REGIONAL TIMES MODEL FOR ANALYZING THE FUTURE USE OF BIOMASS AND BIOFUELS IN FRANCE AND SWEDEN

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## Overview of the presentation

- **Context**
- **Objectives**
- **Model and assumptions**
  - Modeling
  - Case study of France
  - Case study of Sweden
  - Scenarios
- **Results**
- **Conclusion and perspectives**
Biomass and biofuels are increasingly being seen as important energy sources in Europe. The incorporation and future use of biomass sources are however highly uncertain:

- Which land areas are available without competition with food supply?
- Which sources of biomass can be used?
- What is the possible incorporation rate of conversion technologies?
- What is the limit of domestic bioenergy production?

To answer these questions, prospective studies are helpful to policy makers.
Objectives

- A MARKAL/TIMES model of the use of biomass was created
  - Detailed representation of biomass sources (agriculture & forestry)
  - Sub-national/regional representation of the biomass sources
  - Rich technological database (1\textsuperscript{st} and 2\textsuperscript{nd} generation)
- Case studies of France and Sweden, assessing the use of biomass for energy purposes
  - Possible contribution of biomass to the energy sector
  - Technologies utilized to convert biomass
  - Regional utilization of biomass sources
MARKAL/TIMES model

- Considered time horizon: 2005-2050
- The model only considers:
  - Available agricultural land for energy without food competition
  - Available wood for energy without competing with other sectors
- Detailed technology database including the most promising 2nd generation biofuel production
  - Biomass-To-Liquids (BTL) processes
  - 2nd generation cellulosic ethanol processes
- Considers co-products by the conversion technologies
General outline of the sub-national MARKAL/TIMES model
In the model, France is divided into 9 regions.

Each region has a detailed economic description (cost of production and transport by resource).

Potentials and cost of biomass sources according to the VALERBIO project.
# Case study of France

## Context

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<thead>
<tr>
<th>Starch crops</th>
<th>Sugar crops</th>
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<td>Maize grain</td>
<td>Sugar beet</td>
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<td>Maize straw</td>
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## Objectives

- Oil crops
  - Rapeseed
  - Sunflower
  - Soy bean

## Model and assumptions

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<th>Woody crops</th>
<th>Grassy crops</th>
<th>Forestry products</th>
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<td>Rapeseed</td>
<td>Sunflower</td>
<td>Soy bean</td>
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# Case study of France

## Amount of available forest defined per:

- **Region**
  - 9 regions

- **Wood types**
  - Small wood (crown & small branches)
  - Medium wood (top stem & large branches)
  - Big wood (stem)

- **Accessibility classes**
  - Easy
  - Moderately difficult
  - Difficult
  - Very difficult

![Diagram of forest structure](image-url)
Case study of Sweden

- In the model, Sweden is divided into 21 counties
- Forestry resources expressed on county level
- Agricultural resources expressed on a national level
## Agricultural resources:

- **Expressed on a national level**
- **Potentials according to the RES2020 project**
- **Costs according to an extensive literature review**

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<th>Conclusions and perspective</th>
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Case study of Sweden

- Forestry resources separated into:
  - Forestry residues (crown & branches)
  - Pulpwood (top stem & small stems)

- Detailed cost-supply curves of forestry residues for each county

- Pulpwood expressed on a national level
Numerous potential level scenarios were created considering aspects such as:

- Business as usual (BAU)
- All for industry (wood and/or agricultural crops are mostly used for non-energy purposes)
- All for energy (wood and/or agricultural crops are mostly used for energy purposes)
- Medium/ high availability of short rotation forestry
- Moderate/ high price of biomass
Numerous demand level scenarios were created considering:

- Heat for direct heating
- Biofuels for road transport
- Electricity from CHP

- Heat from CHP
- Biofuels for air transport
Results

Mix of technologies for biofuel production in France
Results

Marginal price and regional utilization of forest residues in Sweden

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The sub-national MARKAL/TIMES model can be used to assess:

- Limit of domestic bioenergy production
- National/regional utilization level of biomass sources
- Difference in utilization rate between regions
- Mix of technologies utilized to convert biomass
- Incorporation rates of 2nd generation conversion technologies
Conclusions & perspectives

- For France we observe:
  - The objective of 20 Mtoe bioenergy production can be reached, but 40 Mtoe might be too ambitious
  - High diversification in utilized conversion technologies and in utilized biomass sources
  - 1st generation biodiesel and ethanol will still be important sources of biofuels by 2050
- For Sweden we observe:
  - High utilization rate of forest residues
  - Large differences in regional utilization of biomass sources
  - Regions can be seen as price setters of biomass sources
THANK YOU FOR YOUR ATTENTION

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