A **Factsheet**
for Civil Society

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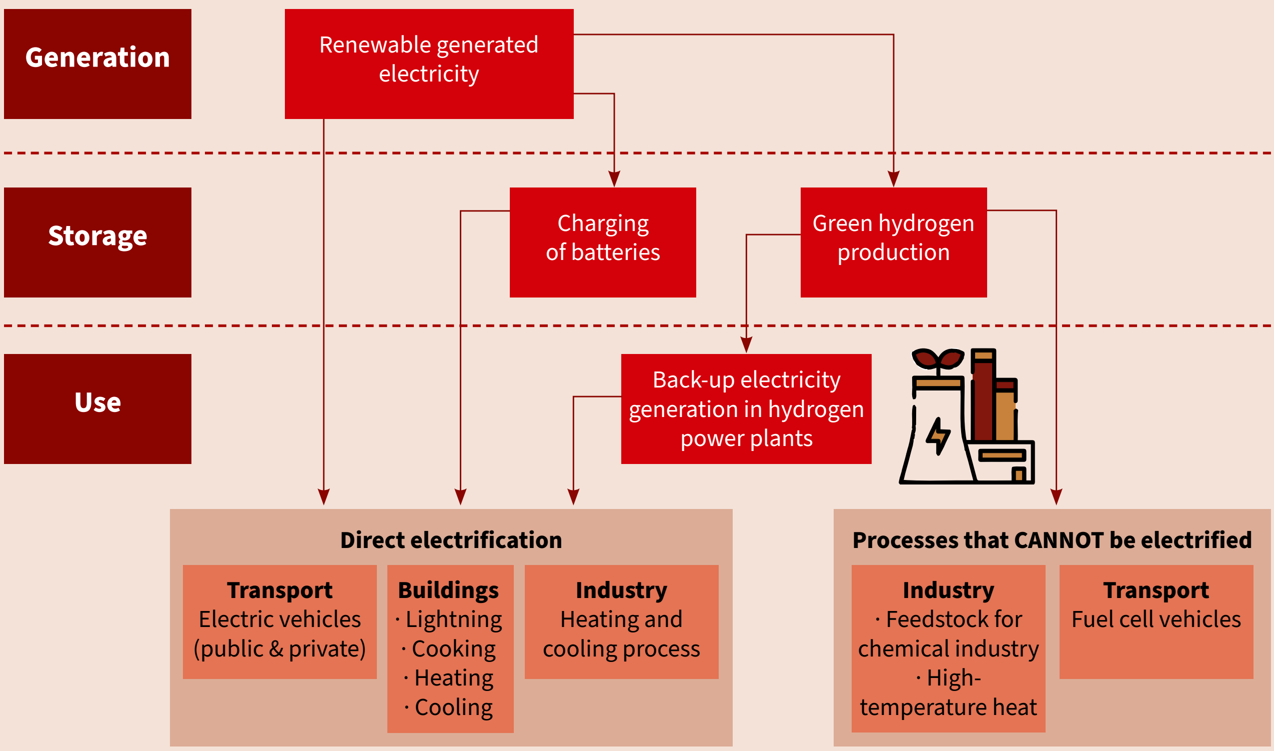
Unlocking 100% renewable electricity in Africa and elsewhere

Background:

In many regions in Africa, a continent particularly vulnerable to the impacts of climate change, people lack reliable access to electricity. Making electricity accessible for all could help foster resilience within the context of climate change. Due to the declining importance of fossil energy resources and the multiple benefits of renewable energy sources, it is therefore imperative

Electrification

As we strive towards a low-emissions energy supply, one of the initial steps involves a complete transition of the electricity supply to renewable sources. This shift towards renewable electricity will also prompt other sectors that previously ran on fossil fuels, such as cars with combustion engines, to adopt electric motors instead.



Processes that cannot be electrified directly can frequently be powered by hydrogen derived from renewable energy. By incorporating electricity generated from renewables into industrial processes, emissions from these processes can be either wholly averted or substantially reduced.[4]

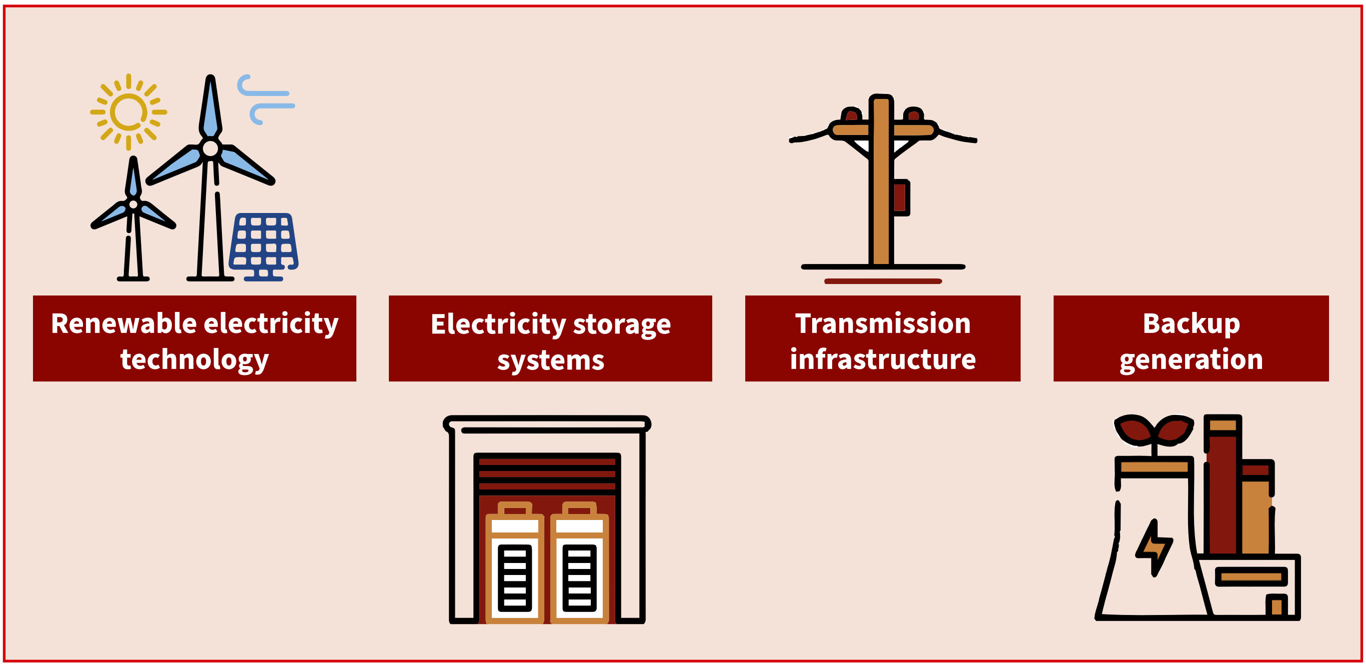
to avoid lock-in effects and actively promote both the establishment and the transition to systems based on 100% renewable energy. Several African countries, such as Tanzania, Uganda, and Kenya, have already included renewable energy targets in their national plans.

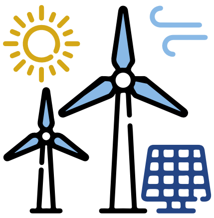
Creating an electricity system exclusively reliant on renewable energies such as solar photovoltaic (PV) or wind energy is possible. However, it requires significant flexibility to address irregularities in renewable electricity generation and ensure system stability.[1] There are three essential trends guiding the design of future electricity systems to achieve this flexibility: digitalisation, decentralisation, and electrification.[2] Alongside flexibility, prioritising energy efficiency remains crucial.[3]

In the following, we will demonstrate what an electricity system based on 100% renewable energy needs by focusing on the energy transition in Africa. While our findings can be applied on a global level, it is important to note that our fact sheet primarily addresses the technical feasibility aspect, omitting policies and regulations, which remain essential considerations.

	Global North	Global South
Challenges	❯ Existing electricity generation and supply systems need to be transformed. ❯ Frequently, the potential for renewable electricity generation is lower than in less densely populated countries.	❯ Fragmented systems with power outages are prevalent. ❯ Especially in rural areas, electricity assess is minimal or absent. ➜ A **simultaneous transition** (where fossil infrastructure exists) **and expansion of renewable electricity** is needed. ❯ Financial limitations can hinder progress.
Opportunities	❯ Extensive grids, often spanning large areas and even international borders, are common. ❯ The implementation of smart grid technology offers the potential to: - Enhance efficiency and thereby limit demand - Stabilise periods of peak demand that might otherwise surpass system capacity ❯ Electricity storage will serve as a backup for times of peak demand or low generation.	❯ Leapfrogging to a system based on renewable electricity from the outset is a viable approach in regions lacking electricity infrastructure. ❯ Ensuring a diverse range of renewable electricity sources is crucial to avoid dependence on a single type, such as hydro. ❯ There exists potential for high rates of renewable electricity generation. ❯ Decentralised systems provide flexibility and security of supply in remote areas. ❯ Extending grids grants access and safeguards against blackouts in regions close to national grids. ❯ Electricity storage will serve as a backup for times of peak demand or low generation.

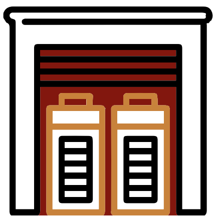
Essential components for a flexible 100% renewable energy based electricity system





Renewable electricity technology

The expansion of solar energy systems (including concentrated solar power[5] and solar PV panels) and wind energy systems is vital for achieving electricity supply that is 100% based on renewable technology. Additionally, geothermal power holds promise as an additional source of renewable electricity. At present, a large share of renewable electricity originates from large-scale hydro power plants. However, these plants have a negative impact on ecosystems and social structures, and their susceptibility to climate change underlines the importance of transitioning to the aforementioned alternative sources of renewable electricity.



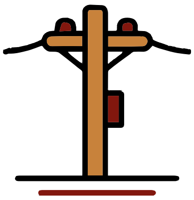
Electricity storage systems

Energy storage systems offer a means to balance out demand that exceeds supply at a certain time. Stored energy can be retrieved during periods of high demand or in times of low generation.

- **Battery storage:** It is mostly lithium-ion batteries that are used in electronic devices, electric vehicles, and large-scale storage systems.[6,7] Their features include long life cycles, low self-discharge, and high energy density.[8]

- **Pumped hydro energy storage:** This mechanical energy storage system operates by using excess energy to pump water from a lower reservoir to a higher one during periods of low energy consumption. The stored energy is then released by directing water from the elevated reservoir to the lower one via a turbine, generating electricity.[6]

- **Green hydrogen:** Serving as a long-term energy storage medium,[3] green hydrogen can be produced via electrolysis in a system based on 100% renewable electricity. Thereby, excess renewable energy is employed to split water into oxygen and hydrogen. The stored energy can then be released through fuel cells, for example.[6]



Transmission infrastructure

- **Grid expansion:** To reduce the likelihood of power outages and to facilitate wider electricity distribution, the grid must be expanded to link electricity generation sites with consumption centres.
- **Enhancing flexibility:** For more flexibility, national grids can be connected.
- **Decentralised solutions in remote areas:** Decentralised solutions such as mini-grids may be a more reliable and cost-effective solution for remote areas than connecting them to the main grid.

Backup generation

- Power stations fuelled by green hydrogen can serve as a bridging solution in cases where there is a shortcoming in electricity generation from renewable energies.

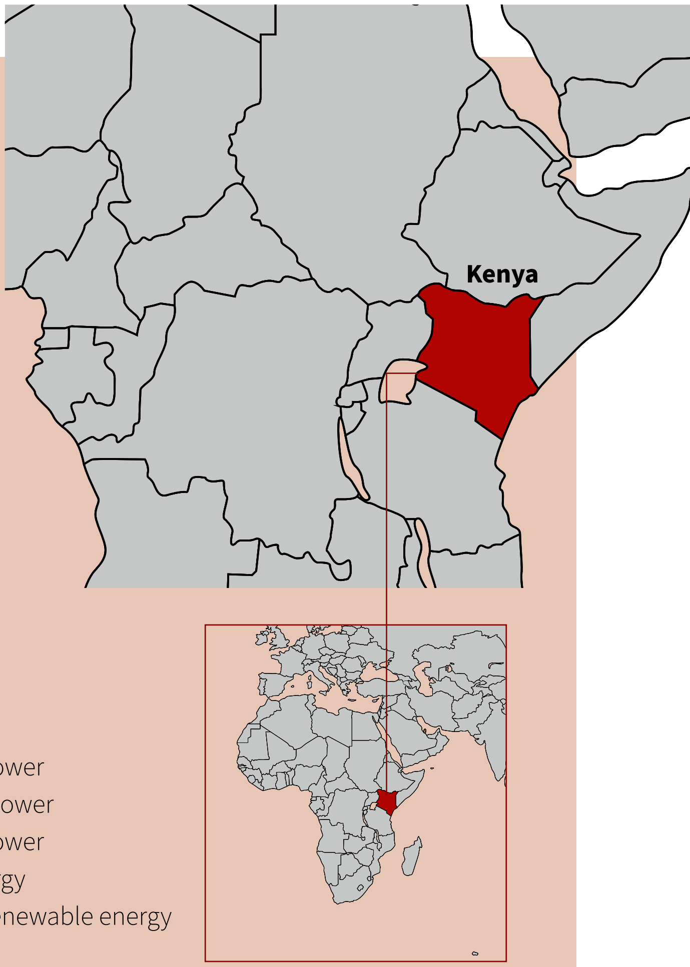
Possible challenges:

- **Limited financing:** Many countries in the Global South identify limited access to finance as a barrier to expanding their renewable electricity generation.
- **Technical capacity and availability of technology:** As the majority of the technology for renewable electricity generation is manufactured in Asia and Europe, capacity expansion relies heavily on the availability of technology.[9]
- **Insufficient infrastructure:** At present, electricity systems have not yet been established to provide 100% electricity access. In numerous African countries (and beyond), both transmission infrastructure and generation facilities are inadequately developed to provide 100% renewable electricity. Expanding access could contribute to further promoting renewable electricity sources.
- **Policies and regulations:** Implementing and regulating plans to achieve high shares of renewable electricity requires comprehensive frameworks encompassing various perspectives, including social, environmental, and economic impacts – a complex undertaking.

Case studies:

In the subsequent case studies, we analyse two countries that are either near or on a promising trajectory towards achieving a 100% renewable electricity system. These cases can serve as exemplary models for African and other countries of the Global South that are working towards this objective.

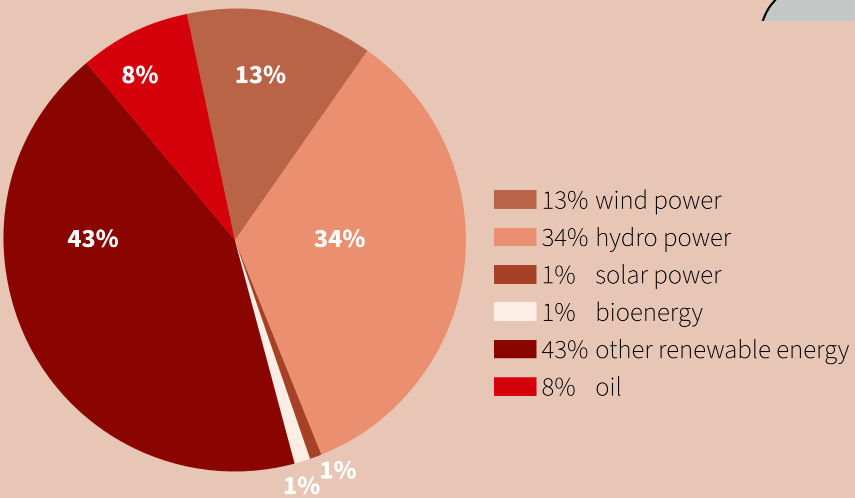
Kenya



Current status:

- Kenya is leading the way on the path to 100% renewable energy by 2030.[10]
- In 2022, the national share of renewable electricity reached 90%[10] (13% wind power, 34% hydro power, 1% solar power, 1% bioenergy, 43% other renewable energy[11]).
- As of 2022, 75% of households in Kenya had access to electricity.[12]

Kenya's Electricity Mix



Challenge: Not only providing renewable energy, but also guaranteeing energy access for all

Plans:

- Kenya Off-Grid Solar Access Project (2017-2023) (KOSAP)[13, 14]
  - Flagship project by the Ministry of Energy, financed by the World Bank
  - Objective: providing energy access to regions not connected to the grid
- Climate and Development Partnership between Kenya and Germany[15]
  - Objective: increasing the share of renewable energy to 100% and expanding both infrastructure and industry

  ➔ Kenya has the potential to become a front-runner among African countries in the transition to a sustainable development path and the adaptation to the impacts of climate change

Outlook:

➔ Mini-grids are identified as an essential tool for achieving complete energy access[16]

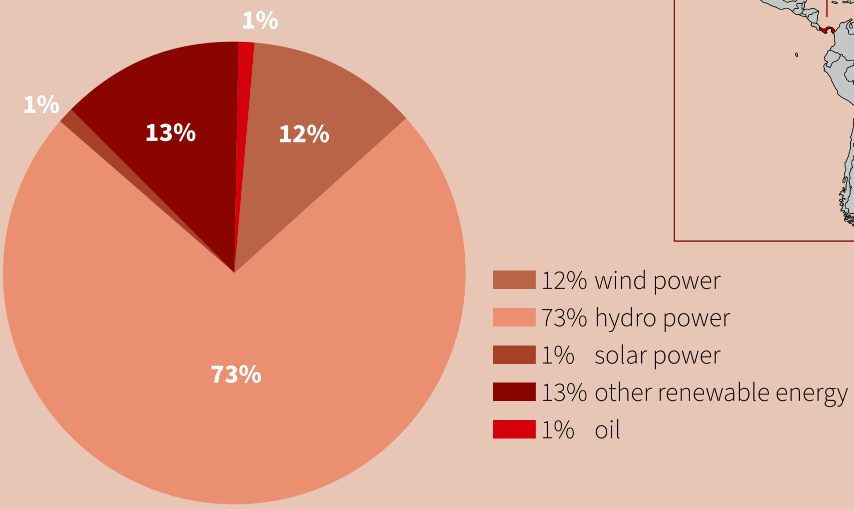
➔ The SEforALL goal envisions universal access to electricity by 2030[17]

Costa Rica

Current status:

- In 2022, 99% of the electricity produced was derived from renewable energies[18] (12% wind power, 73% hydro power, 1% solar power, 13% other renewables).

Costa Rica's Electricity Mix



Challenge: Decarbonising the entire energy supply

Plans:

- National Decarbonisation Plan (2018-2050)[19]
  - In compliance with the Paris Agreement, the plan envisions the decarbonisation of the various sectors contributing to national emissions (including energy, agriculture, industrial processes, and waste) by 2050.

- VII National Energy Plan (2015-2030)[20]
  - The plan prioritises energy efficiency and distributed electricity generation.
  - The plan is built on seven separate objectives:
    - Enhancing energy efficiency
    - Optimising distributed electricity generation
    - Ensuring sustainability of the electricity grid
    - Developing sustainable electricity generation
    - Fostering a more environmentally-friendly vehicle fleet
    - Advancing sustainable public transport
    - Promoting cleaner fuels

The project **"Ensuring a People-Centered Energy Transition in Africa through Civil Society Engagement"** aims at strengthening the engagement of civil society in energy system transformation processes in five African countries – Morocco, Nigeria, Cameroon, Botswana, and Kenya. The project promotes an approach to implementing energy initiatives focused on transformational change in the energy sector through more appropriate policy frameworks and enabling environments on the national, regional, and continental level. Thereby, the project contributes to an effective acceleration of the renewable energy transition, which not only results in significant short- and long-term emissions reductions but also in well-designed renewable energy systems that meet the energy needs of the population and are more resilient to extreme weather events, droughts and supply shortages.

The project is implemented by PACJA with the support of Germanwatch and is financed by the International Climate Initiative (IKI) of the German Ministry for Economic Affairs and Climate Action, the Ministry for the Envrionment, Nature Conservation, Nuclear Safety and Consumer Protection and the Federal Foreign Office.

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PACJA PANAFRICAN CLIMATE JUSTICE ALLIANCE

Supported by:

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IKI INTERNATIONAL CLIMATE INITIATIVE

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Footnotes

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