

## RENEWABLE MINIGRID DEPLOYMENT IN ETHIOPIA

The World Bank is using a platform based on Copernicus Sentinel data in order to support its electrification projects in Africa, thereby reducing planning time and costs and increasing accuracy in execution.



### THE CHALLENGE

Access to affordable and reliable energy is a prerequisite for development. The UN's Sustainable Development Goal 7 (SDG 7) explicitly targets "universal access to affordable, reliable and modern energy services" by 2030, but more than 730 million people still lacked access to electricity in 2020, with around 50% of these people living in fragile and conflict-affected settings. Regional disparities continue to persist, and the access deficit is particularly acute in sub-Saharan Africa. The Global Facility on Mini Grids, part of the World Bank's ESMAP, supports the integration of mini-grids into national electrification programmes and World Bank lending operations. One way it does this is by developing the practical knowledge needed to scale up mini-grid deployment. A persistent challenge to successful mini-grid deployment has historically been the time and cost required to identify, characterise and prioritise sites, by seeking information from local or national stakeholders and visiting each of these sites to assess their suitability. Often, significant resources were spent on visiting communities that were ultimately found not to meet the requirements for mini grid electrification, or more suitable communities had not been considered because they had not been identified as potential options. Thus, a national mini-grid portfolio planning approach (incl. implementation tools), based on latest geo-spatial modelling advances and taking full advantage of the increasing availability of granular satellite data on customer locations and demand, existing grid infrastructure, and socio-economic activities, i.a., needed to be developed to guide the efficient allocation of resources for the preparation of mini grid project pipelines. Finally, a platform was needed that incorporated all relevant data layers, accessible to relevant stakeholders so that project development decisions would not have to be made on the basis of incomplete datasets and manual workflows.



## HOW SATELLITES CAN HELP

Understanding local conditions and areas where investments could have a long-term, sustainable impact on development is a major challenge for development banks. The geospatial intelligence platform VIDA uses Sentinel-2 data of the EU's Copernicus programme to have an additional source of data on rural communities in developing countries, where data is often missing or inaccurate. Information and indicators on e.g. the local and regional economy or agricultural activity are often missing. Using EO data from the Sentinels, VIDA derives several dozen indicators and parameters for each village. These indicators include:

- Current access levels in the village based on measured night-time illumination
- Distance to electricity grid infrastructure
- Settlement size and growth over time
- Building footprints, including building types (commercial data) and identification of village cores and outskirts
- Agricultural activity (e.g. temporal NDVI layers)
- Security data (e.g. political events/violent attacks)
- Climatic conditions
- Access to surface water (e.g. temporal S-2 and S-1 data)

One of the main advantages of using Sentinel satellite data is its frequent global coverage every 5 days. Time series are particularly important for understanding agricultural productivity and soil fertility around a community, as well as the potential for population growth. The ability to have a synoptic view of settlements and surrounding fields on a global scale via a web platform is a great advantage, providing timely and complete information according to the information needs of ESMAP and other users.

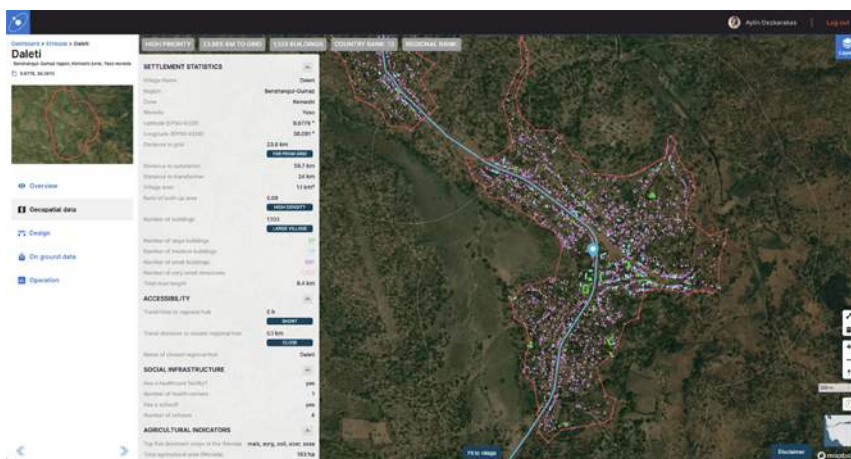


Figure 1: Settlement statistics in the VIDA dashboard

## The satellite data:



Sentinel-2 carries an innovative wide swath high-resolution multispectral imager with 13 spectral bands. The combination of high resolution, novel spectral capabilities, a swath width of 290 km and frequent revisit times provides unprecedented views of Earth. Sentinel-2 images can be used to determine various plant indices such as leaf area chlorophyll and water content providing information useful for agricultural and forestry practices and for helping manage food security. Sentinel-2 also provides information on pollution in lakes and coastal waters. Images of floods, volcanic eruptions and landslides contribute to disaster mapping and help humanitarian relief efforts.

Copernicus Sentinels data are available under an open and free data policy.

Sentinel-2 data can be accessed at <https://scihub.copernicus.eu>

More info: <https://sentinels.copernicus.eu>

## The Service Provider

VIDA is a map-based online platform that helps governments, development banks and the private sector plan and monitor renewable electrification projects. VIDA provides a comprehensive catalogue of satellite imagery and geospatial data, as well as a set of analysis algorithms to identify and characterise off-grid villages. VIDA users then add their own field surveys and IoT sensor data to refine the analysis and select the most appropriate communities for investment.



<https://www.vida.place>



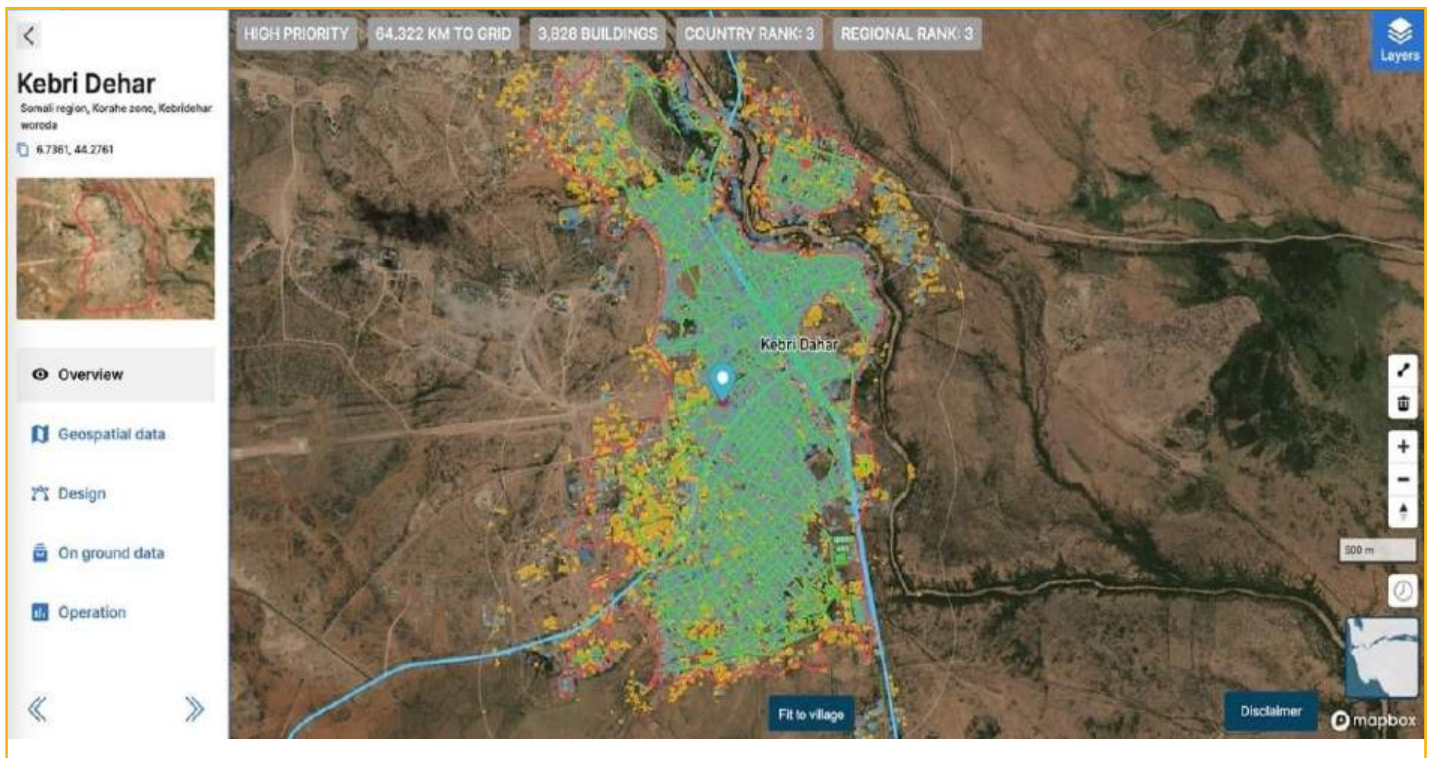


Figure 2 Exemplary image incl. analytics from the VIDA platform

## WHO IS CONCERNED?

VIDA has enabled transparent site selection for renewable energy mini-grid projects, based on the team's experience in the energy access sector and stakeholder requirements. Using VIDA, the World Bank/ESMAP and its clients can follow a more data-driven process to select viable sites for mini-grids. Thanks to the scalability of the platform and its algorithms, VIDA enables large-scale, country-wide investment planning for transformational electrification programmes. Site selection can take into account policy priorities as well as the technical parameters already used to analyse communities. Ultimately, this can deliver value for money by identifying projects with higher financial viability (or lower viability gap) based on factors such as the presence of productive loads, denser settlements or higher consumption households.

Both the World Bank/ESMAP teams and the government counterparts implementing the projects have access to VIDA. World Bank/ESMAP staff access it regularly to review site information and compare sites selected through different screening approaches (as in Ethiopia). Government counterparts also access the platform regularly and plan to use it both as a repository of geospatial data and as a tool to further prepare for investments (by guiding survey teams and then validating and updating the data as survey data from the communities under consideration become available).

Some work on mini-grid market analysis and even site identification has already been done by various government institutions and development partners. ESMAP is cross-referencing VIDA's site identification, characterisation and prioritisation with these earlier or

### The Primary Users

**ESMAP** is a partnership between the World Bank and 22 partners (donors) to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition needed to achieve Sustainable Development Goal 7, which aims to ensure access to affordable, reliable, sustainable and modern energy for all. ESMAP helps shape WBG policies and programmes to achieve the objectives of the WBG Climate Change Action Plan.



<https://www.esmap.org>

parallel initiatives to compare results and highlight any overlap. The function of estimating agricultural electricity demand is an emerging field, but one that ESMAP expects will be critical to right-sizing mini-grid solutions and directing investment to areas where electrification has significant potential as a multiplier for rural development. To this end, ESMAP is trying to gather as much information on agricultural productivity as possible to improve the village-level analyses it is currently conducting with VIDA.

The (regional/local) governments and government agencies working with ESMAP in the target countries benefit from the independent data and information analysis on the platform. They collaborate on these projects to benefit from better, up-to-date information on where mini-grids can have the greatest impact. Regional partners can see which settlements are or will be electrified and plan or monitor their own initiatives accordingly. They can see which areas are best suited for mini-grid electrification and where newly electrified customers could potentially use appliances or productive tools.

## WHAT ARE THE BENEFITS?

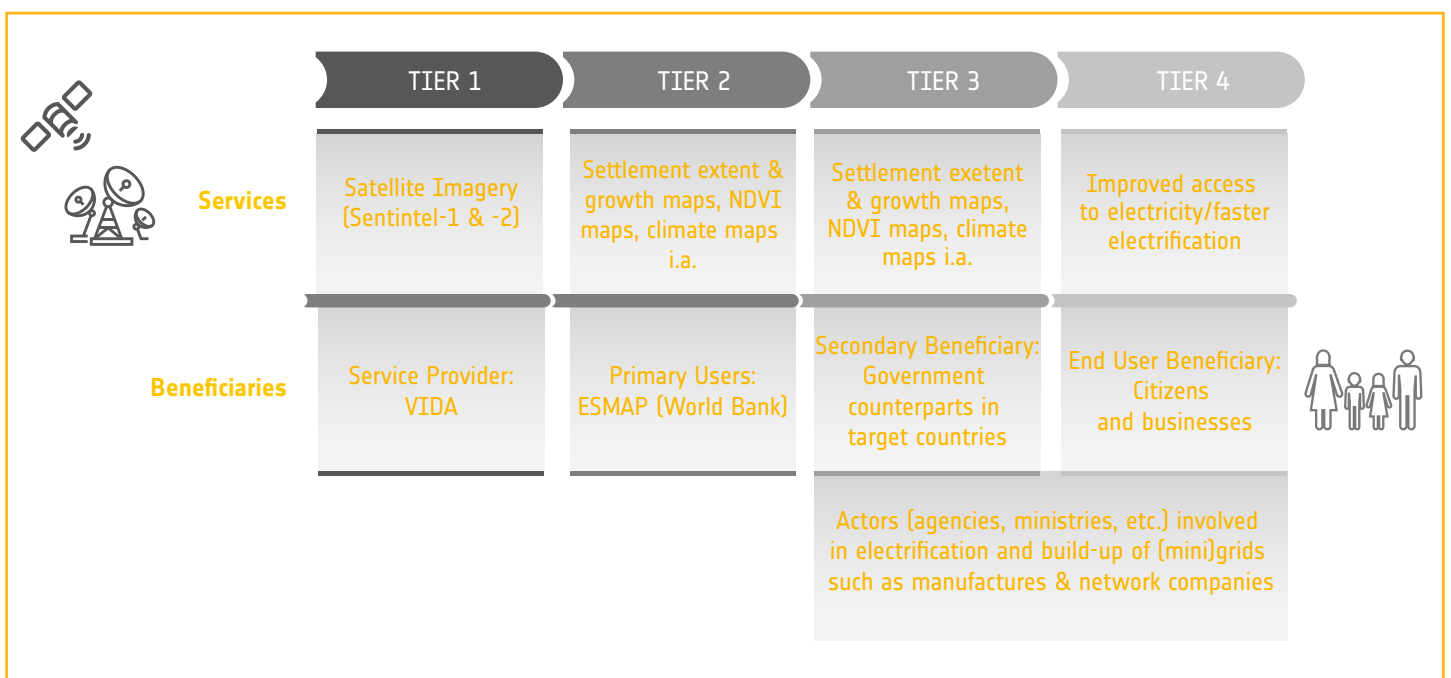


Figure 3: Value chain of the main stakeholders and beneficiaries

The use of satellite imagery, and in particular imagery from the Sentinel fleet, has been a “game changer” for ESMAP and the World Bank teams and government clients it advises on the identification and assessment of mini-grid sites. The use of the VIDA platform has facilitated its work with national and regional counterparts, providing them with a common and objective basis for discussion on the prioritisation of mini-grid project sites. A demonstration project under the ESA Business Applications Programme calculated that VIDA users save on average up to 70% in cost and time compared to traditional site identification and preparation methods. VIDA’s research and development activities are continuing in close collaboration with ESMAP and other user organisations, and the platform will be enhanced in the near future. At present, it is already providing valuable insights that would have been difficult to obtain by other means, let alone site visits.

**Economic**

- Increased revenue due to high application scalability (VIDA)
- Cost savings through more efficient analysis, data-driven project planning and execution, reduced field surveys (ESMAP)

**Environmental**

- Reduced pollution through faster replacement of fossil fuel power sources
- Reduced impact on natural resources due to transition or initial access to renewables

**Regulatory**

- Improved efficiency in monitoring implementation and better information available to monitor compliance

**Innovation**

- Sentinel data has led to the creation of a new service, a new way of generating income and the creation of a new successful business.
- The global nature of Sentinel data has provided access to different international markets.

**Societal**

- Common understanding through shared maps so that end beneficiaries are transparently involved
- Strategic value through nationwide energy transition efforts

**EXTENDED IMPACT**

The use of satellite imagery to speed up and improve site selection and project planning is not only of interest to ESMAP/World Bank and their government counterparts. Mini-grid manufacturers, other suppliers or related industries may be interested in gaining a better understanding of the market and potential opportunities through platforms such as the one provided by VIDA. It can provide them with global access to information where they can offer their products and services for the best return on investment. Similarly, potential users may include NGOs and investment companies that need more objective and reliable data and information on where to most effectively deploy and channel their often limited (financial) resources. In addition, other (national/multilateral) development banks (e.g. AfDB, EBRD or KfW), development agencies (e.g. GIZ) and international financial institutions (IFIs) are potential users or are currently investigating how they can use the information provided by VIDA.

However, this is not the only way to extend the impact of VIDA. It can be applied to other geographies where a decision support system is needed to assess rural communities for electrification or other types of interventions. Because the Sentinel fleet provides global, periodic coverage, the reach of the VIDA tool is also global.

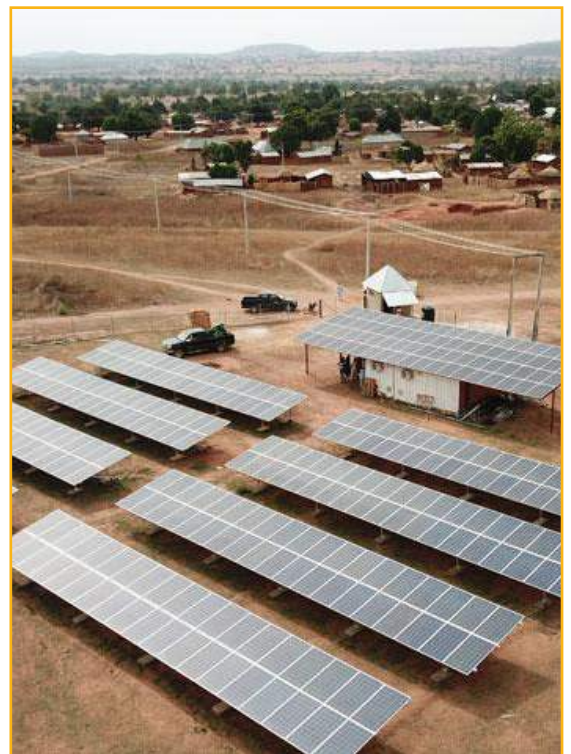


Figure 4:



## ABOUT THE PROJECT

The Sentinel Benefits Study (SeBS) is conducted by EARSC (European Association of Remote Sensing Companies) with partners The Greenland, IIASA (International Institute for Applied Systems Analysis) and Evenflow on behalf of the European Space Agency (ESA). It has the goal to study 20+ full cases by analysing the impact of the use of Sentinel data along a value-chain. This short case has been prepared where there has been an interesting use made of Sentinel data, but it has not (yet) been possible to conduct a full case. It tells the story of the use of Sentinel data without going deeply into the economic or environmental benefits.



We acknowledge that the understanding of the case was supported by discussions with Philippe Raisin and Aylin Oezkarakas from VIDA as well as Ashish Shrestha from ESMAP (World Bank). We thank them for their valuable insights and availability.

**Do you know an interesting case demonstrating the benefits derived from the use of Sentinels data?**

**Email [info@earsc.org](mailto:info@earsc.org)**

**More Information on Sentinels Benefits Studies:**

**[www.earsc.org/sebs](http://www.earsc.org/sebs)**



The Sentinels Benefits Study is funded by the EU and ESA. The views expressed in this study cannot be taken to reflect the official position of the EU or of ESA.



***“As we scale up mini grid deployment to help our client countries advance towards their universal access goals, it’s essential that we have a transparent and data-driven means of identifying, characterizing and prioritizing a large number of potential mini grid project sites, as we have done with the VIDA platform using Sentinel-2 data.”***

*Ashish Shrestham - Consultant, Energy Sector Management Assistance Program, World Bank*

