainable Futures (ISF) at the University of Technology



Participants from Tanzania and Bangladesh during a south-south exchange study tour in 2016. Study tours are a highly visual way to raise awareness for the co-benefits of renewables.

3. The status quo of Renewable Energy in Tanzania, Bangladesh and Costa Rica

Sydney (UTS) and emphasises a bottom-up electrification scheme that aims to achieve universal energy access, accelerate clean cooking and avoid GHG emissions. The resulting scenarios are used in manifold ways: to raise awareness of the feasibility of 100 % RE; to demonstrate its cost competitiveness in the country; to discuss the policy processes needed to achieve certain aspects, such as e-mobility; to showcase different technologies required for the transition; to translate the abstract long-term vision of 100 % RE into concrete year-by-year steps; and to raise support at the international level. Furthermore, to have in-depth discussions on the results and put these forward to policy-makers, it is necessary to translate the key findings into policy outputs as well as easy-to-understand and visually appealing materials, such as infographics.

A technical analysis of a 100 % RE pathway should be accompanied by a policy roadmap, highlighting the policy changes needed to reach 100 % RE. The scenario can form the basis of discussions for this roadmap as it gives information about the number of jobs created, investments needed, RE potential and more. The policy roadmap should eventually provide insights into the current state of RE in the country and its energy policy framework as well as opportunities and barriers for RE acceleration. It should further provide specific and science-based policy recommendations. Lobby meetings and further workshops will also need to be initiated in order to put these results forward to decision-makers.

Catalogue of methods

Method	How to use it
Workshops	→ Workshops are particularly useful when certain information or input needs to be gathered.
Lobby meetings	→ Lobby meetings are a crucial part of this work and make sense when buy-in from decision-makers for specific activities and results is needed.
Study tour	→ Study tours are a highly visual way to raise awareness for the co-benefits of renewables and can give rise to ideas for the project itself. Since study tours require financial resources, key stakeholders need to be identified for participation, but the list should include policy-makers, multipliers and community organisations.
International and national events	→ Events are an opportunity to showcase projects and their results. They provide a platform for partners and government officials and can thus increase ownership.
Webinars	→ Webinars do not require financial resources and can have several formats, from informative sessions to gathering information. The usability of webinars depends on the internet access penetration rate and might vary between countries.
Radio show	→ Radio shows and podcasts can be used to reach the broader public and raise awareness for renewables and the project. The usability depends on the show's penetration.

The current situation in the three pilot countries – Tanzania, Bangladesh and Costa Rica – varies significantly, not just geographically, but also in terms of existing stages of RE development, awareness of climate change, action areas for sustainable development, civic space and many others.

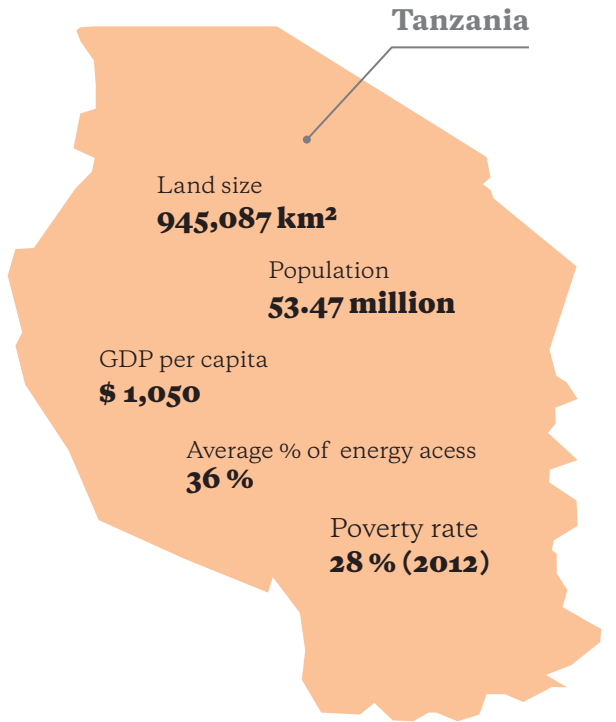
3.1 Tanzania

Tanzania is endowed with abundant, high-quality renewable resources that could play a significant role in meeting the nation's growing energy demand and helping it become a middle-income country. Yet, roughly 88 % of Tanzania's total energy consumption is based on biomass for firewood and charcoal. RE (excluding large hydro) currently accounts for a mere 4.9 % of generation capacity (African Development Bank 2015, p. 15). With more than 53 million inhabitants, Tanzania is also East Africa's largest country. Around 70 % of the population live in rural regions, only about 7 % of whom have access to electricity. 10 % of households connected to the national grid are located in urban or semi-urban areas (Teske/Morris/Nagrath 2017). This is severely stifling the potential for economic development and the population's level of earnings, which is further constrained by the average poorer household spending about 35 % of their income on energy. This backdrop, however, gave rise to a number of innovative business models, from pay-as-you-go to rent-to-own schemes. The 100 % RE scenario for Tanzania has shown that it is possible to scale up RE deployment to 100 % whilst making it affordable for everybody and increasing the level of earnings of rural households.

“100 % RE gave us, as civil society, a voice on the international stage. We now need to follow up.”

Sixbert Mwanga, Executive Director, CAN Tanzania

Tanzania has no single dedicated institution with the capacity and expertise to set the country on a path towards 100 % RE. Decision-making is fragmented between different institutions with a mandate to work on RE development, such as the Ministry of Energy and Minerals, the Rural Energy Agency and others. These scattered responsibilities and lack of transparency made it more difficult to identify and address the key change-makers such a process needs.



Interview with Sixbert Mwanga, CAN Tanzania

How did your work on 100 % RE contribute to Tanzania's long-term energy vision?

Sixbert Mwanga: We value the inclusivity and flexibility of the approach, which was able to set itself deep

into the minds of energy stakeholders in Tanzania. And we noticed that people started to think about long-term plans even beyond their children's generation – five or even seven decades ahead! The development of the 100 % Renewable Energy scenario with different stakeholder groups across sectors was definitely a turning point.

Did the project strengthen CAN Tanzania's within the country and vis-à-vis the government?

Mwanga: The work on 100 % RE opened many doors for us as a civil society organisation (CSO). We became trusted and reliable partners for both the government of Tanzania and development agencies working in the country. Bringing in the voices of citizens led to a rethink of our current centralised energy system. As we bring in more opinions, the discussions intensify, which is good if we want to maximise the benefits of re-newables.

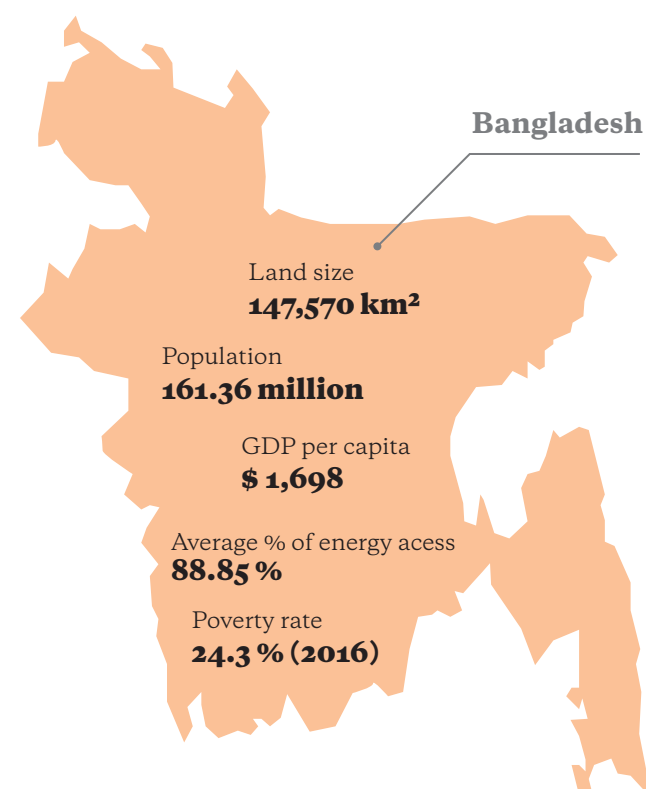
What did you learn from the project?

Mwanga: When people ask me what CAN Tanzania is, I describe us as a “think and do tank” that revolutionises how we think and perceive energy in our country. Bringing people together and guiding discussions need strong leadership. This is a journey that takes time, as we have learned over the past years, but we facilitate that journey step by step. This also means contesting the currently centralised nature of our energy system. I argue again that governments, development partners and civil society should embrace approaches that empower citizens and stakeholders to choose and opt for energy that is local, specific, clean, reliable and yet still untapped. Tanzania's abundant Renewable Energy sources are the way to drive development. Communities have already recognised the transformative power of renewables and are acting. Now it is up to the government to follow suit.

3.2 Bangladesh

“Renewable Energy for Bangladesh means securing our future. 100 % Renewable Energy will ensure energy security, create millions of green jobs, reduce inequalities and sustain the environment. It gives Bangladesh the opportunity to become a modern developed country.”

Dipal Barua, Councillor World Future Council, Founder of the Bright Green Energy Foundation



As one of the countries most vulnerable to climate change (Germanwatch 2015), Bangladesh has sought to implement a low-carbon pathway since 2009. It recognises that climate change could lead to an annual GDP loss of about 2 % by 2050, which could even rise to a loss of 9.4 % by 2100 (ADB 2014). At the same time, Bangladesh accounts for a mere 0.35 % of global GHG emissions (CDKN 2016), with its energy sector being the single largest CO₂ emitter, contributing 40 % of GHG emissions. This figure is expected to grow by about 6.7 % annually (ADB 2018). The current share of renewables accounts for only 3 % of

the energy mix (Uddin et al. 2019). Renewables could reduce emissions from the energy sector to virtually zero. They could also provide a huge opportunity for the South Asian country to accelerate economic development whilst improving energy access, livelihoods and the health of millions of people. In fact, the very successful deployment of solar home systems (SHS) in the last decade, with over five million systems, has significantly supported electrification a boost to rural economic development and educational aspects (Marro/Bertsch 2015). Yet, the RE potential has not yet been exhausted: Bangladesh has over 300 days' worth of sunshine per year as well as utility scale potential for offshore wind energy (Teske/Morris/Nagrath 2019). The 100 % scenario from 2019 found that 100 % RE by 2050 is feasible and economically viable for Bangladesh, with the electrification of large parts of the country's transportation system a possibility.



Interview with Jahangir Hasan Masum,
Coastal Development Partnership Bangladesh

How can your work on 100 % RE contribute to Bangladesh's long-term energy and development vision?

Jahangir Hasan Masum: The 100 % RE roadmap has already initiated a debate to revise the long-term energy and development strategy of Bangladesh.

They are now considering a massive scale-up of Renewable Energy – something that has been missing from the current Bangladesh Power System Master Plan (PSMP) 2016 altogether. The roadmap promotes the idea that international development finance for renewables is actually financing climate change mitigation, eventually reducing the immense climate risks Bangladesh is facing.

How can a multi-actor partnership be established within reduced civic space?

Masum: Any long-term energy development perspective has to go through a contested policy space where a powerful private sector has more influence than citizens and civil societies, even in the existence of a very active civic space. Credible research aiming to achieve SDG 7 – clean and affordable access to energy for all – is the starting point for initiating a multi-stakeholder driven policy dialogue. When civic space is reduced, peer-to-peer exchanges to increase energy awareness are a good starting point to get people interested in the issue. More importantly, however, CSOs should approach the issue of renewables complementary to the government's plans. Wherever possible, the research should build upon existing government data and plans and point out suggestions for improving those. The process has had much success in Bangladesh in developing good relations with key government institutions, such as the Sustainable and Renewable Energy Development Authority (SREDA).

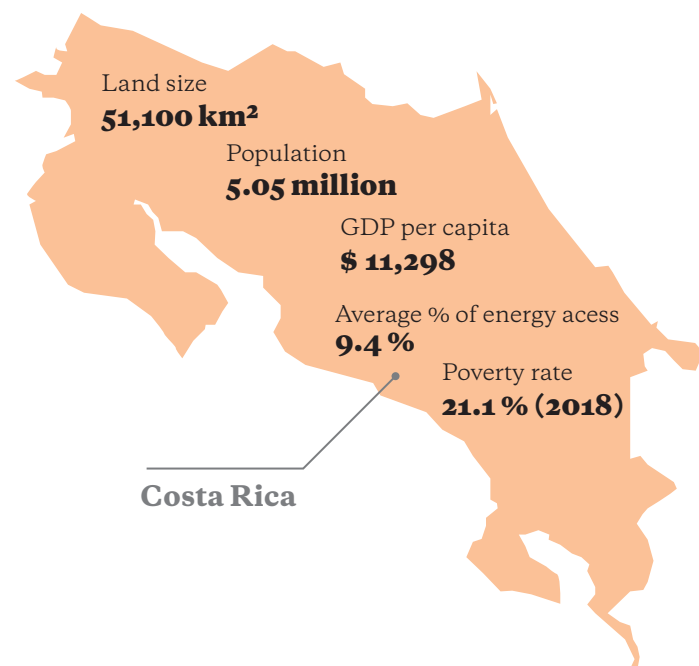
What is the strength of your work on 100 % RE?

Masum: As all countries of the world are expected to raise their ambitions to reduce GHG emissions and achieve Agenda 2030, working on 100 % RE roadmaps plays a crucial role in integrating renewables into the NDC and SDG processes. And it does so through science. The collective efforts of national and international experts in the project not only enhance the quality of evidence, but also the project's credibility. Sometimes I feel governments pay more attention when policy work is done through scientific studies. We should further explore how partnerships between CSOs and universities could strengthen CSOs and increase their knowledge base.

3.3 Costa Rica

Costa Rica is a unitary presidential constitutional republic in Central America. For decades, Costa Rica has experienced political stability and steady economic growth, which has also benefitted social development. This includes a significant increase in per capita income as well as near universal access to healthcare, education and pensions (OECD 2016). Yet, inequality has been on the rise since the mid-1990s. Due to its geography, Costa Rica is highly vulnerable to extreme weather events such as cyclones and flooding. Data from the Ministry of National Planning and Economic Policy (MIDEPLAN) reports that between 1988 and 2012, extreme weather events have resulted in economic losses totalling USD 1.3 billion (MIDEPLAN 2014).

Costa Rica's living standards are well aligned with sustainable natural resource use and decarbonisation has been effectively mainstreamed throughout the population. In fact, the country aims to be the first carbon-neutral country by 2021 and to reach net zero emissions by 2050 as stipulated in its Decarbonization Plan (Government of Costa Rica 2019). The Decarbonization



Plan is structured around four main pillars: 1) transport and sustainable mobility; 2) energy, green building and industry; 3) integrated waste management; 4) agriculture, land use change and nature-based solutions. Pillar two foresees that by 2030 the national grid will be capable of operating at 100 % with renewables. Costa Rica is the only country that has achieved almost 100 % renewable electricity, running solely on renewables for most of the year. Large hydropower accounts for about 80% of renewables used. Yet, the demand for fossil fuels, in particular oil, has been increasing in recent years, mostly owing to the transport and industrial sectors.

“The project supports the democratisation of decision-making processes around decarbonisation in Costa Rica”

Adrián Martínez Blanco



Interview with Adrián Martínez Blanco,
La Ruta del Clima, Costa Rica

Costa Rica is already a leader in Renewable Energy. What can a 100 % RE roadmap contribute?

Adrián Martínez Blanco: The roadmap creates a dialogue about decarbonisation pathways by partly using a separate set of data and a different – energy tailored – model to do so. This roadmap can bring the discussions to a whole new level where we can talk about science-backed policy choices that can be adopted. We hope that the roadmap will highlight the importance of e-mobility, in particular for

public transportation. While electric vehicles are currently promoted through tax reductions, they stipulate the purchase of cars, rather than promoting public transportation modes such as e-buses.

Why should multi-actor partnerships be at the core of the 100 % RE vision?

Martínez Blanco: The focus on people is very important. It supports the democratisation of decision-making processes around decarbonisation in Costa Rica and aims to leave no one behind. This is crucial for Costa Rica, as rising inequalities have become increasingly concerning and are especially prevalent between urban and rural regions. Rural areas are often forgotten in development initiatives, even though they are more vulnerable. The roadmap can help to highlight these inequalities and provide support to achieve a just energy transition. For example, the country's refinery RECOPE is proposing to employ first-generation biofuels from sugar cane by doubling its production and eventually introducing second-generation biofuels. This proposal has lots of negative externalities and does not reflect the use of current technological developments to reduce emissions.

How do you intend to use the outcomes of the 100 % RE scenario?

Martínez Blanco: We focus on dialogue. The Decarbonization Plan at its core forces the NDC to jump from a 2° C degree goal to 1.5° C. This is a major change that most people have not noticed. It also implies that for the next year a public participation process has to be done to allow for a more ambitious NDC. However, this may not take place adequately. We want to use the outcomes to nourish this process and engage stakeholders in the upcoming NDC process. We want to focus on how this information is useful for the people, CSOs, private sector and academia to influence decision-making. Especially since the Decarbonization Plan does not play a major role in national political debates.



To build a successful multi-actor partnership and develop a 100 % RE roadmap, a variety of stakeholders are needed: from civil society and academia to utilities, ministries and banks.

4. Lessons learned: developing and implementing a process for 100 % RE

The following lessons learned from the process of developing 100 % Renewable Energy roadmaps provide an overview of the results, barriers and opportunities that might arise. They are divided into three categories: general lessons based on the technical scenarios, lessons learned from the national process set-up and, lastly, lessons learned from national and international policy processes.

4.1 Lessons learned: technical 100 % RE scenario

Renewable Energy scenarios can enable policy-makers to develop robust and science-based RE policies. The importance of such RE scenarios as a tool for long-term energy planning cannot be overstated: they enable policy-makers to justify RE targets and policy objectives within their government, as well as offering insights into investment needs, RE potentials and more. They can initiate the development of a joint RE vision – and thus establish multi-actor partnerships – and they highlight relevant transition pathways. Such scenarios are “necessary to describe possible future development pathways, giving decision-makers a broad overview of the implications of various options” (Teske/Morris/Nagrath 2019). Scenarios can help gauge investment needs to achieve the energy transition, GHG emission reductions, job creation and GDP growth and thus enable long-term planning for RE infrastructure and investment priorities. Such scenarios can, however, by no means be a definite prognosis, but should instead be seen as a what-if analysis that supports decision-makers in shaping their future energy system. While scenarios can provide answers to some of today’s questions, such as the amount of investment needed to achieve a shift to 100 % RE, other issues cannot be addressed without a high level of uncertainty as any modelling process will always work with a set of assumptions to model possible future pathways for a) GDP growth, b) future electricity demand, c) industry development, d) cost reduction of RE technologies, etc. To overcome these uncertainties whilst balancing long-term planning versus short-term development, flexible, continuous exchange and engagement between stakeholders are needed. Therefore, setting up a multi-actor partnership is essential to develop validated scenarios that are relevant to current policy processes. Only with in-depth engagement throughout all sectors and validated data can the requirements and needs of a

functioning energy market be established over a longer period of time.

Despite their usefulness for long-term planning, scenarios are yet to play a more significant role in policy-making. Sometimes, access to necessary software capacities, data, skills and knowledge is limited. At other times, there is simply a disconnection between science and policy, even though scenarios demonstrate the feasibility of 100 % RE and highlight the benefits of boosting energy access.

An energy system powered by 100 % RE is feasible and often cheaper

A 100 % RE-powered energy system is achievable. Costa Rica has paved the way by demonstrating that a system that runs on renewable electricity for almost 365 days a year is feasible with today’s technologies. While stakeholders in Tanzania and Bangladesh have highlighted the major challenges for Renewable Energy in their countries, the 100 % RE scenarios prove that a transition to renewables is achievable with existing technology and significant improvements in energy efficiency. It is most noteworthy that Bangladesh – a country with a challenging geography and limited available land – can transition to 100 % RE by 2050 without utilising crop lands or housing areas. What is more, by tackling its unique challenges, such as severe flooding in coastal areas, Bangladesh may become a leader in the innovative implementation of RE technology, such as floating solar homes and wind turbines.

An energy system powered by 100 % RE is cheaper

The transition to 100 % RE is not only feasible, it is also cheaper and leads to extensive fossil fuel cost savings. In fact, the scenarios conducted by the Institute for Sustainable Future at the University of Technology in Sydney showed that by shifting fossil fuel expenditures into RE deployment, the resulting fuel cost savings would be more than enough to finance the investments needed to shift to a Renewable Energy system. Bangladesh, for instance, could cover 180 % of its energy transition to 100 % RE simply by transferring fossil fuel investments and subsequent fossil fuel cost savings to renewables.

100 % RE is best suited to provide energy access for all

The scenarios show that universal access to energy – with a particular focus on stable electricity supply – is possible by 2050 at the latest. In the case of Bangladesh,



Having representatives from all stakeholder groups participate is key for developing 100 % RE strategies.

it is possible within one generation. Achieving stable and clean energy access for all will be crucial for the further economic development of countries in the Global South. The study conducted in Tanzania showed that poverty and energy access are directly linked: poverty rates are highest where no energy infrastructure exists.

A model focusing on expanding a distributed energy system, emphasising a bottom-up electrification process, can guarantee energy access for even the most remote locations and can increase economic opportunities for the population. A system such as this is based on the inherent modularity and decentralised nature of Renewable Energy, whereby energy can be used where it is being harvested. Therefore, the ISF’s scenarios found a three-step solar-swarm grid most suitable. This approach focuses on pico-grid development in a first step, which will then be connected to micro-grids and eventually transmission grids in a final step. This would be well suited for a country such as Bangladesh where SHS are widely used to power rural households and where transmission grids are currently very unstable.

A system of this kind can significantly boost reliable energy access, especially in countries like Tanzania where only around 33 % of communities have access to electricity (Bishoge et al. 2019) and grid development is uncoordinated between levels of governance. What is more, a decentralised grid system can support economic value creation across the country. In fact, around 70,000 households in Tanzania already have access to electricity via decentralised solar home systems – and the number is growing rapidly. Distributing companies are aiming to interconnect SHS to micro-grids and eventually transmission grids. These developments are currently private sector initiatives in the East African country.

Significant improvements in energy efficiency are indispensable

To achieve a renewable-powered energy system and reduce CO₂ emissions at the scale and speed necessary to limit global warming to 1.5° C, significant improvements in energy efficiency are crucial. The scenarios developed for Tanzania, Bangladesh and Costa Rica showed that a

doubling in energy productivity over the next ten to fifteen years needs to accompany the dynamic expansion of RE across all sectors if significant CO₂ emission reductions are to be achieved. To do so, existing energy efficiency standards for electrical applications, buildings and vehicles need to be strengthened in order to maximise the cost-efficient use of RE and to achieve a high level of energy productivity by 2030.

Moreover, the 100 % RE scenario for Tanzania highlighted that energy efficiency improvements help to reduce the growing energy demand for wood to fuel traditional cooking stoves and accelerates the shift to modern and sustainable biomass, solar and geothermal heating, as well as electric cooking, by 2050.

Storage requirements can be reduced when using a mix of state-of-the-art technologies

Renewable Energy shares in the energy mix are variable. Therefore, an energy system based on RE needs to be able to flexibly cope with the changing mix, for instance



The 100 % RE scenario for Tanzania highlights that energy efficiency improvements help to reduce the growing energy demand.

“Credible research is the starting point for initiating a multi-stakeholder driven policy dialogue”

Jahangir Hasan Masum, Executive Director, Coastal Development Partnership Bangladesh

through storage. Storage will have to play an important role in the future due to growing energy demand, economic development and population sizes. The modelled scenarios take this into account and show that storage and dispatch requirements can remain within a maximum of 10–20 % of total energy generation by 2050, although high shares of renewables will be dispatched. Current and near-term storage requirements are still very low, as the scenarios for all three countries show. Tanzania, for instance, has only minor requirements of about 6 % by 2030, most of which are short-term storage requirements to even out the day-and-night variations of solar PV systems. In 2050, batteries will continue to shoulder more than half of the entire storage demand. Bangladesh, on the other hand, will need floating storage devices to avoid battery damage in the case of flooding.

Limiting global warming to 1.5° C requires 100 % RE

All scenarios show that transitioning to 100 % RE can reduce GHG emissions to the levels necessary to limit global warming to 1.5° C, as agreed in Paris in 2015. This means that higher ambitions in NDCs, especially in the transport sector, will be necessary in the coming years.

Even then, if we are to truly build a sustainable world without any further damage caused by anthropogenic climate change, the rate of deforestation needs to be reduced drastically. Tanzania alone loses up to 125,000 hectares of forest cover annually. Instead, large-scale reforestation projects need to be initiated (Teske et al. 2018) and sustainable forest management practices need to be developed and implemented.

4.2 Lessons learned: establishing a process

The energy transition cannot be achieved by one individual or a single group of stakeholders alone. It requires the broad participation of all sectors. Only then can political changes – such as within ruling parties in government – be overcome and the vision of 100 % RE truly be implemented. CSOs can play a crucial role in driving this process as representatives of the public. The role of CSOs

has been changing over the past years – from activists demonstrating for a cause, towards facilitators, conveners and drivers of innovations and facilitators of change. They have become increasingly effective in tackling societal challenges due to increased communication possibilities both online and offline and through new models of public participation. CSOs have become established supporters of national and international policy processes and international fora through the establishment of formal consultative processes.

As such, CSOs have a major role to play in the energy transition as connectors between the people and the government, awareness raisers, and facilitators of the shift to 100 % RE. This includes CSOs working on topics such as social and economic rights, ecosystem protection and gender equality. Their integration into the debates adds value to the integrated approach of roadmap development, as they provide valuable input from some of the key action areas to achieve sustainable development – a unique selling point of multi-actor partnerships. The inclusion of CSOs across areas thus provides the means to shift to 100 % RE while simultaneously implementing Agenda 2030.

The role of CSOs, however, varies from country to country. While CSOs enjoy broad opportunities for participation in some countries, the opposite might be the case elsewhere. In Brazil and the Philippines, for example, the role of CSOs is becoming increasingly diminished. In Bangladesh, CSOs need to navigate the space between public participation to tackle societal challenges and a more restrictive state authority.

Diligently map stakeholders

To build a successful multi-actor partnership and develop a 100 % RE roadmap, a variety of stakeholders are needed: from civil society and academia to utilities, ministries and banks. In addition to these stakeholder groups, a stakeholder mapping exercise should include the country's most relevant initiatives, development organisations and banks, as well as political parties. The latter is important as buy-in from different parties allows a long-term view on the implementation of 100 % RE to be maintained, e. g. in case the ruling party changes after an election. In addition, it is important to map and include multipliers (media, community organisations, etc.), to raise awareness among the broader public.

What is even more important than listing stakeholders is understanding their position vis-à-vis Renewable

Energy in the country: Who are the leaders for RE? Who are the potential opponents and what are their arguments? Which ministries and governmental bodies need to be included in the project? Who are the change-makers? What is their motivation to act as they do? Where do they stand in relation to 100 % RE? The choice of stakeholders included in the process and their respective roles will determine the project's success in the long run. To set up an inclusive MAP, it is necessary to also engage stakeholders who might oppose the transition to 100 % RE and to keep an open mind as to how to engage them and ideally convince them of the benefits of RE.

The ideal outcome of the project would be that a 100 % RE target is set and actively pursued through the implementation of enabling policy frameworks. For that, government ownership of 100 % RE is mandatory. Involvement from the early stages onwards and bilateral meetings are crucial. Utilising international government-led initiatives such as International Renewable Energy Agency (IRENA) or Sustainable Energy for All (SEforALL) may leverage buy-in.

Build a platform for continuous and supportive peer-to-peer policy dialogues

Continuous peer-to-peer exchanges foster relationships and increase ownership of the energy transition and other objectives. Such dialogues need to be institutionalised in a platform that is coordinated by national stakeholders and equipped with enough human capacities and resources to facilitate regular meetings and bilateral exchanges. CSOs can utilise these exchanges to establish themselves as supporters rather than being watchdogs of the government. In Tanzania, this exchange was relevant in order to gather and validate energy data that was otherwise missing. Peer-to-peer exchanges and discussions to collect data also proved to have a positive impact on the development of a shared vision of 100 % RE. In Bangladesh, exchanges attracted government buy-in, and in Costa Rica they were important to align the objective of 100 % RE with already existing government targets on net zero emissions.

Part of this peer-to-peer dialogue was a study tour to Bangladesh to enable South-South exchange on how distributed energy systems can accelerate electrification whilst empowering citizens to actively take part in the energy transition. This also provided insights into barriers for distributed RE in Tanzania as well as opportunities to scale-up RE deployment.

The relationships built during the workshop series in Tanzania, Bangladesh and Costa Rica were further employed in joint international events, such as the High-level Political Forum or COPs, where government, CSOs and international partners collaboratively explored the interaction between Renewable Energy and Sustainable Development Goals (WFC 2017). Building relationships can also develop synergies with other organisations and government institutions. In Tanzania, extensive relationship building led to an increased role in national energy processes by – among others – developing a consultation process for a national long-term energy strategy.

Develop interactive workshop formats

Interactive workshop formats stimulate out-of-the-box thinking, allow new alliances to be unveiled and for different voices and perspectives to become more visible. For this to happen and for the desired results of the workshop to be achieved, the moderator needs to have an arsenal of tools at their disposal that can facilitate discussion in order to enable the desired outcomes. Workshops should aim to give enough background information so that participants have the same level of understanding of the issue at hand. This should ideally be done with a mix of informative keynote speeches and interactive working sessions that include all participants. At the same time, it is important to utilise other methods, such as bilateral meetings with government representatives.

Keep a long-term view of the process and objective

Building the trust and relationships needed to implement the transition to 100 % RE takes time – and might well be one of the most challenging aspects of such a process. Depending on the stakeholders involved, the changes in political systems, the international environment and available funding, the path from developing a shared vision, i. e. a 100 % RE roadmap, to the actual implementation and deployment of RE technologies may take several years. To set up and follow through with such a project, one needs to actively engage change agents and key stakeholders. The policy dialogue needs to be designed in a way that makes the process relevant, timely and engaging. In addition, this process needs to be flexible enough to accommodate any changes that might occur during the project's duration.

Such an extended, indepth process for disrupting policy changes needs funders who understand that a project of this nature takes time and are willing to finance an endeavour that does not necessarily show immediate results. While funding is abundant, the number of funders willing to step in seems to be limited. This adds another planning dimension to consider when setting up such a project.

Be aware of, and sensitive to, cultural specificities

The way people behave and interact with each other depends to a large extent on personal upbringing and social interaction. As such, it might be worthwhile pointing out that some barriers may arise in one country that do not play a role in another. In Tanzania, for instance, the collection of wood for fuel plays a role in community-building and social interaction, especially for women. Stakeholders from Bangladesh, on the other hand, pointed out that this was not the case. Rather, the collection of wood for cooking would be abandoned if clean and electrified cooking systems were readily available. Having representatives from all stakeholder groups and sectors participate in a MAP process signals respect for cultural and group specificities. In those cases where people from different backgrounds are involved, intercultural communication needs to be strengthened, information provided and clarification supplied. This strengthens the importance of an approach that respects cultural sensitivities in its structural development, implementation and conclusion.



Tanzanian representatives explore solar irrigation systems in Bangladesh during a study tour.

4.3 Lessons learned: policy implementation

Make the process relevant

A strategic integration of renewables into the climate change and development agenda is necessary to meet international commitments. Hence, processes and narratives need to build upon other policy priorities dominating in the respective national context. This may include job creation, poverty reduction, GHG emission reduction potential, education and the circular economy. The project needs to stay relevant over the whole project period. The process and topics might therefore need to be adapted if circumstances such as changes in government, international agreements or geopolitical aspects shift.

In Tanzania, for instance, the project contributed significantly to data gathering and was thus seen as very useful and supportive by the government as they lacked the capacities to carry out such actions themselves. In Costa Rica, the project aimed to support the existing Decarbonization and Energy Plans by looking through a magnifying glass at the RE potentials and electrification of the transport sector. In Bangladesh, the project emphasised the productive and innovative uses of RE to foster development perspectives.

Joint development of a compelling narrative eventually leads to political relevance. In Tanzania the link between Renewable Energy and poverty eradication was made, while in Costa Rica the narrative developed around the country's Decarbonization Plan, i. e. to become the first carbon-neutral country by 2021.

It is crucial to have an appealing and convincing project narrative that is achievable, inclusive and positive and was developed by local stakeholders. The 100 % RE roadmap eventually paints a picture of Renewable Energy and its opportunities for a country's development, rather than that of a burning platform, urging action to be taken. This picture of RE as a socio-economic driver also makes the case for the linking of roadmaps to existing climate and development plans, which are said to be one of the main drivers behind RE deployment and "might motivate society to pursue the transition (to 100 % RE) for a net positive outcome" (Go 100 % RE Platform 2018). Indeed, the rapid deployment of RE over the past years has been driven mostly by a range of co-benefits that are advancing economic development, improving energy security, enhancing energy access and mitigating climate change (Climate Investment Funds 2018).

One such co-benefit may be the imperative of reducing the incidences of respiratory illness, which can be realised through reduced air pollution. This, in turn, can partly be achieved by substituting conventional diesel cars with electric cars (WHO 2018). Clearly communicating the economic and social advantages in terms of the specific possibilities of a 100 % RE future helps to increase acceptance of the transition itself.

One of the best examples of how this can be done successfully across a whole country is illustrated by Costa Rica. The government succeeded in mainstreaming the narrative of decarbonisation for the greater good. Rather than merely meeting climate targets, the country's Decarbonization Plan was developed with a view to benefiting its people and increasing social wealth. Costa Rica has a long tradition of pursuing progressive policies for the benefit of social goods. By abolishing its army in 1948, Costa Rica was able to redistribute funds to provide free education and health services, and environmental protection. By choosing social goods, rather than economic benefits, environmental protection became part of Costa Rica's collective identity, with large parts of the population recognising the national benefits of protecting the environment and taking action to mitigate climate change. In 2000, the country's Supreme Court ruled oil concessions void because indigenous communities were not consulted properly. Only two years later, former President Abel Pacheco declared that Costa Rica would not exploit oil. A memorandum followed, which still stands to this day (Engler/Martinez 2003). The Decarbonization Plan marks the most recent action in this long line of measures. Launched in early 2019, it aims to make Costa Rica the first carbon-neutral country in the world and achieve net zero emissions by 2050. To ensure that the Plan was designed for the people, it was developed with the people. High-ranking government officials teamed up with international political leaders to ensure national and international media coverage while the President of Costa Rica made television and radio appearances. Carlos Manuel Rodriguez, Minister of Energy, also engaged in intensive meetings with citizens where they could hold him accountable.

Build coherent governance frameworks

Power structures influence communication, engagement processes and relationship building. In some cases, they might even delay a policy dialogue. Such structures might be interministerial or exist across sectors. In

addition to power structures, different mandates across different authorities can lead to uncertainty about responsibilities. In Tanzania, for instance, the Ministry of Environment is part of the Climate Vulnerable Forum (CVF) and as such was involved in an international declaration at COP 22 in Morocco to shift energy resources to 100 % renewables by 2050 at the latest. Yet the decision-making power regarding the implementation of this vision on a national level lies with the Ministry of Energy. This requires coherent communication and co-ordination between the two authorities. A 100 % RE roadmap should thus aim to support the establishment of coherent governance frameworks that can break silo thinking. Continuous peer-to-peer dialogues will ideally improve inter-ministerial and cross-sectoral communication and collaboration.

In addition, such exchanges should be institutionalised. This is rarely the case at the moment as CSOs and governments often lack the personnel capacities and financial resources to implement continuous exchange mechanisms. Thus, peer-to-peer dialogues remain infrequent and subject to the resources available to individual organisations and authorities. This has implications for monitoring activities as well, as they are subject to the same activities and capacities. In Tanzania, almost no data on the status of RE deployment was available and monitoring is still rather fragmented, which made the process more relevant for the ministries. In Bangladesh, abundant data is available but might vary depending on the governmental body publishing the information.

Aim to strengthen policy coherence

“The process can fill the gap where governments do not have the capacities to do so. It strengthens us as civil society in Costa Rica”

Adrián Martínez Blanco, Director, La Ruta del Clima

By emphasising socio-economic benefits and linkages to other policy priorities, stakeholders from different sectors can become RE advocates. Hence, engaging sub-national governments, civil society and community organisations plays a crucial role in developing a joint and integrated vision for renewables. Doing so allows these actors to be brought on board more easily because they see the benefits renewables can offer in the face of current challenges, such as sanitation, crop yields and water

access. Although RE can play a role in tackling all these issues, communities often fail to recognise the advantages on offer due to a lack of knowledge. And while awareness raising and advocacy might be helpful, it will remain difficult to engage some communities even in basic training sessions on RE and environmental protection (Gallagher/Wykes 2014). One way to address this issue is to include the socio-economic aspects of RE in the policy dialogue right from the start. Costa Rica did just that with their Decarbonization Plan. Growing inequalities between rich and poor and the urban and rural populations led the government to place special emphasis on social inclusion during their national-level planning for the Decarbonization Plan. They added the aspect of a “just transition” to highlight the inclusiveness of decarbonisation as a transversal issue, with a particular focus on increasing the sector’s opportunities on the labour market. In addition, the Decarbonization Plan aims to improve education and cultural awareness for carbon-free initiatives. In Bangladesh, the rapid deployment of SHS led to increased awareness of the co-benefits of RE, specifically regarding job growth, electrification and productive uses, such as solar irrigation (Centre for Public Impact 2017).

Vested interests and outside influence can have a significant impact on the process

Stakeholder mapping must include unveiling vested interests as well as potential influences on energy policy decisions. This may include lobby interests, geopolitical relations, personal power relations of certain stakeholders or competing policy priorities.

Given that an energy transformation driven by renewables brings changes radical in their scope and impact, it is essential that such structures be considered. In the case of Tanzania, Bangladesh and Costa Rica, the transition to 100 % RE increases their energy independence significantly, which reduces the risks inherent in vulnerable energy supply lines and volatile prices. However, international relations, economic interests as well as geopolitical regimes may counter this. Further, the roadmaps in all three countries proved that renewables can be a powerful vehicle of democratisation as they make it possible to decentralise the energy supply, empowering citizens, local communities and cities. What is more, such a transformation may change historical power structures and challenge certain interests.



The 100 % RE scenario for Tanzania has shown that it is possible to scale up RE deployment to 100 % whilst making it affordable for everybody.

By articulating this within the policy dialogues and also including these challenging voices in the conversation, the policy roadmaps can at least encounter some of these underlying, sometimes hidden influences.

Strengthen the policy-science interface

Policy-science interfaces are critical to shaping future-just governance. This is of particular importance when developing long-term policy frameworks for fundamental transformations such as those called for in the Paris Agreement and Agenda 2030. In Tanzania and Bangladesh, the development of scientific scenarios was considered to offer the largest added value. Political decision-makers were particularly keen to access knowledge but also data relevant to the shaping of energy policy. While Costa Rica has vast expertise in conducting climate models and has already developed a policy-science interface, the role of RE, and the necessary investment calculations in particular, have not formed part of this work. The examples show that policy-making is still too often disconnected from science.

This situation is further aggravated by the fact that scientists and policy-makers at times do not seem to speak the same language. This results in an apparent disconnect between information provided by scientists and information needed and used by policy-makers. The policy dialogue across sectors is specifically designed to enable science-based policy-making. Indeed, a study by Weichselgartner/ Kaspersen (2010) showed that research that has been created collaboratively, with both policy-makers and scientists developing the research agenda, receives higher overall recognition.

Looking at experiences in Costa Rica and Bangladesh specifically, it has become clear that an inclusive and interactive policy dialogue with peer-to-peer exchange more efficiently facilitates cross-sector and cross-governance dialogues. By jointly developing parts of a technical scenario to inform policy recommendations, stakeholders gain a common understanding of the problems facing a transition towards 100 % renewables.

In addition, it has become clear that research needs to address the informational needs of policy-makers in order to receive recognition. This is especially true of Costa Rica, a leading decarbonisation country with a strong research focus. This means that research needs to be translated into policy-friendly briefs and other outputs. In addition, infographics and/or factsheets can help to improve the policy-science interface by making tables, statistics and assumptions more visually appealing. In the end, only involved policy-makers can say what kind of output they need in order to strengthen renewables within their country.

Actively seeking linkages with other initiatives is important

In order to close the gap between international commitments and national actions, renewable energies need to be mainstreamed within national contexts. This can be achieved by building on platforms such as the NDC Partnership, United Nations bodies, IRENA, SEforALL, or other development and Renewable Energy initiatives. 100 % RE roadmaps can inform the development of action agendas for initiatives such as SEforALL or the NDC process under the United Nations Framework Convention on Climate Change (UNFCCC). These linkages work both ways: just as RE roadmaps can inform them, initiatives and platforms can help to scale up renewables by including results in their strategies or distributing roadmap findings among their broader multi-stakeholder network.

5. Conclusion and what lies ahead



A model focusing on expanding a distributed energy system, emphasising a bottom-up electrification process, can guarantee energy access for even the most remote locations.

A huge transformation lies ahead of humanity as it faces one of its biggest challenges. To make this transformation a reality, everybody will need to think outside the box: the future cannot be shaped by ideas from the past. Hence, new alliances need to be built, people need to become part of the transformation, new approaches need to be tried out, innovative ideas need to be facilitated and new business models need to be developed. For this, strengthening change-makers and building capacities across all sectors is crucial. This is what this 100 % RE roadmap approach is doing. The Paris Agreement and Agenda 2030 provided the mandate to facilitate system transformations; now it is up to humanity to operationalise these changes at the national level. Sharing experiences, learning from each other and replicating success will be more important than ever.

The narrative that 100 % RE is possible, feasible and less costly than investing in obsolete fossil fuels needs to be based on scientific findings and knowledge of RE's potential and its benefits not only for tackling the challenges of global warming, but also for society and the economy. Highlighting the manifold benefits of renewables to national and international action areas is an important first step in this process.

Strengthening the role of multi-actor partnerships as the fundament to this work is another important step as a holistic transformation can only happen if all sectors are on board. Only then can political short-term interests, which can undo years of work when political power changes hands, be overcome. That is why academic buy-in, which has been shown to have a significant impact on the long-term sustainability of transition processes, needs to be ensured. It provides the scientific knowledge, as well as capacity-building measures, for local planning and implementation expertise.

Our work needs to focus more heavily on bridging the gap between science and policy and fostering science-based policy-making by integrating academia into policy needs. Scientifically sound 100 % RE pathways also need to be backed by opinion leaders.

Decision-making needs to build upon the needs and the will of the people, and politicians need to act for the good of everyone.

We need to achieve 100 % RE for all.

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