World Future Council

VOICE OF FUTURE GENERATIONS

AMBITION FOR THE FUTURE

100% RENEWABLE ENERGY TO ACCELERATE SUSTAINABLE DEVELOPMENT

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1. INTRODUCTION

The recently published IPCC (Intergovernmental Panel on Climate Change) Special Report on 1.5°C argues that "warming from anthropogenic emissions from the pre-industrial period to the present will persist for centuries to millennia and will continue to cause further long-term changes in the climate system"[1]. Meanwhile, the International Energy Agency (IEA) recently published their annual Global Energy and CO2 Status Report, which shows that global emissions grew by 1.4% in 2017 – after flattening in the three previous years. This means that global emissions have reached a historic high of 32.5 gigatonnes (Gt)[2]. As planetary resources and intact ecosystems become ever more limited and exploited, and humanity stumbles from one global catastrophe to another, the need for just and sustainable global development becomes increasingly apparent.

This worrying trend comes against the backdrop of the landmark Paris Agreement, which was signed by 195 parties and which left us with an opportunity to avert the worst climate impacts before it is too late. Each state is requested to generate Nationally Determined Contributions (NDCs) (Par. 23 and Par 34 1/CP.21). A first analysis of these NDCs is already underway with the stock-taking process – the "Talanoa Dialogue"[3] – taking place in 2018. In parallel, the Agenda 2030, adopted in 2015, provides us with a plan for "people, planet and prosperity" that leaves no one behind. The truth is that while a kaleidoscope of international, national and local commitments struck in 2015 aim to keep global climate change to 1.5°C, existing policy measures, legal frameworks and initiatives that are supposed to implement these commitments are nowhere near these ambitions.

Our chances of limiting global warming to 1.5°C look increasingly slim if we postpone actions any longer and don't work together; however, research indicates that this target is achievable if we fully decarbonize our economy and society by no later than 2050. This ultimately means a transition to 100% renewable energy (RE) and a complete phase out of fossil fuels. Although this vision has received international support in recent years – particularly from the 48 member states of the Climate Vulnerable

Forum (CVF), which have committed themselves to transitioning to 100% RE before the middle of the century (Marrakech Communiqué of COP22) – we lack the concrete policies and initiatives designed to operationalize these commitments.

Fortunately, a shift to 100% RE is no longer an utopian ideal, as the seismic changes in energy markets in recent years have shown: "we are on the verge of a profound and urgently necessary shift in the way we produce and consume energy"[4], away from fossil fuels consumption towards RE. However, such a complete and just transition towards 100% RE by around 2030 at the latest is nothing short of a paradigm shift in how we think about and consume energy if we are to succeed in limiting climate change while striving for greater economic development within planetary boundaries for us and future generations. In fact, several studies have demonstrated the link between the transition to 100% RE and the achievement of sustainable development, including the 17 SDGs – just as the nexus between development and energy is undeniable, so is the one between *sustainable* development and *renewable* energy[5, 6].

Both present and future generations rely on us to set the path towards a sustainable future which is not threatened by overconsumption, land degradation, and climate change – and all the security threats stemming from these developments. Therefore, this report highlights, how 100% RE is a prerequisite for achieving justice and dignity for present and future generations and provides us with options on how to achieve a carbon net zero society through 100% RE, including a mechanism to finance this transition. The links between these elements – namely regenerative cities, sustainable agriculture, peace and disarmament and education for sustainable development – and 100% RE underpin the reasoning and strong necessity to transition to 100% RE. The clarification of these interrelationships enables a comprehensive approach to climate action and policy design that disrupts single silo thinking while leaving no one behind.

1 IPCC (2018). Global Warming of 1.5°C. IPCC Special Report, available at: http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

2 OECD and IEA (2017). Global Energy and CO2 Status Report, p. 1, available at: http://www.iea.org/publications/freepublications/publication/GECO2017.pdf

3 The Talanoa Dialogue was launched at the UN Climate Change Conference under the Presidency of the Republic of Fiji (COP23). It is a process of inclusive, transparent and participatory dialogue that involves the sharing of ideas, skills and experience through story telling. It was designed to help countries to check progress and seek to increase global ambition to meet the goals of the Paris Agreement.

4 World Future Council (2014). How to achieve 100% Renewable Energy – Policy Handbook, p. 1, available at: https://wfc.world/2JcLUYj

5 Dincer, Ibrahim. (2000). Renewable Energy and Sustainable Development: A Crucial Review, Renewable and Sustainable Energy Reviews, 5/2, pp. 157-175, available at: https://www.sciencedirect.com/science/article/pii/S1364032199000118

6 World Future Council, Brot für die Welt (2018). 100% Renewable Energy for Sustainable Development, available at: https://www.worldfuturecouncil.org/wp-content/uploads/2018/03/100SDG_webversion.pdf

2. CLIMATE JUSTICE FOR FUTURE GENERATIONS

The decisions taken today will have a major impact on the world of tomorrow. The 5th IPCC Assessment Report highlights the long-term impact of our actions: "Most aspects of climate change will persist for many centuries even if emissions of CO2 are stopped"[7]. Climate change action (or inaction) of people today can jeopardize rights and well-being of generations to come as well as environmental sustainability.

In Article 3 of the United Nations Framework Convention on Climate Change (UNFCCC), the international community recognizes that climate change is fundamentally an intergenerational problem[8]. That is why we must strive to put intergenerational justice and the protection of long-term interests at the heart of policy-making. Building upon short-term interests, political decision making confined to single-issue silos, business models driven by short-term profit and stakeholder demands for immediate returns – the current decision-making structures "borrow environmental capital from future generations with no intention or prospect of repaying. […] We act as we do because we can get away with it: future generations do not vote; they have no political or financial power; they cannot challenge our decisions,"[9] stated the UN Commission on Environment and Development in 1992. Our obligation to present and future generations requires that all human decisions respect planetary boundaries, recognize the interconnection of people and planet, and encourage the best use of natural and cultural resources.

It is, therefore, necessary to abandon the current system which repeatedly fails to fulfil the rights and needs of present and future generations and instead promote change from a holistic and century-long perspective, including establishing strong institutions. The concept of Future Justice provides such a perspective and informs a political action plan that promotes adequate and adaptable governance frameworks based on just cooperation, broad-based participation and equitable sharing of resources and benefits of economic, scientific and technological progress. It shows how environmental, economic and social concerns converge in the long-run and combines the championing of better solutions with the blunt condemnation

7 IPCC (2013). Climate Change 2013. The Physical Science Basis. Summary for Policymakers, available at: http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf

8 UN (1992). United Nations Framework Convention on Climate Change, available at: https://unfccc.int/resource/docs/convkp/conveng.pdf

9 UN (1987). Report of the World Commission on Environment and Development: Our Common Future, available at: http://www.un-documents.net/our-common-future.pdf

of behaviour that threatens future generations.

Some of the risks associated with climate change are limited to particular economic sectors and regions, while others will have cascading effects, including systemic risks due to extreme weather events, risks of food and fresh water insecurity, or risks of loss of terrestrial, inland water, and marine ecosystems[10]. Those hit hardest by climate change are generally the least responsible, as the burden of climate change is distributed unequally. This includes women's and children's disproportional exposure to climate change risks, due to their overrepresentation among the world's poorest people. Furthermore, climate change is seen as a driver of human migration and will continue to reshape its patterns.

To avoid these and other catastrophes, the Paris Agreement recognizes the importance of climate justice[11] (Paris Agreement Article 2.1). In line with this, we inevitably touch upon the concept of Future Justice. A full transition towards 100% renewable energy plays a vital role in placing the health and rights of present and future generations within the core of climate action. It safeguards fundamental rights for future generations, such as the right to a healthy environment, the right to physical and mental health as well as the right to work.

Due to its holistic and cross-sector applications, 100% RE is also linked to most goals stipulated in the Agenda 2030, and all its 17 SDGs, far beyond the obvious SDG 7 "Ensure access to affordable, reliable, sustainable and modern energy for all". A 100% RE pathway contributes to improving the well-being of life on Earth today and tomorrow. As the planetary impacts of global warming become more apparent with every passing day, the goal of building and maintaining an energy system run on 100% renewable energy is no longer an idealistic utopia anymore, but a global public good of the highest order and of the utmost urgency[12].

2.1 The Necessity for a Global Energy Transition

Both present and future generations rely on us to chart a course towards a future which is not threatened by climate change. 100% RE offers this opportunity and, what's more, can serve as a means for socio-economic development. It can "create an equitable society for todays and future generations"[13].

In recent years, a substantially increasing number of national governments, cities, and businesses have committed themselves to a 100% renewable energy future. They do so, not just because of the compelling morality of mitigating climate change, but because they also see the technical feasibility and economic advantages of the transition to 100% RE. A recent article by Bloomberg shows that in 2016, solar power became the cheapest source of electricity in the global south for the first time[14]. With capital costs declining and virtually no ongoing fuel costs, 100% RE is within reach even for indebted or weak economies. Indeed, 100%RE offers more than just replacing fossil with renewable sources: landlocked countries, for instance, often rely on fossil fuel imports to meet their energy needs; a transition to 100% RE could make such countries energy self-sufficient. This will also have a positive impact on the number and scale

10 IPCC (2014). Climate Change 2014. Impacts, Adaptation, and Vulnerability. Summary for Policymakers, available at: http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/ar5_wgII_spm_en.pdf

11 UN (2015). Paris Agreement, available at: http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

12 Greenpeace International (2015). Energy [R]evolution. 100% Renewable Energy for All. A Sustainable World Energy Outlook 2015, available at: http://issuu.com/greenpeaceinternational/docs/energy-revolution-2015-full-hr/1?e=0/30193852

13 World Future Council, Brot für die Welt (2017). 100% Renewable Energy for Sustainable Development, p.4., available at: https://www.worldfuturecouncil.org/file/2017/09/100SDG_v11_low-quality.pdf

14 Randall, Tom. "Point: Solar That's Cheaper Than Wind," Bloomberg, 14 December 2016. [Online]. Available: https://www.bloomberg.com/news/articles/2016-12-15/world-energy-hits-a-turning-point-solar-that-s-cheaper-than-wind

of wars waged over energy reserves, including the recent devastating war in Syria[15]. In addition, there are many examples how RE is positively interlinked with development. In fact, it is linked to each of the 17 Sustainable Development Goals (SDGs) formulated in the Agenda 2030: from improving indoor air by replacing inefficient (biomass-based) cook stoves, to accelerating rural economic development by providing decentralized energy solutions, and to increasing food security and improving agricultural practices.

It's clear that the 100% RE transition is about building a new positive narrative that ensures that energy can continue to play the fundamental role in socio-economic development it has played so far, but without environmental degradation and the concentration of economic power in the hands of a few.

2.2 The Building Blocks for 100% Renewable Energy

The operationalization of the 100% RE vision mostly depends on the existence of political will. In spite of becoming a global movement, most decision-makers still lag behind when it comes to actually translating their visions into action. As the movement for 100% RE gains further traction, policy makers, change agents and champions need the tools to operationalize commitments. Fortunately, there are already basic guidelines. These so-called "building blocks"[16] for 100% RE help to translate commitments and visions into concrete actions by helping to scale up, monitor and evaluate performance in the RE sector and include the following:

- Activate local resource potential
- Develop a 100%RE roadmap
- Formalize aims and functions
- Promote energy conservation and efficiency
- Increase and integrate RE across sectors
- Identify financial resources
- Support decentralization and inclusion
- Nurture vertical and horizontal cooperation and integration
- Promote knowledge generation and capacity building
- Engage in networks

The 10 building blocks are a practical toolkit for a sustainable transition to 100%RE

These building blocks are flexible and can be interchanged, depending on the local context in place. While some countries have already committed to a 100%RE target, they may not yet have implemented it across policy areas or linked it to other processes such as implementing the Agenda 2030. Yet, other countries might not have an official 100% RE target.

Furthermore, the application of these building blocks have shown that it is more sustainable to develop a 100%RE strategy together with key governmental bodies, NGOs, research institutions, banks and other relevant local, regional or national change agents. It is important to notice that neither states, cities, regions,

15 Ganser, Daniele. "Swiss Institute for Peace and Energy Research," SIPER, [Online]. Available: https://www.siper.ch/en

16 The "100%RE Building Blocks" toolkit has been published by the Global 100%RE Campaign and aims to catalyze actions for 100% RE by providing principle guidelines, which can be adopted to all levels of actions – be it sector specific, regional governments, city authorities or national governments.

nor businesses can work in isolation, nor can they achieve 100%RE without engaging across all levels of government and key stakeholder groups. "Establishing, strengthening alliances and supporting a constructive dialogue among the different levels of government are therefore recommended to any successful 100% RE roadmap"[17]. Ideally, such vertical cooperation is formalized and integrated into all decision-making processes.

This course of action guarantees that the 100% RE vision is jointly developed and answers the core questions for implementing it: What exactly does 100% RE mean for the people involved? Which sectors can be easily included, which are more difficult to reach to achieve 100%RE? Which potentials for RE deployment exist? Which barriers exist (institutional, vested interests, fossil fuel infrastructure, and lack of finance)? Ideally, discussions will actively feed into credible 100% RE scenarios that go beyond pure Excel spreadsheets and include context-specific key issues such as energy access, employment growth and others.

A continued dialogue will strengthen new partnerships and facilitate knowledge transfers. However, it is crucial to understand that such multi-stakeholder processes in policy-making are lengthy and need to be flexible enough to adapt to changing circumstances.

3. 100% RE
TO STRENGTHEN CORE ELEMENTS FOR A JUST FUTURE

The upcoming and urgently needed transition of our energy system is intertwined with a number of demanding challenges our society is confronted with, including global impacts of rapid urbanization, food security, land degradation, territorial conflicts reinforced by energy security concerns and the rights of children and youth. All these aspects are core elements that need to be addressed in order to build a just society for future generations.

The dynamic between climate change and the need for an energy transition in these areas takes a dual-shape: as the consequences of climate change worsen, these areas will feel the stresses most acutely and reactions, in turn, could further aggravate the original conditions, multiply risks and crises and hamper our efforts to mitigate climate change; yet, conversely, it's also in these areas that key solutions to avoiding the worst climate impacts are found and large-scale rapid deployment of these solutions could have positive impacts across a range of issues related to peace, justice and development. In short, there is a clear feedback-loop and our actions will decide whether that's a negative or a positive one.

The transition to 100% RE can be immensely beneficial to these priority sectors for future justice in a variety of ways. What form this can take is explained in the following chapters, which will also provide pathways for sustainable development that leaves no one behind.

17 Boselli, Filippo; Leidreiter, Anna. (2017). 100% RE Building Blocks. A Practical Tool for a Sustainable Transition to 100% Renewable Energy, p. 68, available at: https://go100re.net/wp-content/uploads/2017/05/100RE-Building-Blocks.pdf

3.1 Building and Sustaining Peace

The interplay between climate change, energy security, peace and justice is multi-layered and complex. In the last decade, a host of institutions and high-level officials have started recognizing how these issues interact with each other. On the one hand, climate change is a threat multiplier, which could trigger hostility and threaten peace and stability within and between countries; on the other hand, access to and control over fossil fuels has been a major catalyst for violent conflict and military intervention. A just transition to 100% RE can address both challenges and offer alternative paths to peace, justice and development.

3.1.1 Climate Change as a Threat Multiplier

In March 2007, UN Secretary-General Ban Ki-moon warned that climate change might pose as much of a danger to the world as war.[18] The next month, the UN Security Council held its first debate on climate change indicating that global warming has elevated to the top of the international security agenda, rivalling the threat of war. Initiated by the United Kingdom, former Foreign Secretary Margaret Beckett compared emerging climate change to the "gathering storm" before World War II: "An unstable climate risks some of the drivers of conflict – such as migratory pressures and competition for resources – getting worse"[19]. A Report by the European Commission released in 2008 held that, "The core challenge is that climate change threatens to overburden states and regions which are already fragile and conflict prone"[20]. This analysis has been supported by the defence and security establishments in many countries, including the US Department of Defense, which in a 2015 report stated that "global climate change will have wide-ranging implications for U.S. national security interests over the foreseeable future because it will aggravate existing problems — such as poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions — that threaten domestic stability in a number of countries"[21].

Besides these political statements, the impacts of climate change on security have become subject to research, investigating the impacts of climate-related events on social and political stability on different parts of the world. Particularly unstable are fragile and weak states with social fragmentation, poor governance and management capacity. By altering the natural and social environment, climate change is a potential driver for violent conflict, including civil wars and military interventions that in turn are associated with various negative consequences such as famine and economic crises, forced displacement, resource exploitation and environmental degradation. There is a wide range of possible conflict constellations associated with the effects of climate change on rainfall

18 Climate change is our top priority, says UN chief, The Guardian, 2 March 2007, available at: https://www.theguardian.com/environment/2007/mar/02/climatechange.climatechangeenvironment

19 Beckett, Margaret. "Climate Change - the Gathering Storm", Speech at The Yale Club, New York City, 16 April 2007, at: https://www.fpa.org/events/index.cfm?act=show_event&event_id=216

20 "Climate Change and International Security", Paper from the High Representative and the Europe- an Commission to the European Council (S113/08), 14 March 2008, available at: https://www.consilium.europa.eu/media/30862/en_clim_change_low.pdf

21 "National Security Implications of Climate-Related Risks and a Changing Climate", Report of the United States Department of Defense, 23 July 2015, at: http://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf

and water scarcity, land use and food security, migration and refugee movements, extreme weather events and natural disasters, vegetation and biodiversity, which can become conflict factors individually or in conjunction. They may trigger societal tipping points, leading to social unrest, riots, violence, crime and armed conflict.

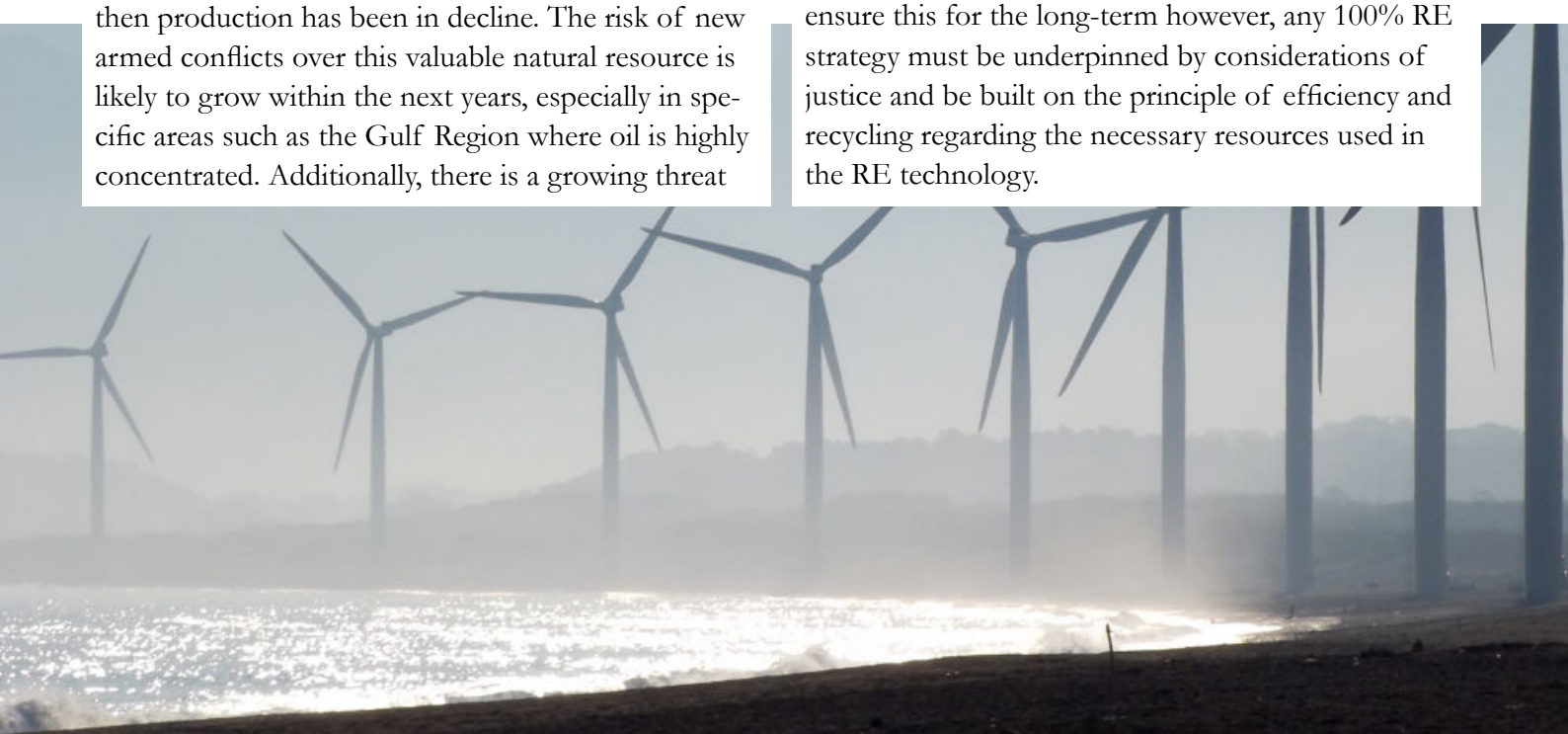
3.1.2 Control over Fossil Fuels as a Trigger for Conflict

There are diverse, complex and often interlinked causes for the existence of conflicts but many of them are tied up with energy security issues, mainly related to access to oil and gas fields. In fact, oil is often considered the main trigger-factor for conflicts following three mechanisms: first, when oil revenues are not legally overseen, corruption is incentivized, which weakens political institutions and is corrosive of public trust in institutions; second, oil is in many cases the main financing vehicle of warfare; third, the high dependence on rents generated by fossil fuels leads to a stagnation of socioeconomic development due to highly volatile market prices of fossil fuels.

Furthermore, tensions and conflicts over the possession and exploitation of oil and gas resources have considerably influenced international geopolitical dynamics. The concern is that in the future more conflicts may arise, especially because the global conventional oil production peaked in 2006 and since then production has been in decline. The risk of new armed conflicts over this valuable natural resource is likely to grow within the next years, especially in specific areas such as the Gulf Region where oil is highly concentrated. Additionally, there is a growing threat parallel to the related oil-issues, which is the new reliance on nuclear energy, which introduces a host of additional health, safety and security concerns, including the diversion to nuclear weapons development. Furthermore, the continued existence of nuclear weapons means that conflicts between nuclear-armed states have the potential to extinguish life on earth as we know it.

3.1.3 100% RE as Path to Peace and Justice

While the path to peace and justice relies up on different measures, peace and security can be improved considerably across the world simply by decreasing the over-reliance of countries on oil and gas. Unlike fossil fuels, which are characterized by the uneven geographical distribution of natural reserves, RE is abundant across regions and countries. By reducing the over dependence on fossil fuels reserves and instead decentralizing the energy structure, a transition towards 100% RE can improve the energy autonomy of countries and reduce current conflicts and prevent the emergence of new ones. In order to ensure this for the long-term however, any 100% RE strategy must be underpinned by considerations of justice and be built on the principle of efficiency and recycling regarding the necessary resources used in the RE technology.



Lastly, a transition to 100% RE can also support better institutions and governance structures through what is known as energy democracy. Energy democracy goes beyond national security of energy supply to bringing energy resources and infrastructure under public or community ownership or control. The term is grounded on the basic understanding that "the decisions that shape our lives should be established jointly and without regard to the principle of profit" and it is being practiced by an ever-growing number of decentralized community energy initiatives around the world. These communities often reframe energy access as a social right, rather than a profitable commodity. A growing number of experts and communities believe that de-carbonization of the energy economy is critical not only for mitigating climate change but also for achieving a more just, sustainable and resilient economy. In addition, some experts note that an equitable, ecologically sound energy system should serve the needs of the world's peoples, and that an energy transition will be advanced by a shift to public and community control. The distributed nature of RE – which theoretically are public goods accessible to all – helps to facilitate this process.

Importantly, a transition to 100% RE will benefit the achievement of all SDGs, which in turn will contribute to the maintenance of peace. A world that is violent and unpeaceful is at the same time unsustainable and unjust, and vice versa. Strategies for preventing the causes of violent conflict integrate a set of measures, including the preservation and efficient use of natural resources, implementing principles of equity and justice, strengthening cooperation and changing lifestyles. Accordingly, concepts of peace that rely on avoiding dangerous conflict, on preventive arms control, the reduction of violence and the abolition of nuclear weapons, and on compliance with human rights and cooperation, will improve the conditions for the co-operative implementation of sustainable development. The inherent linkages need to be further developed in a mutually stimulating way to an integrated concept of sustainable peace.

3.2 Unlocking the Transformative Power of Cities

Cities are home to more than half of the world's population and most of global economic activities. By 2050, 66% of the population are projected to live in urban areas; that's an additional 2.5 billion people to the situation today[22]. Thus, urbanization will be a defining trend over the next decades, especially for younger generations seeking better economic, political and social services and benefits. The large shift of population to urban areas, the separation of resources produced and extracted in rural areas yet consumed in cities, and urban-based activities are major contributors to the global problems of our time: climate change, biodiversity loss, resource depletion and soil degradation. Urban areas, although covering less than 2% of the earth's surface, consume 78% of the world's energy and produce more than 60% of all carbon dioxide and significant amounts of other greenhouse gas emissions, mainly though vehicles, energy generation, industry and biomass use[23]. Therefore, cities and local governments are playing an increasingly important role in combatting climate change and driving the energy transition.

While cities and their residents contribute significantly to climate change, they are equally vulnerable to the adverse effects of climate change, such as rising sea levels, storm surges, coastal flooding, air pollution or heat stress. The Fifth IPCC Assessment Report states that urban climate change risks are increasing with widespread negative impacts on people's livelihoods, health and assets and on local and national economies and ecosystems[24]. The urban poor, especially those living in informal settlements, are particularly affected by the risks of climate change, because informal settlements are often located in vulnerable areas with

22 UN (2014). World Urbanization Prospects. 2014 Revision. Highlights, available at: https://population.un.org/wup/Publications/Files/WUP2014-Highlights.pdf

23 UN-Habitat. Climate Change, available at: https://unhabitat.org/urban-themes/climate-change/

24 IPCC (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Urban Areas, available at: https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap8_FINAL.pdf

25 Ibid.

inadequate basic infrastructure and services[25].

Rapid global urbanization, the speed and scale of current energy and resource consumption as well as urban resident's extreme vulnerability to climate change underline that "our struggle for global sustainability will be won or lost in cities"[26]. The implementation of 100% RE at the city level is crucial to meet the needs of future generations and to ensure a life of dignity for all by ending (urban) poverty. The choices we make today in cities will determine scale and impact of climate change, our ability to reduce emissions and to meet the 1.5°C limit.

In order to achieve a just future, we must acknowledge the transformative power of cities and implement urban development concepts that embrace future generations. Cities are not only problem makers, but also hubs for innovative and transformational solutions to advance sustainable development and behaviour. This has been recognized by the world community by including a stand-alone urban goal in the Agenda 2030; the SDG 11 calls for "mak[ing] cities and human settlements inclusive, safe, resilient and sustainable". The UN-HABITAT III New Urban Agenda adopted in the same year also stresses the relevance of cities as actors of change by promoting a new model of urban development capable of integrating all facets of sustainable development in order to promote equity, welfare and shared prosperity. Cities are the testing ground for transformative new concepts, and this ambition continues with direct benefits for sustainable development: cities around the world are working to provide desirable conditions to attract people – such as clean air, sustainable urban transport, extensive green spaces, and safe communities.

3.2.1 Imagine a Regenerative City

Regenerative cities is a promising concept to safeguard the resources we depend on and embrace future justice in urban development strategies. A regenerative city is

26 UN Deputy Secretary General (2017), available at: https://www.un.org/press/en/2017/dsgsm1080.doc.htm

CASE STUDY

>> CITIES

Dunhuang: 100% Renewable Energy City

Dunhuang City is a famous historical and cultural city in Gansu province, China and strives to become an internationally renowned tourist cultural city. Short on fossil fuels, Dunhuang is heavily dependent on imports of fossil fuels. However, Dunhuan has abundant solar and wind energy resources, desert and semi-desert land resources and excellent transmission capacity of the power grid. In 2009, the first large-scale PV power station in China was built in Dunhuang, followed by a very rapidly developing PV market in China. Dunhuang launched the construction of the New Energy Demonstration City in 2011 and worked on developing towards a 100% Renewable Energy City concept since 2015. This concept has been further developed ever since and Dunhuang City moves step by step towards a 100% renewable energy city[I].

Vancouver: Greenest City Action Plan

In 2009 the City of Vancouver (pictured above) set out to develop the Greenest City Action Plan. The consultation and participation process that was developed, with contributions from over 60 City staff, more than 120 organizations, and thousands of individuals, sets an example of best practices in citizen engagement and partnership building. In 2011, Vancouver implemented its Greenest City Action Plan with the goal of becoming the greenest city in the world by 2020 and defining ten sectoral targets. The success of the plan and partnerships built to achieve the targets led the city to build on it and create further targets, including community-wide 100% renewable energy by 2050[II].

I Hu Runqing, 2018 & Feng, Kui; Yan, Xuedong (2018). China Urban Development Review – Special Edition of Green Cities, available at: https://www.worldfuturecouncil.org/wp-content/uploads/2018/03/English-Version-China-Review.pdf

II Boselli, Filippo; Leidreiter, Anna. 100%RE Building Blocks – A practical Toolkit for a sustainable transition to 100% Renewable Energy, p 19, available at: http://www.go100re.net/wp-content/uploads/2017/05/100RE-Building-Blocks.pdf

an urban development approach that is based on an environmentally enhancing, restorative relationship with the natural systems from which the city draws resources for its sustenance. A regenerative city maintains a symbiotic, mutually beneficial relationship with its surrounding hinterland not only by minimizing its environmental impact but by actively improving and regenerating the productive capacity of the ecosystems on which it depends[27, 28].

Establishing a symbiotic relationship between urban areas and their surrounding areas lies at the heart of the regenerative city vision. A 100% renewable energy target involves cooperating with neighbouring land, usually rural, with capacity to produce more energy than they need for their own consumption. Rural communities can produce energy and export surpluses to nearby energy intensive urban areas. However, such cooperation requires developing new forms of solidarity and smart systems[29].

Therefore, the regenerative city goes beyond a sustainable city: it stresses the need for cities not only to *sustain* the natural resources they absorb, but to actively *regenerate* them. Materials and goods from the region are prioritized; energy comes from local renewable energy sources; waste is re-defined as a by-product that can always be recycled or reused in another process; water is recycled or treated before discharged into natural water bodies; and organic waste is treated and used as soil fertilizer[30].

3.2.2 Catalyzing the potential of Regenerative Cities

The idea of regenerative cities is directly linked to an energy system based on decentralized renewable energy generation; one that enables local value creation and fosters a mutually beneficial relationship with the city's peri-urban and rural territory. There are tremendous opportunities for urbanisation to promote the energy transition for all citizens.

Deploying renewable energy in cities reduces pollution, improves air quality, supports sustainable transportation, and reduces traffic congestion. This again enhances health, safety, and well-being of urban residents and thus the attractiveness of cities[31]. Therefore, urban authorities often lead the energy transition. During COP 21 in Paris in December 2015, nearly 1,000 Mayors and Councillors pledged to reach the 100% renewable energy target within their municipalities. These cities consider a 100% RE target not only a technically and economically feasible option but an ethical imperative in the face of global climate change. They have already set RE targets, enacted energy efficiency standards, or transitioned to public transport powered by renewable fuels or electric vehicles[32].

Through transitioning to local 100% renewable energy generation, cities can enhance their resource and energy self-sufficiency. By focusing on local assets and maximizing decentralized local renewable energy potentials, such as photovoltaic rooftop systems, cities can reduce their dependence on national and international energy production and thus on volatile prices for imported fuels[33].

By using local energy sources, cities can extract value from their immediate and surrounding areas, while ensuring long-lasting returns. City investments in a

27 Girardet, Herbert; World Future Council (2010). Regenerative Cities, available at: https://www.worldfuturecouncil.org/regenerative-cities

28 Girardet, Herbert; Schurig, Stefan; Leidreiter, Anna, and Woo, Fiona (2013). Towards the Regenerative City, available at: https://www.worldfuturecouncil.org/towards-the-regenerative-city

29 Ibid.

30 Schurig, Stefan; Roumet, Claire. (2014). Imagine a Regenerative City, available at: https://www.worldfuturecouncil.org/wp-content/uploads/2016/01/WFCplus_2014_Imagine_a_Regenerative_City.pdf

31 World Future Council and Brot für die Welt (2018). 100% Renewable Energy for Sustainable Development, available at: https://www.worldfuturecouncil.org/wp-content/uploads/2018/03/100SDG_webversion.pdf

32 UIRENA, IEA and Ren21 (2018). Renewable Energy Policies in a Time of Transition, available at: http://www.ren21.net/wp-content/uploads/2018/04/17-8622_Policy_FullReport_web_.pdf

33 World Future Council (2014). Imagine a Regenerative City, available at: https://www.worldfuturecouncil.org/wp-content/uploads/2016/01/WFCplus_2014_Imagine_a_Regenerative_City.pdf

renewably powered economy are investments with lasting returns. Part of the revenues generated by renewable energy production projects may also be used to finance measures aimed at reducing energy use (supporting households with home renovation projects, improving public lighting energy efficiency, retrofitting public buildings, etc.), thus creating a virtuous circle towards achieving 100% RE[34]. Furthermore, 100% RE attracts green capital and enables more innovative financing mechanisms.

3.3 Agroecology

Food security, biodiversity and climate resilience are intrinsically intertwined. With a growing world population that is expected to reach nine billion people by 2050, agriculture will need to produce 60% more food globally to meet the growing food demand. This places great importance to the agricultural sector in order to meet the challenges of hunger and malnutrition and to achieve SDG 2 "End hunger, achieve food security and improved nutrition and promote sustainable agriculture". In addition, SDG 15 "Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss" is inextricably linked to agricultural development.
So far, however, most food production has been based on high-input and resource-intensive farming systems at a high cost to the environment. As a result, soils, forests, water, air quality and biodiversity continue to degrade. Therefore, the current trajectory of growth in agriculture is unsustainable and destroys the basis of life for millions of people. The agricultural sector's adverse impacts on the climate intensify these issues. Activities associated with food production, such as deforestation, soil treatment and methane emissions from livestock, contribute a significant share of the greenhouse gas emissions that are causing climate change – 17% directly through agricultural activities and an additional 7% to 14% through changes in land use[35]. Agriculture is the largest emitter of methane, mostly from ruminants, and nitrous oxide, mainly from manure and fertilizers, two gases with significantly higher global warming potential than CO2[36].

34 Bringault, A., et al. (2016). Cities are Heading Towards 100% Renewable Energy by Controlling Consumption. Food for Thought Action, available at: http://www.energy-cities.eu/IMG/pdf/publi_100pourcent_final-web_en.pdf

35 OECD (2015). Agriculture and Climate Change, available at https://www.oecd.org/tad/sustainable-agriculture/agriculture-climate-change-september-2015.pdf

36 IPCC Working Group III (2014). Agriculture, Forestry and Other Land Use (AFOLU), In: Climate Change 2014: Mitigation of Climate Change. IPCC Working Group III Contribution to AR5; Cambridge University Press, p. 822 Available at: http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf

It is also one of the main users of fossil fuels in Western countries, thus also contributing further to GHG emissions.

At the same time, agriculture is projected to be substantially affected by climate change and climate variability, both in terms of crop yields and the location where different crops can be grown. The food production affected by a changing climate leads to an increase in the food market prices, as well as to volatile and unreliable food production, which aggravates food security. Even though small scale farmers in the Global South produce the biggest share of food for the world's population, they suffer disproportionately much from the negative effects of global warming.

In the face of the increased pressure on natural resources such as clean water and fertile soils, a growing population and the challenges connected to climate change, we have to quickly transition to a more sustainable food and agricultural system, with less environmental consequences and more socioeconomic benefits, in order to provide our children and grandchildren with uncontaminated soil, a healthy environment, sufficient and healthy food, and a stable climate.

3.3.1 A Robust Set of Solutions to Just and Sustainable Food Systems

Agroecology offers a unique pathway these sustainability needs for future generations while ensuring no one is left behind. It promotes three goals at the same time: a sustainable use of natural resources, poverty eradication and climate resilience.

Agroecology is based on "applying ecological concepts and principles to optimize interactions between plants, animals, humans and the environmental while taking into considerations the social aspects that need to be addressed for a sustainable and fair food system"[37]. It addresses the root causes of problems and provides long-term and holistic solutions based on:

co-creation of knowledge, including farmer-to-farmer learning, sharing and innovation promotion; planning and managing diversity; building synergies in food systems; producing more and using less external resources; supporting biological processes that drive the recycling of nutrients, biomass and water within production systems; protecting and improving rural livelihoods, equity and social well-being; supporting culture and food traditions; and reconnecting producers and consumers through circular and solidarity economies[38]. Thus, agroecology can play an important role in building resilient communities, adapting to climate change and generate multiple sustainability benefits.

In order to evolve food systems that are equally strong in environmental, social, economic and agronomic dimensions, agroecology requires an enabling environment that is based on effective and responsible governance mechanisms at different governance levels[39].

37 FAO. Agroecology. Overview, available at: http://www.fao.org/agroecology/overview/en
38 FAO. The 10 Elements of Agroecology, available at: http://www.fao.org/agroecology/knowledge/10-elements/en
39 Ibid.

3.3.2 Boosting Agroecology through Renewables

While it might appear counterintuitive, an integrated and sustainable food-energy industry can enhance food production and nutrition security, conserve the environment, advance economic growth, and empower communities, especially in remote rural areas[40].

The agriculture - renewable energy nexus is often neglected, but both issues appear closely interlinked upon closer examination. Both organic and conventional farming are still dependent on fossil energy[41]. A detailed analysis of the potential of RE is thus crucial for scaling up agroecology. Renewable energies can be integrated into all production and processing stages of the agricultural production, including irrigation, fertilization and mechanization. It can provide communities with energy for primary production such as solar or wind-based water pumping for irrigation, biofuels to run the machinery, and solar-based desalination. Solar or geothermal based food drying, solar cooling and refrigeration can be utilized to storage the harvest. Food processing and preservation can be done by RE driven mechanical processing, or RE controlled cooling or heating, which can help to improve productivity and reduce food waste. This can reduce or even eliminate the food sector's dependence on fossil fuels, lower the carbon footprint of agricultural operations, safe resources and thus contribute to mitigate climate change.

Through integrating decentralized RE systems into sustainable farming practices, communities or single farmers, especially the ones in remote areas, can allay energy security concerns and increase their resilience. For example, in many countries, water pumping for agriculture often puts stress on the electricity demand, especially during peak times and hence endangers food security. Substituting centralized on-grid systems with decentralized RE-based pumping options can actually create much more resilient communities and avoid blackouts due to excessive electricity demand, especially during the more frequent climate anomalies such as extremely dry seasons. This can help support agricultural activities in the most impoverished regions of the world and increase crop yield[42].

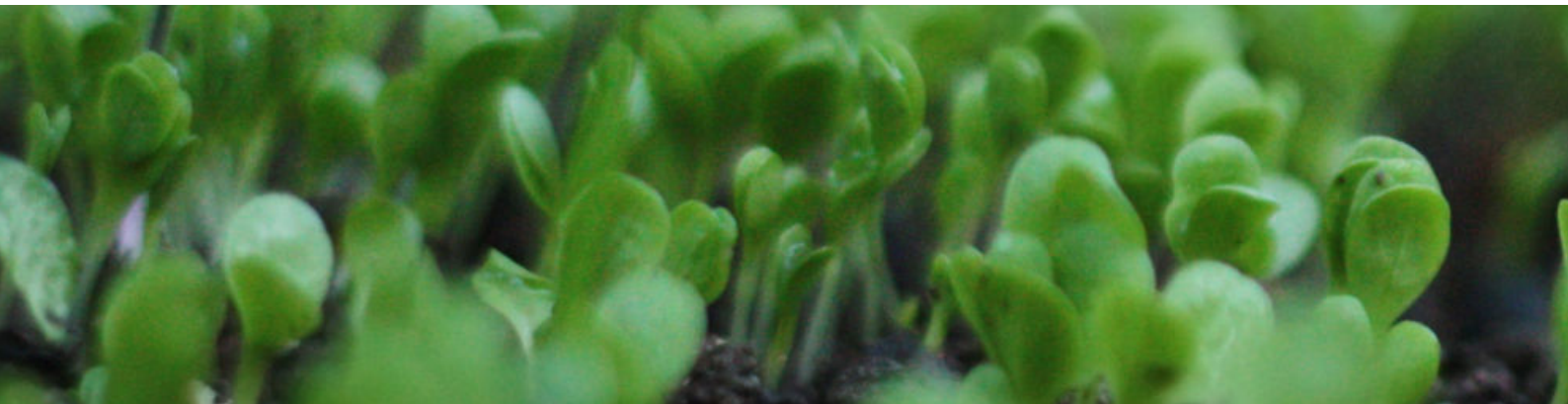
Using renewable energies in agroecological processes can also reduce costs and the dependence on fuel prices and thus decreases price volatility. Beyond the use of renewables within agroecological farming practices, farmers can also produce and harness alternative energy sources on their land. Thereby, farmers can diversify their farm and food processing revenues. However, food and energy production should not exclude one another. An opportunity to reduce land-use competition between energy and agricultural sector is, for example, using agrophotovoltaic installations. An agrophotovoltaic pilot plant at Lake Constance in Germany combines electricity and crop productions through constructing photo voltaic installations on top of crop production fields. The dual use of space increased the efficiency of land use by 60%[43].

40 IRENA (2015). Renewable Energy in the Water, Energy and Food Nexus. Available at: http://www.irena.org/documentdownloads/publications/irena_water_energy_food_nexus_2015.pdf

41 Ramaraj, Rameshprabu and Dussadee, Natthawud (2015). Renewable Energy Application for Organic Agriculture: A Review. International Journal of Sustainable and Green Energy. Special Issue: New Approaches to Renewable and Sustainable Energy. 4 (1-1), pp. 33-38.

42 Ibid.

43 Seeger, Daniel (27 November 2017). PV Increases Efficiency of Cultivable Land Use by More than 60%, Fraunhofer ISE Says, available at: https://www.pv-magazine.com/2017/11/27/pv-increases-efficiency-of-cultivatable-land-use-by-more-than-60-fraunhofer-ise-says



CASE STUDY

>> AGROECOLOGY

Solar Powered Irrigation Systems in Bangladesh

Following Bangladesh's success in expanding solar home systems to provide electricity in rural areas, the World Bank is supporting the government's effort to install 1,250 solar-powered irrigation pumps by 2018. The low-cost technology is well suited for the country's flat terrain and abundant sunshine. The Rural Electrification and Renewable Energy Development Project II (RERED II) is piloting solar-powered irrigation solutions using a public-private partnership model. The benefits for the farmers include a massive reduction in irrigations costs that are usually powered by diesel generators and the improvement of the farmer's quality of life[I].

Eco-villages in rural India

Guna is a company that seeks to empower communities and especially women through organic, ecological agriculture based activities and by providing access to renewable energy to rural population for electrification, drudgery reduction and post-harvest management. Guna participated in the development of Ladakh's (India) first certified eco village, Takmakchik, where it distributed 67 Indian made solar cookers (one for each household) and 30 portable solar dryers, for efficient apricot post-harvest management. The solar cookers can be used 250 days a year, thus saving 536 kg liquid petroleum gas per month in the village (8 kg per family per month). Thanks to the solar dryers, women have less labour since they no longer have to move around to dry their crops[II].

I Mahbub, Mehrin Ahmed (2016). Solar Irrigation Pumps: A new Way of Agriculture in Bangladesh, available at: http://blogs.worldbank.org/endpovertyinsouthasia/solar-irrigation-pumps-new-way-agriculture-bangladesh

II GUNA (2018). Available at: http://gunaorganics.org/

3.4 Promoting Education for Sustainable Development and Decent Jobs

A comprehensive energy transition is fast-developing and future-oriented and requires both a technical and social transition. While the transition to 100% RE delivers concrete solutions to some of our present challenges and future needs, it also presents profound challenges to our current energy systems, as under RE systems production is increasingly decentralized and democratized. This sometimes comes with uncertainties and misunderstandings about the technical and economic developments in the energy sector and how these will affect our lifestyles.

Therefore, basic knowledge-transfer and outreach needs to be done in a simple, timely and regular way so that people can understand and support this transition. The effective participation of people and all stakeholders – as a common tenet of both Education for Sustainable Development (ESD) and sustainability – should not be underestimated when it comes to the acceptance of RE. Here, education as well as the ability to become an energy producer and part of the new energy paradigm will support acceptance of the energy transition.

Education and green jobs play an essential role within this remodelling process as it empowers people to adapt and become part of the transition by acquiring new knowledge, dealing with uncertainties, encouraging changes in their attitudes and behaviour and helping to implement change and thus prioritize well-being of future generations yet to come.

3.4.1 Education for Sustainable Development and Future Justice

The worldwide education initiative of the UN Decade of Education for Sustainable Development (ESD) from 2005-2014 was launched to support the UN Millennium Development Goals (2000-2015). Environmental sustainability was one of the 8 goals of the MDGs. States parties committed themselves to embedding the guiding principles of sustainability within their educational systems.

The Sustainable Development Goals (SDGs) (2016-2030) as "an action plan for people, planet and prosperity" clearly underline how society, the economy and our environment are equally important pieces of the sustainable development puzzle. Achieving these challenging goals requires active participation of present

generations, so ensuring our education systems are fit for purpose is therefore vital.

Within the UN system, ESD has increasingly become a central concept representing a paradigm shift in how we respond to themes such as green jobs, climate change, water management and resource governance in joined up ways. While target 4.7 of SDG 4 on education specifically addresses ESD and related approaches, it is clear that the role and impact of education on the whole 2030 Agenda goes much further. Research by the International Council for Science (ICSU) has shown that education, training and learning need to be properly recognized not only as relevant to all other SDGs, but also as a means by which progress on the other SDGs can be secured.

For example, education and training is critical to lifting people out of poverty (Goal 1), adopting sustainable farming methods (Goal 2), fostering good health and well-being (Goal 3), achieving literacy and improving life chances (Goal 5) and promoting the sustainable use of natural resources and the uptake of renewable energy (Goals 6 & 7). There are similar direct links between education and economic vitality and entrepreneurship (Goal 8), the circular economy and waste prevention (Goal 12), understanding of the impact of climate change (Goal 13), and facilitating participative, inclusive and just societies (Goal 16). Quality education and ESD gives us the key tools – economic, social, technological, even ethical – to pursue and achieve the SDGs and recognize unsustainable development patterns[44].

Through related approaches like climate change education (CCE), learners are similarly given the tools and knowledge to understand the causes and consequences of climate change, prepare them to live with the impacts and empower them to adopt more sustainable lifestyles. "Climate literacy" among people of all ages will be an essential element of the global response to the challenges climate change presents us with.

3.4.2 RE to amplify sustainable education

ESD equips people of all ages with the skills and values needed to become responsible citizens of the world. Quality education can greatly support students from Kindergarten throughout their entire lives to become environmentally literate critical thinkers; the responsible leaders, advocates and consumers of tomorrow.

The so-called "whole school approach" involves reorienting teaching, learning and the institution itself towards an innovative learning environment that serves as a model of sustainable practices. Schools learn to embed sustainability in the curriculum and learning processes, facilities and operations, interaction with the surrounding community, governance and capacity-building. This can often be the best way to demonstrate to learners what sustainable energy production and use looks like. Integrating solar, biomass or wind energy in the school grounds and learning about them across different subjects (science, economics, engineering etc.) gives students the opportunity to see first-hand that these technologies work and why they are important to our future. The myriad sustainable energy technologies and solutions help pupils to understand and practice how to decrease their own carbon footprint and to care for earth's living systems. Students can also be involved in the installation, monitoring or maintenance of these school installations which increases the skills and knowledge of RE into the community.

There are also positive and encouraging examples on how the decentralized and affordable use of RE in rural and remote areas of the world contributes to realizing the right to education for children and adults

44 ICSU and ISSC (2015). Review of the Sustainable Development Goals. The Science Perspective, Paris: ICSU, p. 29, available at: https://council.science/cms/2017/05/SDG-Report.pdf

and the right to protection, especially for girls.

Being equipped with RE means these households are no longer dependent on daylight, giving access to technology and information and helping young learners to complete their studies in the evening. Girls are often taken out from school to support their mothers at home and to collect fuel wood which puts them at risk to be harassed, abducted or sexually abused. Decentralized energy can contribute to freeing them from these activities, to continue schooling and reduce risks of sexual attacks by lighting up streets and roads. All of which RE can offer.

3.4.3 A Just Transition

There is a growing emphasis worldwide on the need to equip learners with a set of key competences or essential skills, also defined as '21st century skills', that are necessary to succeed in education and for personal development, employment and inclusion in a knowledge society. These skills, fostered by quality education and ESD, will play a vital role in addressing youth unemployment in many countries by providing the skills needed for decent and green jobs and in helping to smooth the transition to a greener, low-carbon economy powered by renewables. A major 2018 report released by the Global Commission on the Economy and Climate has found we are significantly under-estimating the benefits of creating a cleaner and climate-smart green economy. Bold climate action could generate more than 65 million new low-carbon jobs and deliver at least US$26 trillion in economic benefits through to 2030, compared with business-as-usual. The five key areas of green opportunities identified are: developing clean energy systems, improving urban planning, shifting to sustainable agriculture, smart water management and decarbonizing industry[45].

Each part of the RE value chain requires skills and workforce capabilities, which stimulates local business and employment. RE has the potential to create indirect jobs in the fields of research and training, decentralized production (local small energy systems, distribution, consultancy), or in related industries, such as the production and diffusion of energy efficiency products and services. Education for Sustainable Development provides the links and the necessary competencies to speed up with these developments.

In order to equip the next generation with a better understanding of sustainability and the energy transition, as well as to provide them with the opportunity to realize a just transition, education for sustainable development is a core element for a just future. This and other core elements need to be realized if we are to build a sustainable and healthy planet for future generations by urgently transitioning to 100% renewable energy.

44 ICSU and ISSC (2015). Review of the Sustainable Development Goals. The Science Perspective, Paris: ICSU, p. 29, available at: https://council.science/cms/2017/05/SDG-Report.pdf

45 New Climate Economy (2018). Unlocking the Inclusive Growth Story of the 21st Century. Accelerating Climate Action in Urgent Times, available at: https://newclimateeconomy.report/2018/

CASE STUDY

>> ESD & SUSTAINABLE JOBS

Abu Dhabi

In Abu Dhabi a state-of-the-art renewable technology educational facility has shown that hands-on experiential learning strengthens the engagement visitors with sustainability topics and leads to changes in understanding and behaviour. By showcasing this 'off-the-grid' building operation, and seeing how solar, wind, geothermal and energy-saving devices can lead to a decrease in CO2 production, students come to understand how the installation of low-carbon technologies make a building more efficient and eco-friendly. Learners can also evaluate the lifestyle choices they make by means of an interactive personal carbon footprint calculator which suggest ways to improve their results through lifestyle and behavior changes[I].

Thailand

In Thailand, ESD is highly integrated into the curriculum of primary and secondary education through the framework of a 'sufficiency economy'. Since 2002, the country's education plan has promoted the inclusion of ESD in five distinct ways. One of these ways is the inclusion of ESD-specific learning modules. Renewable energy is one of these learning modules, discussed in its relationship to local contexts, sustainable lifestyles and the sufficiency economy.

I Mahbub, Mehrin Ahmed (2016). Solar Irrigation Pumps: A new Way of Agriculture in Bangladesh, available at: http://blogs.worldbank.org/endpovertyinsouthasia/solar-irrigation-pumps-new-way-agriculture-bangladesh

4. FINANCING A JUST FUTURE

Achieving a just future for today's and future generations requires a drastic and rapid shift towards 100% RE at the latest by 2030. Such a paradigm shift requires a massive increase of the annual renewable energy investments. Estimations range in the order of $1.5 to $2 trillion[47]. Although the costs of renewable energies have recently declined sharply and further downturns can be expected, annual global RE-investments have stagnated since 2011 at an insufficient level below $300 billion. The reason for this is not a lack in green investment finance (e.g. Green Bonds); there is, however, a lack in bankable projects to attract green investors[48].

The crucial question now is: How to remove the market barriers and increase the number of bankable projects? To unleash the full potential of renewable energy and boost investments to the necessary scale at the necessary speed, the following challenges need to be overcome.

The problem of insufficient profitability

Despite decreasing prices of renewable technologies, RE projects have high upfront investment costs, which often lead to investors in developing and emerging markets demanding (partial) additional grants for reaching profitability. A lack of profitability of green investment with pure private finance could be solved by a one-time or permanent grant. Such grants can mobilize a large amount of additional private money to enter the field of green climate finance.

The problem of unknown risk

Economic conditions differ from country to country, which presents a variety of risks in cost accounting. Especially in non-industrialized countries, the experiences with RE projects are scarce and therefore examples as a basis for any risk calculation are limited. These uncertainties hinder investments or lead to high interest rates which are in stark contrast to SDG 7 – "Affordable and Clean Energy for All". This conflict of aims could be solved by loan guarantees.

47 Kroll, Matthias (2017). Unlocking the trillions to finance the 1.5°C Limit, Future Finance – Policy Brief, 09/2017, available at: https://www.worldfuturecouncil.org/unlocking-the-trillions

48 IRENA (2018). Scaling up Renewable Energy Investment in Emerging Markets, White Paper, p.3, available at: http://coalition.irena.org/-/media/Files/IRENA/Coalition-for-Action/Publication/Coalition-for-Action_Scaling-up-RE-Investment_2018.pdf

The conflict of aims between high profitability and SDG 7

Green investments should also provide energy in line with SDG 7 "clean and affordable Energy for all", which means that the price for the new renewable energy must be low. This could lead to a situation that the estimated earnings are not sufficient to cover all costs and the demanded profit.

Therefore, additional monetary support must be provided, in order to bring the global expansion of RE to the necessary scale at an affordable price. However, funding from public budgets or instruments such as emissions trading or CO2 taxes, are not realistic options to cover the gap between the current $300 and up to $2,000 billion needed. An additional innovative financing mechanism is required.

This tool can be established through cooperation between non-industrialized countries, Development Financial Institutions (DFIs), the Green Climate Fund (GCF), and central banks of industrialized countries. DFIs and countries scaling up RE deployment should develop a national finance roadmap, identifying the necessary financial requirements for concrete projects, infrastructure and technology requirements. This cooperation could also be used by countries to meet their Nationally Determined Contributions (NDCs) described in the Paris Agreement.

4.1 Scaling up Green Finance by by Using Guarantees

The approved finance roadmaps identify which RE-investments can be implemented, if credit guarantees from the DFIs lower the level risk and thus the interest rate demanded. Since DFIs will only cover a part of the risk, central banks should cover the bulk of it and will bundle the credits into a bond with a homogenous risk category. The high involvement of central banks, by backing the guarantees, justifies interest rates at the level of AAA government bonds (e.g. 1.5% or 2.5%). This low interest level would unlock a huge amount of additional RE investments. Central banks would only become involved in the case of a default and the impact for their balance sheets would be small.

With high up-front costs, some RE projects may require an additional onetime or permanent grant. Hence, the role of central banks increases. In this case, DFIs can issue virtually perpetual Green Climate Bonds to central banks of industrialized countries. Ideally, to the central banks of the countries where the bulk of the renewable energy equipment is produced, in order to prevent currency problems[49].

The new capability of the DFIs to receive new and virtually repayment-free money by issuing these standardized Green Climate Bonds to central banks opens new possibilities to fund many additional RE investments and provides private investors with the certainty of financial returns needed to step in. To reduce exchange rate fluctuations, central banks should set up an agreement to recognize these standardized Green Climate Bonds as a tender between them.

49 In this case central banks would support the exports of their own countries.

4.2 The New Role for Central Banks: Coordinating a "Climate Bailout"

Central banks played a key role in managing the banking crisis by adding unprecedented amounts of new bonds to their balance sheets, without losing their independence or endangering monetary stability. They are the most powerful economic institution in our current economic system, because they cannot become insolvent in their own currency and are the producer of the legal tender in their respective country. Hence, central banks can and should play a pivotal role in facilitating a "climate bailout". Central banks would do well in becoming more involved in financing RE projects around the world. In fact, it is often part of their mandate[50]. The Bank of England has repeatedly stressed that climate change would damage financial stability and therefore belongs to their mandate. Based on the articles 127 (TFEU) and article 3 (TEU), protecting the environment is also part of the ECB's mandate: "…a high level of protection and improvement of the quality of the environment" (TEU, Art.3, para. 3).

The annual margin available to central banks to purchase these standardized Green Climate Bonds lies within "normal" growth in their balance sheets and can be estimated at least to a global total value of approximately $300 billion[51]. Central Banks from a few industrialized countries could already initiate such a new "standardized Green Climate Bond system".

Ideally, all UNFCCC member states and their central banks participate in this finance model. To kick-start and test the model, a small group of countries like the Climate Vulnerable Forum (CVF) and industrialized partners are launching it. To do so, these countries should co-develop national roadmaps for a sustainable 100% RE strategy on which base financial requirements (guarantees and grants) will be identified and embedded into a complementing 100% RE finance roadmap. Subsequently, the MDBs should issue the corresponding amount of 'Standardized Green Climate Bonds'. Central banks should be ready to guarantee these and also to purchase and hold such bonds. Thus, the income of the MDBs from the sale of such standardized Green Climate Bonds will be virtually repayment free and the MDBs will receive new funding to facilitate new RE investments. The resulting planning and income security would open additional investment opportunities for private finance at low yet sustainable interest rates.

50 Carney, Mark (29 September 2015). Breaking the Tragedy of the Horizon. Climate Change and Financial Stability, Speech, available at: https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability

51 Kroll, Matthias (2017). Unlocking the Trillions to Finance the 1.5°C Limit, Future Finance Policy Brief 09/2017, available at: https://www.world-futurecouncil.org/unlocking-the-trillions/

POLICY RECOMMENDATIONS

1 | SET A 100% RE TARGET

It has become clear that the only way to reach the objectives of the Paris Agreement is through a complete and comprehensive decarbonization of our energy systems. An important first step that countries should take is setting domestic 100% RE targets. Such a 100% RE target should be set across all sectors of energy use, including power generation, mobility, heating and cooling, and cooking. Countries are further encouraged to commission scientific institutes to develop technical scenarios that demonstrate how that target can be achieved, including through extensive measures of enhancing energy efficiency. Those technical scenarios should, in turn, underpin multi-stakeholder processes aimed at distilling key policies to achieve the target in an effective and timely manner.

2 | EMBED THE 100% RE TARGET ACROSS POLICY AREAS AND SDG PROCESSES

In order to optimally reap the benefits of 100% RE for other sustainability indicators, policy-makers have to abandon the silo approach to policy making. Active efforts should be made to integrate 100% RE policies in other areas such as social and economic welfare, employment, research and education, agriculture, innovation and health. In order to do this, it is recommended to map the co-benefits of 100% RE to unveil the links among different development priorities and support the creation of cross-sectoral approaches to policy making. One such policy-approach that has been used is the "Building Blocks approach", which offers a model that can be applied across policy areas and levels of governance.

3 | ADOPT A "LEAVE NO ONE BEHIND" APPROACH TO ENERGY POLICY

Access to modern energy services must be regarded as a prerequisite for a life of dignity. Energy policies should thus be underpinned by a human rights-based "leave no one behind" approach, i.e. one that prioritizes that all parts of societies, including the most marginalized, can access energy and can equitably and fairly reap the multiple benefits that come with it. The only low-cost, democratic and effective solution is decentralized, community-based RE development. In Global South countries, this means prioritizing off-grid development via stand-alone RE solutions (such as solar home systems, solar irrigation systems) or micro-grid systems for villages.

POLICY RECOMMENDATIONS

4 | ESTABLISH THE NECESSARY CROSS-DEPARTMENTAL AND FUTURE-ORIENTED INSTITUTIONS

Ensuring 100% RE can have a positive effect on achieving sustainable development objectives and adopting a cross-disciplinary approach to policy-making requires unprecedented cooperation between different government departments and between national and subnational governmental entities. Creating dedicated institutions, as well as institutionalized processes, is vital to effectively leverage the mutually reinforcing interplay between RE and sustainable development. In addition, institutions safeguarding the rights of future generations – those that can review policies to assess its negative or positive impact on generations to come – are needed to bring long-term planning and considerations of inter-generational justice to the heart of policy-making.

5 | PROMOTE AGROECOLOGICAL CONCEPTS

Leaving no one behind and ensuring future justice means that hunger must be eradicated. To do so, without leaving behind degraded landscapes and an unsustainable consumption of meat and dairy, countries should promote agroecological concepts which are focused on smallholder farming within villages or states. Examples have shown that such a transition to sustainable agriculture – which often includes the use of mini-grids and solar water irrigation systems – promotes (rural) economic development and boosts eco-tourism.

6 | PROMOTE SUSTAINABLE LIFESTYLES

A just future cannot be achieved if we don't re-think our production and consumption patterns. This becomes particularly true, as more and more young people move from rural to urban areas. Yet, cities can be especially vulnerable to climate disasters and also incentivize unsustainable consumption. Promoting regenerative cities, based on decentralized RE solutions, can make urban areas more resilient against the consequences of climate change, provide a leadership role for sustainable energy solutions and improve overall health and wellbeing of its residents.

7 | PROMOTE MANDATORY EDUCATION FOR SUSTAINABLE DEVELOPMENT

The promotion of education for sustainable development (ESD) is crucial to achieve the desired lifestyle changes. ESD provides people of all ages with the necessary knowledge, skills, values, tools and behaviours to understand the causes and consequences of unsustainable behavioural patterns. Decision makers are encouraged to make ESD mandatory which will not only have a positive impact for future generations, but will help to ensure a just transition of jobs towards green and decent jobs as well.

POLICY RECOMMENDATIONS

8 | ENSURE ADEQUATE CIVIL SOCIETY PARTICIPATION

For the achievement of the SDGs and a transition towards 100% RE, participation of the whole spectrum of civil society, including stakeholders from the environment, climate, development, faith and justice movements is indispensable. A participatory approach is needed to ensure justice and a sense of ownership but also to manage the transition effectively. The decentralized structure of RE requires a much more distributed and participatory infrastructure of operation than fossil fuels. This requires a more horizontal decision-making system. Within this context, civil society engagement is essential to ensure communities are supported in this transformational process.

8 | STRENGTHEN CAPACITY BUILDING

While the exchange of best practices and policy solutions is necessary, these cannot be simply imposed from above, but rather need to gain legitimacy from buy-in and commitments of all local actors. Countries need to build their own domestic capacity and expertise to support the transition towards 100% RE and ensure benefits of such a transition remain local. The 100% RE transition should thus be perceived as a unique opportunity to mobilize local actors and further strengthen local civil society organizations and small enterprises, which can lead to spin-offs in innovation and initiatives aimed at socio-economic progress. Simultaneously, capacity must be built within parliaments and governments to increase recognition and strengthening of non-violent conflict resolution mechanisms to address the likelihood of an increase in violent conflicts due to climate change.

9 | RE-DIRECT FOSSIL FUEL SUBSIDIES

Fossil-fuel consumption subsidies worldwide amounted to about $260 billion in 2016, dropping from $325 billion in 2015. Despite this drop, the amount of money dedicated to incentivizing fossil fuels is still almost double the $140 billion spent on support for renewables in power generation. Countries and subnational entities are encouraged to remove all consumer fossil fuel subsidies and redirect this money to develop renewable energy solutions. Fossil fuel subsidies represent just under half of the budget needed to fund universal energy access, doubling the share of renewable energy in the global energy mix, and doubling the rate of improvement in energy efficiency by 2030. Re-directing money that is currently used to subsidize fossil fuels, which in fact undermine sustainable development, could also fill the SDG financing gap.

10 | DEVELOP RE FINANCE SOLUTIONS

As important as identifying what mix of renewables can make a country reach 100% RE, is mapping the finance mechanisms best suited to support RE projects. International and national key stakeholders, decision-makers and financial institutions should thus come together to co-develop an energy finance plan for each state.

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