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VEF VIRTUAL SERIES

VEF VIRTUAL SERIES FOOD SYSTEMS TRACK POLICY BRIEF

The VEF Virtual Series is an initiative launched by the United Nations Industrial Development Organization (UNIDO) in partnership with the Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP) and Sustainable Energy for All (SEforALL).

Assembled in anticipation of the Vienna Energy Forum 2021, the VEF Virtual Series was designed as a platform for discussion with the aim of providing recommendations and action-oriented solutions to assist countries in aligning their COVID-19 recovery efforts with inclusive and sustainable industrial development. It produced eight virtual sessions per track, gathering selected representatives from the private sector, academia, think tanks, non-governmental organisations (NGOs), civil society organisations (CSOs), governments and international organisations.

Guided by the theme "Accelerating Energy Transition," the 2020/2021 edition of the series explored the pathways that stimulate demand and promote economic recovery in three end-use sectors: Food Systems, Industry and Products.

The VEF Virtual Series culminates with the launch of three Policy Briefs that address the needs of developing countries and emerging economies, and unlock opportunities to pursue the energy nexus with each end-use sector. This Food Systems Track Policy Brief provides the findings and recommendations of over 120 leading experts that contributed to the VEF Virtual Series, representing different sectors, institutions and geographies.

Executive Summary

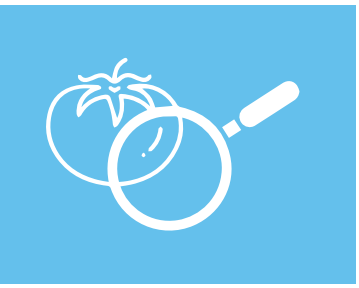
Countries face two important, closely interlinked challenges of meeting increasing demands for energy with sustainable energy solutions and supporting the transformation of food systems so that both production and environmental sustainability are improved at the same time. Addressing this challenge will be critical for the achievement of most Sustainable Development Goals (SDGs) and countries' Nationally Determined Contributions (NDCs). Three main drivers behind the food systems transformation are ensuring food security, mitigating the greenhouse gas (GHG) emissions of the end-use sector and increasing resilience to climate change-induced hazards.

This Policy Brief aims to assist the development of action-oriented solutions that help countries align their energy transition efforts with a sustainable and inclusive food systems transformation. It demonstrates the role that sustainable energy (renewable energy and energy efficiency) can play in supporting a more rapid and more sustainable transformation of food systems from smallholder farmers to large-scale operations. The Policy Brief highlights the need for improved coordination to achieve these goals, especially between the energy and food sectors. It also highlights the potentially significant contribution that new digital applications and improved access to and use of data can have in enabling a practical and economically viable energy-food systems transformation.

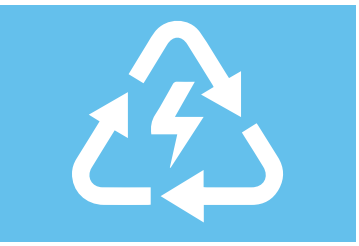
The policy recommendations provide action-oriented recommendations for policy makers working at the nexus of developing countries to help them align their energy transition efforts with a sustainable food systems transformation. The Policy Brief also seeks to elaborate the benefits of designing and implementing integrated policies for the energy-agriculture nexus.

This Policy Brief is based on the discussions of 120 leading experts working on the area during the VEF Virtual Series. The context is supported by the research wherever needed.

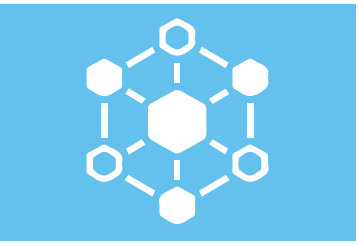
Key Findings



The needs of the end-use sectors (e.g., affordable and reliable energy supply) along the food value chains should be considered in integrated policies to better align the sustainable energy and food systems transition. To accelerate the energy transition for food systems transformation, a global programme will be launched. The programme will aim to ensure food security through productive uses of energy (PUE), support agro-industrialisation through sustainable energy solutions, promote digitalisation and innovation to build adaptive food systems, and enable the required policy environment and institutional setting.

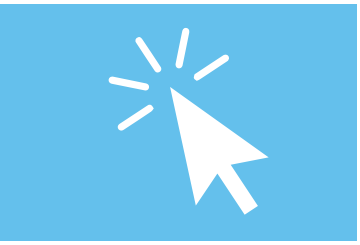


Renewable energy and energy efficiency improvements can contribute significantly to the sustainable transformation of food systems by enabling the decarbonisation of inputs, post-harvest stages and consumption, and by improving productivity and added value.

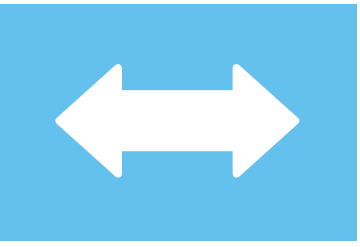


The interrelationships between food systems and energy need to be recognised in analysis, planning, institutional relationships, policy and finance mechanisms, instead of being treated as separate entities. Multi-disciplinary expertise and effective communication between energy and food experts are critical to strengthen the effectiveness of interventions in the nexus.

Planning is impeded by the lack of available data or poor access to data (e.g., on demand estimates, use of diesel-powered equipment, food waste, etc.) and the inefficient use of existing knowledge on energy-food linkage as well as of existing solutions and approaches. These planning shortfalls hinder coordination and make it difficult to correctly target investments to meet exact user needs.



Recent developments in digital applications provide a means to accelerate progress in the integration of sustainable energy into food systems.



There is a pressing need to design and implement approaches comprehensively addressing both the access to renewable-based solutions/energy-efficient appliances and the traditional constraints of the agriculture sector (inadequate agronomic training, business development skills and market linkages).

Recommendations

Improve the policy environment with incentives and holistic, integrated approaches to value chains to unlock the benefits of sustainable energy integration in food systems.

New financing models (e.g., PAYGO) along with demand stimulation and clustering small investments can improve the finance and investment environment in developing countries.

Harness the power of digital tools and big data systems to derisk investments, improve access to finance and foster innovation and new businesses. Coherent policies on digital transformation should consider equal access to data and the effective use of existing datasets along with privacy and ownership.

Effective coordination among government institutions and national and local policies is crucial to tap the opportunities that emerge from the food systems and sustainable energy transition.

Mainstream gender and youth considerations throughout the agri-food value chains. Leave no one behind in the energy and food systems transformation.

Introduction

Even though food systems have been transforming with ever-increasing efficiency and productivity, they still fail to provide adequate food supply while contributing to GHG emissions and environmental degradation. Around one third of total global GHG emissions[1] stem from food systems, including the activities comprising agriculture and land use, storage, transport, packaging, processing, retail and consumption. Food systems are also responsible for around one third of total end-use energy[2]. The COVID-19 pandemic has the potential to shift the trajectory of the food systems transformation towards sustainability. The disruption of food systems during the pandemic has highlighted the vulnerability of countries that depend heavily on agricultural imports or foreign workers. A global call to build back better from the pandemic[3] encourages countries to invest in resilient food systems and local value chains[4]. This, alongside the recognition of the potential value of a green economy for employment and economic growth, creates a unique opportunity to accelerate the role of an energy transition that supports food systems transformation. This transformation opens up a great window of opportunity for improved energy efficiency and the uptake of renewable energy technologies in decarbonising food chains and PUE[5].

The integration of renewable energy solutions into food chains can lead to multiple wins. These include sustainable improvements to living conditions and livelihoods, improved agricultural productivity, reduced food loss through efficient post-harvest solutions, improved access to markets, reduced local pollution and global emissions, positive impacts on health, reductions in workloads, increased diversification, job creation, and the potential to reach vulnerable groups such as women and youth[6] and those who are marginalised in remote areas with no grid access.

1 Crippa, M., Solazzo, E., Guizzardi, D. et al. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. Nature Food 2, pp. 198–209.
2 IPCC (2019). Special Report on Climate Change and Land. Chap. 5: Food Security.
3 United Nations Department of Global Communications (2020). Climate Change and COVID-19: UN urges nations to 'recover better'.
4 UNIDO has recently published a guide, "Short Food Supply Chains for Promoting Local Food on Local Markets", to promote Local Food in Local Markets.
5 In this Policy Brief, PUE refers to the use of sustainable energy to facilitate and/or increase income-generating activities in value chains.
6 UNIDO points this out in its Clean Energy Mini-Grid Policy Development Guide (2021).

Research Summary and Results

The potential role of an energy transition in transforming food systems includes the following:

Improving the efficiency of food production:

Renewable energy-powered irrigation has the potential to significantly increase production and address vulnerabilities associated with climate change. Research suggests that in Africa solar power alone could support the irrigation of 6–14 million new hectares of land that has the potential to improve food security and reduce the population at risk of hunger and malnutrition[7]. However, the risk of depletion of groundwater reserves with over-irrigation should not be overlooked.

The utilisation of domestic renewable energy sources enhances energy security and thus contributes to the adaptive capacity of smallholder farmers and self-sufficiency in the face of climate-induced hazards and disruptions or lack of power/fuel supply. Examples include off-grid solar systems to power irrigation systems and other essential processes such as cold storage or heating (e.g., from bioenergy in poultries) to minimise production losses as well as to power early warning systems and provide access to emergency services.

Improving post-harvest handling of food in agricultural businesses:

Modern cold storage solutions: Highly efficient refrigeration units and cold chains have the potential to reduce post-harvest losses from 30%[8] to less than 10%[9]. Renewable energy solutions (e.g., solar energy) are proven sources to power such units. Cold chain solutions help maintain the quality of produce, assisting access to markets and improving livelihoods for farmers. Often, small-scale cold storage can provide cost-effective, practical solutions for entrepreneurs in rural areas. In some cases up-front costs might be prohibitive, but the growth in urban middle classes is increasing the demand for perishable goods and creating incentives for improvements in the economics of cold chains. However, creating this demand supply linkage between farmers and this growing urban middle class can be challenging.

Food processing: Basic food processing at the village level provided by the use of renewable energy can help farmers add value to their produce, improve local nutrition and save farmers' time. This upgrade can create income and directly improve the livelihoods of vulnerable groups, especially women. Larger-scale food processing and packaging, connected to electricity from the grid or larger-scale off-grid renewables, can create jobs in peri-urban and urban areas. In Africa in particular, the food processing sector has significant upgrading potential, and this creates a substantial investment opportunity if affordable, efficient and sustainable technologies can be developed.

7 Xie, H., Perez, N., Anderson, W., Ringler, C., and You, L. (2018), Can Sub-Saharan Africa Feed Itself? The Role of Irrigation Development in the Region's Drylands for Food Security, Water International, vol. 43, No. 6, pp. 796–814.
8 FAO (2019). Reducing post-harvest losses.
9 GIZ (2016). Promoting Food Security and Safety via Cold Chains.

Using bioenergy and circular systems:

Waste and residues can be used to produce renewable electricity, thermal energy (heating, cooling) or energy for cooking, thus helping to reduce energy access deficits. This also improves waste management (e.g., by replacing open burning and reducing land and water pollution) and has the additional benefit of producing organic fertiliser as a by-product. This, in turn, provides additional monetary value that can improve the economic feasibility of bioenergy projects, while also reducing chemical use and GHG emissions. However, due consideration must be given to the possible competing uses of food chain residues, i.e., among soil management, animal feed, bioenergy and bio-products.

Food waste can be reduced through technology improvements, process optimisation and the utilisation of by-products. There is general agreement on the importance of innovative techniques and technology mixes for the processing, transport and storage of agricultural commodities, while creating the minimum amount of waste and using the minimum amount of energy[10].

Enablers:

Enabling factors with the potential to catalyse this energy transition in the food sector include the following:

Digitalisation[11]: Digitalisation increases the efficiency of energy use, improves energy and food supply processes, and helps to create highly interconnected systems[12], all of which contribute to improved cost-effectiveness and economic viability. Furthermore, digital applications can help overcome many of the problems associated with remote locations, providing farmers with a decision support system based in real time that caters effectively for variable energy consumption[13]. Digital systems can match the energy demand of food systems with supply, reducing energy wastage and costs. These benefits are, however, dependent on good network coverage, electricity access and equitable access to phones and other appliances, particularly for women.

Coordination: At all levels, from sub-national to international, coordination among the agricultural, energy, water and finance sectors is critical. Food, energy and water planning, implementation and impact assessment need to take place in tandem, and financial institutions need to consider the linkages between them. If this coordination is absent, both the food systems transformation and the energy transition will be more costly and more likely to lead to unintended negative impacts (e.g., on environmental resources). Where this coordination is present, progress can be accelerated, impact can be scaled and environmental sustainability will be easier to manage. Coordination between energy and food players should take full advantage of the synergy between their respective business cases. When food players improve their income thanks to better access to energy, they are in a better position to afford paying the right tariff to cover the operational costs of energy developers and providers.

10 This is highlighted in UNIDO, World Bank and GIZ (2021). An International Framework for Eco-Industrial Parks.
11 Digitalisation is a broad concept which, in this paper, refers to all economic processes that are either directly or indirectly influenced by some digital technology, including helping improve the safety, productivity, accessibility and sustainability of energy systems. Adapted from IEA (2017) Digitalisation and Energy and OFSE (2018) Digitalization and Development Cooperation: An Assessment of the Debate and Its Implications for Policy.
12 IEA (2017). Digitalisation and Energy.
13 See the policy brief that covers these topics with a focus on East Africa: Powering Agriculture: Unlocking Africa's Next Green Revolution, SAIIA Policy Briefing No. 207 (August 2020), authored by Rebekah Shirley (Power for All).

Data and investment information: The energy transition requires the existence of data that enables effective planning, targeting and monitoring. Many organisations collect data, but it is not always freely shared. The use of remote sensing and big data applications is changing the data landscape. Additionally, the options for rapidly collecting and analysing data in cost-effective ways are increasing. The combination of these new approaches and more sharing of data provides real potential to support progress in the energy transition. Adequate robust information is critical to derisk and optimise investments in clean energy for food systems transformation and financing in energy-food linkages. Digitalisation, combined with recent progress in remote sensing[14], and comprehensive cost-benefit analysis of renewable energy investments in food chains[15] can significantly contribute to filling this gap.

Climate finance: Many countries recognise the importance of enhancing the food value chain as part of their national priorities for climate action, including renewable energy and/or more energy efficient solutions to replace fossil fuels in their NDCs. More than half of the NDCs (55 of 163 examined) include food value chain dimensions[16]. This creates an opportunity to leverage climate finance for projects in the nexus of energy and food systems.

Skill development: Enhancing institutional and technical capacity and awareness of sustainable energy solutions in food systems can add value to local activities and products in rural areas and assist the adoption of sustainable agro-industrialisation.

Integrated land use of food and energy systems: This includes methods such as agrivoltaics, in which solar panels are co-located with shade-tolerant crops. This can significantly reduce the land footprint of renewable energy technologies, which is expected to increase in the future. The integration of bioenergy systems into agricultural landscapes (e.g., agroforestry, intercropping) offers opportunities to improve soil, climate change adaptation and resource use efficiency as well as mitigate pressures on current land use[17].

CONCLUSIONS

Sustainable energy technologies provide the means to support food systems transformation along all the stages of the agricultural value chain – from increasing production and improving processing, storage, waste reduction and transport to improving produce sales. These technologies range from the provision of new sources of renewable energy in off-grid areas to the improvement of energy efficiency and circular approaches in larger food processing operations. This Policy Brief has highlighted several examples of the integration of energy and food, which showcase how this should be an essential element enabling food systems transformation that helps implement the Goals of the 2030 Development Agenda and the Paris Agreement. It has also highlighted the critical enablers for making this happen: appropriate digitalisation that supports improved access and efficiency and brings down costs; improved coordination that maximises the synergies among energy, agriculture, water and finance and reduces risks; optimal provision and use of data that enables effective planning, targeting and monitoring; and creation of an enabling ecosystem through capacity building. These are by no means the only conditions required.

A suitable policy environment at national and regional levels will itself be a prerequisite for these enablers, for encouraging collaboration between national and international bodies, and for stimulating the provision of finance. In addition, specific attention is needed for inclusive approaches to ensure that no one is left behind in the energy and food systems transformation.

14 For example, solar mini-grids for maize chains in Uganda (ibid).
15 Such as comprehensive cost-benefit analysis tools like FAO's Investing in Sustainable Energy Technologies in the Agrifood Sector (INVESTA).
16 FAO (2019). Priorities Related to Food Value Chains and the Agri-food Sector in the Nationally Determined Contributions (NDCs).
17 UNCCD and IRENA (2017). Energy and Land Use. Fraunhofer (2020). Agrivoltaics: Opportunities for Agriculture and the Energy Transition: A Guideline for Germany.

Policy Recommendations

Policy Environment

An enabling policy environment is a crucial factor for the uptake of sustainable energy solutions in food systems. Research and development (R&D) can be used to interpret collected data to help make science-based decisions on policies and incentives. The recommended actions to improve the policy environment are given below.

- **Coherence in policy:** A coherent policy environment that considers the nexus of energy and food will itself facilitate increased investment and encourage domestic entrepreneurs by instilling greater confidence and ensuring continuity. Implementing minimum energy efficiency infrastructure and appliance efficiency standards[18] is key in achieving policy coherence.
- **Positive incentives:** The removal of fossil fuel subsidies[19] will free up financing resources that can be used to incentivise decentralised sustainable energy solutions such as PUE applications or mini-grids and to support applied research for sustainable energy use in farms. The application of duty-free status to imported technology and tax breaks for all renewable energy developments should be encouraged. Prefabricated biodigesters and PUE appliances are good examples of what can be introduced.
- **Value chain approach:** Policies need to support the opportunities to integrate renewable energy and energy efficiency/energy efficient appliances that exist across entire food value chains. Particular attention can be provided to either end of the chain – i.e., on the one hand, providing low-carbon energy for agricultural inputs and, on the other hand, stimulating demand by food chain actors for clean energy, which can green value chains, and transform smallholder farming as well as small and medium agri-food businesses.

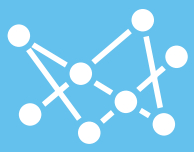
Finance and Investments

One way or another, every energy service system (fossil or renewable) has some sort of incentive, including in developed countries. Indeed, fossil fuels receive many more incentives than renewable energy receives, and affordability remains one of the key barriers hindering the market adoption of sustainable energy technologies. Credit scores, insurance and asset finance are the three critical precursors to tackle this. Create credit reference systems between appliance providers to facilitate access to credit among farmers. Identify risks and determine how to alleviate/support the price fluctuation of commodities throughout the value chain. Develop variable funding systems where farmers can have different payments depending on the harvest cycle (i.e., higher payments during harvest, lower payments in growing season). The public sector can support the private sector through longer loan tenure (e.g., an additional five years) since the investments typically require long-term funding, and commercial lenders usually are not able to provide loans above seven years of tenure.

18 E.g., VeraSol.

19 Fossil fuel subsidy reform should assess the impact on vulnerable groups, and adequate safety nets should be established in parallel with their removal.

- **Demand:** Understand the demand for sustainable energy solutions through studies, surveys, digital technologies and smart sensing. Stimulate demand for sustainable energy in food chains by demonstrating the potential impact on incomes (e.g., through catalytic enterprises and awareness campaigns), and use this demand to encourage greater and adapted engagement by financial institutions. Demand can then be aggregated following an anchor-business model.
- **Clustering:** Use new big data tools and institutional arrangements (e.g., farmer cooperatives, agro-industrial parks) to cluster small-scale energy investments, hence reducing transaction costs and making them more attractive to financial institutions.
- **New financing mechanisms:** These have benefits in both the energy supply and demand side:
    - From the energy supply side: Improve access to financing through financial technologies to increase the affordability of investments, Industry 4.0 technologies to better assess the energy demand and public-private sector partnerships.
    - From the energy demand side: Enhance the affordability of energy through schemes such as mini-grids and Pay As You Go (PAYGO) systems for adoption of appliances by end users, linked to support to the development of information and communications technology (ICT)-based payment options and complemented with improved performance of renewable energy applications in food systems compared to fossil fuel ones.
- **Link energy supply and demand business cases:** Better investigate and communicate the opportunities that lie in synergies between the business plans of energy suppliers and energy consumers. Raise awareness of the benefits of investing in projects or initiatives that work at the nexus of energy and food to remove existing barriers to finance that only supports individual sectors (e.g., energy access only, agriculture only).



Digital Transformation

Data and digital tools can potentially bring new opportunities, help manage risks and foster innovation, facilitate access to finance, and improve energy efficiency and coordination. This is a complex area for policy, with a need to manage trade-offs between open access benefits and an enabling environment that fosters innovation and investment. Other considerations for a coherent policy on data and digitalisation include:

- **Capacity:** Increase awareness and capacity among all actors in agri-food chains on the potential uses and value of data to foster innovation and accelerate digitalisation.
- **Equal access to data:** Developing policies that encourage open access to data but that also guarantee data protection when it is needed will be critical. Data should cover and should be available at all levels. For instance, farmers can use data to better plan agricultural activities. Data covering farmers can improve the bankability of projects at this level, for instance, by enabling clustering of small investments.
- **Improving coordination:** Coordination in data collection and use reduces duplication and provides cost-efficiencies. Policy can stimulate collaboration in the planning phase of major data exercises and can further help by standardising the different data methodologies governments use.
- **Effective use of digital data systems:** The collection, processing and sharing of historic and updated datasets on the energy and food sectors will avoid unnecessary costs and enable investment. Existing datasets on energy, agriculture, climate, food waste, population, transport, etc. can all be overlaid to support an understanding of energy-agriculture needs and possibilities, thus easing the matchmaking between demand and supply.

Multi-Stakeholder Coordination

In general, the food-energy nexus approach is not entirely mainstreamed yet: most of the organisations, implementers, investors and lenders are looking at it either from a purely agricultural lens or from an energy lens. Collaborative approaches help identify the exact needs of end-users and accelerate aligning of the sectors' transition to sustainability.

- **Coordination within governments:** Improve the institutional setting, promoting enhanced collaboration among the different government institutions: ministries, public agencies, etc. from the agriculture and food, energy and water sectors.
- **Integrated multi-stakeholder approaches:** Support a more effective use of multi-stakeholder approaches, including the finance and information technology sectors in all stages of national and local level policy formulation and implementation.
- **Capacity:** Strengthen the capacities of key local stakeholders, including civil society organisations (CSOs) and non-governmental organisations (NGOs), so they can effectively engage with the different government entities for more inclusive governance and policy development.

Gender and Youth Empowerment

Recognise that the full and active engagement and leadership of women and youth are central to the achievement of the clean energy transition and food systems transformation. Policies should include measurements to provide equal opportunities for women and youth to lead, participate in, benefit from and make decisions about inclusive and sustainable development.

- **Capacity**: Provide capacity building and skills development for women through energy-entrepreneurship programmes and business development support. Additionally, offer micro-financing support to ensure women can effectively enter the market. An increased presence of women in enterprises will trigger greater social impacts.
- **Address social barriers:** Most women in developing countries spend money on their family instead of investing in business. Find social solutions that support addressing time poverty, e.g., subsidised childcare or collecting sex-differentiated data related of farming households, and identify sustainable energy technologies offering time-saving gains for women.
- **Sharing knowledge and connecting:** The creation of knowledge exchange platforms at the country level is a great way for women and youth associations to seek support.
- **Youth friendly agriculture:** Make agriculture attractive and interesting for youths by using effective communication channels (social media and TV shows[20]), promoting sub-sectors that provide relatively quick returns, and promoting the use of affordable technology that reduces onerous work and improves the perception of agriculture (e.g., hydroponics, agri-photovoltaics).

20 Examples of successful TV shows are Shamba Chef and Ferme Factory.

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Abbreviations

CSO	Civil society organisation
GHG	Greenhouse gas
ICT	Information and communications technology
NDCs	Nationally Determined Contributions
NGO	Non-governmental organisation
PAYGO	Pay as you go
PUE	Productive uses of energy
R&D	Research and development
SDG	Sustainable Development Goal

Valuable input and comments on this Policy Brief were provided by:

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