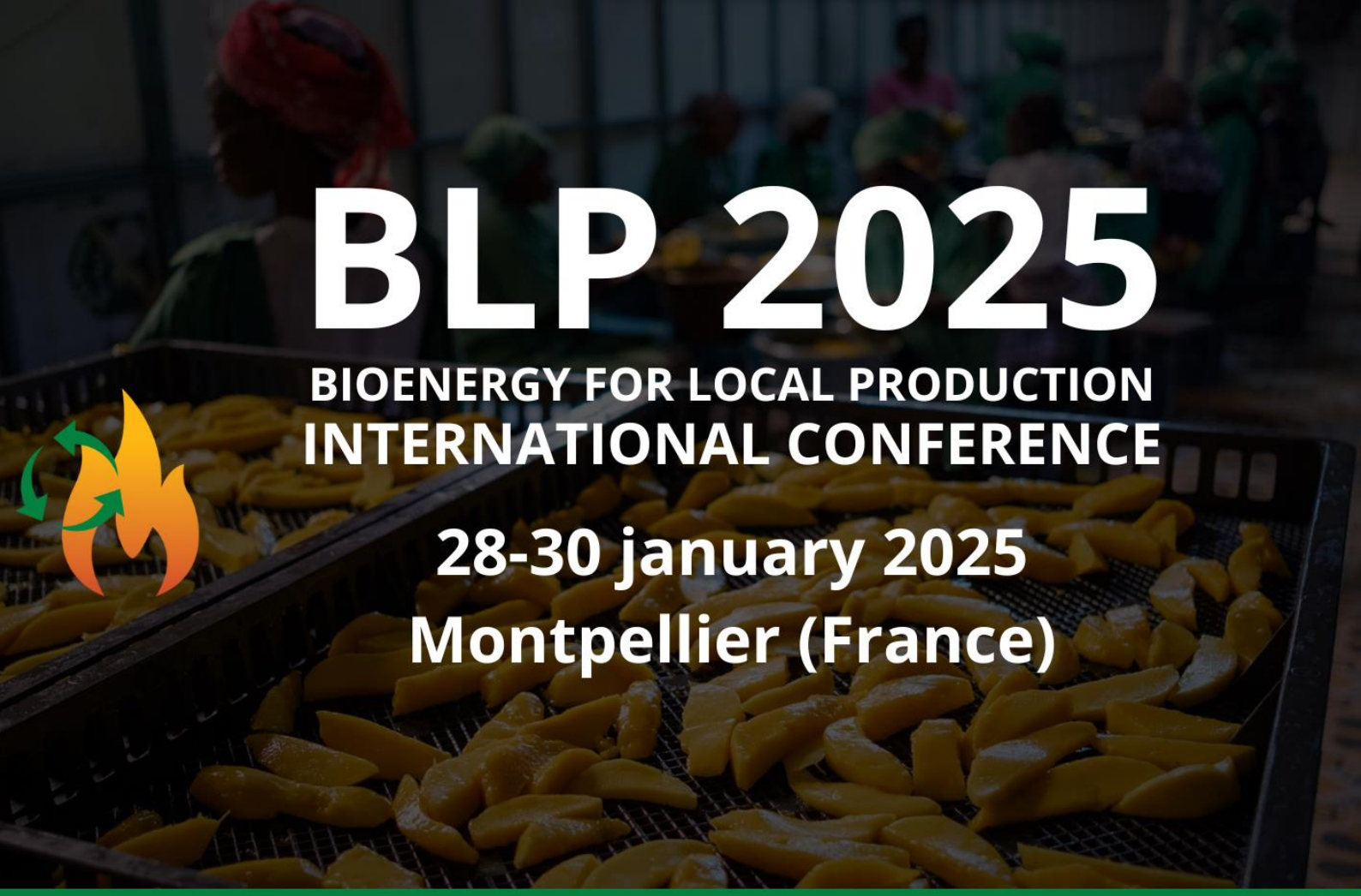

BLP 2025

BIOENERGY FOR LOCAL PRODUCTION
INTERNATIONAL CONFERENCE

28-30 january 2025
Montpellier (France)

Summary document of the international conference on local bioenergy for production units

Three days of exchanges, experience sharing and building a sustainable energy future for SMEs.
Together, let's cultivate innovation for local and responsible bioenergy.

BIOSTAR
DES BIOÉNERGIES POUR LES PME D'AFRIQUE DE L'OUEST

BIO4AFRICA

Under the auspices of the UNESCO IDBio chair

and with the support of Montpellier Méditerranée Métropole

CONFERENCE FUNDED BY EUROPEAN UNION & THE AGENCE FRANÇAISE DE DÉVELOPPEMENT AS PART OF DESIRA AND HORIZON 2020 PROGRAMS

TABLE OF CONTENTS

How to cite this document

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BLP2025

Bioenergy for local production

The partners involved in the BioStar and Bio4Africa projects organized an international conference on small-scale bioenergy for local production and use which took place in Montpellier from January 28 to 30, 2025.

Nearly 150 participants from over 30 countries registered to discuss the technical, social, and economic aspects of current practices to address challenges and encourage innovation.

In order to identify the methodologies and practices that should be promoted to facilitate the sustainable development of bioenergy innovations for small and medium-sized enterprises, it is essential to gather and compare technical, social, and economic feedback, along with the opinions of development players, private sector actors, decision-makers, and researchers working on bioenergy.

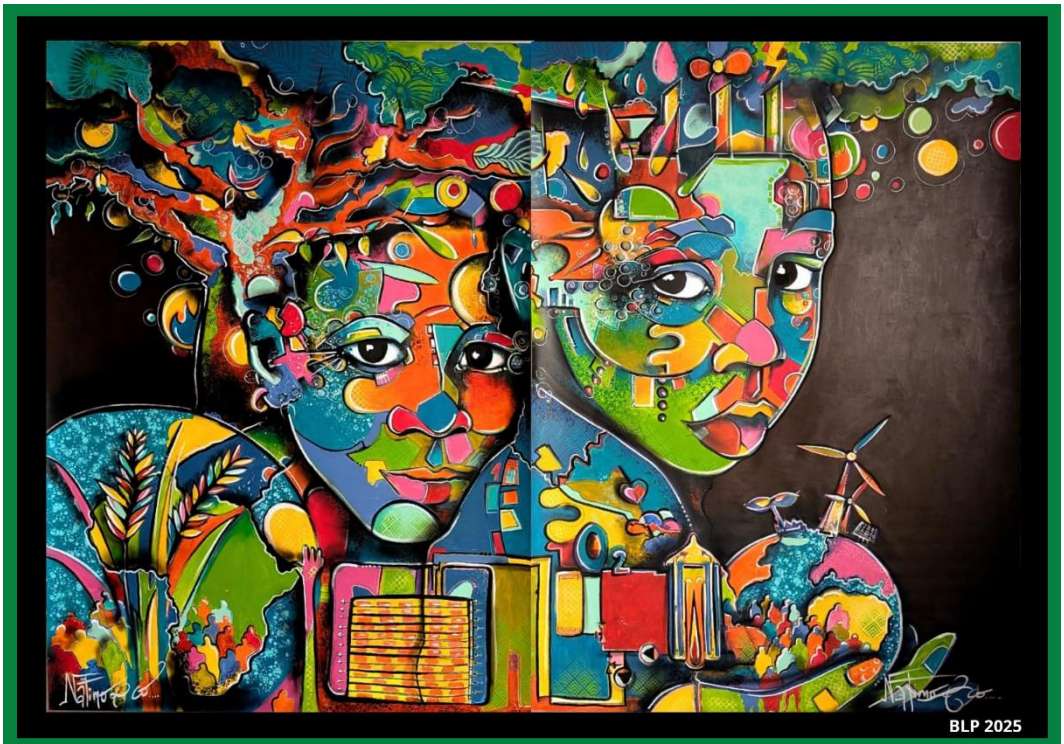
This summary aims to highlight the key points that emerged during the three-day conference, and to draw some initial lessons for a new research, action, and investment agenda.

1. Abstract

The speeches and discussions at the three-day BLP 2025 conference highlighted the challenges of developing small-scale bioenergy technologies, especially in terms of their economic viability and the reduction of harmful emissions. Compromises must be continuously made between the technical performance of equipment, production costs, and ease of use (ergonomics).

Multiple presentations highlighted the need and importance of developing bioenergy for productive purposes, especially on small, potentially decentralized scales. This type of renewable energy is poised to become an increasingly important part of the energy mix of both northern and southern countries. The value of this type of international conference lies in its ability to provide much-needed practical input that is vital for shaping development aid policies and strategies.

The conference provided an opportunity to take stock of recent technical advances, some of which show particular promise, and to reinforce the conviction that biomass can play a key role in a sustainable energy mix. In particular, scenarios for scaling up and circular economies encouraged the emergence of innovative solutions that optimize resource use while minimizing environmental impacts. These avenues offered valuable insights into overcoming existing obstacles and accelerating the transition to more sustainable and resilient energy systems. The event also helped strengthen a multidisciplinary community of researchers and companies engaged in small-scale bioenergy for productive use.



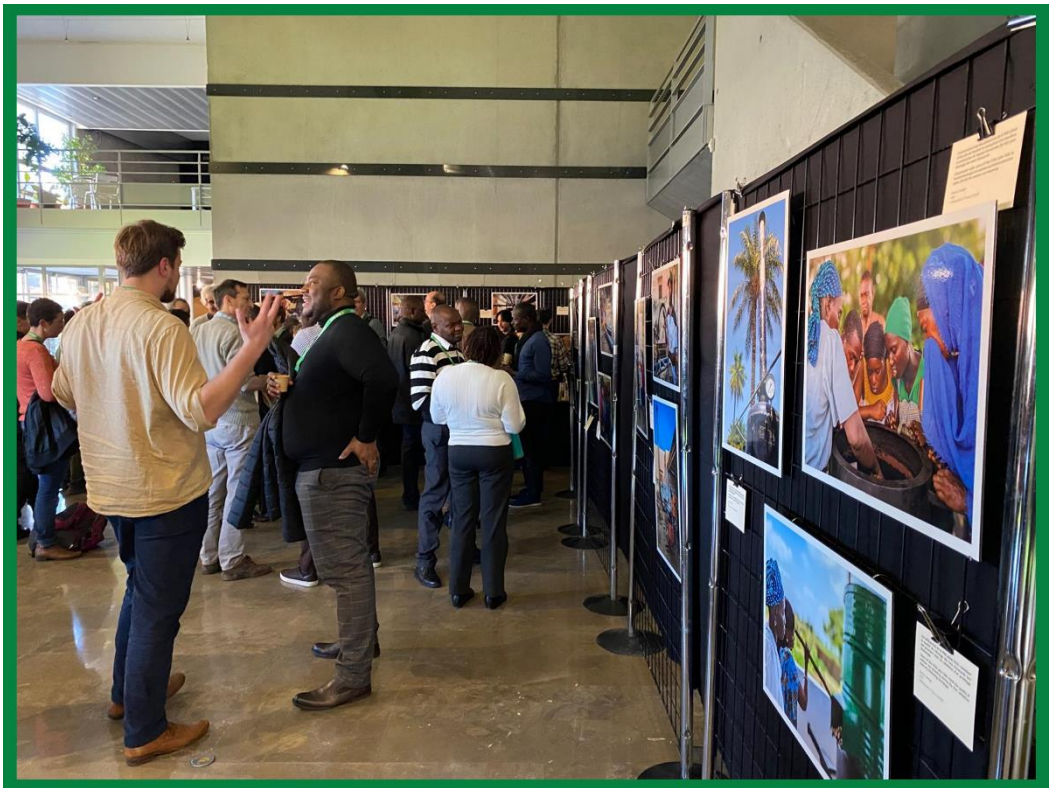
Collaborative painting

During the three-day conference, solidarity artist Natimo led the creation of a participative fresco on the theme of bioenergies, in partnership with the Miroir association, which supports young people in extremely precarious situations in Saint-Louis (Senegal).

2. Introduction: the challenges and proceedings of the BLP 2025 conference

Today, bioenergy is a promising solution for securing a local and sustainable supply of energy for productive purposes, particularly for small and medium-sized food processing companies (SMEs). The development of bioenergy for local use is fully in line with a circular economy and energy independence approach, not only in Africa and Europe, but also in other regions of the world, underscoring its universal character.

In this context, it is essential to compare feedback on technical, social and economic issues by involving all stakeholders, including development players, companies, policymakers, and researchers working in the field. This pooling of knowledge and practices should make it possible to leverage existing achievements, draw concrete lessons, and collectively identify the methodologies and practices to be promoted to sustainably support the development of bioenergy innovations for SMEs.



BioStar photo exhibition

An exhibition of 35 photos recounting the actions of the BioStar project was presented. Designed to be tourable, it can be distributed to partners and donors.

Based on feedback from the field and research and development work, the **BLP - Bioenergy for Local Production** conference aimed to identify the approaches and methodologies to promote in order to contribute to the sustainable development of low-power bioenergy for productive use, whether in Africa, Europe or other regions of the world. Held in Montpellier, France, from January 28 to 30, 2025, the conference brought together 150 experts from over 30 different countries for three days of discussions on the challenges of developing bioenergy innovations in small and medium-sized businesses.

This international conference focused on three main themes:

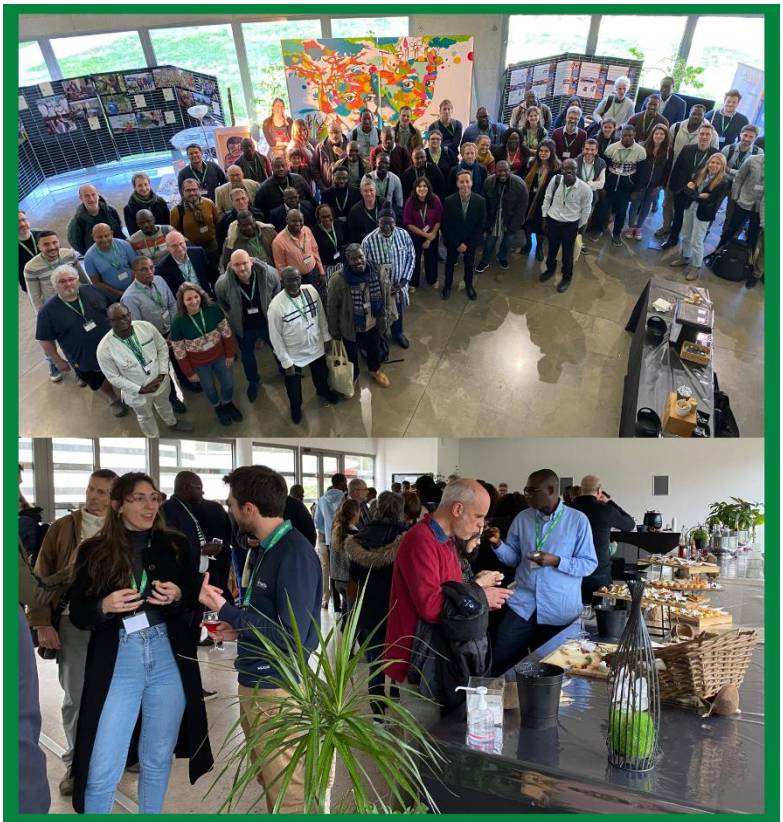
1. **How can we develop technologies and processes adapted to the use of biomass energy for local production:** what are the challenges, approaches, and tools for technological development?
2. **What strategies can facilitate the large-scale deployment of locally-developed technologies:** how can we structure innovation trajectories, support co-design, and promote experimental initiatives at local, regional and national levels?
3. **How can bioenergy fit into a circular economy dynamic:** what are the technical, social, and environmental impacts? What are the evaluation methods? What is the role of public policy?

These themes were the focus of several sessions with complementary formats:

- **Five cross-cutting, multidisciplinary plenary sessions** that brought together leading experts from diverse fields to discuss the key technical, economic and social challenges of bioenergy for local use. Presentations were made by representatives of research institutions (University of Hohenheim, University of Lorraine, CIRAD, University of Montpellier, Thomas Sankara University, etc.), international organizations (Consultative Group on International Agricultural Research - CGIAR, ECOWAS Centre for Renewable Energy and Energy Efficiency - ECREE, etc.) and public institutions (European Union, AFD, the Agence de Programme sur l'Énergie, etc.);
- **Five theme-based sessions** featuring presentations and feedback on technologies, design and deployment trajectories, and environmental and socio-economic impacts, in East and West Africa, Latin America and Europe;
- **Three discussion panels** that were designed as interactive spaces for collective reflection, bringing together people with diverse backgrounds for open, in-depth discussions.

The enthusiastic response to the first edition of the international conference "BLP - Bioenergy for Local Production" confirmed the growing interest and momentum around this theme. In all, some fifty speakers contributed their views, helping to identify the key conditions and methods for encouraging the development of bioenergy innovations within a circular economy framework.

The complete schedule for the three days is in Appendix 1, and all of the presentations made during the conference are accessible at https://blp2025.com/programme/.



Cocktail reception

On the second evening of the conference, a convivial event was organized, including a tasting workshop of regional products and wines (with and without alcohol), encouraging informal encounters and discussions.

3. A shared assessment of opportunities offered by biomass energy for productive purposes

3.1. Bioenergy for production: an opportunity for local development

Access to energy on demand - Biomass, which comes from a wide range of sources such as wood, agricultural residues, and post-harvest agricultural waste, represents a major energy resource for local areas. Unlike the sun and wind, which are intermittent sources, it can be stored and used whenever needed. These characteristics make biomass a strategic lever, particularly for meeting the energy needs of rural or isolated areas. Using new bioenergy technologies to extract energy from biomass enables the local production of heat, motive power and/or electricity, while helping to reduce greenhouse gas emissions.

However, as Sandrine Michel (University of Montpellier) noted in her presentation on energy mix scenarios, it is important to maintain a realistic outlook: despite its many advantages for local use, bioenergy will remain marginal on a global scale, including in Africa. Nonetheless, bioenergy can make a significant contribution at local levels, where it responds effectively to specific needs and strengthens local resilience.

Helping SMEs to become energy self-sufficient - Beyond providing access to energy, small-scale bioenergy is a real catalyst for stimulating local economies. It boosts the competitiveness

of small and medium-sized businesses, especially those in the agri-food sector, by offering them reliable, appropriate, and less expensive energy, while decreasing their reliance on imported fossil fuels. The dried mango sector serves as a good illustration. Bioenergy processes make it possible to avoid dependence on imported butane gas, an expense that can represent up to 60% of the cost price, while exposing production units to frequent supply disruptions (*BioStar project: co-design of a cashew nut shell staged combustion boiler*, Alexandre Parfait SANOU, PRUNE, Laurent VAN DE STEEN, CIRAD – *Analysis of the environmental and health impact of cashew nut shell energy recovery in Burkina Faso*, Marie SAWADOGO, 2iE). In addition, they encourage the creation of jobs in the collection, processing, maintenance, and equipment management sectors which cannot be relocated.

Reducing by-product waste - Bioenergy also contributes to the recovery of by-products whose management – which is often challenging due to the risk of pollution, fire or nuisance - impose significant costs on companies. By providing a treatment solution that is both useful and productive, they pave the way for leaner, more resilient production models that are more respectful of ecosystems while generating value from residues that were previously considered a burden. For example, several speakers (Nitidae, IED, CIRAD, UGB, WINDA, PRUNE, etc.) reported on various initiatives to convert cashew nut shells into energy. When poorly managed, cashew nut shells present an environmental issue due to their polluting properties and the difficulty of burning them using unsuitable processes. However, when the right process is used (such as pyrolysis, staged combustion or gasification), cashew shells become an excellent fuel for a variety of applications, including heat and/or power generation.

3.2. A lever in the fight for food safety

Reliable and affordable access to energy is essential for the efficient operation of food processing plants, particularly during harvest periods when products need to be processed quickly to ensure that they can be preserved, stored, and packaged. These operations consist of multiple stages and require energy-intensive equipment: shelling, drying, pressing, pasteurization, and cold chain systems.

Security of post-harvest processing - Recovering energy from agricultural residues is a particularly appropriate solution for rural areas, where access to the electricity grid is often limited, unreliable, or prohibitively expensive. The concrete examples implemented in Africa under the BioStar and Bio4Africa projects illustrate the relevance of this model. By managing their own source of energy, agri-food SMEs can set up sustainable operations near production areas, thereby limiting post-harvest losses associated with transporting raw produce to faraway urban centres. These initiatives help to strengthen the local economy by creating jobs, supporting value chains, stimulating innovation, and improving farm incomes by adding value to products.

Integrated scenarios - At the conference, AFD, the European Union, and other institutional actors reaffirmed their commitment to supporting the development of energy innovation in the agricultural sector at the local level, with a particular focus on agri-food processing. They are now exploring the best strategies to support the design and dissemination of local innovations that combine agri-food processes and clean energy, including bioenergy and photovoltaics.

4. Key challenges, at several levels

Biomass holds significant potential for generating energy for local use. However, several major challenges must be overcome to facilitate the wider deployment of viable, sustainable solutions.

4.1. Diverse biomass sources vs. standardization

Biomass resources come in a wide variety of forms and have a wide range of physico-chemical characteristics (*Biomass combustion*: *issues, challenges, and technological development*, Pr. Yann ROGAUME, University of Lorraine, LERMAB). This diversity can be an asset in terms of biomass resources, but it can also pose technological constraints, as it requires specific technical choices depending on the type of biomass available. The nature and physico-chemical characteristics of the biomass directly influence the choice of the valorization process. There are several parameters to consider:

- **Humidity**: Biomass with high water content (such as fruit waste or organic effluents) is particularly well suited to biological processes such as methanization or alcoholic fermentation. These technologies are available on a variety of scales, including pico or micro methanization (*Feedback on pico/micro methanization*, Luc GERUN, S3D Ingénierie). Conversely, dry biomass (wood, shells, husks) is better suited for thermochemical processes such as combustion, pyrolysis, and gasification. Numerous concrete examples were presented at the BLP event, demonstrating the diversity of approaches and application contexts (*Cashew gasification in Cambodia*, Brice NICOLAS, IED - *Pyrolysis of cashew nut shells in Burkina Faso*, Étienne PERRIER, Magloire SACLA-AÎDE, Nitidæ – V*alorization of shea tree by-products for a cooperative in northern Togo*, Aristide DEJEAN, Best Energies).
- **The presence of extractable compounds** can impose additional constraints. Cashew nut shells, for example, contain a corrosive phenolic liquid (CNSL) that is volatile at low combustion temperatures, making it a source of toxic fumes. The work conducted under the BioStar project on designing staged combustion furnaces exemplifies the need to adapt equipment to the specific characteristics of the biomass to develop a high-performance process.
- **Mineral content** may also pose technical constraints. For example, rice husks, which are particularly rich in ash and silica, can clog equipment or cause ash to vitrify at high temperatures. This necessitates adjustments in conversion conditions (*Bioenergies*: *challenges linked to the development of medium-power local energy solutions*, Pr. Joachim MÜLLER, University of Hohenheim).
- **The physical form or granulometry of biomass:** some very fine or powdery biomasses (sawdust, bran, flour) require mechanical pre-treatment (compaction, granulation) to obtain a granulometry compatible with the equipment (furnaces, gasifiers, boilers). For example, different preconditioning processes correspond to different biomass mixtures (*Challenges and issues in biomass conditioning*, Matthieu CAMPARGUE, RAGT Énergie).

The diversity of biomass calls for tailored engineering, integrating both the constraints of the source and the requirements of the energy conversion processes. A precise technical-

economic approach, combined with solid knowledge of local resources, will make it possible to leverage the bioenergy potential of each type of biomass, aiming for sustainability and energy sovereignty. The characterization of biomass is the starting point for identifying the processes that can be used to extract value from it (*Characterization of West African agricultural waste as feedstock for thermochemical conversion processes*, Capucine DUPONT, IHE Delft). However, the question of scale still needs to be addressed to make the equipment profitable.

4.2. Technologies struggling to be adopted

A wealth of feedback highlighted the obstacles to be overcome in order to ensure the long-term adoption of bioenergy equipment. There are many reasons for this, as the presentations highlighted:

- **Sectors competing over biomass use.** To ensure the sustainability of bioenergy systems, consideration must also be given to the hierarchy of biomass uses, taking into account other uses such as food, biomaterials, energy, and return to the soil in the form of compost or organic fertilizer.
- **Value chains are sometimes fragmented.** The links in the chain – from biomass production to end use, including the supply chain and distribution – can be disrupted, hampering the effective use of technologies that can quickly break down. The quality of biomass also depends on harvesting and storage conditions.
- **Lack of technical standards.** Each of the players develop their own solutions on a small-scale or stand-alone basis, which can undermine the reliability of the technologies deployed and jeopardize their long-term viability.
- **A wide range of technical skills.** A wide range of technical skills are required to manufacture and repair bioenergy equipment: mechanical, thermal and sometimes electronic. However, the level of technical expertise available can vary from one locality to another, and from one structure to another, which limits wider dissemination.
- **Organizational skills.** In addition to the technical aspects, the success of bioenergy projects also depends on strong organizational capabilities: team management, planning, operational monitoring, partnerships, and financial management.

Valorization technologies must be designed with all of these factors in mind. In technological terms, this means finding the best compromise between several criteria: power, ergonomics, ease of use, robustness, safety, investment and maintenance costs, etc., while ensuring that the equipment is acceptable to all end users, thereby ensuring that it remains firmly rooted in the local environment.

4.3. The challenge of economies of scale

The cost of mobilizing biomass can be a major obstacle, especially when the supply radius is large or fragmented. It is therefore crucial to dimension equipment in a way that strikes a balance between economies of scale and proximity to resources. Units that are too small struggle to be profitable, while those that are too large require complex and costly logistics. Mastering this logistical equation is essential for ensuring the economic viability of projects.

This continues to be a key concern for donors, who seek to support the replication and scaling up of successful innovations that can be adapted to different contexts, and thus meet the needs of as many people as possible. This change of scale is also vital for mobilizing private sector actors, as it broadens the potential market: more customers generate more opportunities and therefore more interest in getting involved.

4.4. A need for strategic support and positioning of public policies

A key challenge is the positioning of public policies and the organization of support for local bioenergy sectors. As emphasized several times during the plenary session, public organizations and donors who recognize the strategic role of bioenergy for local development are still debating over which levers should be mobilized. Several avenues are being actively explored:

- **The role of professional and interprofessional organizations**, such as the work of ECREE (ECOWAS Centre for Renewable Energy and Energy Efficiency) in structuring local supply chains.
- **The coordinated engagement of several types of players**: research, the private sector, NGOs, local authorities, etc., to encourage the emergence of deep-rooted, coordinated solutions.
- **The pivotal role of public decision-makers:** Public decision-makers play a decisive role in the development of bioenergy. To accomplish this, it is essential to give them the time and resources they need to grasp the often complex technological and strategic issues at stake. These solutions are still largely overlooked, if not absent, from energy planning programmes. However, it is important to remain cautious and nuanced.

5. Concrete solutions to advance together towards technologies that work

Discussions during the conference highlighted possible solutions to the major challenges noted.

1. Technologies adapted to small units for local development;
2. Diverse scaling strategies;
3. Circular economy scenarios.

5.1. Technologies adapted to small units for local development

Several projects, such as BioStar and Bio4Africa, have developed and validated innovative solutions for African SMEs at different scales. These initiatives have focused on the multi-purpose use of local biomass as energy sources (heat, motive power, electricity) and biomaterials (biocomposites, biochars, compost, etc.), through integrated approaches that combine thermochemical, biological, and mechanical processing.

Create local technologies adapted to the characteristics of the biomass available:

Discussions revealed that technologies need to be tailored to the characteristics of the biomass available.

- **Wet biomass** can be converted into energy through biological processes such as methanization and composting, producing gas and fertilizers. The primary technical challenges in this field are miniaturizing digesters to facilitate their application at the local level and ensuring a sufficient supply of biomass to continuously feed digesters year-round, as this technological option is ill-suited to the seasonal nature of agricultural production/processing.

- For **dry biomass**, the thermochemical process offers several possibilities. The conditioning and preparation of fuels are essential steps prior to their transformation. Combustion generates heat, while pyrolysis yields coal and combustible gases to produce heat. As for gasification, it is a solution for generating electricity on a local scale. Significant advances have been made in Europe over the last ten years, particularly in small-scale combustion, with improvements in domestic heating appliances that use wood and agro-residues.

Take into account the ecosystem and value chains in equipment specifications:

- The workforce often remains a crucial factor in the operation of bioenergy processes. While this is a major strength in African contexts, as users learn to navigate potential malfunctions and use equipment effectively, the human factor also remains a source of unpredictability for designers, who must anticipate uses and accommodate varying levels of technical expertise.
- From the outset of innovation projects, it is important to consider constraints relating to the supply of materials, electrical and electronic equipment, and instrumentation, as well as the limited local availability of system maintenance services, which complicates the local manufacture and operation of equipment. (*BioStar Project: co-design of a cashew nut shelling boiler powered by heat from cashew nut shell combustion*, Ibrahima MANÉ, WINDA, Hélène DUPEUX, CIRAD).
- In this context, it is essential to adopt "low-cost" approaches, not only to reduce investment costs, but also to design robust solutions that can be repaired locally and adapted to available resources and skills. This approach requires collaboration with local stakeholders, a detailed analysis of existing value chains, and a strong understanding of socio-economic realities to ensure the adoption and sustainability of technologies.

Adopt a "tailor-made" approach:

The project-based approach facilitates the design of customized equipment tailored to the specific characteristics of each type of biomass, ensuring efficient and clean energy conversion while addressing the specific needs of SME users. This ‘tailor-made’ approach requires a different way of thinking about the direct transfer of equipment designed in European

contexts, which prioritize process automation, large production units, and compliance with European standards.

For example, in his presentation (*Sustainable, local and citizen-based heat*), Frédéric Bourgois, founder of Coopéos, presented high-performance but complex equipment that requires accompanying services (e.g., heat sales) to function. In Africa, solutions must be tailored to their context, such as the equipment developed under the BioStar project, which must be designed simply enough to be manufactured and maintained by local equipment manufacturers (*BioStar Project: bioenergy for SMEs in West Africa*, Joël BLIN, CIRAD).

Encourage the involvement of different stakeholders to ensure real, honest, and useful contributions:

Most projects today draw inspiration from participatory approaches to develop innovations tailored to their users and contexts of use. The presentations at the conference emphasized the importance of *commitment*, i.e. building a genuine, comprehensive relationship based on trust, in which all stakeholders – whether equipment manufacturers, SMEs, customers, researchers, donors or politicians – are involved, invested, and collaborate to jointly design and define the most suitable equipment. This commitment is often requested from researchers, but frequently overlooked for beneficiaries, whose participation requires active facilitation in order to listen to what they have to say without biased preconceptions. Without this genuine commitment, the players remain mere spectators, and the innovation runs the risk of sinking into oblivion, joining the graveyard of equipment with which we are all too familiar (*BioStar Projet: bioenergy for SMEs in West Africa*, Joël BLIN, CIRAD – *Conception trajectories for BioStar innovations*, Ignace MEDAH, IRSAT).

5.2. Diverse scaling strategies

There are several scaling strategies that incorporatie various dimensions (*Scaling innovation: from readiness to application*, Murat SARTAS, CGIAR). The definition and implementation of replication or dissemination strategies are often requested by funding bodies and constitute an objective for impact-oriented research. However, the low-cost and tailor-made approaches developed in these projects derive their effectiveness by being grounded in specific local contexts in terms of uses, needs, and available biomass resources. Attempting to standardize or transpose them for industrial purposes would run the risk of making them lose their contextual relevance, which is precisely what underpins their success at the local level. Yet sticking to a tailor-made approach restricts their economic potential and limits their access to larger markets. A balance must therefore be struck between local, customized solutions and standardized, replicable solutions. Several avenues were explored during the conference, and are presented here:

Integrating small local units into a portfolio of innovations:

An effective strategy for reconciling the local specificity of equipment with its scaling potential is to incorporate it into a local production unit (LPU) approach within a portfolio of both technological and organizational innovations. This modular approach makes it possible to offer

different combinations of equipment to ensure adaptability to local contexts while encouraging wider dissemination and adoption.

Work on cashew nut shell pyrolysis processes is a good illustration. Initial equipment developed to address the heat requirements of the cashew nut sector (*The full story of the cashew pryolyzer across borders: genesis, challenges, future*, Pascale MARTEL-NAQUIN, CEFREPADE, Thierry GODJO, UNSTIM Bénin, Étienne PERRIER, Nitidae) was subsequently optimized to meet the wider needs of this sector, and even adapted for use in other sectors, such as mango drying (*BioStar Projet*: *co-design of a cashew nut shell staged combustion boiler*, Alexandre Parfait SANOU, Prune, Laurent VAN DE STEENE, CIRAD).

This portfolio of innovations should be designed to extend beyond technology to include new forms of organization. It must be considered on a territory-wide scale rather than that of a single player, otherwise there is a risk that the most profitable markets will be allocated to the same investors, creating greater energy dependency (*How can we explain the unequal treatment of renewables in Africa's energy future?*, Sandrine MICHEL, University of Montpellier).

Design "open" equipment that can be modified according to the context:

'Open' design means that technical choices can be redefined at every stage of the equipment design process to adapt the solution to new contexts. The fewer the flexibility criteria, the fewer the number of features of a component, making the technology more adaptable and flexible to other methods of operating, repairing, and so on. Conversely, equipment locked in by strong, standardized technical choices will have more limited replication possibilities, as all of the services required to develop the same technology in another context must be recreated, such as sourcing the right sensor from China, etc. For example, while a PID reactor control system may be extremely efficient, it requires microelectronics skills and components that may not be available locally. Making the design process more "open" by limiting flexibility criteria and prioritizing technical specifications will encourage local replication and adaptation (*Conception trajectories for BioStar innovations*, Ignace MEDAH, IRSAT et al.).

Under the BioStar project, for example, bioenergy equipment has been designed to generate the steam required for processing cashew nuts through the combustion of cashew shells. Several technical solutions have been developed to meet the needs of different types of SMEs and the specificities of the Senegalese and Burkinabe contexts (*BioStar Projet: co-design of a cashew nut shelling boiler powered by heat from cashew nut shell combustion*, Ibrahima MANÉ, WINDA, Hélène DUPEUX, CIRAD).

Rely on innovation platforms that facilitate their implementation, planning, and evaluation:

These mechanisms convert simple consultation forums into genuine co-creation processes, structured around human, technical, scientific, and economic resources, designed to stimulate the development, experimentation, adaptation, and dissemination of bioenergy solutions tailored to the specific needs of a territory or sector. An innovation platform serves as an interface between research, industrial players, local authorities, SMEs, end users, and any other relevant stakeholders to promote the emergence of relevant technologies, their validation in real-life conditions, and their scaling up.

Meant to be either long-lasting or short-lived, these innovation platforms are used to rethink technological innovations designed on an ad hoc basis in order to pool ideas, challenge organizations, services and public policies, and drive more systemic change. They facilitate profound changes in practices and enhance visibility to attract more substantial funding by involving consultations with several key players in the landscape (government, private sector, donors) (*Innovation platforms as the support for dissemination and communication of innovative technologies - Feedback from DeSIRA projects around the world*, Chloé LECOMTE, CIRAD). These platforms can be combined with types of services, such as training (e.g. Université Gaston Berger de Saint-Louis, Senegal), the implementation of territorial action plans (Ecowas Observatory for priority actions), experimentation or demonstration (test platforms), and the acceleration of entrepreneurship (UNDP Accelerator Lab, by Gina Lucarelli).

Rely on multi-stakeholder co-design approaches:

In addition, several presentations of the BioStar project showcased the relationship between co-design approaches and scaling strategies. The scaling and dissemination of these technologies depend directly on the quality of this integrative approach and on their impact at the local level (*Scaling flash drying: RTB Food project on scaling up small-scale cassava drying units*, Alejandro TABORDA ANDRADE, agricultural innovation consultant).

In addition, several key players need to be involved in the early phases of equipment design and technical development.

- **Upstream involvement of the private sector:** Collaboration between users and manufacturers during the innovation process ensures that technologies align more closely to real needs. The feedback presented at the conference emphasized the importance of involving companies in the project as early as possible to better aggregate market constraints and customer data from the outset (*Bioenergy and territorial development: The experience of biogas digesters in West Africa*, Xavier BAMBARA, former coordinator of Burkina Faso's national biodigester programme and of the Alliance for Biodigesters in West Africa). Several public-private partnership models were also presented, such as social enterprises (*Bridging innovation and practice: Reaching smallholder farmers with bio-based solutions for sustainable agriculture in Africa*, Robert KUBAI, EAFF, Morris EGESA, AFAAS*)*, solidarity cooperatives (*Sustainable, local,aand citizen-based heat*, Frédéric BOURGOIS, Coopéos), and connection platforms, such as the Bio2E platform on methanization (*Pre-composting of inputs in continuous batch methanization: Issues and recommendations*, Diana GARCIA-BERNET, LBE-INRAE).

- **Involve local professional and economic organizations** in promoting and supporting innovations, facilitating their integration into existing value chains. In the BioStar project, **interprofessional organizations (IOPs)** play a crucial role in disseminating bioenergy equipment to agri-food SMEs. They facilitate networking, organize visits to pilot SMEs to share best practices, and support companies in replicating equipment on a regional scale. In addition, IOPs are essential for raising awareness among policymakers by informing and mobilizing local, regional, and national authorities.

Through strategic advocacy, they guarantee the institutional support needed for scaling up bioenergy technologies.

- **Involvement of public authorities** - the most common way public authorities are involved is through advocacy, which is essential for supporting these efforts and encouraging widespread adoption. The experiences shared at the conference demonstrate a variety of ways to involve public authorities, such as working on new information channels and providing feedback to public decision-makers to develop relevant and appropriate policies, and involving them in the coordination of innovation platforms.

Capacity-building for manufacturers is also part of the scaling scenarios to enable the adaptation and resizing of equipment on a case-by-case basis while adopting a more comprehensive approach. This strategy complements co-design approaches, which are essential for developing technology that closely reflects actual usage practices and ensures decent working conditions (*BioStar project: bioenergy for SMEs in West Africa*, Joël BLIN, CIRAD).

5.3. Circular economy scenarios

The circular economy is increasingly being highlighted as a response to structural challenges and transitions in Africa. However, as emphasized at the conference, this approach is relevant and applicable at the local level everywhere in the world. By adopting this model, countries can reduce their reliance on limited resources, diversify their economies, and create new employment opportunities. By way of illustration, the African Union Commission has drawn up the Circular Economy Action Plan for the African continent, which serves as a roadmap for the transition to a circular model. This plan requires the agricultural and agri-food sector to create jobs in rural areas over the next two decades, yet this sector faces limited access to resources, particularly energy.

The discussions and case studies presented at the conference highlighted several key advantages of bioenergy for sustainable and resilient production at the local scale:

- **Support the diversification of markets for organic by-products.** From an environmental perspective, replacing fossil fuels with renewable biomass sources significantly reduces the carbon footprint of production processes. Furthermore, the recovery of organic by-products in the form of biochar, digestates, ash and tar opens up new opportunities for market diversification, generating additional income for local players;
- **Use carbon credits and climate financing** to enhance the sustainability of investments in this sector. Adopting biomass-based energy models also enables local businesses to secure their energy supply, thereby reducing their vulnerability to fluctuations in the price of electricity and fossil fuels (*Bioenergy and territorial development: The experience of biogas digesters in West Africa*, Xavier BAMBARA, former coordinator of Burkina Faso's national biodigester programme and of the West African Alliance for Biodigesters – a topic that also was discussed during the panel discussion "*Contribution of bioenergy to local sustainability: Social, economic & environmental*");

- **Modernize production infrastructure.** Improving working conditions is another major challenge. Access to clean, stable energy encourages the modernization of production infrastructure and lightens the workload, particularly in the agri-food sector. Introducing energy solutions tailored to the needs of small processing units optimizes process efficiency and ensure improved health and ergonomic conditions for workers (*Evaluating the impacts of bioenergy on the working conditions of workers in SMEs in Senegal and Burkina Faso*, Mohamed PORGO, Université Thomas Sankara);
- **Promoting the exclusive use of bioenergy in agri-food processing** offers a major advantage in accessing new markets. By guaranteeing that their products are made without fossil fuels or non-renewable wood, companies are meeting growing sustainability requirements and can apply for labels that promote environmentally responsible practices. This transition strengthens their competitiveness while contributing to a greener, more sustainable economy;
- **Integrate bioenergy into local economic ecosystems.** The emergence of innovative socio-economic models (energy cooperatives, public-private partnerships, etc.) is an effective response to the challenges of employability and the attractiveness of jobs in the renewable energy sector;
- **The importance of promoting green financing mechanisms** to encourage the development of bioenergy innovations and their deployment in rural areas.

Putting bioenergy to productive use is part of an integrated approach that combines energy efficiency, reduced environmental impacts, and local socio-economic development. The implementation of public incentive policies, combined with enhanced cooperation between economic and institutional actors, appears to be an essential condition for ensuring the long-term viability and dissemination of these solutions.

6. Conclusion

To promote sustainability and resilience in the face of climate change, converting agricultural waste into bioenergy to power local SMEs is fully in line with a virtuous circular economy approach. This process enables these SMEs to secure their energy sovereignty, create added value, and boost local job creation.

Drawing on feedback from projects carried out in partnerships around the world, the BLP 2025 conference provided a unique opportunity to share lessons learned with stakeholders from over 30 countries, and to identify the prerequisites for promoting the growth of bioenergy for use by SMEs worldwide. It provided a forum for exploring knowledge and experiences in the field of bioenergy, laying the groundwork for possible futures.

The three-day conference was a genuine success, both in terms of the quality and diversity of the presentations, and the many discussions and sharing of experiences. In particular, these confirmed that:

- bioenergy is now one of the solutions capable of ensuring a local and sustainable supply of energy for productive purposes, especially for small and medium-sized enterprises (SMEs);

- their small-scale development for local use aligns fully with a circular economy approach, not only in Africa and Europe, but also in other parts of the world, highlighting its universal nature;
- feedback from concrete, recent experiences not only contributes to the technological improvement of innovations at the local level, but also informs public policy and development aid financing arrangements.

The participants gained new perspectives, a strengthened network, and fresh ideas, whether for setting up new projects, establishing new scientific collaborations, or streamlining information channels on the topic of bioenergy for productive purposes at the local level.

Acknowledgements

The Organizing Committee of the conference would like to extend its warmest thanks to all the participants and speakers who helped make this event a success.

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BLP 2025 - TUESDAY, JANUARY 28

8h00 - 8h30 - COFFEE RECEPTION *(bananier hall)*

8h30 - 10h00 - INTRODUCTORY PLENARY SESSION *(amphitheater)*

- *Welcome from the organization - Conference objectives and challenges*
  Elisabeth CLAVERIE DE SAINT MARTIN, CEO of CIRAD and Organizing committee
- *Commitment of donors and promotion of innovation at the local level among economic stakeholders in West Africa*
  Christophe LAROSE, Team Leader, Sustainable Agriculture, General manager International Partnerships, European Commission
- *Challenges related to the development of bioenergy for productive purposes*
  François GIRAUDY, ARB division of Agence Française de Développement
- *Issues linked to the development of and access to short-circuit energy as part of a local approach*
  Alexandre LEGRIS, Agence de Programme sur l'Énergie Décarbonée

10h30 - 12h30 - PLENARY SESSION *(amphitheater)*

- *Bioenergies: challenges linked to the development of medium-power local energy solutions*
  Joachim MÜLLER, Hohenheim University
- *Scaling innovation : from readiness to application*
  Murat SARTAS, Innovation and Scaling Lead, Alliance of Bioversity and CIAT & IITA
- *How to accelerate grassroot innovations: inspirations from UNPD Accelerator Labs*
  Gina LUCARELLI , UNDP Accelerator LAb

12H30 - 14H00 - COCKTAIL RECEPTION

14h00 - 18h00 - THEMATIC SESSIONS

Technical developments dedicated to the use of biomass energy by enterprises: Local biomass & processes *(amphitheater)*

- *BioStar Project: Co-design of a shea nut roaster using churning sludge as fuel*
  Sayon SIDIBIE, Ousmane DIMA, 2iE - Hervé JEANMART, Catholic University of Louvain
- *Challenges and issues in biomass conditioning*
  Matthieu CAMPARGUE, RAGT Énergie
- *Pre-composting of inputs in continuous dry batch methanization: Issues and recommendations*
  Diana GARCIA-BERNET, LBE-INRAE
- *BioStar project: co-design of a cashew nut shell staged combustion boiler*
  Alexandre Parfait SANOU, 2iE - Laurent VAN DE STEENE, CIRAD
- *Pyrolysis of agricultural wastes with the Brasilian Kiln*
  Patrick ROUSSET, CIRAD
- *Pyrolysis of cashew nut shells in Burkina Faso*
  Étienne PERRIER, Magloire SACLA-AÏDE, Nitidæ

Large-scale deployment of locally developed technologies *(badiane room)*

- *Scaling flash drying : RTB Food project on scaling up small-scale cassava drying units*
  Alejandro TABORDA ANDRADE, agricultural innovation consultant - Arnaud CHAPUIS, Thierry TRAN, CIRAD
- *The full story of the cashew pyrolyzer across borders: Genesis, challenges, fut*
  Pascale MARTEL-NAQUIN, CEFREPADE - Thierry GODJO, UNSTIM Benin
  Étienne PERRIER, Nitidae
- *Innovation platforms as support for the dissemination and communication of innovative technologies - Feedback from DeSIRA projects around the world*
  Chloé LECOMTE, CIRAD, *et al.*
- *Hydrothermal carbonization and anaerobic digestion of agricultural and forestry waste: Practical implementation in Senegal*
  Lat Grand NDIAYE et *al.*, UASZ
- *Conception trajectories for Biostar innovations*
  Ignace MEDAH, IRSAT, *et al.*

BLP 2025 - WEDNESDAY, JANUARY 29

8h30 - 9h00 - COFFEE RECEPTION *(bananier hall)*

9h00 - 12h30 - PLENARY SESSION *(amphitheater)*

- *Renewable energy development strategy in West Africa*
  Francis SEMPORE, ECOWAS Center for Renewable Energy and Energy Efficiency (ECREE)
- *How can we explain the unequal treatment of renewables in Africa's energy future?*
  Sadrine MICHEL, University of Montpellier
- *Evaluating the impacts of bioenergy on the working conditions of workers in SMEs in Senegal and Burkina Faso*
  Mohamed PORGO, University of Thomas Sankara
- *Biomass combustion: Issues, challenges, and technological development*
  Yann ROGAUME, University of Lorraine, LERMAB
- *Sustainable, local, and citizen-based heal*
  Frédéric BOURGOIS, COOPÉOS

12H30 - 14H00 - COCKTAIL RECEPTION

14h00 - 18h00 - THEMATIC SESSIONS

Technical developments dedicated to the use of biomass energy by enterprises: Sustainable technologies & local contexts *(amphitheater)*

- *BioStar Project: Co-design of a cashew nut shelling boiler powered by heat from cashew nut shell combustion*
  Ibrahima MANÉ, WINDA - Hélène DUPEUX, CIRAD
- *Feedback on pico/micro methanization*
  Luc GERUN, S3d Ingénierie
- *Cashew gasification in Cambodia*
  Brice NICOLAS, IED
- *Carbon recycling biostation in côte d'ivoire*
  Kossia OUATTARA, LONO
- *Valorization of shea tree by-products for a cooperative in northern Togo*
  Aristide DEJEAN, Best Énergies
- *Biochar uses for soil amendment and water purification in Côte d'Ivoire*
  Casimir BROU YAO, Kouassi Benjamin YAO, Institut National Polytechnique-Houphouët-Boigny (INP-HB)

Bioenergy as part of the circular economy *(badiane room)*

- *Bioenergy and territorial development: The experience of biogas digesters in West Africa*
  Xavier BAMBARA, former coordinator of Burkina Faso's national biodigester program and of the west african biodigester Alliance
- *The development dynamics of the occitan biogas and biomethane sector: An evaluation of the innovation system in terms of its circularity*
  Clément BONNET, University of Montpellier
- *Analysis of the environmental and health impact of cashew nut shell energy recovery in Burkina Faso*
  Marie SAWADOGO, 2iE
- *Characterisation of West-African agricultural waste as feedstock for thermochemical conversion processes*
  Capucine DUPONT *et al.*, IHE Delft
- *A participatory exploration of the expected impacts of technological change on small and medium food-processing enterprises in Burkina Faso and Senegal*
  Livia BARTOLOMEI, Université ROMA TRE

18H30 - COCKTAIL RECEPTION

BLP 2025 - THURSDAY, JANUARY 30

8h30 - 9h00 - COFFEE RECEPTION *(bananier hall)*

9h00 - 10h20 - PLENARY SESSION *(amphitheater)*

- *BioStar project: bioenergy for SMEs in West Africa* - **Joël BLIN, CIRAD**
- *Bio4Africa project: bio-based solutions for sustainable agri-food systems in rural Africa* - **Jean-Michel COMMANDRE, CIRAD**

10h50 - 12h30 - DISCUSSION PANEL *(amphitheater)*

Development and adaptation of technical solutions:
Contextual and local approaches

1. What are the determining factors and criteria taken into account when making technological choices?
2. What are the keys to ensuring that the equipment designed meets the expectations/needs/ know-how of concerned parties ?
3. How can we find the right balance between technical performance and economic profitability?

Testimonials from key players, followed by discussion with participants

10h50 - 12h30 - BIO4AFRICA FINAL CONFERENCE *(badiane room)*

Green valorization of agricultural wastes - Moderator: Knud TYBIRK, FBCD

- *Biomass pelletization for energy and biorefinery use*
  Benjamin RABDEAU et al., RAGT
- *Green protein products from fresh leaves by biorefinery in Uganda*
  Wim VAN DOORN, Mohammed SHARIFF, KRC
- *Novel biorefinery whey applications*
  Aleksandra AUGUSTYNIAK *et al.*, MTU
- *Up-grading agro-wastes from western Africa in biocomposites applications*
  Souha MANSOUR *et al.*, CIRAD
- *Bioeconomy effects in rural Ghana*
  Moses N'GANWANI TIA *et al.*, Savanet

12H30 - 14H00 - COCKTAIL RECEPTION

14h00 - 15h00 - PLENARY SESSION *(amphitheater)*

- *Strategy for the development of bioenergy for productive purposes at the local level*
  François GIRAUDY, ARB division of Agence Française de Développement
- *Projets Nexus énergie Eau Alimentation & économie Circulaire*
  Vanessa MARTOS POZO, ECOWAS Center for Renewable Energy and Energy Efficiency (ECREE)

15h30 - 16h30 - DISCUSSION PANEL *(amphitheater)*

Contribution of bioenergy to local sustainability: Social, economic, and environmental

1. Cascading biomass valorization : How can we prioritize biomass uses according to local contexts and needs?
2. How can we guarantee the sustainability/economic viability of bioenergy innovations? Can the environmental impact of bioenergy and/or by-products bea a lever for developing the bioeconomy?

Testimonials from key players, followed by discussion with participants

14h00 - 16h30 - BIO4AFRICA FINAL CONFERENCE *(badiane room)*

Sustainability, business, outreach and policy recommendations
Moderator: Marie-France THEVENON, CIRAD

- *Life Cycle Assessment results on the technologies of Bio4Africa*
  Giorgios LANARAS-MAMOUNIS, DREVEN
- *Circular business models for small-scale biobased technologies in rural Africa: Co-creation and validation with local stakeholders*
  Evangelia TSAGARAKI, Q-PLAN INTERNATIONAL - Morris EGESA, AFAAS
- *Bridging innovation and practice: Reaching smallholder farmers with bio-based solutions for sustainable agriculture in Africa*
  Robert KUBAI, EAFF - Morris EGESA, AFAAS
- *Summary of policy recommendations to enhance bioeconomy*
  Daniel WILLY, AATF

16h30 - 17h00 - RESTITUTION & CONCLUSION *(amphitheater)*

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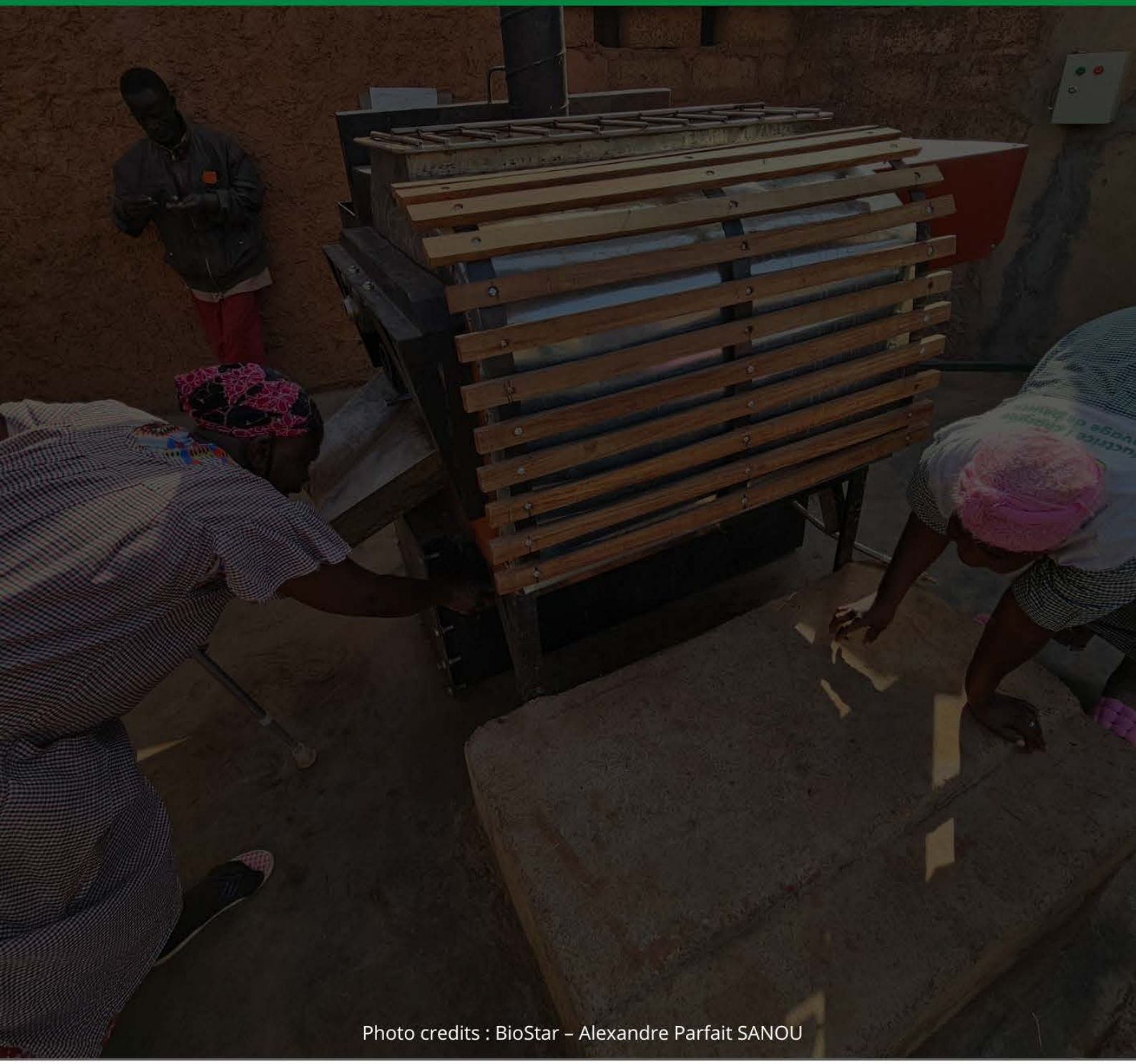

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