Lessons learnt from AFD bioelectricity portfolio

Expert workshop on wood energy

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Outline

1. AFD at a glance
2. Bioelectricity
3. Example of AFD's operations
4. Conclusions

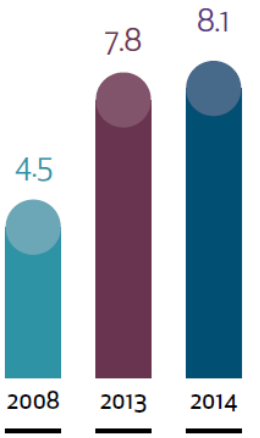
AFD - French bilateral development bank

71 offices
around the world

more than 90 countries
helped

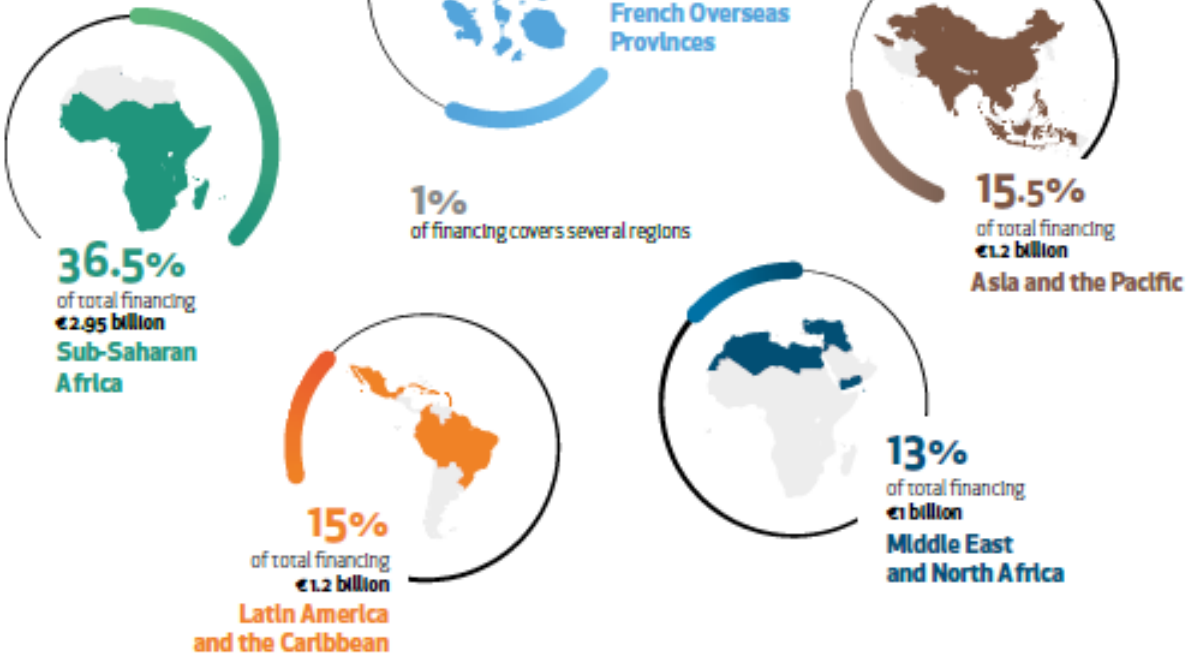
1,744 employees

The € 8 billion* milestone surpassed



Financing committed by the AFD Group (AFD and Proparco)
in billions of euros

*of which €245 million from other donors.



Three pillars of AFD's energy strategy

Fight against climate change

1. Sustainable Energy

Renewable energies & energy efficiency

Type of projects:

- Renewable energy
- Combined cycle, co- & tri-generation
- Energy efficiency in industry, buildings, transport

Improve living conditions

2. Access to Energy

Closing the energy divide; improving access in rural & peri-urban areas

Type of projects:

- Rural and peri-urban electrification
- Traditional household fuels
- Bioenergy

Support economic development

3. Reliable Energy

Protecting & strengthening energy systems

Type of projects:

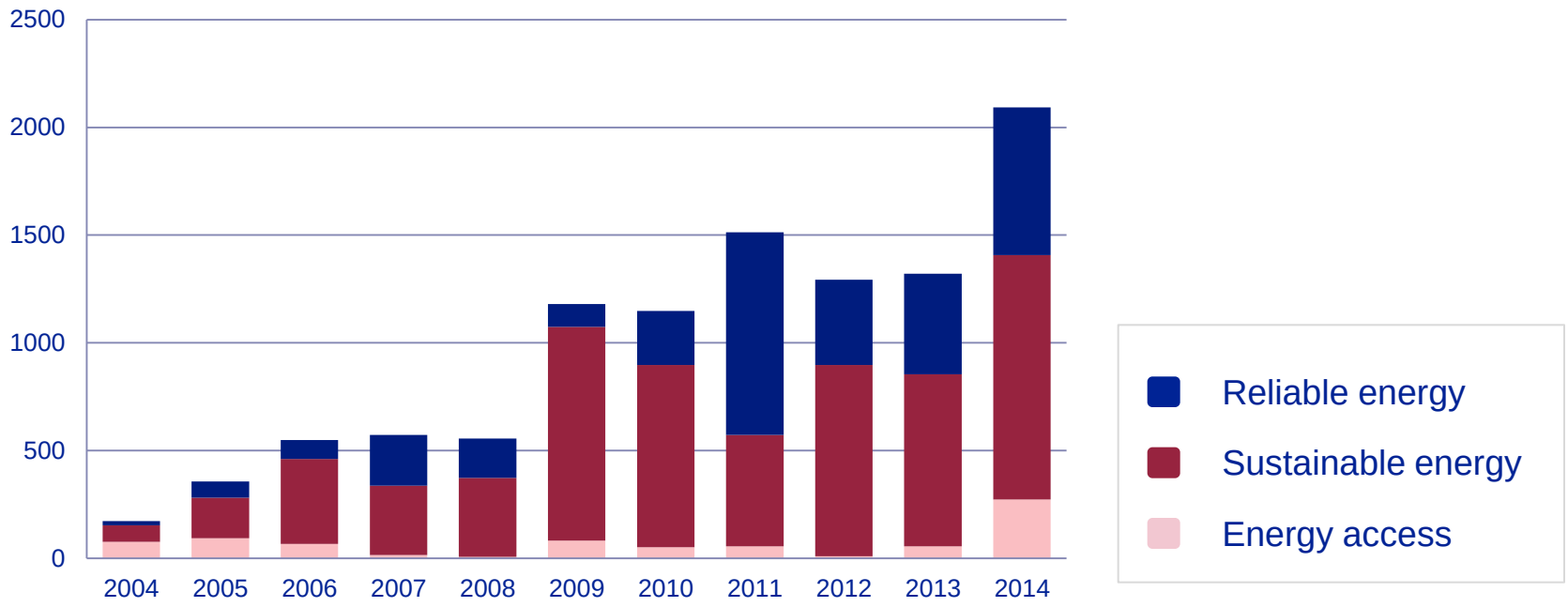
- Transmission, distribution networks
- Development of natural gas as a transition to greener energy mix
- Support private sector involvement
- Regional interconnections

Cross cutting

Policy support & capacity building for the energy sector

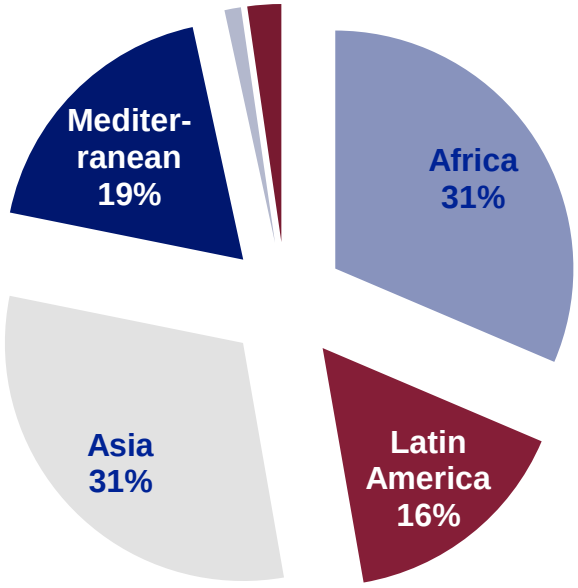
Key figures for AFD Group in the energy sector 2004-2014

- Over **Euros 11 billion committed** in the energy sector
- Around Euros 1.5 billion per year, i.e. **20% of AFD Group total commitments**
- On average, **Euros 275 million by Proparco**
- **2015 set a new record: Euros 2 billion**

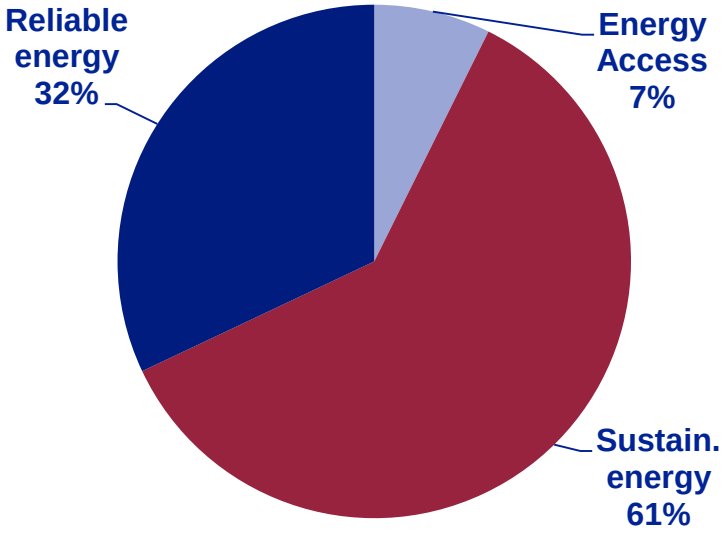


Key figures for AFD Group in the energy sector 2004-2014

- 600 MEUR per year of projects in Sub-Saharan Africa (30% of commitments)



- ~ 60% of commitments towards sustainable energy (RE & EE)



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High added-value modern bioenergy

- **From energy recovery of "recoverable" waste…**
  - agro-industrial wastes (concentrated onsite)
  - logging and sawmill waste
  - agricultural waste (scattered in the fields)


Cotton stalks (5 t / ha)

➡ **The challenge is to adapt the approach to each industrial sectors :**

- *More advanced sectors : sugar, paper and cardboard*
- *Developing sectors : oil palm residues, rubber, sawmills*
- *Other industries (cement, detergents): relevant solution when they have not valued resources around their sites (compressed bagasse, hulls, rice residues, etc.).*
- *Underrepresented despite significant raw potential sectors : peanut, cashew, cocoa, etc.*

- **… to energy-specific plantations**
  - forest plantations (bioelectricity or bio-heat industrial)
  - agroforestry plantations (egg shrub oilseeds)

➡ **The challenge is to structure the value-chain in a competitive way**

Study on the use of agro-industrial wastes for heat and electricity cogeneration in Africa

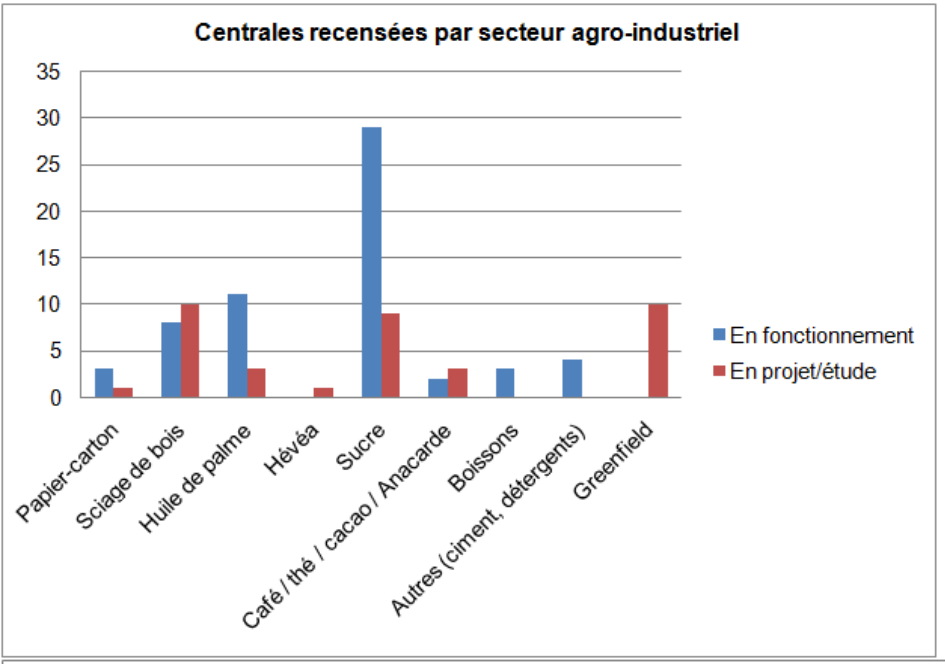
Africa-EU Energy Partnership
Renewable Energy
Cooperation Programme RECP

- Biomass resources (wood, agricultural residues and agro-industrial) are abundant in Africa-Saharan, where they are used primarily as fuel for cooking, heating and other household uses. **Energy use on an industrial scale is in development, with industrial sites generating biomass wastes looking for techno-economic solutions for onsite valorization**

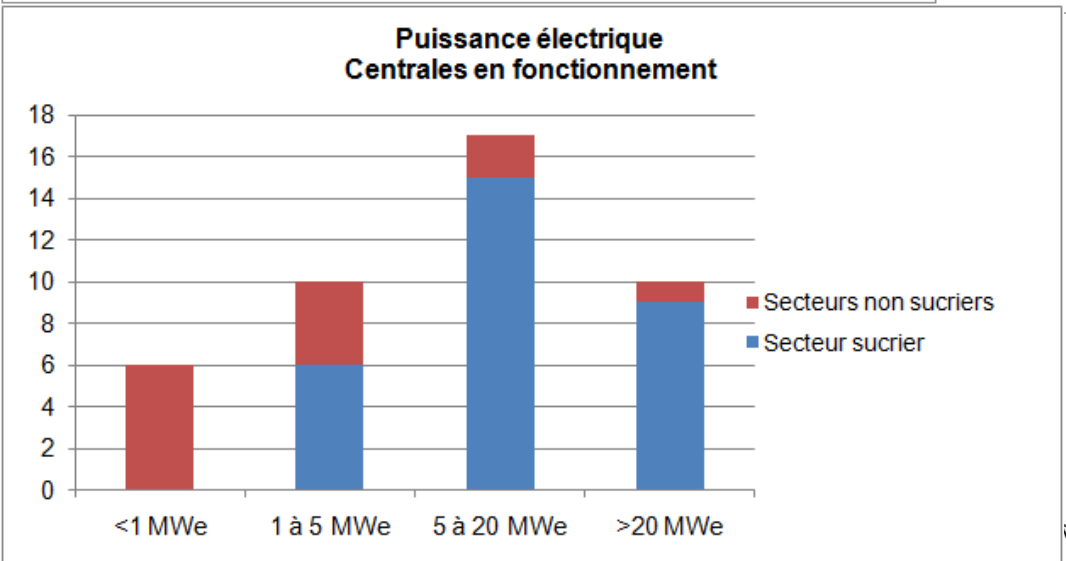
- The study identifies and characterizes existing projects and provides an estimate of potential new projects of power generation from data agro-industrial sectors in the 6 countries studied.

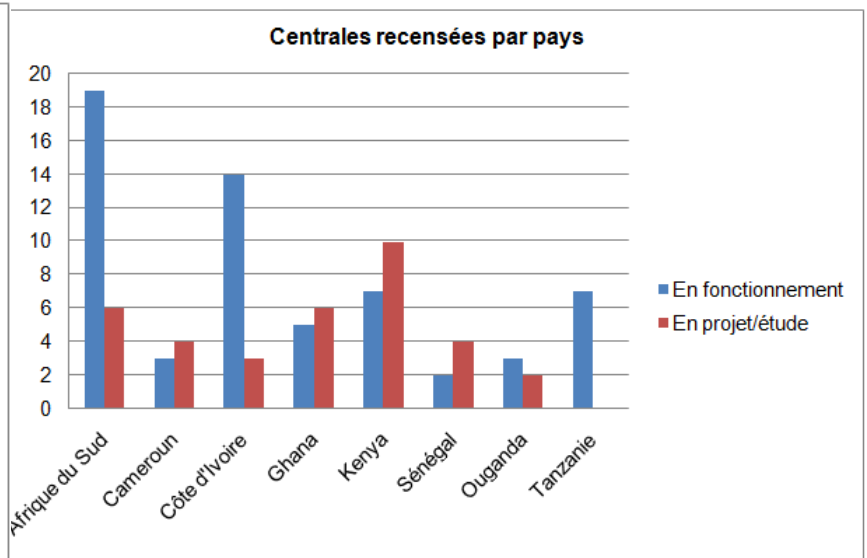
Synthesis available at : http://www.afd.fr/home/projets_afd/energie-afd/energie-et-afrique

Some results of RECP study
Analysis of existing biomass power plants

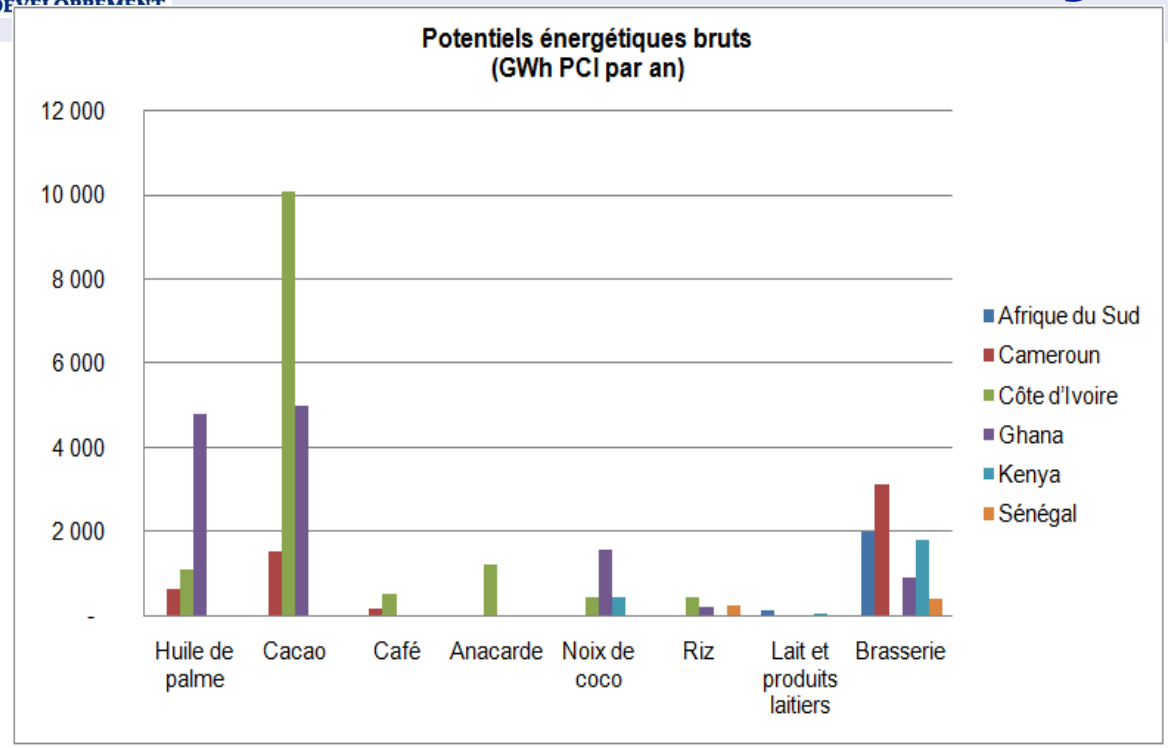


- Concentrated on three agro-industries : Sugar, saw mills and paper
- Advanced countries: Ivory Coast, South Africa, Tanzania
- Average capacity: 5-20 MWe





Some results of RECP study
...yet potential is huge



Challenges

- **Understand the drivers for each agro-industry**: What are the issues in the sector? types of by-products? Need to diversify? Need to secure electricity supply? Need funding for modernizing a production system?
- **Build ad-hoc partnerships.** Energy can provide the added value needed to improve productivity of the agricultural production scheme

Some results of RECP study
ressources not always valued

- Challenges
  - Valuing wastes/resources generated by a business (agricultural, industrial)
  - Limit management costs (collection, storage, transport, incineration, landfill, etc.)
  - Use the produced energy onsite or sell to the network?

15 years bagass deposit, in Kenya

Trunks of end of life rubber trees, in Ghana

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1. From sugar-bagasse…to wood
The most favourable

- **Favorable conditions**:
  - Sugar yield : **80 t / ha / year** (but available only 6 months per year)
  - Heat is needed in the industrial processes (drying / crystallization).
  - Driver for the industry: optimize the burning system (modernization of boilers can reach a yield of 60-70% instead of 30%)

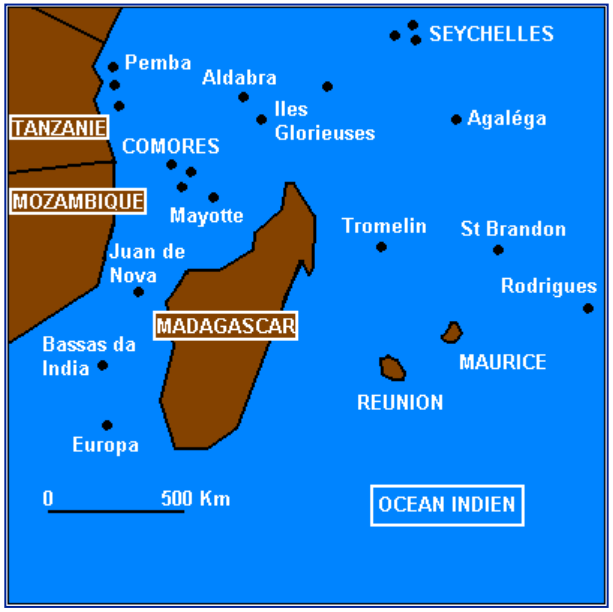
- Special case of **islands** with very expensive electrical mix - biomass therefore quickly becomes competitive.

- Long-standing experience in the **French Overseas departments**:
  - Step 1 (in the 1990ies) : Bagasse -> bagasse + coal (*Charbonnière of France*, Réunion and Guadeloupe);
  - Today: substitution wood / coal : ex La Martinique with Albioma - project from 30 to 60 MW, wood comes from the United States and eventually Brazil.
  - Albioma Model: JV established with each sugar partner, even competitors!

- **Future opportunities**:
  - Developing regional wood value chain, eg by importing the East African wood for the Reunion or Mauritius;
  - Developing local energy crops (ex-fiber cane / strong performance already developed in Brazil)

Development of bio electricity in Mauritius and Reunion

- Two sugar islands, highly dependent on the sugar economy (context of the end of guaranteed prices for sugar)
  - In Mauritius, cultivated area is decreasing 1000 to 2000 ha / year
  - In Reunion, uncertainties on earnings of the industry from 2017
  - One driver is to diversify incomes

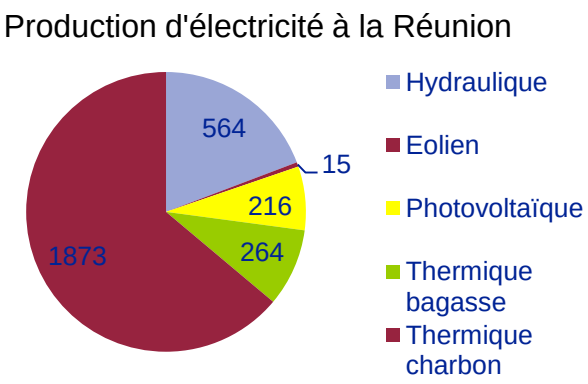


Maurice

- 4 bagasse-coal power plants sugar, 1 coal plant
- **13% of electricity comes from bagasse in 2013**
- Target of 35% electricity from renewables by 2020
- Pass the original bagasse electricity from 350 to 600 GWh / year

Réunion

- 2 central bagasse-coal **9% of the electricity in 2013**
- Objective: 50% renewable electricity in 2020 (38% in 2013)
- Biomass to increase from 20% to 60% of electricity mix in 2023



Potential for biomass development

Figures in tones of carbon avoided per year

Options	Maurice	Réunion
Power plant linked to sugar industry (> 30 MW)	**111 900**	**52 700**
Improve plant performance	42 000	6 000
Incorporate green waste	2 500	7 000
Reap the cane tops and straws	56 000	14 000
Planting new cane varieties	11 400	14 300
Injecting ethanol into the turbines		11 400
Small units (<10 MW)	**60 500**	**39 000**
Dedicated energy crops	57 000	17 000
Forest plantations and wood by-products	3 500	22 000
Methanisation	**4 400**	**14 800**
Livestock manure, food processing, waste	4 400	14 800
Total local biomass	**176 800**	**106 500**

Proposed projects | **Identified projects** | **Innovative or difficult projects**

Bio-electricity in Mauritius and Réunion
Lessons learnt

- **Key point is always the electricity tariff**
  - In Mauritius, the Central Electricity Board is not ready to introduce attractive pricing for biomass
  - In Reunion, the metropolitan consumer bears the additional costs, but biomass is still paid less than other renewable energies !

- "**Moving drivers**" : starting point is the valorization of local agro-industry wastes ; then the energy-oriented logic increases and biomass is possibly imported

- **Developing regional synergies between Mauritius and Reunion / East Africa**

- **Potential to "recover" abandoned lands for energy-culture?** Concerns about the future of the abandoned lands of small farmers by studying the potential of growing fiber cane

2. Wood.

Example of cogeneration power plant in North China

Project

Sector : renewable energy / biomass

Country : China

Grant year : 2013

Cost of the project : 50,7 Million €

Partner : Yichuan NRDC

Context

- Great increase in energy demand and fossil fuel consumption and pollution in China
- Important biomass resources underused in the country. Great quantities of residues from forest exploitation and agricultural exploitation
- Strong policies and incentives in the sector to bring total production from biomass to 20 GW by 2020

Content and financing

- Construction of a **30 MW cogeneration power plan + supporting equipment :**
  - Biomass consists of a 80% forest residues and a 20% harvest (around 190 000 tons a year)
  - One power line to connect the power plant to the network (29.5 km, 66kV)
  - A collecting system of the biomass 60 km around the power plant site
  - Reform of the heat network devoted to a 650 000 m² area.
- 50,7 M€ between an AFD sovereign loan (35 M€), Yichun NRDC (8.7 M€) et Bank of China (7M€)

Impacts

- Valorization of local biomass through the power plant and the local industry (ashes)
- Additional income for forestry workers
- Environment :
  - 300 000 tCO2 saved each year and 2500 tons of SO2/y as coal power plant are completely dismantled
  - 30MW of renewable energy

Wood, drivers and conditions of success

Driver = heat in cold countries

Ex China **: integration of different functions** via the municipality, which is both forest manager, operator of heating networks and manager of the plant

Driver = self-generation when an industry is off- grid

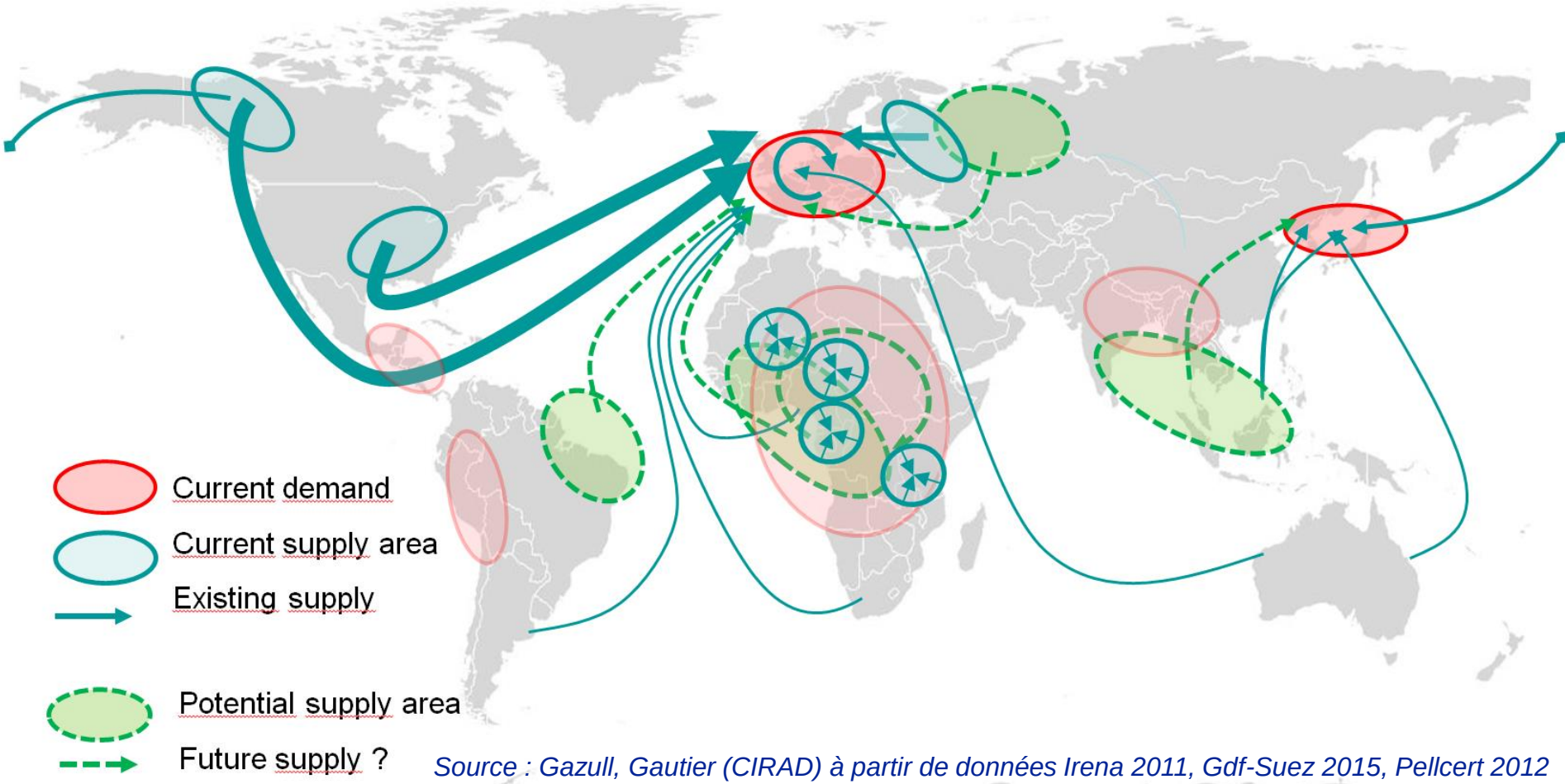
Ex Cameroon : Rougier was interested by self-generation for sawmills to substitute fuel oil -> **a competitive option as long as they stay off-grid** for 5-10 years.

(but the prospect of having the network (and thus electricity at 8ct) within 2 years has derailed the project. NB factory cost = € 10 million = 10 sawmills !!)

Driver = international markets

International wood markets grow and create a price signal which should be enough to develop an industrial sector, more competitive than the current African industry. This is consistent with the need for diversification of forest concessions (decreasing timber market).

International trade in wood fuel (wood chips, pellets, charcoal)



Source : Gazull, Gautier (CIRAD) à partir de données Irena 2011, Gdf-Suez 2015, Pellcert 2012

3. Palm oil
Ivory Coast, SIFCA and Biokala

- SIFCA was financed (equity and loan) by Proparco for specific programmes targeted at village plantations
- Today, a project is under appraisal with Biokala and EDF to use palm "wood" for bio-electricity (as there is a rotation/clear cut of all trees every 5 years)
  - Difficulties to reconcile two different logics
  - Importance of tariff incentives !

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Conclusions

- Bio-electricity is not “the easy way” to develop REN
  - Main issue is to secure the supply of biomass “fuel”
  - Significant development costs (compared to solar or wind power) and high complexity which can be prohibitive for small projects (<5 MW)
  - At the end, energy cost remains quite expensive compared to high-capacity coal or high-capacity hydro and geothermal
  - Financing needs for energy developments are often far more important than the agribusiness capacities ; and we need to combine very different “mindsets”: agribusiness (pick out logic) & energy company (investor logic).

- These difficulties can be overcome by:
  - A strong regulation of the sector (including specific tariff eg in Martinique 22 ct€ / kWh)
  - A decision-making process that include local added-value ; and compare with marginal cost of electricity

- Role of donors?
  - Enhancing public policies: biomass plan, pricing, promoting broader economic rationality
  - Bridging agribusiness with energy companies
  - How to manage small projects (<€ 10m)?

- **The potential additional energy production and local value-added are considerable**

Vielen Dank
Merci

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