ALER Associação Lusófona de Energias Renováveis

ANALYSIS OF INTERNATIONAL STATISTICAL DATA ON ACCESS TO ENERGY AND RENEWABLE ENERGY IN LUSOPHONE COUNTRIES

SUMMARY TABLE

	AO	BR	CV	EG	GB	MZ	PT	STP	TL	source
Electrification rate	32%	99,7%	90,2%	67,6%	17,2%	21,2%	100%	68,6%	45,4%	GTF
nº of people without access to electricity (Millions)	16	0,8	0,2	0,3	1	16	0	0,1		REN21
Access to clean cooking fuel and technologies	47,7%	93,1%	70,9%	21,5%	3,0%	4,4%	100,0%	30,4%	3,6%	GTF
nº of people relying on traditional biomass (Millions)	13	9,6	0,2	0,4	2	26	0	0,1		REN21
share of RES in TFEC	50,8%	41,8%	26,2%	6,4%	87,1%	88,9%	30,5%	41,6%	19,0%	GTF
RES consumption in electricity	53,2%	73,1%	17,3%	44,9%	0,0%	91,2%	60,7%	10,5%	0,0%	GTF
RES consumption in transport	0,0%	17,6%	0,0%	0,0%	0,0%	0,0%	4,8%	0,0%	0,0%	GTF
RES consumption in heating	69,1%	50,4%	73,1%	6,2%	91,8%	96,3%	34,6%	58,6%	31,9%	GTF
Hydro installed capacity (MW)	921	98 009	0	127	0	2 187	6 168	2	0,3	IRENA
Wind installed capacity (MW)	0	10 740	26	0	0	0	5 303	0	0	IRENA
Solar installed capacity (MW)	13	23	14	0	0,3	13	460	0,1	0	IRENA
Biomass installed capacity (MW)	30	14178,7	0	0	0	14	673,5	0	0	IRENA
Total RES electricity generation (GWh)	5 067	430 490	155	127	0,4	16 290	24 372	7	2	IRENA
Score of regulatory Indicators for Energy Access	48,3	100				38,16				RISE
Score of regulatory Indicators for Renewable Energy	17,43	66,86				31,29				RISE

AO – Angola | BR – Brazil | CV – Cape Verde | EG – Equatorial Guinea | GB – Guinea-Bissau | MZ – Mozambique | PT – Portugal | STP – São Tomé and Príncipe | TL – East Timor | PALOP – African Portuguese-speaking Countries
GTF – Global Tracking Framework 2017 | AAER – Atlas of Africa Energy Resources | REN21 - Renewables Global Futures Report 2017 | IRENA – IRENA RESource database

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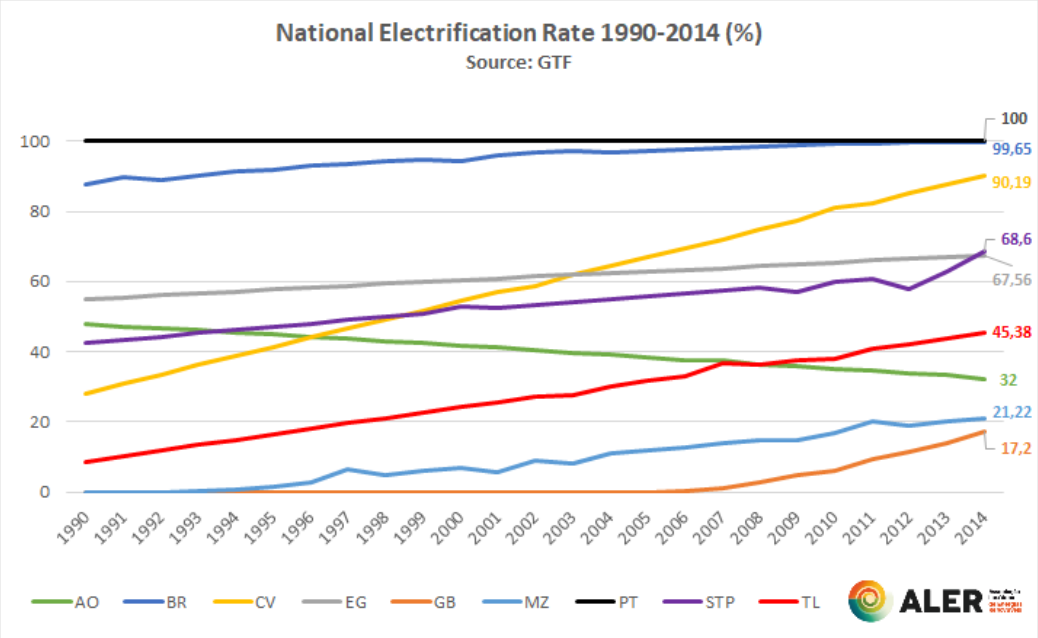
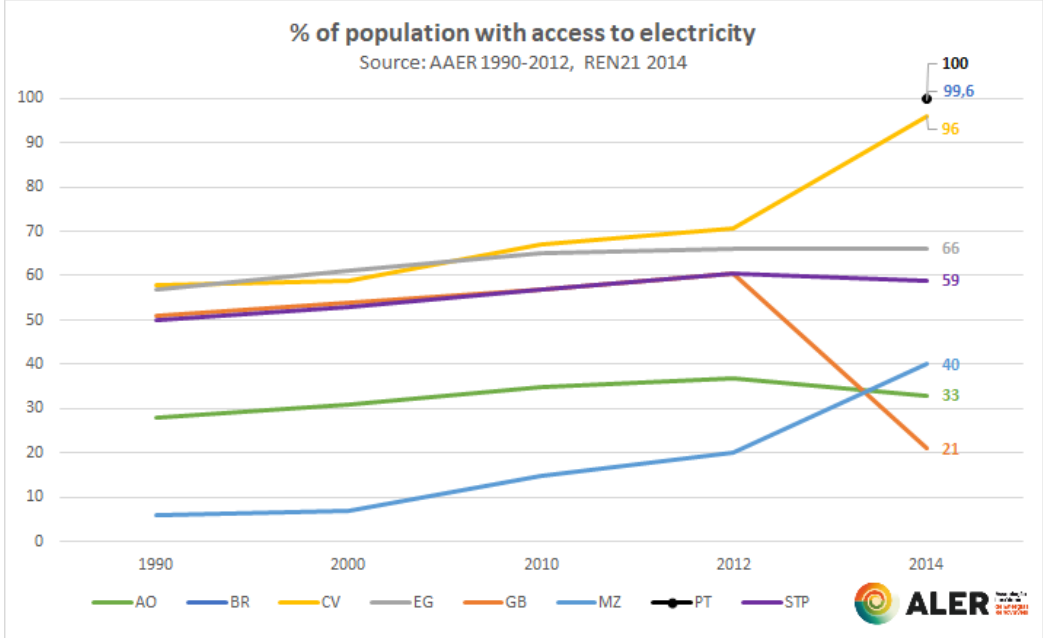
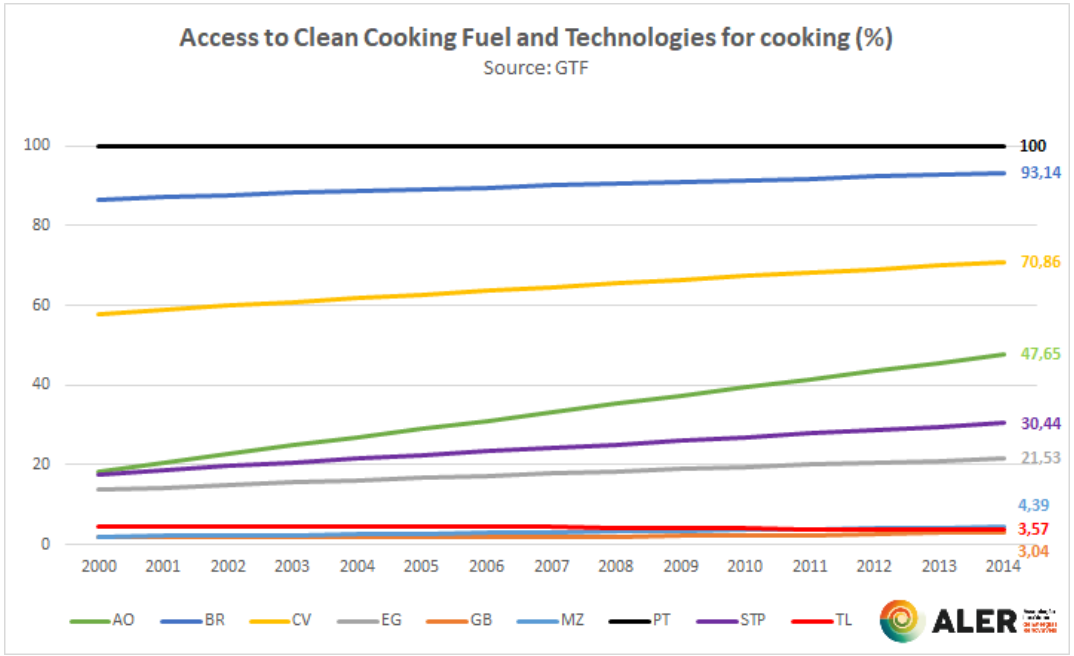
ENERGY ACCESS: ELECTRIFICATION RATE

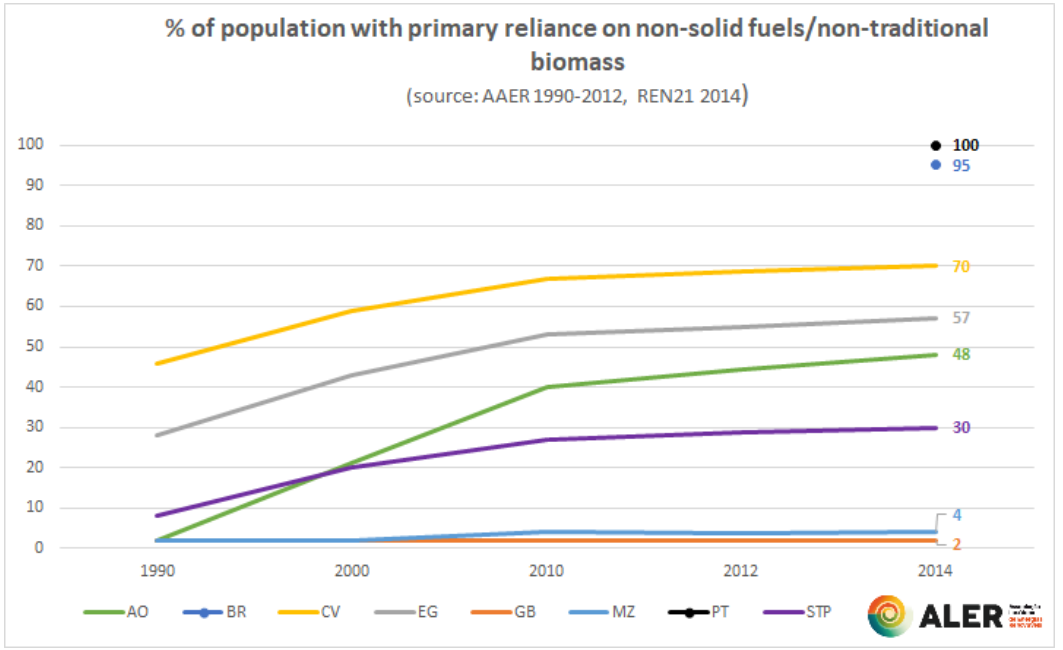




- Only Portugal guarantees universal electricity access to its population. Brazil is very close to this target with 99,65%, but the remaining percentage still corresponds to 0,8 million citizens;
- Among African countries, Cape Verde is the one with the highest electrification rate (90% or 96% according to sources) and Guinea Bissau with the lowest (17.2% or 21%);
- Mozambique and Angola join Guinea-Bissau in the list of Portuguese-speaking African countries with electrification rates below African average, which is 45%;
- In terms of population, Angola and Mozambique are the countries with the higher number of citizens without electricity access; 16 million in each. In total, and apart from East Timor for which there is no data available, there are 34.4 million Portuguese-speaking citizens without access to electricity;
- Cape Verde is the country with the highest positive evolution of the electrification rate since 1990, followed by East Timor. Guinea-Bissau has also seen considerable progress since 2007, and São Tomé and Príncipe since 2012. Angola is the only country whose electrification rate has consistently declined over time, from 48% in 1990 to 32% in 2014;
- The figures presented vary considerably according to different sources. Mozambique shows the greatest disparity, with a difference of 19 percentage points regarding 2014 values. This difference can also be related to different methodologies, as some consider only on-grid electrification and others add off-grid electrification. This situation reflects the absence of official national statistics and the lack of consensus on the definition of electrification rate.

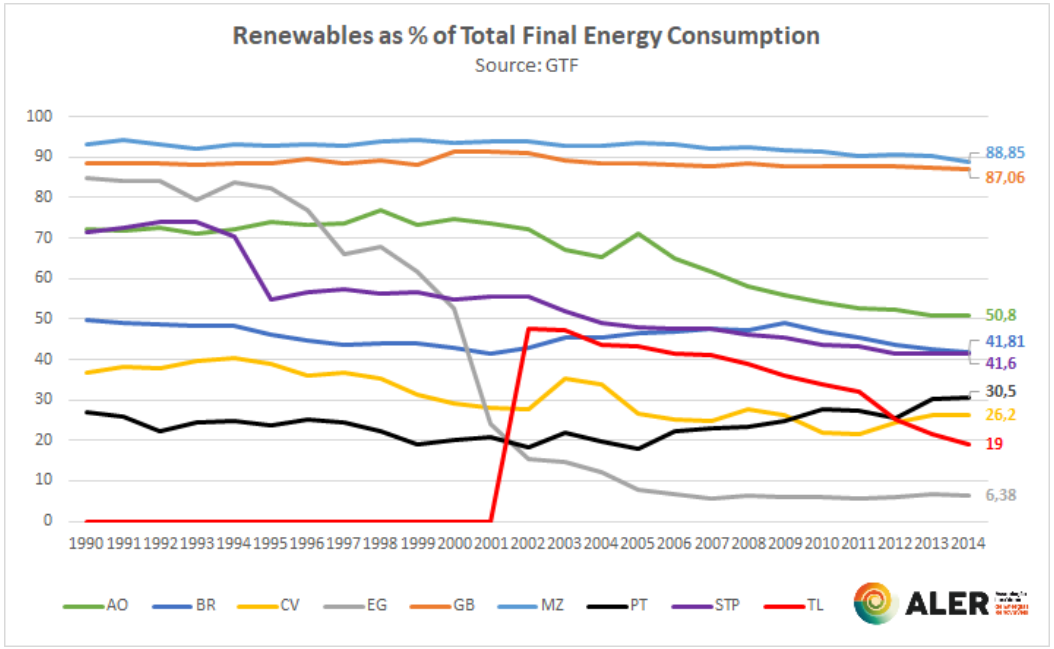
ENERGY ACCESS: RELIANCE ON TRADITIONAL BIOMASS

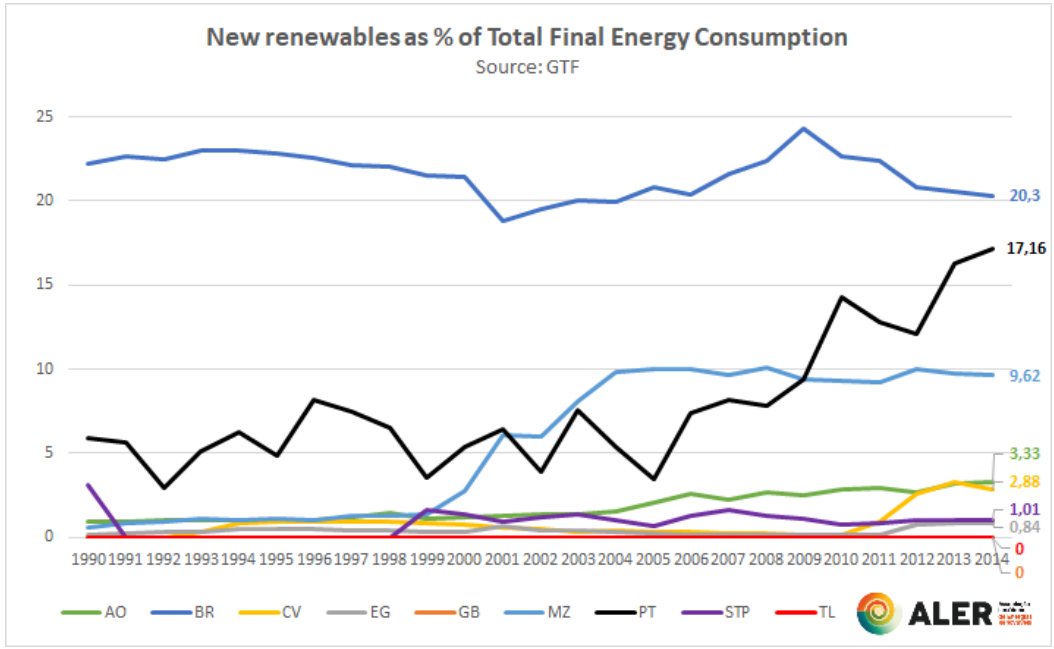




- Portugal is the only Lusophone country in which the entire population has access to clean and modern fuels and technologies for cooking, followed by Brazil (between 93% and 95%);
- Among the Portuguese-speaking African countries, Cape Verde is again the country with the best situation (between 70% and 71%) and Guinea-Bissau is the country with the least encouraging scenario (between 3% and 4%), followed closely by Mozambique (4%). These values are also related to the percentage of rural population where the use of traditional biomass abounds;
- Mozambique, Sao Tome and Principe and Equatorial Guinea (according to one of the sources) join Guinea-Bissau in the list of African Lusophone countries with a percentage of access to clean fuels and cooking technologies below the continent's average, which is 31%. East Timor is also far below the Asian developing countries average of 50%. This situation reinforces the need to work on programs to promote improved cookstoves and sustainable fuel production to limit the environmental impacts of deforestation and soil erosion;
- Mozambique is the country with the highest population dependent on traditional biomass and solid fuels (26 million), followed by Angola (13 million) and Brazil (9.6 million). In total, there are 51.3 million Lusophone citizens dependent on traditional biomass;
- Angola is the country with the best evolution, followed by Cape Verde, São Tomé and Príncipe and Equatorial Guinea. In Guinea-Bissau and Mozambique the situation has remained virtually unchanged over time and in East Timor it has worsened;
- For this indicator values are already more similar between sources, with the exception of Equatorial Guinea where there is a difference of 35 percentage points, which totally changes the picture in this country.

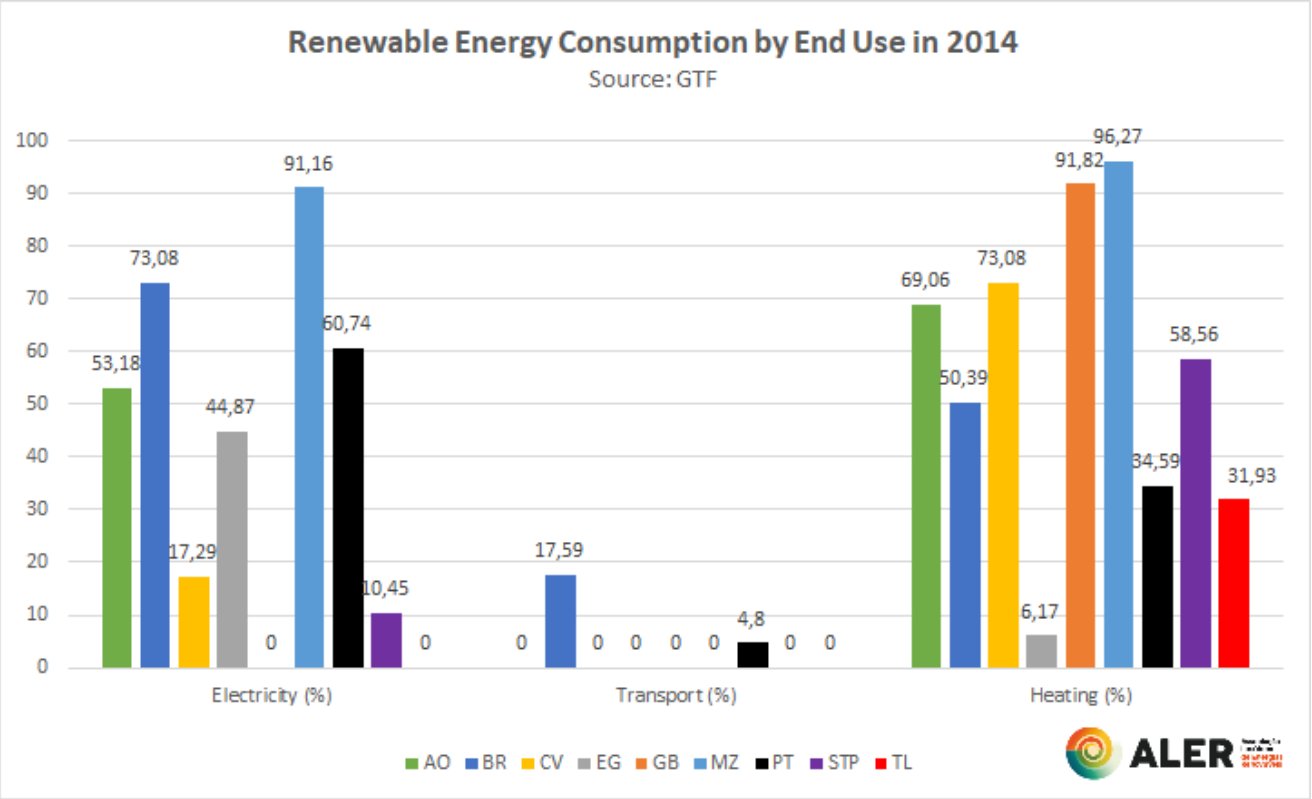
RENEWABLE ENERGY CONSUMPTION IN FINAL ENERGY





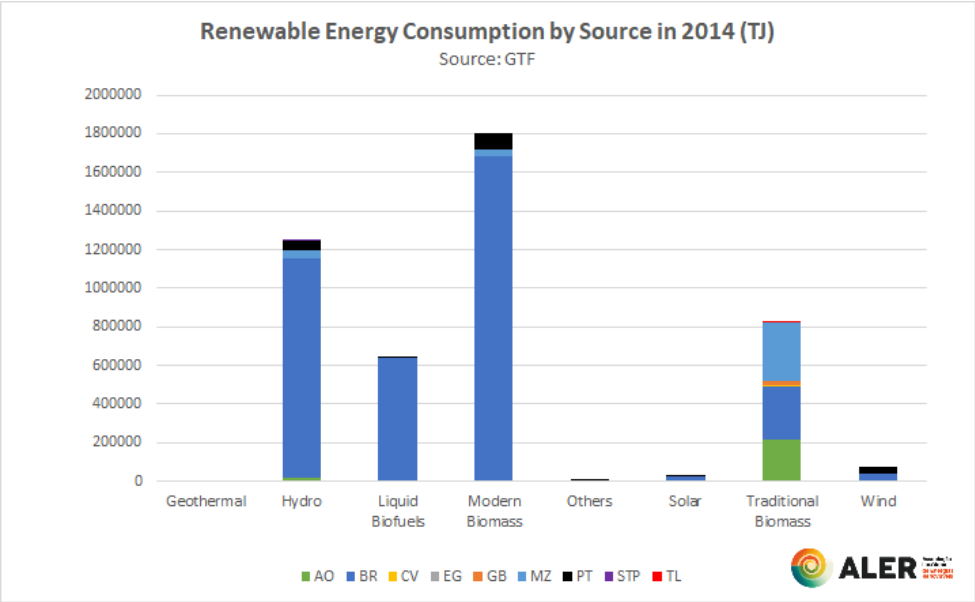
- Since the beginning of the 1990s, Mozambique has been the Lusophone country with the highest percentage of renewable energies in final energy consumption (88.85%), followed by Guinea-Bissau (87.06%). Given that final energy consumption includes all forms of energy and not just electricity, and given the dependency on traditional biomass in both countries, this can be one of the main reasons. The only other Lusophone country with more than half of the final energy consumption from renewable sources is Angola. Brazil and São Tomé and Príncipe have similar values around 42%, followed by Portugal with 31%, Cape Verde with 26%, East Timor with 19% and finally Equatorial Guinea with only 6%;
- Looking into the evolution over time, only Portugal managed to increase the share of renewables in final energy consumption since 1990 (East Timor too, but only because this contribution has only started since 2002, but has been declining since then). The most significant falls were in Angola, São Tomé and Príncipe and East Timor. These declines do not necessarily mean a decrease in the consumption of renewable energy but that the country has not been able to keep pace with the evolution of total final energy consumption;
- However, if we consider only the new renewable energies, i.e., excluding traditional biomass, Brazil takes the lead with 20.3%, followed by Portugal with 17.16%. Of the other countries, only Mozambique has a relevant percentage of 9.62%, followed by Angola (3.33%), Cape Verde (2.88%) and Sao Tome and Principe (1.01%);
- While Brazil has maintained a relatively constant share of new renewable energies consumption (excluding a drop in 2001 and a peak in 2009), Portugal, Mozambique (since 2000) and Cape Verde (since 2011) have seen exponential growth. It should be noted that the great interannual variability in Portugal is related to the hydrological regime, given the great weight of hydro energy in the final energy mix.

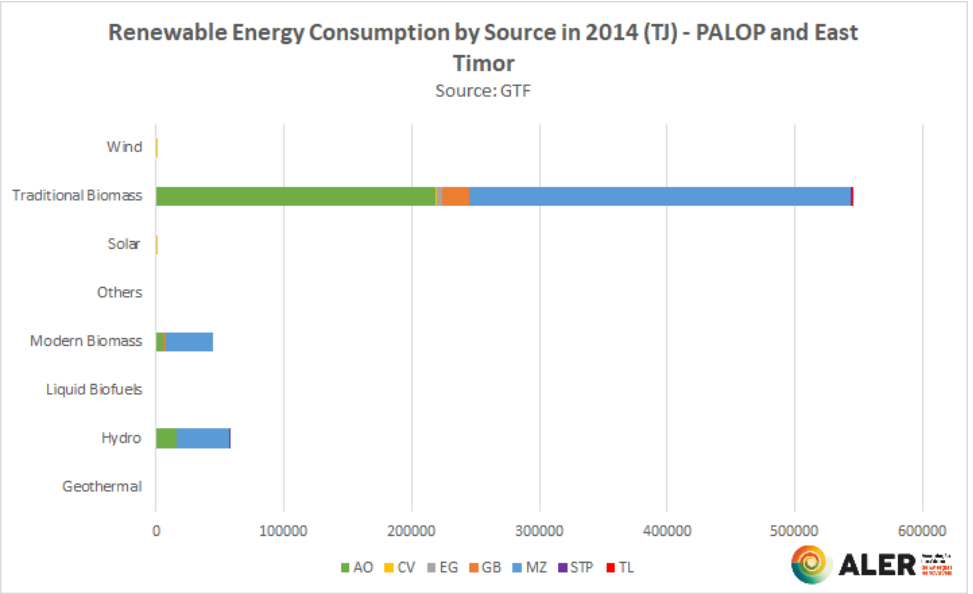
RENEWABLE ENERGY CONSUMPTION IN FINAL ENERGY (CONT.)



- In terms of the type of use, in all African countries (except Equatorial Guinea) and East Timor, the highest percentage of use of renewable energy is for heating (which corresponds to heating for cooking and not room heating) due to the Influence of use of traditional biomass;
- On the other hand in Portugal, in Brazil and curiously also in Equatorial Guinea, the highest percentage of renewables is in electricity;
- Portugal and Brazil are the only countries with a contribution of renewables to the transport sector, especially Brazil thanks to biofuels;
- Mozambique is the country with the highest share of renewables in both electricity and heating, both above 90%.

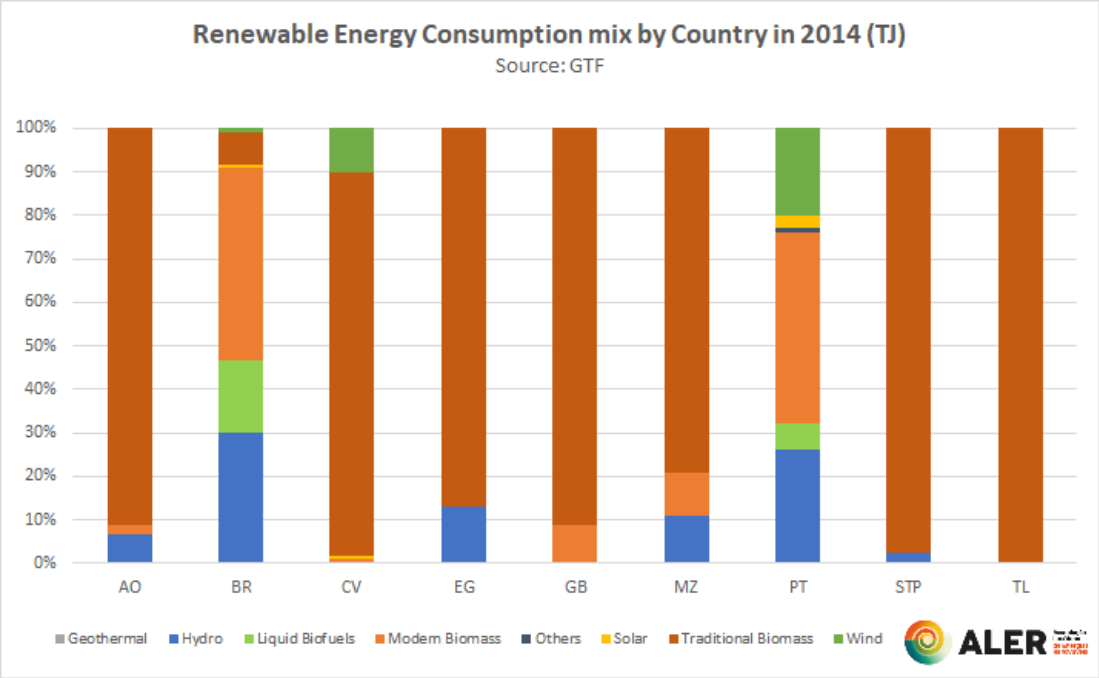
RENEWABLE ENERGY CONSUMPTION IN FINAL ENERGY (CONT.)





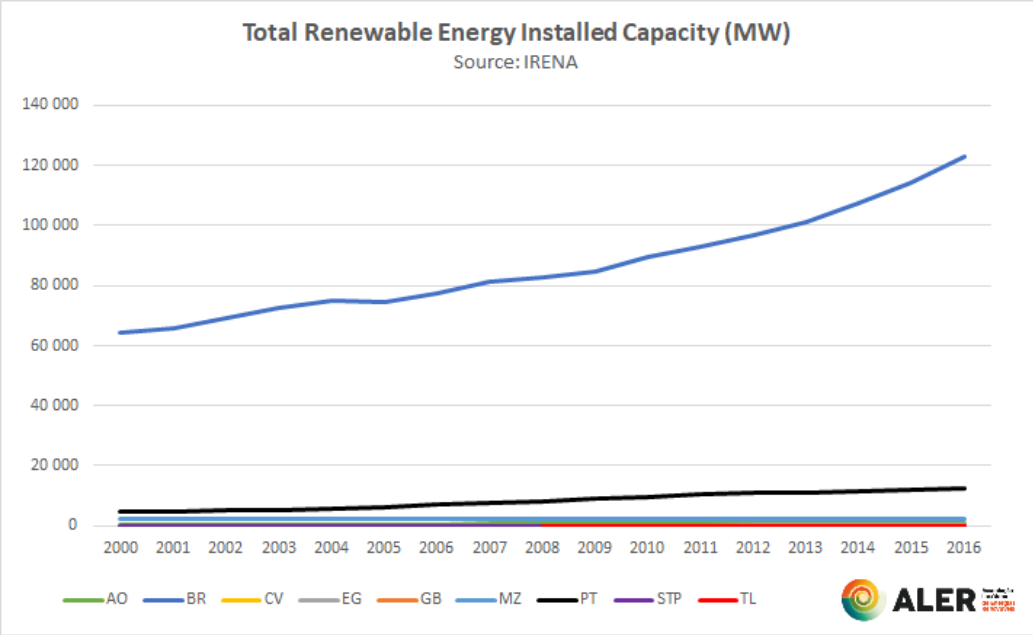
- Technology wise, if we add up the renewable energy consumption of all Portuguese-speaking countries, the one that most contributes to the final energy consumption is modern biomass, followed by hydro, traditional biomass and biofuels. Due to its size and high use of renewables, namely hydro, biofuels and modern biomass, Brazil has a huge influence on this analysis;
- If we focus only on African countries and East Timor, traditional biomass has a prominent place and is consumed in all these countries. Afterwards comes hydro, with contributions from Angola, Mozambique, and Equatorial Guinea and São Tomé and Príncipe in a much smaller scale. Finally, the other major source is modern biomass, consumed in Angola, Guinea-Bissau and especially in Mozambique, and on a small scale in Cape Verde as well. Wind power is only present in Cape Verde and solar, although it is the most abundant resource, still has no expression, being only consumed in Cape Verde according to this data. Overall, Angola and Mozambique are the main contributors to these consumptions, which is explained by the size of these countries in comparison with the others.

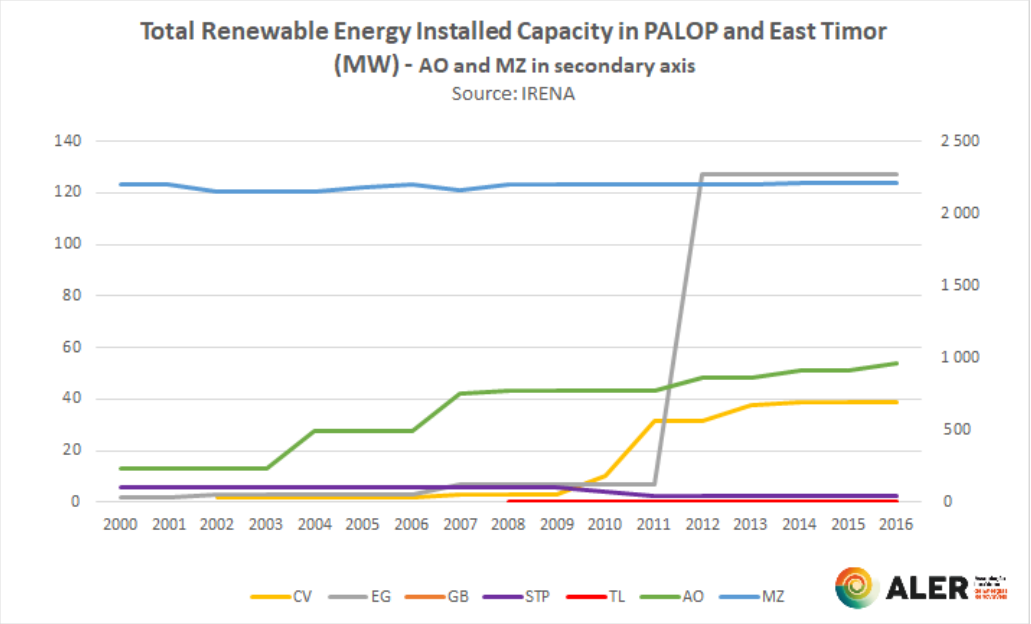
RENEWABLE ENERGY CONSUMPTION IN FINAL ENERGY (CONT.)



- Looking into the mix of renewable energy in final energy consumption for each country, once again we see that traditional biomass corresponds to most all renewable energy consumption in all of them except Brazil and Portugal. Wind has a greater weight in Portugal, followed by Cape Verde and Brazil. Solar energy also has expression only in these same countries, with lower quotas. This differences reflect the extent of which countries consume more or less electricity.

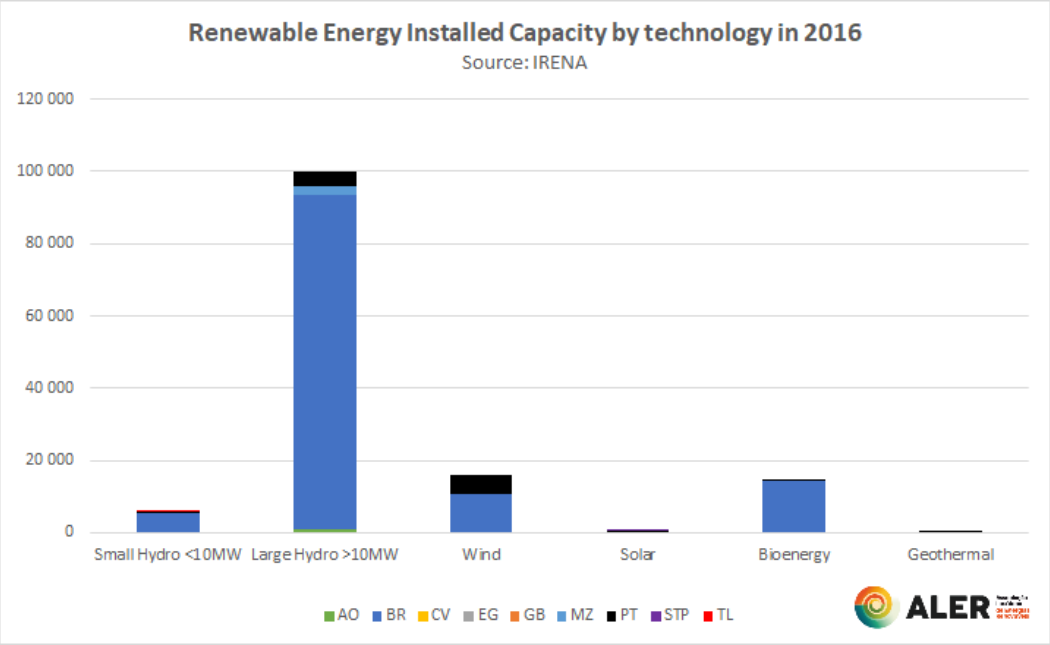
RENEWABLE ENERGY INSTALLED CAPACITY FOR ELECTRICITY GENERATION

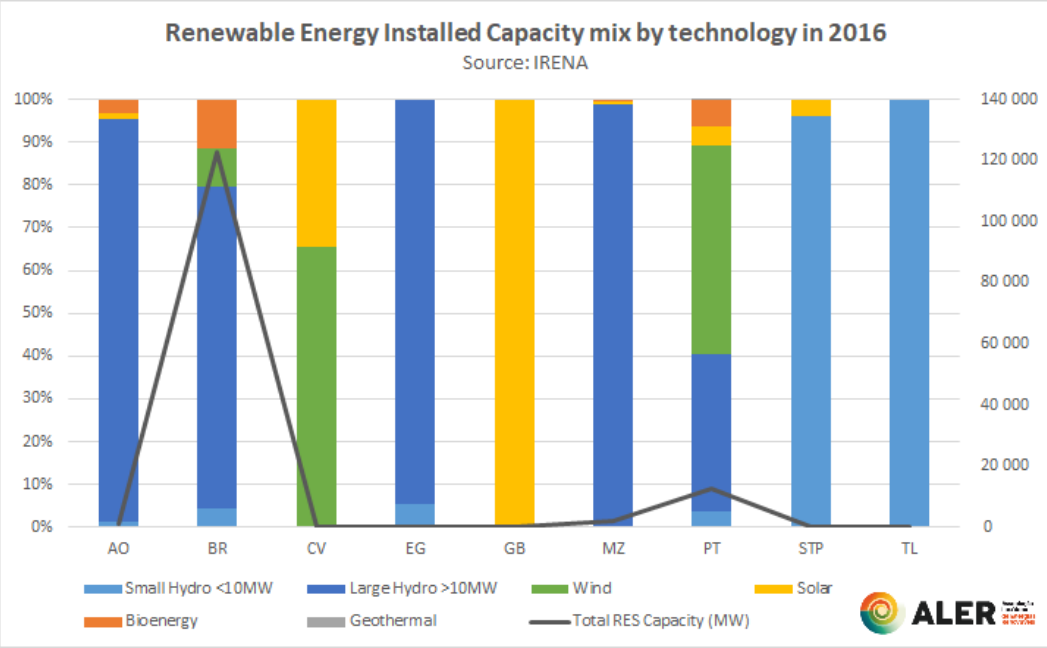




- Brazil is by far the country with the highest installed capacity, due to its size. Total capacity has been increasing at a steady and considerable pace since 2000. Portugal is the next country with the largest renewable installed capacity, which is more relevant given its small size;
- Analysing the same chart without the influence of the two countries mentioned above, the two largest African countries, i.e. Angola and Mozambique, whose data are to be read on the secondary axis to the right of the chart, are the ones that follow. While Mozambique's capacity has remained relatively stable, in Angola the leaps regarding the operation of new power plants are more visible. Among the remaining countries Equatorial Guinea is the one which has more renewable energy installed capacity, a reality effective only since 2012. Cape Verde is next with an increase since 2010. São Tomé and Príncipe has seen its already diminutive renewable energy installed capacity fall from 2010. The remaining countries do not have relevant renewable energy installed capacity.

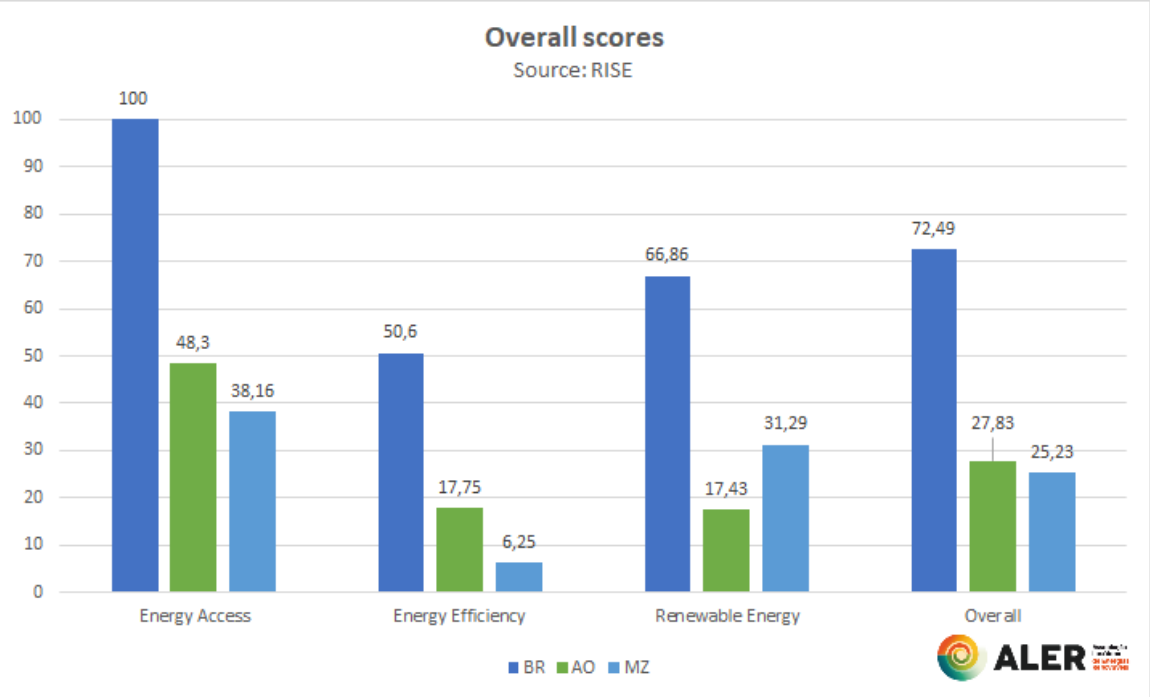
RENEWABLE ENERGY INSTALLED CAPACITY FOR ELECTRICITY GENERATION (CONT)





- In a cumulative analysis by technology, large hydro is the main contributor, followed by wind, small hydro, solar and finally geothermal energy that is only used in Portugal;
- Looking at the weight of each technology in each country mix, we verify that hydro, whether large or small, makes up most of the renewable installed capacity in Angola, Brazil, Guinea-Bissau, Mozambique, Sao Tome and Principe and East Timor. Wind is significant in Brazil, Portugal and Cape Verde, where, despite the installed capacity following this order for the three countries with Brazil reaching an impressive 10.7 GW, the weight in the mix follows the reverse order. In terms of solar, not only it is important to highlight the case of Portugal that has by far the largest installed capacity, but also the case of Cape Verde, which despite its size has more solar installed capacity than Angola and only less 9 MW than Brazil according to the data available in IRENA. Biomass resources are only used to produce electricity in Angola, Brazil, Mozambique and Portugal. In terms of the general mix, Portugal has the most diversified and Cape Verde stands out because it only has the so called “intermittent renewables” more difficult to manage, aggravated by the fact that they are distributed in isolated and small island electricity systems. For this reason, Cape Verde is an excellent example that proves that it is possible to integrate this type of renewables without problem, even in small electricity systems.

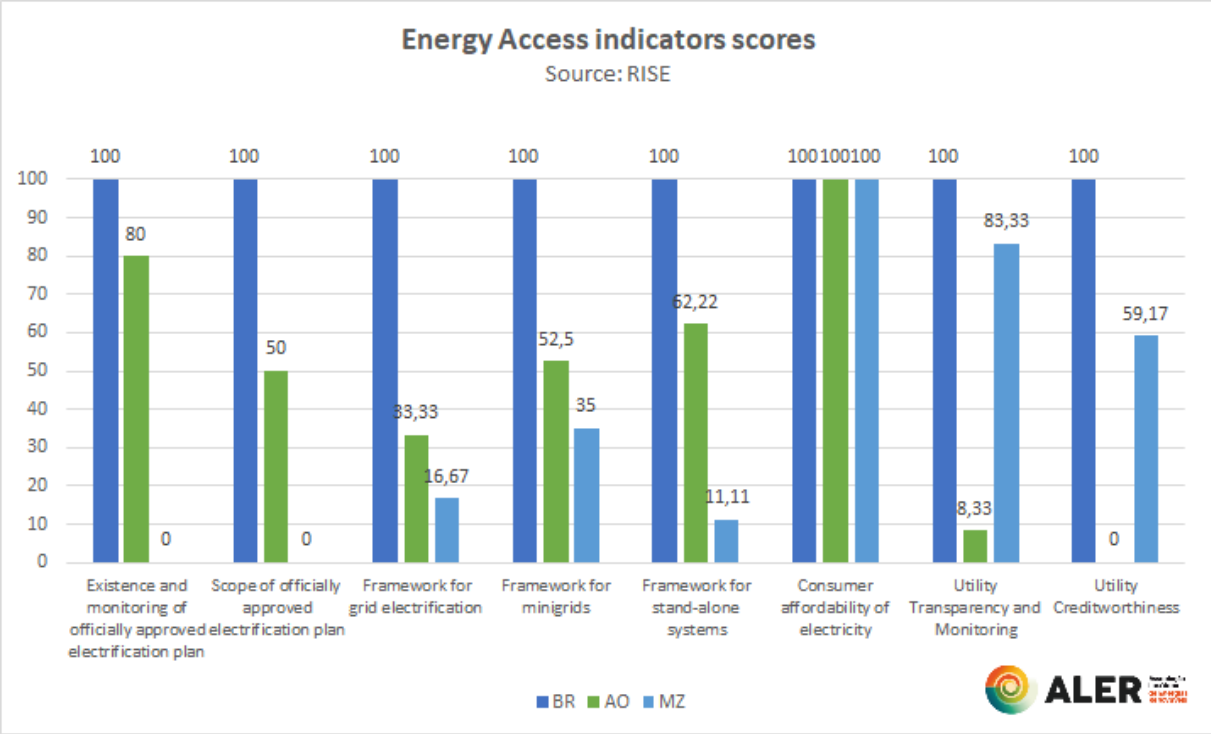
INDICATORS FOR INVESTMENT



- RISE only presents data for three of the nine Portuguese-speaking countries: Brazil, Angola and Mozambique;
- For the overall indicators, Brazil has scores always above 50, receiving the maximum score for energy access. Its lowest score is for energy efficiency, which is common for the other two countries. The scores for Angola and Mozambique are very low and far below the regional average for Sub-Saharan African countries. In the case of Angola, the lowest score is for the renewable energy indicator. This reality is not very favourable for the development of these markets and attraction of foreign investment, so there is still a lot of work to be done that falls within ALER's scope of action.

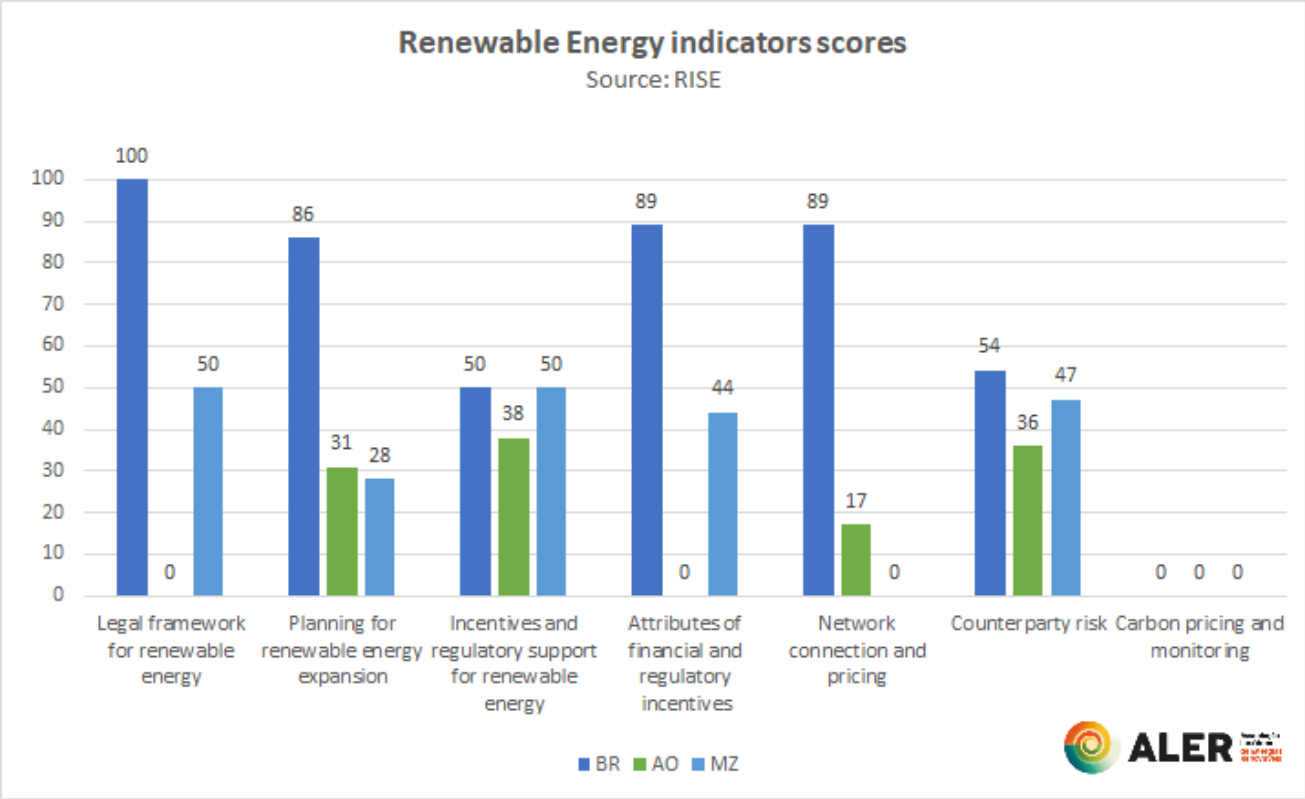
[i] **RISE- Regulatory Indicators for Sustainable Energy (2016)**

INDICATORS FOR INVESTMENT (CONT.)



- Analysing energy access indicators in detail, Brazil receives a maximum score in all of them. Angola and Mozambique, on the other hand, only reach this score curiously for the consumer affordability of electricity, which is probably due to the fact that tariffs are highly subsidized in both countries, even though they do not cover production costs. Angola compares best regarding the existence and scope of policies and frameworks, an area in which Mozambique scores very low or even zero. However, Mozambique receives higher scores in the evaluation of the utility, unlike Angola.

INDICATORS FOR INVESTMENT (CONT.)



- For renewable energy indicators, Brazil maintains high scores, except for counterparty risk and carbon pricing and monitoring. In this last indicator, all the Portuguese-speaking countries analysed receive the minimum grade. Angola is consistently below Mozambique, except for network connection and pricing, which receives zero score in Mozambique. This is also the indicator in which both countries score worse, followed by the one of planning for renewable energy expansion. It is shown that Angola receives a zero score regarding the legal framework for renewable energy and the attributes of financial and regulatory incentives, components considered essential for the participation of the private sector that in this context is difficult to develop.