RE4AFAGRI

RENEWABLES FOR AFRICAN AGRICULTURE: INTEGRATING MODELLING EXCELLENCE AND ROBUST BUSINESS MODELS

Project Coordinator: Manfred Hafner (HEAS)

Partners involved:

HEAS, IIASA, UCT, TFE, POLIMI, UNIZM, UNIRWA

LEAP-RE

Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy

RE4AFAGRI

Renewable Energy for African Agriculture

The LEAP-RE project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement 963530.

Why RE4AFAGRI ?

Sub-Saharan African agricultural sector presents challenges

- **More than half** of the sub-Saharan African (SSA) population depends directly or indirectly on **agriculture as their labour and income source**
- In sub-Saharan Africa (SSA) about **80% of the agricultural production comes from smallholder farmers**
- Most farmers practice **rainfed agriculture (covering >90% of cropland)**

Rainfed agriculture => **low** agricultural **Productivity**

No electricity (lack of cold storage and crop processing) => **raw crops sold** to wholesale market

Poverty traps and **inequality** traps, as well as **food** insecurity

Scope of RE4AFAGRI

But solutions exist and opportunities for development are huge!

RE4AFAGRI

- Sustainable **irrigation** and **community-wide renewable electricity**
- Increased **productivity** & local **crop processing**
- Agriculture as **leverage** for reduction of poverty and inequality

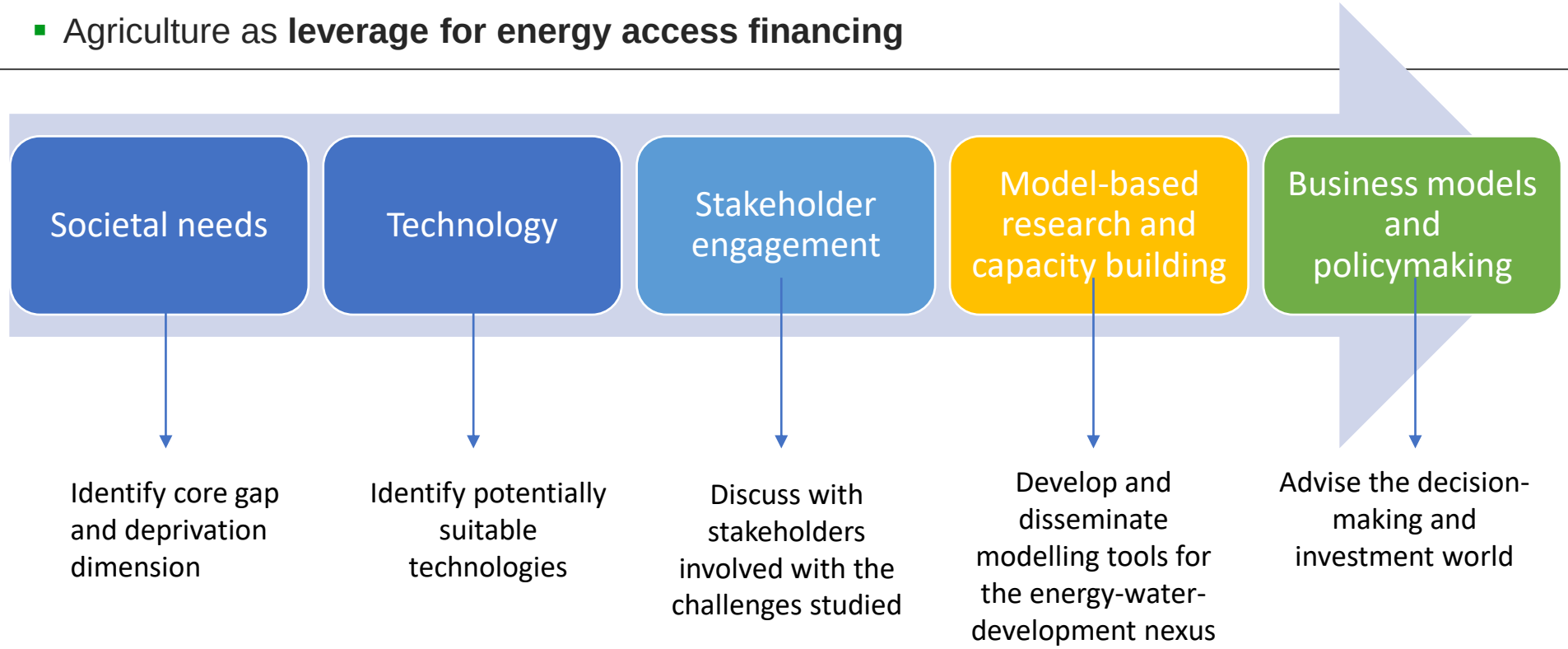
RE4AFAGRI project

LEAP-RE

Aims of the project

Demonstrating **technological, economic, and business model pathways** to:

- Sustainable cropland **irrigation** and community-wide renewable **electricity access**
- Increased agricultural **productivity, local crop processing and cold storage**
- Agriculture as **leverage** for reduction of **poverty and inequality**
- Agriculture as **leverage for energy access financing**

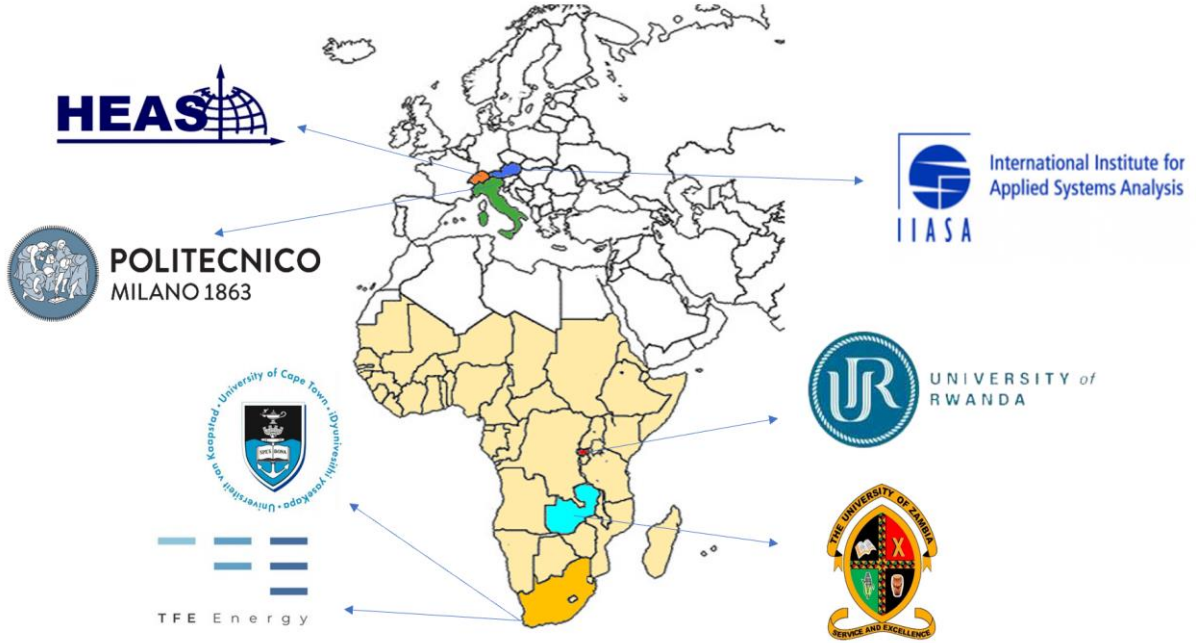


RE4AFAGRI consortium

Consortium

The RE4AFAGRI consortium combines:

- **climate-water-energy-land-food-development nexus modelling** expertise (**IIASA, UCT, POLIMI/TO**)
- **business model and policy development** capacity (**TFE-A, HEAS***)
- a deep knowledge of the **local realities** and the implied research avenues (**UNIZA, UNIRWA**).



*** project coordinator**

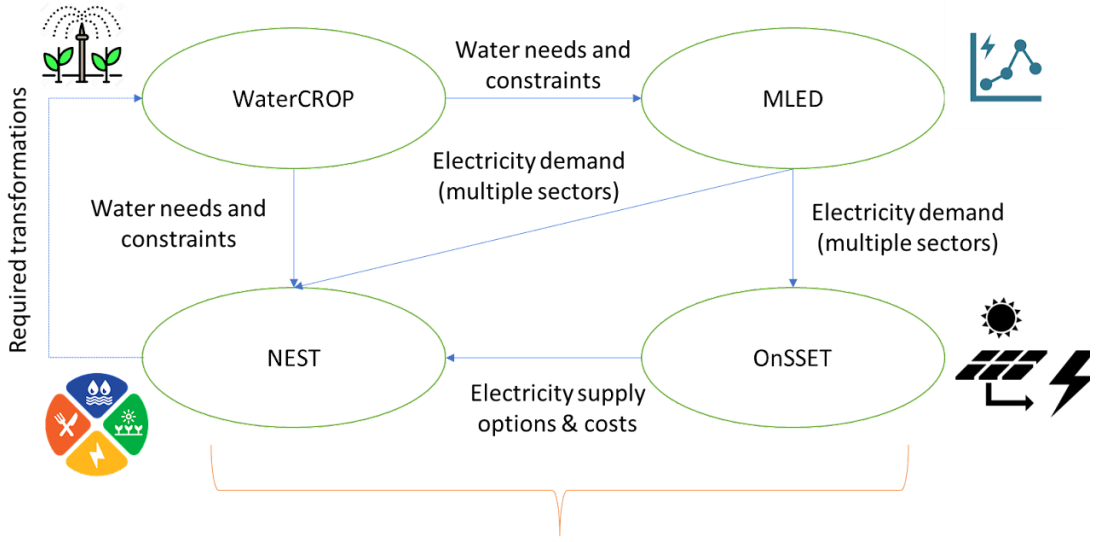
The team includes **scientists, business experts, and policy researchers.**
In addition, a **large number of external stakeholders and target users** from **African institutions and international organisations** were also involved through focus groups, workshops and capacity building activities.

RE4AFAGRI open-access tools

LEAP-RE

The RE4AFAGRI platform

zenodo GitHub



Infrastructure and investment requirements estimated and impact analysis

The techno-economic model

TFE Techno-Economic model for LEAP RE (2) .XLSX

File Edit View Insert Format Data Tools Help

Insert country name below: Nigeria		Insert staple crop 1 below: Maize				Insert staple crop 2 below: Cassava			
User to answer questions in blue:	**Unit**	**Irrigation**	**Drying**	**Shelling**	**Milling**	**Irrigation**	**Peeling**	**Grating**	**Milling**
General questions:									
How many hours per day will the equipment be operational?	h/day	6	6	5	5	6	5	5	5
Across how many months per year will the equipment be used?	months/year	6	2	2	6	12	12	12	12
If the equipment will be connected to the grid, what is the tariff?	USD/kWh	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086
If the equipment will be connected to a mini-grid, what is the tariff?	USD/kWh	0.578	0.578	0.578	0.578	0.578	0.578	0.578	0.578
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What is the distance from the farm to the market and back?	km	50	50	50	50	50	50	50	50
What is the fuel consumption of the vehicle that delivers crops to market?	l/km	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
How much do you expect to spend on maintenance per year?	USD/year	33	15	50	50	33	94	94	94
What is the monthly salary in USD that the equipment operator will earn?	$156.63								
Irrigation-specific questions (additional inputs on irrigation sheet):									
What is the upfront cost of the relevant solar water pump?	USD	$2,361				$2,361			
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Agro-processing specific questions:									
What is the upfront cost of the relevant processing machine?	USD		$1,566	$2,420	$3,000		$3,250	$2,000	$285
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Automatic answers, feeding into results sheets:									
Capacity utilization	%	12.50%	1.79%	1.49%	4.46%	25.00%	8.93%	8.93%	8.93%
Operating hours	h/year	1095	156	130	391	2190	782	782	782
Portion of salary (1 worker) attributed to operation of the equipment	USD/year	$469.88	$313.25	$313.25	$939.76	$939.76	$1,879.52	$1,879.52	$1,879.52
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Insert country name below: Rwanda	Insert staple crop 1 below: Maize	Insert staple crop 2 below: Cassava

Main inputs | Price margin inputs | Payback period results | IRR results | Irrigation inputs&calcs_NIG | Irrigation inputs&calcs_RWA | Irri

Contribution of the project to AU – EU R&D cooperation:

model development based on synergetic sharing technical + local knowledge between EU and AU member states research institutions

All tools are open access: free to use for the benefit of the Sub Saharan African community

RE4AFAGRI country applications

The RE4AFAGRI dashboards

- A **powerful decision support tool with interactive dasbhoards**

→ Support **policymaking** through sub-national gaps and needs assessment for tailored measures and investments

→ Support **private infrastructure developers** in site selection for maximising financial sustainability and development impact

- Enriched with **direct access to download the raw output data**

www.re4afagri.africa

The RE4AFAGRI dashboards

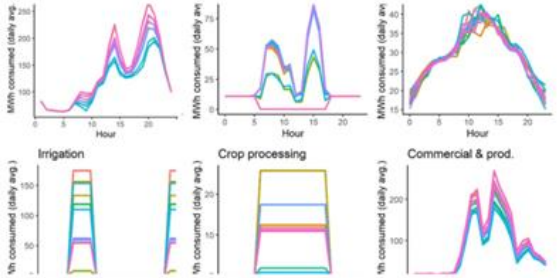
LEAP-RE

Dashboards - Zambia

www.re4afagri.africa

Agriculture and water requirements

Assess the current rainfed irrigation situation and visualize our water requirement estimates to close the irrigation gap



Multi-sectoral electricity demand

Browse our estimates for the community electricity demand from the residential, healthcare, education, water pumping, crop processing and SMEs sectors

Irrigation water pumps

Navigate the technological and investment requirement estimates for installing and operating groundwater and surface water pumps, also with PV + battery

Crop processing

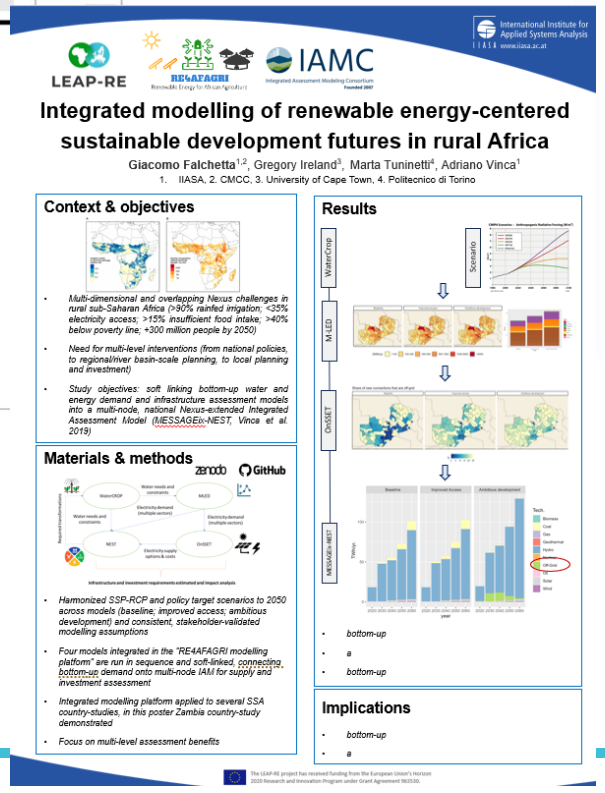
Electricity access

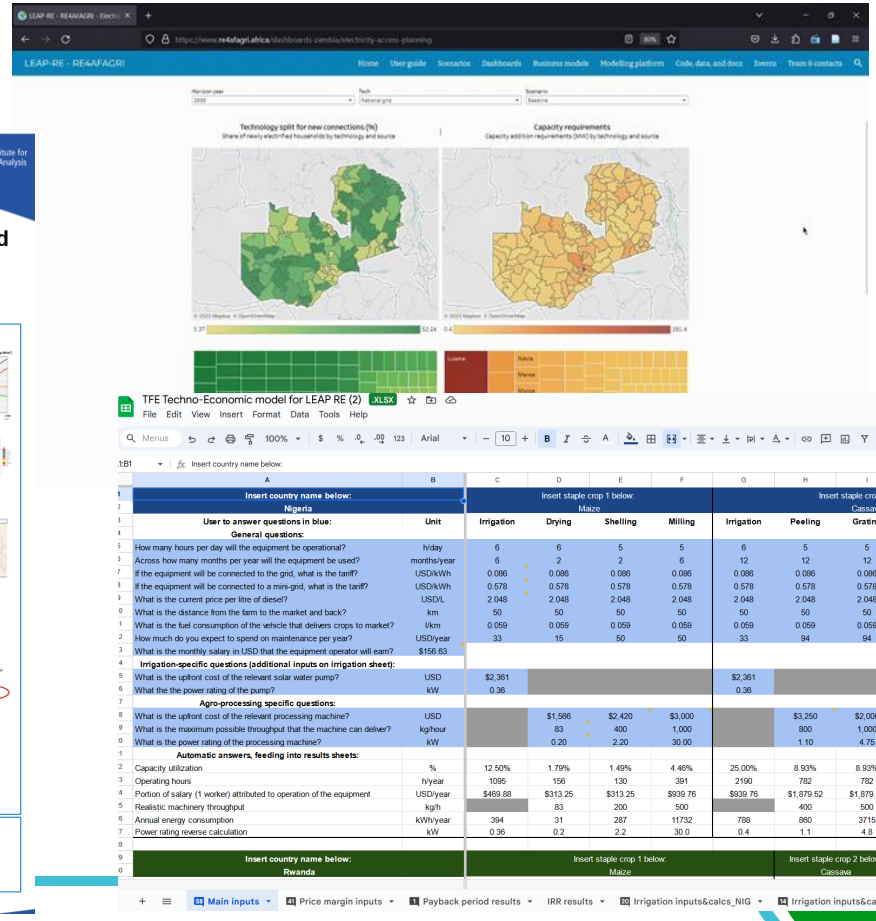
NExus Solutions Tool

Dissemination activities and results: publications, users involved, etc.

- Publication of **RE4AFAGRI platform source code, data, training materials, and dashboards**
- Publication of **techno-economic model and user guide** and report of insights
- Publication of **three scientific papers in high-impact journals (Energy Strategy Reviews, ERL (x2))**
- Presentation of the research at **high-level events and conferences** in Africa (LEAP-RE Stakeholder Forum) and in Europe (EGU23, IAMC 23)

www.re4afagri.africa





Addis Ababa Capacity Building: modelling tools workshops (1 week)

LEAP-RE

RE4AFAGRI's Joint Workshops on tools for planning, scenarios and policy analysis of the water-energy-land nexus for equitable development in rural Africa

Organised with World Resources Institute Africa, 30 in-person participants from 15 African countries in Addis Ababa,
16-20 October 2023
(~125 registered for 2-day hybrid event)

Co-organised and sponsored by

International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

WORLD RESOURCES INSTITUTE

WORLD BANK GROUP
ESMAP

SGCI IOSRS

LEAP-RE
Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy

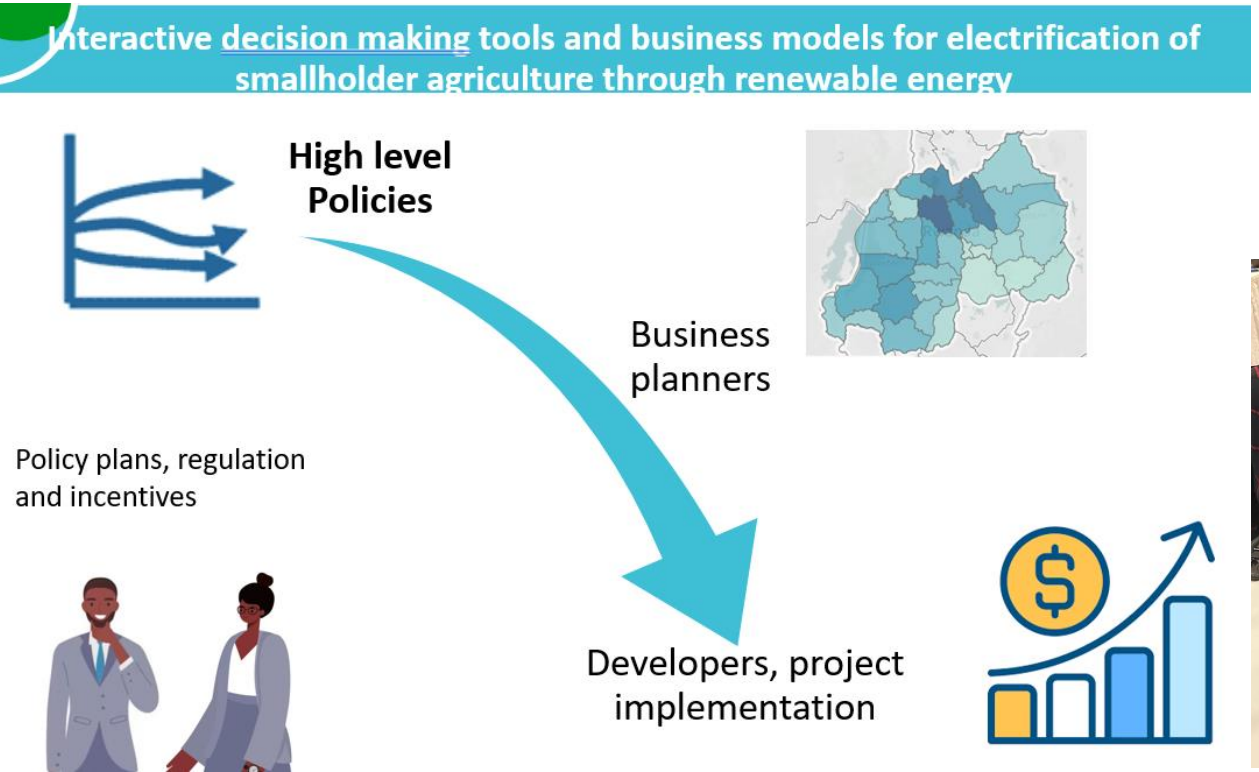
Joint workshops in numbers

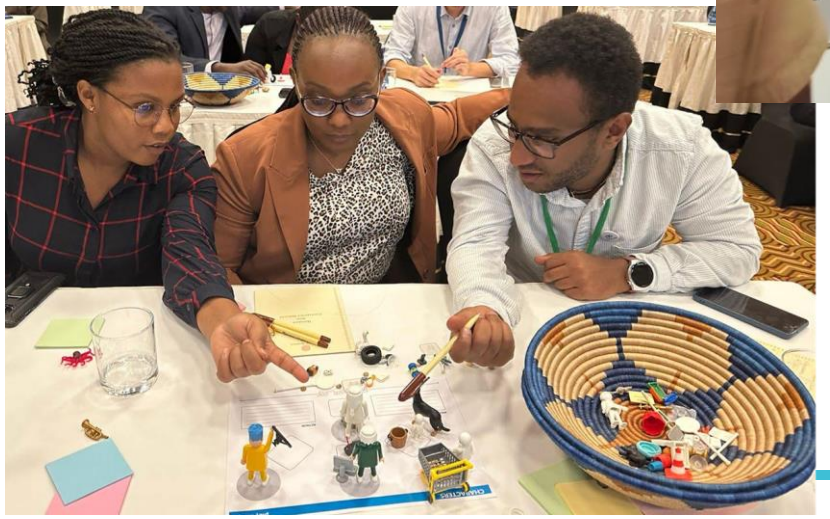
143	30	10	156
applications	participants (in person)	expert trainers	online participants (days 1&2)

1/3 female

Kigali: LEAP-RE stakeholder forum

- **Keynote presentation on RE4AFAGRI**,
- **RE4AFAGRI** Workshop: **Interactive decision making tools and business models for electrification of smallholder agriculture through renewable energy**
- LEAP-RE Workshop: Transversal workshop for business models for decentralized renewable energy
- LEAP-RE RESchool: bottom-up electricity demand assessment





Several Online RE4AFAGRI tutorials

LEAP-RE

➔ youtube videos

- **For final users (RE developers, farmer associations, policy makers)** – tutorials on how to use the platform of models and business model simulations to help the SSA community to reap for themselves the benefit of the RE4AFAGRI work

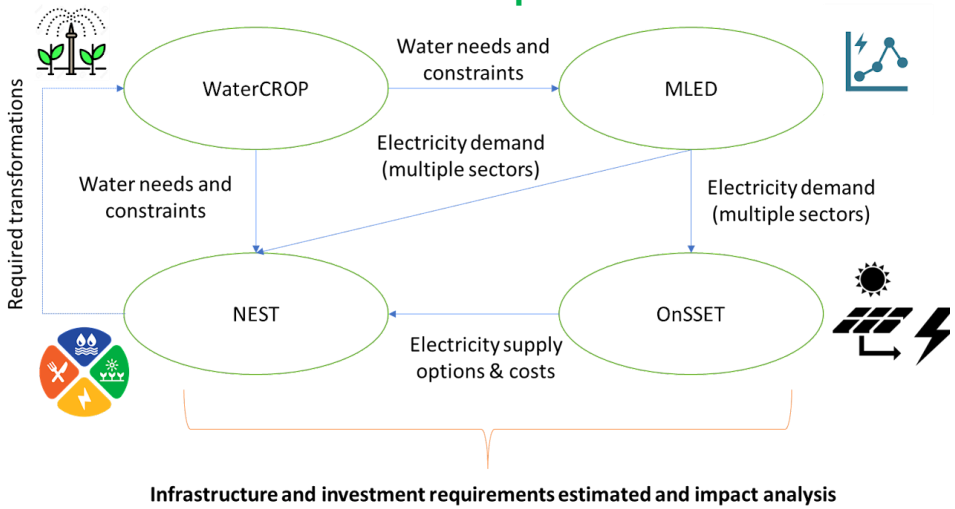
- **For SSA model-developers**: in depth tutorials on the scientific models to allow SSA (and other) researchers to continue developing and adapting the modelling suite to SSA countries

Short introductory Videos for all RE4AFAGRI tools	**Detailed Tutorial Videos of all RE4AFAGRI tools for Users**	**In-depth Tutorial Videos of all RE4AFAGRI tools for modellers**

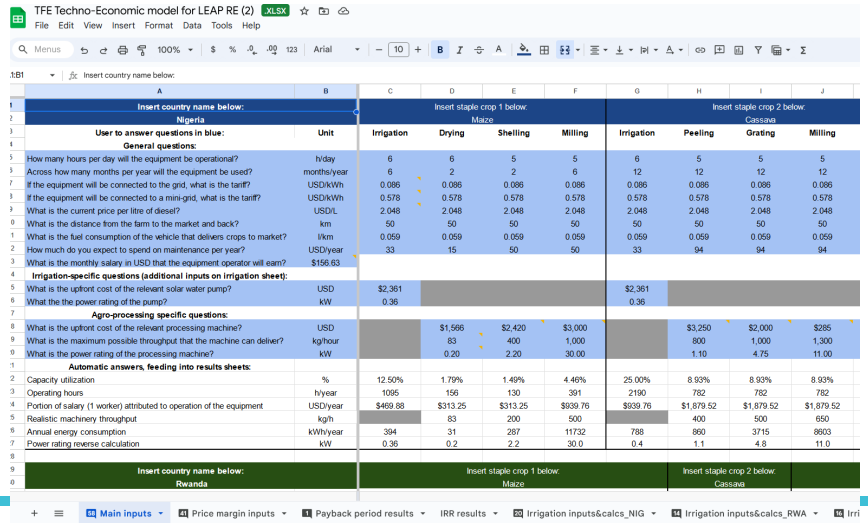
Introductory overview videos

LEAP-RE

The RE4AFAGRI platform



The techno-economic model



TFE Techno-Economic model for LEAP RE (2) XLSX

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Nigeria									
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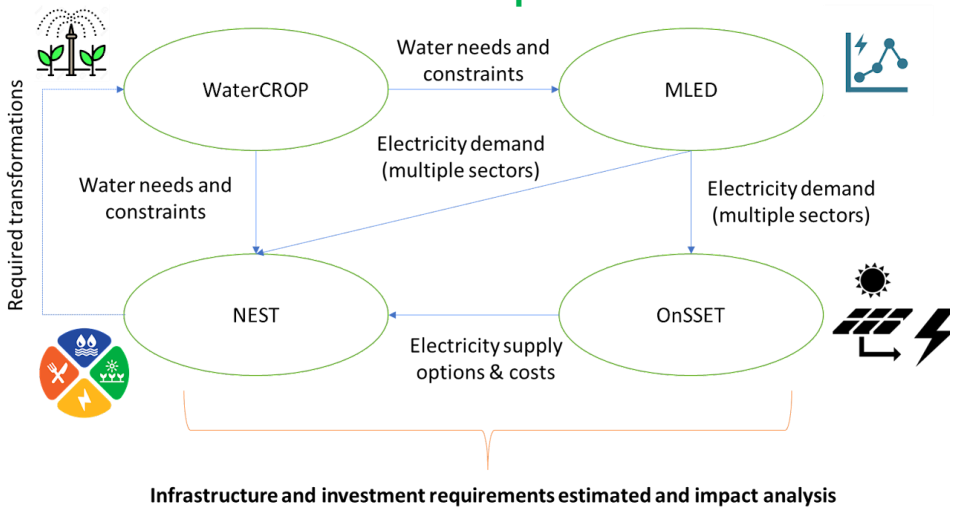
Short introductory and overview Videos on purpose and use of the RE4AFAGRI tools

1) Intro/Overview of RE4AFAGRI project
2) Dashboard and its use
3) Modelling Platform (interaction of the 4 models)
4) WaterCrop model
5) M-LED model
6) NEST
7) Business models and techno-economic tool

Tutorial videos for Users

LEAP-RE

The RE4AFAGRI platform



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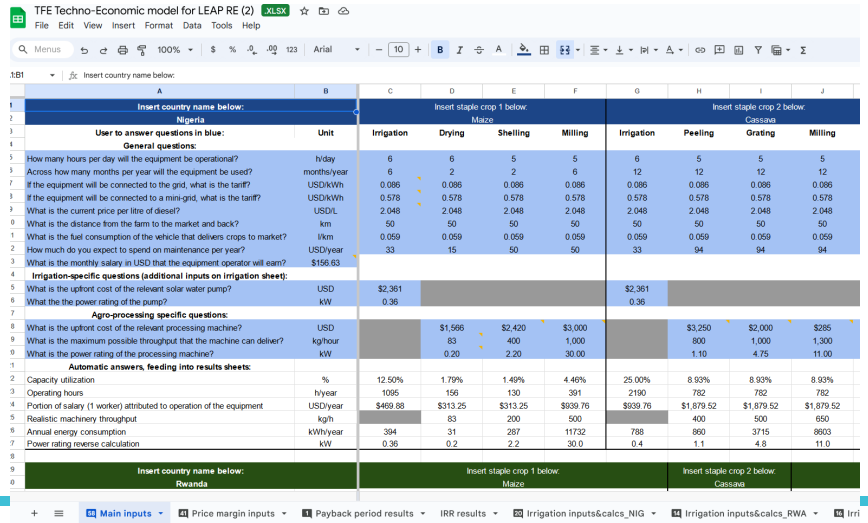

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Detailed Tutorials for Users of the platform (developers, farmer associations, policy makers)

1) Modelling platforms and dashboard training

2) Business models and techno-economic tool training

Tutorial videos for Model-developers

LEAP-RE

WaterCROP

- Software installation procedure
- Model introduction, running and tailoring

MLED

- Software installation procedure
- Model introduction, running and tailoring

NEST

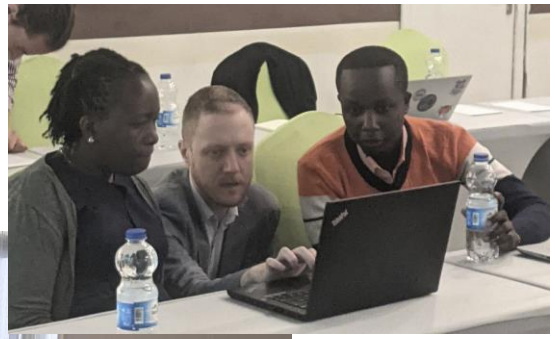
- Software installation procedure
- Model introduction, running and tailoring

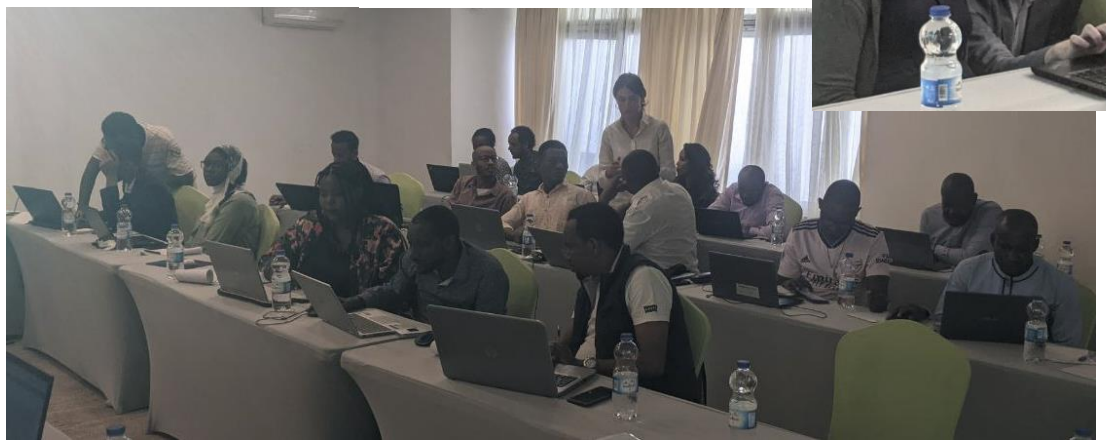
OnSSET

- Software installation procedure
- Model introduction, running and tailoring

Suite of in-depth Tutorials for Model-Developers

- to further work on the RE4AFAGRI tools
- to expand the RE4AFAGRI models to other SSA countries
- to further tailor the RE4AFAGRI modelling suite to the evolving realities of SSA countries





Watch the other training videos...

THANK YOU

CONTACT US FOR MORE INFORMATION

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The LEAP-RE project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement 963530.