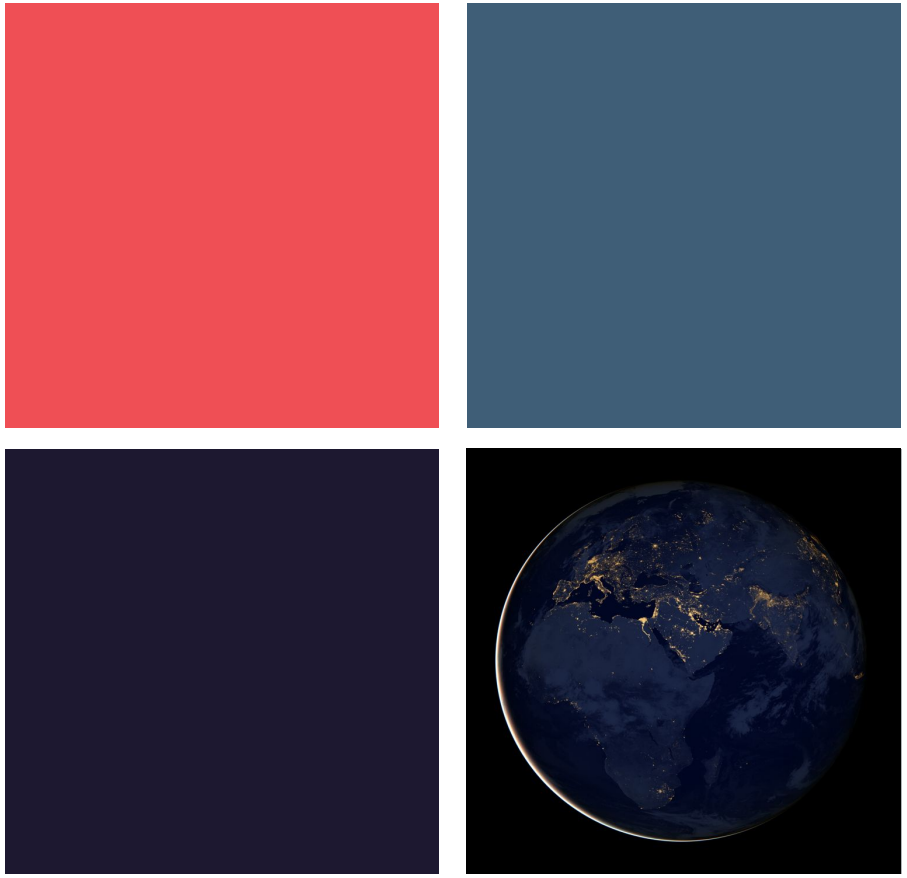
Village Data Analytics



A Product by

TFE Energy

Scaling off-grid electrification using Machine Learning

October 2020

Over 1 billion people live with no electricity.

MORE THAN 210,000 OFF-GRID SOLUTIONS ARE REQUIRED TO ACHIEVE SDG7

PROBLEM

Identifying remote villages for off-grid electrification and gathering useful information about them is a key barrier.

Surveys are **slow, costly and imprecise**. This leads to long project development timelines, low operating margins and restricts access to finance.

NEED

SCALING OFF-GRID ELECTRIFICATION MEANS FINDING PORTFOLIOS OF COMMERCIALLY VIABLE VILLAGES

We need a reliable, fast and scalable method to identify portfolios of commercially viable sites and to make the information available to development organizations, government, donors and energy companies.

SOLUTION: VIDA

VILLAGE DATA ANALYTICS

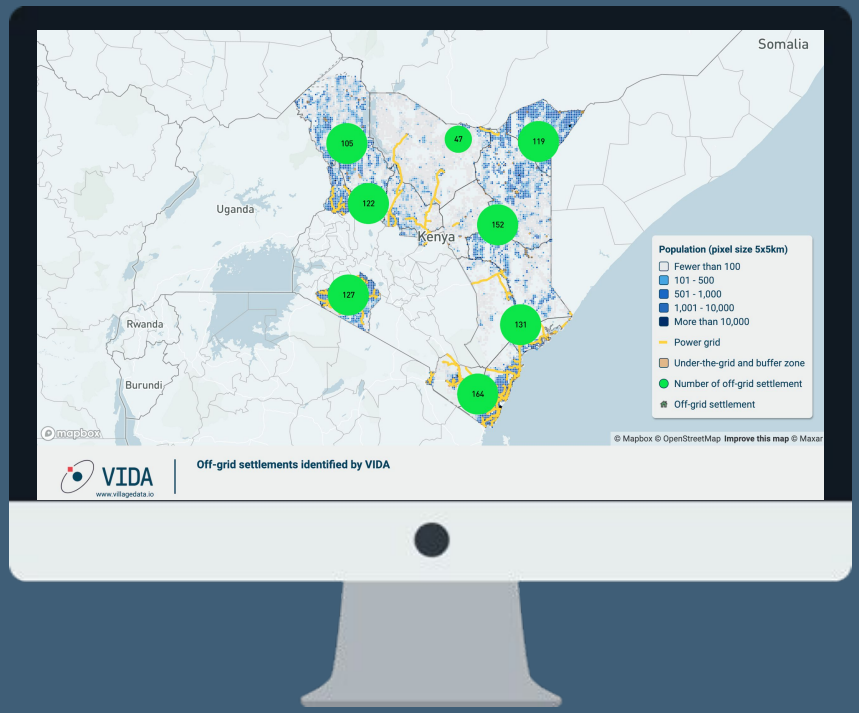
A software-enabled service that extracts vital information about remote villages and determines its suitability for a off-grid electrification.

VIDA uses machine-learning algorithms to predict socio-economic health of a village. This data-driven knowledge de-risks projects, reduces time and costs for viable off-grid planning and investment at scale.

Supported by

INITIATIVE FOR APPLIED ARTIFICIAL INTELLIGENCE

esa European Space Agency



VIDA Interactive UI

WORKFLOW
MACHINE LEARNING ALGORITHMS IN VIDA

Off-grid Villages

VIDA uses machine learning algorithms to identify remote villages in a user-selected area using satellite imagery.

Off-grid viability

A machine learning algorithm predicts the socio-economic health and off-grid viability factors for every village based on the extracted characteristics.

IDENTIFY | EXTRACT | PREDICT | RANK

Village Characteristics

For every identified village, VIDA automatically extracts important village characteristics belonging to categories such as demographics, density, grid access, potential high value customers, water access, agriculture analysis, etc.

Prioritization

Based on the extracted village characteristics and predicted socio-economic health, VIDA scores every village. Villages in the selected geography are ranked based on this score.

IDENTIFY | EXTRACT | PREDICT | RANK

AREA OF INTEREST (AOI)

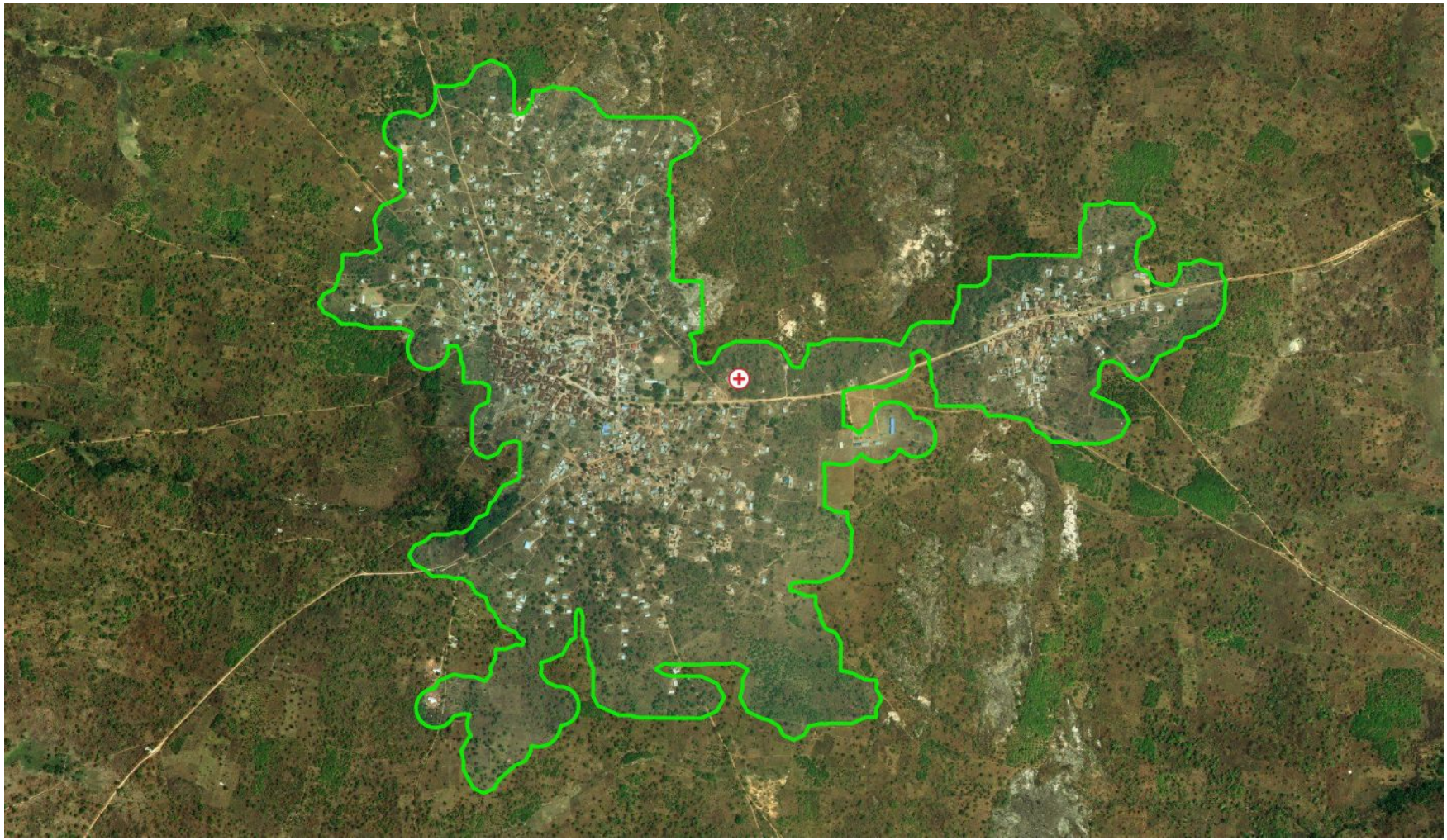
VIDA customers select an area of interest to determine viable sites for mini-grid installation. At scale, VIDA can also run the analysis across the continent.

IDENTIFY | EXTRACT | PREDICT | RANK

IDENTIFY SETTLEMENTS

VIDA uses a proprietary machine learning algorithm to automatically identify villages in the AOI using satellite images. Area marked in purple shows villages or large settlements detected by VIDA.

Actual VIDA screen grab

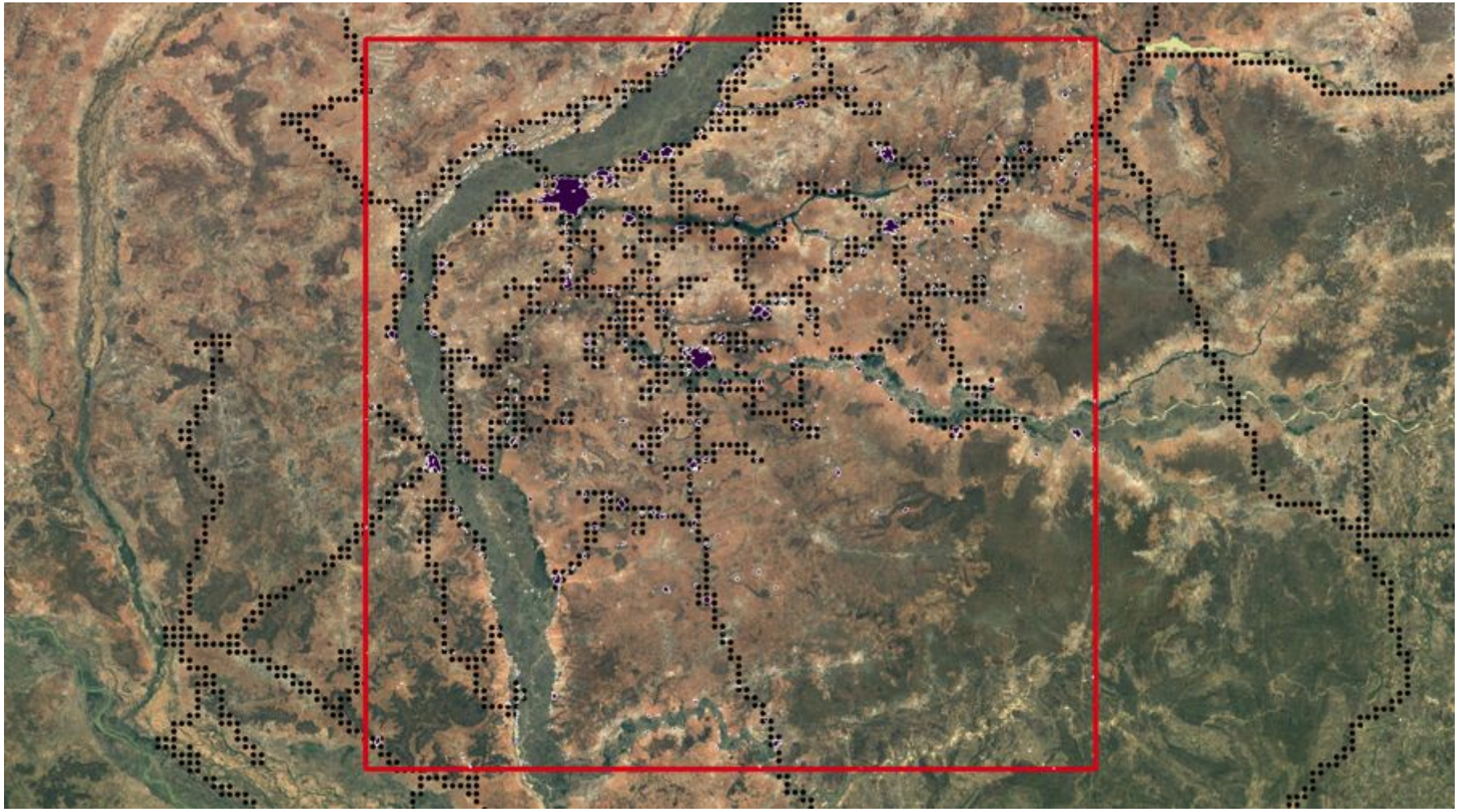


IDENTIFY | EXTRACT | PREDICT | RANK

IDENTIFY SETTLEMENTS

VIDA uses a proprietary machine learning algorithm to automatically identify villages in the AOI using satellite images. Zoomed-in view of settlement identified by VDA.

Actual VIDA screen grab

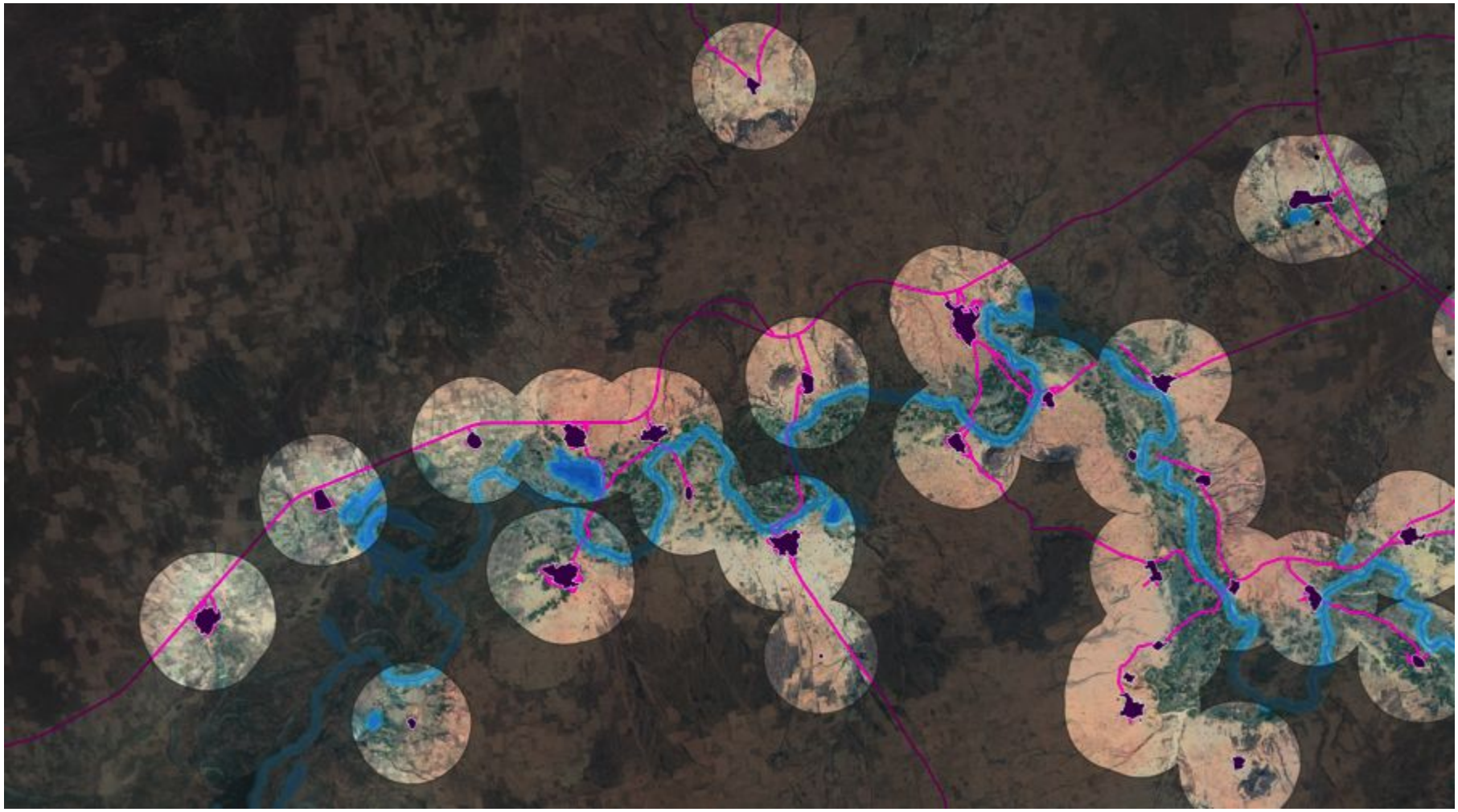


IDENTIFY | EXTRACT | PREDICT | RANK

ACCESS TO GRID ELECTRICITY

VIDA uses a unique night light imagery based electrification status prediction algorithm to detect electrical grid infrastructure. Villages with access to grid are not considered for the remainder of the analysis.

Actual VIDA screen grab

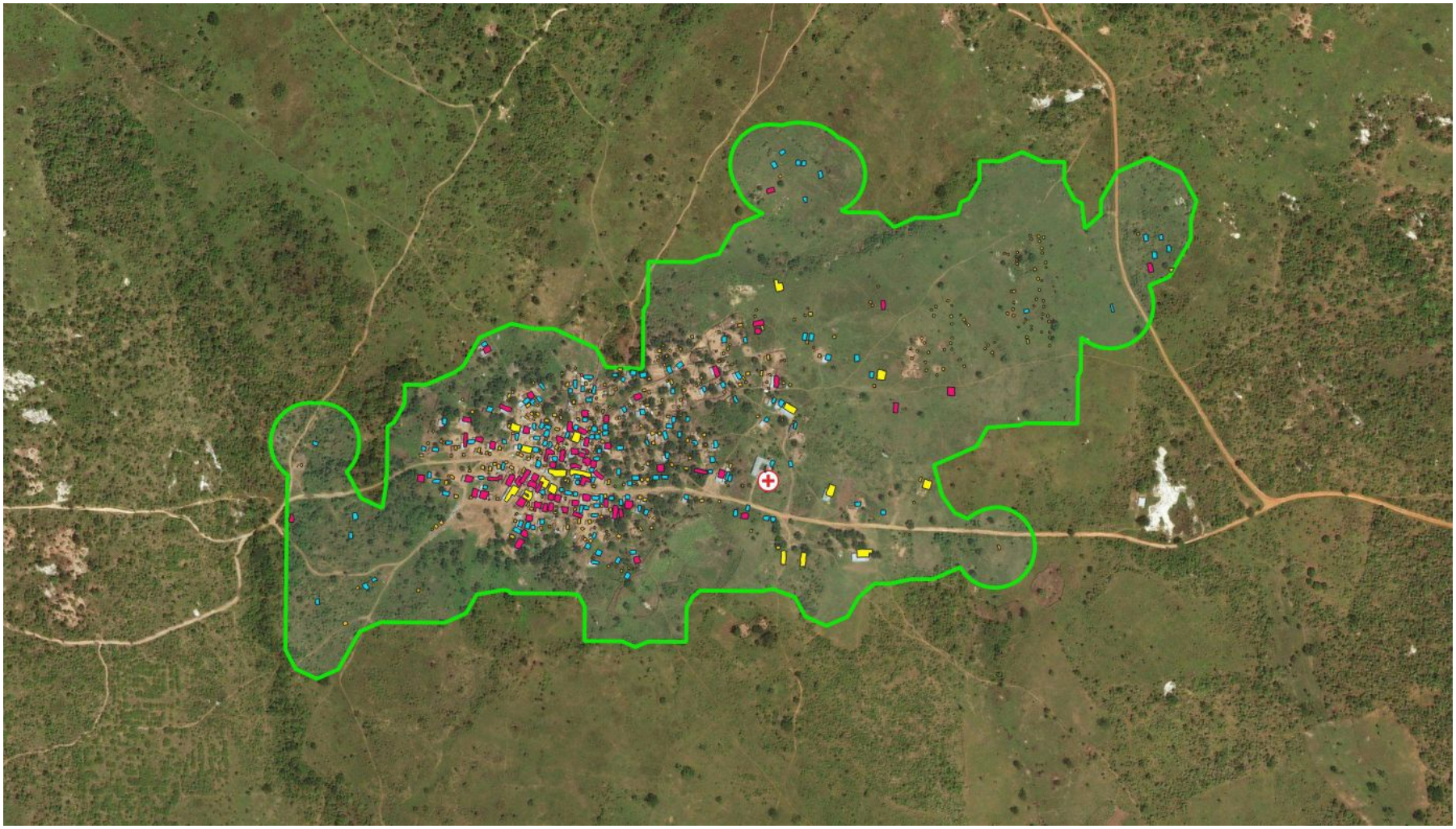


IDENTIFY | EXTRACT | PREDICT | RANK

EXTRACT INFORMATION

VIDA uses its library of algorithms to extract vital information about rural villages. VIDA extracts insights such as: village demographics and size, distance to grid, access to road and type, access to water and agriculture. In total, 15 to 20 quantifiable indicators are extracted from each village.

Actual VIDA screen grab

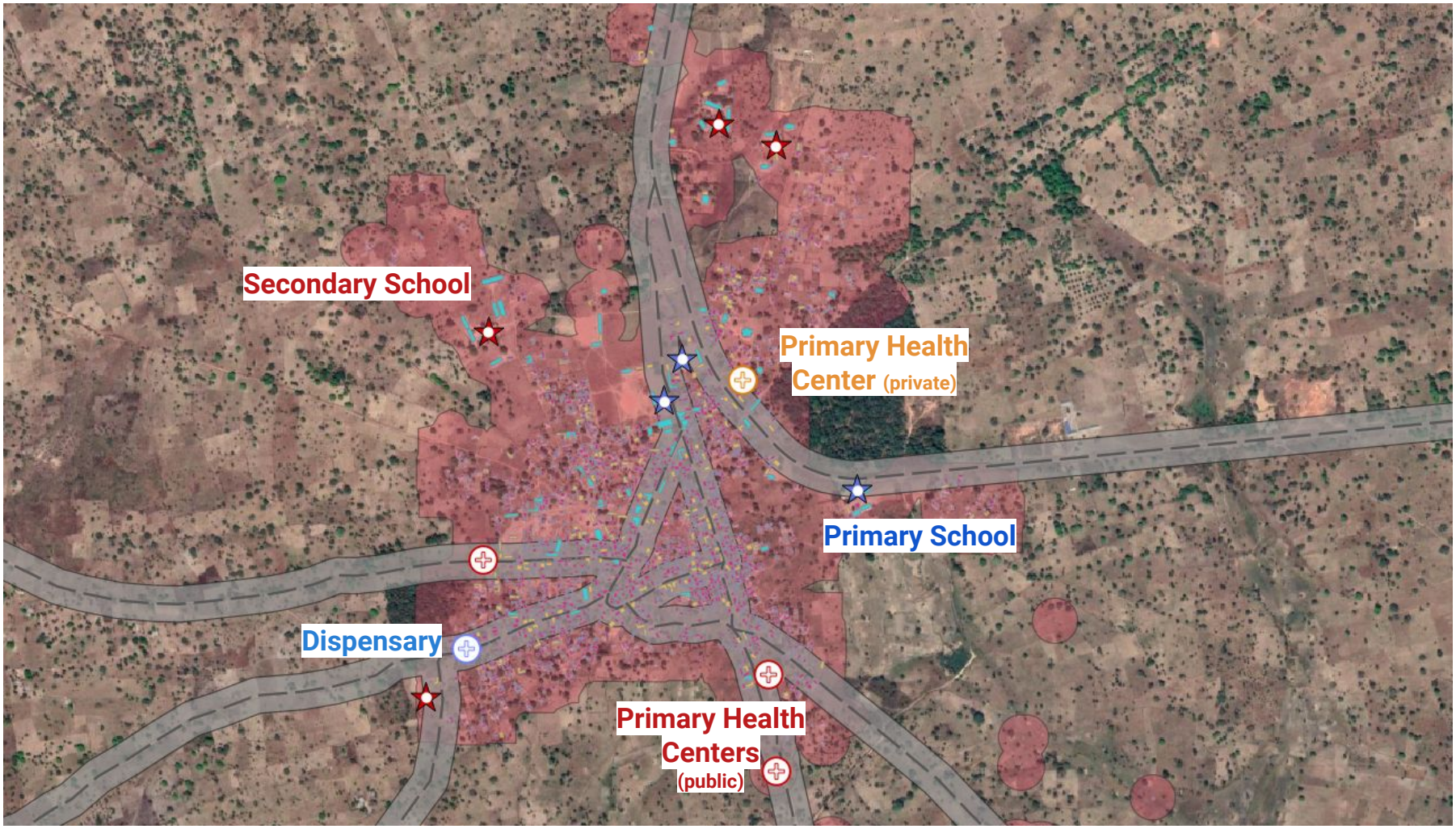


IDENTIFY | EXTRACT | PREDICT | RANK

EXTRACT INFORMATION

Using high resolution imagery, VIDA extracts highly granular village characteristics like the number of rooftops, density of buildings, identification of core and outskirts area, rooftop size distribution, and others.

Actual VIDA screen grab



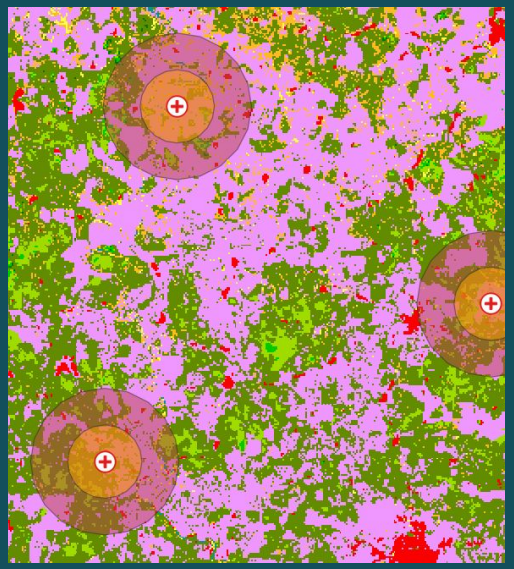
IDENTIFY | EXTRACT | PREDICT | RANK

EXTRACT INFORMATION

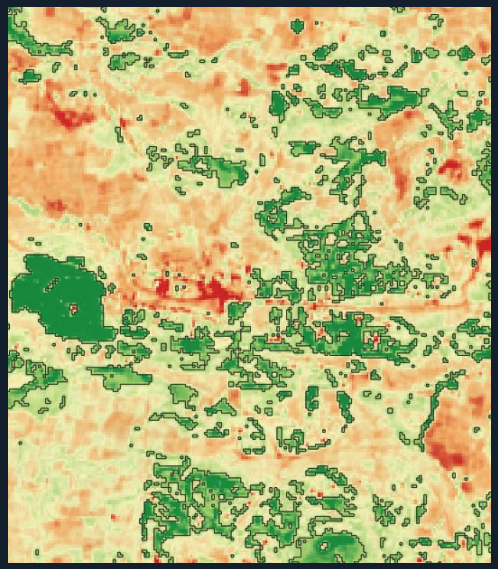
VIDA extracts information around the availability of anchor and institutional loads and productive usage of electricity.

Actual VIDA screen grab

Waterbody analysis



Agriculture analysis



Hyper local agriculture productivity analysis

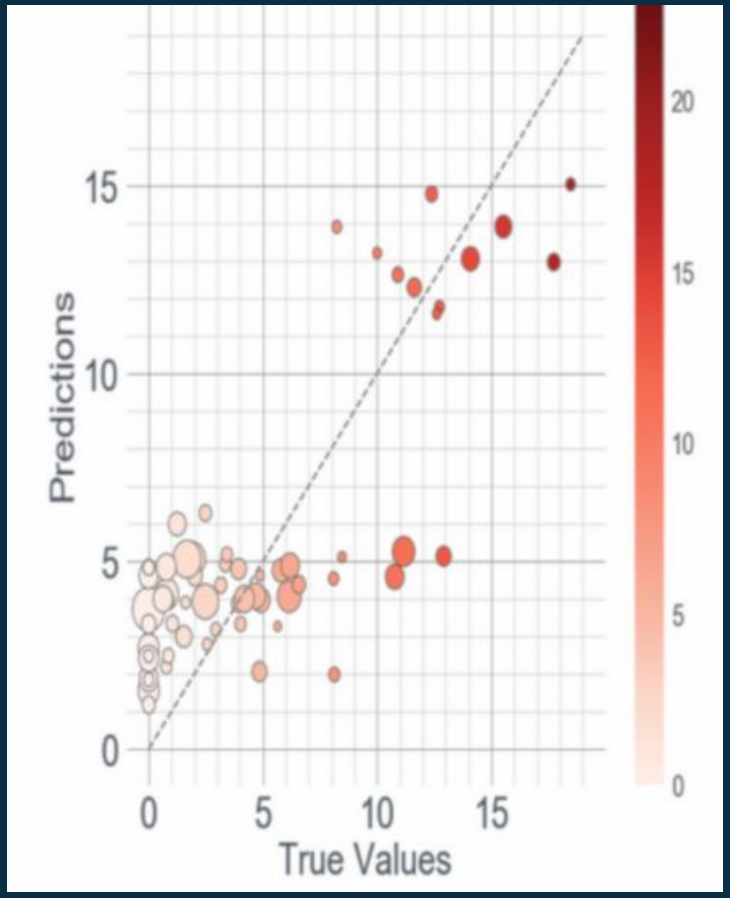
IDENTIFY | EXTRACT | PREDICT | RANK

EXTRACT INFORMATION

VIDA uses the most recent satellite imagery and its algorithms to analyzes agricultural production and water availability.

Actual VIDA screen grab

Asset ownership prediction by ML algorithm



Prediction of off-grid viability

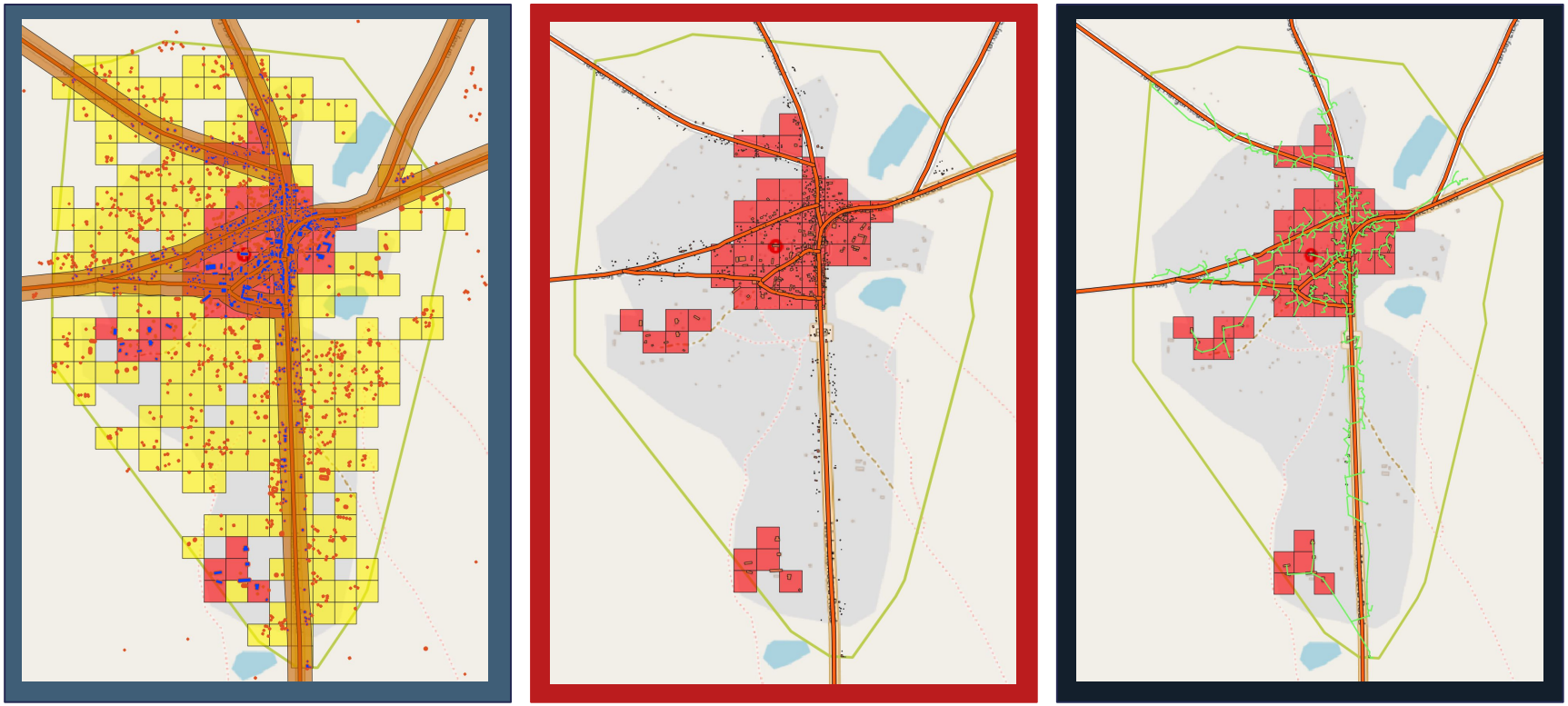
VIDA predicts mini-grid viability of villages based on the extracted characteristics. VIDA provides labels to the village and also predicts a score. Some of the VIDA labels include:

Priorities: High, medium and low priority villages

Village type: Village with mostly small buildings, village with probably commercial buildings, villages with large number of probably commercial buildings

Distribution type: High, medium and low distribution cost per connection

VIDA score: 0 to 100 based on the labels



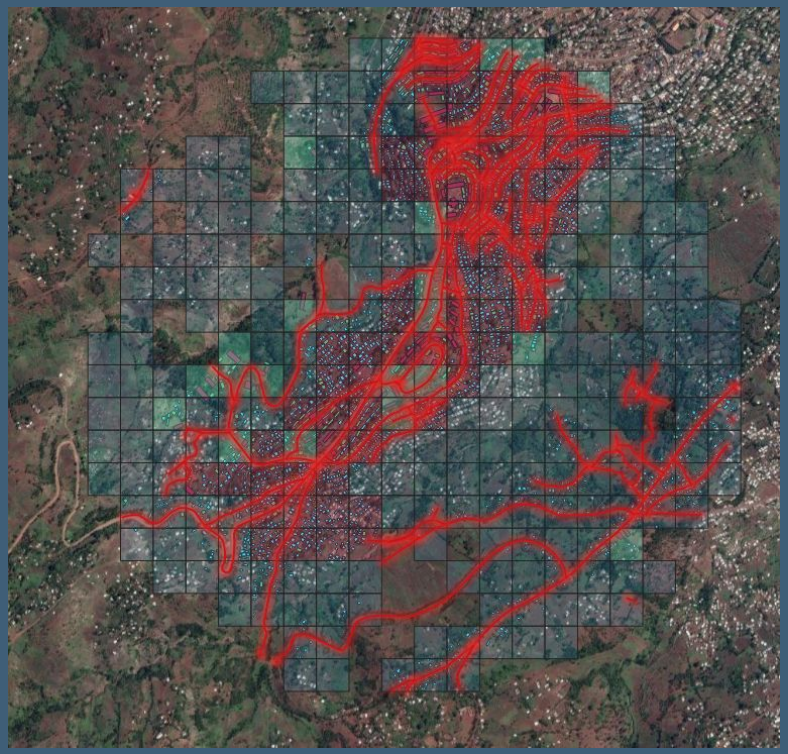
VIDA's analysis to identify village core (red colored areas) and high value mini-grid customers

IDENTIFY | EXTRACT | PREDICT | RANK

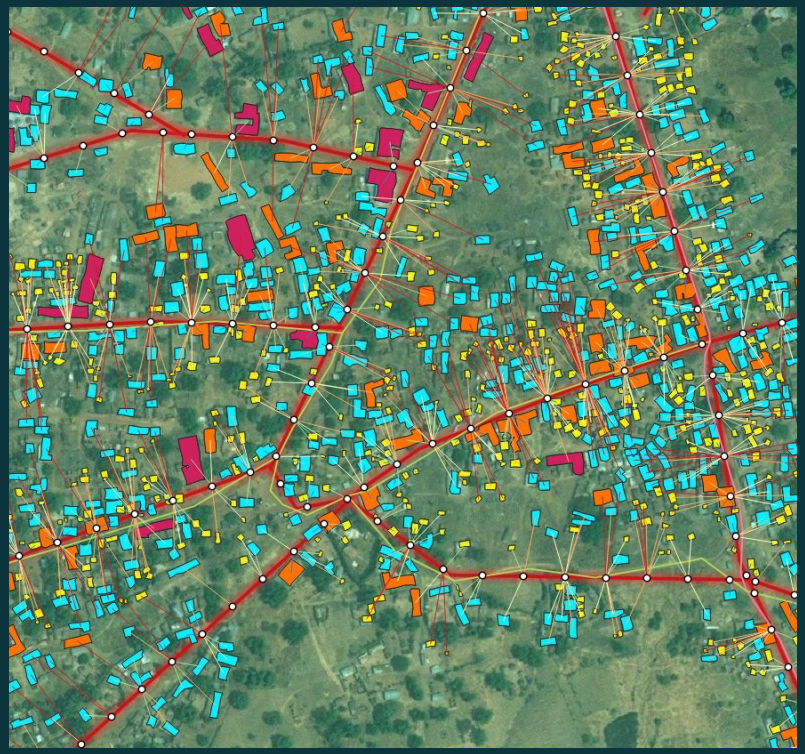
PREDICT OFF-GRID VIABILITY

VIDA's algorithm identifies hyper-local densities, high value customers, associates demand for mini-grid, connection density, and also provides a preliminary mini-grid design. VIDA's algorithm identifies proxies related to demand/$ of investment.

Actual VIDA screen grab



Predicted trunk distribution line



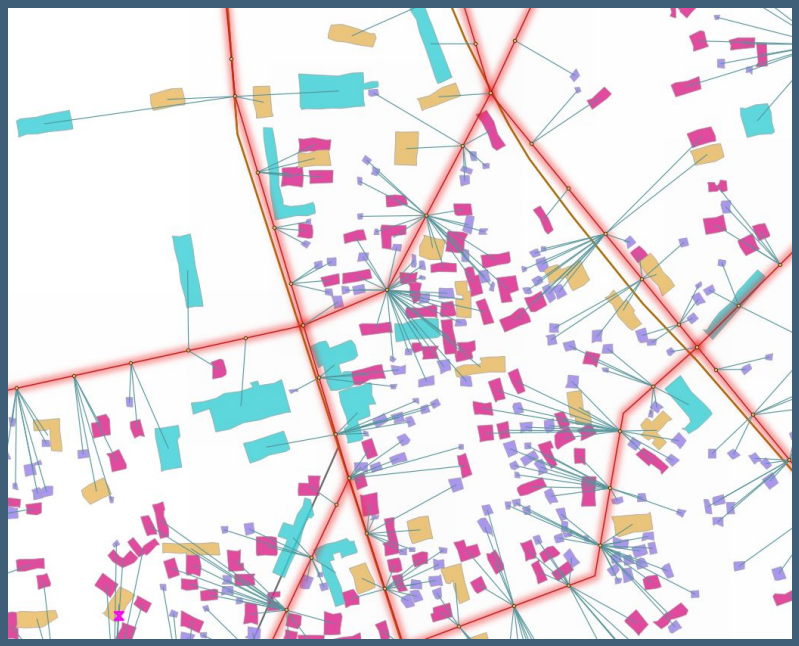
Predicted trunk line, poles and drop-down lines (lines that connect poles to customers)

IDENTIFY | EXTRACT | PREDICT | RANK

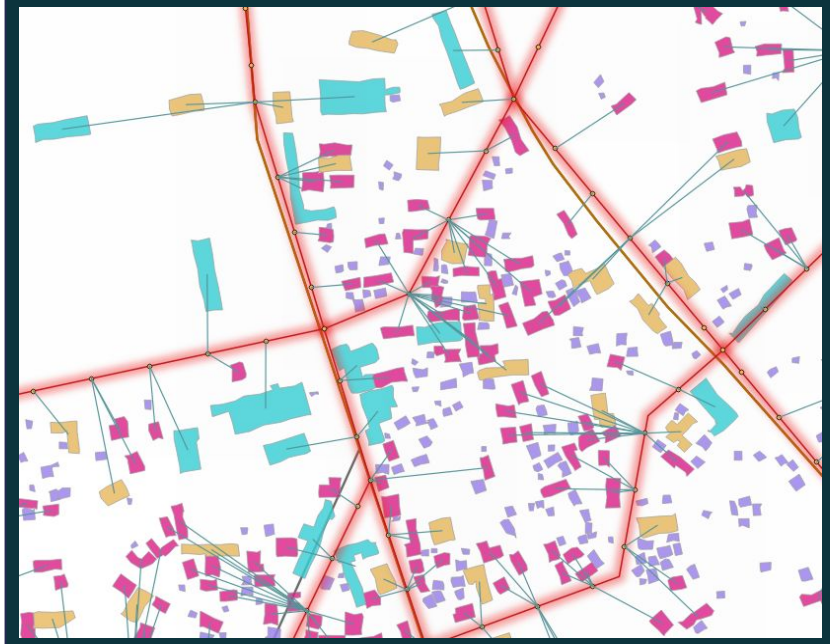
PREDICT OFF-GRID VIABILITY

VIDA's algorithm identifies hyper-local densities, high value customers, associates demand for mini-grid and also provides a preliminary mini-grid design. VIDA's algorithm identifies proxies related to demand/$ of investment.

Actual VIDA screen grab



Scenario 1: Customers in dense area and next to road



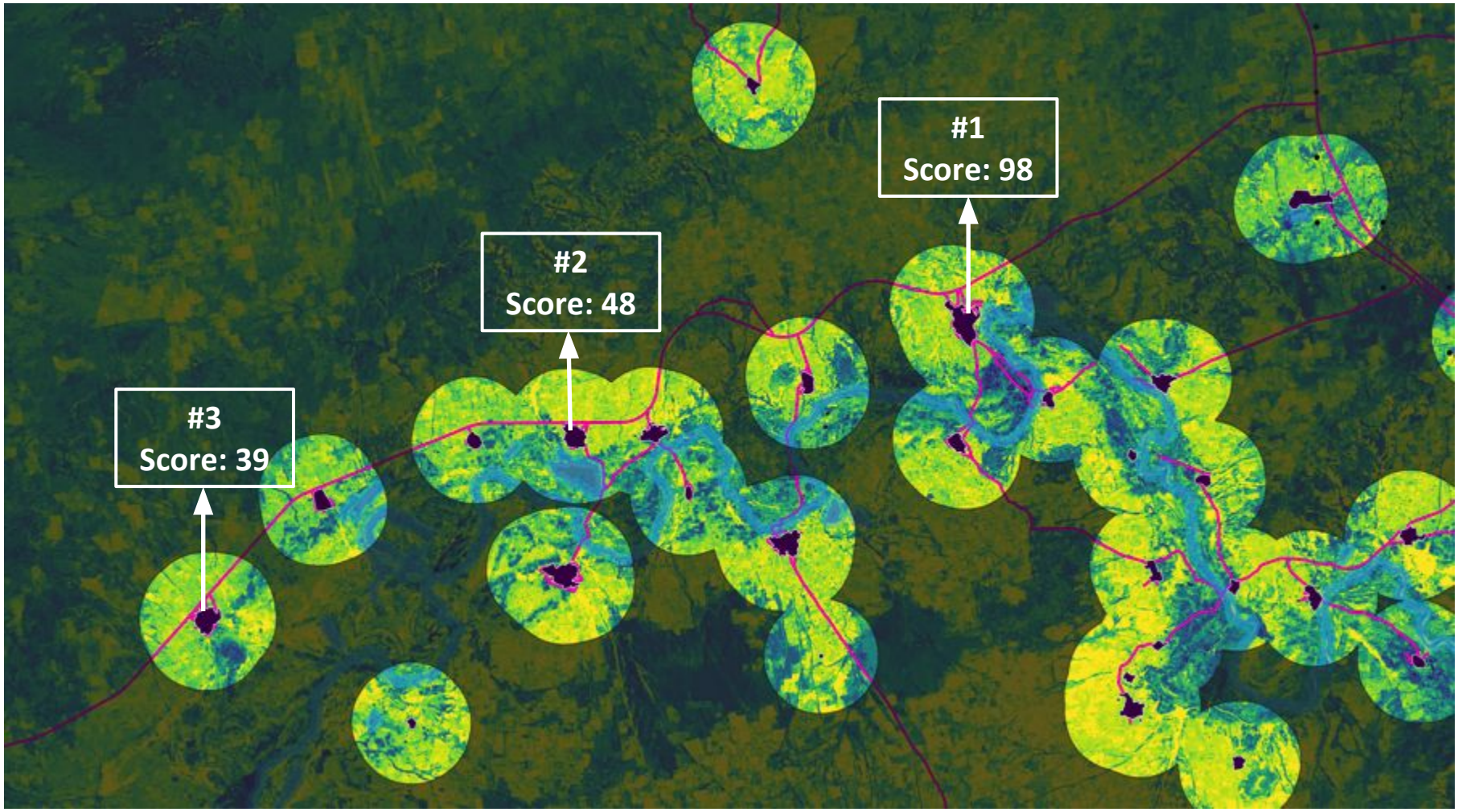
Scenario 2: Customers, excluding small houses, in dense area and next to road

IDENTIFY | EXTRACT | PREDICT | RANK

PREDICT OFF-GRID VIABILITY

VIDA's algorithm identifies hyper-local densities, high value customers, associates demand for mini-grid and also provides a preliminary mini-grid design. VIDA's algorithm identifies proxies related to demand/$ of investment.

Actual VIDA screen grab

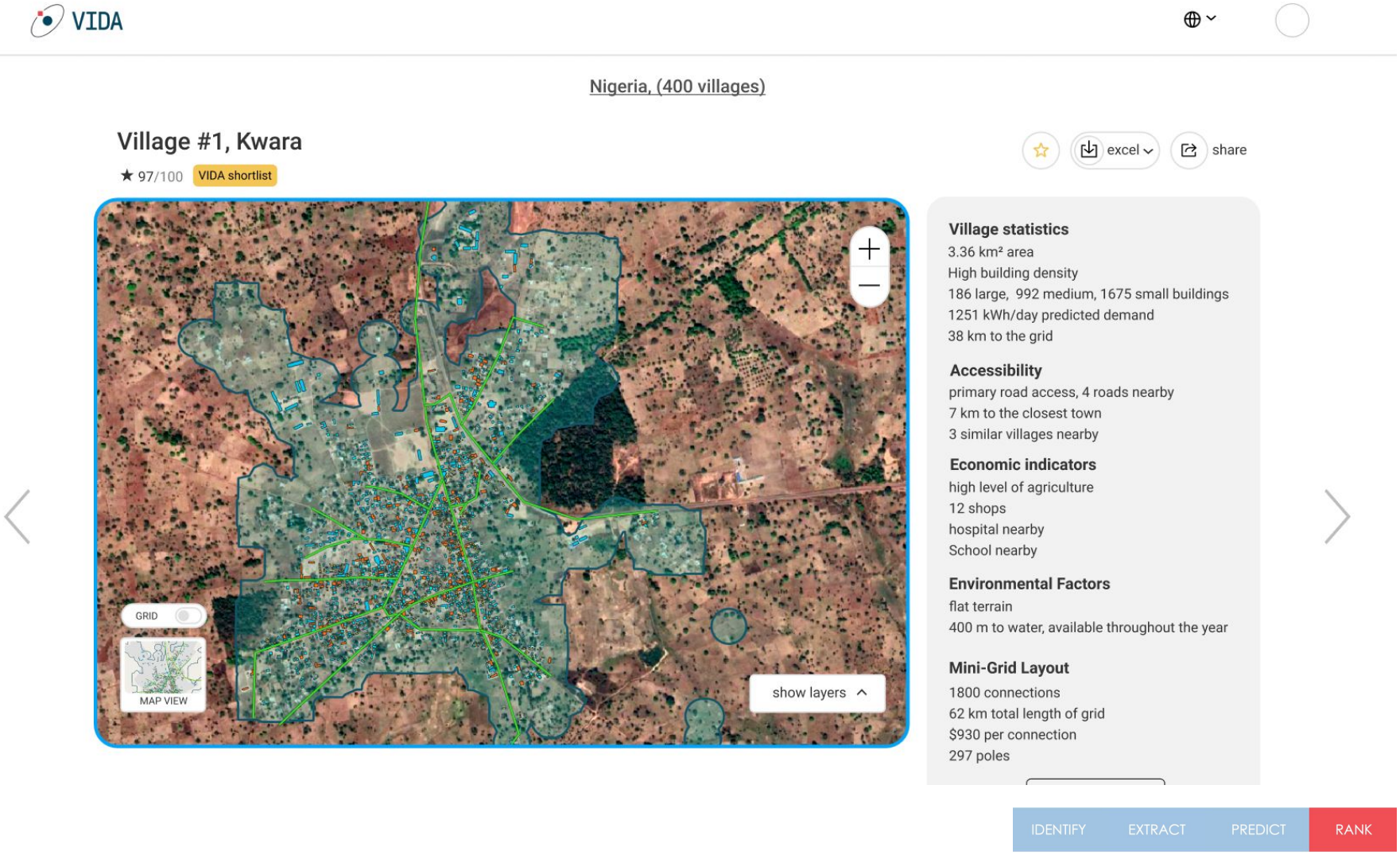


IDENTIFY EXTRACT PREDICT RANK

RANKING

Based on the predicted VIDA score and the labels, VIDA ranked the villages. The output of this analysis is a ranked list of the 317 villages with complete meta-data.

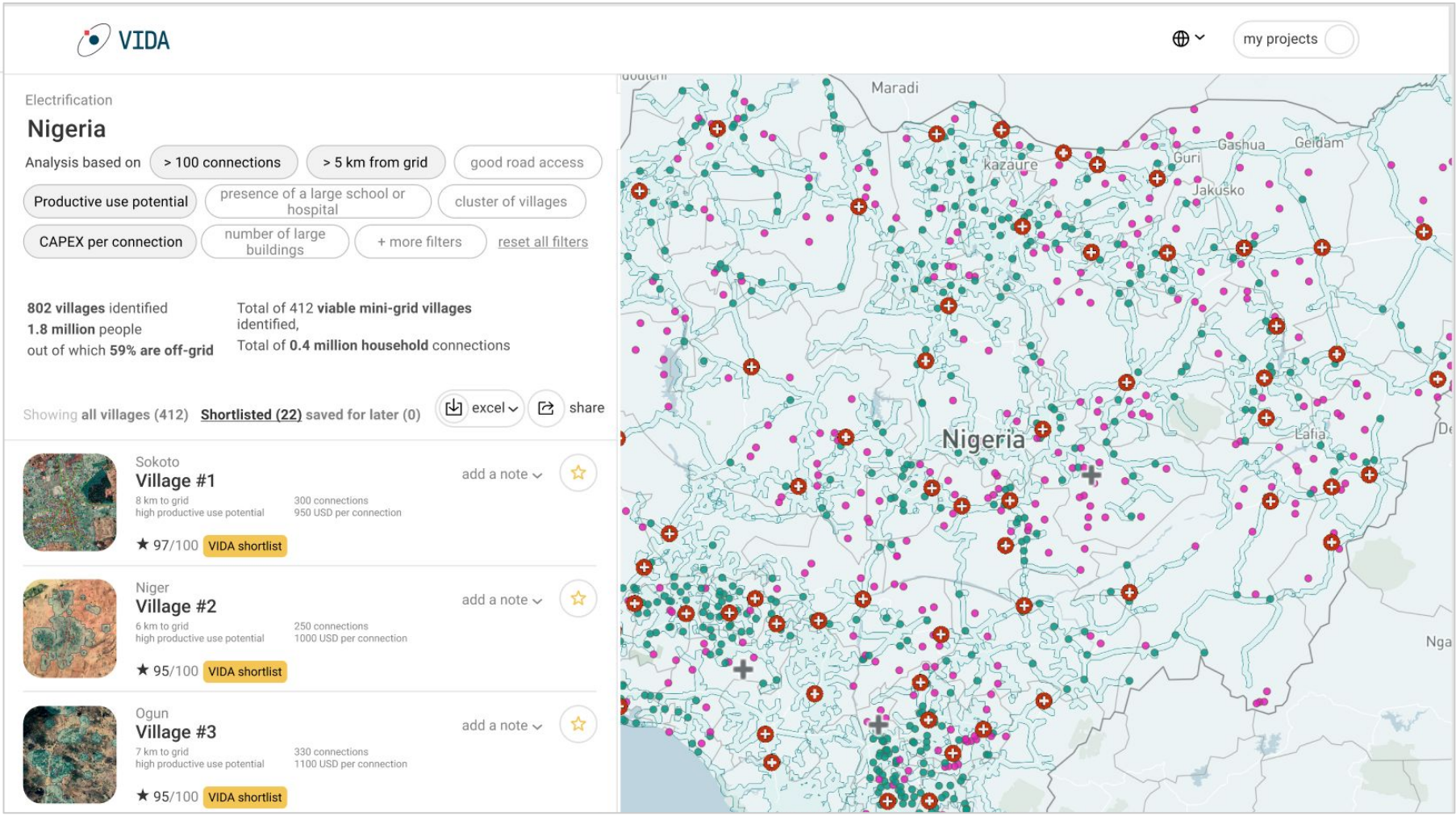
Actual VIDA screen grabs
Score and ranking is representative



VIZUALIZE

All of the extracted, predicted and collected (from ground survey) data is added to an online VIDA user interface (UI).

Actual VIDA screen grabs
Score and ranking is representative



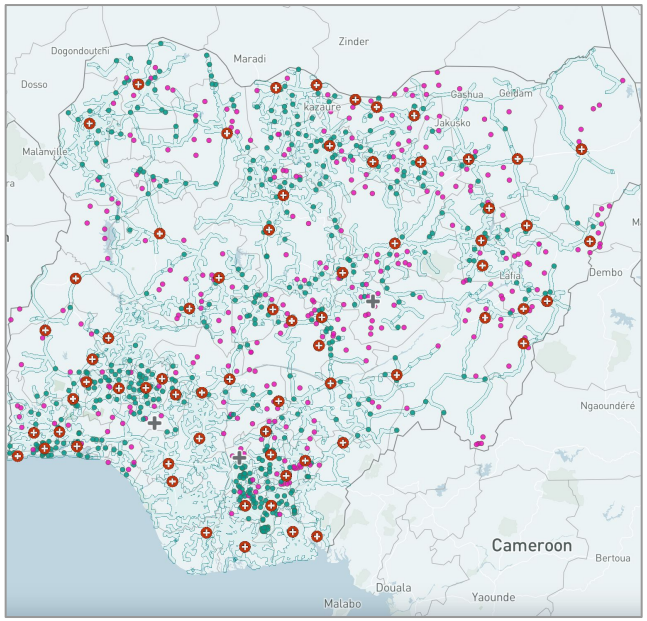
IDENTIFY | EXTRACT | PREDICT | RANK

VIZUALIZE

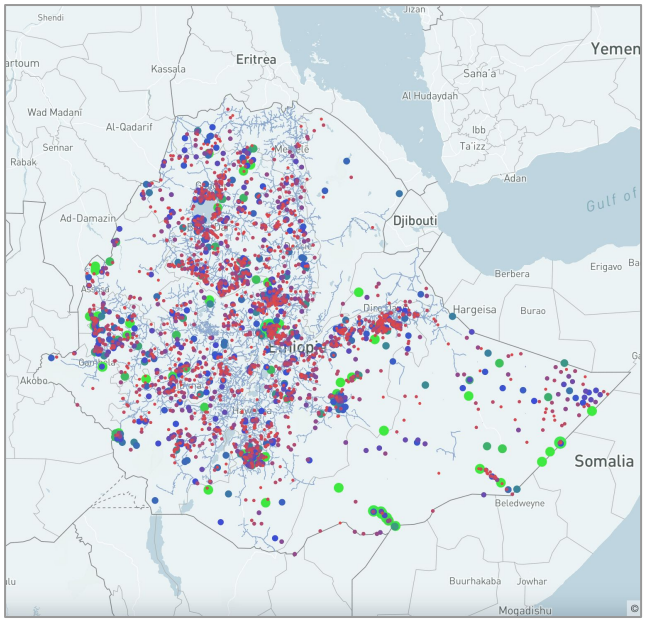
The UI is designed for developers to play around with the data using filters, lists, map views, annotations, etc. The data can also be made available in tendering platforms.

Actual VIDA screen grabs
Score and ranking is representative

VIDA PROJECTS
VILLAGE IDENTIFICATION FOR ELECTRIFICATION IN AFRICA



Prioritization of health facilities for electrification by the World Bank in Nigeria (COVID reponse)



Identification of mini-grid sites in Ethiopia for the World Bank

Identification of mini-grid sites in Nigeria

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REA
RURAL ELECTRIFICATION AGENCY
ENERGY = EMPOWERMENT = EFFICIENCY

THE TEAM
INCUBATED BY ENERGY EXPERT – TFE ENERGY

TFE Energy

VIDA is a TFE Energy initiative

The team brings together high impact technology and deep energy access market expertise in Africa and Asia. The team knows the most relevant village indicators to assess off-grid viability. VIDA has 8 full time employees and is led by Tobias Engelmeier.

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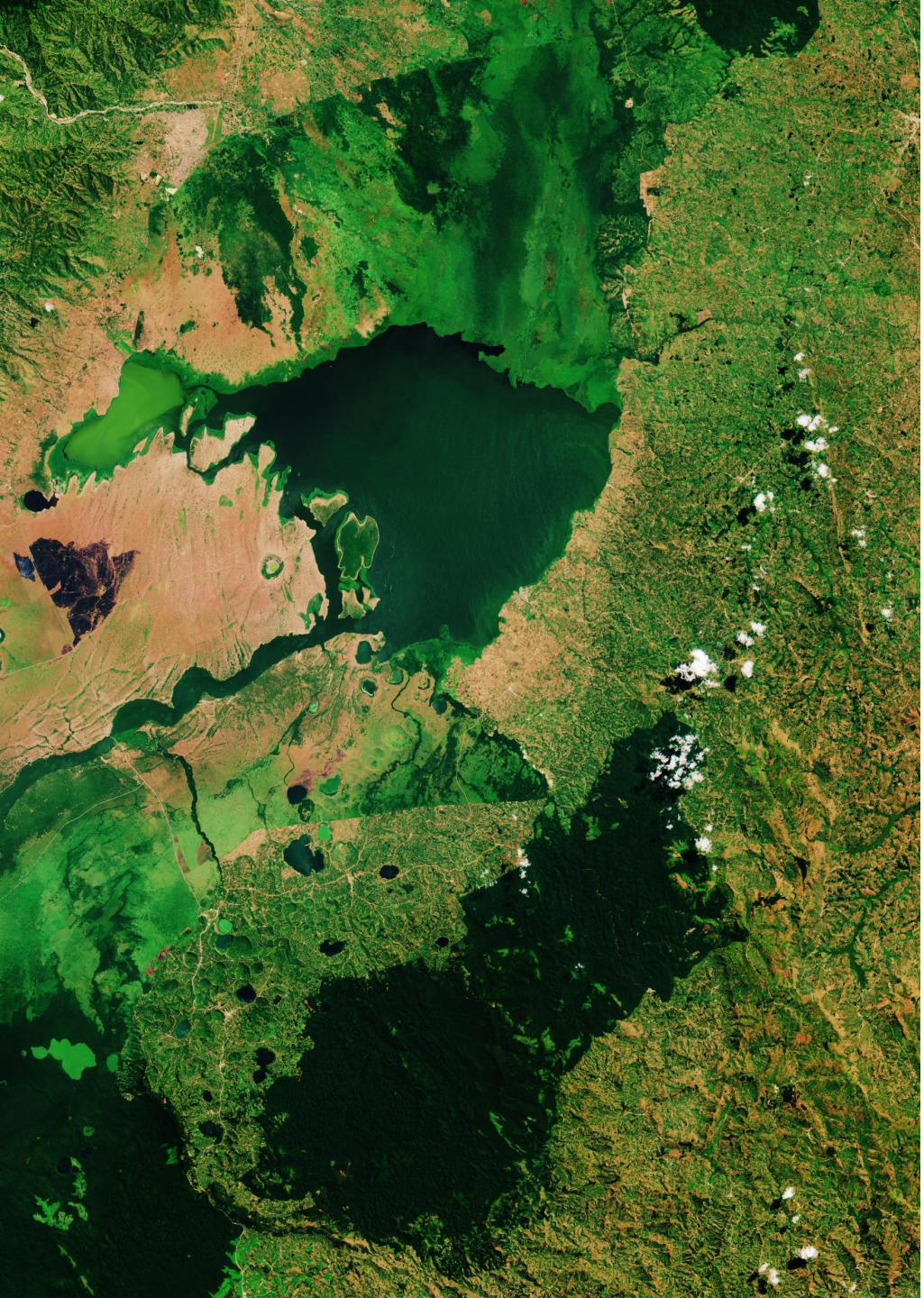
Technology Partner

INITIATIVE FOR APPLIED ARTIFICIAL INTELLIGENCE

appliedAI is Europe's largest non-profit for the application of artificial intelligence and the only official partner of Google in Germany.



Village
Data
Analytics

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