



REFFECT AFRICA

Renewable energies for Africa: effective valorization of agri-food wastes

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TIFEO



PROJECT INFORMATION



CONSORTIUM FIGURES

Coordinator: University of Jaén (UJA), Spain

Total partners: 29

African countries: 11

- 3 clusters: North, West and South

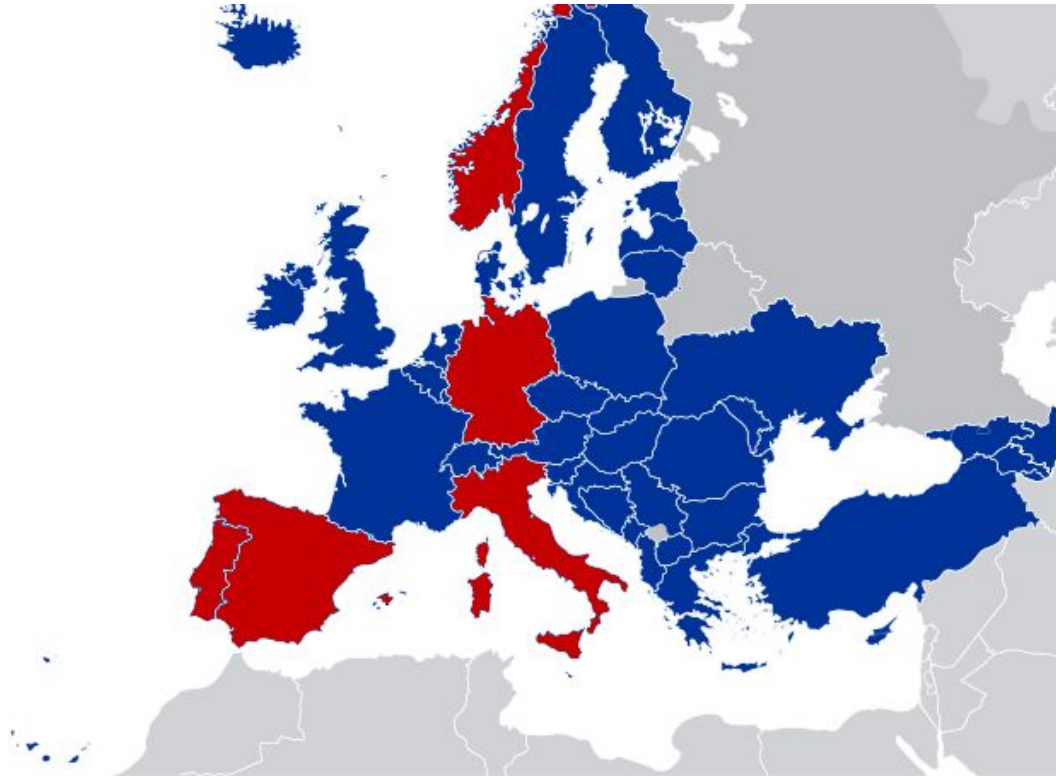
European countries: 5

5 years (November 2021 – October 2026)

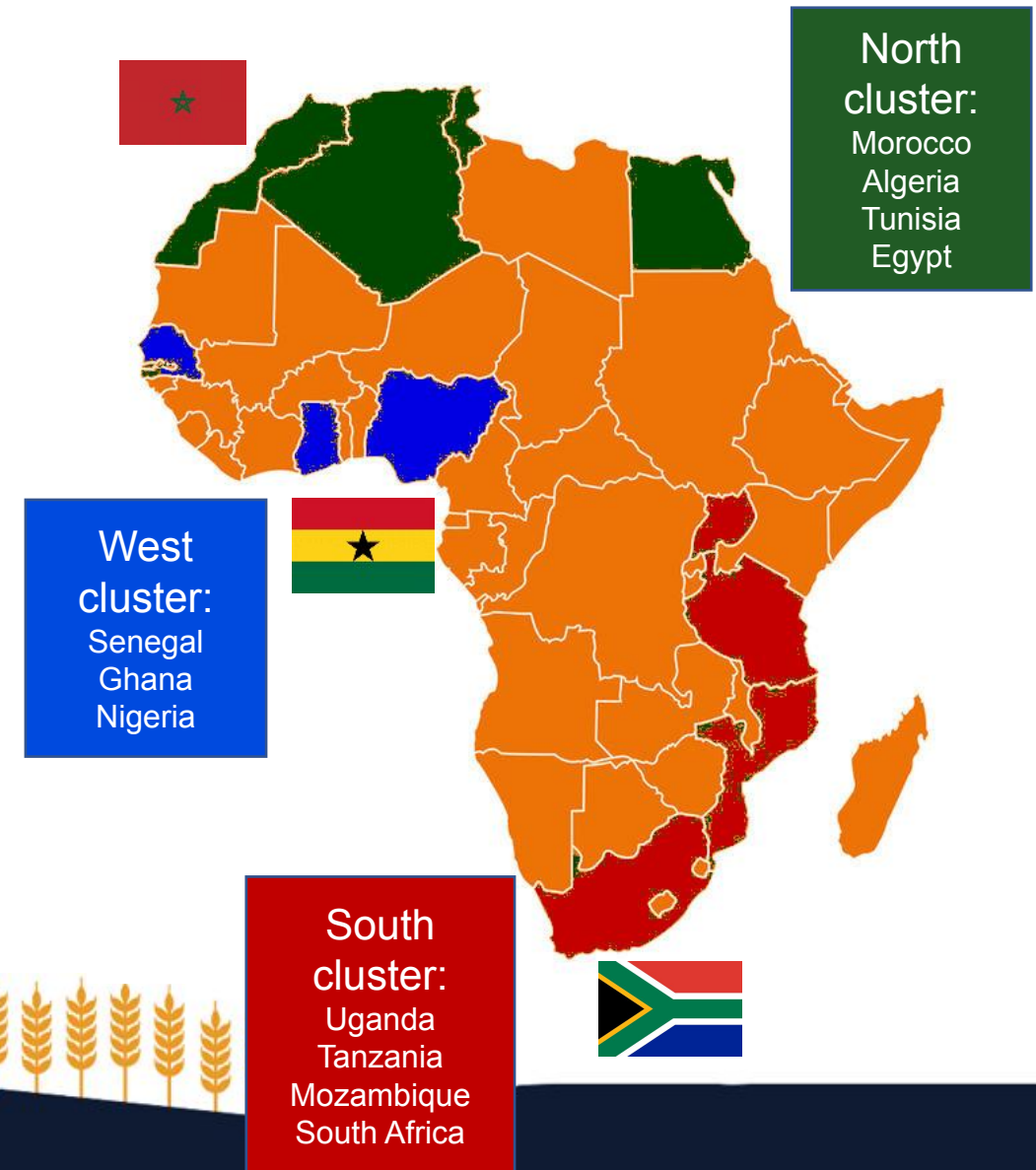
146 proposals submitted → 5 granted

PROJECT CLUSTERS

5 EUROPEAN COUNTRIES



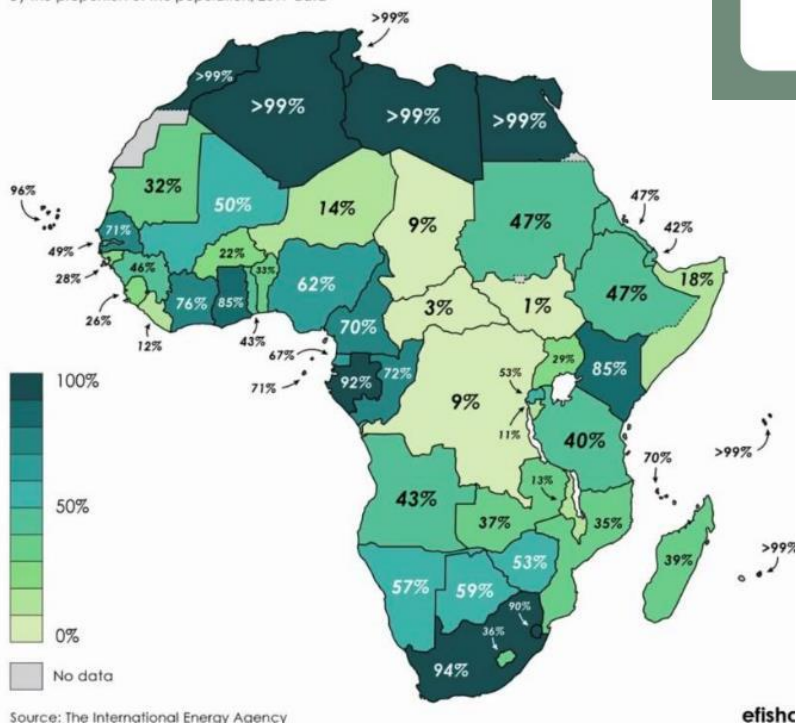
11 AFRICAN COUNTRIES



BACKGROUND

Access to electricity in Africa

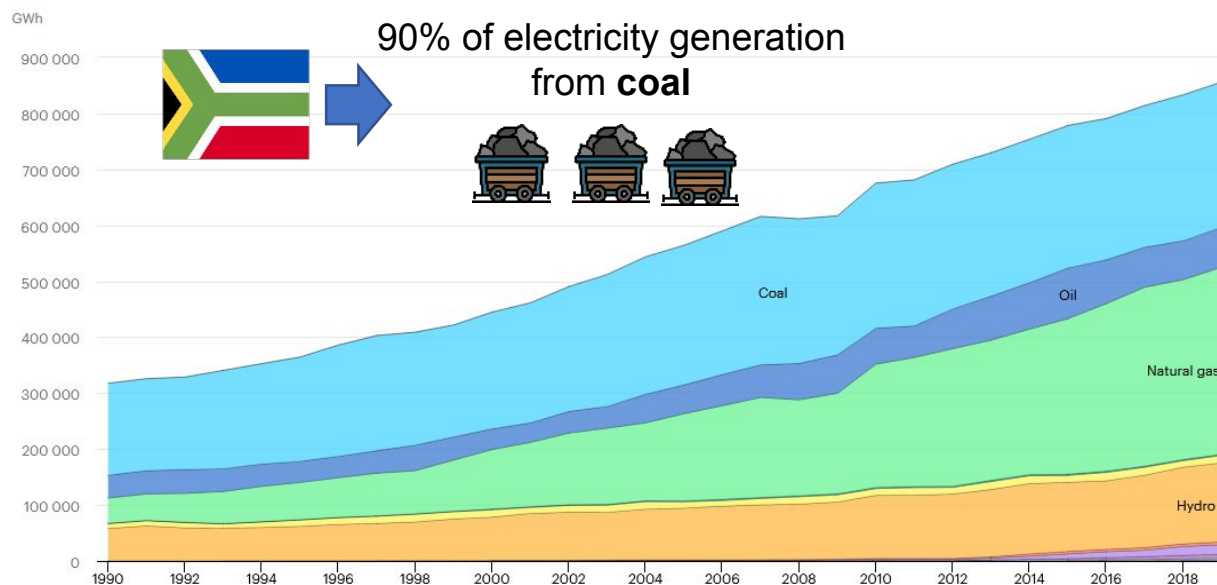
By the proportion of the population, 2019 data



“
About 600
million people
in Africa do not
have access to
electricity

IEA, 2019. Data and statistics

“In sub-Saharan Africa 55% of people **lack access to ELECTRICITY**; in 13 countries, more than 75% of population do not have access to electricity”

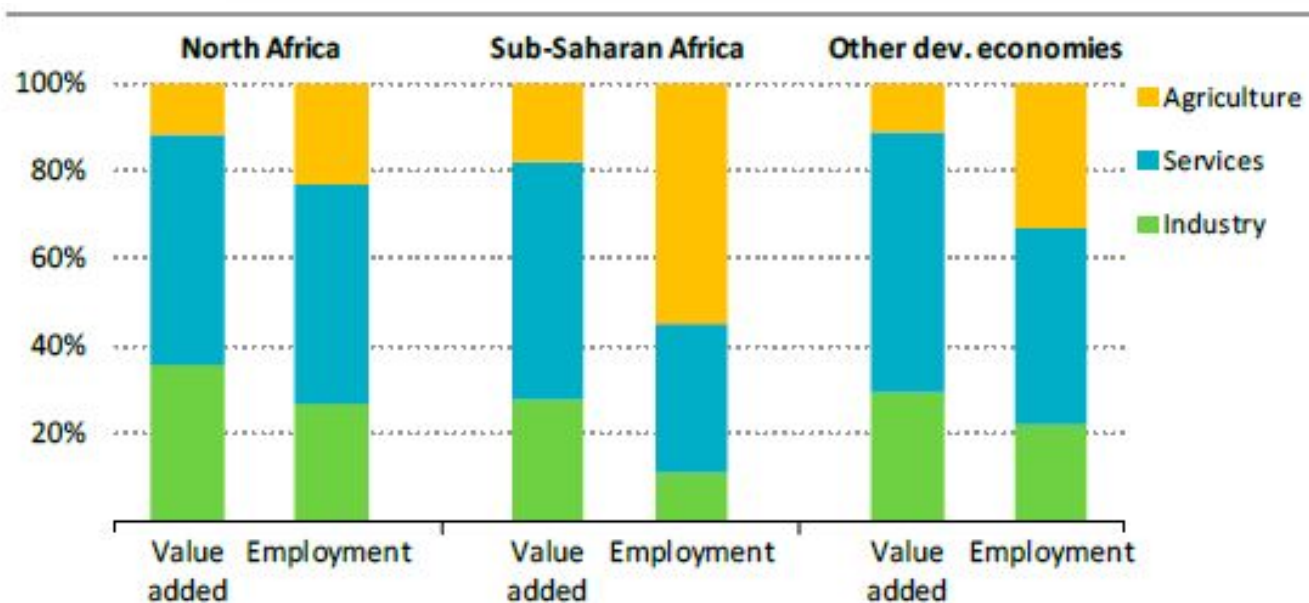


Electricity generation by source in Africa (source: IEA, 2019)

BACKGROUND



Shares of value added and employment by sector in North Africa and sub-Saharan Africa, 2018



*“**AGRICULTURE** accounts for a very large share of employment in sub-Saharan Africa even when compared to other developing economies”*

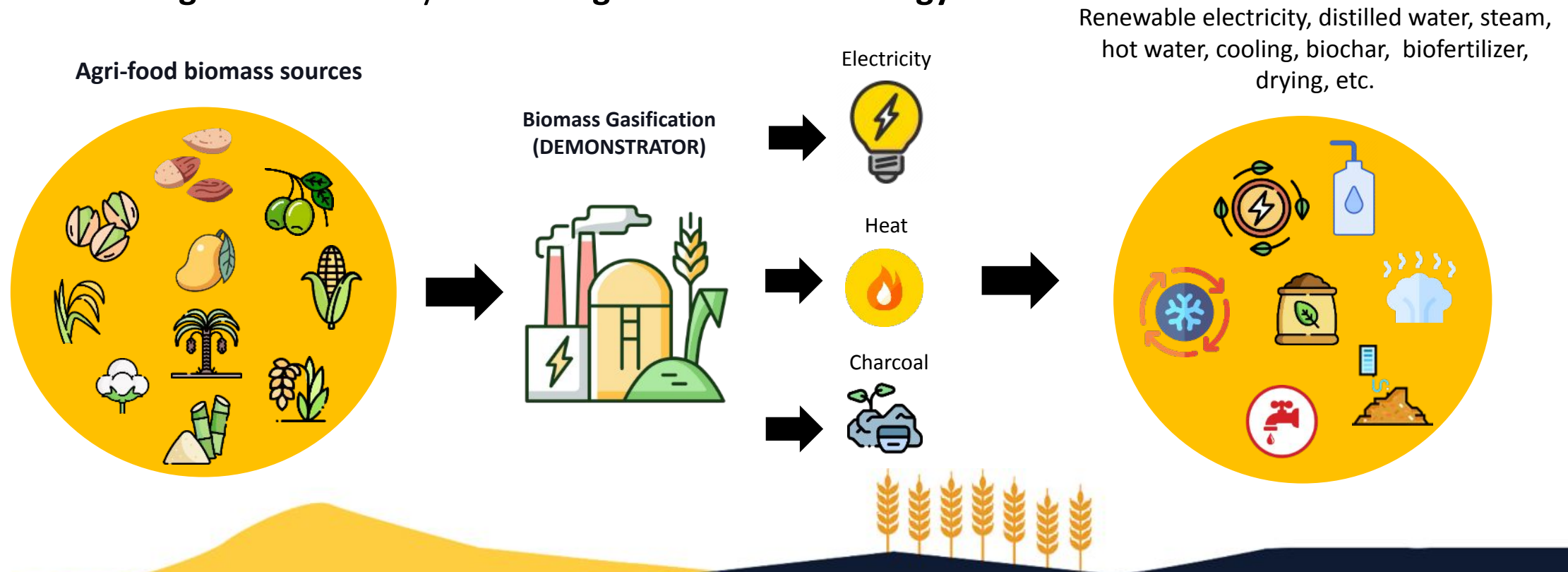


- Sub-Saharan Africa has low share of employment in industrial sectors
- **Agriculture accounts** for only 18% of the economy but **> 50 % of employment**




Aim & objectives

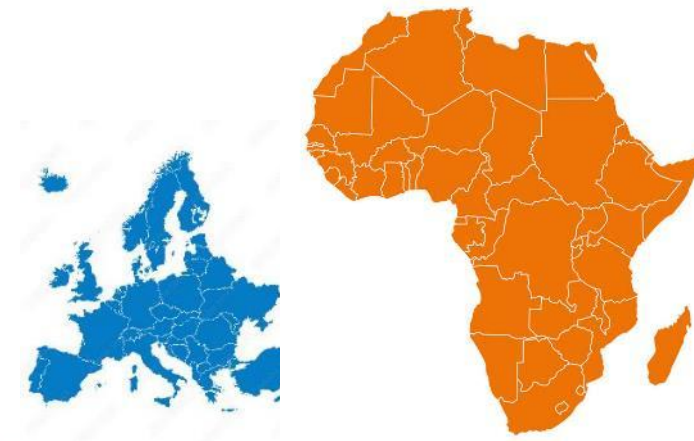
Demonstrate innovative, reliable and adapted sustainable energy solutions for the valorization of **biomass wastes from agri-food industry** based on **gasification technology**.



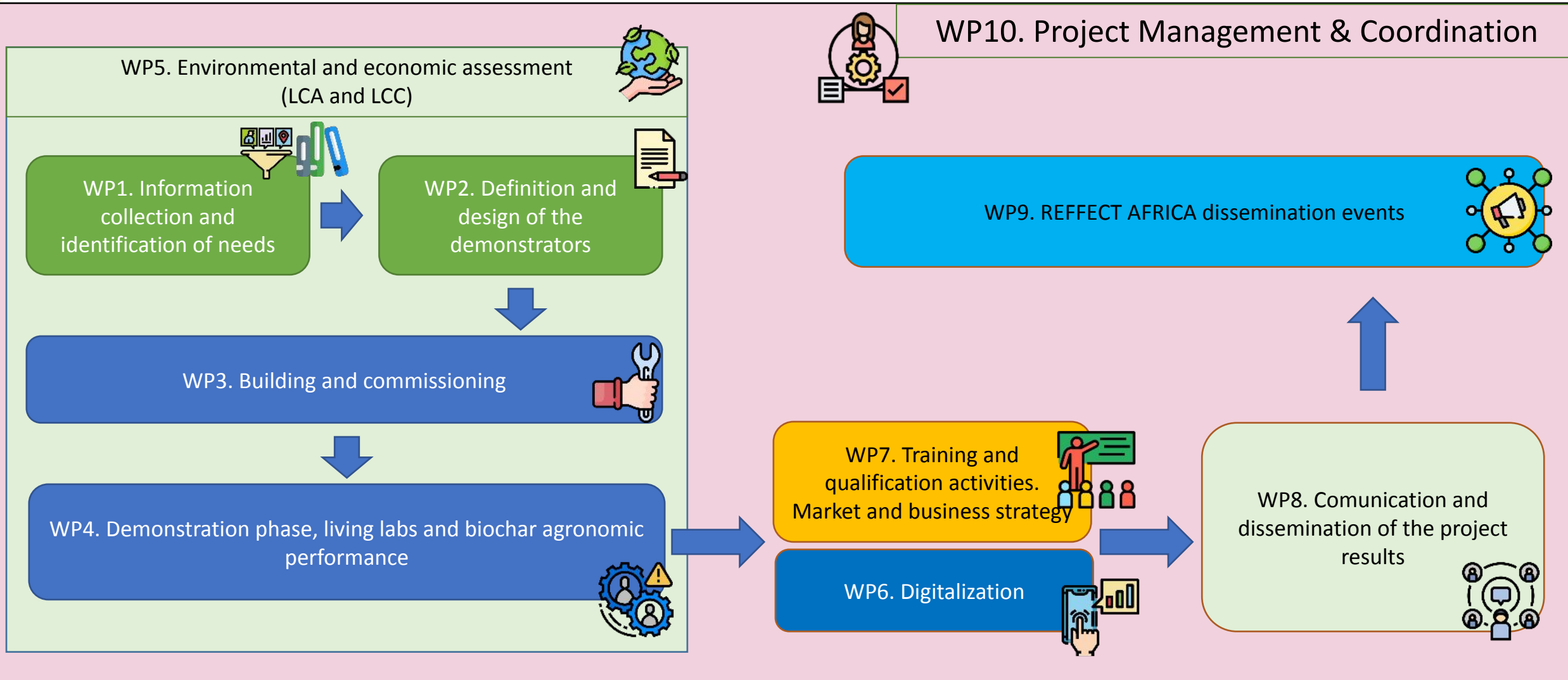
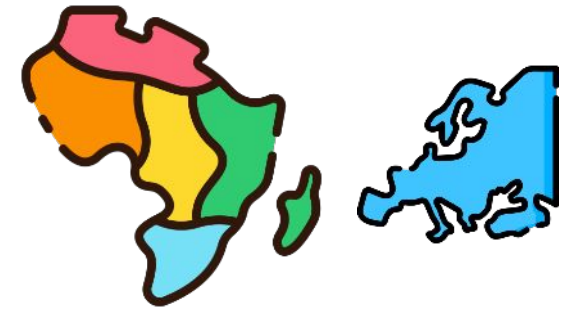
Aim & objectives



- **State-of-the-art** of the 3 most important agri-food value chains in each African Country
 - biomass potential - water sources - energy and soil analyses 
- **Installation and validation** of 3 full-scale **demonstrators** in Morocco, Ghana and South Africa
 - Based on **Gasification Technology** together with other **renewables + water regulation + lab tests**
- **Life Cycle Assessment** of each value chain **before and after the solution**
- Establish **3 Living labs** → for future research and networking
 - Knowledge transfer to the stakeholders and digitalization
- Environmental and socio-economic objectives:
 - **New jobs, training and skills** → income streams and business models
 - **Access to renewable energy** → pollution reduction
 - **Increased competitiveness** of the African agri-food sector



Work Plan



2023 June

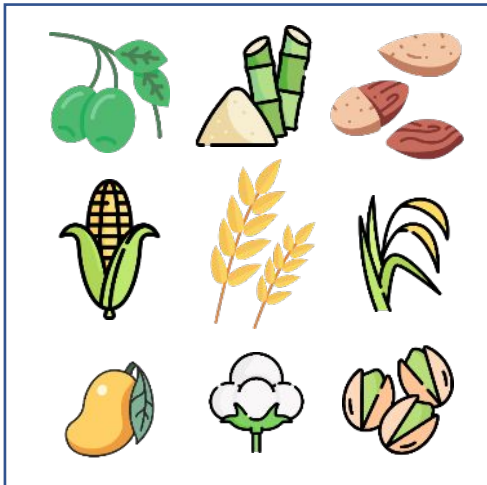
Schedule

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
WP1 Information collection and identification of main energy, water and soil needs					
WP2 Definition and design of the demonstrators					
WP3 Building and commissioning of the demonstrators					
WP4 Demonstration phase, living labs and biochar agronomic performance					
WP5 Environmental and economic impact assessment, LCA, LCC					
WP6 Digitalization					
WP7 Training and qualification activities. Market and business strategy					
WP8 Communication and dissemination of project results					
WP9 REFFECT AFRICA dissemination events					
WP10 Project management and coordination					



Technology: BIOMASS GASIFICATION

Agri-food biomass sources



Biomass Gasification Plant



BIOCHAR



Cost = 2.000 €/kW_e

Payback = 4-6 years

250 kW_e = 350 m²

1.2-1.4 kg/kWh

- Soil amendment
- Extremely porous **activated carbon**
- Absorbs water and nutrients (up to 5 times its weight)
- High cation exchange capacity
- Improve the soil microbial life

Location of the demonstrators

DEMONSTRATOR CHP UNITS

Demonstrator site	ELECTRICAL POWER RANGE	Thermal recovery unit
MOROCCO off-grid	<ul style="list-style-type: none">• 60-70 kW GASIFIER• 60-70 kW Diesel genset (backup)	<ul style="list-style-type: none">• HEAT EXCHANGER for olive oil process
GHANA off grid & on-grid	<ul style="list-style-type: none">• 20-25 kW GASIFIER• 20 kW PV system• 80-100 kWh of battery bank	<ul style="list-style-type: none">• ABSORTION CHILLER for food storage
SOUTH AFRICA on-grid	<ul style="list-style-type: none">• 70 kW GASIFIER	<ul style="list-style-type: none">• ORC SYSTEM

Douar El Hachia

An on-grid application at a food industry in Morocco (at the premises of the olive oil mill Dar Azzaytoun in Douar El Hachia).

Sawla-Tuna-Kalba

A rural off-grid application in Ghana (in the Sawla-Tuna-Kalba District Assembly, at a school compound, which includes a small medical clinic).

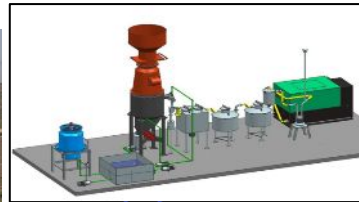
Durban

An urban application at Clairewood Bulk Market, a large-supply market connected on-grid in the eThekwin Municipality, in the city of Durban (South Africa).



Location of the demonstrators: OLIVE OIL COMPANY IN MOROCCO

DARA olive mill (Morocco)



Off grid
connection



SOME RESULTS FROM WP1 & WP2

- Olive oil production and wastes generated.
- Capacity power & size of the gasification plant: 60 kW_e
- Thermal necessities (hot water for the extractions)
- Load profile
- Biomass available at the mill: husk, prunings
- Design of the HRU for biomass pretreatment or heating mill necessities: heat exchanger
- Distance to the utility grid



20-25 ha of olive trees

70-80 tons olive oil

Intensive cultivation
(350 trees/ha)

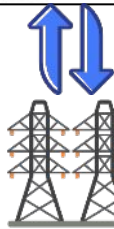
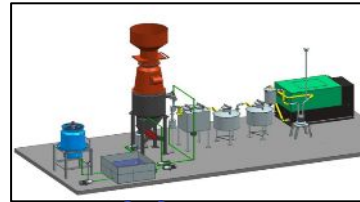
> 250 tons of wastes
(husk, pruning)

420 tonnes of olives

currently
100 kVA diesel genset

Location of the demonstrators: FOOD MARKET IN DURBAN (SOUTH AFRICA)

Clairwood Bulk Market



On grid
connection



Study of *co-composting*
biochar product by
FICOSTERRA → applications as
biofertilizer



SOME RESULTS FROM WP1 & WP2

- Gasifier reactor design (downdraft)
- Electric, heating and cooling power profiles
- Optimization model based on most profitable solution
- Gas cleaning & cooling stage, capacity power & size
- Civil works, delivery time for building, cost analyses, plumbing, workers, crane, electric connections
- Biomass available at the market: wood, vegetables, cartoons, paper residues
- Design of the HRU for CHP applications



Location of the demonstrators: SAWLA COMMUNITY (GHANA)

Electricity



Heat (hot water)



SAWLA COMMUNITY
TECHNICAL SCHOOL (TUSEC)

Cashew orchards

Electricity (pumping)



Fertilizers



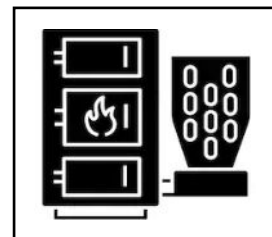
Cashew (anacardo)



Cashew husk



GASIFICATION PLANT



Renewable
Electricity (15 %)



Renewable
Heat (60 %)



BIOCHAR
(15 %)



Power unit (PV + Battery)



20 kW_p
(PV)

80 kWh
(Li-ion)



Biomass: cashew/peanuts shells



Location of the demonstrators: SAWLA COMMUNITY IN GHANA

Nasco Schools



Sawla Community



Sustainable Development Goals





REFFECT AFRICA

RENEWABLE ENERGIES FOR AFRICA:
EFFECTIVE VALORIZATION OF
AGRI-FOOD WASTES

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