PRE-LEAP-RE

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Towards Joint AU-EU funding in Renewable Energies Technologies: An Ecosystem Analysis

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Summary

This Deliverable is a synthesis of the outcomes from three related tasks and aims to provide an overview of the initiatives and networks working EU-AU collaboration in the field; analyse the opportunities, gaps, and trends; and identify potential opportunities for synthesis. The review helps to define coherence and synergy with other existing initiatives, avoiding duplication of efforts with the Europe-Africa ecosystem of actors, and support the development of a future research and human and institutional capacity building agenda for the forthcoming European Joint Programme (EJP) Cofund.

Approval

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PRE-LEAP-RE

PREparing for a Long-Term EU-AU Research and Innovation Partnership on Renewable Energy

Towards Joint AU-EU funding in Renewable Energies Technologies: An Ecosystem Analysis

Deliverable D1

Lead Beneficiary: University of Jyväskylä

10/2018

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About PRE-LEAP-RE

PRE-LEAP-RE – Preparing for a long-term EU-AU research and innovation partnership on renewable energy – is promoting an effective pathway for empowering local research. This pathway could be achieved by fostering EU-AU joint cooperation while creating the condition to transform research into effective innovation, tailored to the specific needs, the capacity and the aspiration of the African people and society which may be different from region to region.

Led by CEA, it gathers 17 partners across Africa and Europe jointly committed to strengthening the overall framework for cooperation in the field of science, technology and innovation (STI). During 14 months, the participants will identify and formulate a strategic Joint Research and Innovation (R&I) Programme for renewable energy technology and establish the organizational principles for its implementation within a forthcoming Joint Programme by bringing together national funding agencies of EU member states, African states and other key EU-AU actors involved in energy research.

For more information visit: www.leap-re.eu

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1 Introduction

1.1 Background

The importance of access to energy and its role for a sustainable development is going to be more evident and consolidated at different levels. It is highlighted within the 2030 Agenda for Sustainable Development where, among the 17 Sustainable Development Goals, Goal 7 is fully dedicated to the energy topic. Moreover, the Sustainable Energy for All (SE4All) initiative, together with the World Bank and the Institute of Economic Affairs (IEA), are promoting more and more the link between energy, services and local development. Finally, the conclusion of COP21, COP22 and COP23 confirmed energy to be at the centre of the discussion for any mitigation actions aiming at reducing the overall emission of greenhouse gasses.

This is reflected with an increasing interest in RE (Renewable Energy) generation technologies, that is achieved thanks to the attention to environmental issues highlighted in the second revision of the Cotonou Agreement (2010), and more recently in 2015, in the Paris Climate Agreement (COP 21), and in the 2030 Agenda (with SDG7).

In this framework, the African Union (AU) and European Union (EU) are stressing the importance of a specific action on Climate Change and Sustainable Energy[1] and they are committed to strengthen the overall framework for Science, Technology and Innovation (STI) cooperation in the energy field. The AU has fully recognised the relevance of STI in the strategic vision of Agenda 2063.

Renewable energy and renewable energy technologies are active fields with substantial existing collaboration, which have produced a number of initiatives and networks. These have generated substantial outputs, including knowledge about the challenges and possibilities for RE technologies penetration in Africa. Nevertheless, some issues preventing the STI virtuous cycle of innovation to be fully activated are still open and need to be closed also by relying on international cooperation with other research systems.

1.2 Aim and Structure

This Deliverable is a synthesis of the outcomes from three related tasks and aims to provide an overview of the initiatives and networks working EU-AU collaboration in the field; analyse the opportunities, gaps, and trends; and identify potential opportunities for synthesis. At the same time, the review can help to define coherence and synergy with other existing initiatives, avoiding duplication of efforts with the Europe-Africa ecosystem of actors, and support the development of a future research and human and institutional capacity building agenda for the forthcoming European Joint Programme (EJP) Cofund. This report was created with the PRE-LEAP-RE partners involved in Work Package 1: JYU, SU, CEA, ACU, InnoEnergy, POLIMI, KINNO, DST, and MESRS.

This report is divided into 8 sections, with Section 1 (above) giving some background and context for the report. Section 2 presents the methodology used for collecting and analysing the data presented in this report. A description of the data and its characteristics follows in section 3. The outcomes of the meta-analysis performed are described in Section 4, followed by a description of potential synergies in Section 5. Section 6 examines if an EJP Cofund is possible based on the data collected in the scope of this report. Section 7 of this reports gives recommendations for topics and themes for future funding. Finally, section 8 summarizes the main conclusions of the report.

[1] 5th AU-EU Summit (Abidjan, in November 2017) , the 4th meeting (Brussels, 17-18 October 2017) of Senior Officials of the African Union – European Union (AU - EU) High Level Policy Dialogue (HLDP) on Science, Technology and Innovation (STI)

2 Methodology

2.1 Rational of the approach

This Deliverable is a synthesis of the work carried out in Work Package 1 (WP1) of the PRE-LEAP-RE project. WP1 is built in a sequential manner, with the outcomes of each task supporting the work in the following tasks. A representation of the WP and its tasks is depicted below, followed by a more detailed description of each of the tasks.

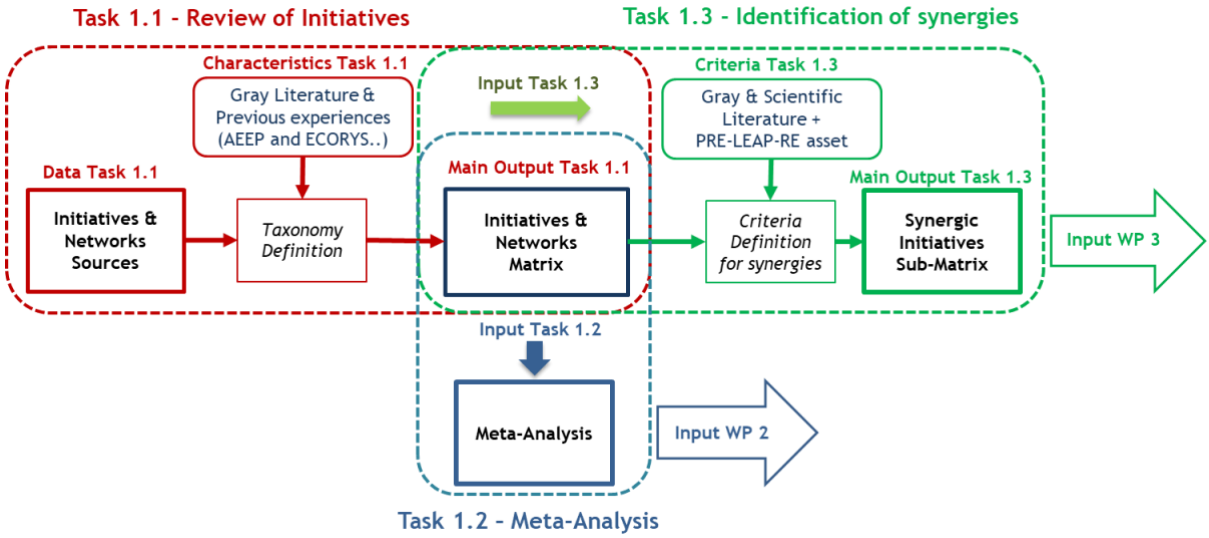


Figure 1 Schematic of WP1 structure and related Tasks

Task 1.1 aims to undertake an identification of the major initiatives and networks, both past and present, and to compile their outcomes and recommendations. Due to the substantial volume of actors and projects in this area, the search also refers, when available, to existing studies having undertaken a similar synthesis task (i.e. the 2015 Study on Renewable Energy and Research and Innovation Capacity of Sub-Saharan Africa, produced by ECORYS).

Special attention has been paid to:

- Initiative Categories: *Research, Innovation, and Human and Institutional capacity building*, to be used in the meta-analysis of the reviewed data in order to strengthen the link between WP1 and WP2, where the formulation of the R&I Agenda, its corresponding, complimentary Human and Institutional Capacity Building Agenda, and the organisational processes (including governance, funding principles and M&E framework) for the forthcoming European Joint Programme (EJP) Cofund has to be carried out;
- Stakeholder Categories and potential synergies among reviewed projects in WP1 and future initiatives, to strengthen the link between WP1 and WP3 (maximizing the number of synergic projects) and increase the effectiveness of WP3, where an inclusive network of stakeholders has to be built following the Quadruple Helix Approach (QHA) to involve the four types of stakeholders: Public Institutions /Policy makers, Academia, Private Sector, and Civil Society.

As output of the T1.1 an Initiative & Network Matrix detailing the results of this review has been produced and serves as the basis for corresponding tasks, as shown in Figure 1, directly linked with WP2 and WP3, respectively.

Task 1.2 builds on the work undertaken in Task 1.1 by performing a meta-analysis of the outcomes and recommendations of the initiatives collected in Task 1.1, with the aim of identifying areas of consensus and disagreement (particularly in regards to suggestions for areas of future research, innovation, or capacity funding), trends, and major findings. This analysis is then compared to the

work of other relevant mapping and synthesis reports (such as the ECORYS study cited above) to formulate a set of areas and topics for development into a research, innovation, and capacity building agenda. Based on the results from the meta-analysis, an evaluation of the appropriateness of an EJP Cofund for future cooperation is also undertaken.

Task 1.3 further elaborates on the work undertaken in Tasks 1.1 and 1.2 to identify opportunities for leveraging synergies between PRE-LEAP-RE and the activities of relevant existing initiatives in support of a future EJP Cofund. Concrete examples for potential collaboration with existing initiatives are identified, and cooperation with other funding programmes is an area of particular focus.

2.2 Conceptual scheme of the Matrix

Task 1.1 (T1.1) was conceived in order to produce an effective output to be used all along the evolution of the Pre-LEAP-RE project. The main output of T1.1 is a **Comprehensive Matrix** collecting Initiatives & Networks already ended or still active during its compilation and involving African and European Players.

As described above, the Matrix is central for WP1, since it represents the output of T1.1 and serves as input to tasks T1.2 and T1.3, which will be then pivotal for WP2 and WP3, respectively, see Figure 2.

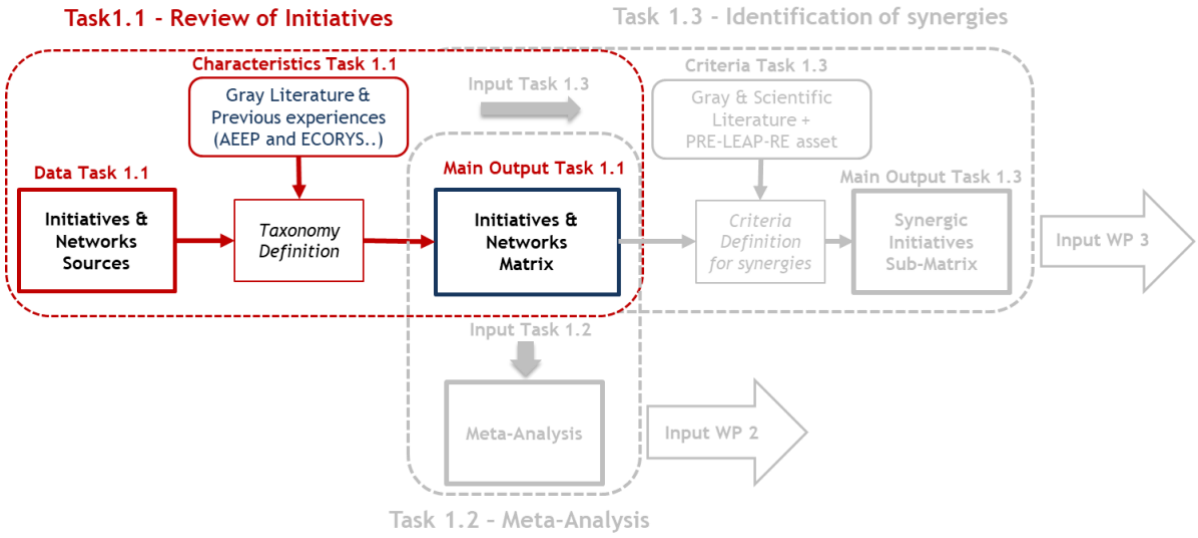


Figure 2 Schematic of WP1 structure with focus on Task 1.1

The process to define the structure of the matrix, its taxonomy, and to compile it has been developed in the first phase of the task, considering the following steps outlined below.

1. *Grey literature and past experiences collection and review*

A collection and review were undertaken of the following:

- **available literature / sources** from the main international organizations and partnerships in energy field, with specific attention to the Africa-EU ones (e.g. Africa-EU Energy partnership); and

- the **previous experiences** of all partners involved in task 1.1 and, more generally, in this project. The experience of the partners has been used in particular to define additional information necessary to better characterize and evaluate the projects inserted in the matrix.

Starting from a preliminary review of available mapping studies regarding Initiatives & Networks in the energy field, it has been possible to determine **two main inputs** in order to compile the matrix:

- **data**, different sources have been used based on already existing reports and initiatives developed between the European Union and Africa. The initiatives included in the matrix have been selected based on specific boundaries that are described in the next paragraph.

- **characteristics**, grey literature and previous experiences have been reviewed in order to define the main characteristics for the definition of the matrix. Through the analysis of studies already present in the grey literature concerning renewable energy technologies evaluation and application in the context of direct collaboration between Europe and Africa, specific categories have been selected and nested under a more general macro-area, as described in the next paragraphs.

Both inputs, data, and characteristics have been used to create the taxonomy of the *Initiatives & Network Matrix* and *Record Cards*. A more detailed description is reported in the next paragraphs.

2. *Preliminary list of macro-area and characteristics*

The characteristics inserted in the matrix have been extrapolated from the main available reports and mapping studies creating a preliminary *long list*. The list has been shared with all partners in order to evaluate the appropriateness of the selected characteristics, possible lack of information and the effectiveness of the characteristics regarding the needs of next tasks and WPs.

3. *Identification of the final characteristic list for mapping projects (Participative approach)*

The preliminary *long list* has been processed through an *iterative participative loop* involving all partners in order to define an updated *short list* including only relevant information.

This process has been completed creating the preliminary structure applied to some relevant initiatives in order to verify the completeness and the effectiveness of the selected characteristics and the capability to highlight the peculiarities and similarities of each initiative.

4. *Creation of the Initiative & Network Matrix structure and the template of the Record Card*

In order to give at the same time a general overview and relatively deep information about the selected projects **two main outputs** have been created:

- **Initiatives & Networks matrix**, including the main information about the projects in order to be used as input for T1.2 and 1.3; and

- **Specific record cards** for each project in order to increase the available information and to have more details available for a deeper analysis concerning the objectives and activities of the projects, as well as the aspects related to the application of the technology in the context in a more general meaning.

5. *Data collection*

The specific information has been collected by partners in the record cards. The selection criteria for the initiatives to be included in the collection was outlined in the 'Guidelines for Records Cards' document developed with partners. The guidelines also gave instructions for completing the record cards. Due to the limits of the study, data collection is not exhaustive, but representative. Some bias may exist due to the data collection methodology, but the use of grey literature and other existing sources of information helps to address this potential bias. The detailed information provided in the record card can be particularly useful to determine possible synergic initiatives (output T1.3). The specific characteristics reported in the *Record Cards* are described in the next paragraphs.

6. *Initiatives & Network Matrix filling and data processing for critical analysis*

The final part of the process included the compilation of the completed Record Cards into the *Initiatives & Network Matrix* (main output of T1.1) and a preliminary analysis of the collected data input into T1.2 and T1.3.

All the participative processes for the determination and filling of the *Initiatives & Network Matrix* is schematically reported in Figure 3 Flow chart of participative process in T1.1, including the involved partners in each phase of the process.

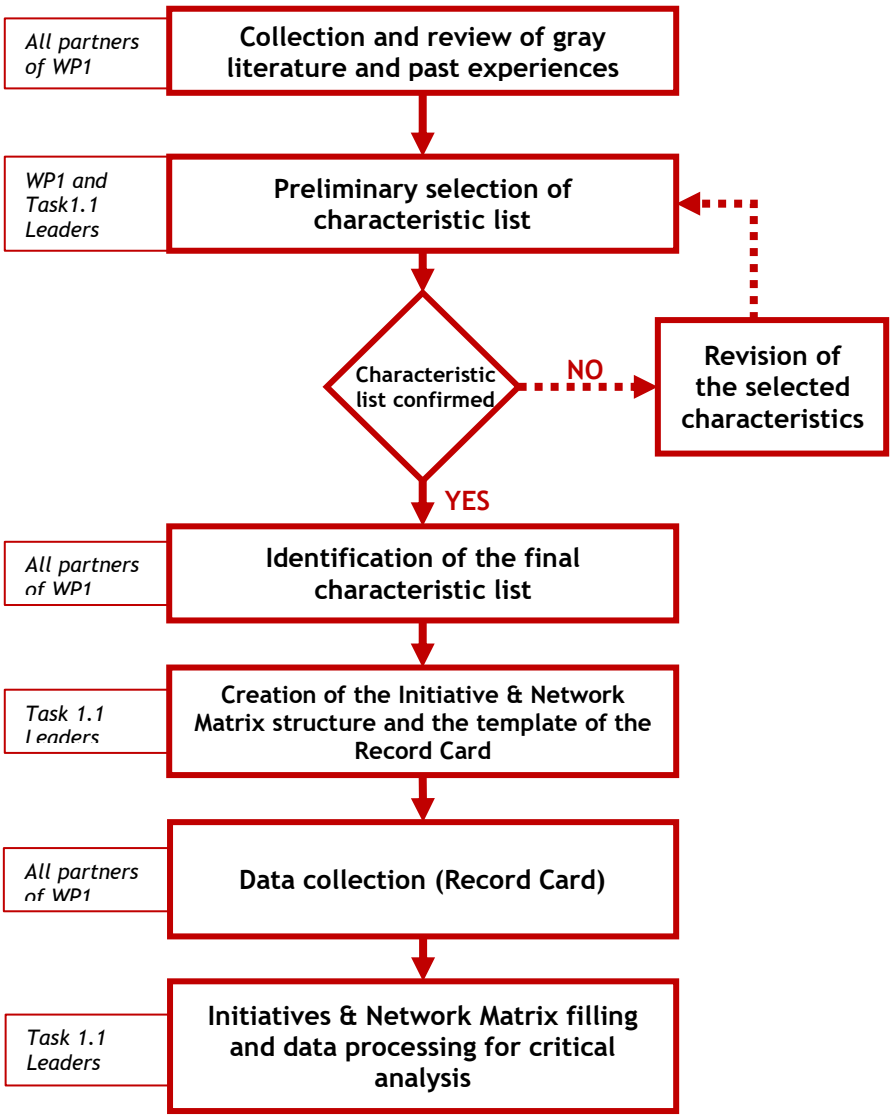


Figure 3 Flow chart of participative process in T1.1

2.3 Framework for Meta-Analysis

Following the completion of the *Initiatives & Network Matrix*, a meta-analysis of the data was performed. The process for analysing the data was driven by a pragmatic approach, and based on the data contained in both the Matrix and the Record Cards themselves. As in Task 1.1, a participative process was utilized for data analysis, which is described below in more detail.

- *Identification of Relevant Themes and Specific Topics for Analysis*

Using the Record Cards as the starting point, a selection of data was selected for further analysis. This data, or 'specific topics', were selected based on the relevance of those topics to the aims of the study: a set of recommendations for future research, innovation, and human and institutional capacity building agendas. The selected specific topics were then thematically grouped into three areas of analysis: 1. information on the programme, project, or initiative; 2. details of the renewable energy technologies utilized; and 3. relevance to other topics. The analytical matrix is shown below

.

Table 1: Topics and Specific Themes Analysed

Theme	Specific Topics
1. **Programme / Project / Initiative Information**	1.1. Objectives 1.2. Activities 1.3. Kinds of actors involved 1.4. Achievement / Results 1.5. Energy Planning Steps
2. **Renewable Energy Technologies**	2.1. Technology readiness levels 2.2. Type of Programme 2.3. Energy Source 2.4. Final Energy Use
3. **Relevance to other topics**	3.1. Nexus with other sources 3.2. Future synergies

- *Analysis of Matrix Data (Participative)*

Meta-analysis of the data was undertaken in a participatory process with the WP1 partners. Each contributing partner was assigned a specific topic to analyse, with the main data for analysis coming from the Matrix and the Record Cards themselves. The analysis was driven by four key questions, which were asked of every specific topic:

1. What are the range and frequency of occurrences?
2. Are there any gaps in the occurrences?
3. What should be explored further?
4. If relevant, what are the areas of agreement or disagreement?

The resulting analysis was then compiled by the T1.2 co-leaders and formulated into a cohesive whole. The results are found in Section 4 of this report.

- *Comparison with Existing Literature*

The analysis of the data collected by the PRE-LEAP-RE was then compared to a selected number of relevant existing publications, particularly those with recommendations for future research in the field of Renewable Energies Technologies between the AU and EU. The aim was to better understand the gaps in existing initiatives / projects with key recommendations in order to make recommendations for the definition of a future research, innovation, and human and institutional capacity building agenda.

3 Data and Characteristics

3.1 Data

In the preliminary phase of selection of Initiatives & Networks some specific boundaries for data collection have been defined, based on the reliability of the sources used and on the goal of the PRE-LEAP-RE project, which focuses on joint initiatives between AU and EU countries/organizations in the field of renewable energy research and capacity building

Regarding the size of the initiative, though not exclusive, more attention is placed on AU-EU projects with partners from different countries/regions, including intercontinental initiatives with extra EU partners and/or donors. These projects can be used to better understand the actual intercontinental network and collaborations of European countries and organizations regarding initiatives in AU regions.

Finally, we have ensured that sources used for the review were available as part of the public domain and initiatives accessible only with specific credentials have not been include in the selection.

The list below represents the main sources used for the initial review. In particular, the first group of sources has been used to define *Mapping reports* and *High Level Initiatives*, and others include *Specific Projects:*

Mapping reports and *High Level Initiatives:*

- AEEP Mapping of Energy Initiatives and Programs Africa (May 2016)
- *Study on Renewable Energy and Research and Innovation Capacity of Sub-Saharan Africa* produced by ECORYS

Mapping reports, High Level Initiatives and *Specific Projects:*

- REN21 Renewable Energy and Energy Efficiency EAC Regional Status Report (2016)
- SEFA Annual Report (2016)
- European Commission – International Cooperation and Development Project Database
- Other single reports on Renewable Energy Projects

3.2 Characteristics

The characteristics reported in the Initiatives & Network Matrix and record cards have been nested under 3 macro-areas. The following macro-areas have been created starting from the structure proposed by AEEP in their 'Mapping of Energy Initiatives and Programs Africa (May 2016)' (Annex 1), where the 'Systematization of Information' is presented including 9 main characteristics that are used as base for the present structure:

1. **General Information.** The characteristics included here are related to the Initiative name, type of initiative (e.g. Mapping Report/High Level Initiative/Specific Project), information about the length and period, the geographical location at continental/national level of partners and donors involved and the budget. These characteristics permit the identification and characterization of the initiative from international cooperation, typology and size, and context point of view.
2. **Technical Information**. These characteristics are more focused on technical type of initiative (e.g. Research/Innovation/Human and Institutional Capacity Building), energy sources and related technologies and final use. Furthermore, the presence of the *Principal Steps of Comprehensive Energy Planning* are identified.
3. **Synergic Information.** The potential presence of future synergies with the selected project is highlighted.

The full list of characteristics created with the participative process described in 2.2 is included in Table 2, with a detailed explanation of each characteristic to better describe the rationale behind their definition.

Table 2 List of Characteristics for General Output Matrix and Record Cards

List of Characteristics:	
Project/Initiatives Name	Name and acronym of initiative
Brief Description	Description of the initiative
Type of Initiative	1. Mapping Reports: *EU-AU reports on RE technologies* 2. High-Level Initiatives: r*elevant programmes that include several EU-AU partners*

	3. Specific Project: on going, past and prospective [2]action
Category of the Initiative	These categories characterize each Type of Initiatives as: Research // Innovation // Human and/or Institutional Capacity Building
Technology Readiness Level	[TR1 to TRL3], or [TRL 4 to TRL 5] or [TRL6-TRL7]
Donor(s)	Institution(s) who financed the project
Funding Agency Level	Governative: Bilateral // Multilateral // Trilateral // Non Governative Private Sector Other
EU Countries	Countries involved in the project at any level
AU Countries	Countries involved in the project at any level
EU Actors	Institution(s) and Partner(s) who actively participated in the project
AU Actors	Institution(s) and Partner(s) who actively participated in the project
EU Stakeholder Category	Category of the main stakeholder from EU side: Academia // Business // NGO // Public Authority // Research Organization // Other
AU Stakeholder Category	Category of the main stakeholder from AU side: Academia // Business // NGO // Public Authority // Research Organization // Other
Start/End Year	Start date End date
Number of Projects Involved	If dealing with High Level Initiatives specify how many projects are present in the portfolio
Budget Currency	Please insert currency USD or Euro
Budget Value	Please insert value
Type of Programme	Renewable Technologies suitable for on-grid penetration // Standalone home-based system // Mini-grid & hybrid mini-grid for community services and productive uses // Innovative storage systems for supporting the intermittency of RE generation // Digitalization for SMART RE technologies and devices // Waste to energy options in urban areas // Renewable solutions for desalination in desert areas // Energy storage // Others.
Energy Source	Solar PV // Solar Thermal // Wind // Ocean // Geothermal // Hydro // Bioenergy
Final Energy Use	Lighting and or domestic appliances// Heating // Cooking // Process Heat // Efficiency// Electricity for productive uses in Agriculture // Electricity for productive uses in Industrial processes

[2] An Action is any initiative (used the same wording of the EU commission), then in the Category we connect the Action with Research or Innovation or Capacity building

Nexus with other sources	Please explain if any nexus with other natural sources as water, food, etc. is considered as outcome of the project.
Geographical Scale	Size of the affected African area: Community // National // International // Continental
Size	If dealing with specific project specify the size of the projects as: Number of beneficiaries // Power // Other (please specify)
Specific Objectives	Brief list of the specific Objectives of the Initiative
Main Activities	Brief list of the main activities of the Initiative
Principal Steps of Comprehensive Energy Planning	Needs Identification // Baseline Load Demand & Forecast Resource // Assessment // Strategy Selection // Technology Optimization // Business Model Identification // Expected Impact
Status at the end of the project	
Actual Status	
Sources	References
Achievements/Results of the projects	Summary of the achievements of the project demonstrating its impact
Possible Future Synergies	Do you envisage any synergies at first glance with PRE-LEAP RE? Please describe them in 100 words

In order to give a more compact overview, a schematic description of the single characteristics included in each macro-area is reported in Figure 4 for the Initiatives & Network Matrix.

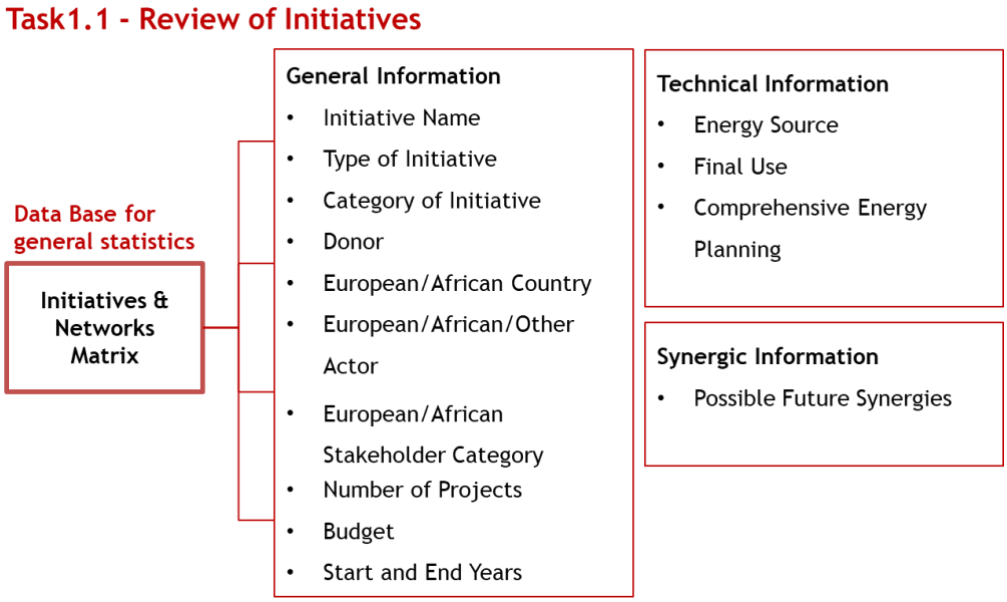


Figure 4 Structure and list of Characteristics of General Output Matrix

In Figure 5, the characteristics inserted in the Record Card are reported, highlighting the ones not already included in the *Initiatives & Network Matrix*. In particular, the characteristics *Objectives* and

Activities of the project and the *Comprehensive Energy Planning* characteristics are added in order to give more detailed information to be used for next tasks and WPs.

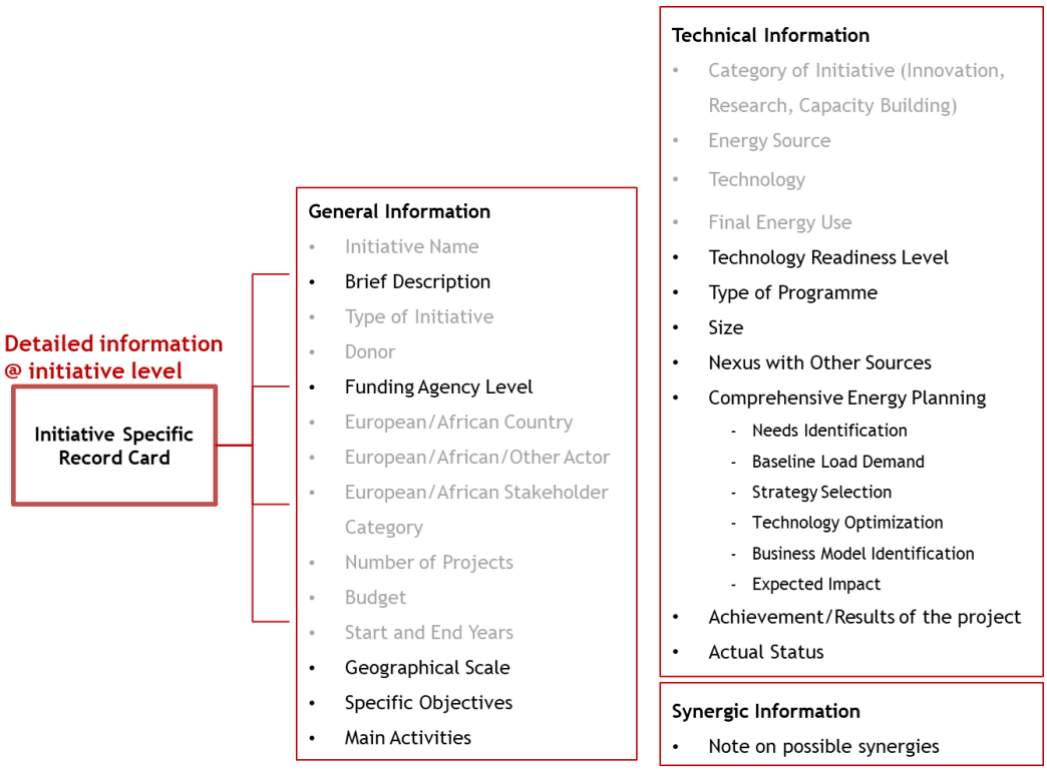


Figure 5 Structure and list of Characteristics of Record Card

4 Meta-Analysis of Data

As the main output of Task 1.1, an *Initiatives & Network Matrix* has been built. In this section, the list of the 89 selected initiatives (Table 3) is reported, grouped by the typology of the initiative. The total number of international initiatives collected from all partners is 130. Some of them have been excluded from the final list taking into account the following criteria:

- geographical relevance with African regions involvement;
- temporal coherence as potential synergic initiative;
- framework coherence as part of AU-EU cooperation programs.

A more detailed overview of the matrix and record card template is annexed to this report in ***Error! Reference source not found.*** Excel file and

Report Card Template annex.

Furthermore, a selection of initiatives involving a single European national donor funding, through national programs, only national actors for developing projects in Africa regions are reported in the annex *National Level Initiatives*. Specific analysis of country distribution, project categories and technological shares are reported also.

Table 3 List of Initiatives

List of Initiatives:
Mapping Reports

1	Research Cooperation in Renewable Energy Technologies for Electricity Generation (REELCOOP)
2	Pro-poor, low carbon development: Improving low carbon energy access and development benefits in Least Developed Countries
3	African Clean Energy Corridor
4	Africa-EU Energy Partnership (AEEP)
5	Africa Renewable Energy Initiative (AREI)
High Level Initiatives	
6	ACP-EU Energy Facility
7	ESMAP
8	ElectriFi
9	EU Africa Infrastructure Trust Fund
10	Africa Enterprise Challenge Fund (AECF)
11	Africa- EU Renewable Energy Cooperation Program (RECP)
12	EEP Africa - Energy and Environment Partnership
13	Energising Development (EnDev)
14	Energy Access Ventures (EAV)
15	EREF ECOWAS Renewable Energy Facility
16	German-Moroccan Energy Partnership
17	Regional Off-Grid Electrification Project (ROGEP)
18	ERANETMED - Waste2Fuel
19	Improving the Governance of the Renewable Energy and Energy Efficiency Sector in West Africa (AGoSEREE-AO)
20	SUNREF East Africa
21	Africa Renewable Energy Initiative
22	Facility for Energy Inclusion OFF-Grid Energy Access Fund (FEI OGEF)
23	UNIDO Energy Programme for West Africa
24	Power Africa (REEEP)
25	Climate Change, Clean Energy and Urban Water (REEEP)
26	Tendering Sustainable Energy Transitions - TENTRANS
27	Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)
28	Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy (STAGE-STE)
29	West African Science Service Centre for Climate Change and Adaptive Land Management (WASCAL)
30	International Partnerships for Sustainable Innovations (CLIENT II)
31	Science Partnerships for the Adaptation to Complex Earth System Processes in Southern Africa (SPACES)
32	Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL)
Specific Projects	
33	CSP4africa: Development of a cost-effective, modular and dry concentrating solar power for Africa

34	EUROSUNMED
35	Olkaria IV
36	Lake Turkana Wind Power
37	Kakono Hydropower Plant
38	Jiji and Mulembwe Hydropower Project
39	Agahozo Shalom Solar Farm
40	Ruzizi III Power Plant
41	Lake Assal Geothermal Plant
42	DOWA – Deep Ocean Water Application Mauritius
43	JCM Greenquest
44	Zagtouli PV Power Plant
45	Rent to Own Solar Home Systems
46	Light Up Our Futures
47	Light Up Liberia
48	Micresol
49	Gulf of El Zayt Wind Farm
50	Developing decentralised renewable energy sources for poverty alleviation and environmental protection in rural areas of Cameroon
51	AU Grid Solar Project
52	Defining best practices in geothermal data management
53	NRW-KNUST Project
54	The Renewable Energy for Food Processing
55	Multipurpose Applications by Thermodynamic Solar (MATS)
56	MICROSOL
57	Regional Certification Scheme for Sustainable Energy Skills
58	Water Saving for Concentrated Solar Power (WASCOP)
59	Royal Society-DFID Africa Capacity Building Initiative
60	100 MW Wind Farm in Assela Ethiopia
61	200 MW Wind Farm Gulf of Suez
62	Local Energy & Development Centres in Mozambique
63	Ikondo Power
64	KCIC
65	Meru Wind Power Station
66	Ngong Wind Power
67	Soroti 10MW Solar Plant
68	Flexible minigrid system for power supply in rural regions
69	MEDiterranean DEvelopment of Support schemes for solar Initiatives and Renewable Energies (MED DESIRE)
70	Green Energy for Green Companies (GR.ENE.CO)
71	Euro-mediterranean GREen JOBs (EGREJOBS)

72	Sunflower Solar Water Pump Distribution Network
73	South African-German Energy Programme (SAGEN)
74	Talek Power
75	Developing Bio-Energy Governance (DEBEG)
76	Biomass Energy Platforms Implementation for Training in Africa (BEPITA)
77	SOLUGAS: Solar Up-Scale Gas Turbine System
78	20MW off-grid solar photovoltaic rooftop project
79	Zambia's first large-scale 50 MW solar power generation plant
80	Production of biodiesel form Algae in selected Mediterranean Countries (MED-ALGAE)
81	Strategic Hubs for the Analysis and Acceleration of the Mediterranean Solar Sector (SHAAMS)
82	Small scale thermal solar district units for Mediterranean communities (STS MED)
83	Development and implementation of decentralised solar-energy-related innovative technologies for public buildings, in the Mediterranean Basin countries (DIDDOLIT-PB)
84	Fostering Solar Technology in the MEDiterranean area (FOSTERINMED)
85	Convergence between EU and MAGHREB MPC innovation systems in the field of Renewable Energy and Energy Efficiency (RE&EE)
86	Mediterranean Activities for Research and Innovation in the Energy Sector (MARE)
87	Empowering Trans-Mediterranean Renewable Energy Research Alliance for Europe 2020 Challenges
88	Enlarged Network in Education and Research for a Growing Impact of Sustainable Energy engineering on local development (ENERGISE)
89	TriNex
90	Starsol
91	Saltinho Hydropower Project
92	Kaboni
93	Solar PV Mini Grids for the Rural Towns of Areza and Maidma and Surrounding Villages in Eritrea

4.1 Data Analysis

In this section, the data collected in the *Initiatives & Network Matrix* is aggregated and analysed[3] in order to highlight some peculiarities of the selected Initiatives and give preliminary information about the trends of the AU-EU cooperation initiatives.

In order to give an overview of the collected data, specific topics from the Record Cards were selected that give both general and technical information. The macro-areas are selected coherently with the main information required for WP2 and WP3, and broken down into the following paragraphs:

- Types of programme,
- Kinds of actors involved,
- Objectives,
- Activities,
- Project results/achievements,
- Energy source,

[3] *Important note: all graphs reported in the analysis consider the % of appearance of specific countries, regional areas, technologies… in the Initiatives. This means the total is usually more than 100%, due to the appearance of the same country, region area, technology… in multiple Initiatives.*

- Final energy use,
- Comprehensive Energy planning steps, and
- Nexus with other sources.

4.1.1 Types of programme (type of initiative, project category)

Figure 6 shows the involvement of different EU countries in the type of initiative defined in the review, where three main categories can be observed:

- **Countries involved in a large amount of initiatives** and cover all type of initiatives (e.g. France, Germany, Italy, Netherlands, UK);
- **Countries mainly involved in mapping and high level initiatives**, with an average lower rate of involvement (e.g. Belgium, Portugal, Spain, Sweden…);
- **Countries not involved in the selected projects** (e.g. Bulgaria, Croatia, Cyprus, CR, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Poland, Romania, Slovakia, Slovenia).

Austria, Denmark and Finland are mainly involved in high level initiatives (HLI) and Specific Projects.

It is important to remark this is a partial analysis, related to International Initiatives that all partners have been collected and it is not exhaustive. Furthermore, some additional analyses need to be carried out for the National Initiatives of each country (see Annex).

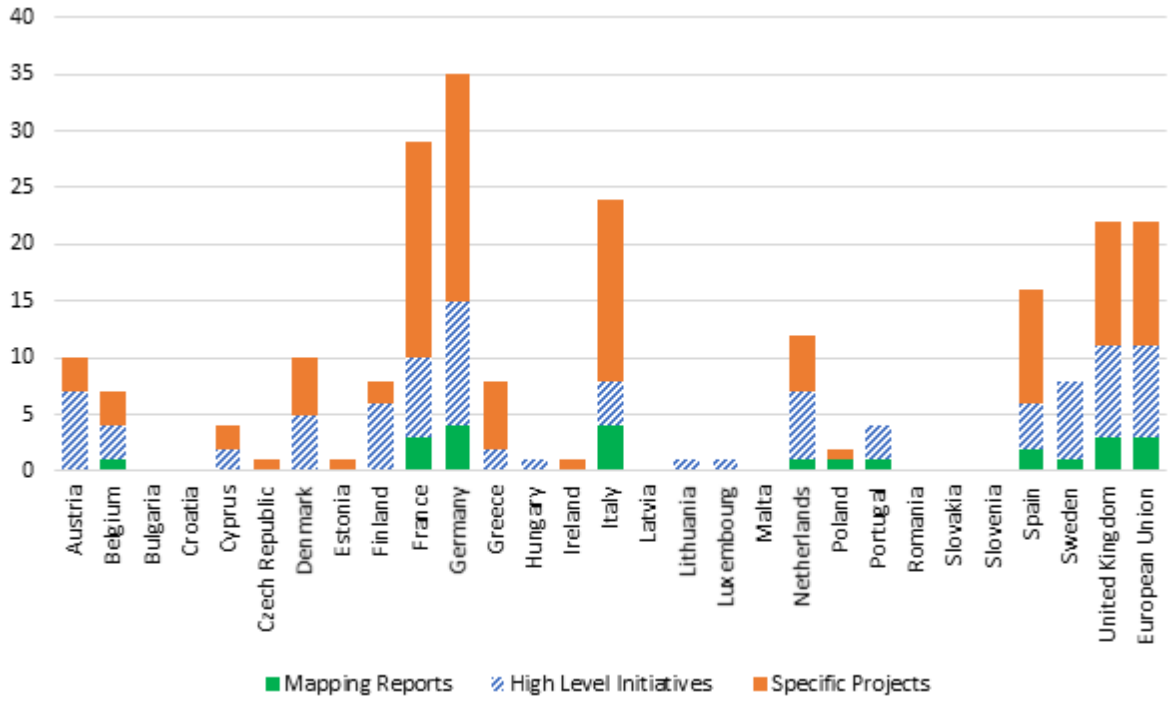


Figure 6 Initiatives per EU countries

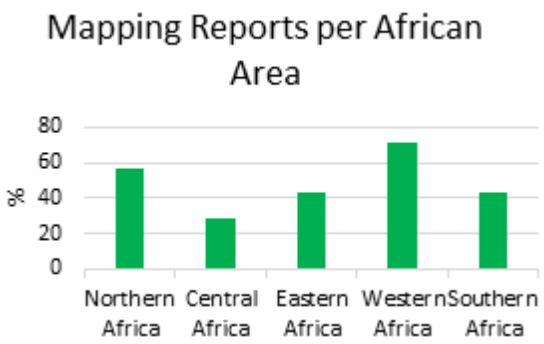
The same analysis has been carried out considering the AU regions (coherently with the UN definition) in order to define those most involved in the mapping reports, HLIs and Specific Projects (Figure 7).

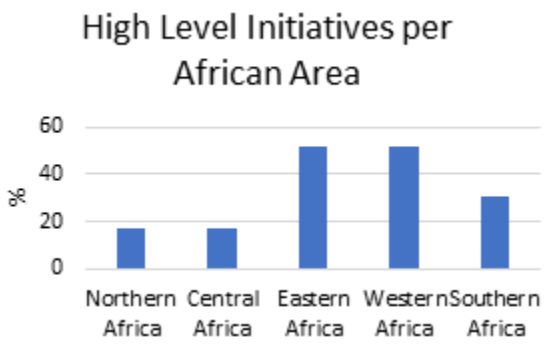
Looking in detail the distribution of African Areas involved in the Initiatives it is evident that:

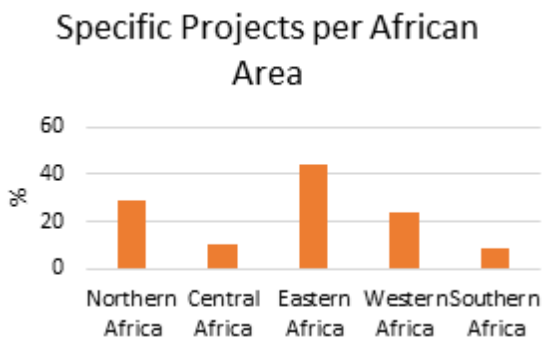
- the number of **African Areas** involved in Mapping Reports is more balanced than in HLIs and Specific Projects, as can be expected for the lower operative involvement required to the partners;
- a relevant presence of **Eastern and Western Africa Areas** is observed for HLIs and an evident difference is also observed regarding Northern Africa between Mapping reports and HLIs; and
- in all kind of initiatives, Central Africa is the least represented.

Furthermore, for *Specific Project Initiatives*, a more detailed analysis is carried out considering all African countries in separate way where Kenya, Egypt, Burkina Faso, South Africa and Tanzania emerge as the most targeted countries.

In Table 4 (below), the Top-5 AU and EU countries involved in different *Initiatives* are reported.







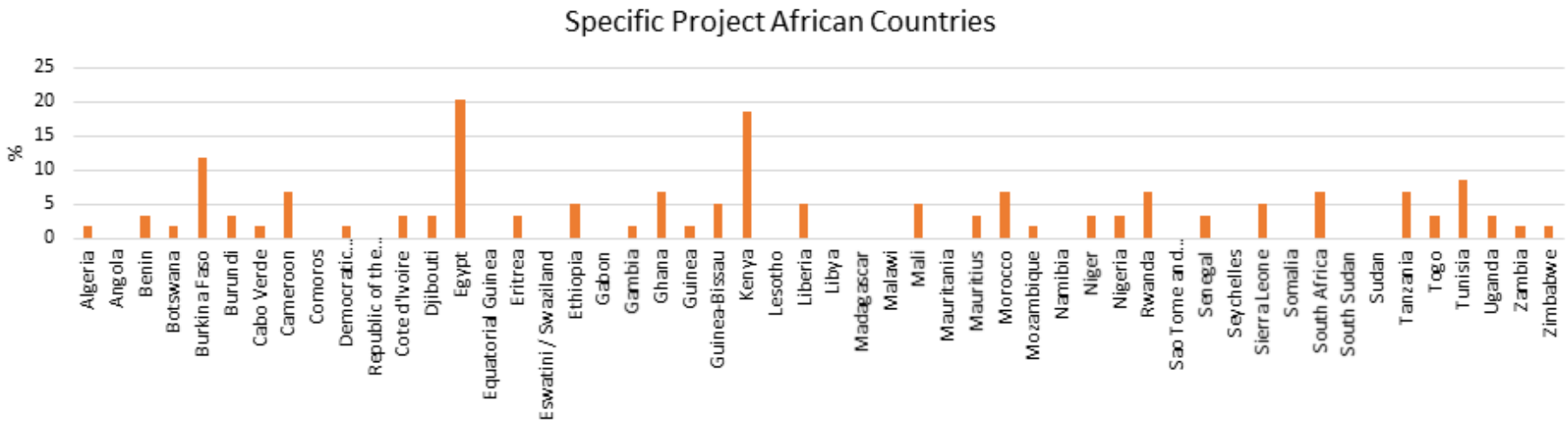


Figure 7 Initiatives per AU countries

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Table 4 Main AU and EU countries

Top Five European Countries	Top Five African Countries
Germany	Kenya
France	Egypt
Italy	Burkina Faso
United Kingdom	South Africa
Spain	Tanzania

In Figure 8, the *Project Category* distribution and related link with *Type of Initiative* is shown, with an equal distribution for *Research* among all types and a substantial predominance of *Specific Projects* for *Innovation* category.

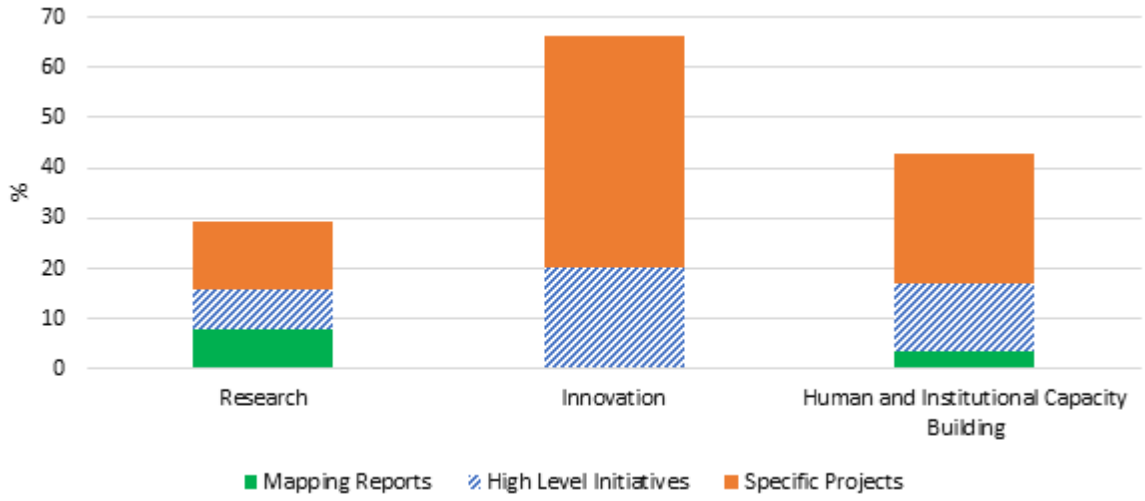

Figure 8 Initiatives per Project Category

4.1.2 Kinds of actors involved

The main actors involved in collaborative Renewable Energy initiatives include a wide range of governmental organizations, networks and partnerships, financial and research institutions, regional organizations and initiatives, and other actors from the private and public sector. The mapping conducted identified more than 310 European and African stakeholders covering areas of administration, Industry, Business, Finance, Academia, Research, are involved at local, national, bilateral, or multilateral level in energy projects. While this is clearly not exhaustive, it does show the diversity of actors involved in the sector, as well as the potential basis for future collaboration in the field.

In order to understand the mix of actors involved, Figure 9 highlights the type of organizations involved and the kinds of initiatives they participate in. It may be underlined that Public Authorities are the most involved, following by research institutions (Academia and Research organisations) and the private sector. A similar share is given for both European and African actors.

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Figure 9 Mix of kinds of actors involved

In Figure 10, the mix of non-AU actors involved in the initiatives is depicted. Most of the initiatives involved, as expected, EU and non-EU actors. It is important to highlight that the category '*1 EU actor*' (e.g. CEFA, Italy; Danish Development Agency, Denmark; University of Westfalia, Germany…) manages a relevant part of the initiatives.

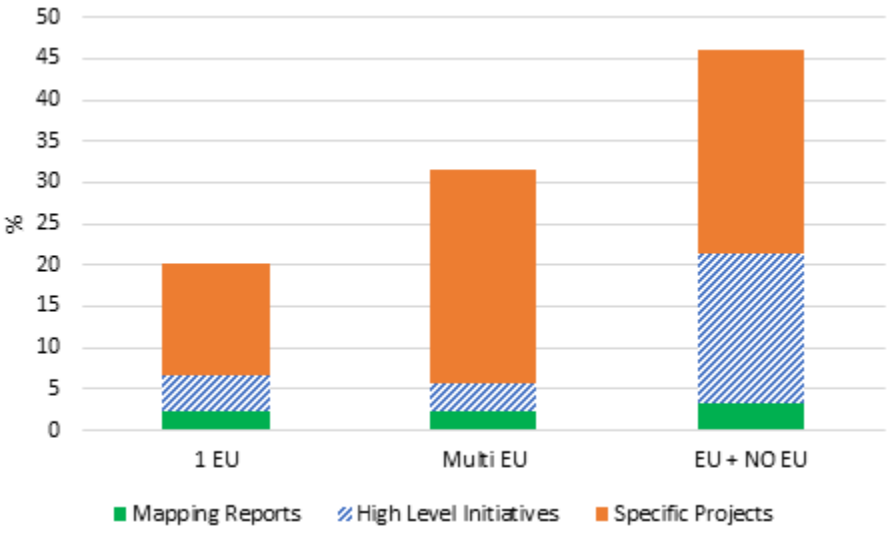

Figure 10 Non-AU actors distribution

In **Error! Reference source not found.**, the top-5 EU and AU actors are reported. As seen in the data r eported in the previous sections, the top-5 actors represent France, Germany and UK for EU countries, and Eastern and Southern Africa for AU regions. It is notable that the top-5 from the African region include a number of Regional Economic Communities (RECs), which serve as influencers, coordinators, and promoters of continental initiatives in the area. Moreover, it is worth noting that advancements in renewable energy policies, infrastructure, and initiatives have been made in several African countries. Nigeria, Egypt, Morocco, and Algeria are good examples of countries with an expanding and developing Renewable Energy sector.

The development of qualified human resources is important to bridge the skills gap. At the same time, research, education and training of new professionals is critical for adapting to new requirements and technology. It is therefore worth noting that a number of universities from both Europe and Africa appear in the mapping.

Table 5 Main EU and AU actors

Top Five European Actors	Top Five African Actors
GIZ	ECOWAS Center for Renewable Energy and Energy Efficiency (ECREE) Gender and Energy Program
Austrian Development Agency	Kenya Electricity Generating Company Limited (KenGen)
CEA	Common Market for Eastern and Southern Africa (COMESA)
German Federal Ministry for Economic Cooperation and Development (BMZ)	Southern Africa Development Community (SADC
French Development Agency (AFD)	Alexandria University (Egypt)

In Figure 11, the mix of donors is reported, with EC and European Bodies representing the majority.

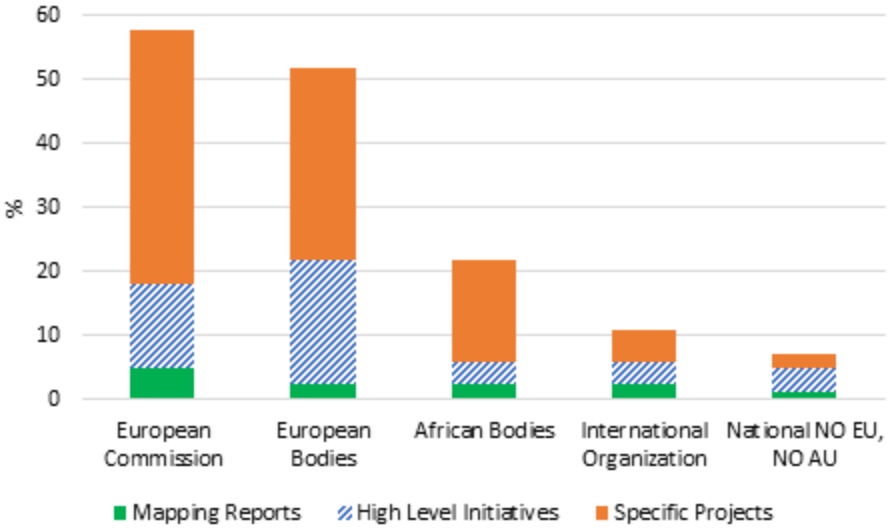

Figure 11 Donors geographical distribution

The same trend is confirmed from Table 6 with African Development Bank present on the top of the top-5 rank (EC represents the main donor, but is not reported in the table to highlight the role other donors different than EC one).

Table 6 Main donors

Top Five Donor
African Development Bank
European Development Fund
European Investment Bank
Kreditanstalt für Wiederaufbau (KfW)
French Development Agency (AFD)

4.1.3 Objectives

A thematic analysis of the objectives of the initiatives included in the Matrix was undertaken in order to better understand the focus found within the collected initiatives. Based on the analysis, the themes were grouped into 8 main groupings, which highlights the trends and main focus areas and from which gaps might be seen. It should be noted that different levels of objectives should be expected – high level initiatives necessarily have different kinds of aims from specific topics. The following groupings were identified:

1. Access to renewable energy,
2. Capacity building and knowledge,
3. Sustainable development oriented goals,
4. Renewables and low carbon technologies,
5. Developing the renewables market,
6. Environmental considerations,
7. Improving efficiency,
8. Security.

Grouping 1 (*Access to renewable energy)* emerged as the most dominant response, proposed by 39 initiatives. These initiatives indicated that their main objective was to contribute to improving,

enhancing and supporting access to energy, and specifically modern energy services to rural and peri-urban populations in Africa. In some instances, initiatives included the private sector, local businesses, and schools as the target recipients' energy service goals. The most commonly mentioned feature of the energy product availed by these initiatives were clean and low-cost energy. The focus on clean energy suggests a concern with environmental preservation while the focus on low-cost energy suggests a concern for the target population's socio-economic capacity. A link can be identified between the clean and low-cost energy product and an attempt to ensure the sustainability of the energy access provided by these initiatives. The aim of improving energy access to the targeted population is supported by enhanced research cooperation, knowledge creation and development of new renewable energytechnologies. Innovation and coopertaion is focused on 3 energy field areas: Photovoltaics(PV), Concentarted Solar Power (CSP), and Grid Integration (GI) followed by intervention in wind, biomass, biogas, biofuel , and others (such as geothermal)and standalone technologies.

Grouping 2 (*Capacity building and knowledge*), is the second most mentioned objective with 21 direct mentions. Capacity building efforts were aimed at creating an enabling environment for renewable energy intervention. Capacity building happened in three different forms: 1) Building the knowledge and technical knowhow capacity of the beneficiary populations on the development and management of renewable energy systems; 2) Building the financial capacity of the target countries and regions, including improving the capacity of the target regions to attract investment in addition to incorporating the local private sector as financers; and 3) Building necessary infrastructure in the target countries to improve the uptake of renewable energy initiative activities. Capacity building and knowledge creation efforts are supplemented by activities and objectives of cooperation implemented by the initiatives. Initiatives implemented two main approaches to cooperation. The first approach pertains to enhancing and supporting research cooperation in knowledge creation with the end goal of capacity building for sustainability. Here, joint activities are pursued to foster the use of existing research facilities while creating a reliable dimension to support scientific communities and industry in collaboration from Europe and Africa. When appropriate, transfer of knowledge activities have been carried out.

The second approach to cooperation is limited to enhancing country cooperation within Africa by implementing activities that support a suitable environment for regional cooperation. This approach utilizes two main strategies: 1) Integrating the private sector in energy generation, transmission and distribution. The private sector is perceived to have the capacity to facilitate African and European business cooperation for co-investment, exchange of expertise and technology and promote investment in Africa's renewable energy markets. 2) Cross border energy sector cooperation through cross country power grid interconnections and grid extension aimed at improved grid stability and integrated electricity markets. This nature of integrate4d activities is believed to demarcate a reliable path for long lasting cooperation.

Grouping 3 (*Sustainable development oriented goals*) emerged as the third common grouping, with 16 initiatives incorporating the SDGs. Some of the sustainable development goals that emerged include: The goal of contributing to reduced poverty levels among rural and peri-urban populations in the target countries and regions; improving the livelihood of beneficiaries through better income and employment; education; green and inclusive growth; and sustainable economic growth. These end goals are consistent with some of the sustainable development goals of the 2030 agenda.

The remaining 12 categories emerged with frequencies of less than 10 mentions out of 81. They were sporadic and inconsistent but worth consideration. Therefore, these categories highlight the gaps and areas.

A gap that emerges from the responses given by the initiatives to the objectives question has to do with energy security. Energy security emerges as the 8th grouping. This means that only 5 initiatives directly identified energy security and sustainability of energy access as a priority goal. This highlights the question of sustainability and the degree of effectiveness of these initiatives.

There is a possibility that the security question is addressed although they fail to emerge clearly in the outlined objectives.

The security gap argument is supported by several other response categories that are addressed sparingly in the objectives of these initiatives. 1) Environmental considerations in the era of climate change (grouping 6) suggests that the initiatives' responsibility towards environmental preservation through their activities ought to be clearly outlined, also to ensure accountability. 2) The initiative to develop the renewable energy market in the partner countries and regions (grouping 5) is mentioned only in 5 cases. The weakness of the renewable energy market in the project countries supports the argument that there is a substantial gap in addressing energy security. 3) Closely linked to RE market development is the issue of private sector incorporation in the initiatives' activities and approaches (grouping 5). With only 3 direct mentions of private sector involvement in the objectives (compared to the share of private sector participants as shown above), the integration of the private sector is not necessarily a central goal for these initiatives. 4) The element of governance (grouping 5) is rendered important by the emerging trend of cross border, regional and international collaboration in renewable energy activities. There is need to control policy and political input in the process of energy production and uptake through well-developed governance frameworks. Collectively, these responses compose a trend that support the security and sustainability gap in the RE initiatives being implemented in Africa at the moment.

4.1.4 Activities

The activities of the initiatives were also analyzed. Initiatives identified in this task engaged in a narrow range of activities. Identified activities are primarily technical and require expertise. This analysis identifies 6 groupings for the activity responses.

1. Design, development, and establishment of renewable energy facilities and related technology
2. Developing innovative and novel systems in renewable energy field areas
3. Capacity building activities
4. Project sustainability activities
5. Financing activities
6. Mapping and exploratory activities
7. Private sector integration
8. Development research and energy policy advisory activities

Grouping 1 (*Design, development, and establishment of renewable energy facilities and related technology*) emerged as the predominant activity, mentioned as the primary activity by 27 initiatives. Activities related to the design, development and establishment of technology, equipment, facilities and plants for energy production and dissemination were offered in most of the initiatives. Technical assistance was a priority in cases where innovative technology in the field of RE was involved, such as the design of prototype RE energy generation systems. Technical assistance was also the primary activity where initiatives engaged in power grid interconnections, grid extensions and grid stability. Design, development and testing was performed as a package when innovative development of prototype and new systems was pursued. In such a case, activity was followed by knowledge transfer through for instance PhD student training.

Grouping 2 (*capacity building activities*) were the second most common activity carried out by these initiatives. Capacity building activities are directed at the recipient country stakeholders. These are development of training programmes, done in collaboration with higher education institutions, in addition to direct training of practitioners at the working sites. Knowledge transfer and dissemination of research and testing outputs are also carried out. These activities are directed at the end goal of establishing an enabling environment for the initiatives, but there was not necessarily a focus on skills transfer. Rather, capacity building activities focused on issues like maintenance and market preparation Therefore, the capacity building activities are closely linked to the third category of activities.

Grouping 3 (*sustainability activities*) include all the capacity building activities in addition to other activities aimed at creating an enabling environment for continuity and success of these RE initiatives. These activities are particularly directed at the recipient country markets with the aim of ensuring that a sustainable market is established in the recipient country for renewable energy services and activities. These activities include knowledge transfer, project ownership transfer, networking between the recipient countries and RE actors from abroad, facilitating regional collaboration and strengthening policy and regulatory frameworks in the field of renewable energy.

Grouping 4 (*development research and energy policy advisory activities*), Projects involved in exploratory and analytic research of the development and general implications of the renewable energy initiatives carried out in partner countries in order to contribute expert knowledge and strengthen relevant policies, contribute to the development of energy regulatory support and inform the development of incentive frameworks that support the stability of renewable energy markets and in the project countries. Other research activities include research and development, research and energy planning, mapping and coordination of existing and future renewable energy initiatives with countries and regions in Africa. Exploratory research was aimed at maximizing the potential of novel renewable energy technologies such as low carbon technologies.

It also emerged that a key assistance offered by these initiatives is **financial support**, which is done in a variety of ways. Financial assistance includes grant financing, private equity, venture capital, investment grants, and bank executed technical assistance. Financial support is offered also to small and private entrepreneurship with a substantial support being directed at the private sector in a bid to integrate them in the RE market. This support is also offered at different stages of the initiatives' engagement. To this extent, initiatives indicated an attempt to **integrate the private sector** in their activities, with 8 initiatives dedicating their activities to supporting the private sector or incorporating the private sector in their activities. **Mapping and exploratory research** of the current status of renewable energy uptake, intervention, activities and development in the recipient countries was a priority activity for 8 initiatives. The dominant activities are those that require skills, expertise, technical knowhow of RE production, and dissemination. Although capacity building efforts of these initiatives is commendable, given the close link between these efforts and the activity and goal of sustainability, an active effort to transfer the technical knowhow (not just knowledge) and build the technical capacity of the recipient countries is still wanting. The initiatives do not indicate a deliberate effort to transfer the skills and knowhow of developing and designing technology, equipment and renewable energy and clean fuels generation. Capacity building pertains to sustainability, which means that recipients are trained on how to manage the outcomes of these initiatives, and not how to develop further initiatives or innovate within the field of RE. Therefore, the main gap that emerges is that of empowering the continent to take charge of their energy transformation process.

The projects considered here have engaged extensively in activities that are aimed at building and elevating the capacity of recipient project owners with regards to availing a suitable environment for the uptake and maintenance of renewable energy systems in the continent. Capacity building thus takes the form of: Financial assistance, mobilization of local stakeholders and the private sector to integrate into the renewable energy sector, Sharing knowhow and resources through educational and research institution collaboration in renewable energy technologies. Training, workshops, knowledge management experience sharing and documenting best practice are other ways in which projects support capacity building. However, there is not a clear indication that projects engage in recipient executed technical assistance. Where the activities involve design, development and testing of new technologies and complex systems, there is no clear indication that this is done in concert, including local actors. To the extent that capacity building is clarified as an activity, there is no clarification that technical knowledge transfer is transferred. This clear mention appears only in two projects. Thus, it seems that there is a need to foster technical knowledge transfer involving at all stages of the project and particularly the stages of design, development and testing of new and advanced technologies in renewable energy. The gap is that of advanced recipient executed technical capacity in renewable energy systems.

An additional gap pertains to the development of the African market for renewable energy through engagement with policy, regulatory bodies and the private sector. Only 3 initiatives indicated an active involvement with renewable energy policy development. Given the number of renewable energy initiatives involving the continent and the continents' capacity to exploit renewable energy, it becomes critical to scale up the continent's readiness to uptake renewable energy use which requires a suitable, welcoming, and knowledgeable policy environment. This implies that there is an urgent need to develop a conducive environment for RE in the continent.

4.1.5 Project Results / Achievements

Due to the paucity of information available from the matrix about the results and achievements arising from the initiatives included, only a few general observations can be made. A large amount of projects related to sub-Saharan Africa deal with large-scale demonstration plants. Most of these demonstration projects concern solar energy: PV and CSP. Other projects involve also wind, geothermal energy, bio resources or hydropower.

Beside these demo projects, few other projects are focused on test platforms in order to validate components in real operating conditions under African climate (PV panels testing, for example).

Beyond these individual initiatives, the future challenges would be, on one hand, to go one-step further with bigger demonstration plants and, on the other hand, to give individual projects an opportunity to connect with similar activities and raise awareness of funding opportunities.

The second part of the projects are studies without experimentations. These studies have different purposes: Analyses of RES potentiality in Africa (Geothermic, bio resources…), feasibilities studies, and definition of best practices. Others are focused on education and training.

4.1.6 Energy source

As evident, many initiatives have been undertaken and a number of projects have been held by EU and the international community, involving a number of different organisations and institutions on different renewable energy sources and technologies.

Attention should be paid to the uneven technological share of renewables related to the initiatives under study, which is logical taking into consideration the availability of renewable resources (such as sun), disparities, different potential, and characteristics of the AU areas and countries.

From a technological point of view, most of initiatives deal **with solar** (photovoltaic and thermal) and **wind technologies**, with a relatively relevant part of initiatives dealing with a **mix of renewable** (all renewable).

The large use of photovoltaic and wind technologies is coherent with the dominant attention to electrification compared to other non-electricity use of energy, as shown in **Error! Not a valid bookmark self-reference.**12, below.

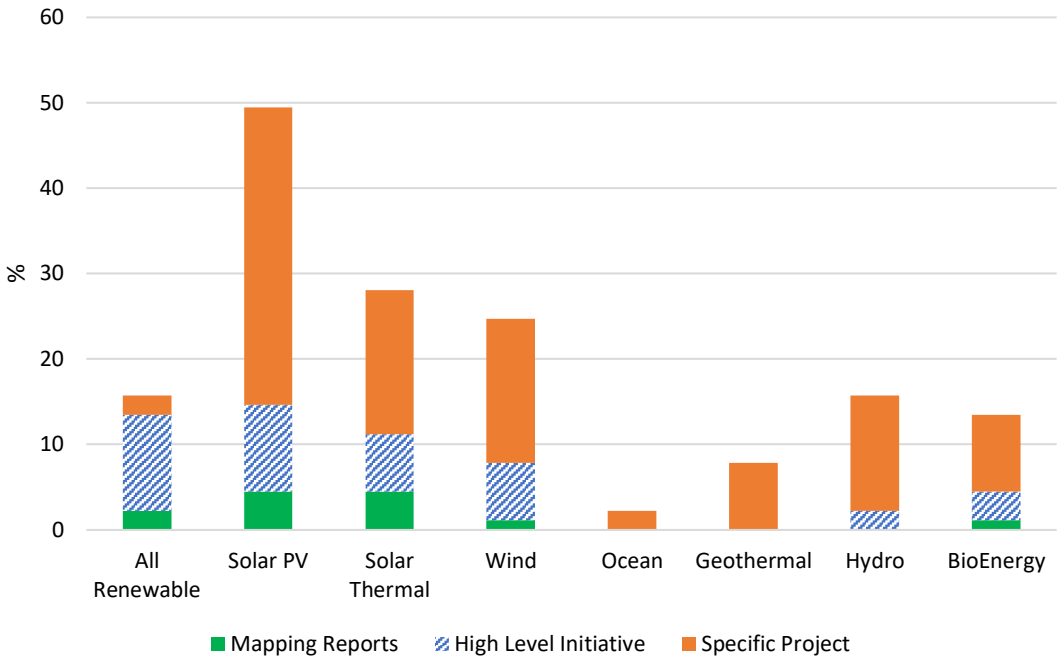

Figure 12 Energy technology share

4.1.6.1 Solar

From the graph it emerges that the majority of the initiatives are related to solar energy in both its potential as source for power and as source for thermal heat. Indeed, 50% of the initiatives collected in the matrix report a focus on solar power. The growing interest in some areas on solar thermal is also appreciated and more recent. This predominance, despite the fact that PV are not the cheapest among the other alternatives, is mainly link to the global diffusion in the continent of solar radiation, which makes it easy to rely on such a source. Considering that wind is only second (and it is, interestingly, only ¼ of the initiatives), while Hydro and bioenergy and geothermal are lagging behind, it is straightforward to understand that more attention should be given to the integration of different paths (e.g. hybrid systems based on local resources and capabilities) that could lead to cost saving, technological advantages (reduce use and better life time for batteries), and non-technological opportunities (like local job creation and better exploitation of resources).

4.1.6.2 Wind

Despite the fact that wind energy has the **largest regional disparities** (wind potential estimation is complex due to the fact that the resources differ considerably over the area of an entire country and of course in the entire continent), its exploitation initiatives have a significant presence both in High Level Initiatives, as well as in a number of specific projects, with 25% of the Initiatives mapped in the present study including this subject. Particular attention should be paid on the development of decentralised generation and stand-alone systems, including energy storage.

Both energy sources appear to be **fit for the context and needs of the majority of the AU countries** involved in the specific mapped projects considering that the majority of the projects are reported to have direct impact to the African areas involved. Furthermore, additional research needs to be carried out in fields that go beyond the technological aspects.

4.1.6.3 Hydro

Hydro Power is the cheapest resource that may be used for power production, nevertheless the competition with water use and the transboundary problems in managing water basin has limited the development of large-hydro and led to the privilege of small-hydro power (run of river solutions rather than big dam). This is a space where research and innovation should keep on working.

4.1.6.4 Geothermal

Geothermal is characterised by big scale and very specific conditions for its availability which make the implementation complex and depended on local resources, policy and governmental actions and funds. In term of research the many issues related to geothermal exploitation with special reference to the environmental implication in those areas where the main potential is assessed. Some attention should also be given to geothermal cooling with special reference to food and beverage.

4.1.6.5 Bioenergy

Bioenergy initiatives and projects have a notable share; however, in order to extract concrete results we should take into account: the "**extreme disparities** between regions – being highest in the equatorial regions and lowest in Northern Africa"[4] (IRENA, 2014) regarding bioenergy potential, as well as the energy nexus with the policies and initiatives for **sustainable agriculture**, as well as the **growing needs** as a result of the expected rise of population and standard of living.. Bioenergy is used for both power generation –in the case of big size power plants – but also for domestic needs – such as for cooking. Both aspects need to be deepened in term of research and innovation: deepening new fuel from waste, from agri-food processes, new combustion chamber, improved cookstoves and other alternatives to traditional and unhealthy domestic cooking. An eye on the competition between bioenergy and food always needs to be kept open.

4.1.7 Final energy use

Looking more in detail at the final energy use, electricity is the main energy vector (as final use), in coherence with the energy source and technology share reported above. The final use of electricity is characterized by a substantial equilibrium among domestic, agriculture and industrial process uses, as shown in Figure 13.

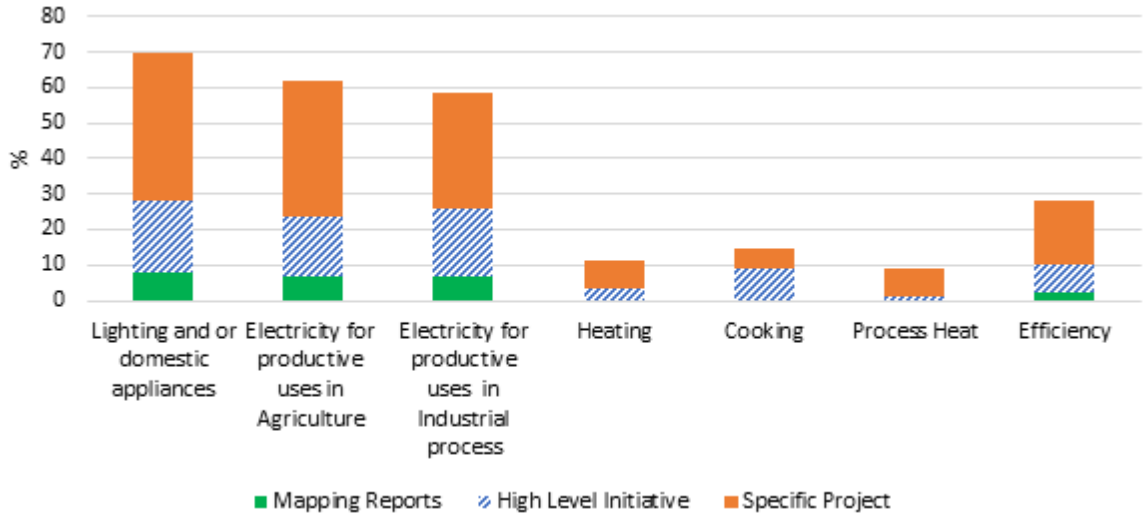

Figure 13 Energy Sector (left) and Electricity (right) final use distribution

In particular, it is interesting to observe the specific role of bioenergy considering its final use for cooking and electricity (Figure 14) and its geographical distribution along different AU regions (Figure 15).

[4] IRENA (2014) Estimating the Renewable Energy Potential in Africa. A GIS-based approach

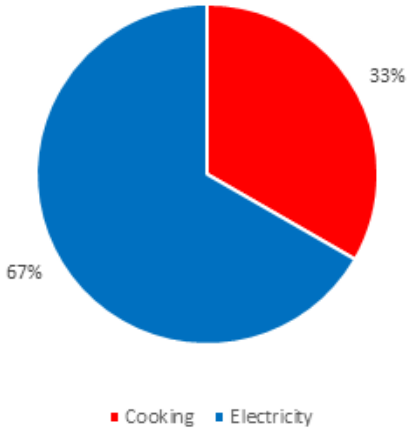

Figure 14 Final use of bioenergy

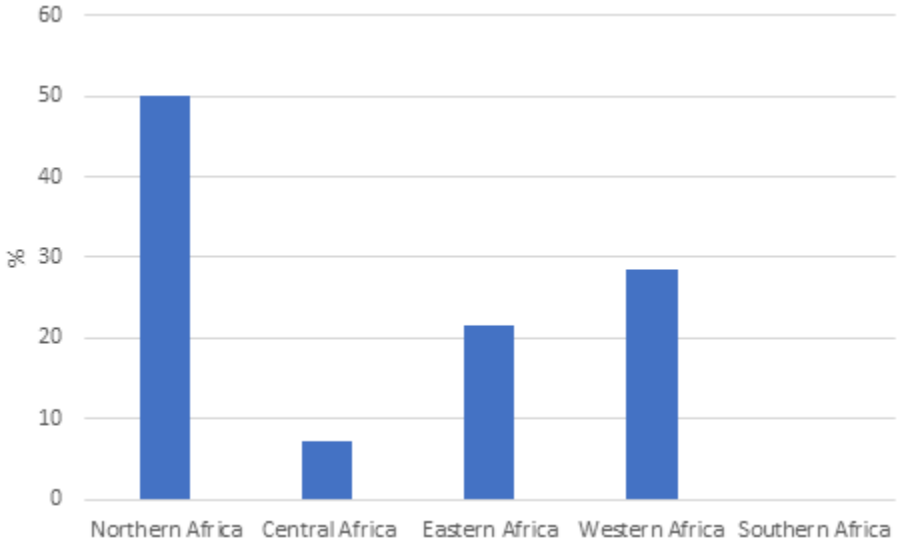

Figure 15 Geographical distribution of bioenergy projects

4.1.8 Comprehensive Energy planning steps

In order to define the scope of the initiatives analysed here the presence of different steps included in the *Comprehensive Energy Planning* has been reported in

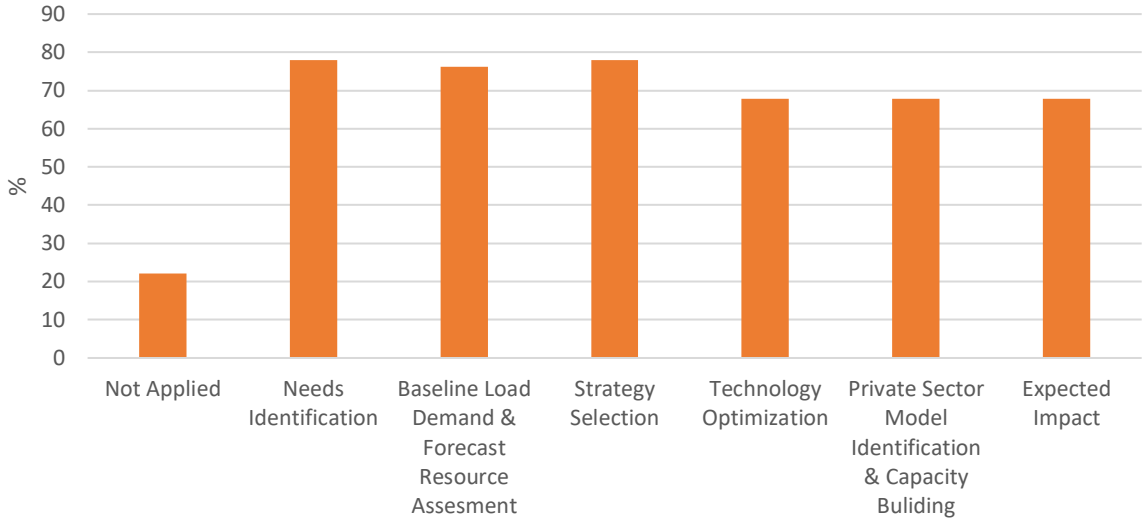

Figure 16. Relevance is given to all the steps that are crucial for a comprehensive Energy Planning aside the technological design and optimisation.

This is important to underline since it provides evidence of a general attention to the need for an holistic approach in the energy sector which goes beyond technical design. This is strongly envisaged by the international scientific community and international organisations and needs to be promoted.

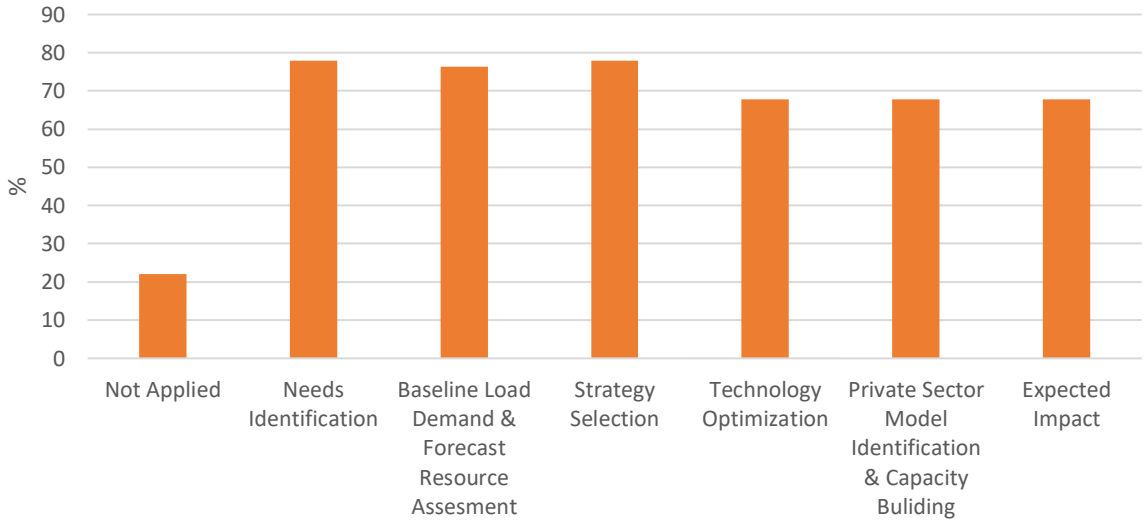

Figure 16 Use of principal steps of Comprehensive Energy Planning

4.1.9 Nexus with other sources

Only a minor number of Record Cards were completed for this section, so only general tendencies can be reported. From the data that was collected, a tendency could be seen for activities at the nexus of food and water, followed by health. Despite a dearth of nexus areas identified, it is clear that potential exists for research and action that connects renewable energies to other related fields, presenting a great potential to be exploited through a holistic approach. Waste management, access to clean water, solar solutions for agriculture, and the social and economic impact on communities are all

relevant for future consideration, and were identified in a gaps analysis as areas deserving further attention. A more detailed search through a further screening of each Initiative is required for a more in-depth analysis.

5 Outcome of the Mapping and final consideration for WP1

This Deliverable is a synthesis of the outcomes from three related tasks and aims to provide an overview of the initiatives and networks working EU-AU collaboration in the field; analyse the opportunities, gaps, and trends; and identify potential opportunities for synthesis. At the same time, the review can help to define coherence and synergy with other existing initiatives, avoiding duplication of efforts with the Europe-Africa ecosystem, and support the development of a future research and human and institutional capacity building agenda for the forthcoming European Joint Programme (EJP) Cofund.

5.1 Toward an EJP Cofund?

As the analysis shows, a majority of these initiatives are funded by European Union or national instruments, or development banks. As the political relationship between Europe and Africa is changing from one based on the more traditional donor-recipient one, to one based on mutual interest, ownership, and design and investment, it is worthwhile to consider the opportunities for developing large scale cooperation instruments with these principles.

A European Joint Programme (EJP) Cofund is such an action, implemented via Horizon 2020, which can be used to transform this cooperative landscape to one based on co-ownership. The EJP Cofund instrument supports the coordination of national research and innovation programmes, aiming to attract and pool a critical mass of national resources on objectives and challenges of Horizon 2020 for achieving significant economies of scale by adding Horizon 2020 resources to a joint effort. For creating joint, bi-regional activity in the field of renewable energy, an EJP Cofund would be suitable as it allows for the implementation of a joint programme of activities, including research and innovation projects and coordination and networking activities amongst others. Both direct consortium activities and single or multiple calls for proposals for support to third parties are supported within EJP Cofunds[5]. An EJP Cofund is interesting for cooperation in renewable energies because it would allow for activities implemented by the partners themselves, not only through competitive calls. This would support the implementation of some of the recommendations made in this report (section **Error! Reference s ource not found.**), such as capacity building, governance support, etc.

Two critical points must be interrogated to determine if an EJP Cofund is possible within the frame of joint EU-AU action in the field of renewable energy:

- Is there sufficient interest in the field for joint action?
- Are there sufficient actors interested in joint activities?

The review undertaken in WP1 and reported in this Deliverable aims to give a better understanding of the breadth and scope of cooperation in the field of renewable energy cooperation between the two regions. Both bilateral and multilateral initiatives were examined, though it is clear that this review cannot be exhaustive, but rather representative of the larger context for cooperation between the two regions. Based on the data presented and analysed above, it is clear that a breadth of cooperation exists. There are initiatives taking place with every region in Africa, and with a large variety of European countries. Moreover, there is a diversity of kinds of initiatives and actors taking part in this cooperation. Finally, there is existing cooperation in a variety of energy sources. Taken together, it is clear there is sufficient interest in bi-regional cooperation in the field of renewable energy to justify joint action.

[5] https://www.era-learn.eu/p2p-in-a-nutshell/type-of-networks/european-joint-programme-cofund-ejp-cofund

The question of whether a sufficient number of actors are interested in joint activities in the field of renewable energies is a more difficult one to answer. From the review and analysis conducted, we can see that there are a large number of actors involved in implementing and funding joint renewable energy projects. However, this does not necessarily signal an interest to take part in a joint cooperation scheme that includes funding to third countries.

The question must therefore be considered from another angle – namely, is there demonstrable interest from European and African partners to engage in this type of cooperation, which may therefore translate into future interest in an EJP Cofund on Renewable Energy? To answer this question, attention should be paid to the results of the ERAfrica[6] and LEAP-Agri[7] projects, both of which involve joint funding activities between African and European partners. The ERAfrica project (an ERA-NET) was widely considered a pilot for testing the appetite of public funding bodies from both regions to participate in joint funding. The first call was launched in 2013 with participation from 15 countries from both regions, with a total of €10.7 million available for funding the call. From this, 17 projects were funded with a total of €8.29 million. Following the success of ERAfrica, the LEAP-Agri project (ERA-NET Cofund) was launched. With 30 partners and 24 funders from 19 different countries from both continents and a total of €27 million available for the call, LEAP-Agri shows a significant increase in both the commitment and investment of both regions to participate in joint funding schemes. While ERAfrica did have a dedicated theme of Renewable Energy, the focus of the LEAP-Agri call was on issues related to food and nutrition security and sustainable agriculture. Despite the differences in fields and instruments, the growth in both the funding available, and in the number of countries and institutions participating in the joint calls from both regions, should be considered promising for pursuing joint action in the field of renewable energy.

Based on the review conducted in WP1, which shows the **diversity** and **interest** of actors from both regions in cooperation on renewable energies, and on the **advancement** in the larger framework for cooperation between the two regions, as well as the future work of this project, sufficient potential exists for the pursuit of an EJP Cofund in the field of renewable energies.

5.2 Potential Synergies to be further exploited in WP3

Encouraging the development and exploitation of synergies between European Union (EU) and African Union (AU) countries in the area of Renewable Energy (RE) is quite significant for Africa and Europe's development. The AU and EU countries have complementary strengths within the RE thematic area. Africa has considerable untapped potential in RE and the EU has a host of skills and technologies to help tap into this potential. Synergy building within the AU-EU partnership in RE should operate in such a way that maximises the capabilities of both regions, and of the initiatives involved.

It is within this context that PRE-LEAP-RE should organise itself in a manner that not only stimulates the AU-EU R&I partnership in RE, but also proposes new forms of collaboration and funding mechanisms that will result in bi-regional ventures. Moreover, building collaboration in the area of skills and technology transfer, applied research, manufacturing and use of local technologies are areas of potential synergy in research, innovation, and human in institutional capacity. The forthcoming partnership should be inclusive of various stakeholders. Philanthropists, public sector, small businesses, venture capitalists, and other non-traditional stakeholders should be considered as potential funders of the proposed tech-development projects, all of which might be reached through strategic synergy building. In the Annex,

[6] https://www.erafrica.eu/
[7] http://www.leap-agri.com/

Another factor to consider is the rate at which policies yield results. Oftentimes tech development moves at a faster pace than policymaking. Government needs to implement policies that will support and adapt to the fast pace that technology and innovation moves at.

The general conception is that PRE-LEAP-RE should adopt an inclusive approach that will focus more on innovation and advocate for policies that will function at the same speed as innovation. The potential impact of this approach can lead to RE initiatives that yield practical solutions to shared RE challenges.

To identify and highlight potential synergies with the selected Initiatives & Networks the data processed in the previous steps are used.

The rationale applied to extract potential opportunities for the PRE-LEAP-RE project is mainly based on the assumption that long-term synergies can be better established among specific actors and donors from different EU countries, which are proposing initiatives in certain AU countries.

For this reason the criteria that we have selected to use are:

- **Top five European Actors,** which are recurrent in the matrix: this criteria is relevant to understand where to extend the consortium, in case the actors (institutions) are not yet involved in the PRE-LEAP-RE project. The key role of French and German actors in the selected Initiatives is confirmed. Austria is also playing a role that would be pivotal for the PRE-LEAP-RE Proposal;
- **Top five African Actors**, which are recurrent in the matrix: this criteria is relevant to understand where to extend the consortium from Africa perspective. In this case the actors (institutions) are not yet involved in the PRE-LEAP-RE project. An extension of the consortium in the Eastern Africa and Southern Africa is envisaged, complementing the current role of Kenya and South Africa;
- **Top five Donors:** this criteria shows the importance of strengthening synergies with the current main donors that are, beside the EC, European organizations (Investment Bank and Development Fund) and German and French agencies. Confirming the key role of European Organization and France and Germany in the selected initiatives;
- **Top five European Countries**, which are recurrent in the matrix: this criteria is relevant to understand where to extend the consortium at country level in case of countries not yet involved in the PRE-LEAP-RE project. An extension of the consortium to at least Austria and Spain is envisaged, complementing the current role of France and Germany, Italy and UK along with other partners;
- **Top five African Countries**, which are recurrent in the matrix: this criteria is relevant to understand where to extend the consortium at country level in case of countries not yet involved in the PRE-LEAP-RE project. An extension of the consortium to at least Egypt and Tanzania is envisaged, complementing the current role of Kenya, Burkina Faso and South Africa along with other partners;
- **Top five Initiatives All-African Regions**, which are involving all or most AU countries: this criteria is relevant to identify and involve the organizations and consortium already acting in the African region at a broad level and interacting with all African regions and countries, through regional and national organization with a strong network along the continent. An extension of the consortium, or identification of synergies, with these partnerships, initiatives, or actors is envisaged, complementing the current role of consortiums already involved.

Table 7 Summary Top Five Actors and Donors

Top Five European Actors	Top Five African Actors	Top Five Donors*	Top Five European Countries	Top Five African Countries	Top Five Initiatives All-African Regions

GIZ	ECOWAS Center for Renewable Energy and Energy Efficiency (ECREE) Gender and Energy Program	African Development Bank	Germany	Kenya	Africa-EU Energy Partnership (AEEP)
Austrian Development Agency	Kenya Electricity Generating Company Limited (KenGen)	European Development Fund	France	Egypt	Africa Renewable Energy Initiative (AREI)
CEA	Common Market for Eastern and Southern Africa (COMESA)	European Investment Bank	Italy	Burkina Faso	ACP-EU Energy Facility
German Federal Ministry for Economic Cooperation and Development (BMZ)	Southern Africa Development Community (SADC)	Kreditanstalt für Wiederaufbau (KfW)	United Kingdom	South Africa	ESMAP
French Development Agency (AFD)	Alexandria University (Egypt)	French Development Agency (AFD)	Spain	Tanzania	EU Africa Infrastructure Trust Fund

** EC is not reported in this list even if it is the most present donor*

All data and information collected and summarized in this section are used for a more detailed analysis and general conclusions reported in the next section. However, it is important to note that the current PRE-LEAP-RE consortium includes either directly (or is directly connected to) 4 out of the 5 top European actors, 4 out of the 5 top African actors, 4 out of the top 5 European countries, 3 out of the top 5 African countries, and with all of the top 5 initiatives. Connections with the missing actors and countries should be developed further to ensure the footprint needed to engage in a large-scale EU-AU initiative. More direct connections with the Regional Economic Communities in Africa, and their centres for renewable energies is important to pursue, as is partnerships with the high-level initiatives and partnerships identified in the matrix.

5.3 Recommendations for PRE-LEAP-RE Roadmap of WP2

This deliverable is an important step in the progress toward an EJP Cofund. It gives a picture of the context for cooperation between Europe and Africa in the field of renewable energies, including highlighting potential areas of development for future cooperation. Using this work as a basis for the development an innovative, relevant, and attractive agenda for research, innovation, and human and institutional capacity building in the field is a crucial step for both the future activities of the EJP Cofund and for attracting potential partners interested in collaboration. Work Package 2 will undertake the work of developing the framework for EJP Cofund based on the results of this study. This deliverable also identifies the key actors and countries already working in the area of renewable energies research, and in particular, those not already part of the PRE-LEAP-RE consortium. Effectively linking to the actors already active in this cooperation, encouraging the development of links to new countries, and developing partnerships with non-traditional and global funding sources are all important strategies for furthering the development of a consortium ready to implement an EJP Cofund. Work Package 3 will undertake this work by building off the landscape of actors and countries active in the field described in this work, as well as the suggested ways forward for expanding the consortium to meet the future needs for cooperation (found in section 5.2).

5.3.1 Technology Development

Research on technology development for energy systems based on **renewable energy** can be confirmed, as highlighted in CCSE and in the ECORYS, as one of the solutions to support Africa in the energy transition that is needed to promote leapfrogging, cost-effective, locally adaptive and sustainable energy systems. In this framework, drivers and barriers are still present for different renewable energy technologies development in Africa and requires further research. By matching the recommendations coming from the CCSE with the results of the PRE-LEAP-RE review, some key elements emerge and may represent the seed of the PRE-LEAP-RE Roadmap.

Photovoltaic Solar Energy and Solar Thermal Heat research is confirmed to be pivotal. Attention should be paid to lifetime, behaviour and adaptation of solar panels in extreme conditions and related maintenance, energy storage systems, photovoltaic systems for agriculture and environmental applications as well as solar heating & cooling and concentrated solar power. Indeed, the majority of the initiatives within the PRE-LEAP-RE review are related to solar energy for its potential as source for both electricity and thermal heat. This is confirmed by the fact that 50% of the initiatives collected in the matrix are reporting a focus on solar technologies for electricity generation (i.e. PV technology). The growing interest in some areas on solar thermal is also appreciated and more recent. This predominance, despite the relatively higher cost of PV compared to the other alternatives, is mainly linked to the global diffusion in the continent of solar radiation, which makes it easy to rely on such a source.

Wind Power Research is also recognized as crucial, with 25% of the Initiatives mapped in the present study including wind power. Particular attention should be paid on the development of decentralised generation and stand-alone systems, including energy storage. Furthermore, additional research needs to be carried out in fields that go beyond the technological aspects, as will be better addressed in the next paragraph.

Hydro Power is the cheapest resource that may be used for power production, despite the competition over water and the transboundary problems in managing the water basin, which has led to privileging small-hydro power: run of river solutions rather than big dam. Despite this, less than 20% of the initiatives are devoted to hydro power, the CCSE and ECORYS study, as well as the Agenda 2063 of the Africa Union, confirm that this is a space where research and innovation should keep on working in terms of choice of technologies and configurations need to be adapted to local conditions.

Geothermal energy is characterised by large-scale activities, which make the implementation complex and dependant on local policy and governmental actions and funds. In terms of research, the many issues related to geothermal exploitation is a fruitful arear for future cooperation, and particularly exploring the environmental implication in those areas where the main potential for geothermal activities exists. Some attention should also be given to geothermal cooling with special reference to food and beverage.

Bioenergy is used both for power generation, in the case of big size power plants, and also for domestic needs, such as for cooking. Both aspects need to be deepened in terms of research and innovation: mainly on the sustainability of the supply chain and adaptation to local context through the introduction of new fuels from urban solid waste, agri-food processes and combustion chamber design, improved cookstoves and other alternatives to traditional and unhealthy domestic cooking systems. Attention to the competition between bioenergy and food needs must always be paid when dealing within the bioenergy sector.

Few initiatives are dedicated to **marine energy** where research is still needed at the level of resource assessment, site localization and exploitation.

Looking at technology development within the **energy supply chain**, from the perspective of single source renewable energy systems, it also becomes evident that efforts need to be mostly focused on Conversion Technologies and End Use Devices.

Resource Assessment is still crucial for marine energy and for a full assessment of the mini-hydro potential.

Distribution becomes an interesting area for research and innovation when dealing with integration on renewable via smart **hybrid mini grid**, either in their **off-grid configuration** or when considering their long-term **integration within the national grid**. This is one of the most attractive areas of research where leapfrogging can be made by leveraging innovation with the **digital revolution** that is currently taking place in the continent.

Indeed, from the PRE-LEAP-RE review, an emerging interest in **resource integration** is envisaged in line with CCSE and other grey literature from reference institutions[8,9,10]. Roughly 15% of the projects are dealing with "All Renewables" even if it is also clear that more research efforts would need to be placed on the effective integration of different sources in a way that could lead to cost saving, technological advantages (reduce use and better life time for batteries) and non-technological opportunities (like local job creation and better exploitation of resources). At this stage, also the urgency of more R&I for **storage systems** and alternative solution to traditional backup diesel generators (like CSP/biomass hybrids with high temperature thermal storage, stationary fuel cells…) become more evident when it is discovered that more than 95% of the projects involving "All Renewables" are indeed testing distribution systems (the remaining being associated to stand alone devices): half as min-grids and half in grid-connected configurations, as reported as reported **Error! R eference source not found.**.

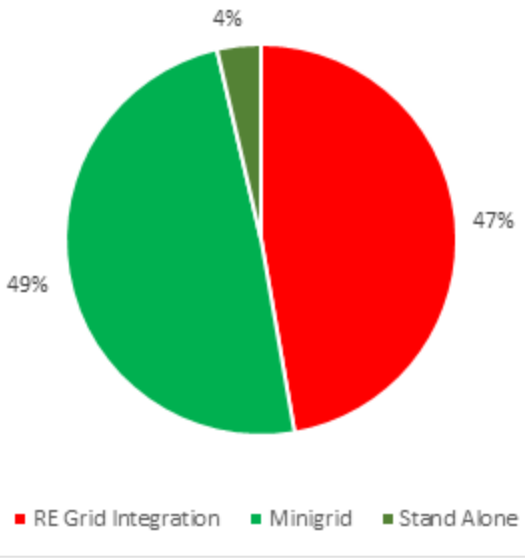

Figure 17 RE Grid Integration, Minigrid and Stand-alone solutions share

From the CCSE Roadmap, it becomes clear that renewable energy and technological development need to go side-by-side with **energy efficiency** as a cost-effective strategy for the energy transition that is needed to promote prosperity in Africa.

In particular, as stated by the AEEP: "*enhancing energy efficiency in Africa plays a crucial role and induces high impact opportunities, providing the same economic services with a reduced consumption*

[8] http://www.euei-pdf.org/sites/default/files/field_publication_file/annex_5_aeep_mapping_of_energy_initiatives_overview_of_initiatives_0.pdf

[9] http://www.euei-pdf.org/sites/default/files/field_publication_file/mapping_of_initiatives_final_report_may_2016.pdf

[10] http://www.irena.org/DocumentDownloads/Publications/IRENA_Africa_2030_REmap_2015_low-res.pdf

of primary energy, or more services with the same consumption of primary energy. Indeed, the International Energy Agency (IEA) recognizes the twofold role of energy efficiency: first, it is a key to ensure a safe, reliable, affordable and sustainable energy system for the future; secondly, it can be seen as one type energy resource that every country possesses in abundance, and it is the fastest and probably least cost way of addressing energy security, environmental and economic challenges…"

Nevertheless, less than 10% of the initiatives analysed involve, partially or fully, energy efficiency with an equal distribution between Demand Side Efficiency and Supply Side Efficiency. This reduced attention is a recognised gap that need to be further supported in any future Roadmap, as also concluded by the AEEP report on Energy Efficiency in Africa[11]

Technology development with specific reference to integration of different sources for off-grid or on-grid solutions, heat applications (process heat, cooling etc.) as well as energy efficiency are areas where **capacity building and local empowerment** need to be designed in order to create the enabling environment to promote more long term and equitable native innovation.

5.3.2 Methodological Approach

Besides the well-recognized importance of technological aspects described above, another crucial aspect is related to the **methodological approach** that needs to be investigated in research and innovation projects. The approach widens from the evaluation for the *needs*, that are at the base of any load curve creation, to the analysis of the *expected impact*. Indeed, technology development and design need to be completed by a more **comprehensive design,** which includes society, market evaluation, business models for long-term sustainability as well as impact on development. This approach is strongly needed to guarantee the long-term social, economic and environmental sustainability of the technologies developed in research and innovation projects as well underlined by the CCSE roadmap for R&I in the renewable sector.

The need for more research and innovation with the frame of **comprehensive energy solutions planning** is also evidenced in the ECORYS study, where economic, social and environmental impacts of RET uptake is analysed concluding that renewable energy in itself is not necessarily positive or negative for the economy, society and environment of the specific context, but It depends on how the energy technology is designed, built, operated, financed and maintained (e.g. thorough project preparation, solid business models, engagement of local expertise and population, etc.). The study also shows evidence of a current gap in the impact assessment work related to RE technology deployment.

The aspects highlighted in the CCSE and ECORYS studies are confirmed by the PRE-LEAP-RE review. The gap evidenced by ECORYS is confirmed by the number of projects where a methodological approach beyond technological development is not applied at all (approx. 20% of the projects), but on the other hand, it can be positively observed that when the project goes beyond the technological development, it includes almost all the steps that are relevant for the Comprehensive Energy Solutions Planning. This can be therefore formalised with further dedicated methodological research (see Figure 16) confirming the importance given to the inclusion of non-pure technological aspects in the analysis and application of the energy systems to ensure their long-term sustainability in both research and innovation projects.

It is also evident, as underlined by ESAMP in the special feature report of the Sustainable Energy Annual Report[12] (2017), that multidisciplinary and holistic **capacity building** is strongly needed for

[11] AFRICA-EU ENERGY PARTNERSHIP, Enhancing energy efficiency in Africa, AEEP Energy Efficiency Workstream, Final report, **ISBN** 9788894122657, 2018

[12] Colombo, Emanuela; Mattarolo, Lorenzo; Politecnico di Milano; Bologna, Stefano; Masera, Diego. 2017. The Power of Human Capital Multi-Level Capacity Building for Energy Access. State of Electricity Access Report. Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/104731494940162971/The-power-of-human-capital-multi-level-capacity-building-for-energy-access

promoting innovation with the frame of the Comprehensive Energy Solution Planning: cross fertilisation among disciplines and competences may increase the chance of breakthrough innovation even along non-technological pathways.

5.3.3 Energy Scenarios Analysis

Both the Technological Development and Methodological Approach described above have to be included in a more general framework directly related to the capacity of understanding and designing energy scenarios at the local, country, and global levels. Middle and long-term sustainability of energy scenarios, as well as the assessment of the needs and potential resources at country or regional levels is also needed to be able to understand the potential implication of technology or energy solutions with the local boundary conditions (economic, environmental and even cultural).

There is a strong need for supporting further research and capacity building on **Energy Scenario Analysis**, which include all modelling approaches and tools aimed to support policy and decision makers to build a long-term plan for energy systems development at the country level.

Specifically, the CCSE indicates the development of models and tools in order to achieve a systemic view on energy demand, energy access, energy security and sustainability is one of the five main action fields. This is also confirmed by the fact that the UN system[13] and the IEA are approaching and promoting a new programme for research and capacity building on energy scenario and modelling as a fundamental element at the country level to set up technological roadmap and energy solutions trends.

The importance of this aspect, even if well-recognized in the main objectives of most of the *Mapping Report* and *High Level Initiatives* analysed in the present PRE-LEAP-RE review, is not converted into specific studies and analysis. This is present, indeed, as main activities in a very limited number of analysed Initiatives (less than 8% of the total) evidencing a potential gap in the present *Research & Innovation Initiatives*, thus giving some space for further research cooperation between AU-EU.

5.3.4 PRE-LEAP-RE infographic as input for Roadmap

The final aim of this section is to support the work undertaken by the PRE-LEAP-RE WP2 team to prepare topics for future joint action. It is important to note that this table should be seen only as a guide for further action – ultimately the definition of a research, innovation, and human and institutional capacity building agenda is dependent on numerous factors, including the interest of funding parties. In order to give a structured vision to these recommendations the PRE-LEAP-RE consortium offers an infographic reported in Figure 18.

[13] https://un-modelling.github.io/modelling-tools/#energy-systems

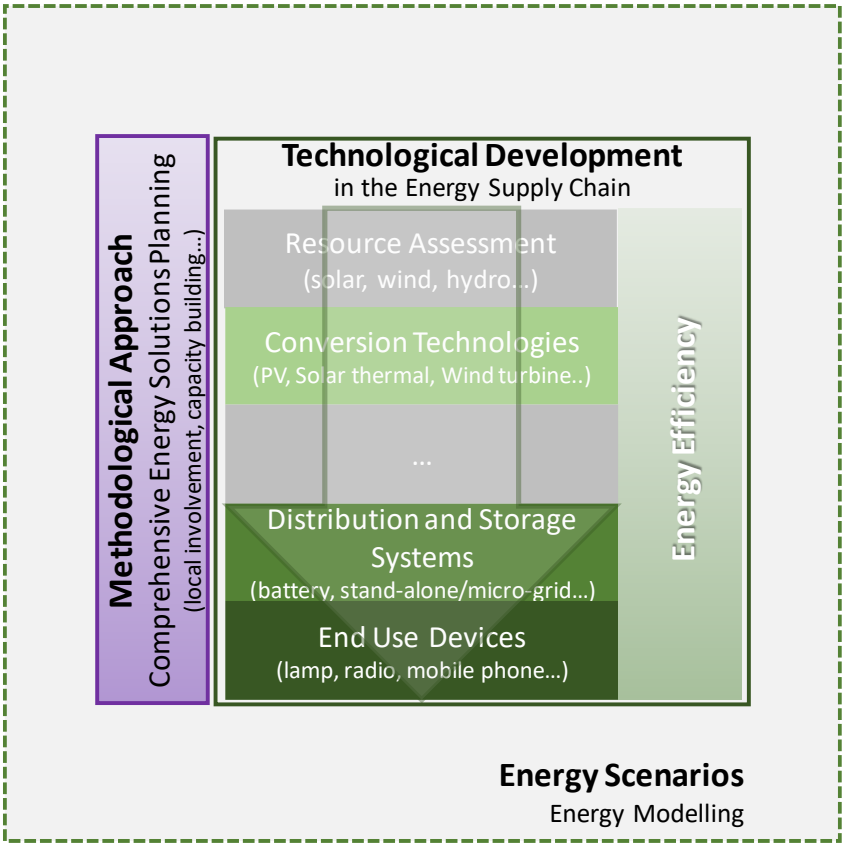

Figure 18 Seeds of the PRE-LEAP-RE Multidisciplinary Frame for Research and Capacity Building Agenda: the technological development needs to be deepen along all the phases of the energy supply chain, keeping a constant eye on energy efficiency as a cross cutting issue along it. Technological development can not walk alone and aside of it a methodological approach needs to be developed in both research and capacity building mostly to guarantee long term sustainability of energy technologies and solutions. Finally, this must be supported by a renovated attention to energy scenarios development which are mandatory to understand the context where technologies and energy solutions will be developed to avoid lock in solution or unforeseeable side effects.

In this picture the **technological development** that is needed within the **energy supply chain** is underlined with most of the attention dedicated to Conversion Technologies and End Uses Devices and to energy efficiency as a backbone of the overall chain. Aside of the Technological development, as reported in the CCSE and ECORYS as well as within the most relevant grey and scientific literature on renewable energy penetration, the need to cope technological development with a more structured **comprehensive energy solutions planning** methodology, activated by needs assessment, including business model definition for technology sustainability and impact evaluation is strongly envisaged and suggest a more **multidisciplinary approach** to energy research and innovation, which is consequently linked to the urgency of promoting a new asset of capacity and competence for local empowerment and ownership which are needed in both the AU and EU. Technology development and the **multidisciplinary approach** need to be finally developed within a frame where research is also made in order to understand the potential and feasible **energy scenarios** that may be developed in a country or region to promote the technological innovation that comply with local endowment, contains, needs, to support policy makers and to enable at local level, the prosperity for both people and the planet that is expected within the Agenda 2030 and the Agenda 2063.

Annex

Report Card Template

WP1 Task 1.1

European Commission | Horizon 2020 European Union funding for Research & Innovation

Title of Proposal: PREparing for a Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy

Legend

Not modifiable
Select from list
Free text

Project / Initiative Name	
Brief Description (100 words)	
Type of Initiatives	
Donors	
European Countries	
European Actors	
African Areas / Countries	
African Actors	
Other Actors	
Partnership Relation Level	
EU Stakeholder Category	
AU Stakeholder Category	
Start Year	
End Year	
Number of Projects Involved	
Budget [$]	
Category of the Initiative	
Type of Programme	
Energy Source	
Final Energy Use	
Nexus With Other Sources	
Geographical Scale	
Size [MW]	
Specific Objectives	
Main Activities	
Evaluation of Principal Steps of Comprehensive Energy Planning	
Needs Identification	
Baseline Load Demand & Forecast Resource Assesment	
Strategy Selection	
Technology Optimization	
Business Model Identification & Capacity Buliding	
Expected Impact	
Status at the end of the Project	
Actual Status	
Sources	
Notes On Possible Synergies	

Task Leaders: Politecnico di Milano (Italy), Department of Science and Technology (South Africa) Specific Record Card

African Countries and Regions

The African regions and related countries are reported in **Error! Reference source not found.**, as d efined by UN.

Table 8 List of African countries grouped in Regions

Northern Africa	Eastern Africa	Central Africa	Western Africa	Southern Africa
Algeria	Burundi	Angola	Benin	Botswana
Egypt	Comoros	Cameroon	Burkina Faso	Lesotho
Libya	Djibouti	Central African Republic	Cabo Verde	Namibia
Morocco	Eritrea	Chad	Cote d'Ivoire	South Africa
Sudan	Ethiopia	Democratic Republic of the Congo	Gambia	
Tunisia	Kenya	Republic of the Congo	Ghana	
	Madagascar	Equatorial Guinea	Guinea	
	Malawi	Gabon	Guinea-Bissau	

	Mauritius	Sao Tome and Principe	Liberia	
	Mozambique		Mali	
	Rwanda		Mauritania	
	Seychelles		Niger	
	Somalia		Nigeria	
	South Sudan		Saint Helena	
	Tanzania		Senegal	
	Uganda		Sierra Leone	
	Zambia		Togo	
	Zimbabwe			

Gaps and Synergies in Bi-Regional RE Initiatives

Mapping Reports			
No.	**Project**	**Gaps**	**Recommended interventions for PRE-LEAP-RE to explore**
1	Research Cooperation in Renewable Energy Technologies for Electricity Generation (REELCOOP)	▪ Research and development	▪ Linking up with private sector to produced applied research.
2	Pro-poor, low carbon development: Improving low carbon energy access and development benefits in Least Developed Countries	▪ Low access to energy by the poor in rural areas ▪ Use of fossil fuels in the energy generation/pollution	▪ Create opportunities to invest on RE projects ▪ Identify new markets for Renewable Energy ▪ Improve energy accessibility for industry and private use in Africa
3	African Clean Energy Corridor	▪ Energy shortages in Africa ▪ Need to produce clean energy in Africa ▪ Need for knowledge and tech-transfer in the continent	▪ Create platform for joint initiatives between AU and EU governments and among Africa governments ▪ Collaboration on technology development
4	Africa-EU Energy Partnership (AEEP)	▪ Research gaps ▪ Low human and institutional capacity ▪ Low skills and knowledge	▪ Joint research ▪ Human and institutional capacity building ▪ Tech-transfer ▪ Mobilising Private sector funding ▪ Business to Business match making
5	Africa Renewable Energy Initiative (AREI)	▪ Research gaps ▪ Low human and institutional capacity ▪ Low skills and knowledge	▪ Joint research ▪ Human and institutional capacity building ▪ Tech-transfer ▪ Mobilising Private sector funding for RE initiatives in Africa ▪ Business to Business match making to link renewable energy initiatives and projects with potential investors and donors

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High Level Initiatives			
No.	**Project**	**Gaps**	**Recommended interventions for PRE-LEAP-RE to explore**
10	ElectriFi	▪ Donor and investment funding ▪ Knowledge of markets	▪ Create a business to business match making where RE projects link up with potential investors ▪ Identify new projects for investment ▪ Collaborate with RE companies to leverage the RE opportunities identified as gaps ▪ Invest in already existing projects for upscaling
11	EU Africa Infrastructure Trust Fund	▪ Donor and investment funding ▪ Knowledge of markets	▪ Identify new projects for investment ▪ Invest in existing projects for upscaling
12	Africa Enterprise Challenge Fund (AECF)	▪ Donor and investment funding ▪ Knowledge of markets	▪ Create a business to business match making where RE projects link up with potential investors ▪ Identify new projects for investment ▪ Collaborate with RE companies to leverage the RE opportunities identified as gaps ▪ Invest in already existing projects for upscaling
13	Africa- EU Renewable Energy Cooperation Program (RECP)	▪ Donor and investment funding ▪ Knowledge of markets	▪ Creating projects to leverage markets for renewable energy in Africa
14	EEP Africa - Energy and Environment Partnership	▪ Donor and investment funding ▪ Knowledge of RE markets	▪ Joint research ▪ Platform for RE engagements
15	Energising Development (EnDev)	▪ Donor and investment funding ▪ Knowledge of RE markets	▪ Collaborate on research and development to identify and exploit new markets for RE
16	Energy Access Ventures (EAV)	▪ Donor and investment funding ▪ Knowledge of RE markets	▪ Collaborate on raising funds on renewable energy projects and initiatives.
17	EREF ECOWAS Renewable Energy Facility	▪ Donor and investment funding ▪ Knowledge of RE markets	▪ Identify areas of potential areas of investment on RE ▪ Create a business to business match making where RE projects link up with potential investors

18	German-Moroccan Energy Partnership	▪ Donor and investment funding ▪ Knowledge of RE markets	▪ Look donor funding for RE projects ▪ Expand the initiative to involve other partners
19	Regional Off-Grid Electrification Project (ROGEP)	▪ Donor and investment funding ▪ Knowledge of RE markets	▪ Collaborate on R&D, skills and tech transfer.
20	ERANETMED - Waste2Fuel	▪ Donor and investment funding ▪ Technologies ▪ Research	▪ Collaborate on the manufacturing of new technologies
21	Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy (STAGE-STE)	▪ Donor and investment funding ▪ Knowledge of RE markets	▪ Research collaboration ▪ Mobilising investment

Specific Projects			
No.	**Project**	**Gaps**	**Recommended collaborations and synergies**
22	CSP4africa: Development of a cost-effective, modular and dry concentrating solar power for Africa	▪ Energy shortages ▪ Untapped renewable energy markets	▪ Mobilise more funding for the project ▪ Link the project with other actors in the development of a cost-effective, modular and dry concentrating solar power for Africa ▪ Identify new market for the project to upscale
23	EUROSUNMED	▪ High cost of renewable energy technologies ▪ Lack of knowledge and skills in the renewable energy value chains	▪ Linking EUROSUNMED with other actors to develop new technologies in three energy field areas, namely photovoltaics, concentrated solar power and grid integration. ▪ Contribute in the establishing of strong networks between EU and MPCs through exchange of students, senior researchers/engineers for transferring knowledge and technologies.
24	Olkaria IV	▪ Energy shortage ▪ Available RE markets not exploited	▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment

25	Lake Turkana Wind Power	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
26	Kakono Hydropower Plant	▪ Energy shortage ▪ Available RE markets not exploited	▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
27	Jiji and Mulembwe Hydropower Project	▪ Energy shortage ▪ Available RE markets not exploited	▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
28	Agahozo Shalom Solar Farm	▪ Energy shortage ▪ Available RE markets not exploited	▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
29	Ruzizi III Power Plant	▪ Energy shortage ▪ Available RE markets not exploited	▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
30	Lake Assal Geothermal Plant	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
31	DOWA – Deep Ocean Water Application Mauritius	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
32	JCM Greenquest	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
33	Starsol	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
34	Saltinho Hydropower Project	▪ Energy shortage	▪ Collaborate on new technologies

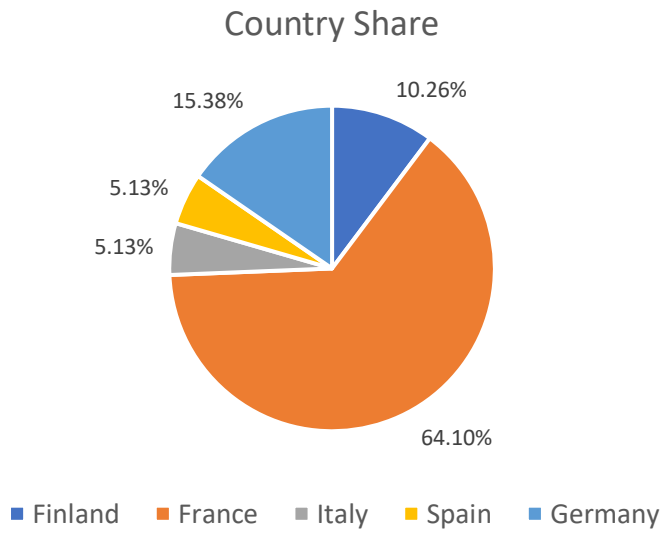
		▪ Available RE markets not exploited	▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
35	Kaboni	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
36	Solar PV Mini Grids for the Rural Towns of Areza and Maidma and Surrounding Villages in Eritrea	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
37	Zagtouli PV Power Plant	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
38	Rent to Own Solar Home Systems	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
39	Light Up Our Futures	▪ Energy shortage ▪ Available RE markets not exploited	▪ Facilitate multi-stakeholder partnership that includes private sector, public sector and the community ▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
40	Light Up Liberia	▪ Energy shortage ▪ Available RE markets not fully exploited	▪ Facilitate multi-stakeholder partnership that includes private sector, public sector and the community ▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
41	Micresol	▪ Energy shortage	▪ Collaborate on new technologies

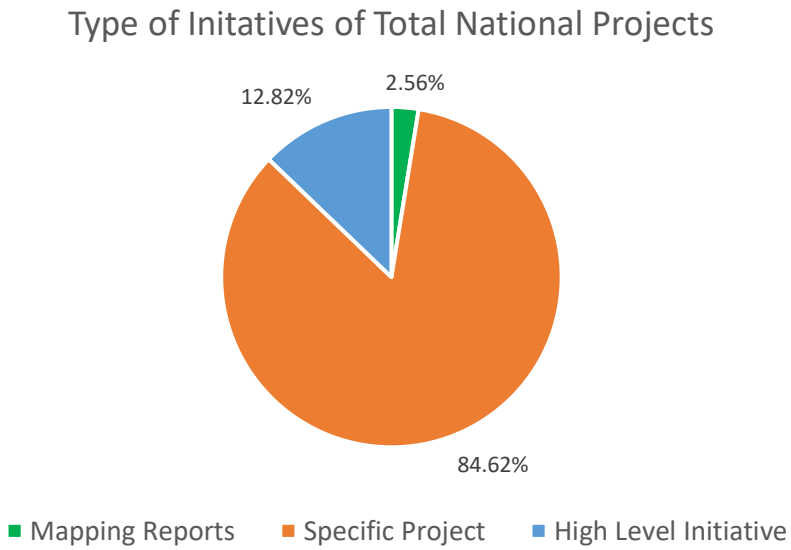
		▪ Available RE markets not exploited	▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
42	Gulf of El Zayt Wind Farm	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
43	Developing decentralised renewable energy sources for poverty alleviation and environmental protection in rural areas of Cameroon	▪ Energy shortage ▪ Available RE markets not exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
44	AU Grid Solar Project	▪ Energy shortage ▪ Available RE markets not exploited	▪ Facilitate collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Help the project attract new investment
45	Defining best practices in geothermal data management	▪ Energy shortage ▪ Available RE markets not fully exploited	▪ Collaborate of data sharing ▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
46	NRW-KNUST Project	▪ Climate change	▪ Collaborate on Research and innovation (R&) ▪ Attract new funding into the initiative
47	The Renewable Energy for Food Processing	▪ Energy shortage ▪ Food shortage ▪ Available RE markets not fully exploited	▪ Cross-sector collaboration in the area of energy, food and water ▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
48	Multipurpose Applications by Thermodynamic Solar (MATS)	▪ Energy shortage ▪ Available RE markets not fully exploited	▪ Facilitate multi-stakeholder partnership that includes private sector, public sector and the community ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment

49	MICROSOL	▪ Energy shortage ▪ Available RE markets not fully exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
50	Regional Certification Scheme for Sustainable Energy Skills	▪ Energy shortage ▪ Available RE markets not fully exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
51	Water Saving for Concentrated Solar Power (WASCOP)	▪ Energy shortage ▪ Available RE markets not fully exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment
52	Royal Society-DFID Africa Capacity Building Initiative	▪ Energy RE shortage ▪ Available RE markets not fully exploited	▪ Collaborate on new technologies ▪ Expand and upscaling the project to improve power production and power supply ▪ Attract new investment ▪ Support research uptake activities, pilot projects/ demonstration plots, scaling up of the project and further research on solar energy would be useful

National Level Initiatives

Projects	39	
Finland	4	10,26%
France	25	64,10%
Italy	2	5,13%
Spain	2	5,13%
Germany	6	15,38%





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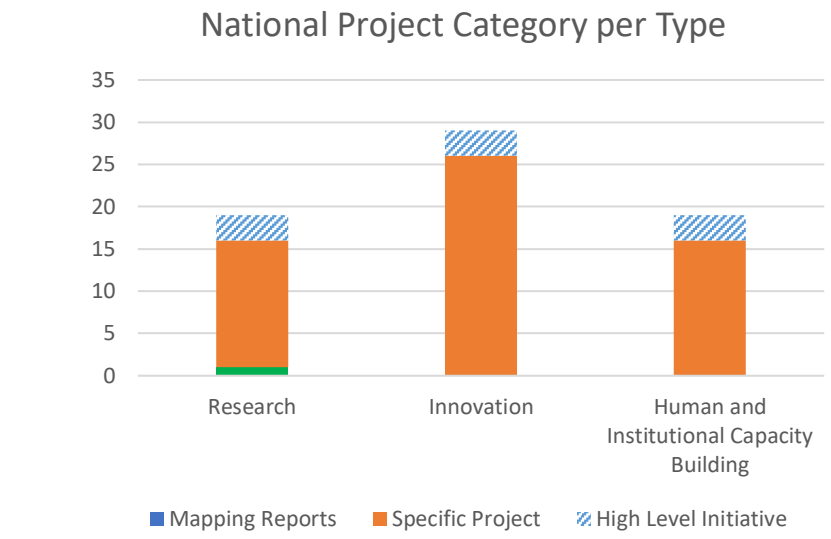
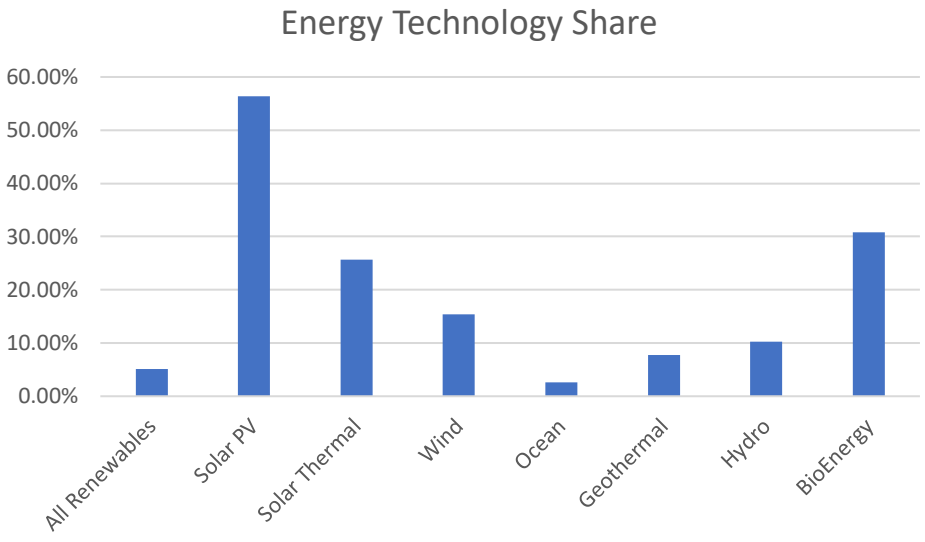
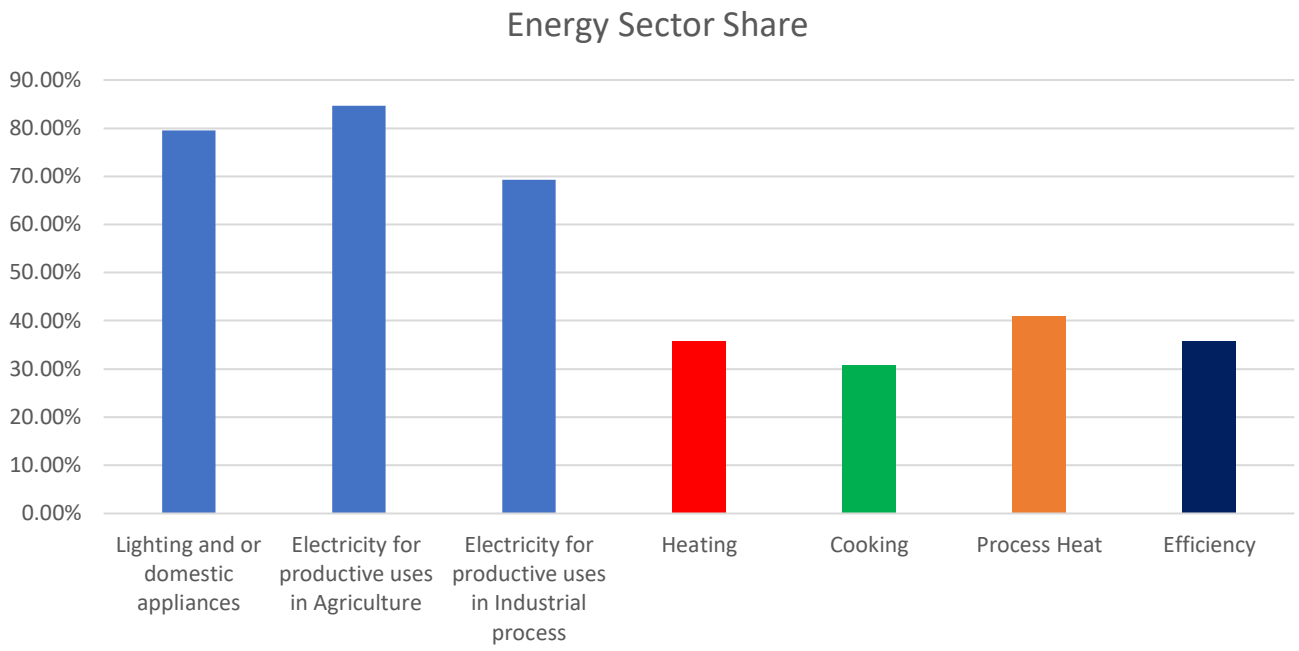

National Project Category per Type
35
30
25
20
15
10
5
0
Research
Innovation
Human and Institutional Capacity Building
Mapping Reports
Specific Project
High Level Initiative


Energy Technology Share
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
All Renewables
Solar PV
Solar Thermal
Wind
Ocean
Geothermal
Hydro
BioEnergy


Energy Sector Share
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Lighting and or domestic appliances
Electricity for productive uses in Agriculture
Electricity for productive uses in Industrial process
Heating
Cooking
Process Heat
Efficiency