COBENEFITS of the new energy world of renewables for the people in South Africa

South Africa is in the midst of an energy transition, with important social and economic implications, depending on the pathways that are chosen. Economic prosperity, business and employment opportunities as well as health impacts, issues related to the water–energy–food nexus and global warming impacts: through its energy pathway, South Africa will define the basis for its future development. Political decisions on South Africa's energy future link the missions and mandates of many government departments beyond energy, such as environment, industry development, science and technological innovation.

Importantly, the whole debate boils down to a single question: **How can renewables improve the lives of the people in South Africa?** Substantiated by scientific rigor and key technical data, the study at hand contributes to answering this question. It also provides guidance to government departments and agencies on further shaping an enabling environment to maximize the social and economic co-benefits of the new energy world of renewables for the people of South Africa.

Under their shared responsibility, the CSIR Energy Centre (as the COBENEFITS South Africa Focal Point) and IASS Potsdam invited the Department of Environmental Affairs (DEA) and Department of Energy (DoE), together with the Independent Power Producers (IPP) Office, the Department of Trade and Industry (DTI), Department of Science and Technology (DST) and the South African National Energy Development Institute (SANEDI) to constitute to the COBENEFITS Council South Africa in May 2017 and to guide the COBENEFITS Assessment studies along with the COBENEFITS Training programme and political roundtables.

We particularly highlight and acknowledge the strong dedication and strategic guidance of the COBENEFITS Council members: Olga Chauke (DEA); Nomawethu Qase (DoE); Gerhard Fourie (DTI); and Lolette Kritzinger-van Niekerk, Frisky Domingues, Thulisile Dlamini and Lazarus Mahlangu (IPP Office). Their contributions during the COBENEFITS Council sessions guided the project team to frame the topics of the COBENEFITS Assessment for South Africa and to ensure their direct connection to the current political deliberations and policy frameworks of their respective departments. We are also indebted to our highly valued research and knowledge partners, for their unwavering commitment and dedicated work on the technical implementation of this study. The COBENEFITS study at hand has been facilitated through financial support from the International Climate Initiative of Germany.

South Africa, among 185 parties to date, has ratified the Paris Agreement, to combat climate change and provide current and future generations with opportunities to flourish. Under the guidance of the National Planning Commission, municipalities, entrepreneurs, citizens and policymakers are debating pathways to achieve a just transition to a low-carbon, climate-resilient economy and society in South Africa. With this study, we seek to contribute to these important deliberations by offering a scientific basis for harnessing the social and economic co-benefits of building a low-carbon, renewable energy system while facilitating a just transition, thereby **making the Paris Agreement a success for the planet and the people of South Africa**.

We wish the reader inspiration for the important debate on a just and sustainable energy future for South Africa!

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Executive Summary

COBENEFITS

Consumer savings through solar PV self-consumption in South Africa

Assessing the co-benefits of decarbonising the power sector

Rooftop solar PV systems have the capability to revolutionise the energy system in South Africa. The metropolitan municipalities alone have an economic rooftop installation potential of more than 11 GW for the residential sector, after taking rooftop restrictions into account.

This study quantifies the expenditure savings that may be achieved by residential and commercial consumers in South Africa when installing rooftop solar photovoltaic (PV) systems with the aim of consuming most of the resulting electricity directly (henceforth termed self-consumption); the study was carried out in the context of the COBENEFITS project with the aim of assessing the co-benefits of a low-carbon energy transition in South Africa.

The analysis is based on scenarios for the future development of PV, including battery costs, the evolution of the retail electricity price and potential modifications to rate design (e.g., the introduction of demand charges). The study further analyses the uptake of PV and PV+Battery systems within these two consumer classes in South Africa up to 2030.

- **Policy message 1:** South Africa has a tremendous potential for rooftop solar PV. In the metropolitan municipalities alone, rooftop solar PV has an economic potential of 15 GW between now and 2030.
- **Policy message 2:** South African households and businesses can save money by investing in solar: annual savings for the residential sector alone sum up to around R12.8 billion.
- **Policy message 3:** In order to benefit from PV self-consumption in South Africa, it is crucial to establish attractive Small Scale Embedded Generation (SSEG) rates, to managing and forecasting the future uptake of self-consumption at municipal and national level and to establish incentives for low-income households to become prosumers.

KEY FIGURES:

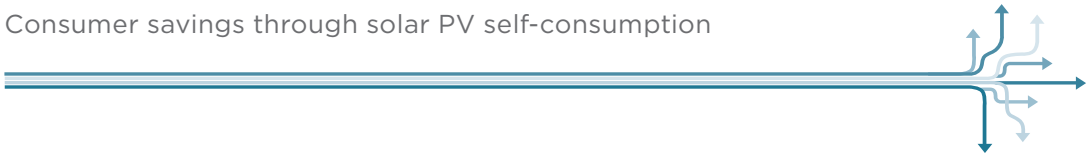
- In the metropolitan municipalities alone, the potential installed capacity of economically viable residential rooftop solar PV amounts to 11.2 GW.
- Assuming that up to 11.2 GW of rooftop PV capacity could be installed by residential prosumers by 2030 (in the metropolitan areas alone), this would result in combined annual savings by all residential prosumers in South Africa of around R12.8 billion.
- For residential prosumers, monthly savings range from R200 to R543 for a 2 kW system (see 2 to 7 below). This would result in annual savings ranging from R2400 to R6500.
- For a typical 60kW commercial system, average annual savings of R20 000 can be realised over the system's lifespan.
- At present, payback times average 6–10 years for commercial PV systems and 10–22 years for residential systems, and are highly dependent on the valuation of PV by the local utility (SSEG tariff).
- PV/Battery systems will start to become economically viable as early as 2028.

COBENEFITS South Africa (2019): Consumer savings through solar PV self-consumption in South Africa. Assessing the co-benefits of decarbonising the power sector

available on www.cobenefits.info

[1] The details of the project can be found on www.cobenefits.info

[2] The term **"co-benefits"** refers to simultaneously meeting several interests or objectives resulting from a political intervention, private sector investment or a mix thereof (Helgenberger et. al, 2019). It is thus essential that the co-benefits of climate change mitigation are mobilized strategically to accelerate the global transition to renewable energies and also low-carbon energy transition (Helgenberger et. al. 2017)



KEY FINDINGS:

- **Small-scale PV systems for self-consumption have already started to become economically viable for both residential and commercial customers.** The payback period for self-consumption systems has reduced sharply in recent years. This is due both to ESKOM tariff hikes and further reductions in the cost of PV systems. With a fair valuation of PV by the local utility (SSEG tariff), payback periods of PV systems for commercial and residential users can be reduced to 6 years and 10 years respectively.
- **An attractive payment scheme (FIT or SSEG tariff) also fosters self-generation and self-consumption** by enabling prosumers to design more capacious systems with the option to feed-in and sell surplus electricity back to the grid. At present, prosumers must design their system to avoid generating surplus electricity (optimisation of self-consumption), because the additional installation costs of a larger system cannot be recouped by selling any surplus energy into the grid. Generally, the tariff structure (i.e., electricity price composition) has a significant impact on the economics of solar (+battery) systems. Introducing demand charges, for instance, can make the business case unattractive.
- **Combined annual savings for residential prosumers in South Africa could add up to around R12.8 billion by 2030** in the metropolitan areas alone, assuming that up to 11.2 GW of rooftop PV capacity could be installed by residential prosumers. For residential prosumers, savings range from R200 monthly to R543 for a representative 2 kW system, giving annual savings of R2400 to R6500. For typical commercial customers, annual savings range from R20 000 (for a 62 kW system) to R65 914 (for a 1 MW system).
- **It is technically and economically feasible to install more than 11 GW of solar PV on residential rooftops in the metropolitan municipalities of South Africa by 2030** (total capacity in 2018: 285 MW). The of solar PV in these areas even adds up to 15 GW between now and 2030.
- **PV+Battery solutions can play an important role in incentivising prosumers and reducing peak load during evening hours.** Assuming further cost reductions for battery systems, economic viability can be reached in less than 10 years. Given that payback periods presently exceed 20 years, PV+Battery solutions need further investment incentives to provide an attractive business case.
- **Overall energy system costs can be reduced by optimally aligning the deployment of large-scale projects and distributed generation in South Africa.** To this end, detailed projections of the uptake of embedded generation will be necessary.