Climate friendly innovations in the forest sector: Technologies, software tools and services

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Policy context

- EU Forest strategy
  - Supporting rural and urban communities
  - Supporting forest-based industries, bio-energy and wider green economy
  - Forests in a changing climate
  - Protecting forests and enhancing ecosystem services
  - Current forests and how are they changing?
  - Innovative forestry and added-value products
  - Working together coherently
  - Forests from a global perspective

Policy context

- EU Bio-Economy strategy
  - Food security
  - Managing natural resource sustainability
  - Reducing dependence on non-renewable resources
  - Mitigating and adapting to climate change
  - Creating jobs and maintaining European competiveness

Policy context

- EU Climate and Energy Framework to 2030
  - At least 40% cuts in greenhouse gas emissions (from 1990 levels)
  - At least 27% share for renewable energy
  - At least 27% improvement in energy efficiency
    - Renewable energy 2015 :17% of total
    - Biomass most important renewable energy source (60% in 2015)

Climate friendly innovations in the forest sector

- Technologies, software tools and services that support forest-based industries, bio-energy, green economy to:
  - Reduce dependence on non-renewable resources
  - Enlarge renewable energy production
  - Reduce greenhouse gas emissions
  - Improve energy efficiency
  - Avoid competition with food production
  - Match sustainability criteria

Aim and method

- Aim: to generate insight in available high TRL techniques, software tools and services to valorise wood and wood waste for the bio- and circular economy.

- Method: Quick scan of
  - Literature
  - EU Cordis database
  - Company web pages and documentation
  - Specific websites for the bio-economy

Results – Technologies Bio-fuels

- Solid fuels: fire wood, wood chips, wood pellets, torrefied wood
  - ➢ Proven technologies
- Liquid fuels: ethanol, pyrolysis oil
  - ➢ New technologies (fermentation, pyrolysis), ethanol and pyrolysis oil can be further processed to chemicals
- Gaseous fuels: syngas, biogas, hydrogen gas
  - ➢ New technologies to optimise gas production, purity and further processing (e.g. syngas can be used for substitute natural gas, (m)ethanol, FT, DME, Diesel, Kerosene, pharmaceuticals, plastics etc.)

Results - Fuels

Feedstock	Technology	Product
Low quality logs, forest residues	Wood splitting, chipping, pelletisation	Fire wood, wood chips, wood pellets
Low quality logs, forest residues, sawmill residues	Pyrolysis	Pyrolysis oil (gasoline, diesel, kerosene)
Low quality logs, forest residues, sawmill residues, Pulp waste, cellulosic ethanol	Fermentation	Ethanol (methanol, buthanol, jet fuel)
Low quality logs, forest residues, sawmill residues ...	Gasification, pyrolysis	Syngas, ethanol, buthanol, DME, FT, diesel, gasoline, jet fuel

Results - Bio-chemicals / Functional materials

Feedstock	Technology	Product
Pyrolysis oil	Hydrolysis	Bioplastics, resin, adhesives
Black liquor	Fast pyrolysis	Lignin
Lignin (from Black liquor)	Extraction, carbonisation	Carbon fibres
Wood chips, paper sludge, special cellulose	Fermentation, fractionation, hydrolysis	Ethanol, food additives, cosmetics, pharmaceuticals, paints
Bark	Grinding	Insulation boards
Paper sludge	Incineration	Admixture for cement
Pulp, recycled paper	Dissolving, digestion	Textile fibres
Wood pulp	Grinding, extraction, micro fibrillation	Fibrillated cellulose, Xylase (functional material and food)
Wood residues	Dehydration,	Bio-plastics
Wood residues	Refining	Reinforcer for bioplastics
Wood fibres	Moulding	Household and office items

Results – Software tools

Software application	Type of data	Name of the tool
Forest stock assessment for forest management planning	Remote sensing data	Forest Warehouse, Swedish GIS-toolbox,
Optimisation of harvest in fragmented landscape	Field data	CSMi biomass module
Management planning mountainous areas	Data from images	IMPACT
Management planning under climate change	Field and expert data	Adaptive forest management tool
e-trading market platform for biomass	Information on pruning	Europrune
Instrument for measuring Wood stacks	Image analysis	Photo analytical camera for measuring woodstocks
Natural resource assessment for subsidies on conservation	Field data	Landserver

Results – Services

Service	Name	Scale
Analysis of biomass compound	Rapid near infrared analysis of biomass	Biomass sample Ireland
Information on biomass valuation chains	Biobased economy route map	Web service Netherlands
Support for project start-ups on renewable energy	Renewable energy support service	Toolkit for SME Wales, UK
Used wood collection and recycling	Wood recycling	City scale in many countries
Support for innovative industrial bio-based value chains	SuperBIO	Project, Europe
Service company providing heat to dwelling houses	Mostoles district heating	Building block, Mostoles, Spain

Conclusions – Potential 1 Fuel & Chemicals

- Pyrolysis oil:
  - Large amount of feedstock
  - Proven technology, relative easy
  - Fuel applications (boilers)
  - Advanced fuels (transport, hydrogen)
  - Potential for chemicals (lignin, acetic acid, phenol, …)
  - TRL 8 / TRL 4
  - Pilot plants in e.g. Netherlands and Finland

Conclusions – Potential 2 Fuel & Chemicals

- Ethanol:
  - Large amount of feedstock (wood residues, forest residues, paper sludge, pulp, special cellulose)
  - Fermentation, fractionation, oxidation, pyrolysis
  - Fuel applications (boilers, generators, transport)
  - Chemical building block for e.g. bio-plastics
  - TRL 4 – 9, and commercial
  - Pilot plants in Netherlands, Sweden, Finland, Germany, Spain, USA

Conclusions – Potential 3 Paper-Functional material

- Carbon fibres
  - Feed stock: lignin abundant
  - Applications: high value bikes, automotive and aviation industries, rotor blades for wind turbines
  - Extrusion, stabilisation, carbonisation, graphitisation
  - TRL 6
  - Demonstrated at lab scale in Sweden

Conclusions – Potential 4 Paper – Paper waste – Textile

- Textile fibres
  - Feed stock: paper/pulp, used textile, recycled paper
  - Applications: textiles
  - Regeneration, carbamate process
  - TRL 6
  - Demonstrated at bench scale in Finland

Conclusions – Potential 5 Forest resource assessments by remote sensing technology

- Tools gathering information on forest resources and assortments by remote sensing techniques and lidar data
  - Frequent update of information
  - Better planning of forest management
  - Better planning/investments of forest industries
  - Different stages of development throughout Europe

Conclusions – Potential 6 Planning tool for harvest and transport in fragmented forest landscapes

- Tools gathering information on biomass resources in fragmented forest landscapes
  - Better planning of forest management and harvest
  - Better planning transport
  - Application in the Netherlands
  - Can be scaled up to other countries

Conclusions – Potential 7 Service company providing heat from biomass

- Mostoles district heating
  - Service company: covers the whole value chain from the biomass in the forest, transport, storage, installing boiler units and hot water piping, maintenance of the boiler system and heating installations, deliverance the heat to dwelling houses
  - Customer pays per kWh
  - No worries about biomass, or installations

Discussion

- To improve the forest value chain all links should be stimulated. Many effort is put in the end of the chain, but also the beginning of the chain should be improved (forest management, resource assessments).

- Biorefineries are increasingly using processes that produce multi-products, Multi-products increase industrial flexibility and reduce environmental and economical risks.

- Many technologies, software tools and services are developed by private companies. Processes are patented and products have trade marks. How to deal with this when supporting development and commercialisation?

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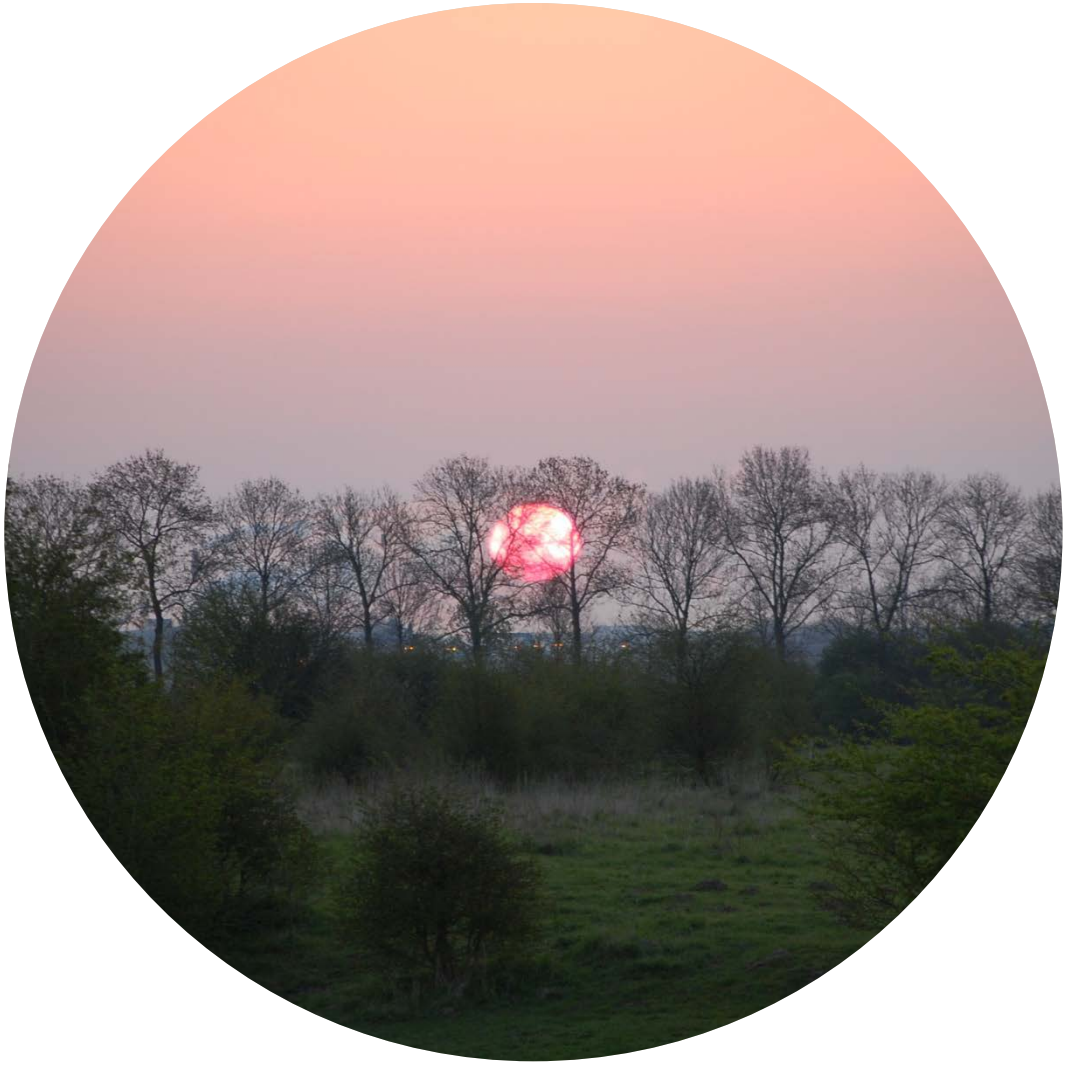

More information ?

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