EU-UNEP Africa Low Emissions Development Strategies (Africa LEDS) Project

End of year progress report as at November 2018

Reporting period	**10/2017–11/2018 (N/A)[1]**

Description

ENRTP/GPGC strategic priority	Climate change	EC Directorate General	DG CLIMA
UNEP/MEA programme of work	UNEP programmes of work 2016-2017, 2018–2019		
Project title	EU–UNEP Africa Low Emissions Development Strategies Project (short title: Africa LEDS Project)		
Geographical coverage	Cameroon, Côte d'Ivoire and Democratic Republic of the Congo for component 1, plus: Ghana, Kenya, Morocco, Mozambique and Zambia for component 2. In addition, a sub-regional and region-wide component		
Date of EC–UNEP agreement signature	15/03/2016		
Project start date	12/04/2016	Project end date	11/04/2019
Overall project duration	36 months		

Responsible entity and branch	UNEP-Africa office
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[1] Please indicate if this is first or last report, and modify the start or end date accordingly.

1. Context and summary of project progress

Context: Significant progress has been registered during the period in all the three project components towards catalysing a country led, demand driven transition to the low emissions development pathway. All components converge to create the structure for the Nationally Determined Contributions (NDCs) implementation that unlocks leading socioeconomic benefits for the country- that goes beyond traditional regulatory approaches. This demonstrates climate action as a solution to catalyse a demand driven transition to the low emissions pathway.

Component 1 implemented in Cameroon, Côte d'Ivoire and the Democratic Republic of the Congo (DRC), involved a ground demonstration of how investment in sectors prioritised equally in country NDCs & economic development visions can unlock leading socioeconomic priorities simultaneously with climate aims of the Paris Agreement. This demonstration provides lessons which are compiled into case studies to inform country strategic policy planning for low emissions development. A leading aspect demonstrated- is the need to prioritise complementarity across sectors to maximise both climate & socioeconomic benefits as opposed to considering actions within sectoral silos.

Component 2 is implemented in all 8 countries - Cameroon, Côte d'Ivoire, DRC, Ghana, Kenya, Morocco, Mozambique and Zambia. It is establishing an analytical framework to inform optimal NDCs implementation investment trajectories by building on modelling technologies already available in the country to ensure confluence and maximise past country investments. A major value-added aspect has been the combination of the various models available in countries for complementarity, so they operate as an integrated model that can forecast both climate and socioeconomic impacts of various NDCs implementation scenarios. By this, inform on trajectories that can maximise both the climate & socioeconomic benefit resulting in optimised NDCs investment policy decisions. This is an improvement from business as usual modelling which focuses on forecasting climate impacts alone.

Component 3 is on peer learning & exchanges of innovative approaches arising from the project. This is occurring both among project countries & across the continent. As a key highlight among project countries, Mozambique, which concluded their modelling actions, became a peer advisor to teams from Kenya & Ghana on how to adapt the ABACUS model to run agro-forestry project level scenarios and linking models for complementarity across sectors for maximised aggregate impacts.

Summary

Component 1 – LEDS planning support
Ground actions have progressed excellently in the three "component 1 and 2" countries.

In **Cameroon**, the project is demonstrated the increased socioeconomic & climate resilience benefit of greening the country's agro-value chains. Accordingly, a 50Ha cassava farm cultivated using indigenous nature-based approaches that protect ecosystems is being linked to a processing unit powered by a mix of solar & micro-hydro (instead of traditional diesel plants). A mobile application is being finalised to ensure low carbon, efficient & cost-effective linkage of the producers to markets (instead of paper processes & physical travel in search of markets which is costlier & has a higher carbon print).

In **Côte d'Ivoire**, rice waste on two 50Ha plots is being converted to biofertilizer and briquettes for cookery (instead of charcoal & firewood which has higher carbon print by depleting forest sinks). Work is also complementing a circular economy initiative in the country by informing ongoing developments to develop a "waste stock exchange" for valuation of waste. This stock exchange will monetise "waste to profit" actions to inform policies towards prioritising enhanced investments e.g. in waste to energy systems in the country.

In **DRC**; the latest update by the country demonstrates substantial progress. Demonstration sites of waste to domestic energy – specifically biogas & briquettes as well as waste to biofertilizer are operational. Sample briquettes & biogas stove solutions to substitute charcoal & firewood have been developed. Case-study documentation is underway.

Component 2 – LEDS modelling support Under component 2, Mozambique has become the first country to finalise their integrated model. This model is now being integrated into policy decision frameworks through the Ministry of Environment. It will enhance coherence in policy decision making across environment, agriculture & energy to ensure the complementarity in investment across sectors needed for NDCs implementation is achieved. Cameroon has finalised their integrated model and are conducting test runs and calibrating the model including using data from aspects of the ground demonstration.
Côte d'Ivoire, DRC, Kenya, Ghana & Zambia have finalised adapting their chosen models to run project level scenarios and are now at the level of combining the models for complementarity to build the integrated model that can forecast both climate & socioeconomic impacts.
Morocco has been experiencing bureaucratic delays in establishing the modelling team. In the period however, the modelling lead institution has been established and strategic direction of the work clarified.

Visibility and Communication: project lessons continue to be shared on both the virtual space through social media & the project website as well as physically through participating in global & continental forums on environment & low emissions development policy. Successes gleaned from this project were used to make a case to convince ministers to endorse policy positions towards premising environment as a solution to socioeconomic growth. The result was the adoption of a relevant high-level decision on Innovative Environmental Solutions at the 3rd UN Environment Assembly (UNEA 3) in December 2017 and adopting instruments of implementing climate action as an accelerator of socioeconomic transformation in Africa at the 7th Africa Ministerial Conference on the Environment (AMCEN) special session in September 2018. In addition, lessons were shared at a continental multi stakeholder conference on low emissions development – the 2018 African Carbon Forum in April.

Regional peer-to-peer learning

Peer learning and exchanges are already being set on two levels – first, amongst project countries and second with non-participating stakeholders across the continent. Accordingly, amongst project countries, experiences from the Mozambique modelling team, specifically on the manual combination of models, have been shared with some project countries. Specifically, the Mozambique team became a peer advisor, sharing lessons on using the ABACUS model to forecast agroforestry scenarios with Kenya and Ghana. At the second level with non-participating stakeholders, selection of institutions to anchor peer learning and exchanges among project countries and with non-participating stakeholders are ongoing to cover all the 5 sub-regions in the continent. This will lead to establishment of Communities of Practice (CoPs) facilitated by the project technical partners to disseminate the low emissions lessons of this project continentally to continually enhance Africa's capacity to implement its NDCs catalytically.

2. Actual results

The following table summarizes accomplishments in the period against the project log frame. Detailed explanations are in the succeeding section on "activities accomplished during the period"

Project component	Project outputs	Indicators	Means of verification	Progress made/results achieved
Component 1: LEDS planning and implementation support	LEDS initiatives developed or improved	3 partner countries develop or improve LEDS plans	LEDS plans prepared by the countries	- DRC ground demonstration sites launched and operational providing data for case-study compilation to inform policy planning commenced in the DRC. – Demonstrations in Cameroon & Côte d'Ivoire near finalisation in readiness for case study developments.
	Implementation of specific LEDS measures initiated	3 partner countries initiate formulation and implementation of LEDS measures for key emissions sectors or economy wide	National and sectoral policy documents and plans and progress reports	– Inter-ministerial policy teams have been established in Cameroon, Côte d'Ivoire and DRC. These will lead in infusing project lessons into policy structures through case-studies developed from the ground demonstrations. - DRC developing case studies from the ground demonstration to inform low emissions development strategies & policies.
	Enhanced global and regional knowledge of LEDS planning and implementation	At least 5 non-partner African countries actively participating in peer forums More than 1 non-partner country formulating LEDS	Survey to collect feedback from countries on use of knowledge and capacity to help strengthen their LEDS and intended	- Project component 1 lessons inform a high-level policy decision at the UN Environment Assembly (UNEA) and the Africa Ministerial Conference on the Environment (AMCEN) – Website visible to global audience and continuously

Project component	Project outputs	Indicators	Means of verification	Progress made/results achieved
		plans based on shared project knowledge Non-partner countries develop and implement LEDS measures based on shared project knowledge	nationally determined contributions LEDS plans developed by non-partner states LEDS shared by non-partner countries	updated with country-level implementation progress. – Twitter account engaged to promote project progress and update global audience including non-partner countries on project implementation progress, experiences and lessons. – Project engaged in third party continental events to share innovative approach of maximizing both the climate and socioeconomic impacts of the implementation of NDCs – the African Carbon Forum. – Selection of hub institutions to host Communities of Practice (CoPs) ongoing. The CoPs are to share project novel approach to NDCs implementation maximizing both climate & socioeconomic aims with stakeholders across the continent.
	LEDS champions cultivated	At least 3 institutions identified as LEDS champions to lead LEDS and implement peer-learning efforts LEDS training and equipping of identified champions	Written communication from champions on their engagement leading the peer-learning efforts Peer-learning efforts reports Active participation of champions in the	The CoPs are providing a platform to cultivate champion institutions in each of the five sub-regions of the continent on demand driven LEDs development in the continent.

Project component	Project outputs	Indicators	Means of verification	Progress made/results achieved
		Partnerships formed between champions to facilitate peer-learning	LEDS online knowledge exchange platform	
Component 2: LEDS modelling support	LEDS actions prioritization and decision-maker support for priority LEDS measures significantly enabled	Priority LEDS actions identified for 8 partner countries At least 8 countries with strengthened LEDS process as a result of the prioritization process	Results of the prioritization incorporated on LEDS or the implementation plan	– Mozambique finalises development of their integrated model to inform NDCs investment policy decisions that maximise both climate & socioeconomic benefits. - Cameroon test running and calibrating model in readiness for handover to policy makers . - Côte d'Ivoire, DRC, Kenya, Ghana & Zambia finalise adapting one aspect of their respective integrated model to forecast project level impacts. – Mozambique policy teams guiding integration of models into decision processes of relevant line ministries.
	Strengthened analysis and communication of LEDS benefits	At least 8 countries with strengthened stakeholder support for LEDS process as a result of improved analysis and	Evidence of communication products (e.g.., webinars, reports, newsflashes, webpages, policy briefs etc.) developed and	– Website visible to global audience and updated with relevant material on project progress and key lessons. – Twitter account engaged to promote project progress and for real-time project progress updates and lessons sharing with

Project component	Project outputs	Indicators	Means of verification	Progress made/results achieved
		communication of LEDS benefits An Africa LEDS website in place as a continental LEDS knowledge management platform	presented to key stakeholders	global audience including non-participating countries. – Project engaged in 3rd party continental events to share an innovative approach of maximizing both the climate and socioeconomic impacts of the implementation of NDCs – 2018 African Carbon forum.
	Improved LEDS modelling capacity	LEDS models adapted for target high emissions sectors economy wide Training of relevant personnel to lead LEDS modelling actions Partner country technical institutes conducting analysis with adapted models	Evidence of countries having adapted and utilized one or more of the LEDS modelling tools to guide the evaluation and design of their LEDS	- Mozambique finalise development of integrated model combining LEAP & ABACUS models. This integrated tool forecasts both climate & socioeconomic impacts of alternative NDCs implementation trajectories to inform optimal investment policy decisions. It extends Mozambique modelling beyond traditional emissions forecasting to matching emissions with key socioeconomic parameters of cost savings, incomes, profitability etc. – Peer exchanges amongst project countries demonstrating enhanced modelling capacity. The Mozambique modelling team leading in sharing lessons on adapting the ABACUS model for agroforestry with counterparts in Ghana and Kenya. - The Cameroon modelling team convened experienced modeller from the University of Paris to work with students from the University of Yaoundé 1 in

Project component	Project outputs	Indicators	Means of verification	Progress made/results achieved
				developing a context specific & indigenous model for Cameroon – enhancing capacity of the next generation of modellers.
	Improved regional and global knowledge	At least 2 non-partner countries report improved LEDS process due to peer-learning forums and project knowledge products Non-partner countries participate actively on LEDS modelling through knowledge platforms All 8 partner countries actively involved in LEDS modelling peer training and knowledge-sharing	Survey to collect feedback from countries on use of knowledge and capacity to help strengthen their LEDS and intended nationally determined contributions Active knowledge-sharing by non-partner and partner countries observed in knowledge-sharing platforms (website, joint reports etc.)	- Project component 2 lessons inform a high-level policy decision at the UN Environment Assembly (UNEA) and the Africa Ministerial Conference on the Environment (AMCEN) – Website visible to global audience updated with relevant material on project progress and key lessons. – Twitter account engaged for real-time project progress updates and lessons sharing with a global audience including non-partner countries. – Project engaged in third party continental events to share innovative approach of maximizing both the climate and socioeconomic impacts of the implementation of NDCs – the African Carbon Forum. - Mozambique team engaged as peer advisor for Ghana & Kenya on soft-linking models to forecast cumulative impact of investments across complementary sectors to inform optimal NDCs implementation policy decisions

Project component	Project outputs	Indicators	Means of verification	Progress made/results achieved
				– Communities of Practice (CoP) set to kickstart to share project novel approach to NDCs implementation maximizing both climate & socioeconomic aims with non-participating stakeholders across the continent.
Project component	**Project milestones:**			**Milestone progress (achieved/started/near complete/not started)**
	• Grant support agreements/contracts signed • Launch of the project at Africa LEDS Partnership event			Achieved N/A
LEDS planning and implementation support	• Inception phase, established activities and launched implementation • Country-specific support activities. • Case studies developed and distributed • Peer-learning and networking activities • LEDS country champions identified • Close out reports for each participating country published			Complete Ongoing, near complete Ongoing Started Ongoing Started

Project component	Project outputs	Indicators	Means of verification	Progress made/results achieved
LEDS modelling support	• Inception phase, activities established, and implementation launched			Complete
	• Suite of models to work with finalized – selection			Complete
	• Training of in-country modelling teams			Ongoing
	• Training and capacity-building of regional technical institutes			Ongoing
	• Network of regional modellers, analysts as well as technical institutes for sustainability of project outputs formulated and installed			Ongoing
	• Knowledge and communication products based on the project and the benefits of LEDS developed and shared with the global community			Ongoing

3. Activities accomplished during the period

3.1 Component 1: LEDS planning and implementation support

Executing a ground demonstration pilot is the leading activity. It entails building on already established sectoral initiatives and linking them for consolidation into a single pilot ground action that demonstrates how NDC implementation can maximize socioeconomic and climate mitigation impacts simultaneously by following on the chosen strategic development trajectory in each country.

3.1.1 Key accomplishments in Cameroon

The ground demonstration action of processing cassava using clean energy options – solar & micro-hydro and linking produce to markets using ICT is now being operated. The resultant data will be among that which is used to calibrate the model under component 2. Specifically, two sites are being operated. The Jakiri site where a micro hydro plant is being used to run cassava processing into flour and the Ngoulemakong site, where solar driers are being used to dry cassava ready for processing. A variety of cassava products are made at both sites – manioc flour, starch powder, manioc cossettes, water fufu etc. The sale of these produce across the country and especially in the Eastern part of

Cameroon is creating a market driven incentive for additional investment in such clean energy powered processing to catalyse a demand driven shift to the low emissions development pathway.

A women's cooperative – SOCOOPROMAN-COOP-CA - provides the raw cassava being processed and linked to markets. Over 13,000 kilograms of cassava are produced per month.

Site 1: Jakiri council (micro-hydro powered cassava processing)

Left: Site 1 – Jakiri council site of the existing micro -hydro power plant mini-grid producing 30 KW to power cassava processing in the Jakiri municipality

Right: Site 1 – Jakiri council site – the cassava processing plant being powered to mill cassava flour.

Site 2: Ngoulemakong county (solar powered cassava processing)

Next steps

- Developing case studies from ongoing ground demonstration to inform continental peer-to-peer learning.

- Collating data from the ongoing ground demonstration to be used to calibrate model under component 2.

- Finalize gazettement of inter-ministerial policy team to infuse project lessons at policy level across government. The case-studies demonstrating successes of project as well as the decision support model under component 2 will buttress formal adoption of this inter-sectorial policy team as permanent decision-making organ for NDCs implementation in Cameroon.

3.1.2 Key accomplishments in Côte d'Ivoire

The waste-to-energy demonstration sites, converting rice waste/ rice husks to fuel briquettes are being operated in Tipadipa and Tiétiékou and monitored in readiness to produce data that will be used to inform calibration of the LEAP model being adapted to run waste to domestic energy scenarios under component 2.

A market analysis of opportunities to expand markets for the briquettes is underway towards informing policy to invest in briquette production enterprises in all rice growing regions of Côte d'Ivoire for market driven uptake of low emissions at community levels.

To enhance sustainable production of rice, the project also synergised efforts with an ongoing UN FAO project on sustainable rice intensification and conducted feasibility on improving the irrigation approaches used to water the rice to enhance efficient resource use. Accordingly, feasibility studies to shift from canal irrigation which wastes water & uses diesel power for pumping to more efficient approaches like solar powered irrigation is ongoing.

The pictures below illustrate the step-wise process of converting rice to briquettes that will be established across rice farms in Côte d'Ivoire to catalyse country led shift to the low emissions development.

Rice farms providing the raw material for briquettes making – rice husks

Biomass to briquettes conversion plant – uses pyrolysis to convert biomass from dried waste to biofuel briquettes which produce more energy per unit.

Left: dried waste biomass briquette before pyrolysis. **Right**: Finished briquettes ready for use after pyrolysis to produce more energy per unit of mass.

Policy team

A framework to absorb project lessons to ensure decisions in agriculture, waste & energy are adequately integrated for complementarity and this is coordinated by the Prime Minister's office. It is composed of key ministries in relation to the sectors identified in the NDC as emitting the most GHGs in Côte d'Ivoire (Agriculture, Energy and Waste).

Next steps

- Developing case studies from ongoing ground demonstration to inform continental peer-to-peer learning.

- Collating data from the ongoing ground demonstration to be used to calibrate model under component 2.

- Finalise market analysis study on fuel briquettes

- Finalize gazettement of inter-ministerial policy team to infuse project lessons at policy level across government.

3.1.3 Key accomplishments in the Democratic Republic of the Congo

Despite internal challenges, ground demonstration actions of waste-to-energy with linkage to enhancing the country's REDD+ process are ongoing in two sites. One is converting organic waste to biogas for domestic & institutional use including in eateries. Another is converting general solid waste to fuel briquettes for sell. These ground actions include a case study on the amount forest cover that will be conserved.

Market analysis conducted provides a positive basis for shift towards briquettes. The study indicates that for a family of 7, usage of charcoal for daily cooking would cost 1,000 Congolese Francs (FC) while equivalent use of briquettes would be up to 3times cheaper at 350 FC. These study findings will constitute part of the case study reports towards informing policy to incentivise briquette production enterprises across DRC for market driven uptake of low emissions at community levels.

The pictures below illustrate the operationalisation of the DRC waste recovery systems – a waste-to-briquettes & waste-to-biogas systems.

Briquettes making – left: preparing the waste and **right:** processed briquettes




Household switch to briquettes


Switch to biogas at institutional and enterprises level

Next steps

- Finalise case studies from ongoing ground demonstration to inform DRC policy planning & continental peer-to-peer learning.

- Collating data from the ongoing ground demonstration to be used to calibrate model under component 2.

- Finalize gazettement of inter-ministerial policy team to infuse project lessons at policy level across government.

3.2 Component 2: LEDS modelling support

This component seeks to enhance existing modelling capacity in countries to go beyond modelling & forecasting emission scenarios as is classically done towards forecasting both climate & socioeconomic impacts simultaneously. The end being to establish decision support systems that inform policy makers on optimal NDCs implementation trajectories that maximize both climate & socioeconomic benefits. And considering that such socioeconomic ends remain the leading priorities of countries, catalyse a demand driven, country led transition to the low emissions development pathway. Different project countries are at various stages of building their decision support systems. Mozambique is the first country to finalise & prepare their final report. Their model is now being integrated into policy decision structures for coherence in policy decision making across environment, agriculture & energy to ensure the complementarity in investment across sectors needed for NDCs implementation is achieved. Cameroon has finalised their integrated model and are conducting test runs. Côte d'Ivoire, DRC, Ghana, Kenya and Zambia have finalised adapting their models to run project level scenarios and are now at the point of combining them to forecast complementary scenarios across sectors to maximise both climate & socioeconomic benefit. A key capacity enhancement aspect demonstrating the catalytic nature of this work is emanating from Mozambique. Being the most advanced, Mozambique became a peer advisor to Kenya and Ghana demonstrating a dimension of south-south cooperation that will be further buttressed by the Communities of Practice (CoP) for continental-wide impact.

3.2.1 Component 1 and 2 countries

3.2.1.1 Key accomplishments in Cameroon

The Cameroon modelling team led by Prof. Isidore Ngongo, a statistics and modelling Professor from the University of Yaoundé 1 working with computer science students from the same university have created an indigenous modelling architecture. They have opted to build from start, a simple computer programme that can forecast the relevant scenarios to inform policy decisions - rather than customize already existing models in the market. This is a break from what other countries are doing - which is building from already existing models in the market and customizing them to forecast their scenarios. The Cameroon team is a mix of youth & experience – where Prof. Ngongo is developing the mathematical models & assumptions for the scenarios and leading in sourcing data to perform test runs, while the computer science students are developing the simple programme that converts the mathematical logic into an interactive computer user interface where users can key in parameters and get the analytical results displayed on a computer screen. This collaboration between experienced professionals & students is providing mentorship opportunities for the next generation of modellers in Cameroon, enhancing modelling capacity & interest amongst upcoming professionals to ensure longer-term sustainability of Cameroon's low emissions development.

The user interface has been completed. The back-end logic of the model has also been finalized with priority NDCs sectors – agriculture, energy, transport, ICT, forests & waste – being built into the model. All this has been documented. Refinement & calibration of the model is now ongoing and near completion. Five critical scenarios representative of the chosen NDCs implementation strategic trajectory and priority sectors of Cameroon are being run. These also cover the logic being demonstrated under the component 1 ground action. Which is "*greening and maximizing productivity of Cameroon's agro-value chains using energy, transport & ICT*".

Accordingly, the five scenarios used to calibrate the model are;

<u>Scenario 1</u>: forecast the climate impact (landfill carbon mitigated, mineral fertilizer production & use emissions mitigated) & socioeconomic impact (cost savings of using organic over mineral fertilizer, net jobs created, net income created, net addition to GDP) of an investment trajectory prioritizing waste-to-bio fertilizer / manure for use in agriculture vis-à-vis a BAU scenario of importing / producing & using inorganic mineral fertilizer & disposing organic waste in landfills. Extrapolate impacts over time to 2035 & over space - coverage of all agro-ecological zones of Cameroon.

<u>Scenario 2</u>: forecast the climate impact (energy generation carbon mitigated) & socioeconomic impact (fuel cost savings, net jobs created in agro-processing & in clean energy, net GDP increases) of an investment trajectory of investing in off-grid clean energy systems (decentralized solar mini grids, micro-hydro) directly linked to power agro-processing vis-à-vis BAU scenarios of

- using off-grid clean energy primarily for domestic & social use;

- using diesel generators to electrify off-grid areas, and

- developing clean energy & agro-processing in silos.

Extrapolate impacts over time to 2035 & over space - coverage of all agro-ecological zones of Cameroon.

<u>Scenario 3</u>: forecast the climate impact (transport emissions mitigated) & socioeconomic impact (net GDP increases, income enhanced, net jobs created) of roads development investment targeted at linking agro-production areas to markets & collection points vis-à-vis a BAU scenario of not prioritizing roads development linking agro-production areas to markets. Extrapolate impacts over time to 2035 & over space - coverage of all agro-ecological zones of Cameroon.

<u>Scenario 4</u>: forecast the climate impact (forest sinks preserved / enhanced etc.) & socioeconomic impact (net income & jobs created in agriculture at farm level & in agro-forestry including tree seedling enterprises, net GDP increases) of prioritizing agro-forestry approaches to grow food vis-à-vis a BAU scenario of ordinary / conventional, non-agro-forestry agriculture approaches. Extrapolate impacts over time to 2035 & over space - coverage of all agro-ecological zones of Cameroon.

<u>Scenario 5</u>: forecast the climate impact (transport emissions mitigated, paper production carbon mitigated) & socioeconomic impact (net income & jobs created in ICT, net GDP increases, cost savings of using ICT apps compared to physical travelling & paper process) of using ICT mobile applications to link farmers & processed agro-produce enterprise to demand markets & suppliers vis-à-vis a BAU scenario of using paper processes that deplete forests & may cost more & physical travelling which emits more emissions & costs more. Extrapolate impacts over time to 2035 & over space - coverage of all agro-ecological zones of Cameroon.

To run the above scenarios, dummy data and data from different projects which share a context like Cameroon is being used. In addition, data from operating the component 1 ground demonstration of cassava being processed to flour using micro-hydro & solar driers and linked to markets using a mobile app is being collated to provide baseline data on costs & benefits from which extrapolation can be done. The current version of the model is limited to running the above scenarios which were deemed most representative of prevailing Cameroon socioeconomic development priorities & climate aims as derived from the vision 2035, the Cameroon NDCs and refined during the in-country scoping meetings. Going forward, the model logic of maximizing both climate & socioeconomic aims simultaneously will be expanded to cover additional scenarios of climate & development priorities that will come online as the country ascends to higher order levels of development. This will open further collaboration opportunities similar to the capacity enhancements provided by this project.

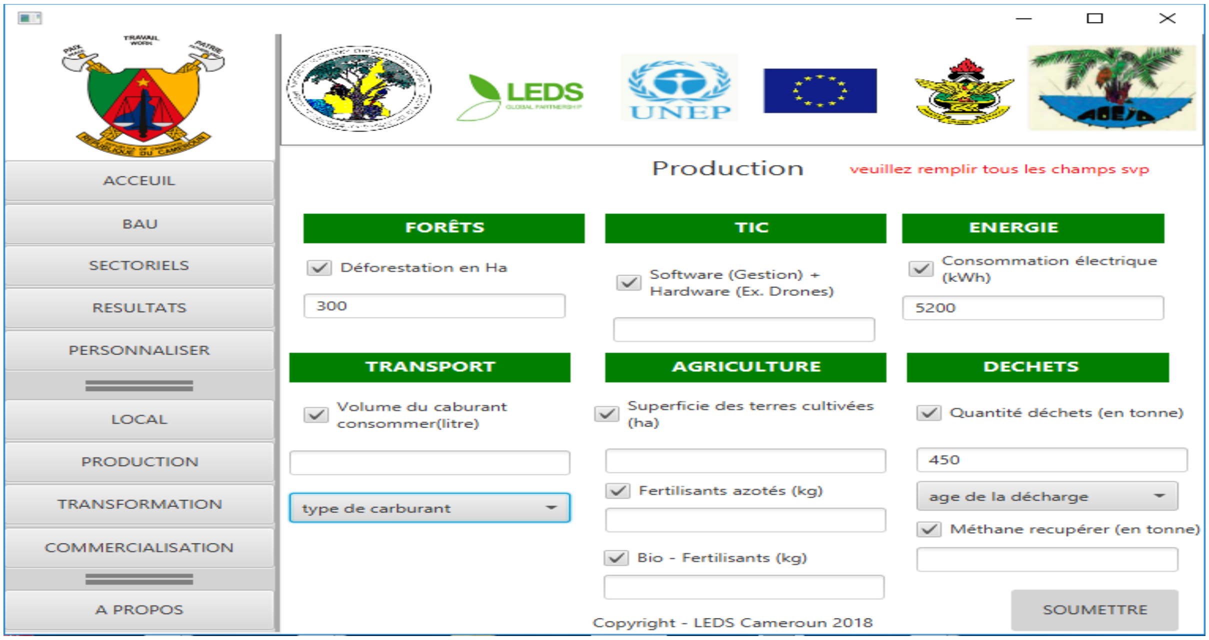
This work is enhancing domestic policy planning & technical capacity towards catalysing Cameroon's transition to the low emissions development pathway. Specifically, to the modelling team, the key value added by this work is enhancement of technical knowledge to model & forecast both climate & socioeconomic aims simultaneously. This is an improvement from the business as usual approach where focus has been on modelling silo climate impacts, without prioritizing socioeconomic aspects which are a critical incentive to drive country-led transition to the low emissions pathway. Additionally, technical capacity has been enhanced ensuring the team can model optimal combinations across complementary sectors with the end-goal of establishing economy-wide synergy towards maximizing both climate & socioeconomic benefit of the country's investments in implementing NDCs. This is also an improvement from the business as usual approach where sector impacts are considered in silos to lose out on potential for synergy across different sectors that is critical to maximizing government-wide benefits.

At the policy level, this work is enabling coherent government-wide policy planning & implementation towards actualizing Cameroon's NDCs & socioeconomic development priorities. This is especially so considering that while NDCs & low emissions progress is domiciled in the Ministry of Environment, the accredited entity to report country progress to the UNFCCC, actual implementation actions occur in other productive ministries. The implication therefore is that policy processes across the different ministries must be synchronized. The model which will be integrated into decision making processes across government will provide a tool to enable the necessary policy collaboration & synchronization.

Once finalized, the entire model will be handed over to the Ministry of Environment which is the lead in NDCs implementation progress monitoring and the government focal point on this work. It is through this ministry that it will be integrated into decision making frameworks across all the other key ministries to harmonize policy planning & Implementation for government-wide coherence in NDCs & vision 2035 implementation investment efforts. Any training for policy makers in using the model including maintenance will be conducted by the University of Yaoundé & coordinated through the Ministry of Environment

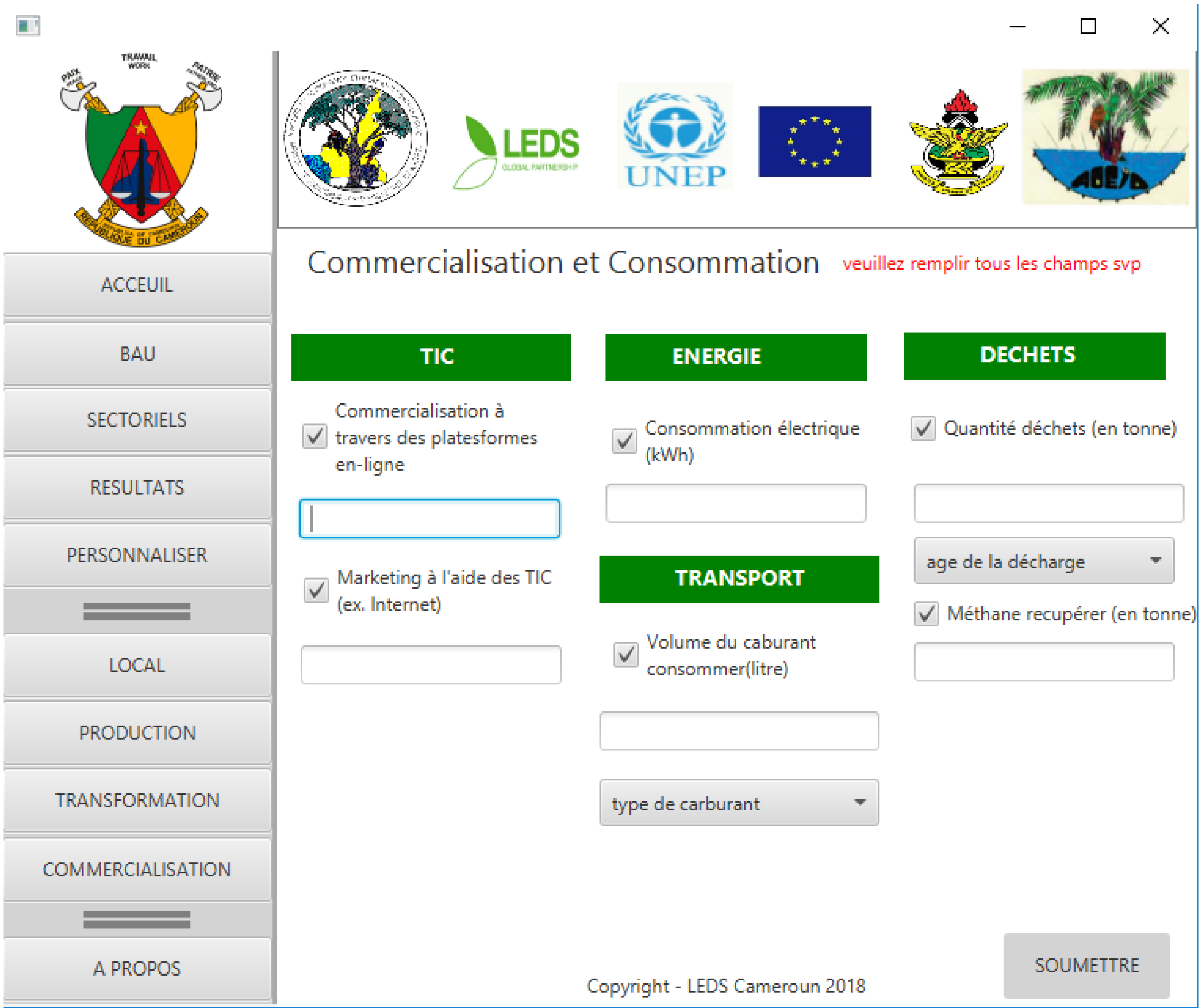
The following are screenshots from ongoing test runs of the model;

Home page of the Cameroon indigenous model

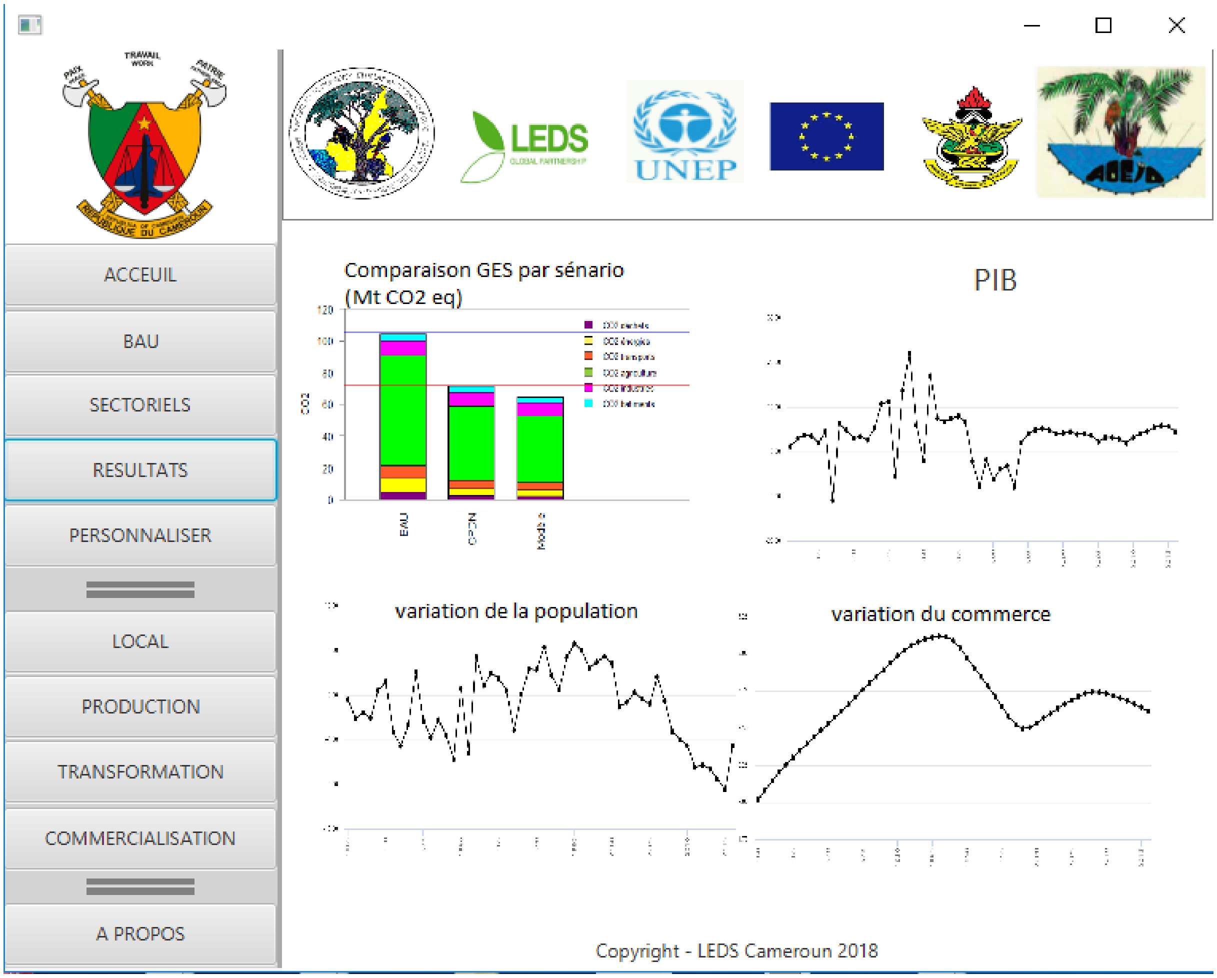


Calculation page of emissions related to production

Calculation page of emissions related to processing / value addition / transformation



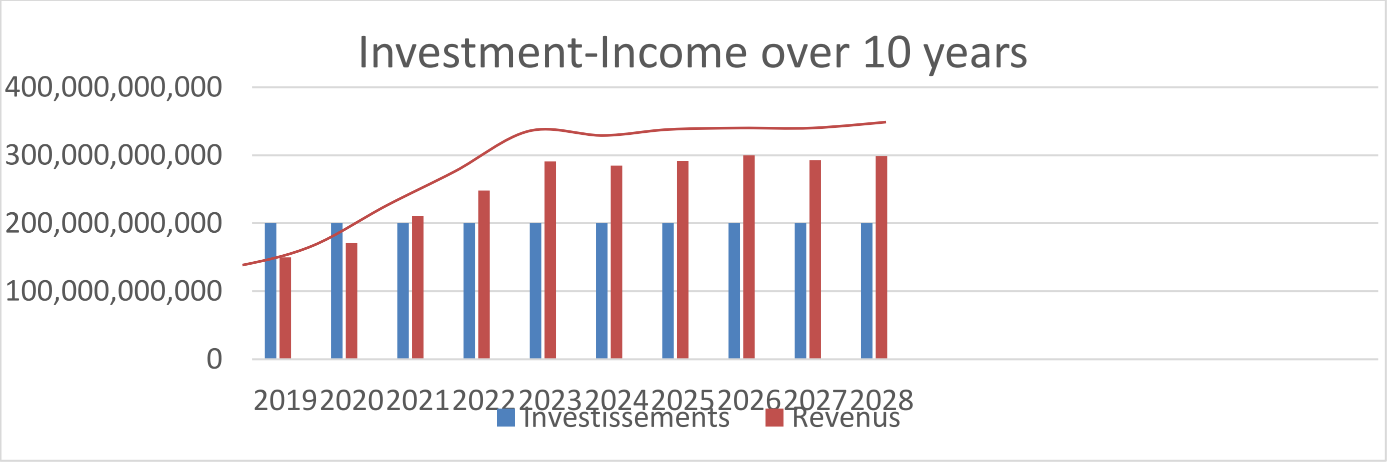
Calculation page of emissions related to consumption



Results page showing socioeconomic aspects (GDP, population & trade) vis-à-vis emissions.

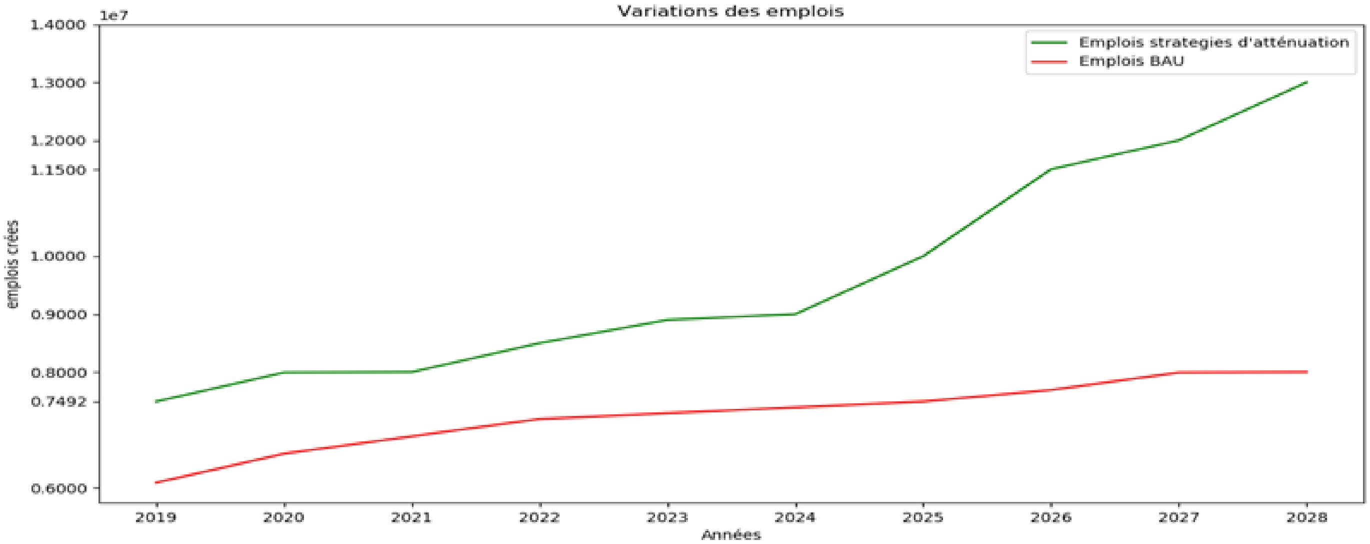
Using data from the ongoing ground demonstrations, the model indicates that the chosen investment trajectory in NDCs implementation of ***greening and maximizing productivity of Cameroon's agro-value chains using energy, transport & ICT***, will break even by 2021. This will be accompanied by energy cost savings, creation of jobs across multiple sectors - agriculture, ICT, transport & energy sectors – and accompanying progressive reduction of emissions. This is relative to BAU investment trajectories where investment in these sectors is conducted in silos rather than in complementarity and where climate considerations as expressed in NDCs are not factored in. The following screenshots illustrate results of this test-run.

Results page indicating rapid break even & better return on investment



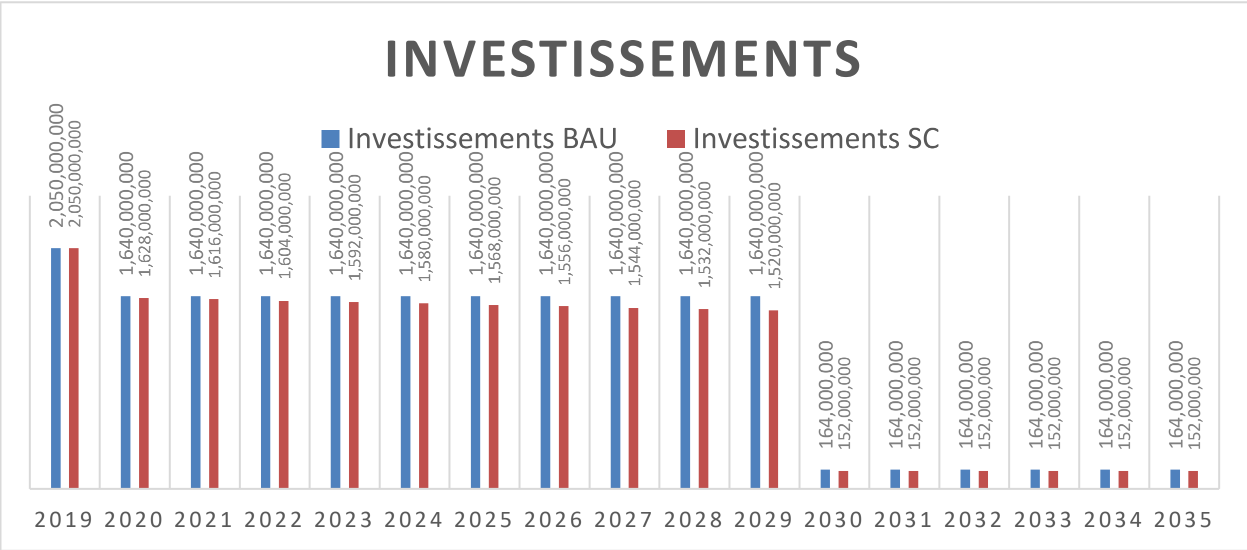
Results page indicating implementing NDCs by investing to green and maximise productivity of Cameroon's agro-value chains using energy, transport & ICT by upscaling actions being demonstrated under component 1 to cover all the 5 agro-ecological zones of Cameroon will break even by 2021 and that revenues will almost double investment costs in 10years.

Results page: more jobs created



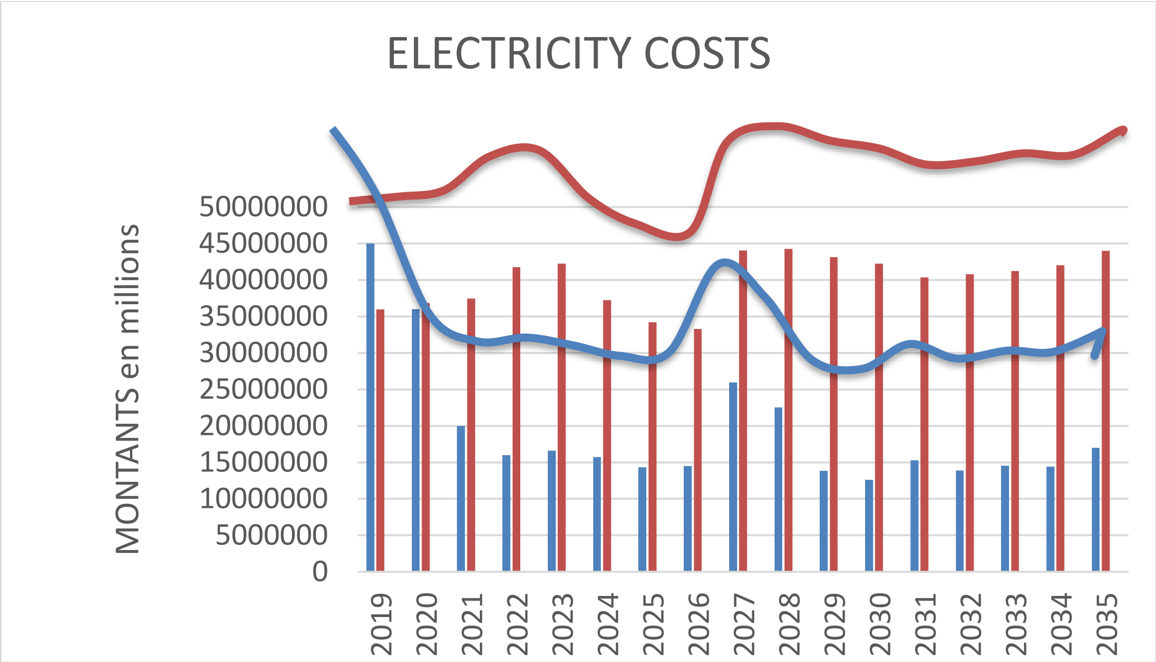
Results page indicating implementing NDCs by investing to green and maximise productivity of Cameroon's agro-value chains using clean energy, transport & ICT by upscaling actions being demonstrated under component 1 will produce 13million assorted jobs along the agro-value chain including in ICT, clean energy & transport. A BAU scenario of silo investmemt by sector will at best produce only 8million jobs.

Results page: lower investment costs



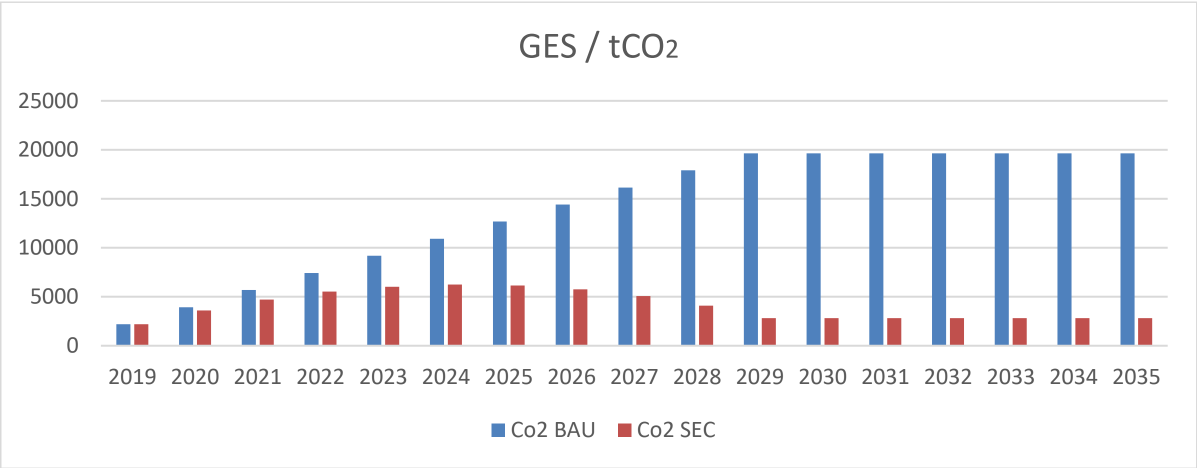
Results page indicating implementing NDCs by investing to green and maximise productivity of Cameroon's agro-value chains using clean energy, transport & ICT by upscaling actions being demonstrated under component 1 will incur much lower investment costs compared to a BAU scenario of silo investment by sector.

Results page: lower energy costs



Results page indicating investing in off-grid clean energy electrification to power greening agro-value chain will cost less than BAU grid connections & diesel generators in place.

Results page: more effective mitigation



Results page indicating implementing NDCs by investing to green and maximise productivity of Cameroon's agro-value chains using clean energy, transport & ICT by upscaling actions being demonstrated under component 1 will mitigate more carbon than a BAU scenario of silo investment by sector.

Next steps

The following measures are envisaged:

- Finalize additional test running of all the 5 scenarios and validating model with additional data from the component 1 ground demonstrations.
- Work as needed with the Ministry of Environment to transfer and install models into decision structures of the relevant line ministries through the inter-ministerial policy task force.

3.2.1.2 Key accomplishments in Côte d'Ivoire

- The Côte d'Ivoire modelling team led by Prof. Veronique Yoboue of the University of Felix Houphouët Boigny shortlisted LEAP, EX-ACT and T21 as the models to build. LEAP and EX-ACT were identified to support GHG emissions impacts, energy/resource shifts and costs/savings, while T21 is to support socio-economic assessment.

- A capacity enhancement workshop led by the project technical team from Centre for Climate Strategies (CCS) led to further refinement of model selection with introduction of the CCS Analytical Toolkit and the Côte d'Ivoire Geographic Information Systems (GIS).

- LEAP and EX-ACT have been adapted to run project level emissions scenarios of waste to energy & waste to biofertilizer respectively. Primary data for these models has been compiled from the ongoing ground demonstrations while secondary data has been obtained through desk studies of similar actions in areas that share the country's context.

- The CCS tool is now being adapted to run socioeconomic parameters instead of T21 since the CCS tool, unlike T21, is freely available.

- A plan of action in combining these models into a derivate enhanced model that can simultaneously forecast climate & socioeconomic impacts of the strategic thrust to NDCs implementation chosen by Côte d'Ivoire of rice-waste to energy and biofertilizer has been finalised. Accordingly, the output of the EX-ACT tool will be input into the LEAP model and the LEAP outputs as input data into the CCS Tool.

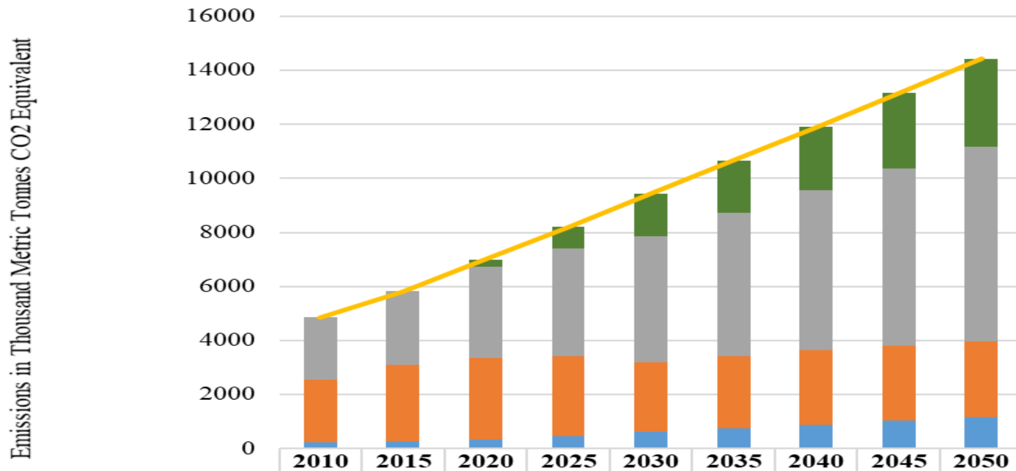
The following screenshots capture the EX-ACT & LEAP emissions runs;

EX-ACT results page: waste-to-biofertilizer run indicates that use of biofertilizer from waste instead of BAU scenario of using mineral fertilizer and decomposing waste in landfills will reduce the country's carbon footprint by 2143.57 tonnes CO_2eq or about 16.42% of GHG emissions. The balance sheet analysis also shows an emission factor of -0.71 tonnes CO_2eq / ha / year for the implementation of this scenario.

Nom du Projet	*projet Gagnoa*	Zone climatique	*Tropical (Humide)*	Durée du Projet (en années)	*20,00*
Continent	*Afrique*	Type de sol dominant	*Sols à argiles 1:1*	Surface totale (ha)	*150,50*

Composantes du projet	Flux bruts Sans	 Avec	 Bilan	Répartition du blian par type de GES Tous les GES en tCO2eq CO2 Biomasse	 Sol	 Autre	 N2O	 CH4	Résultats par an Sans	 Avec
	Tous les GES en tCO2eq Positif=émission / négatif=puits									
Changements d'Usage										
Déforestation	-	-	-	-	-		-	-	-	-
Boisement	-	-	-	-	-		-	-	-	-
Autres CUT	-	-	-	-	-		-	-	-	-
Agriculture										
Annuelle	-	-	-	-	-		-	-	-	-
Pérenne	-	-	-	-	-		-	-	-	-
Riz	13 227,09	11 623,20	- 1 603,89	-	-		- 262,46	- 1 341,43	661,35	581,16
Patûrage & bétail										
Patûrage	-	-	-	-	-		-	-	-	-
Bétail	-	-	-				-	-	-	-
Dégradation et gestion	-	-	-	-	-		-	-	-	-
Coastal wetlands	-	-	-	-	-		-	-	-	-
Intrants & Investissements	1 974,21	1 434,53	- 539,68			- 1 160,00	620,32	-	98,71	71,73
Fishery & Aquaculture	-	-	-			-	-	-	-	-
Total	15 201,30	13 057,73	- 2 143,57	-	-	- 1 160,00	357,87	- 1 341,43	760,06	652,89
Par hectare	101,01	86,76	- 14,24	- 7,71	-	- 7,71	2,38	- 8,91		
Par hectare et par an	5,05	4,34	- 0,71	- 0,39	-	- 0,39	0,12	- 0,45	5,05	4,34

LEAP results page: waste-to-energy run: indicates that reducing by 15 – 25%, the amount of waste burned in the fields for the rice sector alone and converting it to briquettes to replace charcoal in households, businesses and utilities will prevent the burning of over 3million cubic metres of wood by 2050.



	2010	2015	2020	2025	2030	2035	2040	2045	2050
Reduced emissions with scenario	0	0	269	794	1596	1947	2342	2782	3267
Non Energy emission with scenario	2290	2712	3371	4008	4646	5284	5922	6560	7198
Transformation emissions with scenario	2337	2836	3028	2945	2569	2680	2753	2789	2790
Demand emission with scenario	226	271	325	457	629	751	884	1027	1180
Emission BAU	4853	5819	6993	8204	9440	10662	11901	13158	14435

Years

Next steps

- Integrate the CCS toolkit to EX-ACT & LEAP for socioeconomic impacts of waste-to-energy & waste-to-biofertilizer. The following six macro-economic factors will be used;

Macroeconomic factors	Explanation
Overall Net Policy Cost vs. BAU	the option's total collection of costs and savings outperforms the expected net cost of the business as-usual scenario without the policy in place
Avoided Energy Spending	shift to net efficiency, or higher energy savings than use
Shift in Local Energy Sources	shifting from imported to local energy sources and production
Shift in Local Supply Chains	expands activity in sectors that buy inputs to production from other local sectors
Shift in Job Creation	shifting to more labour intense activities compared to baseline.
Shift in Imports / Exports	Net reduction in imports

- Validate model and handover to the Ministry of Environment, the government's focal point for this work and the Prime Minister's Office coordinating NDCs implementation across all government ministries.

- Work as needed with the Prime Minister's Office and the Ministry of Environment to transfer and install models in policy decision structures of the relevant line ministries responsible for energy, agriculture, waste & environment.

3.2.1.3 Key accomplishments in the Democratic Republic of the Congo

Using data being gleaned from the component 1 action of waste-to-energy with linkage to enhancing the country's REDD+, four scenarios have been shortlisted to upscale this paradigm across the country;

a. business as usual (BAU): continuing with the high use of fuelwood;

b. government intervention (GI): based on government's plans to introduce improved fuelwood, the use of briquettes and biogas stoves;

c. further intervention (FI): assumed a much higher proportion of improved use of briquettes and biogas stoves as planned by the government; and

d. High Economic Growth (HEG): Assumes an increase in the use electric stoves, kerosene and biogas stoves for cooking.

For each scenario, level of investment has been projected as follows using excel modelling;

Useful Energy, Fuels and Stoves	Base Year	Business as Usual (BAU)			Government Intervention (GI)			Further Intervention (FI)			High Economic Growth (HEG)		
	2000	2020	2035	2050	2020	2035	2050	2020	2035	2050	2020	2035	2050
Total useful energy (PJ)	**486,93**	**1367,84**	**2967,98**	**6440,01**	**2367,84**	**3513,44**	**6440,01**	**2367,84**	**288829,48**	**626682,17**	**2620459,58**	**306131,05**	**659558,84**
Contribution to useful energy (%)													
Fuel wood	79,0%	79,0%	79,0%	79,0%	45,7%	66,8%	61,6%	45,7%	31,2%	37,1%	0,3%	0,2%	0,2%
Charcoal	15,0%	15,0%	15,0%	15,0%	8,7%	12,7%	11,7%	8,7%	5,9%	7,0%	0,1%	0,0%	0,0%
Improved fuel wood	0,6%	0,6%	0,6%	0,6%	0,3%	0,5%	0,4%	0,3%	0,2%	0,3%	0,0%	0,0%	0,0%
Kerosene	5,3%	5,3%	5,3%	5,3%	3,1%	4,5%	4,2%	3,1%	2,1%	2,5%	94,9%	89,5%	90,7%
Electricity	0,1%	0,1%	0,1%	0,1%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
Agricultural residue(Briquette)	0,0%	0,0%	0,0%	0,0%	38,4%	7,8%	11,0%	38,4%	30,2%	26,5%	2,4%	3,4%	2,1%
Biogaz	0,0%	0,0%	0,0%	0,0%	3,8%	7,8%	11,0%	3,8%	30,2%	26,5%	2,4%	6,8%	6,9%
Total	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
Number of stoves (1000s)													
Fuel wood	38491,20	108125,69	234614,28	509072,94	108125,69	234614,28	509072,94	108125,69	234614,28	509072,94	108125,69	234614,28	509072,94
Charcoal	7301,80	20511,50	44506,45	96571,39	20511,50	44506,45	96571,39	20511,50	44506,45	96571,39	20511,50	44506,45	96571,39
Improved fuel wood	274,00	769,69	1670,10	3623,84	769,69	1670,10	3623,84	769,69	1670,10	3623,84	769,69	1670,10	3623,84
Kerosene	1300,75	3653,94	7928,42	17203,32	3653,94	7928,42	17203,32	3653,94	7928,42	17203,32	7307,88	23780,00	47560,00
Electricity	9,88	27,75	60,22	130,67	27,75	60,22	130,67	27,75	60,22	130,67	27,75	60,22	130,67
Agricultural residue(Briquette)	0,00	0,00	0,00	0,00	0,10	3,00	10,00	10,00	25,00	40,00	100,00	500,00	600,00
Biogaz	0,00	0,00	0,00	0,00	0,10	3,00	10,00	1,00	25,00	40,00	100,00	1000,00	2000,00
Total	**47377,63**	**133088,57**	**288779,48**	**626602,17**	**133088,77**	**288785,48**	**626622,17**	**133099,57**	**288829,48**	**626682,17**	**136942,51**	**306131,05**	**659558,84**

Next steps

- The contribution of the various energy options to the useful energy of DRC is not enough. The number of jobs, incomes, savings etc., as well as the carbon sequestered by the use of this energy needs to be captured to complete the logic behind the component 1. This is the basis for the modelling under component 2.

- Hence, for each of the 4 scenarios highlighted the DRC team will establish the socioeconomic (jobs created; %GDP increased; income increases / cost savings) & climate (carbon emissions mitigated in energy generation; carbon sinks enhanced by minimizing deforestation through limiting use of charcoal & firewood) of using waste-to-energy (clean cook stoves of biogas & briquettes) in households & eateries/restaurants vis-à-vis a BAU scenario of using firewood, charcoal & kerosene in households & eateries/restaurants.
- Test model runs using data from the component 1 ground demonstration

- Transfer models to policy makers for use through the GHG inventory team.

3.3 Component 2-only countries

3.3.1 Key accomplishments in Kenya

The Kenya team is led by Mr. David Adegu who is the GHG Inventories coordinator under the Climate Change Directorate in the Ministry of Environment & Forestry. Key accomplishments in the period include

- A capacity enhancement workshop led by project technical team from NREL resulted in the Kenya team shortlisting LEAP & IJEDI models to run scenarios of their chosen project level priorities of agro-forestry & clean cook stoves. Accordingly, LEAP will focus on energy while IJEDI will focus on socioeconomic impacts for both energy & agroforestry.

- Kenya modelling team with support from the technical team from NREL has begun adapting LEAP to run clean cook stoves & IJEDI for socioeconomic impacts in both agroforestry & clean cookstoves.

- The Kenya team has been linked to Mozambique team experienced in successfully using ABACUS for agroforestry for peer learning in adapting ABACUS to run agroforestry project level scenarios in Kenya.

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Next steps

- Finalize adapting the LEAP model to forecast climate (energy generation / use carbon mitigated, forest sinks preserved enhanced) & socioeconomic (jobs created, %GDP increase, income increases, cost savings) impacts or NPV of an investment trajectory of upscaling clean cook stoves projects / /use of clean cookstoves in restaurants, eateries & households vis-à-vis a BAU scenario of using charcoal, firewood, kerosene cooking facilities in the same settings and extrapolate impact over time (up to 2030) and space (coverage of several to all 47 counties in the country). Plug in IJEDI to refine socioeconomic parameters. Run model and document results.

- Work with Mozambique team to adapt the ABACUS model to forecast climate (forest sinks enhanced) & socioeconomic (jobs created; household income savings, %GDP increased etc.) impacts or NPV of an investment trajectory upscaling agroforestry projects in farms across Kenya vis-à-vis BAU scenario of conventional / non-agroforestry farming projects and extrapolate impact over time (up to 2030) and space (coverage of several counties and all 47 counties). Plug in IJEDI to refine socioeconomic parameters. Run model and document results.

- Amalgamate the above two project types for synergy towards maximizing cumulative impacts.

Explore following three options; first is hard linking LEAP & ABACUS which involves software patches that will make LEAP & ABACUS compatible to operate as one integrated model. The second approach is soft-linking. Where the output from one model is used as input for the next model to calculate the cumulative impact. The third option is manual combination using simple arithmetic computations - manually add-up results of matching parameters to compute a net score for each parameter. Plug in IJEDI to refine socioeconomic scenarios.

- Test model runs using dummy data or data from similar projects implemented in areas sharing Kenya's context.

- Transfer models to policy makers for use through the climate change secretariat in the Ministry of Environment.

3.3.2 Key accomplishments in Ghana

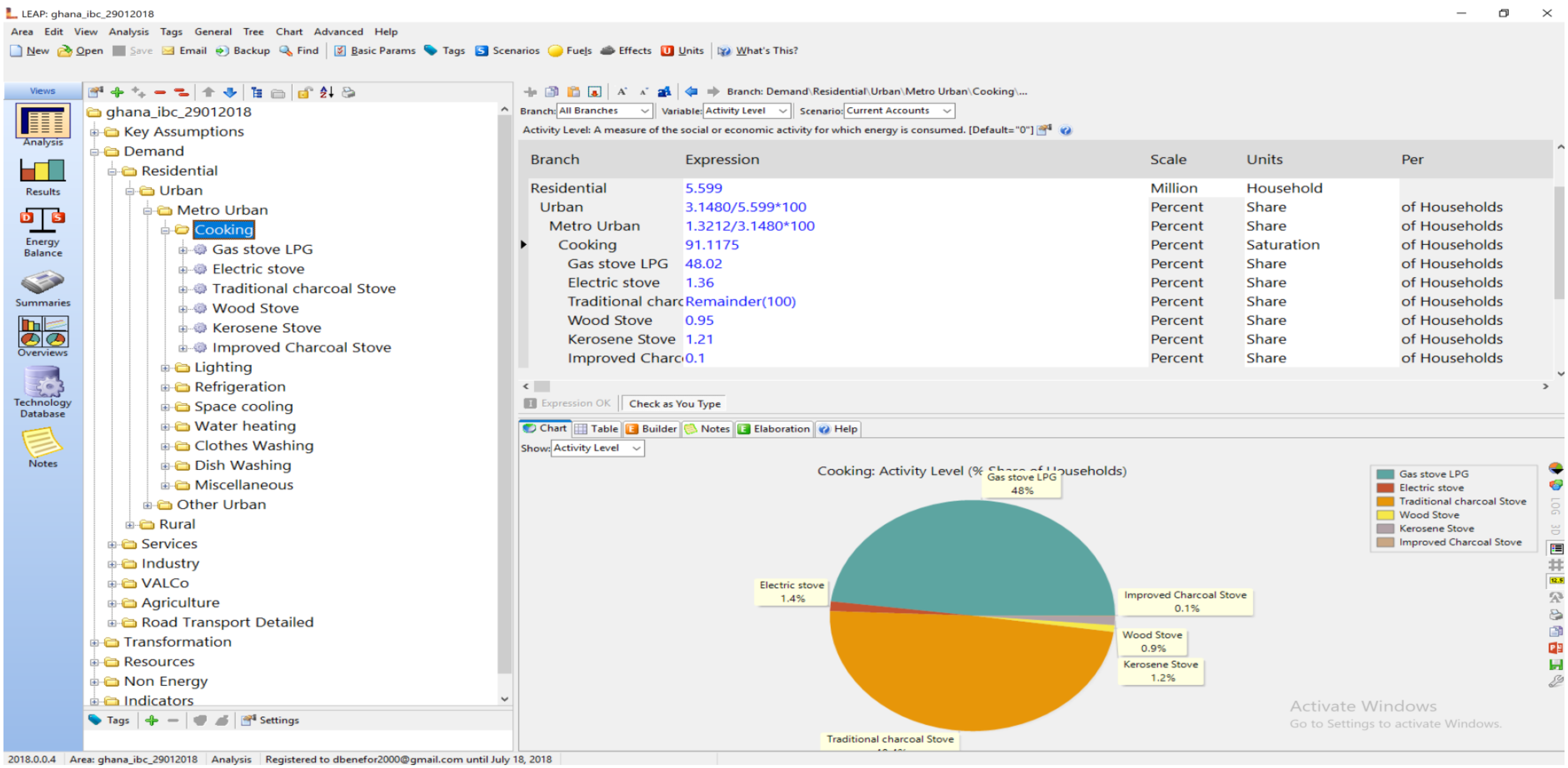
The Ghana modelling team is led by Kyekyeku Oppong-Boadi and Mr. Daniel Tutu Benefoh of the Ghana Environmental Protection Agency (EPA). Ghana stakeholders chose clean cookstoves & agroforestry as the project priorities to maximize both climate & socioeconomic benefits of Ghana's

NDCs implementation. To model scenarios, the Ghana modelling team has adapted an improved version of the LEAP model, called LEAP-IBC, to run clean cookstoves scenarios.

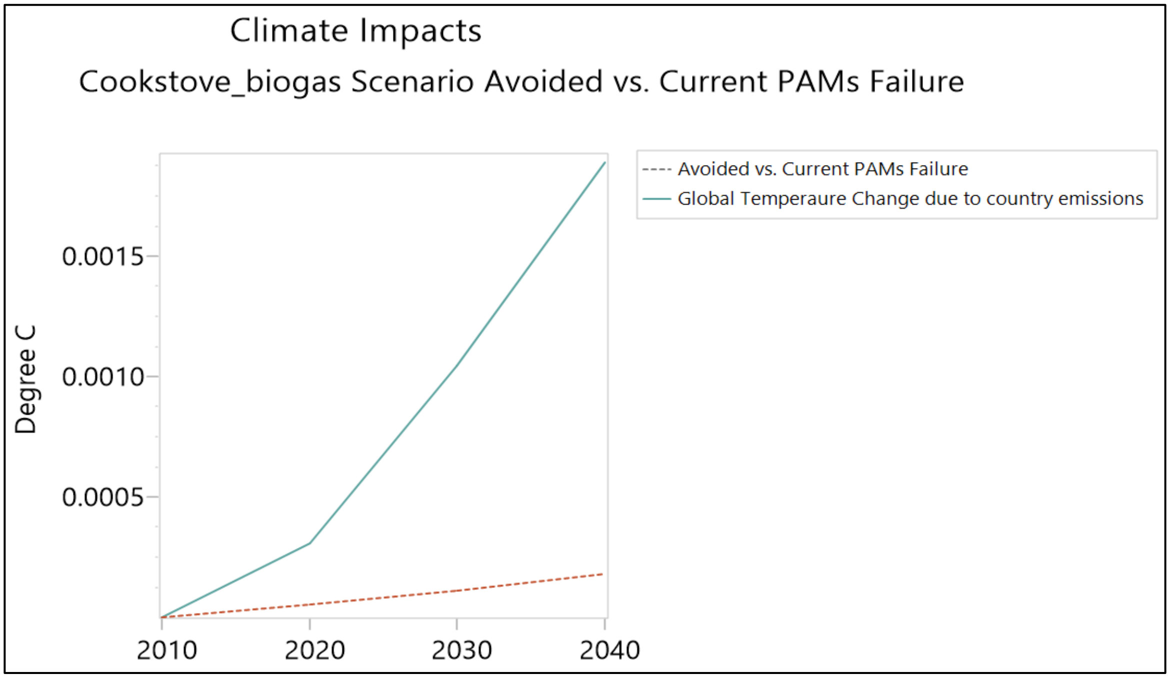
- Accordingly, the test runs have been conducted. They show remarkable climate & health benefit of clean cookstoves. Reducing CO_2 emissions by up to 25%, relative to a BAU scenario by 2040, and reducing emissions of fine particles ($PM_{2.5}$) that drive indoor pollution in domestic cooking, a major cause of respiratory complications by 37% relative to BAU scenario by 2040. The model shows that with widescale adoption of clean cookstoves, Ghana can save an estimated 599 lives from succumbing to black soot related health complications. Climate-wise, Ghana will reduce its contribution to global emissions by 8.7% by 2040 relative to BAU approaches. Such forecasts are critical to inform investment policies in Ghana to drive transition to the low emissions pathway.

- Ghana team linked with the Mozambique modelling experts for peer learning on how to adapt ABACUS model to run agroforestry scenarios.

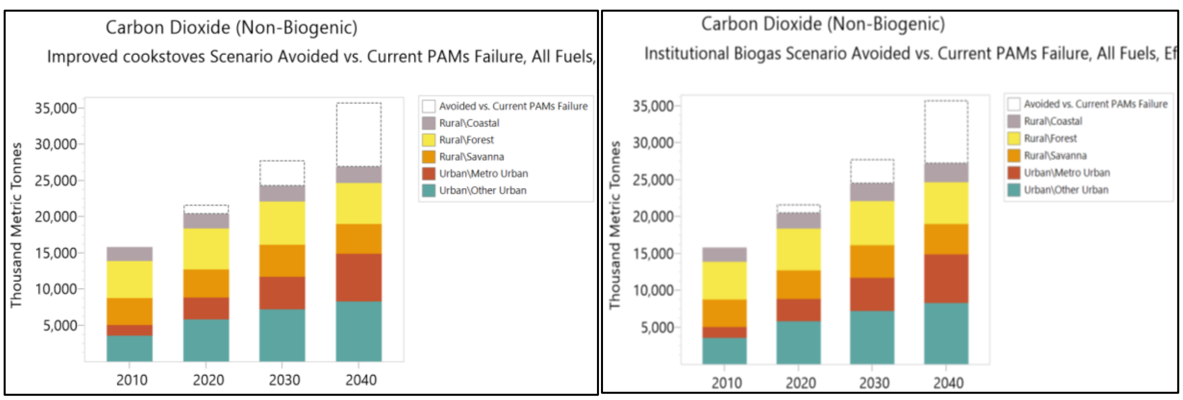
The cascade of test runs showing the successful adaptation of LEAP is in the following screenshots;



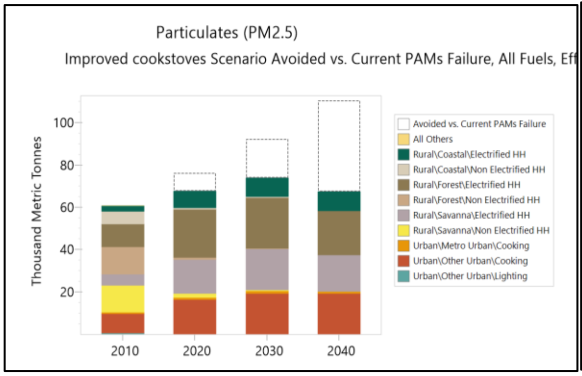
Current account template of the LEAP-IBC adapted for clean cookstoves - showing the cooking technology share in metro urban areas of Ghana

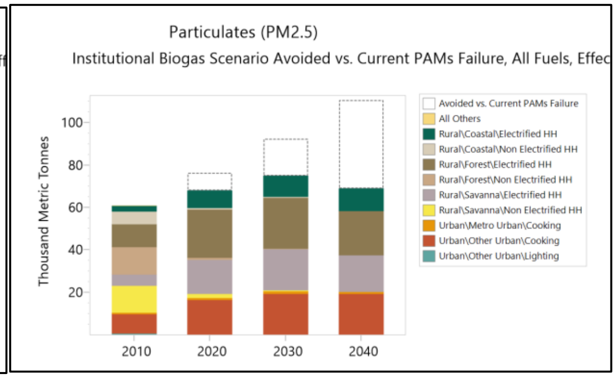


Screenshot: Global emissions avoided – adoption of clean cookstoves vis-à-vis BAU scenario

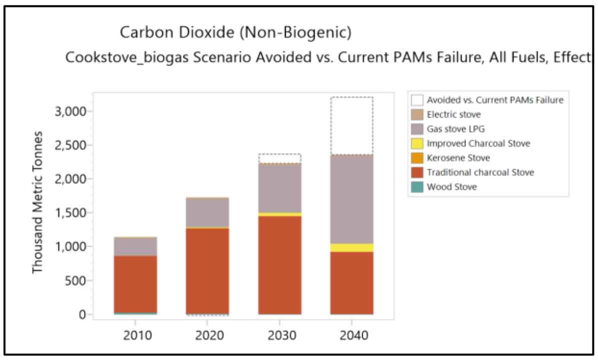


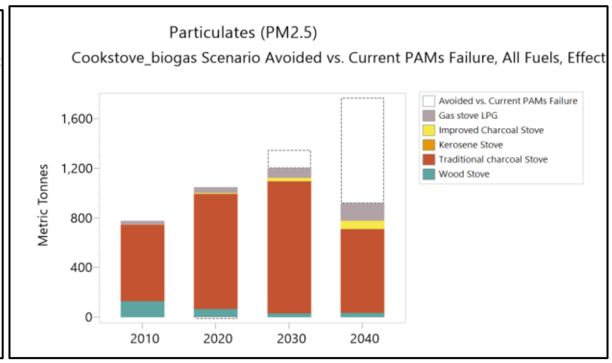
Non-biogenic CO_2 emissions savings from the adoption of improved cookstove and biogas technology



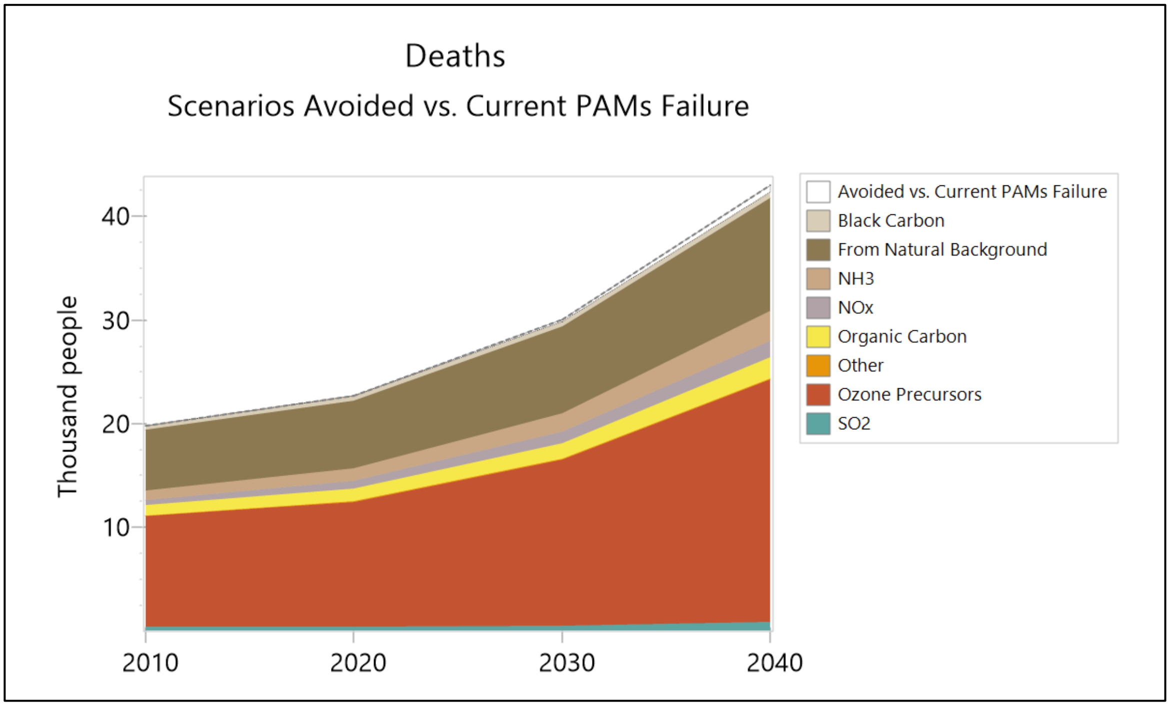


Particulate emissions / soot ($PM_{2.5}$) emissions savings from the adoption of improved cookstove and biogas technology. It is such soot that drives respiratory complications from indoor pollution.





CO_2 and $PM_{2.5}$ aggregate emissions savings from the adoption of improved cookstove and biogas technology



Demonstration of health co-benefits: potentially avoided deaths by adoption of clean cookstoves

Next steps

- Account for socioeconomic aspects of a clean cookstoves trajectory. The current LEAP runs have focused on emissions. Consequently, adapt the LEAP model to forecast socioeconomic impacts (jobs created, %GDP increase, income increases, cost savings) / NPV of an investment trajectory of upscaling clean cook stoves projects/use of clean cookstoves in restaurants, eateries & households vis-à-vis a BAU scenario of using charcoal, firewood, kerosene cooking facilities in the same settings and extrapolate impact over time (up to 2020/30) and space (coverage of entire country). Run this model and document results.

- Run scenarios for agroforestry. Work with Mozambique team to adapt the ABACUS model to forecast climate impacts (forest sinks enhanced) & socioeconomic impacts (jobs created – in agriculture & along forestry value chain, especially supply of seedlings; household cost savings, %GDP increased etc.) / NPV of an investment trajectory upscaling agroforestry projects in farms across Ghana vis-à-vis BAU scenario of conventional / non-agroforestry farming projects and extrapolate impact over time (up to 2020/30) and space (coverage of entire country). Run model and document results.

- Run the combined clean cookstoves, agroforestry scenario for cross-sectorial synergy to maximize benefits. Accordingly forecast the cumulative socioeconomic / NPV & climate impacts of upscaling use of clean cookstoves to processes food sourced from agro-forestry farms vis-à-vis BAU scenarios of

a) upscaling clean cookstoves & agroforestry in silos

b) upscaling use of conventional agriculture, non-agroforestry land use practices (given agriculture is most prevalent land use activity employing a majority – up to 80%) and upscaling use of conventional cooking methods – charcoal, firewood, kerosene.

Explore following three options in running amalgamated / combined scenario; first is hard linking LEAP-IBC & ABACUS which involves software patches that will make the two models compatible to operate as one integrated model. The second approach is soft-linking. Where the output from one model is used as input for the next model to calculate the cumulative impact. The third option is manual combination using simple arithmetic computations - manually add-up results of matching parameters to compute a net score for each parameter.

- Test model runs using dummy data or data from similar projects implemented in areas sharing Ghana's context.

- Transfer models to policy makers for use through the multi-sector NDC team that has been expanded into the NDCs interagency policy taskforce team.

3.3.3 Key accomplishments in Zambia

The Zambia modelling team is led by Prof. Francis Yamba of the Centre for Energy, Environment and Engineering (CEEEZ). Zambia stakeholders chose decentralized clean energy sources of solar/wind/micro-hydro & agroforestry as the project priorities to maximize both climate & socioeconomic benefits of Zambia's NDCs implementation.

- The Zambia modelling team in collaboration with technical partners from NREL shortlisted LEAP & IJEDI as the models to build on towards establishing the enhanced integrated model that can simultaneously forecast climate & socioeconomic impacts of their chosen project level priorities.

The team has been collecting data and establishing baselines with support from NREL on the following:

- Data collection and baseline development - energy (off- grid)
- Data collection and baseline development for sustainable agriculture through integrated crop and livestock farming

- Data collection and baseline development for forest enhancement and natural regeneration: Data is yet to be collected
- I-JEDI data requirements: Energy off grid
- I-Jedi data requirements: Sustainable agriculture
- I-JEDI data requirements: Forest enhancement and natural regeneration-data to be collected
- The Ministry has facilitated the team leader's access to the LEAP licence for the purpose of developing LEDS model;
- The Technical Working Group to lead in infusing model for policy decision making has been formally appointed by the Ministry.

Next steps

Accordingly, Zambia is set to run scenarios on clean energy (off-grid solar & wind) & AFOLU (agro-forestry) by adapting LEAP / I-JEDI models as follows;

On energy: using the integrated LEAP / I-JEDI model

- Scaling use of hammermills using diesel as a BAU vis-à-vis scaling using off-grid solar to power hammermills as the transformative low emissions trajectory. Establish socioeconomic benefits of the net cost savings (fuel saved) & NPV of mills and climate benefits (energy emissions abated);

- Scaling irrigating using fossil powered pumps as BAU vis-à-vis scaling using solar powered micro-irrigation as the transformative low emissions trajectory. Establish socioeconomic benefits of the net cost savings (fuel saved) & NPV of irrigation systems and climate benefits (energy emissions abated);

- Scaling cooking using charcoal & firewood as BAU vis-à-vis scaling using clean cookstoves & biogas as the transformative low emissions trajectory. Establish socioeconomic benefits of the net cost savings in buying charcoal, new jobs created in clean cookstoves and climate benefits (forest sinks enhanced / preserved);

On AFLOU: using the integrated LEAP / I-JEDI model;

- Scaling using inorganic fertilizer (which is mostly imported) & pesticide as BAU vis-à-vis scaling using manure & biological pest control e.g. lime usage as the transformative low emissions trajectory. Establish socioeconomic benefits of the net cost savings (fertilizer & pesticide cost), new jobs in organic fertilizer production and climate benefits (fertilizer production emissions abated);

- Conventional farming e.g. slash & burn as BAU vis-à-vis using conservation agriculture approaches (agro-forestry, natural regeneration etc.) farming approaches. Establish socioeconomic benefits of new jobs created in agro-forestry supply chain e.g. tree seedling enterprises and climate benefits (forest sinks enhanced / preserved);

Integrated scenario: amalgamating the energy & AFLOU to maximize benefits using the integrated LEAP / I-JEDI model;

- Forecast the cumulative socioeconomic impact (i.e. jobs created, income increases/cost savings, %GDP increases) / NPV and climate impact (i.e. the mitigation of energy generation carbon) to be realized by an investment trajectory of scaling up use of solar mini-grid powered hammer mills vis-à-vis BAU scenario of using diesel power generator powered hammer mills.

- Forecast the cumulative socioeconomic impact (i.e. jobs created, income increases/cost savings, %GDP increases) / NPV and climate impact (i.e. the mitigation of energy generation carbon; and the enhancement and preservation of forest sinks) to be realized by an investment trajectory of scaling up use of solar powered micro-irrigation vis-à-vis using fossil powered irrigation.

In all cases, impact will be extrapolated over time (up to 2030) and space (coverage of whole country).- Test run models.

- Transfer models to policy makers through the Ministry of Environment.

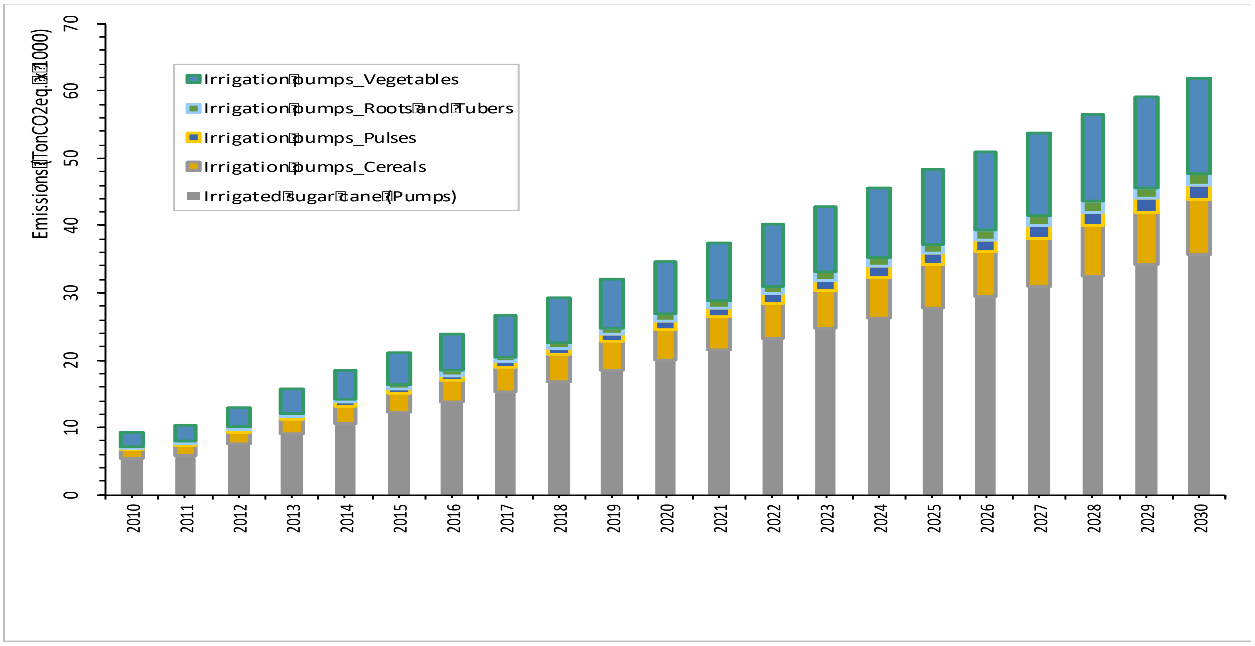
3.3.4 Key accomplishments in Mozambique

The Mozambique modelling team is led by Prof. Almeida Sitoe of the Eduardo Mondlane University. It is the first country to finalise their integrated model. The final report has been published. They are now integrating the model into policy decision structures and providing peer advisory to other countries in line with the peer-to-peer exchanges component. The model will inform optimal policy decisions on investment that will ensure Mozambique not only achieves its NDC aims but simultaneously maximise on its socioeconomic priorities as well. Mozambique prioritised solar powered micro-irrigation and agroforestry as the project priorities most representative of climate & socioeconomic aims of their NDCs.

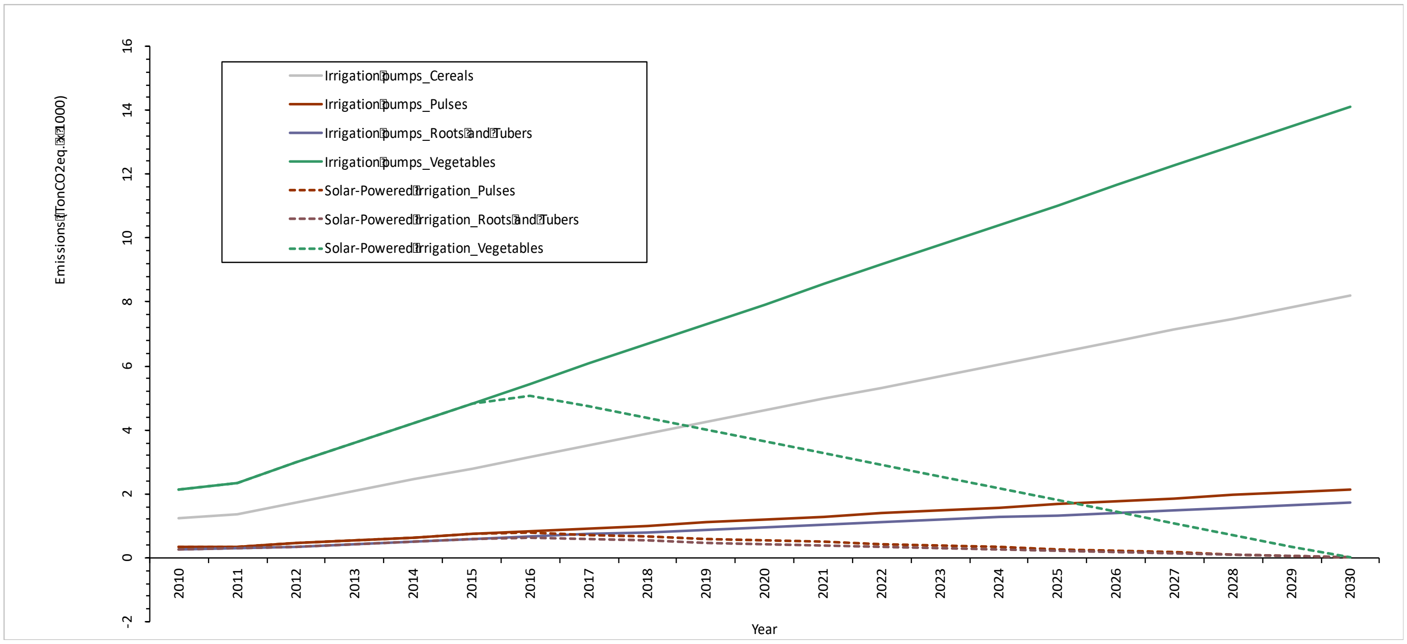
The cascade of test runs showing the successful adaptation of LEAP & ABACUS is in the following screenshots;

EMISSIONS ANALYSIS

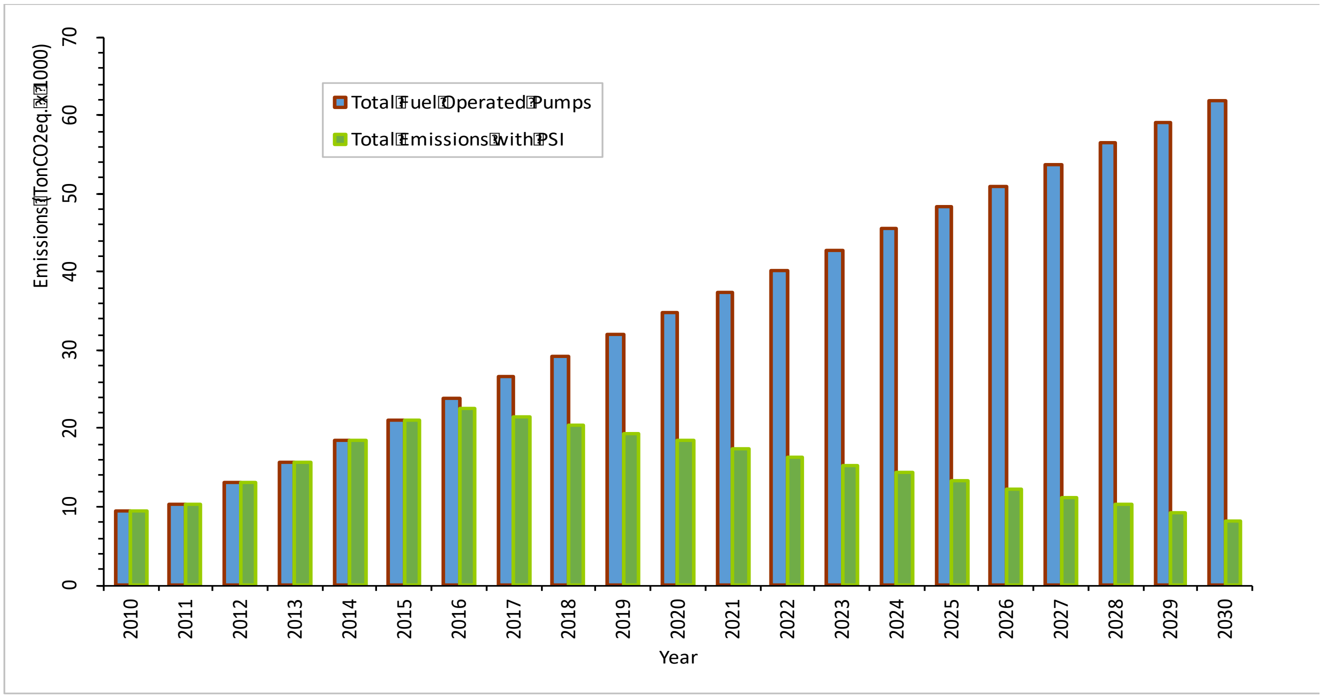
SCENARIO 1: LEAP runs for energy



LEAP run: emissions projection for a BAU investment trajectory (fossil powered irrigation pumps)

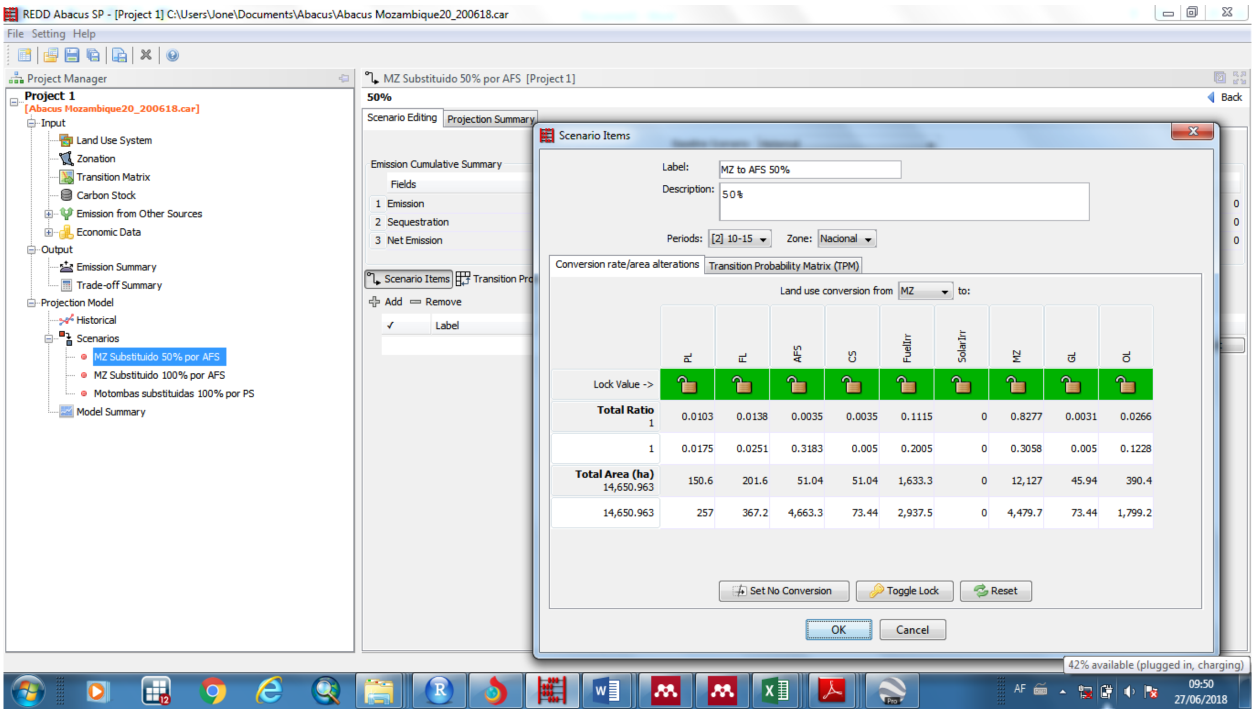


LEAP run – net emissions scenario of replacing conventional fossil powered irrigation with solar powered irrigation

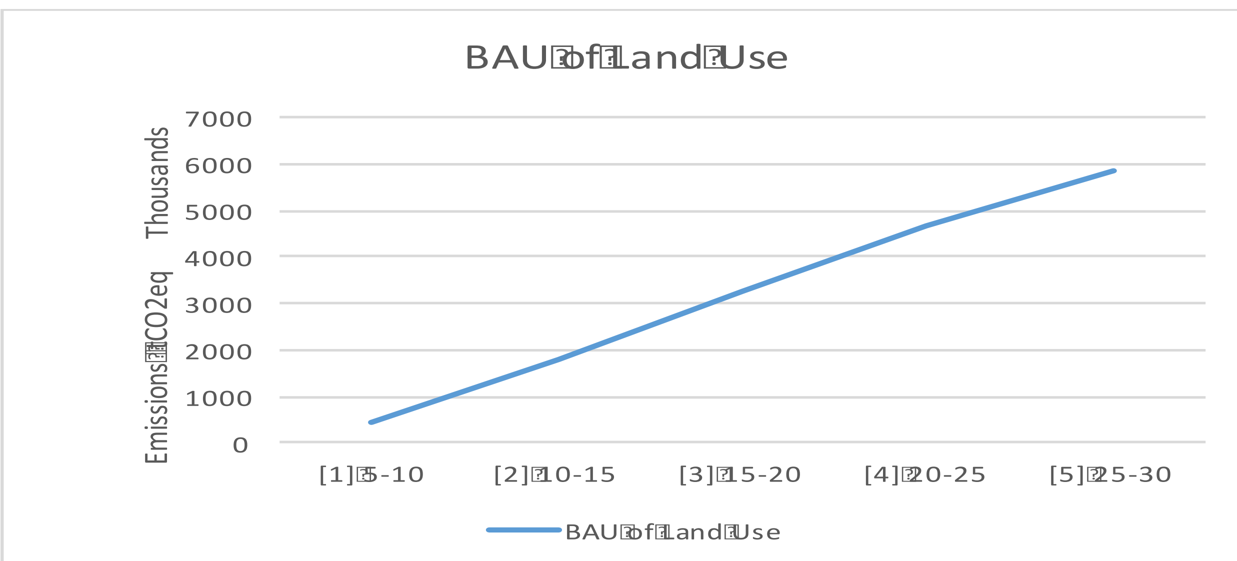


LEAP run – total emissions reduction resulting from scaling solar powered micro-irrigation vis-à-vis BAU scenario of fossil fuel powered irrigation

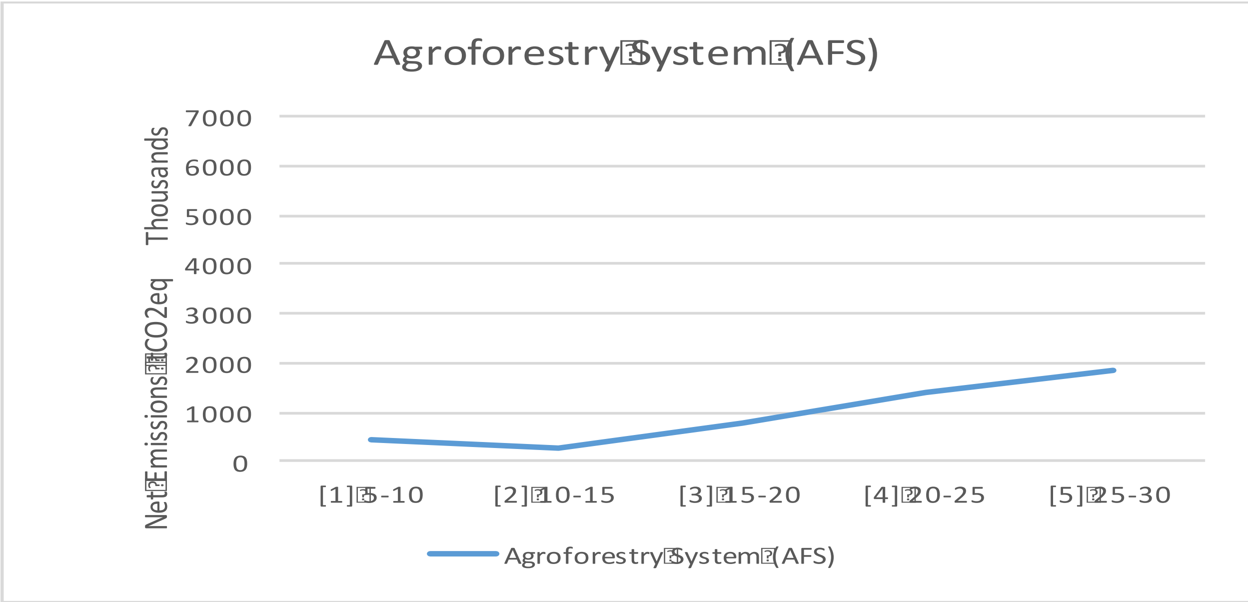
SCENARIO 2: ABACUS runs for agroforestry



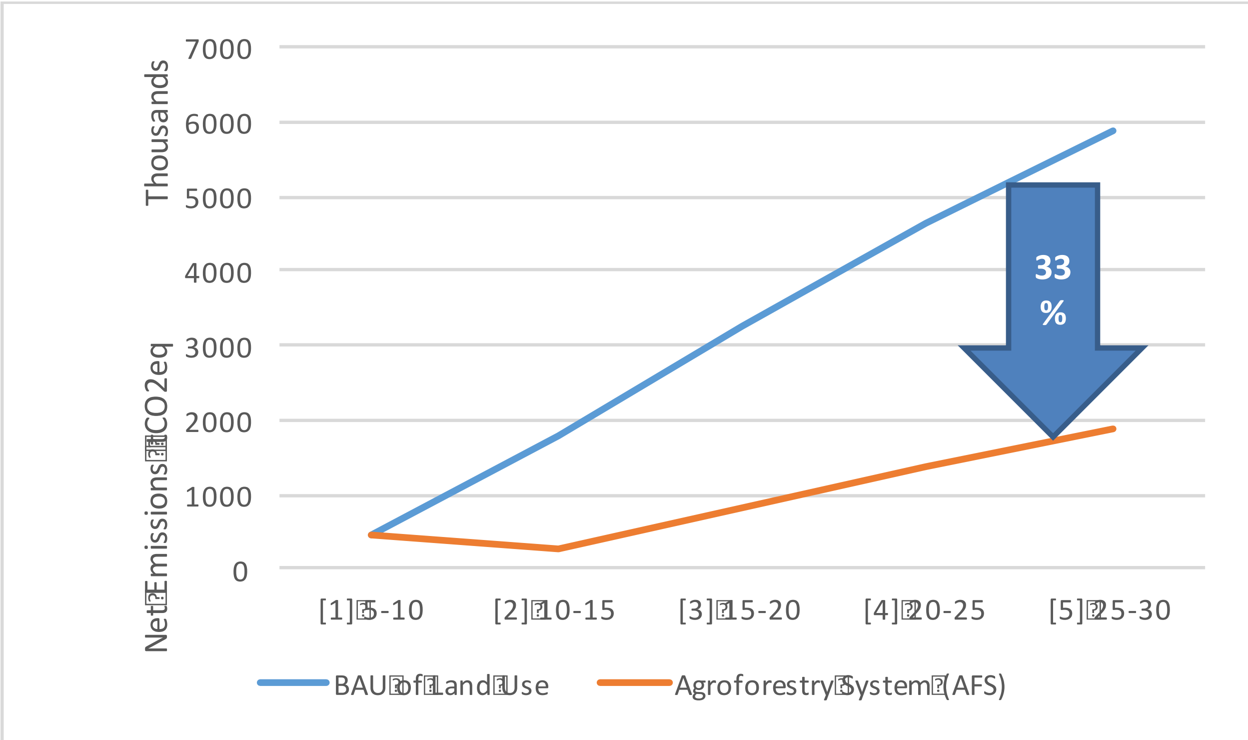
ABACUS user interface adapted to run agroforestry project scenarios



ABACUS run: BAU land use e.g. slash and burn agriculture emissions

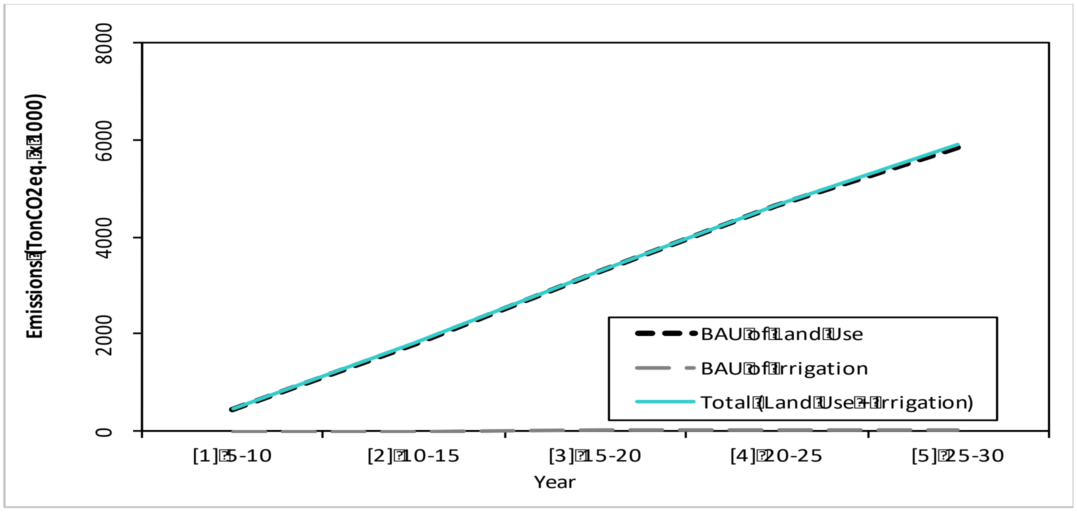


ABACUS run: emissions for agroforestry

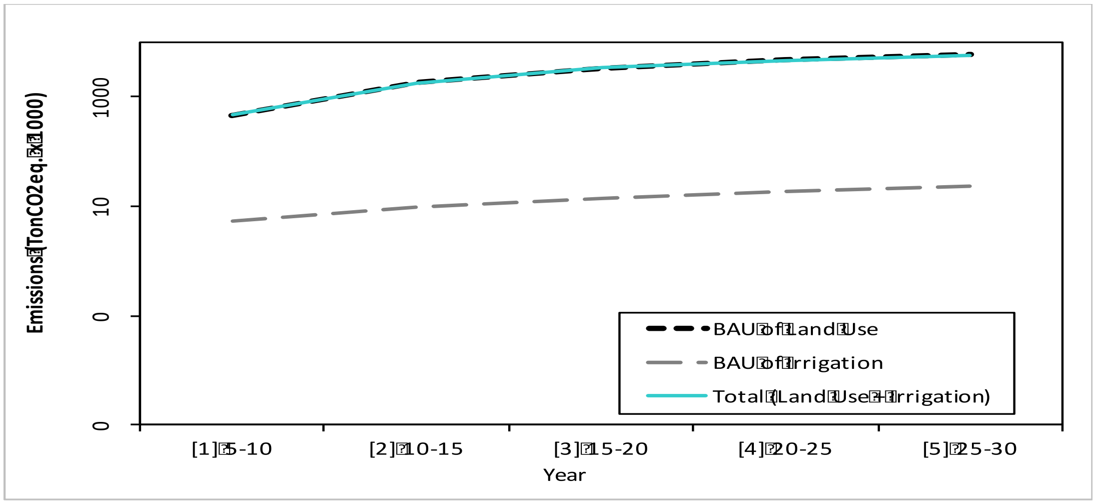


ABACUS run: net emissions sequestered – scaling agroforestry vis-à-vis BAU land uses especially slash and burn agriculture

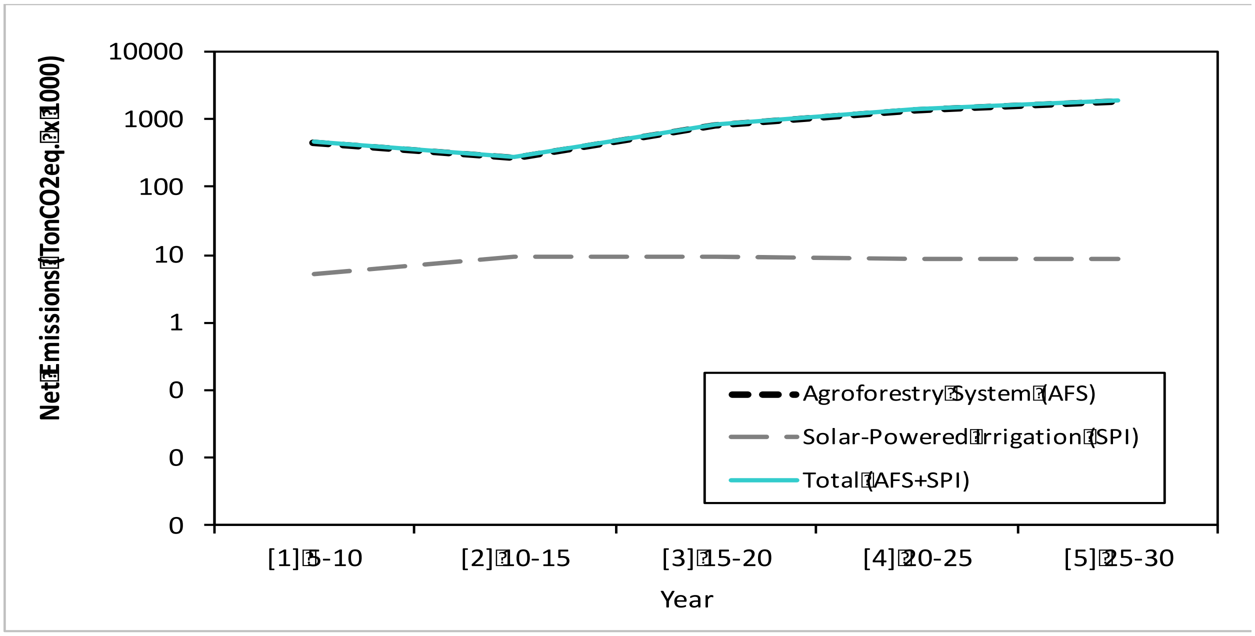
SCENARIO 3: total emissions amalgamation of agroforestry & solar powered irrigation



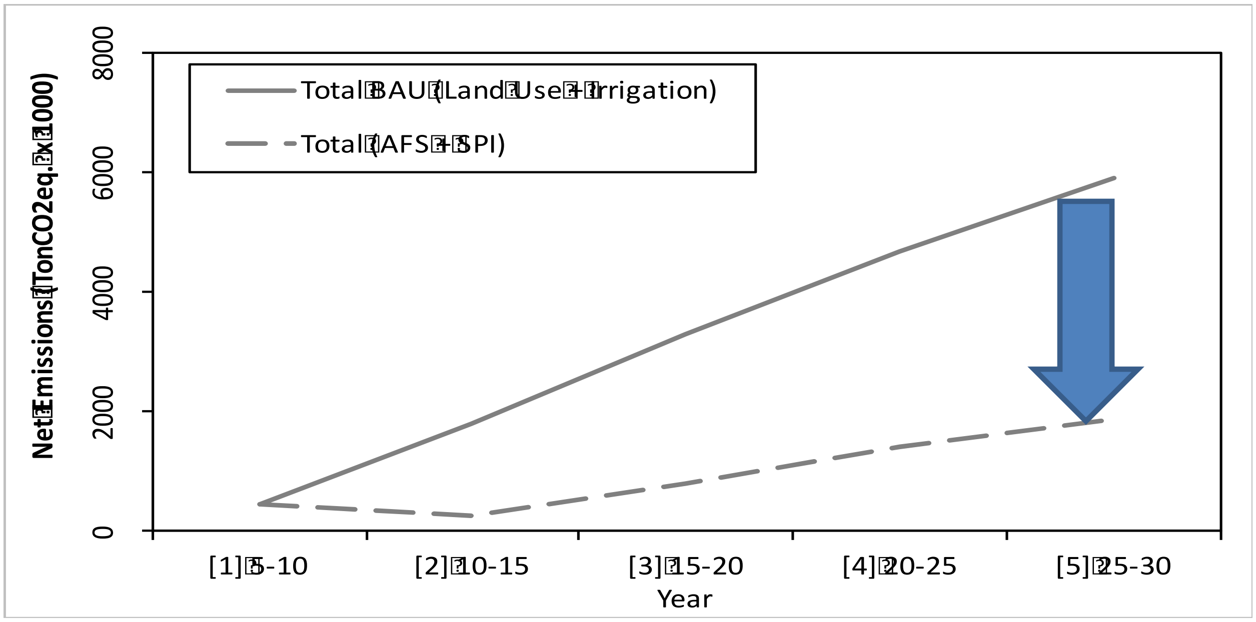
ABACUS emissions run: amalgamation of agroforestry & solar powered irrigation (Normal scale)



Total emissions amalgamation of agroforestry & solar powered irrigation (Log scale)

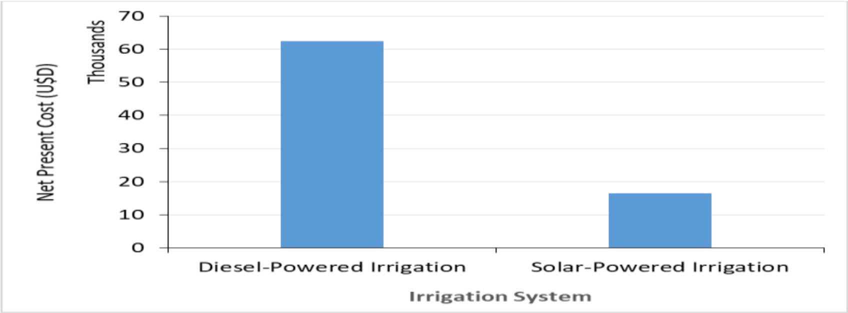


Net emissions on amalgamation - Agroforestry (sequestration) and Solar Powered Irrigation (emission reduction)

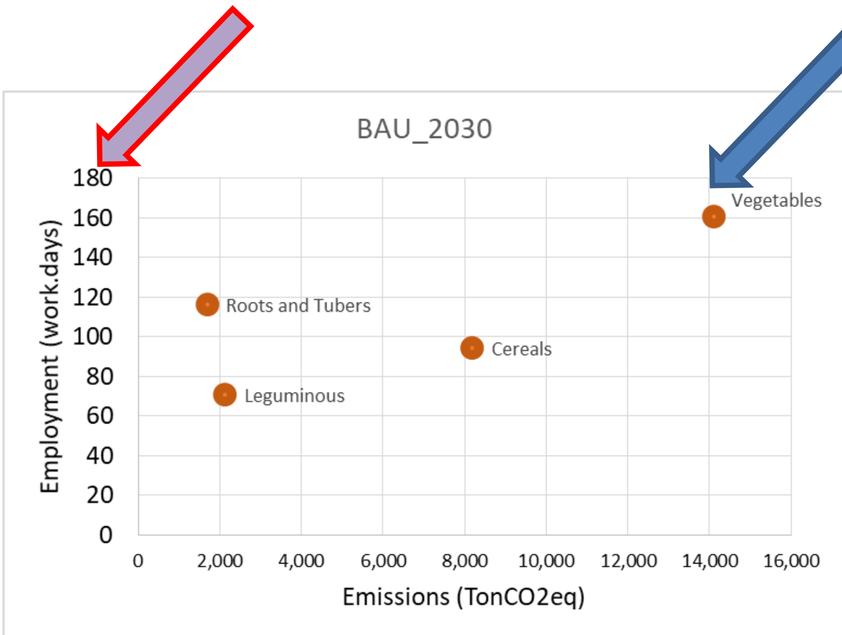


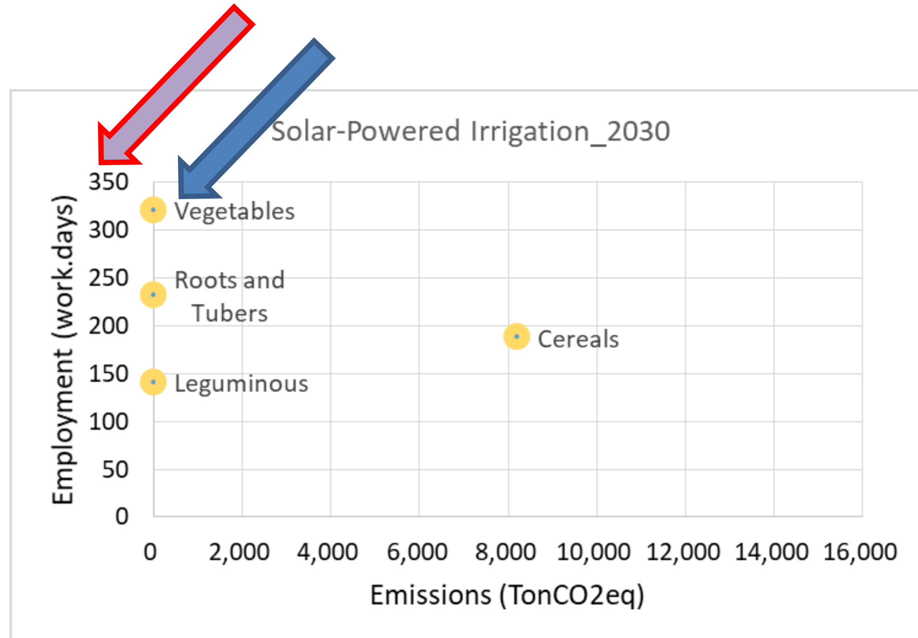
ABACUS run on net emissions sequestered by amalgamation scenario: scaling solar powered micro-irrigation in agroforestry farms vis-à-vis BAU scenario of scaling fossil powered irrigation in non-agroforestry / slash & burn agriculture

SOCIOECONOMIC ANALYSIS

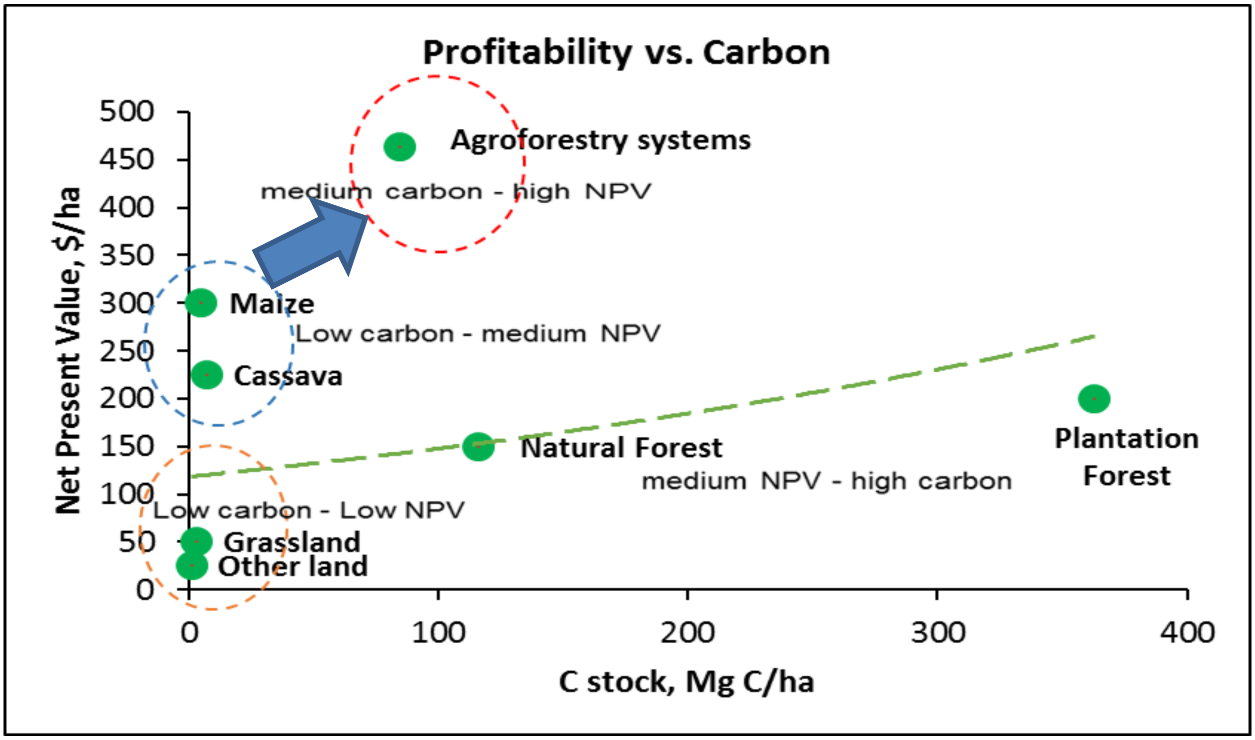


LEAP run: cost analysis of fossil powered irrigation vis-à-vis solar powered irrigation

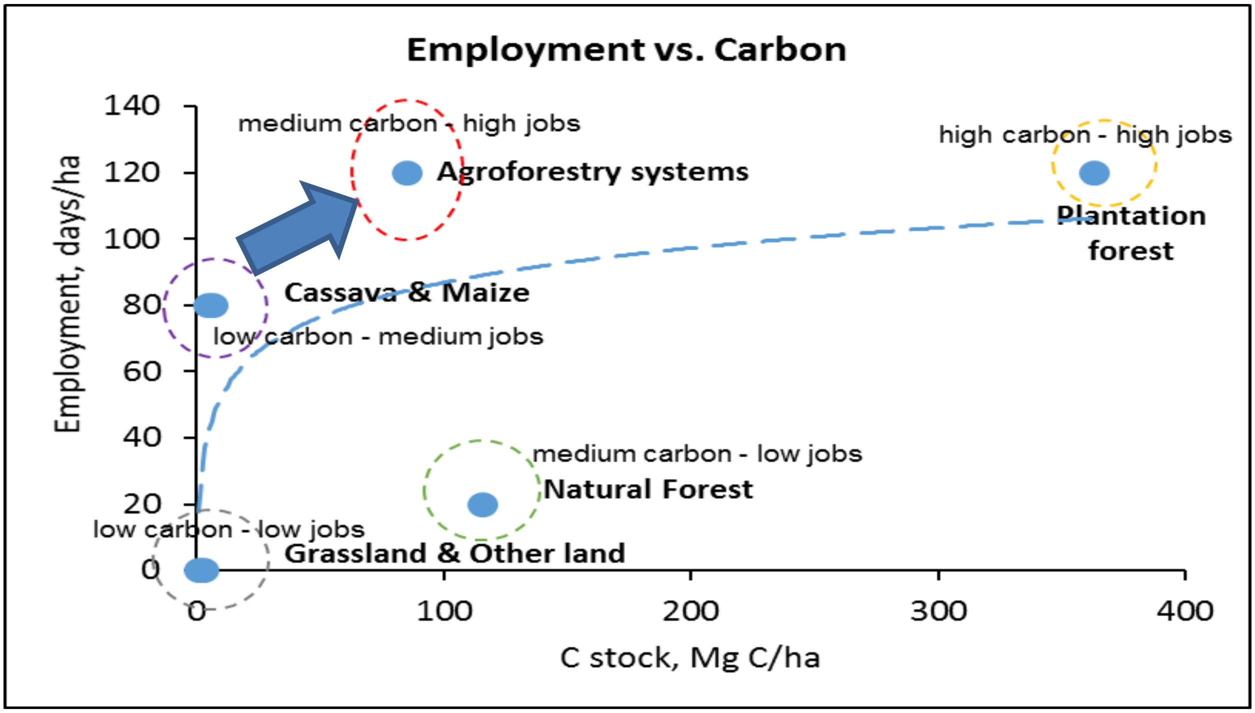




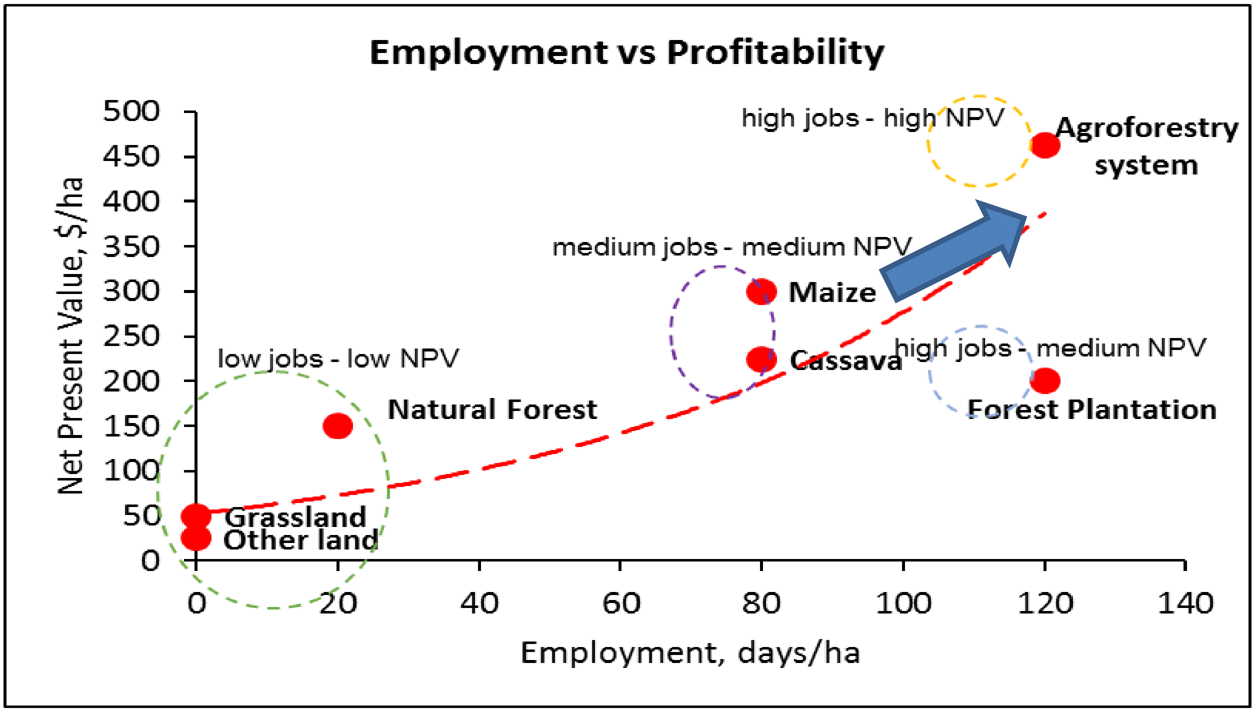
LEAP run: socioeconomic return on investment in terms of jobs against emissions for BAU scenario of fossil powered irrigation vis-à-vis solar powered irrigation up to 2030. Different crop value chains are plotted. An investment trajectory of scaling solar micro-irrigation demonstrates greater benefit both on emissions and jobs relative to a BAU trajectory of fossil powered irrigation.



ABACUS run; cluster analysis between profitability and carbon stock amongst different land uses: socioeconomic return of NPV / profitability against carbon sequestered by converting natural forests into agroforestry vis-à-vis BAU of converting natural forests into conventional slash and burn farms of various crops and control scenario of *insitu* natural forests. Agroforestry provides the most profitability return and sequesters the most carbon compared BAU slash/burn cassava & maize farms. Natural forests & plantation forests however sequester the most carbon but have the lowest profitability return compared to agroforestry and BAU slash/burn cassava & maize farms.

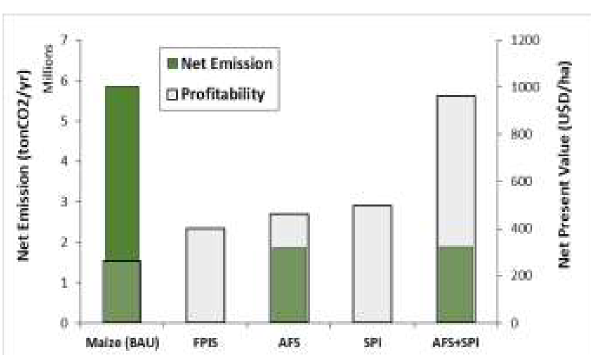


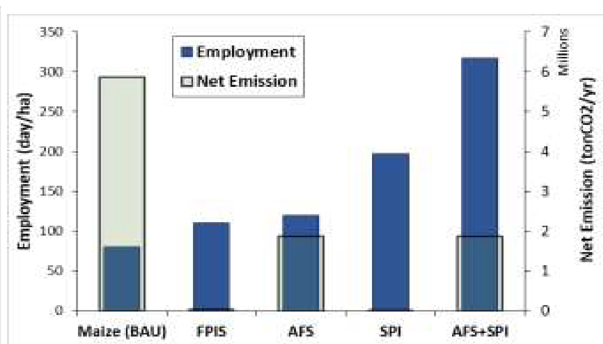
ABACUS run; cluster analysis between employment and carbon stock amongst different land uses: socioeconomic return of jobs created against carbon sequestered by converting natural forests into agroforestry vis-à-vis BAU of converting natural forests into conventional slash and burn farms of various crops and control scenario of *insitu* natural forests. Agroforestry creates most jobs and sequesters more carbon compared BAU slash/burn cassava & maize farms. Plantation forests however sequester the most carbon and create as many jobs as agroforestry. Natural forests sequester slightly more carbon than agroforestry but create least jobs compared to the other options of plantation forests, agroforestry and BAU slash/burn cassava & maize farms.

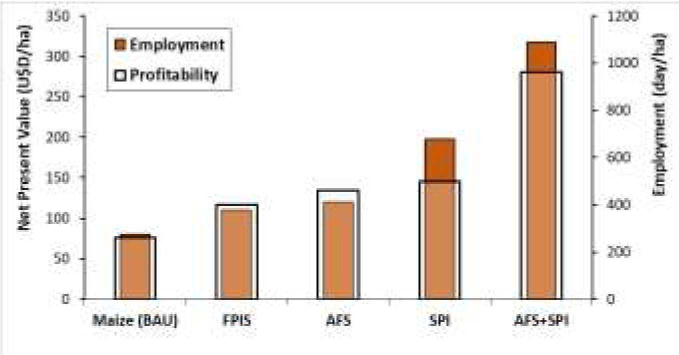


ABACUS run; cluster analysis between profitability and employment amongst different land uses: socioeconomic return of jobs and profitability by converting natural forests into agroforestry vis-à-vis BAU of converting natural forests into conventional slash and burn farms of various crops and control scenario of *insitu* natural forests. Agroforestry creates most jobs and has the highest profitability compared to BAU slash/burn cassava & maize farms. Plantation forests creates as many jobs as agroforestry but has lower profitability than BAU slash/burn cassava & maize farms. Natural forests create the least jobs and have lowest profitability compared to the other options of plantation forests, agroforestry and BAU slash/burn cassava & maize farms.

Amalgamated scenario modelled over maize







Findings suggest that where possible, the combination of agroforestry (AFS) and solar powered irrigation (SPI) should be used to maximize all important parameters of interest - profitability, opportunity of employment, and emission reduction potential. Maize data is used in this example. However, other crops with potential use with agroforestry systems may also be considered to yield similar benefits under amalgamation.

Next steps

- Finalise transfer of models to policy makers through the Ministry of Environment.

- Finalize peer exchanges in supporting Kenya & Ghana calibrate ABACUS

- Engage in communities of practice to share lessons continentally

3.3.5 Key accomplishments in Morocco

The Morocco team is coordinated by Ms. Naima Oumoussa who is the *Chargée de l'Adaptation au Changement Climatique, et inventoriste chargée des Procédés* in the State Secretariat for Sustainable Development.

- Modelling scoping meeting undertaken on 22 February 2018 facilitated by the technical team from NREL and the Morocco modelling team.

Discussions resulted in Morocco stakeholders prioritizing the following sectors as most representative of their NDCs & socioeconomic priorities hence critical to transition to the low emission development pathway - energy, housing infrastructure, transport, industry, agriculture and waste.

- Climate Change Competence Centre for Morocco (4C Maroc) confirmed as the lead institution to coordinate modelling actions.

- Action plan developed and strategic modelling scenarios established as follows;

Scenario 1: agriculture, energy and waste;

- solar powered micro-irrigation using recycled waste water which has both adaptation impacts (conserving water resources) & mitigation impacts (abating emissions of conventional fossil fuel powered irrigation) vis-à-vis business as usual (BAU) scenario of diesel powered canal irrigation that emits and does not conserve water and where waste water is not treated for re-use hence water conservation is low.

Scenario 2: energy & housing infrastructure;

- On energy & housing infrastructure, models can inform on the impacts of scaling up solar home systems & solar water heating systems across housing developments vis-a-vis a BAU scenario of using grid connected power for the above. Climate impacts would be on carbon offset by using solar entirely for housing developments against using grid connected power which is a mixed energy portfolio that includes fossil fuels.

Socioeconomic impacts would be on house hold energy cost savings & jobs created in developing a solar industry to meet the demand for solar power products that would be created by a policy instituting the above vis-a-vis BAU scenario of tapping into grid power.

Scenario 3: energy & transport;

- models can inform on carbon offset and energy savings (fuel costs) by policy decision to scale large scale public mass transit systems in major urban areas vis-a-vis BAU scenario of expanding urban roads that will encourage increased use of personal cars within cities with potential for higher emissions.

Next steps

- Shortlist models to run all the three strategic scenarios - agriculture, energy, & waste; energy & housing infrastructure; and energy & transport.

- Work with the project technical team from NREL to combine models and run them in a cascade such that they operate as an enhanced model that can forecast both climate & socioeconomic impacts of these scenarios.

Three options can be explored in these combinations.

The first option involves "hard linking", where the complementary models are combined using software patches to run as one integrated model.

The second option involves “soft-linking”. For this, the output from one model is used as input for the next model to calculate the cumulative impact.

The third, and potentially most viable approach considering time constraints is “manual combination” using simple arithmetic computations. Here, models are run independently and cumulative score of these runs computed mathematically.

- Test model runs using dummy data or data from countries sharing similar socioeconomic & climate context with Morocco.

- Transfer models to policy makers for use through the State Secretariat for Sustainable Development.

3.4 Key accomplishments on the subregional and regional peer-to-peer knowledge-sharing forums

Peer learning and exchanges are already being set on two levels – first, amongst project countries and second with non-participating stakeholders across the continent through a structure called the "Communities of Practice" (CoP). At the third level, a continental conference is scheduled that will bring technical leads from institutions currently leading project actions in the eight countries as well as stakeholders from the CoP to share lessons on the project's novel approach to NDCs implementation with additional stakeholders drawn from across the continent. Lessons shard will be on AFOLU as well as on establishing structures for NDCs implementation that maximize both climate & socioeconomic aims to catalyse a demand driven transition to the low emissions development pathway.

Peer exchanges among project countries

- Amongst project countries, the Mozambique modelling team is sharing lessons on adapting the ABACUS model to run agroforestry project level scenarios with Ghana and Kenya project countries which have agroforestry as among the priority sectors. Accordingly, an ABACUS manual to guide discussions and a link to the actual model to aid simulations has been shared.

- Online exchanges through webinar sessions have been conducted between April – August 2018. These peer exchanges are demonstrating off-shoots of south-south cooperation within the project.

Peer exchanges through the Communities of Practice (CoP)

At the second level which involves non-project stakeholders, the CoPs are being set up bringing together the eight project countries – Cameroon, Côte d'Ivoire, DRC, Ghana, Kenya, Morocco, Mozambique and Zambia – to benefit from additional experiences and lessons on low emissions development from established networks across the continent – specifically the Africa LEDS partnership (AfLP). Considering that land use is the most significant source of emissions in Africa, the CoP primary focus is land uses – i.e. Agriculture, Forestry and other Land Use (AFOLU) sector. Exchanges are facilitated through interactive online sessions.

To date, the following priority topics have been covered led by NREL;

The first interactive online peer learning session was conducted on 26th April 2018. The focus was on the novel approaches to support linked analysis and modelling for catalytic climate action that maximizes both climate and socioeconomic aims. The session highlighted work in Mozambique under the Africa LEDS project to link the LEAP and ABACUS models for integrated assessment of key climate actions. The session also included an overview of global resources to support AFOLU analysis to enable climate and socioeconomic objectives. The session concluded with an interactive discussion across project partners.

The second peer learning session held on 28th June 2018 focused on use of the International Jobs and Economic Development Impacts model (IJEDI) to support development-driven action in the AFOLU and energy sectors. The session featured presentations by Zambia and NREL on use of the IJEDI model for this purpose, as well as a targeted interactive discussion.

The third peer learning session held on 25th July 2018 focused on linking small-scale energy and agriculture to support development and climate goals. Specific topics covered include LEDS small scale irrigation & scaling up smallholder solar irrigation in Sub-Saharan Africa – refining & building on Mozambique as case of study; rice husk briquettes for cooking fuel building on and refining developments in Côte d'Ivoire.

The fourth peer learning session held on 30th August 2018 also focused on agroforestry and low carbon development in Africa. Mozambique and Côte d'Ivoire were engaged as expert speakers.

A fifth peer learning session held on 30th August 2018 was an AFOLU CoP on agroforestry. Kenya was engaged as an expert speaker to share lessons and experiences with agroforestry modelling as a result of work being supported jointly by the Africa LEDS project and the DOS Compact. A representative from the Kenya Forestry Service presented Kenya's experience on agroforestry intervention and related ongoing analysis. This provided a good basis to cross-hybridise with Mozambique experiences in modelling agroforestry using ABACUS.

All sessions were facilitated via webinar and these peer exchanges are ongoing.

In addition, detailed plans and a presentation for the CoP overall, as well as a broader peer learning plan through the Africa LEDS project have also been developed. A distribution list and member survey has also been developed and is being managed by the Africa LEDS Partnership.

Next steps

- Finalize the peer exchanges between Mozambique and counterparts in Kenya & Ghana on using the ABACUS model.

- Finalize operationalization of the CoPs.

- Develop concept note for the continental conference to guide planning for the continental conference.

- Organize the continental conference.

4. Implementation of the Visibility and Communication Plan

Project lessons continue to be shared on both the virtual space through social media & the project website as well as physically through participating in global & continental forums on environment & low emissions development policy. Successes gleaned from this project were used to make a case to convince ministers to endorse policy positions towards premising environment as a solution to socioeconomic growth. The result was the adoption of a relevant high-level decision on Innovative Environmental Solutions at the 3rd UN Environment Assembly (UNEA 3) in December 2017 and adopting instruments of implementing climate action as an accelerator of socioeconomic transformation in Africa at the 7th Africa Ministerial Conference on the Environment (AMCEN) special session in September 2018. In addition, lessons were shared at a continental multi stakeholder conference on low emissions development – the 2018 African Carbon Forum in April. During this forum, the project approach reached up to 500 diverse stakeholders from government, academia, development community and private sector

5. Conclusion

Significant progress has been registered during the period in all the three project components towards catalysing a country led, demand driven transition to the low emissions development pathway. All components converge to create structure for Nationally Determined Contributions (NDCs) implementation that unlocks leading socioeconomic benefits for the country – beyond traditional regulatory approaches. This demonstrates climate action as a solution to catalyse a demand driven transition to the low emissions pathway. This is the value-added novelty of this project – where climate action premised as a solution to leading socioeconomic development priorities has seen this work influence high level policy trajectories at the United Nations Environment Assembly (UNEA) and the African Ministerial Conference on the Environment (AMCEN) by way of informing the design of decisions. The UNEA & AMCEN represent the highest organs of environment & climate policy making forums driven by member states that set the agenda on implementation modalities of the Paris Agreement in light of the prevailing developmental context.

In addition, with the *Talanoa* Dialogue and the Paris Agreement stock take being two key milestones of the Paris Agreement implementation, and the recently published IPCC report & UN Environment Emissions Gap Reports underscoring the urgent need to increase ambition, this project is set to capacitate countries in the continent with tools & technical know-how to prioritize commitments that will maximize achievement of their socioeconomic priorities. By this, incentivise demand-driven actions by countries in implementing the Paris Agreement.