



REPOBLIKAN'I MADAGASIKARA
Fitiavana - Tanindrazana - Fandrosoana

MADAGASCAR

MINISTERE DE L'ENERGIE

*Expression of Interest to participate in the
Scaling Up Renewable Energy In Low Income Countries Program (SREP)*



M. IBRAHIM ABDALLAH, GENERAL DIRECTOR, TEL. +261 34 83 410 13,
MAIL : dg20energie@gmail.com

II. DESCRIPTION OF THE COUNTRY AND ENERGY SECTOR CONTEXT

General description and context

Madagascar is the fourth largest island in the world by its area; it is located in the Indian Ocean, 400 km to the eastern african coast (Tanzania and Mozambique). The table below provides an overview of the country characteristics with some key socio-economic and environment indicators:

Table 1: Key Country Indicators

Time zone	GMT+3
Area	587 295 km ²
Capital	Antananarivo
Administrative Division	22 regions, 119 districts, 1579 towns and 17,485 Fokontany
Official languages	Malagasy, French, English
Currency	Ariary (Ar). In March 2014, 1 USD = 2,340.44 Ar and 1 EURO = 3 214.21Ar (Central Bank of Madagascar)
Climate	Madagascar is localized in the tropical zone with two main seasons: - Wet and hot season, from November to April - Cold and dry season from May to October.
Population	22,005,222 inhabitants (2012), over 80% live in rural areas and 92% live below the poverty line
Density	37.46 inhab/km ²
Population growth	2.9% (World Bank, 2012)
Life expectancy	64 years (World Bank, 2012)
GDP per capita (USD)	486 (2011)
Gross national income (GNI) per capita	US\$ 430 (World Bank, 2012) ¹
Human Development Index	151 on 186 countries in 2012
Growth rate (%)	2.8 (2013)
Inflation rate (%)	5.8 (2013)
Economical activities	Agriculture and Livestock

Madagascar is one of the poorest countries in the world, with a majority of the population living below the poverty line. Though the country faced some difficult years recently, a new

¹ <http://data.worldbank.org/indicator/NY.GNP.PCAP.CD> - For comparison purposes, the average 2012 GNI for Sub-Saharan Africa was US\$ 1360.

a rapid recovery and sustainable development of the economic growth and well-being of the population in order to achieve this, the country will have to address key issues, including the development of a power sector that is able to provide reliable, cheap and clean power in support of a quick economic growth.

Overview of the energy and electricity sector

The energy sector occupies a critical role in the economic and social development of Madagascar. Today, very few people in Madagascar have access to modern sources of energy, and those live mostly in urban areas. The electricity access rate for the country was estimated at 12% (4.8% in rural area) in 2013. People who do not have access to modern sources of energy use inefficient energy sources (like kerosene), which are often polluting and unsafe, and for which they spend much more than the few privileged people who have access to modern sources of energy. The average energy consumption is 0.315 TOE/capita/year.

Table 2: Distribution of households by source of lighting, by place of residence

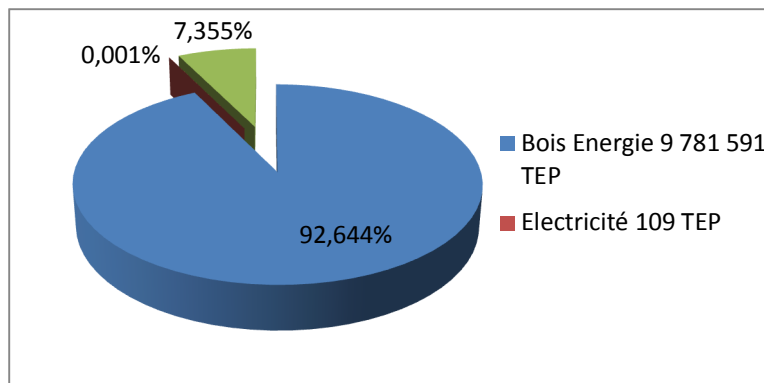
	Electricity	Generator	Kerosene	Candles	Others	Total
Urban	39,1	0,8	53,8	5,8	0,5	100,0
Rural	4,8	1,1	88,9	3,2	2,1	100,0
Together	12,3	1,0	81,2	3,8	1,7	100,0

Unit : %

Source : INSTAT, 2010

Wood energy (including wood and charcoal) represents 93% of the total energy supply in Madagascar in 2012. About 7,5% come from petroleum products which are all imported; this represents an increasing burden for the national budget. The electrical energy, supplied by hydro, solar, and wind, represents 0.001% of the total energy supply in Madagascar.

Figure 1: Energy supply situation in Madagascar, 2012



The electric power production is 506 MW, of which 165 MW is attributed to hydroelectric sources. The remaining 341 MW is obtained from conventional power stations (diesel), 27 kW from solar power, 157 kW from wind, and 40 kW from biomass. In terms of electricity production, the part of hydropower is 54% of total production in Madagascar.

There are three grids in the country; the Antananarivo Grid, the Toamasina Grid and the Fianarantsoa Grid. All equipment for transmission is administered by JIRAMA, the national utility. Whilst reliability and coverage of electricity have increased, electricity generation only

6 in the urban areas and 4.8% in the rural areas. To satisfy demand, so the rate of electrification is low, the electrification agency achieved 140 electrification projects in partnership with ANKAMA and the private sector. These projects serve 215,880 residents and 183 rural villages (October 2012).

Domestic consumption resulted in the sale of electricity showed a volume of 644,236 MWh for number of subscribers to 320,817 in 2001. It increased to 882,910 MWh for a number of subscribers to 444,575 in 2011.

The Government of Madagascar (GoM) acknowledges the necessity to develop renewable energy, particularly, hydropower, in order to limit the exposure to fluctuations in the price of imported diesel and, while increasing the energy supply.

Renewable Energy Potential

Madagascar has a great potential in terms of renewable energy; however, very little has been harnessed so far (see maps in annex):

- In terms of solar energy, many regions of the country have more than 2800 hours of annual sunshine. With an average of 2000kWh/m²/year, Madagascar is among the richest countries in solar energy potential in Africa. The average horizontal insolation is 5,5kWh/m²/day, across the majority of the land area. Photovoltaic (PV) in particular are currently utilized for powering public buildings such as health clinics, as well as an off-grid rural electrification solution.
- Regarding the wind potential, in general, the northern part (around Antsiranana) and the southern part (around Taolagnaro) have wind speeds more than 7m/s (50 m high) favorable to electricity production.
- The theoretical hydropower potential of Madagascar is estimated at 7800 MW. However, only 165 MW of this is currently exploited, indicating the very high potential for further hydropower utilization. Madagascar currently has 7 hydro-electric power plants, as well as 11 small-/micro-hydro plants.
- In terms of biomass, biomass in the south has been identified as having high potential for energy production. Sugar production is high, and bagasse co-generation is common. Investment projects in the field of biofuels are also identified; this is favored by the law governing the ethanol industry which was adopted in 2013.
- Madagascar is believed to have a geothermal potential but the exploration is still at an early stage.

The ESMAP program financed by the World Bank is currently supporting a mapping of renewable energy potential. There is a consensus among stakeholders that the development cost of the sector should be based primarily on the development of the hydroelectric production.

Renewable Energy Policy and Targets

There is no specific renewable energy policy in Madagascar. However, one of the key objectives of the Ministry of Energy is to increase the electricity access rate, and make it affordable to the population, through tapping the renewable energy potential of the country, thus offering a guarantee of sustainability. The Ministry of Energy is therefore currently

support of the European Union. The new policy is

framework, the national utility (JIRAMA) and facilitate

private investment;

- (ii) Encourage the predominance of renewables in the energy mix, at least 5%, 20% and 80% respectively by 2020, 2030 and 2050 ó with a focus on the both small and large scale hydro and the development of alternatives sources;
- (iii) Ensure the sustainable use of natural resources.

With 80% of the national population living in rural areas, the development of rural electrification will be key for the development of the country. A national rural electrification policy was thus developed, endorsing the creation of the Agency for the Development of Rural Electrification (ADER).

Rationale for Selected Sectors for SREP Financing

In this context, the Government of Madagascar has set itself the goal to develop electricity infrastructure: "We must have the means of our growth by developing our infrastructure, like all transport but also the electrical infrastructure, as electricity for all, is the way to provide the means resources of modernity for the country"² with a significant contribution of renewable resource to the energy mix.

However, this objective meets the following major constraints:

- Lack of coordination between the institutions and agencies active in the sector, as well as with departments of other sectors;
- Lack of coordination between institutions, government agencies and private actors involved in the development of renewable energies;
- Weaknesses in the operationalization of the regulatory framework;
- Weakness of energy planning process and the evaluation monitoring system for renewable energy;
- Insufficiency of financial resources to face to high investment costs of renewable energy technologies;
- Limited technical and human resources capacity in the energy sector, and more specifically in the renewable energy sub-sector;
- Lack of private sector mobilization.

The Government of Madagascar intends to use SREP financing to overcome some of these critical bottlenecks in order to facilitate the large-scale development of renewable energies. For instance, the SREP funding will be used to buy down the capital costs of renewable energy investments leading to more competitive electricity tariffs, thus making projects more sustainable. To achieve this objective, the Government considers the option of launching competitive bidding call programs in order to attract the best private sponsors and drive the tariffs down.

Based on the information provided in the sections above, in terms of level of energy access, renewable energy resources and main barriers that need to be addressed in the sub-sector, the Government of Madagascar considers that SREP-funded interventions could complement

² Inaugural speech of the President of the Republic, February 2014

- improvement of the energy sector in Madagascar :
- a. enhance capacity in energy planning and M&E;
 - b. strengthen logistics and more specifically RE equipment;
 - c. continue the institutional and regulatory reforms, especially those dedicated to the RE sub-sector;
2. Undertake RE assessment for mini-hydro and biomass resources; and prepare pipeline of bankable feasibility studies for RE projects, etc. This also includes the extension of the ESMAP program to other fields: solar and wind power.
 3. Design programs to meet the needs of rural areas, including mini-grids and off-grid options with mini-hydro, solar PV and biomass technologies according to the sites selected. This includes the completion of the electrification by renewable energy source in Nosy Be.
 4. Developing a solar PV power plant in the southern part of Madagascar, with private sector involvement.

III. ENABLING POLICY AND REGULATORY ENVIRONMENT

The sector is regulated by a number of policies and laws. The energy sector policy aims at:

- Energy access for all, with sufficient availability to meet the needs and affordability;
- Security of energy supply in quality and quantity;
- Energy sector development, with a vision of sustainable exploitation of natural resources.

The law No. 98-032, passed on 20th January 1999, reforms the electricity sector and promotes private investment and competition in the sector. As part of its implementation, the legislation allowed the liberalization of the different activities on the sector, as production, transport and distribution functions. In this context, a revision of the statutes of the key sectorial institutions (including the national utility JIRAMA) is already underway. The objective is to increase efficiency in the sector.

A regulator was created, the Board of Electricity Regulation (ORE), in order to regulate the sector and facilitate the participation of Independent Power Producers.

For the mobilization of the private sector, the regulatory environment is relatively favorable to energy investments in general. It is characterized by:

- (i) the law No. 2005-020, competition law guaranteeing freedom and fair competition,
- (ii) the establishment of a specialized office, attached to the Ministry of Industry, Trade and Private Sector Development, which task is to provide information, advice and guidance for investors;
- (iii) EDBM (Economic Development Board of Madagascar), an office which functions are to facilitate and promote investment in Madagascar (playing a role of interface between the private sector and the public sector);
- (iv) tax incentives for the import of renewable energies equipment.

Regarding rural electrification, a National Electricity Fund (FNE) was created in 2002, and is managed by the Agency for the Development of Rural Electrification (ADER). The objective

the country, promote access to basic electricity services from renewable energy sources. The FNE is intended to be implemented in rural areas and can represent a good instrument to scale up renewable energy powered mini grids in the country.

IV. INSTITUTIONAL AND TECHNICAL CAPACITY

Institutional framework

At the institutional level, administrations primarily concerned by the development of renewable energy are: the Ministry of Energy, the Ministry of Environment, and the Ministry of Finance and Budget.

The Department of Energy has under its supervision the Board of Electricity Regulation (ORE), the Agency for the Development of Rural Electrification (ADER) and the national utility called JIRAMA.

The General Directorate of Energy's primary mission is the elaboration and implementation of national energy policy, the coordination and control of the activities implemented in the energy sector. The technical departments under the General Directorate are: Department of Electricity, Renewable Energy Department, Department of Bioenergy, Energy Planning Department and regional and related services.

The implementation of big programs, such as: (i) the Recovery and Restructuring Program of Electricity (P2RSE), financed by the World Bank; (ii) the project of the 3rd turbine for the Hydroelectric Power of Andekaleka, funded by the BADEA, OFID, and KFAED; or (iii) the Energy Facility Program, funded by the European Union, demonstrates the ability of the Government of Madagascar to successfully implement energy projects.

Experiences with implementation of renewable energy projects

The use of renewable energies in Madagascar is marked by physical achievements in the domain of solar, wind, hydro and biomass:

- Multiple solar photovoltaic and thermal solar applications have been adopted. This energy is currently used for cooking, heating, drying in the areas of agricultural production, the generation of electricity for telecommunications, lighting, storage of drugs, cooling and pumping.
- The northern and southern parts of Madagascar are favorable to the production of electricity from wind source. The other parts of Madagascar are suitable for wind installation of water pumping or wind turbine low-power.
- Some hydroelectric power plants have been in operation for the past six years (implementation of 3rd turbine -33MW of hydropower plant Andekaleka, Tsiazompaniry -5MW, Maroantsetra -2.4 MW, Sahanivotry -16.5MW).
- Feasibility studies of large hydroelectric projects have been undertaken (Fempona, Antetezambato) and Studies Project Summary (APS) and Detailed (APD), small scale hydroelectric sites studies are available at the Ministry and ADER. Hydroelectric sites have been identified and their development will be conducted under the SREP.

The private sector (IPPs) has also conducted feasibility studies for the hydropower plants of Sahofika site (105 MW) and Mahitsy site (12 MW) for strengthening the interconnected grid of Antananarivo (RIA).

can be distinguished:

- The Institut de Maîtrise de l'Énergie (IME), an agency linked at the Ministry of Scientific Research, which develops programs of research and training in the domain of renewable energies;
- Polytechnic College of Antananarivo (ESPA) provides modules over generalized technologies in renewable energies and Antsiranana Polytechnic College an engineering curriculum hydro-energy / renewable energies;
- Higher Institute of Technology Antsiranana (ISTA) trains high technician systems renewable and alternative energy.
- The National Centre for Industrial and Technological Research (CNRIT) develops research on technologies for renewable energy and industrial level.
- The Malagasy Centre of Cane and Sugar (CMCS) promotes the processing of sugar cane and its derivatives.

However, there is still a need to build capacity and provide technical assistance to all players in the energy sector, as well as customers, in order to support the large-scale deployment of renewable energies.

V. PROGRAMS OF MDBS AND DEVELOPMENT PARTNERS

Technical and financial partners involved in financing projects and programs through public and private institutions have a major role in the promotion of renewable energies in Madagascar. Various partners are supporting the development of the country including multilateral institutions like the WB, AfDB, EU Delegation, BADEA, KFAED, OFID, BEI, and bilateral development partners like GIZ, Switzerland cooperation, Chinese cooperation, AFD, etc. It should be noted that Madagascar is an observer member of IRENA.

Regarding the energy sector, the following projects and programs are ongoing:

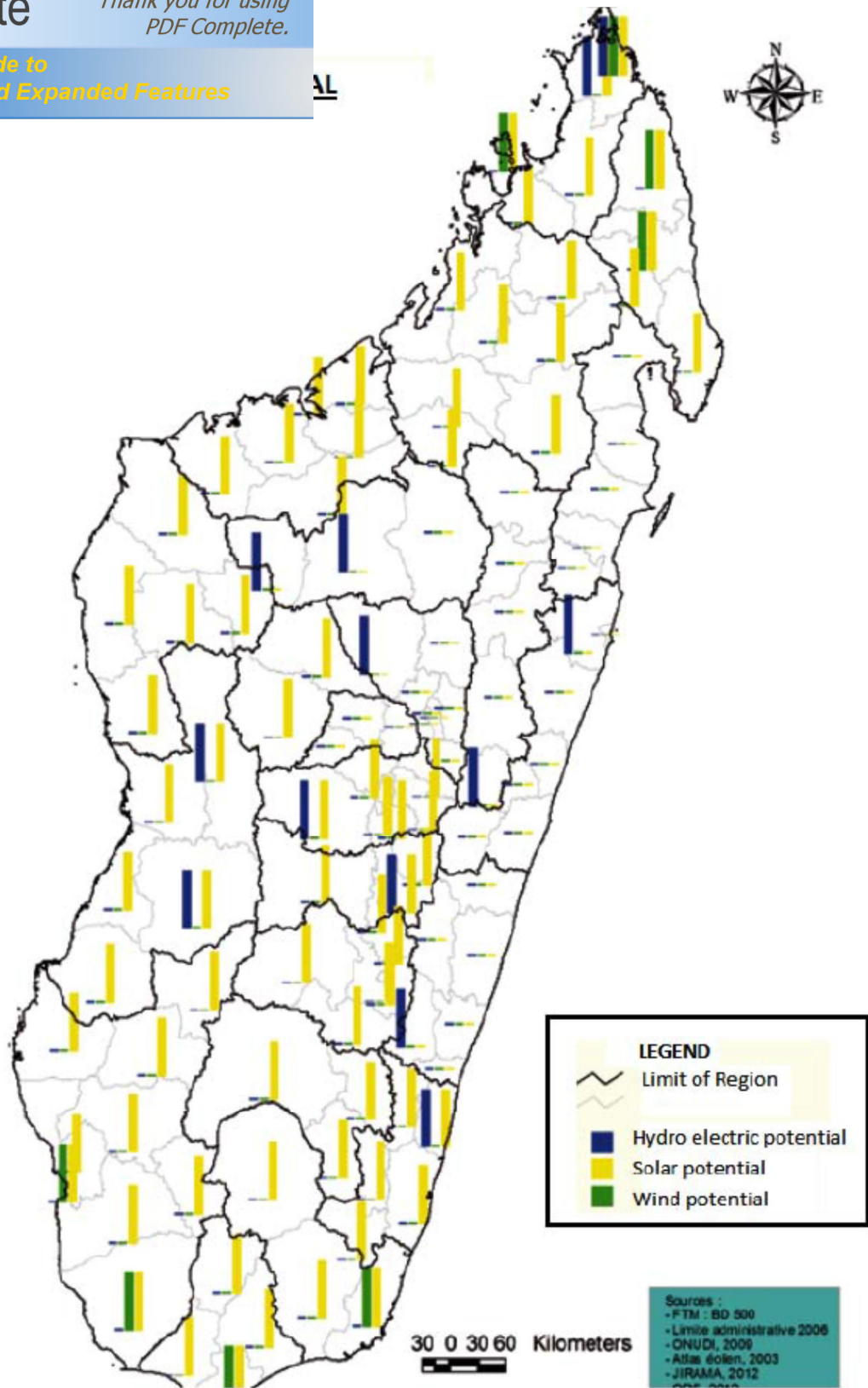
- The Energy Facility Program, funded by the EU, which is a decentralized rural electrification program using renewable energy;
- The ESMAP (Energy Sector Management and Assistance Program), which supports program management and technical assistance for the mapping of renewable energy, including small hydro (<10 MW) administered by the World Bank;
- The development the hydropower site Antafofobe (3.2 MW) on Lily (China cooperation - Madagascar);
- Promotion of Rural Electrification by Renewable Energy (PERER): studies and implementation of small hydro sites, funded by GIZ;
- Study of electrification through renewable energy of Nosy Be, funded by AfDB;
- Study for the development of hydroelectric energy for productive goal in rural areas under GEF funding with the executing agency UNIDO.

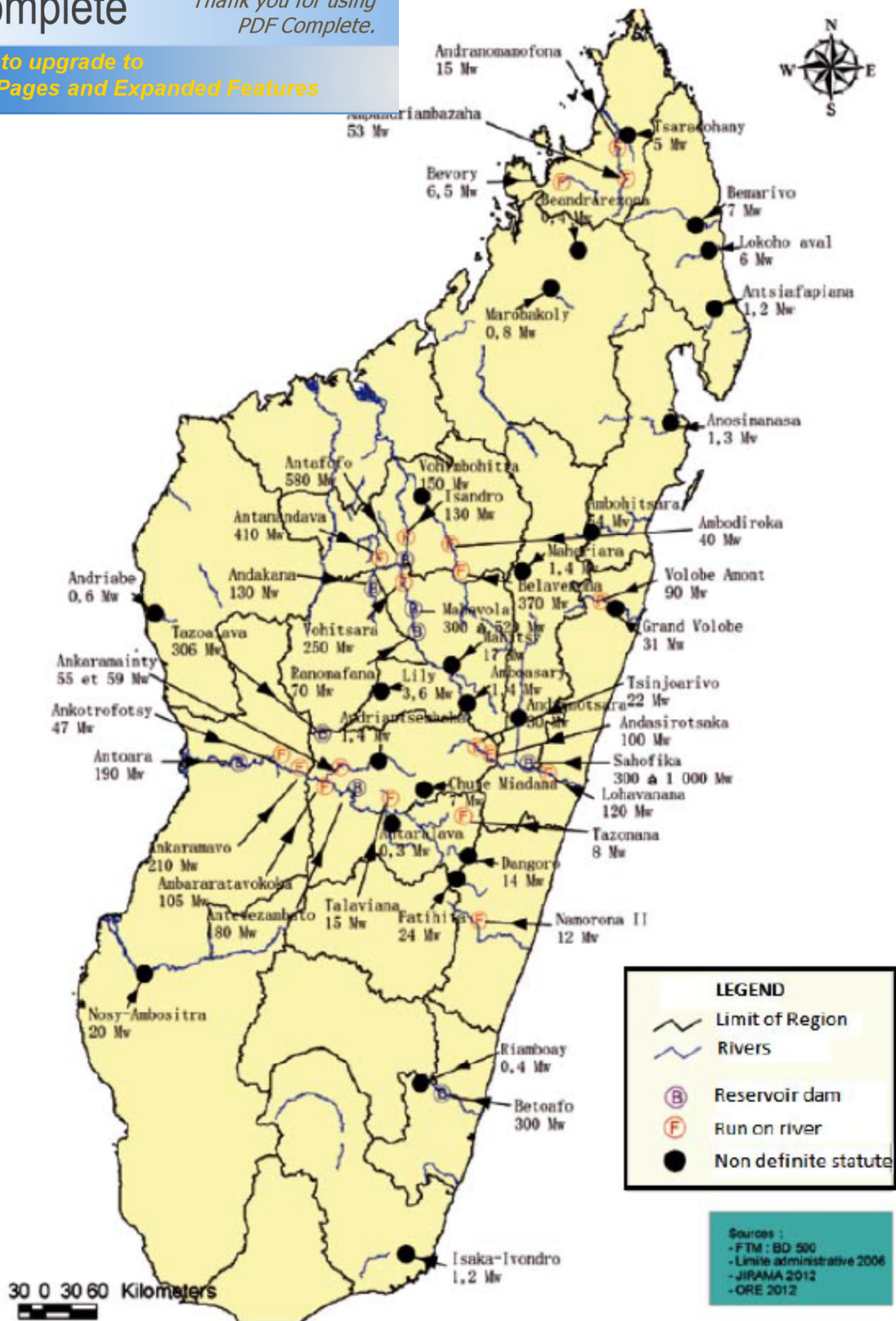
Most of the ongoing interventions are quite small in scale, but interesting in terms of piloting the RE technologies and delivery models that could be scaled up through SREP. The SREP funding will support the establishment a better enabling environment for the development of renewable energy in Madagascar, while also completing the aforementioned RE projects with additional investments.

CRONYM LIST

[Click Here to upgrade to
Unlimited Pages and Expanded Features](#)

	Agence Française pour le Développement
AfDB	: African Development Bank
BADEA	: Banque Arabe pour le Développement Economique en Afrique
BEI	: Banque Européenne d'Investissement
CHE	: Hydropower plant
CMCS	: Malagasy Centre of Cane and Sugar
CNRIT	: National Centre for Industrial and Technological Research
EDBM	: Economic Development Board of Madagascar
ESMAP	: Energy Sector Management and Assistance Program
ESPA	: Polytechnic College of Antananarivo
FNE	: Fonds National pour l'Electricité
GDP	: Gross Domestic Product
GIZ	: Gesellsaft für Internationale Zusammenarbeit
GoM	: Government of Madagascar
GEF	: Global Environment Fund
IME	: Institut de Maîtrise de l'Energie
IRENA	: International Renewable Energy Agency
INSTAT	: Institut National de la Statistique
IPP	: Independent Power Producer
ISTA	: Higher Institute of Technological Antsiranana
JIRAMA	: Société Nationale d'Eau et Electricité
KFAED	: Kuwait Fund for Arab Economic Development
kW	: kilo watt
kWh	: kilowatt hour
MDB	: Multilateral Development Bank
MW	: Megawatt
OFID	: Opec Fund For International Development
ORE	: Office de Régulation de l'Electricité
PERER	: Promotion of Rural Electrification by Renewable Energy
PPP	: Public Private Partnership
TEP/TOE	: Tonne equivalent pétrole / Ton of Oil Equivalent
RE	: Renewable Energy
UNIDO	: United Nations for Industrial Development Organization





Sources :
 - FTM : BD 500
 - Limite administrative 2006
 - JIRAMA 2012
 - ORE 2012

AGRO FUEL POTENTIAL

