Energy storage systems sahrawi arab democratic republic

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In summary, two main approaches are currently used for renewable energy analyses on a continental or global scale: (1) Analyses are performed for one RE type, using a corresponding database32 or (2) integrated analyses for different RE types are performed and data is compiled from various databases33,34 or databases are behind paywalls27. The lack of a comprehensive and up-to-date database covering comparable information of existing and proposed HPPs, SPPs, and WPPs limits integrated renewable energy planning worldwide, in particular for Africa.

Here, a comprehensive, curated and georeferenced renewable power plant database for Africa (RePP Africa) is presented (last revision: 16.11.2022)35. Data records were compiled and processed from various sources for all African countries. The establishment of the database included four steps: compilation, georeferencing, completion, and revision (Fig. 1).

The first openly-accessible and harmonized renewable power plant database covering entire Africa includes georeferenced information on a total of 1074 HPPs, 1128 SPPs, and 276 WPPs. 401 HPPs, 411 SPPs, and 127 WPPs are existing or under construction, with a total capacity of 59.56 gigawatts (GW), 10.56 GW, and 10.53 GW respectively (Table 1). As of November 2022, 673 HPPs, 717 SPPs, and 149 WPPs are proposed with a total respective capacity of 130.85 GW, 53.32 GW, and 16.87 GW.

RePP lists three types of power plant facility status (status_inf): existing (E), under construction (U), and proposed (P). Proposed plants include potential sites where feasibility studies were realized. Once the construction has started, the status changes to under construction. If a plant is officially inaugurated, its status turns to existing. Each data entry is provided with a time stamp indicating when the status was last checked.

For HPPs and SPPs, different operating systems are distinguished. 446 HPPs operate with reservoir storage, 286 as run-of-river HPPs, and 17 HPPs with a pumped-storage system. No adequate information could be provided for 325 HPPs (30% of total), with 86% of these categorized as proposed (281 HPPs). Most SPPs (1072) are operating or proposed as photovoltaic (PV), 47 as concentrated solar power (CSP), and 9 as concentrator photovoltaics (CPV) type plants.

As of November 2022, all 55 African countries have installed or proposed energy generation capacity from RE resources. Solar power and wind power are playing an increasingly important role in the total RE resource

mix, with shifts between installed and proposed total capacity differing among countries (Fig. 2).

Cumulated capacity in megawatts [MW] by country for hydropower, wind power, and solar power plants. In this figure, the Sahrawi Arab Democratic Republic (Western Sahara) is geographically aggregated with Morocco. No statements on the political situation are intended.

The contemporary, curated database on renewable power plants (existing, under construction, proposed) in African countries will enable the research community to address and fill current research gaps and to advance integrated renewable energy modelling. Openly accessible data on renewable energy plants vary in quality among countries. The RePP Africa35 intends to stimulate integrated research and large-scale assessments at a continental level as well as to foster case studies and research activities in data-poor regions of less-studied African countries.

All plants with given coordinates were imported to ArcGIS Pro37 and QGIS38 software. All plants with locations indicated or described by reports or other sources were added manually and coordinates checked for plausibility. Existing plant locations were cross-checked using Google Maps and Open Street Map and, if necessary, corrected. All HPPs were snapped to river lines of the RiverATLAS (HydroATLAS)35 to facilitate further processing.

RePP Africa35 is collated in a single spreadsheet-based file and consists of the hydropower plant database (HPPD), solar power plant database (SPPD), and wind power plant database (WPPD). Figure 3 maps all data records according to resource type (symbol colour, symbol shape) and capacity, i.e. size in megawatts (symbol size).

Map of all hydropower, solar power and wind power plants as compiled in the African Renewable Power Plant database (RePP Africa). Symbol colour and shape indicate renewable energy type; colour intensity indicates status (E - existing and U - under construction, P - proposed); symbol size indicates capacity in megawatts [MW] with small 1-10 MW, medium >10-100 MW, large >100-1000 MW, and very large >1000 MW. No plants are located on open water; all facilities not located on the mainland are located on islands.