



Cirad Research in the field of « Biomass for Energy »

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CIRAD

First, a few words about Cirad (1)

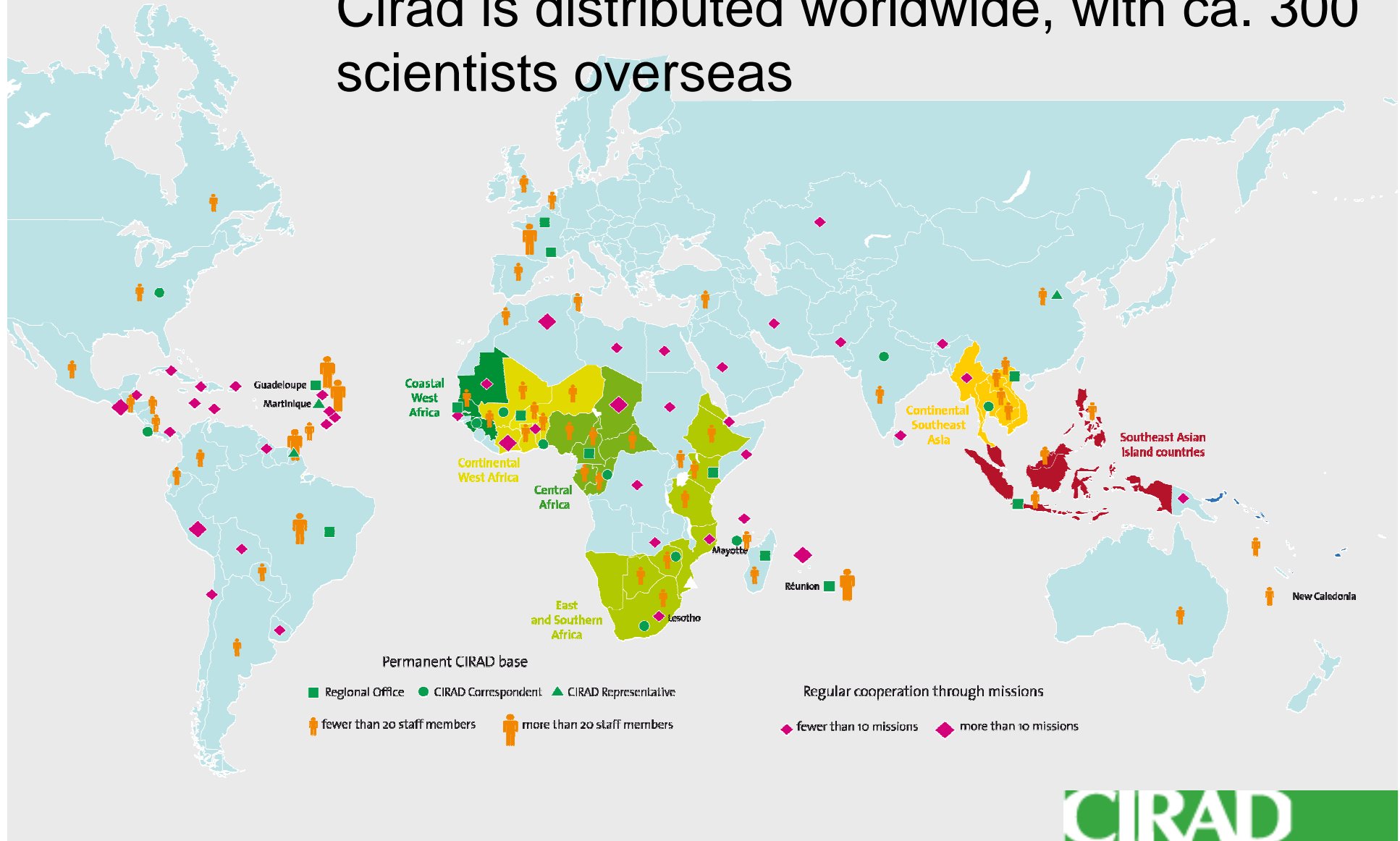


- Cirad is the French “*Center for international cooperation in agricultural research for development*”
- Cirad has the mandate to:
 - **Targeted research** to contribute to development and poverty alleviation.
 - Research centring on the **Millennium Development Goals**.
 - Research in which **methods and knowledge are built in partnership** with stakeholders in developing countries.

First, a few words about Cirad (2)



Cirad is distributed worldwide, with ca. 300 scientists overseas



First, a few words about Cirad (3)



Cirad is organized in 3 scientific departments

- **Biological Systems (BIOS)**
The living world, its characterization and its exploitation: the diversity, biology and functioning of organisms and the relations between them and with their environment
- **Performance of Tropical Production and Processing Systems (PERSYST)**
Biological processes in interaction with environmental conditions and technical interventions
- **Environments and Societies (ES)**
The relations between agriculture, natural resource management and social dynamics, and the links with public policy

First, a few words about Cirad (4)



Cirad addresses 6 priority lines

Ecological intensification

Inventing new types of agriculture that optimize yields and preserve biodiversity

Biomass energy

Studying new sources of energy and analysing how to ensure that they benefit people in developing countries

Food

Innovating, to ensure accessible, safe and varied food supplies

Health risks and emerging diseases

Foreseeing and managing infectious disease risks linked to wildlife and domestic animals

Public policy

Supporting policies aimed at reducing inequality and alleviating poverty

Rural areas

Understanding relationships between agriculture and the environment and between nature and society better, so as to manage tropical areas sustainably



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Ecological intensification

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Biomass energy

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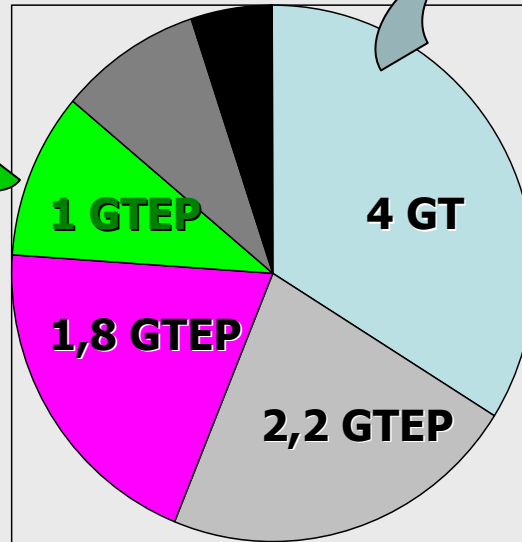
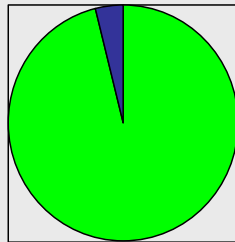
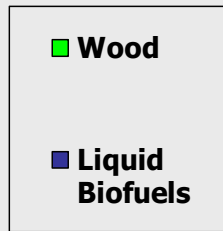
With the following objectives :

- Energy supply of developing countries by sustainable use of forestry and agricultural resources, including chain wastes.
- Improvement of rural development

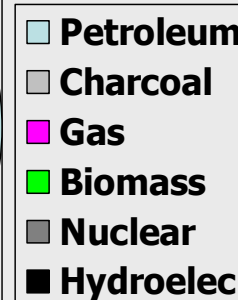
Food

Innovating, to ensure accessible, safe and varied food supplies

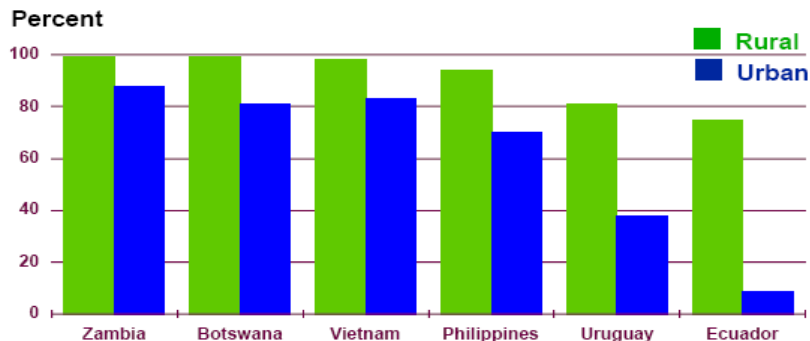
World Energy situation



Among which 1,5 GT for transport fuels



Rural and urban biomass use in 6 countries



Wide energy uses of biomass :
 50% world wood production
 1,5 billion m³/year
 90% of energy supply in Sub-Saharan Africa

Stakes



- Access to energy for rural populations from developing countries, as a mean for poverty alleviation
- Energetic Independence of developing countries towards fossil fuels
- Limitations in greenhouse gas emissions

Stakes



- High potential of biomass to answer these stakes provided that :
 - Natural resources are sustainably managed
 - Other uses of biomass (food ...) and connected resources (land, water..) are not challenged
 - Energetic and environmental balance of the chain supply is satisfactory

A pluridisciplinary approach



A large range of scientific knowledges and expertise in genetic, agronomy, technology, economy, social impacts and public policies.

- Resource production and management
 - Selection
 - Genomics
 - Cultural practices
 - Spatial dynamics
 - Forest management



A pluridisciplinary approach



- Social and economic issues :
 - Resource availability
 - Competing uses of resources
 - Impacts of bioenergy on rural development
 - Public policies and their impacts

A pluridisciplinary approach



- Technologies for decentralised production of energy from small unit in short supply chains
 - **Thermochemical conversion of biomass** :Gasification for heat and power production, Carbonization for industrial and domestic uses (heat), Flash pyrolysis and torrefaction for biomass conditioning (energy concentration)
 - **Combustion of liquid biofuels** in engines and burners for heat and power production



Focus on technological research



- Comprehensive studies of thermochemical reactions involved in biomass pyrolysis and gasification :
 - Tar formation mechanisms during pyrolysis and gasification reactions, and tar cracking conditions.
 - Transfer mechanisms of inorganic matters from biomass to pyrolysis oils during flash pyrolysis
 - Torrefaction conditions to obtain easy grinding of biomass : chemical and physical changes in the torrefied material.
 - Development of analytic method of the reaction products
 - Reaction modelling for further upscaling
 - Environmental impacts of alternative processes and supply chains (LCA, carbon balances, energy balances ...)

Focus on technological research



- Combustion of liquid biofuels in engines and burners
 - Development of specific standard properties for liquid biofuels quality
 - Design of engine and burner modification to optimize biofuels combustion
 - Combustion optimization of new biofuel (third generation, mixt solid-liquid biofuels ...)

Using technical platform



- A 130 m² test platform containing pilot plants for pyrolysis and gasification processes



75 kWth (20 kg/h) stage gasifier



3 kg/h continuous
fixed bed gasifier



1 kg/h fluidized bed reactor
for flash pyrolysis

And laboratories



... analyses and small scale reactors laboratories



Chemical analyses



Thermo-physical analysis (ATG)



Lab scale experiments



New routes for the future...



A new Cirad program to favor cross-cutting research

This new program called ATP, Thematic Planned Action, is focused on the identification of the major factors impacting the life conditions of populations located in rural area with no, limited or difficult access to energy facilities.

This action of a duration of 4 years concerns:

- ✓ 15 researchers from the 3 Cirad departments
- ✓ a large range of scientific areas: social impacts, public policies, economy, agronomy and technology.
- ✓ local institutes, partners of Cirad, contributing to the project in Burkina Faso, Madagascar, Brazil.

New routes for the future...



A specific partnership with INRA (French national research institute in agriculture)

ARP/VEGA: National research program to improve crops of the future to produce bio products, bio material and energy.

A national effort of creating a « **research cluster** » on green and white chemistry and energy processes with research units located in Paris, Toulouse and Montpellier, working together.



Thank you for your
attention

CIRAD