BIOMASS FOR ENERGY USES: METHODOLOGY AND RESULTS FOR FRANCE

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In collaboration with IFP, FCBA, INRA in the Valerbio Project

Overview of the presentation

- Context
- Objectives
- Tools and assumptions
  - Scenarios
  - Resources analysis
  - Technologies description
- Results
- Conclusion and perspectives

Context

- Fossil fuel scarcity and environmental concerns are good drivers for renewable alternatives studies
  - How to assume the continuity of liquid fuel?
  - Are biofuels an acceptable and sustainable solution?
  - Which biomass can be use?
  - Which landfield is available without competition with food?
  - Which rate of incorporation as a substitution?
- To answer these questions prospective studies are helpful to policy makers

Objectives

- This study deals with the methodology elaborated to assess the potential of biomass for energy use in France:
  - Using a detailed representation of biomass sources (agriculture and wood products)
  - Taking into account the spatiality of the resources (the country is separated in several regions)
  - Regarding their economical evolutions (costs of production and transport are forecasted on the time horizon)
  - Having a rich technological database for energy generation with biomass input (1st and 2nd generation)

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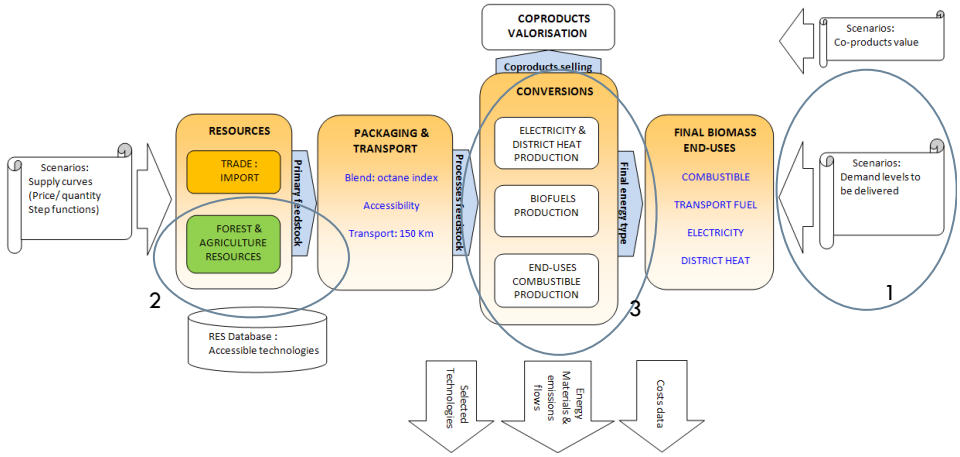
Modeling

- French MARKAL/TIMES Bottom up model is used
  - Time horizon is 2005-2050
  - Demand driven (fuels) and given energy prices
  - All sectors included in the demand forecast
- We only deals with available landfield for energy without food competition
  - Base on marginal and useless landfields
- Detailed technology database including the most promising 2nd generation biofuel production (including co products)

Reference Energy System



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Scenarios

- 3 levels to describe about 50 scenarios
  - **Resources**: combination of agricultural products, wood and Short Rotation Coppice (SRC).
  - **Demands**: several level of bio-energy demands
  - **Technologies**: development's limitations for specific technologies (processes for ethanol production, BtL)
- commodities
  - **Fuels**: direct use of biomass (heat, cogeneration)
  - **Liquid fuels**: direct use of biofuels
  - **Electricity**: use of electricity produced with biomass (by cogeneration or co-product)

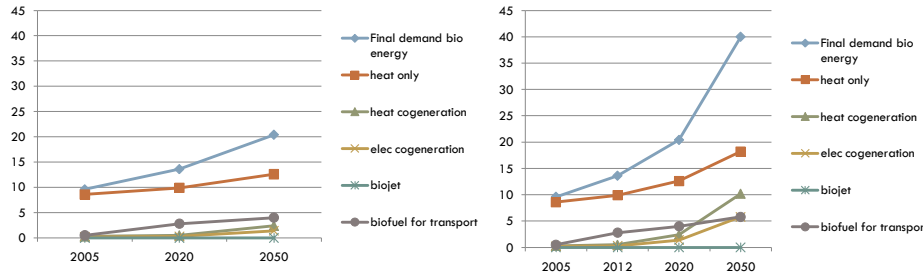
Potential scenarios

- 3 level scenarios
  - P1: BAU (Business As Usual)
  - P2: Dynamic wood (wood is mostly use for non energy applications)
  - P3: All for energy (biomass mostly use for energy)
- For each, 2 kinds of prices for biomass (high and low)

Agricultural products potential	Wood potential	SRC potential	Global potential	
S1A -PB (PB for Moderate price)	S1-F		BAU	P1
S1A –PH (PH for High price)	S1-F		BAU	P1b
S2A –PH	S2-F	S2-SRC	Dynamic wood	P2
S1A –PB	S2-F	S2-SRC	Dynamic wood b	P2b
S2A -PH	S3-F	S1-SRC	All for energy	P3b
S2A -PH	S3-F	S2-SRC	All for energy	P3

Demand scenarios

- 3 levels of imposed production for bio-products:
  - D1: 20 Mteo
  - D2: 40 Mteo (with 2 cases: a)+cogeneration; b)+biojet)
  - D3: 30 Mteo (with 2 cases: a)+cogeneration; b)+biojet)



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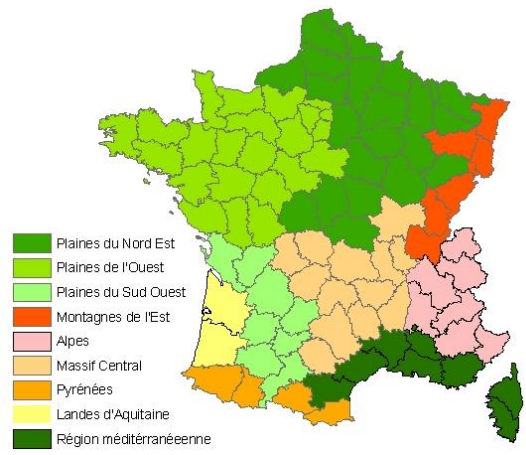
Studied resources

- **Agriculture**
  - Grains, whole plant, straw for :
    - Corn
    - Wheat
    - Rape
    - Triticale
  - Sugar beet
  - Sunflower
  - Miscanthus
  - Eucalyptus
  - Jatropha, Palm, Poplar…
  - Residu
- **Wood**
  - 3 Types
    - Big
    - Medium
    - Small
  - 4 Accessibilities
    - Easy (FA)
    - Moderately Difficult (MD)
    - Difficult (DI)
    - Very difficult (TD)

SRC : Short Rotation Coppice

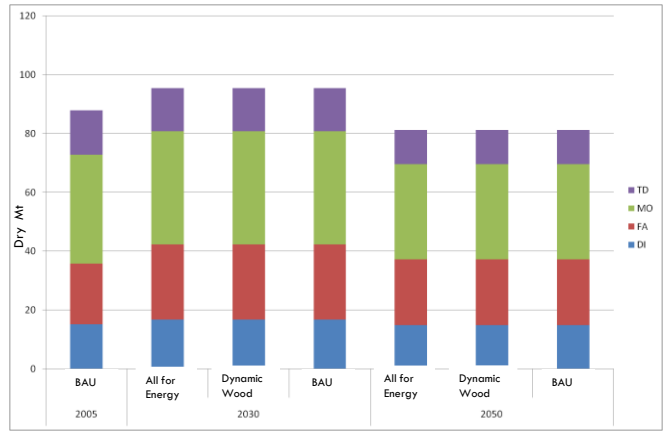
Detailed spatiality for landfield

- Pertinent regions for agricultural and wood resources
- Each region has a detailed economic description (cost of production and transport by resource)
- Realistic evolutions and bounds on region's potentials

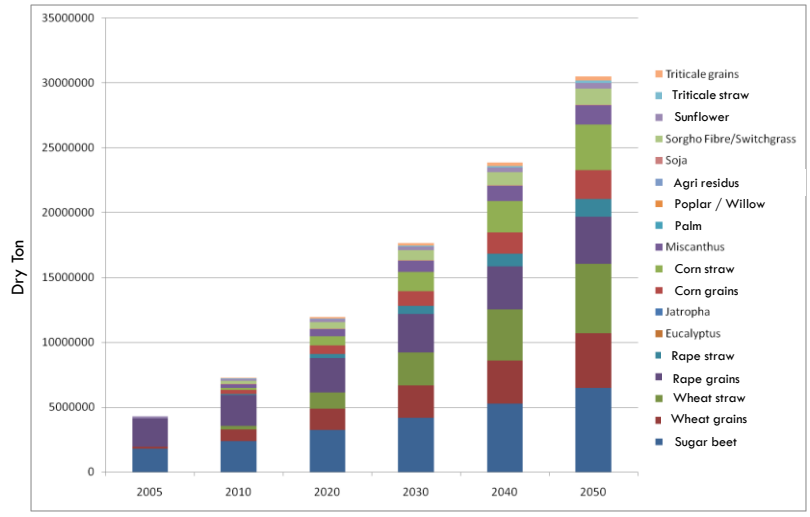


Wood potentials

- Wood potentials (3 scenarios)
  - Imply different costs depending on accessibility
  - Will influence the final choice for the technologies



Agriculture potentials



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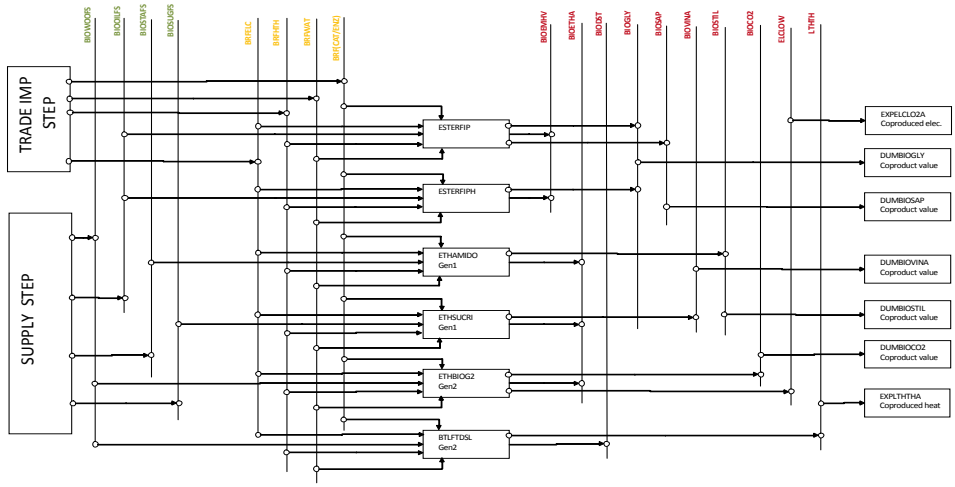
Processes for biofuels production

- Economical values for all of the processes
- Valorization of the production of heat and power
- Valorization of the Co-products

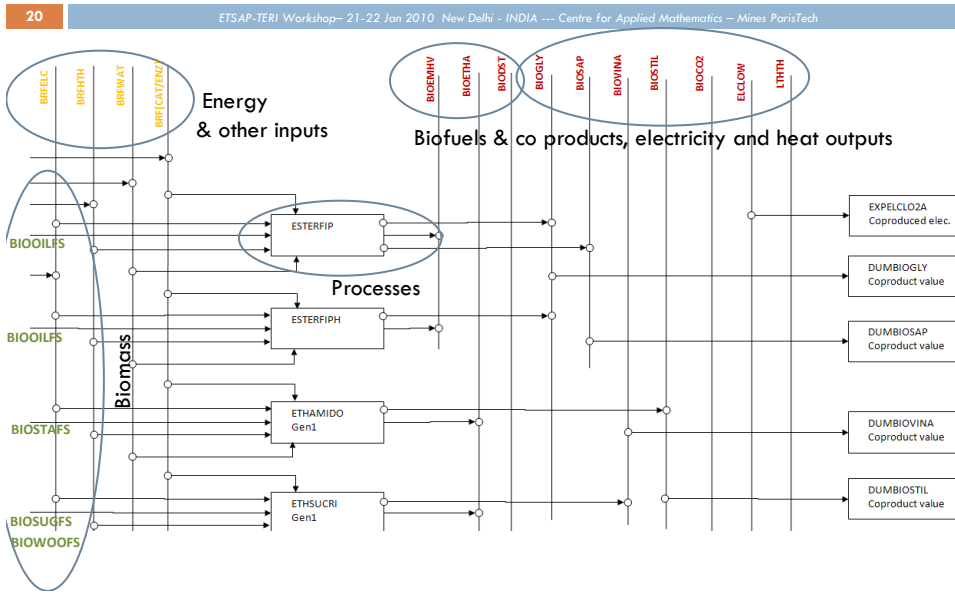
Process	Description
BTLFTDSL	FT (Fischer-Tropsch)-diesel wood
BTLFTDSLB	FT-diesel straw
ESTERFIP	Trans-esterification
ESTERFIPH	Advanced Trans-esterification
ETHAMIDO	Ethanol starch (Amidon)
ETHBOIG2	Ethanol wood
ETHBOIG2B	Ethanol straw
ETHSUCRI	Ethanol sugar

Commodities	Description
BIODST	FT synthetic diesel
BIOEMHV	Biodiesel
BIOETHA	Bioethanol

Biofuels production scheme



A detail of the RES



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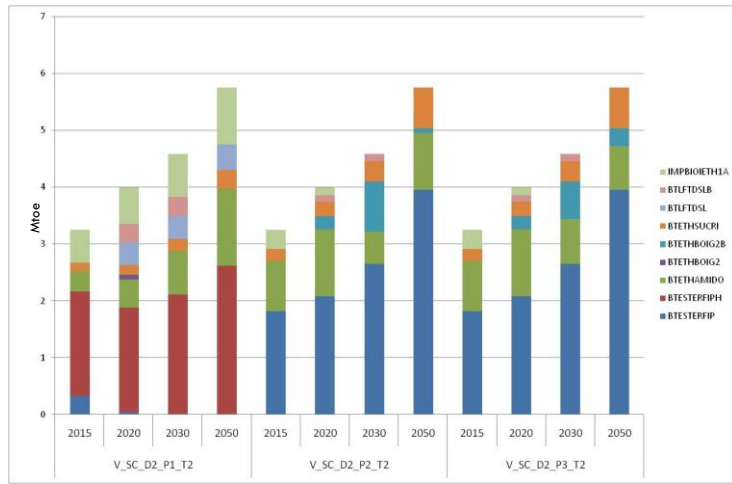
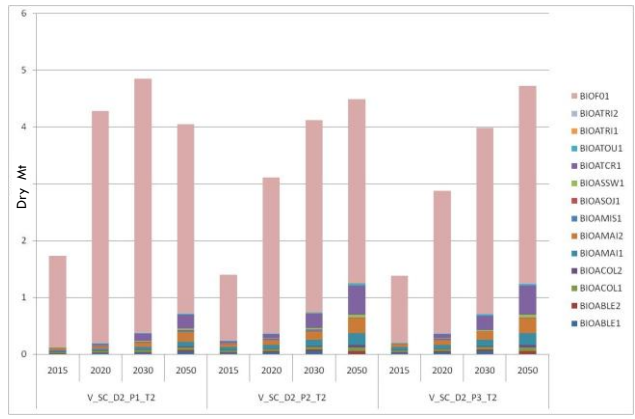
Mix of Technologies

- Mix of technologies for Biofuels production for 3 different potentials



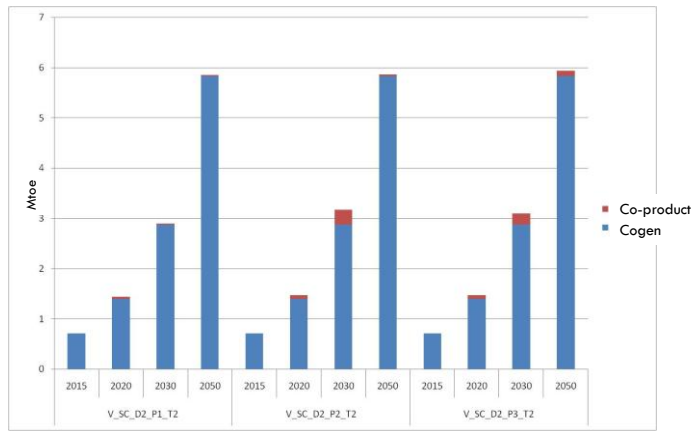
Resources used by zone

- Resources used for one zone, for 3 different potentials and a given demand scenario



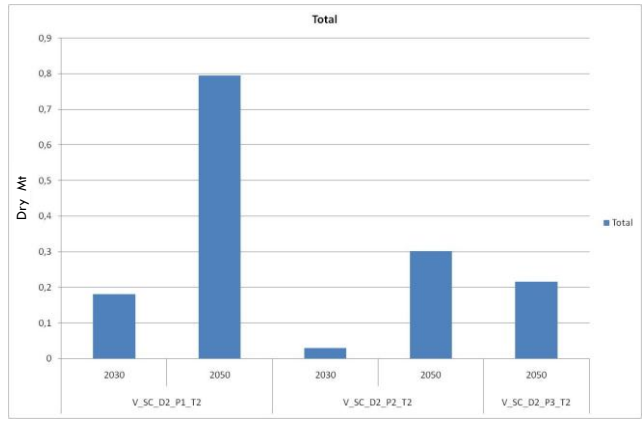
Electricity production

- Electricity production (cogeneration and co-product)



Imports

- Biomass import



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Conclusions & perspectives

- Detailed potentials for biomass with their evolution for each region
  - Permit to assess the future implantation of conversion unit
- Validation of the Implementation of this cutting up in the French model
- A Tool to assess the limits of the French potential of biomass for biofuels is operational
- Results are promising and several detailed cases will be published soon
- Sensitivity analysis will be carried out
- Detailed scenarios can be presented to policy makers

THANK YOU
FOR YOUR ATTENTION