

# **Remote sensing techniques for village identification: Improved electrification planning for Zambia**

Catherina Cader\*<sup>a</sup>, Alin Radu <sup>a</sup>, Paul Bertheau <sup>a</sup> and Philipp Blechinger <sup>a</sup>

Reiner Lemoine Institut, Rudower Chaussee 12, 12489 Berlin

Access to energy remains a challenge in many regions of Africa. In Zambia, approximately only 28% of the total population of 17 million has access to electricity, with even lower access rates of 5% in rural areas. One of the first challenges in providing these regions with reliable electricity is identifying the location of small settlements that still lack access to electricity. Systematic electrification planning requires in detail information about the current extent of electrification and the spatial location and distribution of villages and households without access. If this is available, transparent planning mechanisms can assess different electrification options such as stand-alone systems, mini-grids or grid extension. This paper aims at detecting a sample of Zambian villages without electricity through remote sensing techniques. These techniques involve applying various machine learning algorithms to classify medium resolution Sentinel 2 multispectral imagery. This method provides quick and accurate results on large areas with minimum costs, since many satellite imagery providers offer their products for free, as well as a significant amount of open source satellite image processing software exists. Exploring the existing classification algorithms and finding the best fit for the detection of built up areas in each region are the main challenges that we are addressing. As a final product we aim to identify the location, spatial extension and number of people of rural settlements in the research area. Combining this with night light and infrastructure data will reveal the level of energy access of each settlement. These results will support official bodies such as the Rural Electrification Authority (REA) as well as private project developers with an entrepreneurial interest in the region. Thereby, this knowledge enables improved legal and regulatory decisions as well as increased private sector participation.

**Keywords:** Remote sensing; Village detection; Spatial planning; Energy access; Zambia

Corresponding author: Identify by \*

Email address: [catherina.cader@rl-institut.de](mailto:catherina.cader@rl-institut.de)

Telephone: +49 3012 0843 40