

Africa-EU Renewable Energy Cooperation Programme (RECP):
Higher Education for Renewable Energy

Country Mapping



Mozambique

May 2015



Figure 1: Map Mozambique (CIA, 2014a)

Content

1	Mozambique at a Glance	1
1.1	Population and Geography	1
1.2	Government and Legislation	2
1.3	Economy and Infrastructure	3
2	Energy and Renewable Energy	5
2.1	Overview	5
2.2	Energy Policy.....	6
2.3	Renewable Energy	7
2.3.1	Potential and Projects	7
2.3.2	Market and Jobs	8
2.4	Conclusion: Barriers, Trends and Patterns	9
3	Education and Higher Education.....	11
3.1	Primary and Secondary Education.....	11
3.2	Higher Education	11
3.2.1	Shape of higher education	11
3.2.2	Higher education policy.....	13
3.2.3	Quality assurance	13
3.2.4	Higher education staff.....	13
3.2.5	Funding of higher education	14
3.3	Renewable Energy Higher Education	14
3.4	Conclusion and Recommendation.....	15
4	References	16

1 Mozambique at a Glance

1.1 Population and Geography

Table 1: Population (World Bank, 2014a), (CIA, 2014a)

Population, total (2013)	25,833,752
Population, growth (2013)	2.5% per year
Population density (2013)	32.9 / km ²
Urban population (2013)	31.7%
Life expectancy at births	49.5 years
Major Cities (2007)	Maputo (1,766,184), Matola (675,422), Beira (546,000), Nampula (477,900), Chimoio (238,976)
Language (1997 census)	Emakhuwa 25.3%, Portuguese (official) 10.7%, Xichangana 10.3%, Cisená 7.5%, Elomwe 7%, Echuwabo 5.1%, other Mozambican languages 30.1%, other 4%
Ethnic Groups	African 99.66% (Makhuwa, Tsonga, Lomwe, Sena, and others), Europeans 0.06%, Euro-Africans 0.2%, Indians 0.08%
Religion	Roman Catholic 28.4%, Muslim 17.9%, Zionist Christian 15.5%, Protestant 12.2% (includes Pentecostal 10.9% and Anglican 1.3%), other 6.7%, none 18.7%

Table 2: Geography and climate (CIA, 2014a)

Location	South-eastern Africa, bordering the Mozambique Channel, between South Africa and Tanzania, 2,470 km Coastline
Area	799,380 km ²
Neighbouring Countries	Malawi, Zimbabwe, Tanzania, South Africa, Zambia, Swaziland
Climate	tropical to subtropical
Terrain	mostly coastal lowlands, uplands in centre, high plateaus in northwest, mountains in west
Natural hazards	severe droughts; devastating cyclones and floods in central and southern provinces

1.2 Government and Legislation

Table 3: Government system Mozambique (CIA, 2014a), (Transparency International, 2013)

Official name	Republic of Mozambique
Conventional short form	Mozambique
Form of state	Republic
Administrative divisions	1 city: Cidade de Maputo 10 provinces: Cabo Delgado, Gaza, Inhambane, Manica, Maputo, Nampula, Niassa, Sofala, Tete, Zambezia
Chief of state	President Filipe Nyusi (since 15 January 2015); next presidential election 2019
Head of Government	Prime Minister Alberto Clementino Antonio Vaquina (since 8 October 2012)
Parties as distributed in the Assembly of the Republic	FRELIMO 74.7%, RENAMO 17.7%, MDM 3.9%, other 3.7%
Independence	25 June 1975 (from Portugal)
Corruption perception index ¹	30 (of 100), Rank (119 of 177)

After its independence from Portugal in 1975, Mozambique underwent a phase of prolonged civil war until the peace agreement in 1992 between the communist liberation fighters of FRELIMO² and the anti-communist Mozambican resistance of RENAMO³ (CIA, 2014a) (Wikipedia, 2014).

Since the constitution of 1990, instated under Joaquim Chissano, Mozambique is a multi-party democracy with free elections (Wikipedia, 2014). Currently, the government is led by President Armando Guebuza, the Prime Minister Alberto Vaquina and the cabinet. The president is elected every 5 years (CIA, 2014a).

The 2009 presidential election was widely criticised due to various illegitimacies, such as voter fraud by the FRELIMO party, which led to the removal of Mozambique from the list of electoral democracies by the Freedom House (CIA, 2014a). Recently, the violence between the former civil war parties resurged as the armed wing of the RENAMO started a military campaign against military and civil targets (World Bank, 2014).

¹ The corruption perception index is developed by Transparency International. A value of 0 is counted as highly corrupt and 100 as very clean.

² Frente de Libertação de Moçambique

³ Resistência Nacional Moçambicana

1.3 Economy and Infrastructure

Table 4: Economic figures (World Bank, 2014a), (CIA, 2014), (CIA, 2014a), (UNDP, 2014)

Overview			
World Bank Rating	Low income		
Human Development Index HDI (2013)	0.393 (Rank: 178/187)		
GINI Index (2009)	45.7 (Rank 37/141)		
Population living below poverty line	54.7%		
Currency	New Mozambican Metical, MZN		
Economic Indicators	2011	2012	2013
GDP (in constant 2005 Billion US\$)	9.80	10.51	11.26
GDP per capita PPP (constant 2011 international \$)	926	968	1,012
GDP per capita growth (annual %)	4.6	4.6	4.5
Unemployment, total (% of total labour force) (modelled ILO estimate)	7.5	7.5	--
Unemployment, youth (% of total labour force aged 15-24) (ILO)	12.8	12.8	--
Ease-of-doing-business index (1: most business friendly)	--	142	139
Inflation, consumer prices (annual %)	10.4	2.1	4.2
Structure of Economy	2011	2012	2013
Agriculture, value added (as % of GDP)	30.8	30.3	29.3
Industry, value added (as % of GDP)	21.7	22.9	23.7
Services, etc. value added (as % of GDP)	47.5	46.8	47.1

With a Human Development Index of 0.393, Mozambique has one of the lowest human development in the world. The high GINI Index of 45.7 indicates a high income inequality, which further exacerbates the situation of the people.

The World Bank rates Mozambique as a low income country. However, since 2001, GDP growth rates have been consistently above 6% and as high as 11.9% in 2001, but it declined slightly to 4.6% in 2013. The World Bank names it one of Africa’s “frontier economies”. The main challenge of the Mozambican economy is to allow for the participation of the population in the positive effects of the substantial economic growth. In order to achieve this, the World Bank suggests a poverty reduction strategy consisting of the diversification of

sources of economic growth, strong investment in infrastructure, education and health, and a more refined social net to protect the most vulnerable citizens (World Bank, 2014).

The economy is mostly based on the service sector and the agriculture sector, with a contribution to the GDP of 47% and 29% respectively. The industrial sector only represents 24% of the country's GDP. However, the country has become a world-class destination for mining and natural gas developments. Vast untapped coal reserves have attracted multinationals such as Brazilian's Vale and Australian Rio Tinto (World Bank, 2014).

Table 5: Infrastructure Mozambique (CIA, 2014a), (Internet World Stats, 2013)

Railways	4,787 km
Roads	30,331 km, of which 6,303 km paved
Airports (2013)	98 in total of which 21 have paved runways
Telephones (main lines in use) (2012)	88,100
Telephones - Mobile cellular (2012)	8.108 million
Internet users (2013)	1.33 million (5.3%)

Mozambique's infrastructure is well developed in some sectors, including its east-west transport infrastructure, power grid, and water and sanitation networks. However, the nation still faces critical challenges in these and other areas, including developing north-south transport connections, properly managing the water system, and expanding hydroelectric generation to meet growing energy demands (Dominguez-Torres & Briceño-Garmendia, 2011).

Major seaports include the cities of Beira, Maputo and Nacala. Mozambique possesses a fair telecommunications system, that is however, shackled with strong state influence, lack of competition and high costs. However, there is a rapid growth in the mobile phone coverage (CIA, 2014a).

2 Energy and Renewable Energy

2.1 Overview

Table 6: Country Energy Overview (EIA, 2014), (World Bank, 2014a), (World Health Organization, 2014), (World Bank, 2013)

	2001	2011
Energy use (TWh)	38.39	59.78
Energy production (TWh)	36.34	92.32
Net import of energy (% of Energy use)	5.34	-54.43
Electricity consumption (TWh)	7.00	10.82
Electricity production (TWh)	11.76	16.66
Electricity consumption per capita (kWh/person)	383.02	440.17
Total electricity capacity (MW)	2,388	2,429
Electric power transmission and distribution losses (% of output)	10.72	14.74
Access to electricity, total	7%	15% (2010)
Urban	n.a.	45%
Rural	n.a.	2%
Electricity production by source (in % of the total electricity production)		
Hydro	99.7%	99.9%
Nuclear	0.0%	0.0%
Oil, gas and coal sources	0.3%	0.1%
Renewable Energy excl. Hydro	0.0%	0.0%
Share of population using solid fuels (2010)	95%	

The comparison of energy use to energy production shows that in 2001 only a small fraction had to be imported. In 2011 Mozambique exported over 50% of the produced energy. Mozambique is a net exporter of electricity. The country's electricity consumption of 440 kWh per capita is at a medium level for this region and about 20% lower than the SSA average of 535 kWh per capita in 2011. The electricity generation capacity remained nearly constant at 2,400 MW. Since 2001 the installed hydro power capacity remains at 2,180 MW. Thermal power capacity increased from 204 MW in 2001 to 249 MW in 2011.

The energy losses in the transmission and distribution grids of 14.7% are approximately twice as high as the SSA average and an indicator for low grid reliability. Electricity supply is inconsistent with frequent blackouts (Reegle, 2014). The total access to electricity was 15%

in 2010. The share of population using solid biofuels for cooking stood at 95% in 2010 (Mozambique Energy Profile; comparison: Rwanda: >95%; Zimbabwe: 71%).

Currently, Mozambique focuses on the improvements to the efficiency of existing hydropower plants rather than on increasing generation capacity. On the other hand, grid losses rose by 40% in the decade from 2001 to 2011. Due to the export surplus, additional customers could be supplied with electricity by connection to the grid.

2.2 Energy Policy

Table 7: Mozambique Energy Policy (Reegle, 2014), (IRENA, 2013)

Organisations responsible for energy policies	Ministry of Energy (Ministério da Energia, ME) (including the National Directorate for Electrical Energy (DNEE), National Directorate for New and Renewable Energies (DNER) and National Directorate of Fuels (DNC))
Energy regulator	National Electricity Council (CNELEC)
Government Agencies	Ministry of Agriculture and Rural Development (Ministério da Agricultura - MINAG) Ministry for the Coordination of Environmental Affairs, MICOA
Energy policy publications	Energy Policy (1998) Energy Sector Strategy (2000) Energy Reform and Access Project (2003-2011) Electricity Master Plan for Development of the National Grid 2005-2019
Targets to increase use of Renewable Energy	2,000 MW each wind, solar and hydro power capacity but without any target period Strengthen the rural areas: 82,000 solar PV systems, 1,000 bio-digesters, 3,000 wind pumping systems, 5,000 renewable-energy-based productive systems, 100,000 solar water heaters
Subsidies/Incentives for RE	Capital subsidies Public investments

The main public authority for electricity is the Ministry of Energy which is responsible for all energy resources. The Ministry of Energy includes the National Directorate for Electrical Energy (DNEE), which is responsible for the analysis, preparation and elaboration of energy policies. The National Electricity Council (CNELEC) is the energy regulator of Mozambique and was established in 2004. Among the main responsibilities are the regulation of generation, transmission and sale of electricity (Reegle, 2014).

With its Energy Policy (1998), the government acknowledges the importance of providing households and the productive sector with energy. Main focus of this policy is the installation of additional generation capacity, improvement of the management within the electricity sector and the increase of exports and efficiency. In order to support the implementation of the Energy Policy, the Energy Sector Strategy (2000) specifies the role of the private sector, targets the development of more competitive markets, and the need for regulation. The strategy outlines the activities for various energy sub-sectors to reach the goals of the Energy Policy (Reegle, 2014).

From 2003 to 2011 the Energy Reform and Access Project accelerated the use of electricity for economic growth and social services in a commercially viable manner. This project supported the national Energy Strategy and also encouraged the development of renewable energy like photovoltaic systems and micro-hydro power and contributed to the reduction of Greenhouse Gases. The Electricity Master Plan for Development of the National Grid (2005) focuses on the expansion of the electricity grid in short-to-medium term until 2019 (Reegle, 2014).

2.3 Renewable Energy

2.3.1 Potential and Projects

Solar: There is currently no photovoltaic generation facility connected to the grid. A small off grid market exists for solar home systems from local suppliers or government projects. Components are often of low quality. The programme Energising Development Mozambique, funded by several European and an Australian Agency, has started designing an energy efficient compact small solar home system in cooperation with a local enterprise and with higher quality products (energypedia, 2014). Mozambique has a huge and virtually unexploited solar potential and is endowed with favourable solar radiation between 1,650 kWh/m² and 2,500 kWh/m² per year (Reegle, 2014).

Wind: In Mozambique there is no wind power plant connected to the grid. In order to gather information about the wind potential in Mozambique, several measurements are currently carried out and more are planned. Along the Nissa coast, there is some potential with an average wind speed of 6 m/s (Reegle, 2014), (energypedia, 2014).

Biomass: Biomass constitutes currently about 80% of energy consumption of the households in Mozambique with an even higher share in rural areas. There is a high potential for jobs in the electricity sector because Mozambique's small and medium sized enterprises can be involved in all stages of the supply and production chain. Bagasse wastes from the sugar industry, copra wastes from the coconut industry and other sources could enable Mozambique to quickly build up an industry based on clean, indigenous biomass fuels with a capacity of hundreds of MW (Reegle, 2014), (energypedia, 2014).

Hydro: In Mozambique there is currently 2,180 MW of hydropower installed. The country's energy generation relies almost completely on hydropower. The generation potential is

estimated at 15,000 MW in about 100 locations. “Potential sites for [...] micro hydropower schemes are located in the mountainous terrain and perennial streams and rivers of Manica, Tete and Niassa provinces. A study on medium-sized and large plants reveals that the small hydropower potential is very high in the Central (Sofala, Manica and Zambézia provinces) and Northern (Nampula, Cabo Delgado and Niassa provinces) parts of the country, in particular in the provinces Tete and Niassa” (UNIDO; ICSHP , 2013). Two main projects which are on their way are the additional 850 MW expansion of the Cahora Bassa dam and the new Mphanda Nkuwa dam with 2,500 MW. Other recent projects are listed in Table 8.

Table 8: Hydropower projects in Mozambique (energypedia, 2014)

Project Name	Type of Project	Size	Comments
Cahora Bassa North Bank	Hydropower expansion	850 to 1,300 additional MW	Detailed feasibility study is underway
Mphanda Nkuwa	Hydropower	2,500 MW	Env. + Soc. Impact Study underway
Massingir	Hydropower	40 MW	EDM managed
Lurio	Hydropower	120 MW	
Majawa	Hydropower	25 MW	
Malema	Hydropower	60 MW	
Moatize	Coal fired power plant	1,500 MW	IES is the developer
Temane	Combined Cycle natural gas fired power plant	300-400 MW	On the SASOL gas pipeline. 2010

2.3.2 Market and Jobs

There are two main actors in the electricity market in Mozambique. Electricidade de Mocambique (EDM) is in charge of generation, transmission and distribution but owns only 10% of the generation capacity. EDM is supervised by the Mozambican Ministry of Energy. The remaining 90% generation capacity is owned by Hidroelectrica de Cahora Bassa (HCB), a company jointly owned by Portugal and Mozambique which operates as an Independent Power Producer (IPP). HCB is the largest company dealing in hydroelectric schemes in Southern Africa (Reegle, 2014).

Other IPPs are emerging, particularly in hydropower generation. According to the Electricity Master Plan and the Generation Master Plan, public private partnerships will be included for the deployment of new electricity generation. (Trade Knowledge Network, 2013)

The Mozambique Government (Ministério da Energia) already launched a strategy (2011 – 2025) for the development of new and renewable energies, comprising – additionally to the further development of already dominant hydroelectric sources – in particular wind and solar energy. One major objective is the electrification, addressing on and off-grid measures (Ministério da Energia, 2011).

The GIZ Project Development Programme (PDP) Sub-Saharan Africa supports German renewable energy businesses in accessing the Mozambican markets, among others. The support is for business areas such as photovoltaic, hybrid systems or mini grids. It also assists the private sector in developing new business models (GIZ, 2012).

Most private companies in the renewable energy sector are based in Maputo and have several lines of business. Between 2008 and 2012, 21 biofuel projects were approved, mainly with jatropha, coconut and sugar cane. There are around 20 companies generally specializing in photovoltaic installations, small-scale hydro and biofuels. In recent years there has been some private interest in wind and solar thermal energy, too. Fosera Southern Africa Limitada, a private company, assembles pico solar photovoltaic systems. A factory has been constructed for the assembling of photovoltaic modules with a capacity of 5 MWp per year as a result of agreements between the Mozambican and the Indian governments. (Trade Knowledge Network, 2013)

Currently, there are no known residential PV installations in grid-connected areas or for large consumers, due to the low costs of electricity and the relatively reliable energy supply by the national grid. In case the Feed-in Tariff legislation is approved, the attractiveness of installing such systems is expected to strongly increase. Few established companies regularly sell or install solar water heaters. From most of the PV companies, the core business is not related to trading energy products in general or PV products in particular. Most of them import PV systems and products together with other retail hardware, and import it for own sale. The PV market is currently a tender market and equipment is only imported on demand or after the tender has been won. There are about 16 international companies registered as accredited engineering consultants with Fundo de Energia (FUNAE), mainly with head offices in Brazil or Portugal and local subsidiaries in Mozambique. Some of them also belong to the around 13 accredited contractors registered with FUNAE (GIZ, 2014).

According to estimations, the charcoal sector provides 214,000 full-time jobs, plus the ones in the commercial fuelwood value chain. Wood fuels are one of the few sources of jobs and income for many in rural areas. Green Resources intends to plant eucalyptus trees for industrial purposes, which is expected to create 10,000 jobs. The company will use a grant from the European Development Fund, to build two methane-free charcoal factories (Plas, et al., 2012).

2.4 Conclusion: Barriers, Trends and Patterns

Mozambique has a large potential for hydroelectric power. At the moment there is about 2,400 MW of hydropower installed and the potential for further 12,500 MW exists. There are several projects for hydropower plants in line and the next two projects could add 3,350 MW which would more than double the current capacity.

The major share of the electricity consumption is covered by hydropower, but only 20% of the population has access to the grid. Therefore the main challenges in the electricity sector for Mozambique are to ensure that affordable electricity is available to meet the domestic

demand. The grid needs to be extended with a focus on loss reduction and the avoidance of blackouts to avoid a negative impact on economic growth.

The government of Mozambique is committed to supporting decentralised electrification of social infrastructure (rural schools, clinics and administrative offices) and to increase access to modern energy services to villages and rural enterprises through PV systems, micro/pico-hydro schemes, modern biomass energy, and other renewable energy technologies (energypedia, 2014).

Beside its hydro resources the country has large oil and gas reserves. Therefore to invest in renewables will – more than in other African countries – be a political decision, in order to give the electrification in particularly rural areas high priority.

3 Education and Higher Education

3.1 Primary and Secondary Education

Mozambique’s education system consists of seven years of primary and five years of secondary schooling before students can enter university in the country or abroad. Primary education is compulsory and free, the official entry age is six years. Some primary schools operate in three shifts as the demand exceeds the number of available places. After successful completion of the primary school, pupils may continue with the secondary level or enrol in teacher training colleges, vocational schools or secondary education for adults. Secondary education consists of a three-year junior secondary and a two-year senior secondary stage (SACMEQ, 2014).

The enrolment ratio for primary, secondary and tertiary education is shown in Table 9.

Table 9: Gross Enrolment Ratio in the primary, secondary and tertiary education sector (Unesco Institute for Statistics, 2014)

	Primary Education	Secondary Education	Tertiary Education
Gross Enrolment Ratio	105% (2012)	26% (2012)	5% (2011)

3.2 Higher Education

3.2.1 Shape of higher education

There are 26⁴ higher education institutions (13 private and 13 public institutions) in Mozambique; most of these are located in Maputo (Kotecha, Wilsom-Strydom, & N Fongwa, 2012). Although there are a large number of private universities, the major share of higher education is provided at public universities. Eduardo Mondlane University (UEM), founded in 1975, is the largest and oldest of them and has an estimated student population of about 30,000 (Universidade Eduardo Mondlane, 2012). Universidade Pedagogica has been established in 1985 with a focus on teacher training and is now the country’s second largest university⁵. Further important public higher education institutions are the Instituto Superior de Relacoes Internacionais (ISRI), Universidade Lúrio in Nampula and the University of Zambezi in Beira (Kotecha, Wilsom-Strydom, & N Fongwa, 2012).

Some of the state and privately-owned universities and higher education institutions are listed in Table 10; data about the missing institutions was not available.

⁴ According to Cuamba, there should be more than 40 institutions in Mozambique (Cuamba, Personal Comment, 2014).

⁵ According to Cuamba, the Pedagogical University could have more students than Eduardo Mondlane University (Cuamba, Personal Comment, 2014).

Table 10: Universities in Mozambique (SARUA, 2012)

State universities and higher education institutions	Privately-owned, accredited universities or colleges
Eduardo Mondlane University	Catholic University of Mozambique
Pedagogical University	Saint Thomas University
Polytechnic University	Higher Institute of Science and Technology of Mozambique
Lúrio University	Higher Institute of Transport and Communications
Zambeze University	Technological University of Mozambique
Higher Institute of Health Science of Mozambique	Jean Peaget University of Mozambique
Higher Polytechnic Institute of Manica	Alberto Chipande Higher Institute of Science and Technology
Holy Family Pedagogical University	Mussa Bin Bique University
Higher Institute of International Relations (ISRI)	

At the public universities, it can be observed that the majority of enrolments listed in Table 11 are in education, followed by business, management and law. Among the major fields of study, agriculture has the lowest enrolment.

Table 11: Student enrolment by major field of study and level of study (SARUA, 2012)

	Undergraduate	Postgraduate < Masters	Masters	Doctoral
Agriculture	762	0	0	0
Business, management and law	10,734	0	25	0
Education	33,679	0	587	0
Health sciences	1,445	0	52	0
Humanities and social sciences	5,929	0	139	3
Science, engineering and technology	5,616	0	86	0
Other	296	0	0	0

Enrolment at the postgraduate level accounts for a very small proportion of the total enrolment in public universities in Mozambique. While there are more than 58,000 enrolments at undergraduate level, there are less than 1,000 students registered for

masters' degrees. Currently only three students pursue a doctoral study in Mozambique's higher education institutions.

3.2.2 Higher education policy

Article 114 of the legislation for higher education, which covers the directives for Mozambique's higher education policy, states that:

- "Access to public institutions of higher education shall guarantee equal and equitable opportunities and the democratisation of education, taking into account the requirements in terms of qualified staff and the raising of educational and scientific standards of the country.
- Public institutions of higher education shall be corporate persons governed by public law, and they shall have legal personality and enjoy scientific, teaching, financial and administrative autonomy, without prejudice to the appropriate evaluation of teaching standards, in accordance with the law.
- The state shall recognise and supervise private and co-operative education in accordance with the legislation." (Kotecha, Wilsom-Strydom, & N Fongwa, 2012)

The Ministry of Higher Education, Science and Technology (MHEST) is in charge of the higher education policy in Mozambique. As part of its decision-making process, the ministry is supported by two advisory bodies, the Higher Education Council and the National Council on Higher Education (Kotecha, Wilsom-Strydom, & N Fongwa, 2012).

3.2.3 Quality assurance

Mozambique has a national quality framework for higher education and the Department of Higher Education is implementing quality assurance procedures in order to enhance the quality of higher education. Some universities, e.g. the University of Zambeze, have internal quality assurance frameworks in place. These measures include internal evaluations to assess the quality of their work and their teaching staff as well as tracking of student performance (Kotecha, Wilsom-Strydom, & N Fongwa, 2012).

3.2.4 Higher education staff

Staff members at higher education institutions in Mozambique are almost exclusively national citizens, for example the share at Universidade Pedagogica is 97.8%. A high share of staff members are male, they also fill most of the management positions. Table 12 shows the qualification level of the staff at higher education institutions in Mozambique. More than 60% of the university staff has only an undergraduate level qualification and only about 12% have a doctoral degree (Kotecha, Wilsom-Strydom, & N Fongwa, 2012).

Table 12: Highest level of qualification for academic and research staff (SARUA, 2012)

	Undergraduate	Postgraduate < Masters	Masters	Doctoral
Agriculture	No data	No data	No data	No data
Business, management and law	103	0	55	15
Education	549	0	190	90
Health sciences	126	0	114	46
Humanities and social sciences	202	0	94	46
Science, engineering and technology	451	0	118	90
Other	28	0	5	7
Total	1459	0	576	294

3.2.5 Funding of higher education

In 2006 nearly 19% of national budget was allocated to education which is equal to five per cent of the GDP (Unesco Institute for Statistics, 2014). “In 2001, total education expenditure comprised 6.5% of gross domestic product and higher education expenditure only 0.8% of gross domestic product. However, since 2004, public spending on higher education increased dramatically, growing by 23% between 2004 and 2005 and 6% the following year. Spending on higher education now constitutes between 64% and 70% of the total education budget. Given that Mozambique is one of the poorest countries in the world, this is a shocking statistic in terms of its implications for access to primary and secondary education” (Pillay, 2008).

3.3 Renewable Energy Higher Education

Mozambique aims to increase its capacity to further develop the use of internal energy sources and to develop expertise in renewable energy at government institutions. Both university education and vocational training schemes are part of these efforts.

At Eduardo Mondlane University, a PhD programme in Energy Science and Technology has been established which focuses on renewable energy. Furthermore, there are renewable energy courses included in graduate-level curricula in both the Faculty of Science and the Faculty of Engineering (IRENA, 2012). Currently, a Renewable Energy Master programme is under development. It is designed for an intake of 15 to 20 students per year and will have a technical as well as a non-technical track. The programme intends to cooperate with other universities in the region, particularly with Mekelle University (Ethiopia), the University of Dar es Salaam (Tanzania), Makerere University (Uganda) and the University of Malawi (Cuamba, Personal Interview, 2014).

With support from the Swedish International Development Cooperation (SIDA), the Solar Energy Research Programme has been implemented at the Department of Physics in the Faculty of Sciences at Eduardo Mondlane University in 1991. The programme activities include testing and optimisation of solar energy systems, the development of capabilities for local manufacturing in the solar sector as well as studies on solar resources and energy policy (INFORSE, 1999). One example for research at Eduardo Mondlane University is an assessment of solar energy resources in Mozambique (Cuamba, et al., 2006).

3.4 Conclusion and Recommendation

The private higher education institutions have a main impact in the higher education sector in Mozambique. Private higher education was only officially permitted in 1993, since then 13 public universities and other higher education institutions have been founded.

Currently, less than two per cent of all students enrolled in public universities attend master courses and only three students are pursuing doctoral studies.

Within two five-year strategic plans from 1999 to 2009, the government of Mozambique intended to increase access to education in general and especially to tertiary education. The quality of education was addressed as well. But there is still a lack of qualified personnel for the education of students in tertiary institutions.

Like almost all African universities also Mozambique needs long-term and close cooperation with experienced universities in the field of renewable energy. In the case of Mozambique the language is particularly important. Therefore, in addition to regional cooperation with the neighbouring countries, international cooperation with Portuguese and/or Brazilian Universities is highly recommended. Potential cooperation partners with strong research background in Renewable Energy are the Instituto Superior Técnico (IST) in Lisbon focussing on science and engineering or the Grupo de Estudos do Setor Elétrico (GESEL) at the Federal University of Rio de Janeiro (UFRJ) with a focus on energy policy and economics. A good entry point for the RECP would be financial and personnel support for the new Master programme at Eduardo Mondlane University.

4 References

- CIA. (2014). *Country Comparison: Distribution of family income - GINI Index*. Retrieved August 06, 2014, from <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2172rank.html>
- CIA. (2014a). *Mozambique overview CIA World Fact Book*. Retrieved August 04, 2014, from <https://www.cia.gov/library/publications/the-world-factbook/geos/mz.html>
- Cuamba, B. C. (2014). Personal Comment.
- Cuamba, B. C. (2014, June 17). Personal Interview.
- Cuamba, B. C., Chenene, M. L., Mahumane, G., Quissico, D. Z., Lovseth, J., & O'Keefe, P. (2006, November). A solar energy resources assessment in Mozambique. *Journal of Energy in Southern Africa*, 17(4). Retrieved from <http://www.erc.uct.ac.za/jesa/volume17/17-4jesa-cuamba.pdf>
- Dominguez-Torres, C., & Briceño-Garmendia, C. (2011, November). *Mozambique's Infrastructure: A Continental Perspective*. Retrieved August 07, 2014, from <http://elibrary.worldbank.org/doi/book/10.1596/1813-9450-5885>
- EIA. (2014). *US Energy Information Administration: International Energy Statistics*. Retrieved August 09, 2014, from <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=2&pid=2&aid=7&cid=WA,&syid=2001&eyid=2011&unit=MK>
- energypedia. (2014, June 10). *Mozambique Energy Situation*. Retrieved September 10, 2014, from https://energypedia.info/wiki/Mozambique_Energy_Situation
- GIZ. (2012). *Tapping into new markets: Project Development Programme (PDP) Sub-Saharan Africa*. Retrieved April 24, 2015, from <https://www.giz.de/en/worldwide/14915.html>
- GIZ. (2014, March). *Subsector Analysis - Solar Business in Mozambique*. Retrieved April 24, 2015, from <https://www.giz.de/fachexpertise/downloads/giz2014-en-project-development-programme-subsector-analysis-PV-mozambique.pdf>
- IEA. (2012). *World Energy Outlook 2012*. Retrieved from <http://www.worldenergyoutlook.org/publications/weo-2012/>
- INFORSE. (1999). *Sustainable Energy News No. 24*. Retrieved February 1, 2015, from <http://collections.infocollections.org/ukedu/en/d/Jh2107e/4.3.html>
- Internet World Stats. (2013, December). *Africa*. Retrieved April 30, 2015, from <http://www.internetworldstats.com/africa.htm>
- IRENA. (2012). *Country Case Study - Renewables Readiness Assessment*.
- IRENA. (2013). *Renewable Energy Country Profile Mozambique*. Retrieved September 09, 2014, from <http://www.irena.org/REmaps/countryprofiles/africa/Mozambique.pdf#zoom=75>

- Kotecha, P., Wilsom-Strydom, M., & N Fongwa, S. (2012). *A Profile of Higher Education in Southern Africa - Volume 2: National Perspective*. Retrieved August 20, 2014, from <http://www.sarua.org/files/publications/SARUA%20leadership%20Dialogue%20Series/SARUA%20Profiles%20of%20HE%20Vol%202.pdf>
- Ministério da Energia. (2011). *A Estratégia de Desenvolvimento de Energias Novas e Renováveis (EDENR)*. Retrieved from http://www.adelsofala.org.mz/data/documents/Estrategias-de-Desenvolvimento-de-Energias-Novas-e-Renovaveis-Ministerio-da-Energia_1.pdf
- Pillay, P. (2008). *Higher Education Funding Frameworks in SADC*. Retrieved from http://www.sarua.org/files/publications/TACF/Chapter3_full.pdf
- Plas, R. J., Sepp, S., Pigaht, M., Malalane, A., Mann, S., & Madon, G. (2012, December). *Mozambique Biomass Energy*. Retrieved April 25, 2015, from http://www.euei-pdf.org/sites/default/files/files/field_pblctn_file/EUEI%20PDF_Mozambique_BEST_Final%20Report_Dec2012.pdf
- Reegle. (2014). *Energy Profile Mozambique*. Retrieved September 09, 2014, from http://www.reegle.info/countries/mozambique-energy-profile/MZ#role_government
- SACMEQ, T. S. (2014). *Education Fact Sheet - Mozambique*. Retrieved September 03, 2014, from <http://www.sacmeq.org/sacmeq-members/mozambique/education-fact-sheet>
- SARUA. (2012). *Mozambique Data profile 2012*. Retrieved September 03, 2014, from <http://www.sarua.org/files/Country%20Reports%202012/Mozambique%20data%20profile%20Eng.pdf>
- Trade Knowledge Network. (2013, January). *Investment Incentives for Renewable Energy in Southern Africa: The case of Mozambique*. Retrieved April 24, 2015, from http://www.iisd.org/pdf/2013/investment_%20incentives_%20mozambique.pdf
- Transparency International. (2013). *Corruption perception index 2013*. Retrieved August 05, 2014, from <http://cpi.transparency.org/cpi2013/results/>
- UNDP. (2014). *Human Development Report*. Retrieved April 28, 2015, from <http://hdr.undp.org/sites/default/files/hdr14-report-en-1.pdf>
- Unesco Institute for Statistics. (2014). *Country Profiles - Mozambique*. Retrieved September 03, 2014, from <http://www.uis.unesco.org/DataCentre/Pages/country-profile.aspx?code=MOZ®ioncode=40540>
- UNIDO; ICSHP . (2013). *World Small Hydropower Development Report - Mozambique*. Retrieved from http://www.smallhydroworld.org/fileadmin/user_upload/pdf/Africa_Eastern/WSHPDR_2013_Mozambique.pdf
- Universidade Eduardo Mondlane. (2012). *UEM em números - 2012*. Retrieved October 30, 2014, from <http://www.uem.mz/index.php/sobre-a-uem/uem-em-numeros>

- Wikipedia. (2014). *Mozambique article*. Retrieved August 07, 2014, from <http://en.wikipedia.org/wiki/Mozambique>
- World Bank. (2013). *SE4all Global Tracking Framework*. Retrieved April 26, 2015, from Tracking Report: <http://www.unep.org/pdf/778890GTF0full0report.pdf>
- World Bank. (2014). *Mozambique World Bank Country Overview*. Retrieved August 07, 2014, from <http://www.worldbank.org/en/country/mozambique/overview>
- World Bank. (2014a). *World Bank Database*. Retrieved August 04, 2014, from databank.worldbank.org
- World Health Organization. (2014). *Global Health Observatory Data Repository, Mozambique statistics summary*. Retrieved August 07, 2014, from <http://apps.who.int/gho/data/node.country.country-MOZ>