Unlocking Geospatial Insights

Through integrated knowledge systems

UNDP's GEOHUB

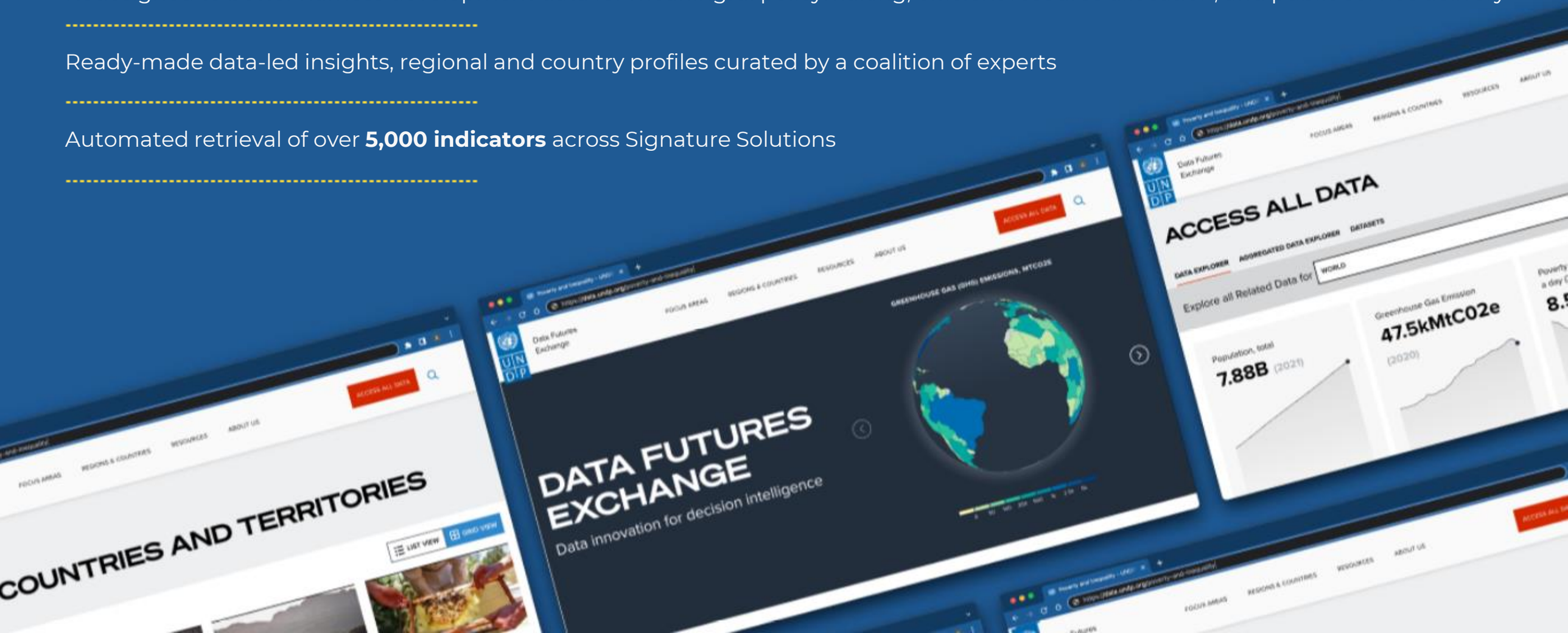
Unlocking the power of data

DATA FUTURES EXCHANGE

Redesigned to better harness development data for meaningful policymaking, efficient resource allocation, and public service delivery

Ready-made data-led insights, regional and country profiles curated by a coalition of experts

Automated retrieval of over **5,000 indicators** across Signature Solutions



Geospatial data is different

Assumes knowledge of coordinates and projection systems - LOCATION

Embedding coordinates and projections in data files and software increases the complexity and costs

Geospatial databases can be relatively large in size and are organized in layers

Some datasets have also temporal dimensions (satellite data)

Metadata is required to organize and manage spatial data efficiently

To leverage geospatial data and knowledge, UNDP must bring it into one centralized data store and develop scalable geospatial services and modern intuitive user interfaces to abstract away all inherent complexity

UNDP's GEOHUB

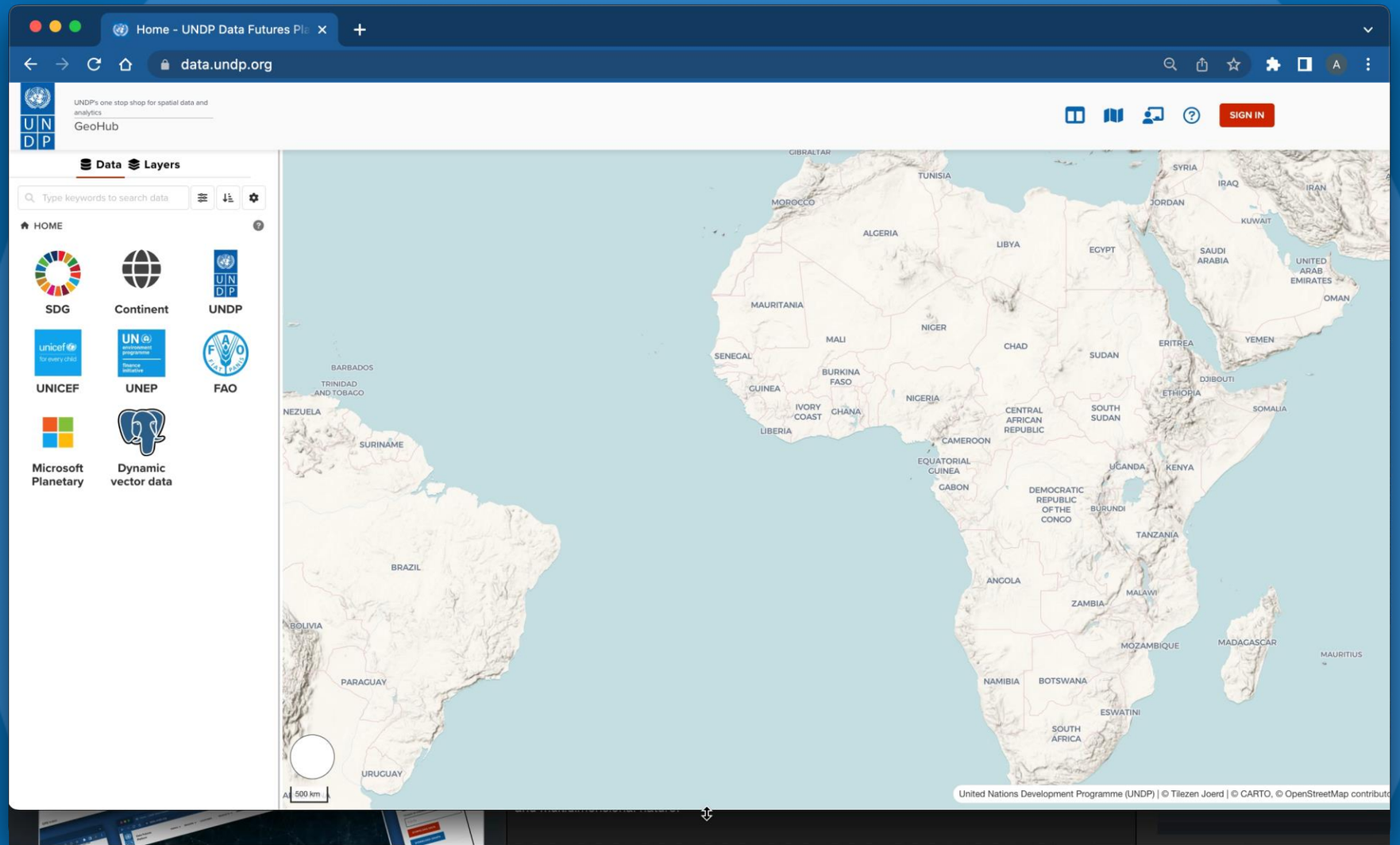
A centralized ecosystem of geospatial data and services to support development policy-makers

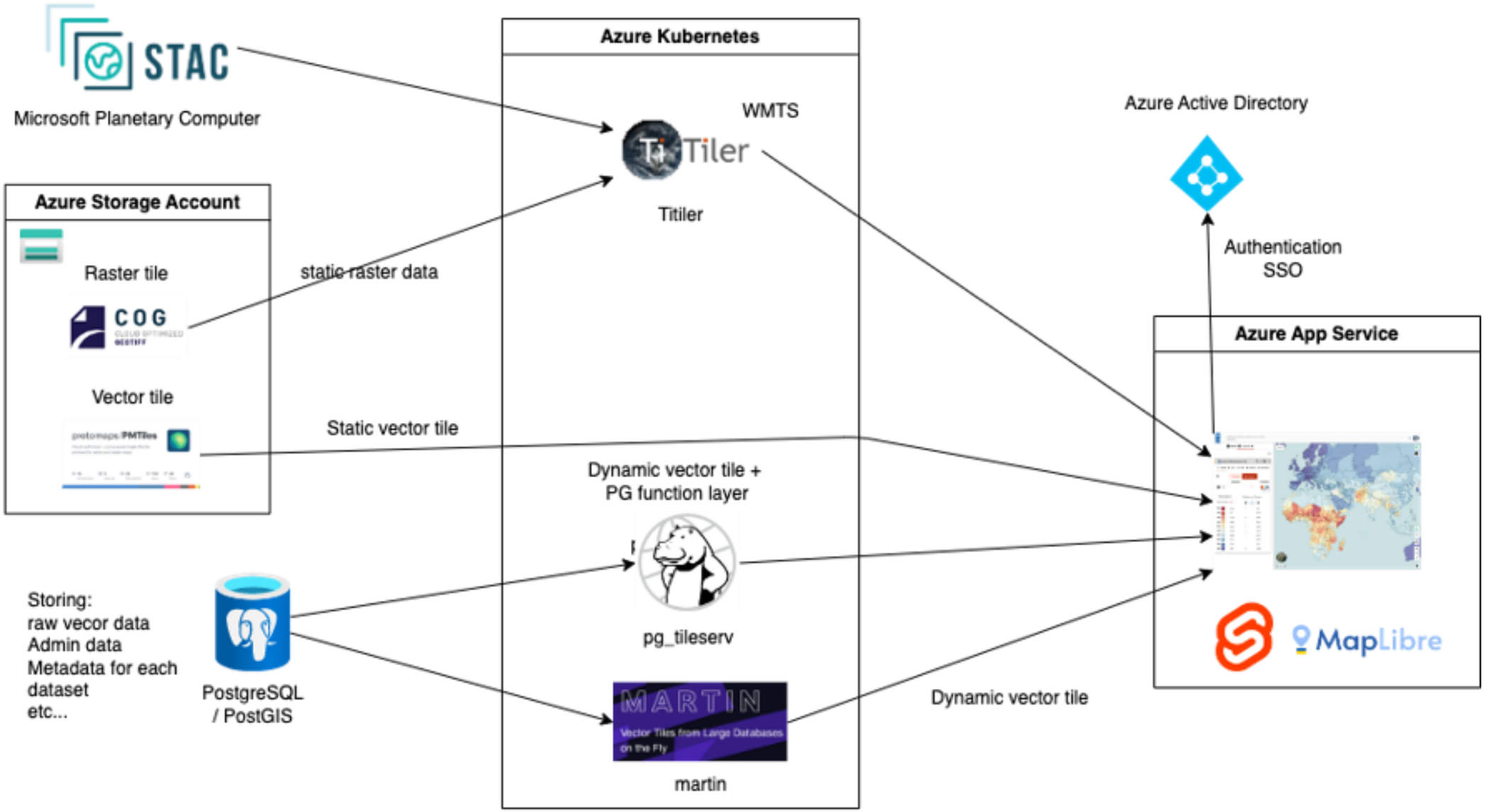
Centralized geospatial database

Data catalog

Map-sharing feature

Custom dashboards




STAC
Microsoft Planetary Computer
Azure Kubernetes
WMTS
Tiler
Titiler
Azure Active Directory
Authentication
SSO
Azure Storage Account
Raster tile
COG
static raster data
Vector tile
Static vector tile
Azure App Service
Dynamic vector tile +
PG function layer
pg_tileserv
Storing:
raw vecor data
Admin data
Metadata for each
dataset
etc...
PostgreSQL
/ PostGIS
MARTIN
Vector Tiles from Large Databases on the Fly
martin
Dynamic vector tile
MapLibre

Sample Applications

Unlocking Finance at Scale

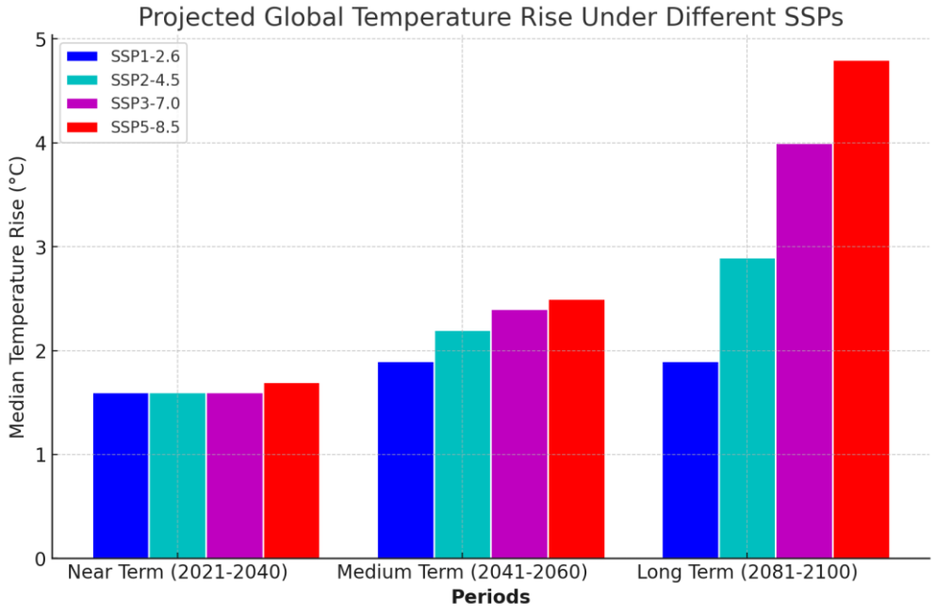
Green and Resilience Debt Platform
Climate Hub/GCF/ECB

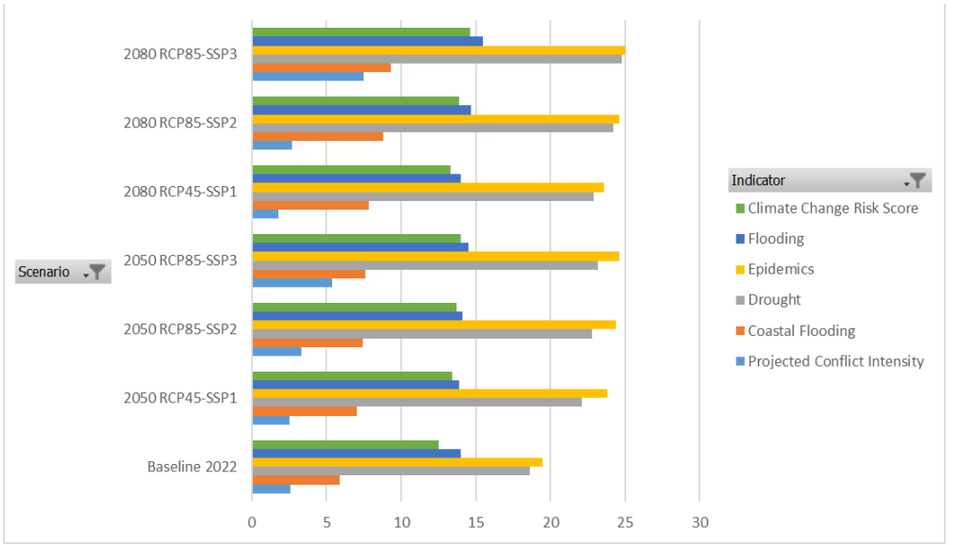
Gap & Contextual Analysis

Angola, Cameroun, Cote d'Ivoire, Kenya, Namibia, Senegal, Uganda

Identified Gaps and the Imperative for Extra Work:

- **Lack of detailed data to understand risks to an investment:**
  - Current CRAs often generalize findings at a regional or national level, which can result in either underestimating or overestimating risks.
- **Insufficient Consideration of Social Factors:**
  - Existing CRAs primarily focus on physical and economic impacts, neglecting social, cultural, and political factors.
- **Neglect of Indirect Impacts:**
  - Understanding these indirect impacts is crucial for comprehensive risk management.
- **Limited Future Projections:**
  - Many CRAs rely on historical data and fail to incorporate future climate projections. This makes the assessments static and unresponsive to evolving climate conditions.
- **Exclusivity in Adaptation Consideration:**
  - A holistic view is essential for effective climate risk management.
- **Inadequate Cross-Sector Analysis:**
  - Existing CRAs usually analyze sectors in isolation, missing out on the interdependencies that could either mitigate or amplify risks.





Measuring and tracking impact on vulnerable communities

Loss and Damage

Informing the Next Generation of Disaster Loss and Damage Databases

COUNTRY PILOTS

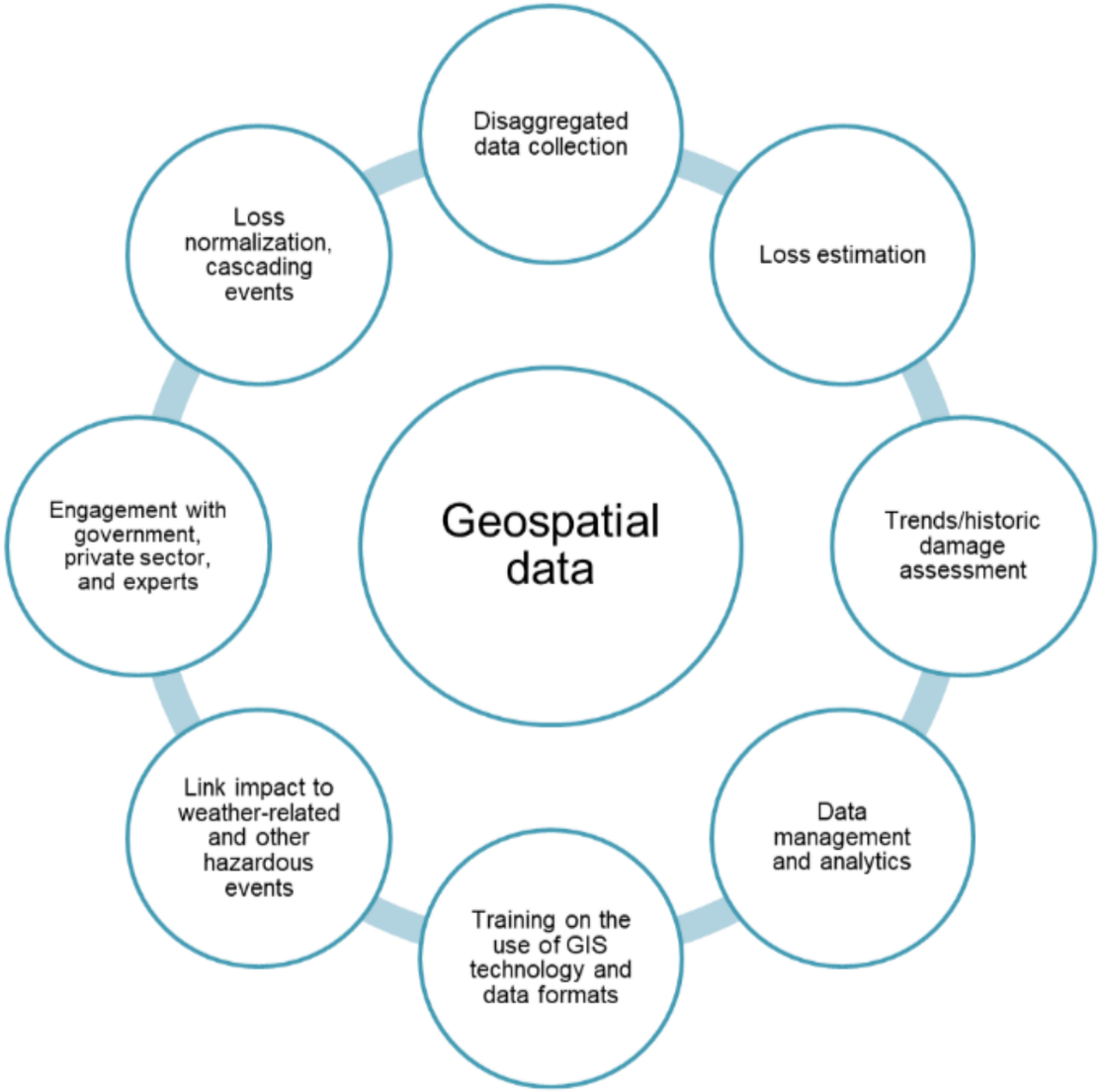
ENHANCING COUNTRY LEVEL KNOWLEDGE SYSTEMS

Engagement
- Country level needs and maturity assessment
- Leveraging resources from government and external partners

Data
- Access to subnational data, data cleaning, and data integration

Analytics
- Need to do more with data
- For example, loss estimation, linking hazardous events to impacts, e.t.c.

Infrastructure
- Data storage space
- Data management
- Visualization



Generate Real-time data on energy access

UNDP-IBM Partnership

A SOCIO-ECONOMIC CASE FOR ENERGY ACCESS INVESTMENTS

To support UNDP's commitment to enable **500 million additional people** to have access to sustainable, affordable, reliable energy by 2025, UNDP is making available **analytics** that can help a country achieve three things:

1

Identify those that will be left behind - who does not have reliable access - where are they?

2

Map vulnerable households where affordability is low - a case for private and public investments for energy access

3

Explore potential impact of energy access across SDGs

UNIVERSITY OF MICHIGAN

IBM

FREDERICK S. PARDEE CENTER FOR INTERNATIONAL FUTURES
JOSEF KORBEL SCHOOL OF INTERNATIONAL STUDIES

WHAT'S THE VALUE TO RBx AND COs?

(1) **Identify those that will be left behind** - who does not have reliable access - where are they?

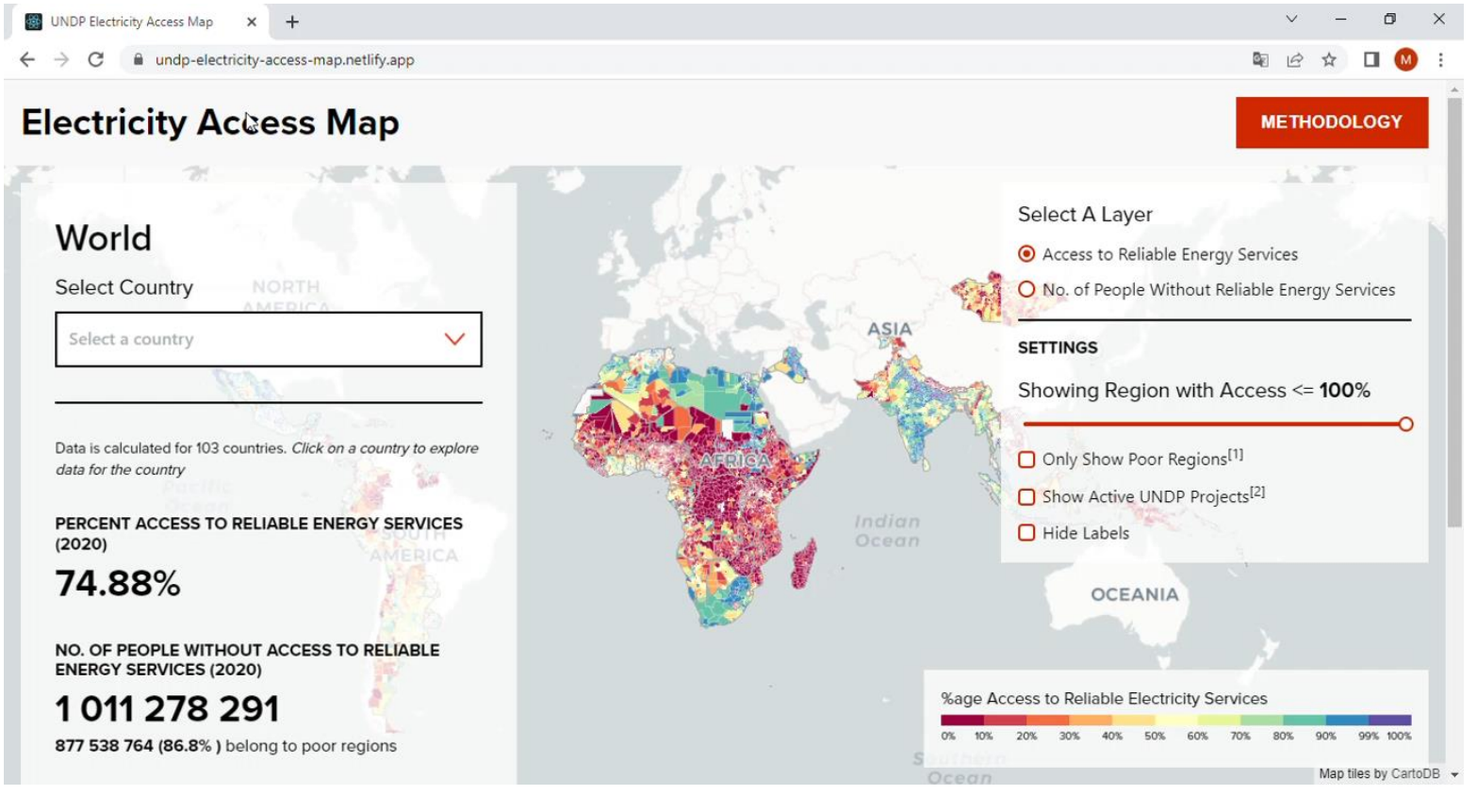
AI with data on settlements and night lights to assess reliable

ELECTRICITY ACCESS

- Focus on the **most vulnerable areas**
- Complements **official data** (e.g. National Statistical Offices)

Users can:

- Select areas with access lower than 25%
- Select areas in which largest part of population is poor
- Identify where UNDP projects are

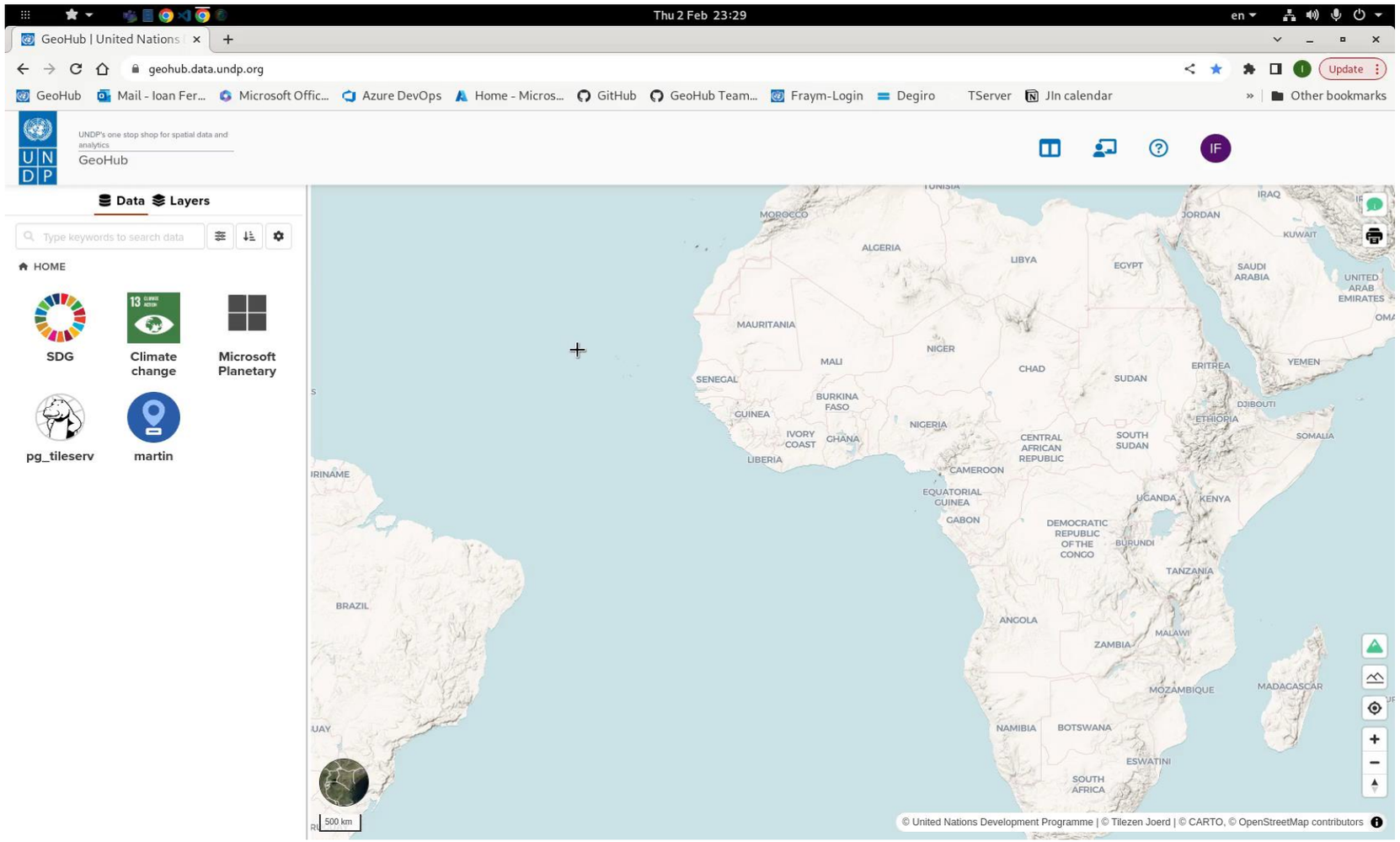


WHAT'S THE VALUE TO RBx AND COs?

(2) **Map vulnerable households where affordability is low** - a case for private and public investments for energy access

Users can:

- Identify in **high resolution**, the locations and areas that lack electricity access
- **Evaluate the progress** on electrification in an accurate manner at the hyperlocal level
- Visualize and forecast **SDG7-related indicators**.
- **Overlay** with additional indicators (e.g. wealth index)



WHAT'S THE VALUE TO RBx AND COs?

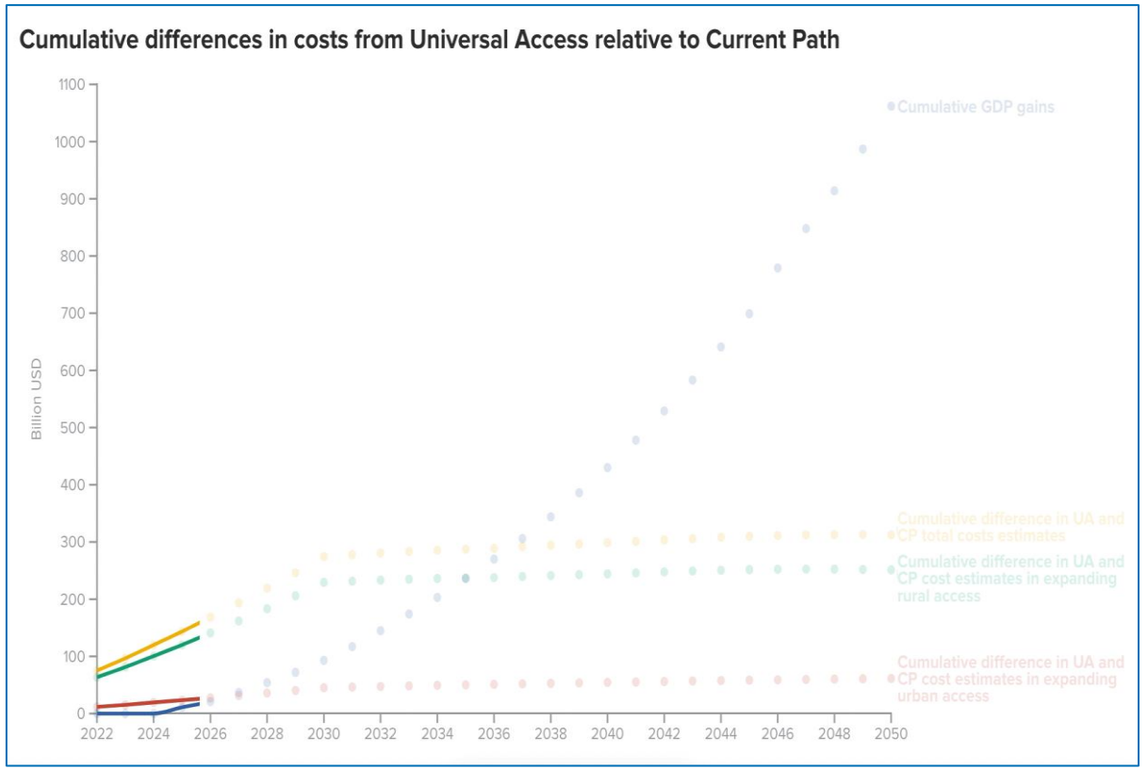
(3) Explore potential impact of energy access across SDGs

Users can:
Compare **global, regional and country-level** analysis of **gains vs costs** of electrification

Approximated cost of **new construction and the cost of maintaining or renewing clean and sustainable energy access infrastructure.**

Costs disaggregated by **urban and rural areas**

SDG Push+: Effects of accelerating universal access



110
Million
fewer people in poverty by 2030

3.8
Million
cumulative deaths from respiratory infections and diseases could be averted by 2030

16
Trillion dollars
in GDP gains by 2030

IBM Sustainability Accelerator

IBM’s **flagship social impact program for sustainability**.

IBM
Sustainability
Accelerator

Pro bono delivery of technology and expertise critical but inaccessible for organizations aiding populations especially vulnerable to environmental threats.

Nonprofit & governmental orgs will benefit from 2 years of top IBM sustainability-aligned offerings:

Expertise

- IBM Garage for Sustainability
- IBM Research, Consulting, SMEs, etc.

Solutions & data

- IBM Cloud credits
- Weather data APIs
- AI Apps

Capacity building

- Cash grants
- SkillsBuild for training
- Tech mentorship

Electricity Access Forecasting

Progress:

- Completed initial version of enhanced electricity forecast model (Kenya/Kimisu testbed); uses cellular automata (rule-based computation applied to grid "cells" that correspond to settlements)
- Achieved model accuracy of 97% and 86% for 1-year and 8-year forecast, respectively
- Initiated migration of forecast code over to IBM Cloud environment

Up Next:

- Dec 2023: Finalized randomization factors for model and finish code migration; test E2E code for another region
- Dec 2023: Initiate stakeholder feedback sessions (phase 1: NYS, phase 2: global)
- Jan 2023: Design and begin scaling strategy of electricity access forecasting layer

Clean Energy Equity Index (CEEI)

Progress:

- Completed 2 stakeholder feedback sessions with New York Economic Development Council (EDC) and National Renewable Energy Laboratory (NREL)
- Initiated global CEEI data framework and methodology
- Started expansion of climate risk MVP (Kenya and Brazil) to 3 additional countries → Namibia, Ivory Coast and Senegal

Up Next:

- Dec 2023: Finalize weighting for CEEI indicators and model validation of NYS; deliver final shapefiles and upload to GeoHub
- Dec 2023: Complete 1 to 2 more stakeholder sessions for NYS index; deliver feedback summary report and initiate global feedback (mid-Dec); targets: Kenya and Brazil
- Jan 2023: Design and begin scaling strategy of global CEEI; continue feedback with country offices

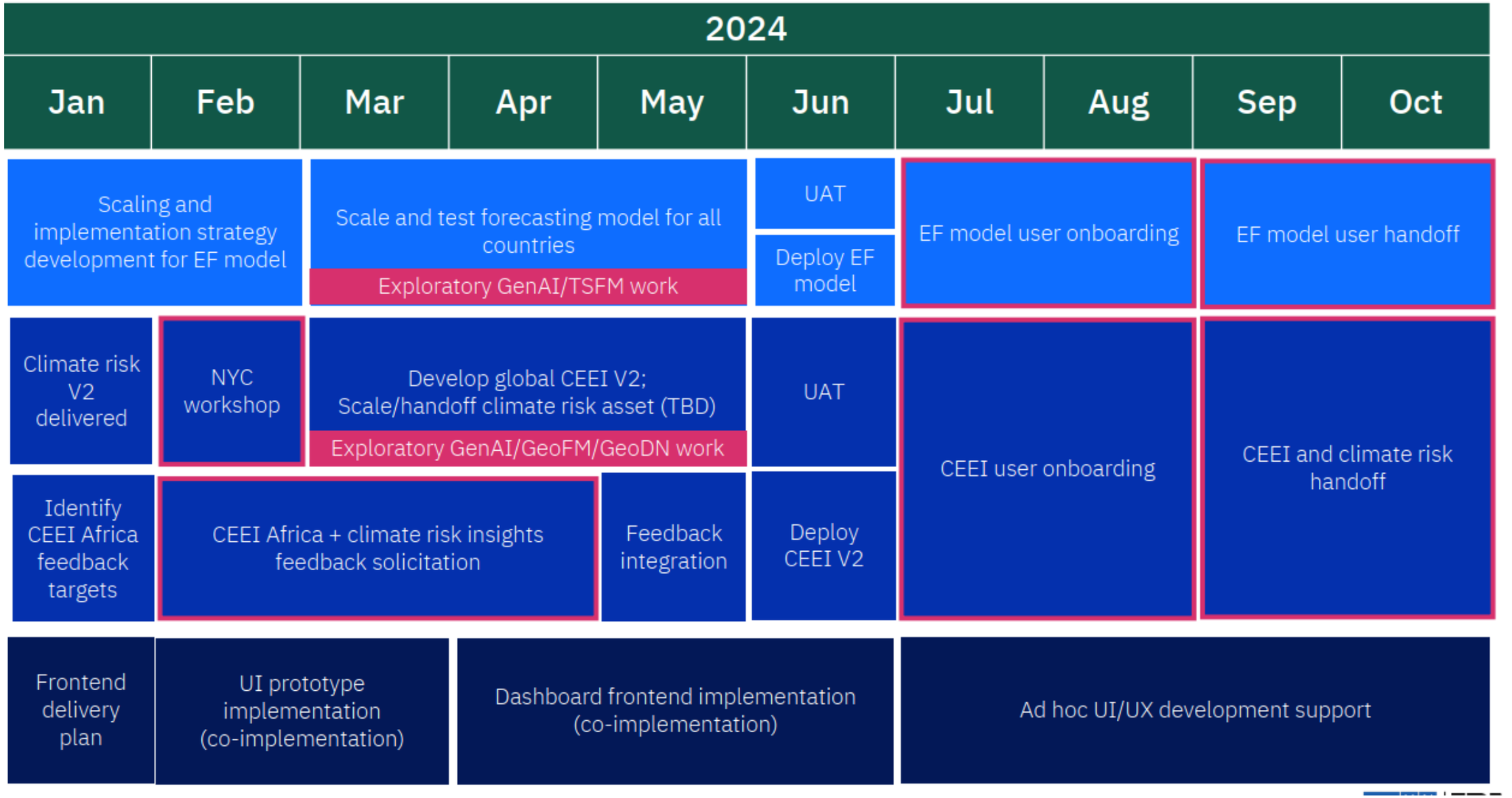
GeoHub 2.0

Progress:

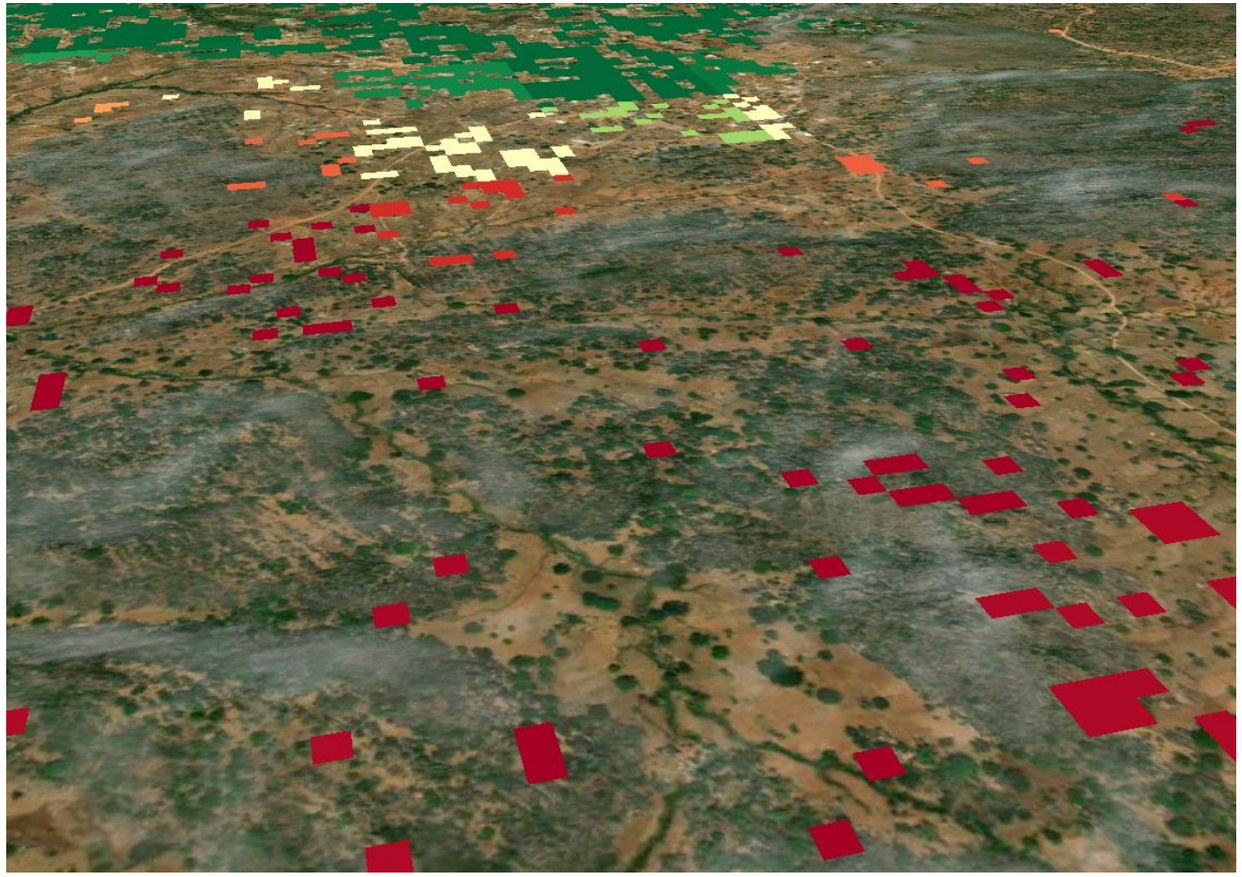
- New GeoHub UI prototype delivered and presented to UNDP
- New sub-workstream initiated with design team to improve GeoHub dashboarding capabilities

Up Next:

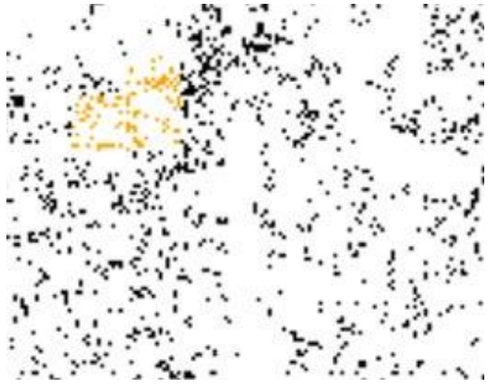
- Dec 2023: Finish dashboard UX assessment and prototype
- Jan/Feb 2023: Implementation of new UI prototype (+ conversion of IBM Carbon design template) and dashboard improvements
- Ongoing: Collaborate in project-wide stakeholder feedback sessions


2024
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Scaling and implementation strategy development for EF model
Scale and test forecasting model for all countries
Exploratory GenAI/TSFM work
UAT
Deploy EF model
EF model user onboarding
EF model user handoff
Climate risk V2 delivered
NYC workshop
Develop global CEEI V2; Scale/handoff climate risk asset (TBD)
Exploratory GenAI/GeoFM/GeoDN work
UAT
CEEI user onboarding
CEEI and climate risk handoff
Identify CEEI Africa feedback targets
CEEI Africa + climate risk insights feedback solicitation
Feedback integration
Deploy CEEI V2
Frontend delivery plan
UI prototype implementation (co-implementation)
Dashboard frontend implementation (co-implementation)
Ad hoc UI/UX development support

Forecasting Electricity Access - HREA



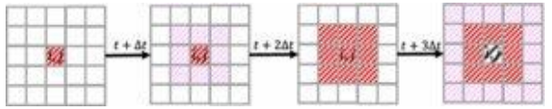
- Derived from VIIRS Day Night Band
- Evaluated only areas covered by settlements Statistical empirical model
- 2012-2020

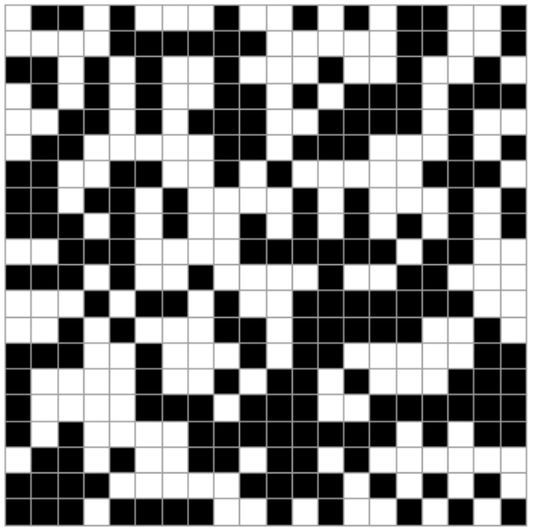


Forecasting Electricity Access - Model

Cellular Automata

- Space is split into equal areas/squares
- Time-aware ($t_0..t_1..t_n$)
- Natural fit for electricity access forecasting

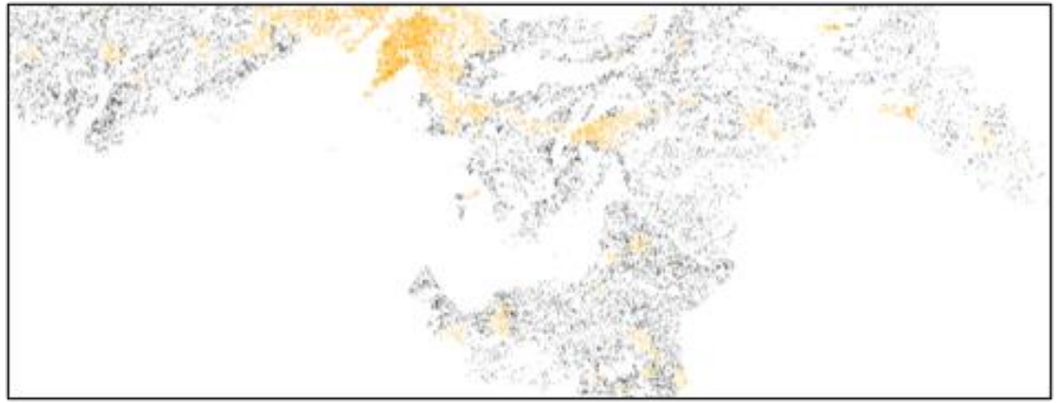




Forecasting Electricity Access - Model

Issues

- Data contains lots of errors/noise
- HREA data is **sparse – neighborhood**
- 2 levels model:
  - 1 km blocks model => aggregation
  - Settlements level
- We are working at level 1 so far



Forecasting Electricity Access – Status and Next Steps

- IBM is developing code to deploy the model to IBM cloud-engine infrastructure
- Two developers from IBM are getting familiar with Geohub's frontend technology
- IBM is going to run the EF model in selected areas from specific countries (Angola, Peru and Vietnam) - layers for every year in 2020-2030 interval as outputs
- IBM is implementing UI/UX design created using Geohub webcomponents
- Feeback on possible improvements of the model expected (covariates) on the workshop of Feb 20th (hosted by IBM/SE4ALL/UNDP)
- MVP: pilot MVP for Kenya, Angola, Madagascar, Peru, Viet Nam. By end of May, a scale up of all countries.
    - Functions: Display original and forecasted data in timely-smart way
      Access to bi-variate mapping of electricity access vs. poverty
      Ability to interact with the data at administrative level
      Ability to compare 2 ways to forecast electricity access

Clean Electricity Equity Index (CEEI)

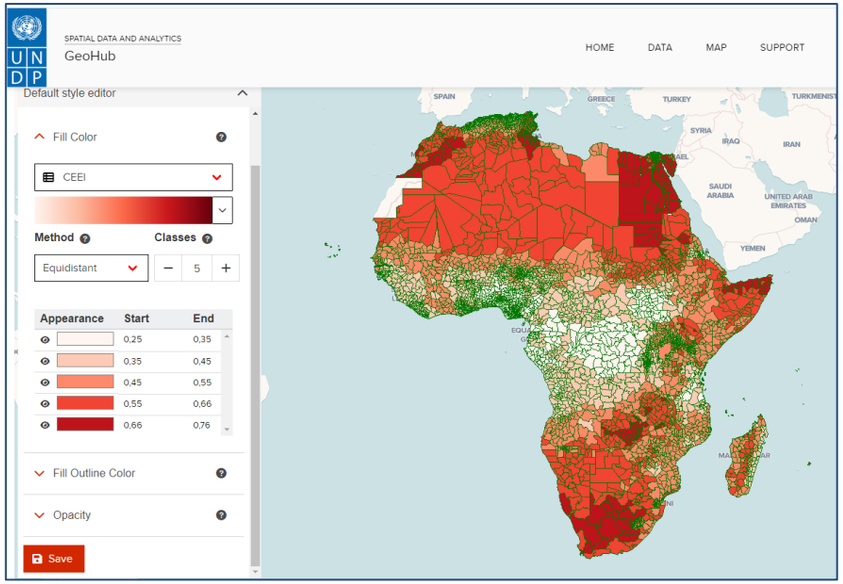
Rationale:
- Urgency for energy transition
- Not everyone benefits equally without specific efforts for equity

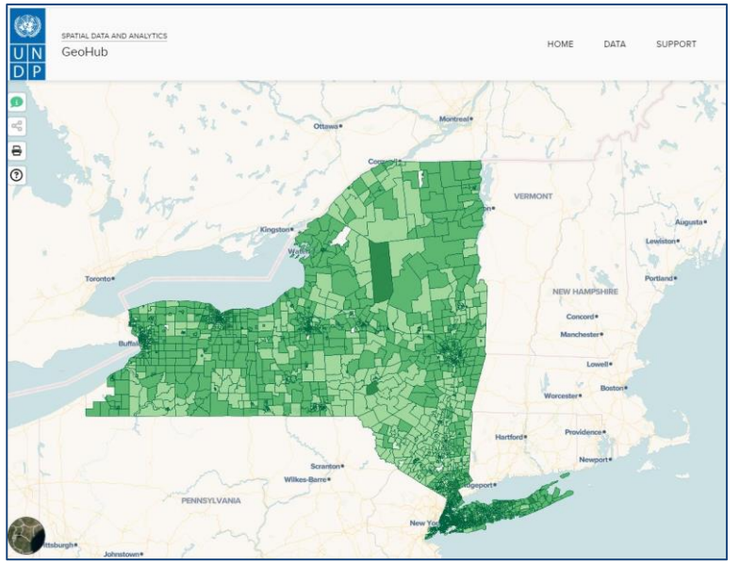
What's known?
- Evolution in the understanding of energy transition pace
- Variations in transition pathways and their impacts on households

What's still limited?
- Limited understanding of spatial distribution of opportunities and burdens
- Lack of insights into the intersection with existing geographical patterns of socioeconomic inequality
- Special attention/empirical application to countries in the Global South

→ **CEEI**

Clean Electricity Equity Index (CEEI)

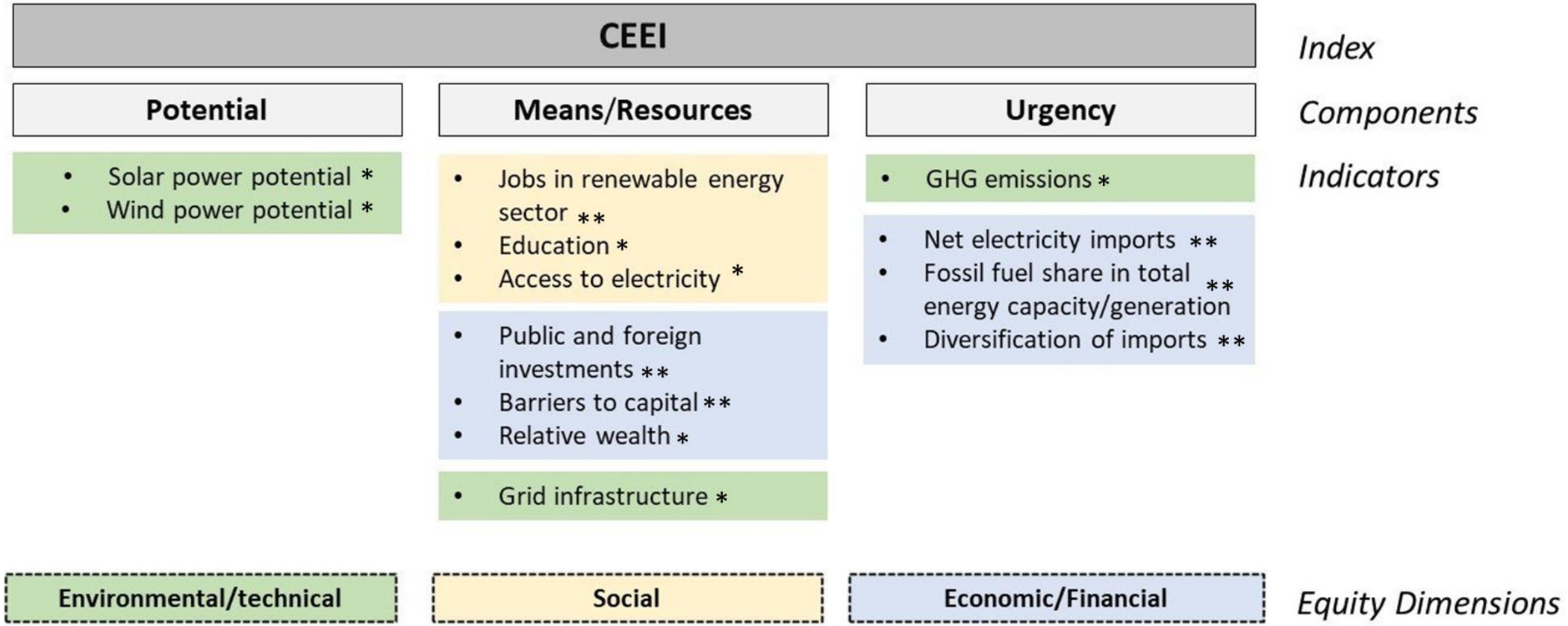




- Principles: energy justice, spatial justice theory
- Dynamic and evidence-based **spatial** composite index – the clean electricity equity index (CEEI)
- Evaluate, on **a fine-scale basis,** the **urgency, potential, and the available means and resources** for a transition to renewable electricity, considering **equity** as a **multidimensional aspect (composite indexes)**
  - Identifying areas requiring an **immediate transition,** which are **less likely to benefit** from it, and where **existing inequalities** might be exacerbated
  - **Flexible framework**: users can adapt it based on data availability, regional and country needs (e.g. NY)
  - Initial focus: Africa

CEEI – Conceptual Framework

Building the foundation based on concepts, stakeholder feedback, and data availability



* Data available at subnational level

* Data available at national level

CEEI – Status and Next Steps

- SBU has finalized the layer for NY – it as currently at Geohub.
- UNDP-SBU-IBM is testing how CEEI results change according to the different datasets used and exploring the feasibility of using AI to disaggregate data
- The most accurate version will be presented at the workshop on Feb 29th (hosted by IBM/SE4ALL/UNDP). Initial feedback from stakeholders will assist the team in identifying any additional testing required.
- MVP: CEEI layer at the global-level on the Geohub
    - Functions: ability to conduct comparative analysis at geographic level