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Report on the capacity building activities

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Summary

Within RE4AFAGRI, a number of tasks are devoted to advancing the state-of-the-art of energy-water nexus modelling in rural areas of developing countries to bridge the current gap between large-scale and local-scale frameworks and agricultural and electrification modelling. Relatedly, Task 12.5 of the RE4AFAGRI project is responsible for empowering African scientists, practitioners, and stakeholders with the knowledge and tools necessary to shape policies and strategies that promote balanced and inclusive growth. This report summarizes capacity building activities that have taken place in the Re4AFAGRI Task 12.5

Approval

Date	By
2024-01-15 23:38:23	Dr. Manfred HAFNER (HEAS)
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LEAP-RE

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

Report on the capacity building activities as deliverable for Task 12.5

Deliverable D12.7

WP12 of LEAP-RE (RE4AFAGRI)

www.leap-re.eu

https://www.leap-re.eu/re4afagri/

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Acronyms

IIASA: International Institute for Applied Systems Analysis

LEAP-RE: Long-Term Joint Research and Innovation Partnership on Renewable Energy between the European Union and the African Union

M-LED: Multisectoral Latent Electricity Demand assessment tool

MESSAGE: Model of Energy Supply Systems And their General Environmental Impact

NEST: NExus Solutions Tool

OnSSET: Open Source Spatial Electrification Tool

POLITO: Politecnico di Torino

RE4AFAGRI: Renewable Energy for African Agriculture – Modelling Excellence and Robust Business Models

SSA: Sub-Saharan Africa

UCT: University of Cape Town

WaterCROP: Water Crop assessment model

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1. Background

The **LEAP-RE H2020-funded project** is the Long-Term Joint Research and Innovation Partnership on Renewable Energy between the European Union and the African Union. The **RE4AFAGRI** project ("Renewables for African Agriculture: Integrating Modelling Excellence and Robust Business Models"), part of the Pillar 2 of the LEAP-RE initiative, is run by a consortium of 8 African and European organizations.

The RE4AFAGRI project aims to inform and contribute to the transformation of the African smallholder farmers' agriculture and demonstrate planning and implementation approaches to the integrated water-energy-food-environment-economic development nexus management and business models for infrastructure implementation that are truly tailored to the local needs and socio-cultural and economic and financial context.

Within RE4AFAGRI, a number of tasks are devoted to advancing the state-of-the-art of energy-water nexus modelling in rural areas of developing countries to bridge the current gap between large-scale and local-scale frameworks and agricultural and electrification modelling. Relatedly, Task 12.5 of the RE4AFAGRI project is responsible for empowering African scientists, practitioners, and stakeholders with the knowledge and tools necessary to shape policies and strategies that promote balanced and inclusive growth.

2. Approach and target groups

A core goal of the RE4AFAGRI project is to **share knowledge** about the modelling platform with research institutions in Africa and in Europe and enable those research institutions to become **autonomous** in operating the platform and applying it to **local contexts**.

To achieve this goal, a number of actions and activities have been organized during the RE4AFAGRI project. These span from the organization of country focus-groups (and follow-up contacts) to exchange knowledge with relevant stakeholders, to the organization of hybrid in-person and online training activities in Africa (detailed in this report), to the realization and online publication of video training materials.

The key approach underlying all these activities has been one of **knowledge exchange**, rather than a conventional unidirectional capacity building. This implies the **mutual sharing** of knowledge between RE4AFAGRI partners and researchers and Task 12.5's target institutions and users to facilitate learning and innovation.

Moreover, one of the key **potential risks** (and associated contingency actions) identified during the project writing stage was the possibility that the models are **underutilized** after the end of the project, and therefore that limited impact is achieved. The contingency actions proposed to mitigate this risk included the publication of detailed documentation

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(https://github.com/iiasa/RE4AFAGRI_platform/wiki) and materials (https://www.re4afagri.africa/code_data_docs) for the model training and ensuring that special effort was devoted to identifying most suitable local research institutions.

Concerning this latter aspect, the development of a **scientific and stakeholder research network** has been at the core throughout the duration of RE4AFAGRI. First, as detailed in Deliverable 12.2 (https://www.leap-re.eu/wp-content/uploads/2023/01/LEAP-RE-D12.2-Joint-EU-AU-report-on-agreed-project-vision.pdf), **focus groups** have allowed creating awareness and understanding about LEAP-RE and RE4AFAGRI among a diverse set of stakeholders in several African countries, as well as in a number of international research and development organizations. Second, a careful **selection** of participants including a broad range of **diversity criteria** (nationality, gender, background) has been specifically aimed at creating a very diverse community of users. Finally, **follow-up mass dissemination activities**, including the publication of online contents in social media and of online training videos and materials is explicitly designed to ensure that both "spontaneous" new users (users learning about RE4AFAGRI externally from project activities) and "second-degree" users (users learning about RE4AFAGRI from people who had previously been engaged in RE4AFAGRI activities) can develop sustainable skills for utilizing the RE4AFAGRi modelling platform and its models.

3. TFE virtual workshops on the techno-economic model

- Virtual workshops for audiences in Rwanda, Nigeria, Zambia and Zimbabwe respectively:
    - Three virtual events were held in July-August and September 2023, one for each case study country (Nigeria, Rwanda and a combination of Zimbabwe and Zambia) to present the techno-economic model developed in task 12.4 as well as findings from the business model report.

    - Participants gained insights into modeling results for each of the countries and an overview of how the model's methodology works. We presented popular business models used by practitioners around the continent to electrify smallholder farmers and the status of regulations, infrastructure and financing that affect mini-grids and off-grid solar in each country.

    - Each event was concluded by opening the floor and inviting participants to share insights from their contexts on the factors that influence their business model operations. The feedback often reconciled with our research: That access to finance remains an issue, that regulatory frameworks are often too slow-moving and that interest rates remain prohibitive. Occasionally additional comments were made that we did not consider in our research, e.g. the need for smallholder farmers to have access to water storage facilities to fully benefit from irrigation, and hence the need to integrate these costs into budgeting.

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- During each session the audience was made aware of the in-person event to be held at the Second LEAP-RE Stakeholder Forum in Kigali and all participants were invited. All participants in these virtual events also gained early access to the techno-economic model to assess the financial viability of electrifying smallholder agriculture.

- In total 55 participants attended the webinars:
  - 25 attended the Nigeria event;
  - 18 attended the Rwanda event;
  - 12 attended the Zimbabwe and Zambia event.

4. The RE4AFAGRI "Interactive decision making tools and business models for electrification of smallholder agriculture through renewable energy" session at the 2nd LEAP-RE Stakeholder Forum in Kigali

At the Second LEAP-RE Stakeholder Forum, we set out to present all RE4AFAGRI outputs in an interactive format. The session started with setting the agenda, followed by a presentation of the golden thread running through all of the RE4AFAGRI outputs. First was the NEST model, presented by Adriano Vinca, used to assist policymakers with data-driven decision making pertaining to infrastructure development. Next was Giacomo Falchetta, who presented the RE4AFAGRI dashboards, which assist energy providers with identifying high-potential areas for electrification of agriculture. Finally André Troost presented the rationale behind the techno-economic model and conducted a live demo, designed to help energy companies on the ground to identify agricultural activities that are financially feasible to electrify. During the demo, audience members were asked to participate by answering questions such as how many hours per day a solar water pump operates in their home countries. This information was fed into the model in order to demonstrate that it is customisable and user-friendly.

Our aim was to ensure that the session contains two-way communication and that the audience co-creates the outcomes with us. Towards this end, we sketched a fictional manager of a mini-grid company and asked the audience to do the same, using Lego objects to further visualise the scenario in which this mini-grid developer operates. We demonstrated how our RE4AFAGRI models and tools benefit the mini-grid developer using the Lego objects.

The final aim was to facilitate a new emerging conversation amongst participants of how electrification interventions aimed at smallholder agriculture can be improved. Towards this end we asked the question of what else is missing from the discussion. Participants added more Lego objects to their sketched scenarios to express their thoughts on what else could be needed, for example a person with a bag of money, referring to investment.

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Figure 2: picture from the RE4AFAGRI capacity building event at the LEAP-RE Stakeholder Forum in Kigali

5. The RE4AFAGRI, IIASA and WRI joint Workshops in Addis Ababa

In the context of Task 12.5, **an in-person workshop on the water-energy-land nexus organized by LEAP-RE RE4AFAGRI was organized between October 16th and October 20th 2023 in Addis Ababa, Ethiopia.** Jointly organized by IIASA and the World Resources Institute (a key external stakeholder involved with RE4AFAGRI), the workshop brought together in Addis Ababa **more than 30 researchers and practitioners from 14 African countries (selected among 143 applicants), and additionally 9 expert trainers,** to arrange a week-long joint workshop[1] focusing on tools for planning, scenarios, and policy analysis of the water-energy-land nexus.

[1] For details, refer to https://iiasa.ac.at/events/oct-2023/re4afagri-iiasa-and-world-resources-institute-wri-joint-workshops.

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Figure 1. The joint workshops "in numbers".

The **selection of the in-person participants** was based on a two-stage internal review process (involving at least two LEAP-RE researchers' independent screening per candidate) of the applications received. Criteria included qualifications, CV and experience, knowledge of the topics covered by the workshop (agriculture, water and hydrology, energy planning, etc.), as well as previous experience with programming languages and modelling tools. In addition, explicit attention was given to pursue the highest possible degree of diversity in terms of gender and nationality of the selected participants.

The organizing committee of RE4AFAGRI (Manfred Hafner, HEAS), IIASA (Edward Byers, IIASA; Giacomo Falchetta, IIASA), and WRI worked closely with the secretariat of IIASA's Sub-Saharan Africa Regional Member Organization, the **Science Granting Councils Initiative (SGCI),** who helped to publicize the events and sponsored the attendance of participants. The **World Bank Energy Sector Management Assistance Program (ESMAP)** was also involved in training activities on rural electrification and generously sponsored hotel accommodation for participants. Appendix 3 illustrates details on the different funding sources, amount, and use.

The workshops were organized into two parts (**Figure 1 and Appendix 1 for the detailed agenda**): the first one, taking place on Monday and Tuesday, introduced in-person and online participants (the first two days were arranged in hybrid in-person and virtual format and made openly accessible via Zoom to anyone registering online) to ongoing data and model-based work for water-energy-land-food nexus assessment, with a specific focus on **both public decision-making and private system developers and investors**. This included a keynote talk by the World Resources Institute on Monday, 16 October, demonstrations of Global Forest Watch, Aqueduct and the Energy Access Explorer, and a demonstration of the RE4AFAGRI modeling platform's dashboards. In addition to in-person participants, the first two **were followed by 156 online participants**. The event was opened **by H.E. Dr. Sultan Woli, State Minister of the Ethiopian Ministry of Water and Energy.** A networking event including local experts form Addis Ababa concluded the first day's activities for in-person participants.

While the Addis Ababa event, entitled Hybrid Joint Workshops on Tools for Planning, Scenarios and Policy Analysis of the Water-Energy-Land Nexus for Equitable Development in

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Rural Africa was focused on the technical models of RE4AFAGRI, as a consortium we decided to also present aspects of the business model work done by TFE at the event. Participants included mostly academic modelers specialised in energy access modeling, which is why we deemed it appropriate to present details of the wider context in which energy access models are embedded, i.e. the macro-operating environment and the ground realities of financial viability.

Towards this end, André Troost presented a brief overview of the abovementioned techno-economic model and discussed different manifestations of business models for smallholder electrification.

Days 3-5 were dedicated to hands-on training on a range of quantitative modeling tools related to the water-energy-land-food nexus. Training in days 3-5 was split into two tracks focused on energy and nexus issues, with participants choosing their track of preference and receiving more in-depth tuition on open-access models in those themes.

	Workshop #1: 2 days	***Workshop #2: 3 days***
	Introduction to tools, assessment and policy analysis of the water-energy-land nexus in SSA	***Technical course on WEL-nexus modelling tools***
Content	- Introductions to RE4AGRI & WRI projects - Lectures and hands-on activities on WEL nexus modelling approaches, GIS and web-based tools and data platforms, including: WRI Aqueduct, AgriAdapt, RE4AGRI Modelling Platform	Advanced tuition on 2 of the 5 models: ONSSET, M-LED, WaterCROP, NEST, WRI Energy Access Explorer
Target participants	Broad: policymakers, researchers, analysts, academics, working in assessment and planning in the water resources, agriculture, irrigation, and energy sectors. Typically those in mid-career stage and/or with Masters degree equivalent.	Specialist: As for #1, but requiring computer programming skills in a high-level language, e.g. Python, R, Matlab, Julia, etc.
Learning outcomes	Learn about key linkages in WEL-nexus and how they are covered in analytical frameworks Understanding of how insights from different tools can be used to support scenario analysis and policy design	Understand model structures, basic setup, and how to apply to different national and regional contexts
When & how	16-17th October, 2023, In person AND online (**hybrid event**)	18-20th October, 2023, **In person only**
Nexus networking event with local experts: 16th October 2023, evening (TBC)		

Figure 1: structure of the workshops

RE4AFAGRI researchers involved in the delivery of the trainings involved Giacomo Falchetta (IIASA); Gregory Ireland (University of Cape Town); Marta Tuninetti (Politecnico di Torino); and Adriano Vinca (IIASA). Additional trainers included researchers from WRI **(see Figure 3: joint photo of participants and trainers**). The teaching materials are made openly available at are available – along with links to code, data repository, and user guides – at https://www.re4afagri.africa/code_data_docs.

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The workshops had the crucial benefit of **building a community and network of experts across sub-Saharan Africa** who will be able to further develop their existing skills and technical capacity within their organizations and countries in coming years. The success of the workshops lay not only in their informative content, but also in their ability to **trigger action**. Attendees were inspired to rethink traditional, siloed approaches to energy, land, and water resource management and devise innovative and integrated solutions tailored to different and context-specific settings of rural Africa. The workshops facilitated the creation of **cross-disciplinary networks**, enabling professionals from diverse backgrounds and countries to collaborate and pool their expertise, thereby amplifying the potential for impactful change. The in-person participants and trainers remain in touch via a Slack (instant messaging) community that was created specifically for communication on both content and technical aspects of the training.

Overall, the joint workshops held in Addis Ababa have been a key objective since the RE4AFAGRI project's inception to ensure that the best research methodologies and insights using open-source models and data are disseminated among local researchers and practitioners working across sub-Saharan Africa.

Figure 3: group picture of trainers and trainees (see Appendix 2 for a full gallery of the workshops)

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6. Developing an online legacy for capacity building

RE4AFAGRI researchers intend to leverage on the success of the workshop to **organize online training and dissemination activities in early 2024** to further expand the pool of users and developers of the RE4AFAGRI modelling platform and extend the project impact onto an even larger community and number of countries.

The videos will be recorded, professionally edited, and publicly made available on IIASA's YouTube channel and the RE4AFAGRi project website. In addition, they will be extensively disseminated through social media engagement, e.g. Twitter and LinkedIn, and will be sent to the living community of almost 200 people that was created following the hybrid Addis Ababa workshops.

The RE4AFAGRi project website contains a growing resource of documentation on the models and links to their source codes, and will be supplemented with powerpoint slidedecks also.

More specifically, we intend to record and make available three categories of training videos:

1. **Short intros** (for dissemination purposes ~3-5 minutes each)
2. **RE4AFAGRI Platform training** (~1 hour each)
3. **RE4AFAGRI Platform training** (~1 hour each)

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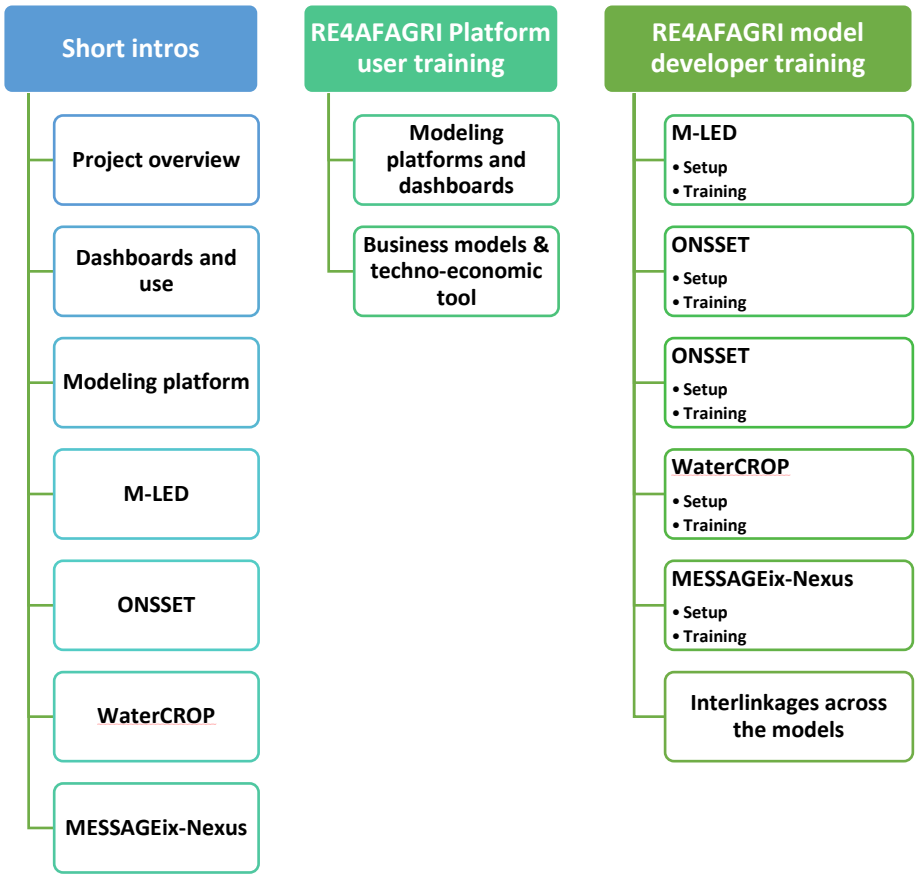

Figure 2. Overview of the training videos planned.

The first category of videos will include the following:

1. Project intro / overview video
2. Dashboards and use introductory video
3. Modeling platform (the four models) introduction videos. For each model, a model-specific introductory video on functioning and purposes
4. Business models & techno-economic tool introductory video

Concerning video trainings for users of the platform, we intend to record long-format training videos for:

1. Modeling platforms and dashboards training
2. Business models & TFE's techno-economic tool training

Finally, relative to video trainings for developers of the models, the following video lectures will be made available:

1. Software installation procedure, a detailed video for each of the four models

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2. Model introduction, running and tailoring, a lecture for each model and a joint lecture on interlinkages across models

7. Supplementary online dissemination

- ESI Africa article:
  - Outputs from RE4AFAGRI were showcased in a published article on the renowned power sector platform, ESI Africa. The article briefly introduces the reader to what RE4AFAGRI is, acknowledges LEAP-RE and the European Commission, provides high level information of different RE4AFAGRI workflows and points the reader to the official RE4AFAGRI website where the different outputs can be accessed. The article can be accessed here.
- ARE case study:
  - The same content is currently being prepared for publication on the website of the Alliance for Rural Electrification, an industry body representing energy access and distributed renewable energy in the Global South. The ARE website can be accessed here.

8. Conclusions: replication and exploitation

Building on the research-related activities from RE4AFAGRI, this activity has focused on the crucially important capacity building and dissemination potential of the models that have been developed. The program of capacity building was developed with multiple levels of technical complexity and different modes of engagement, aiming to meet user's needs and competencies in appropriate ways. Although the workshops would traditionally be considered as the primary capacity building activity, development of the online materials, including instruction videos, will create a highly accessible legacy for researchers worldwide interested in the nexus and open-source modelling. By choosing the RE4AFAGRI modelling platform, users are joining a global community of researchers and practitioners using established, open-source data and tools.

Appendix 1: extended agenda of the Addis Ababa workshops

The complete agenda of the Addis Ababa workshops is found at:
https://docs.google.com/document/d/1zKSy2YkRFvnYA7Ggl5r9P0HUjRNhOI-N

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Appendix 2: additional Addis Ababa workshops pictures

A photogallery of the Addis Ababa event is found at https://iiasa.ac.at/news/oct-2023/successful-joint-workshop-supports-equitable-development-in-rural-africa.

Appendix 3: Addis Ababa workshops: funding details

A number of different stakeholders participated logistically and financially to the successful workshop. Approximate costs largely related to travel, accommodation and subsistence, and not including personnel time, have been estimated below.

Source	Purpose	Estimated value (EUR)
EC Horizon 2020 LEAP-RE	Workshop travel costs and accommodation for 4 trainers and 13 participants Networking reception for 45	22.000
LEAP-RE Partner co-funding (50%)		
World Resources Institute	Workshop venue costs & lunch, travel and subsistence of 3 training staff	6.000
World Bank ESMAP	Sponsored hotel accommodation, breakfast and airport transfers for 16 participants	8.000
Ethiopian Biotechnology Institute	Hotel accommodation for 8 local Ethiopian participants	3.250
South Africa National Research Foundation	Travel & accommodation costs for 1 participant	1.750
Zambia National Science and Technology Council	Travel & accommodation costs for 1 participant	1.500
Kenya National Research Fund	Travel costs for 2 participants	1.400
Total estimated value of contributions		43.900

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