

INTEGRATED PROCESSING OF BIOMASS RESOURCES TO OPTIMIZE ECONOMICS AND SUSTAINABILITY

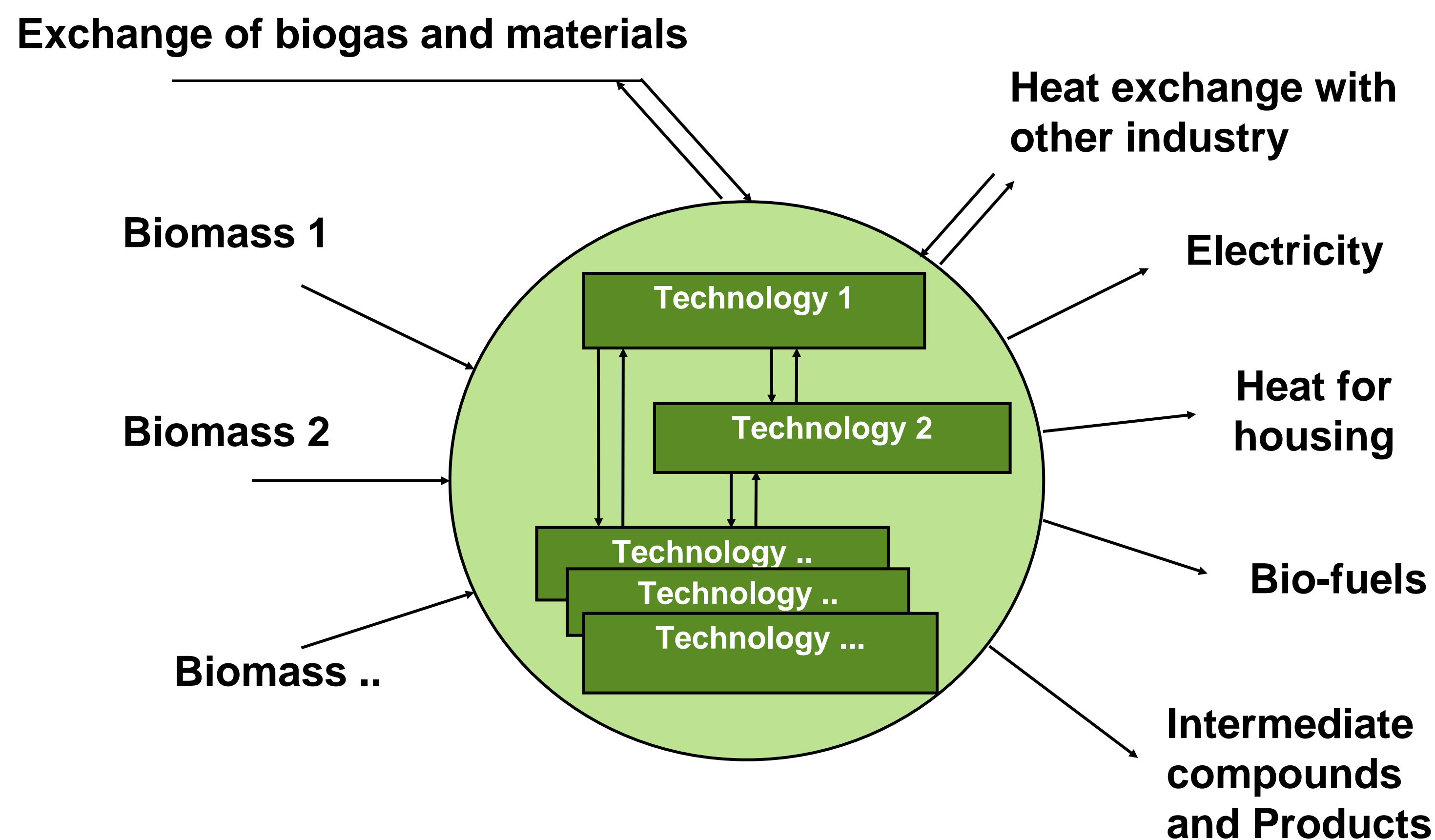
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0 Energy Conversion Park (ECP) Interreg project, 2010 - 2013

A biomass energy conversion park (ECP) is defined as a synergetic multi-dimensional biomass conversion site with a highly integrated set of conversion technologies in which a multitude of regionally available biomass (residue) sources are converted into energy and materials. It will increase energy efficiency and improve profitability so biomass can compete better with fossil sources.

5 partners from Belgium and the Netherlands have developed 'proof of principle' business cases for 5 cases in the region



Schematic representation of an ECP

1 Results of the Energy Conversion Park project

Conclusions & Recommendations

- Simple models make possible to optimize integrated processing of waste biomass resources.
- Integration of different biomass processing steps leads to improved product and energy output, better economic performance, and better CO2 emission reduction and sustainability.
- Process integration increases the economic possibilities to use low-value biomass waste streams.
- Combined biomass processing facilities make it easier to respond to seasonal variability in supply and demand

Public Products & Information

- Simple models and tools to assess and optimize energetic and economic optimisation of possible process integration configurations
- Webbased knowledge system to disseminate experience gained when developing such optimised biomass procurement plants (*accessible through www.ecp-biomass.eu – main information in Dutch*)
- 5 case studies for real business models in Flanders and the Netherlands: Breda, Moerdijk, Lommel, Beerse-Merksplas, Sluiskil
- Papers, posters and publications, in English (*accessible through www.bio-based.nl → projects → ECP project*)

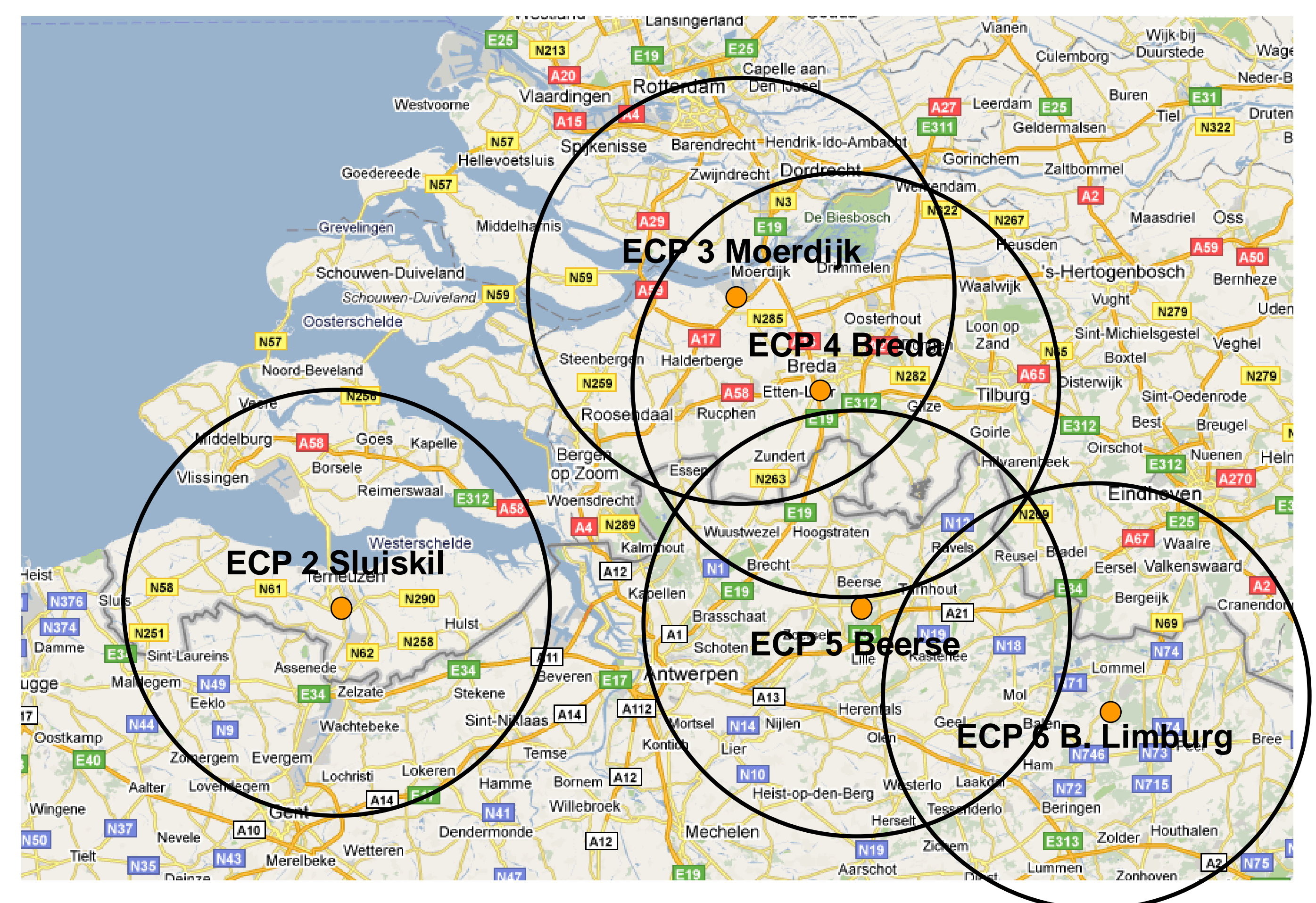


fig 1 ECP cases for which business cases have been developed with their main resources area (local low value biomass streams)

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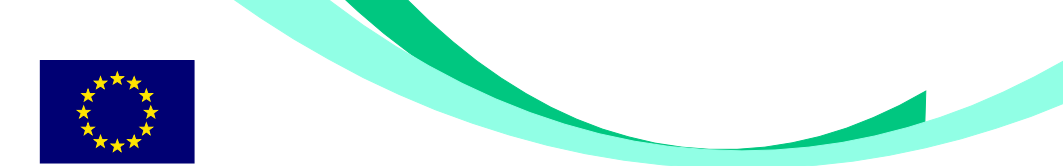
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ECP-partners



Subcontractors



2 Process Integration example: case ECP Moerdijk

Of the 5 cases for which business models have been made: **Moerdijk** is a good example to show how an actual and economic feasible business case would look like thanks to extensive process integration and bio-cascading

- Innovative aspects are the integrated processing of low grade biomass leading to higher value products and at the same time maximal use of the available resources.
- The more expensive technologies: grass refining, pyrolysis and biogas upgrading, are made economically more feasible through the use of 'cheap' heat and materials produced by the other processes.

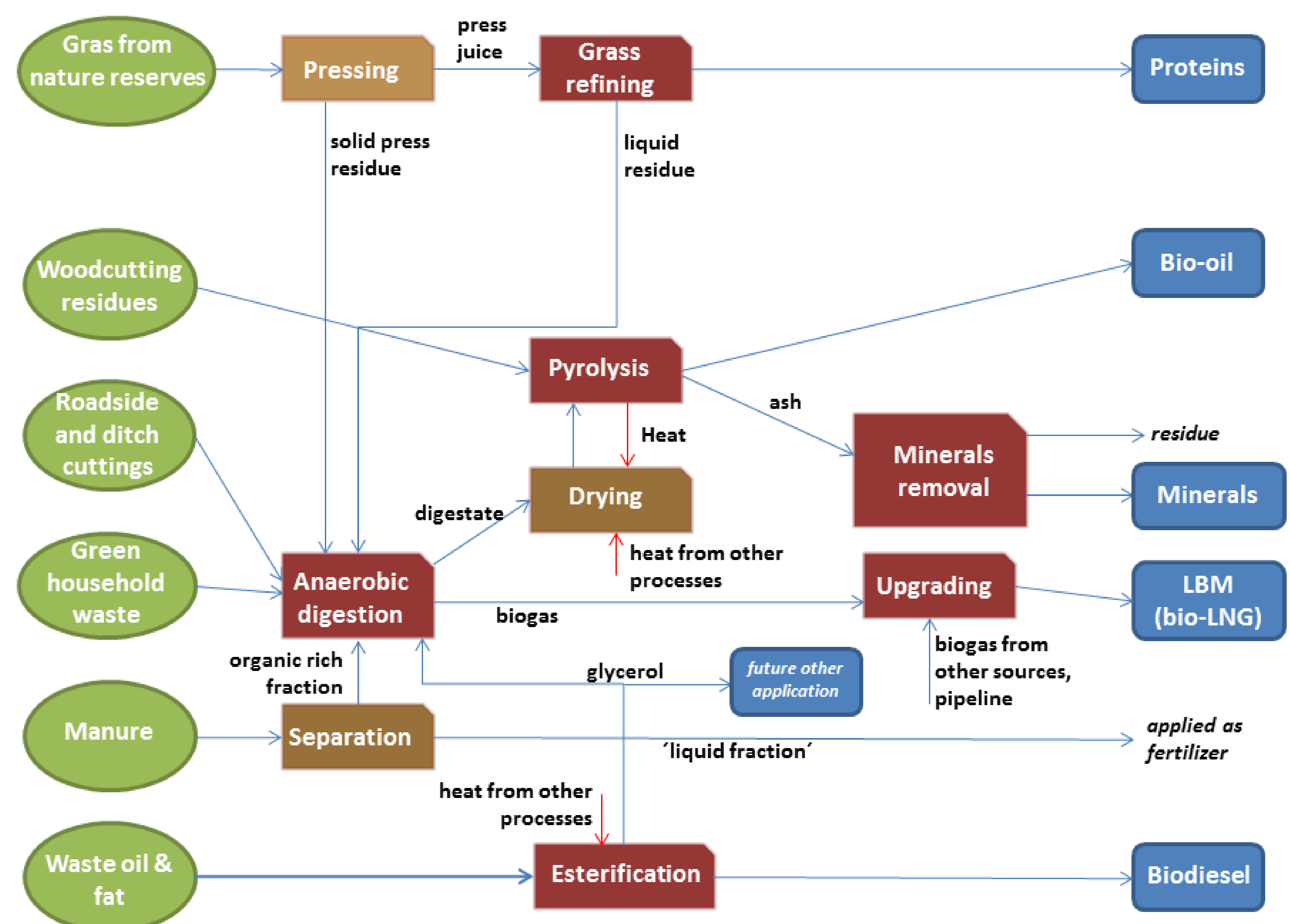


Fig. 2 proposed set-up for the ECP Moerdijk
(heat integration options are shown only partially)



3 Sustainability

- Optimal and better use of low valued regional resources is possible.
- '2nd generation' biofuels because of use of real waste streams, no 'ILUC'.
- Reduction of import of biomass for 'renewable energy' requirements through novel technology options using local biomass for biobased chemistry and materials.
- Energy and resources available for further fossil C reduction through biocascading

→ *Extra options for fossil C replacement*

4 Effect of input and output variations

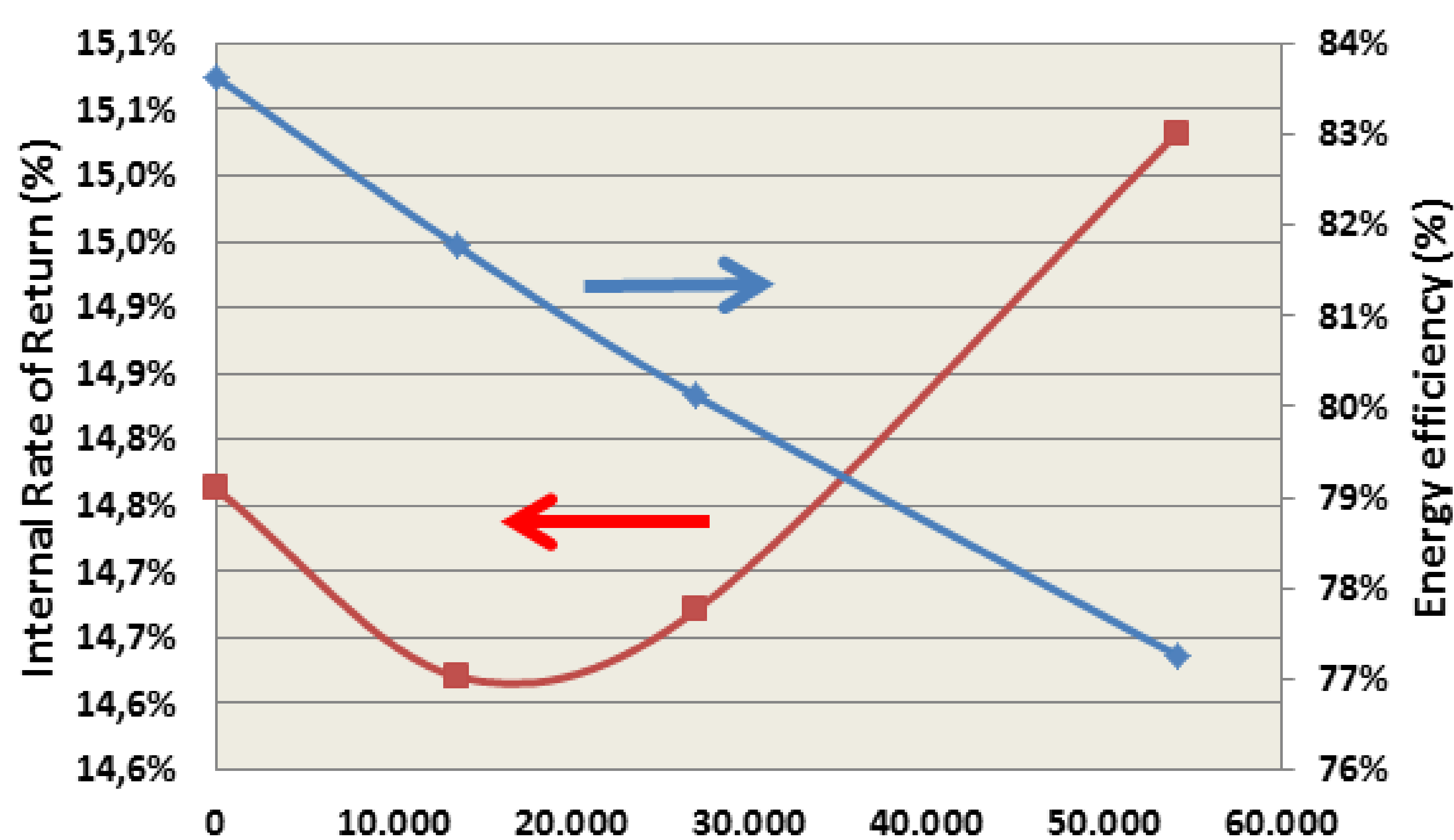


Fig. 3 Internal rate of return of the ECP Moerdijk as a function of the grass from nature reserves input

- The IRR is hardly influenced by variations of grass input, the energy efficiency somewhat more.
- It implies that the 'extra' profit from extracting proteins just balances the extra costs involved.

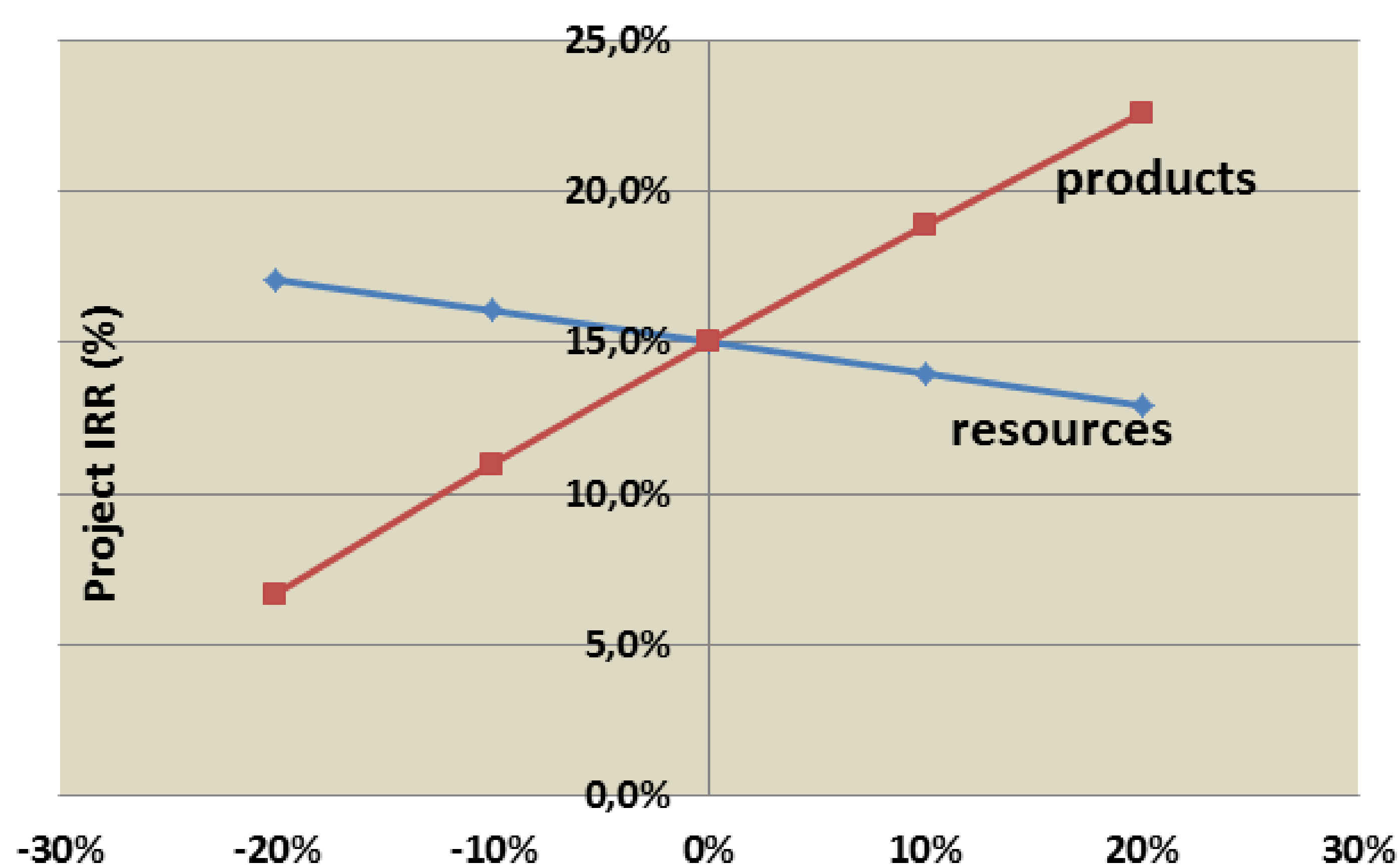


Fig. 4 Internal rate of return of the ECP Moerdijk as a function of prices of products and resources

The profitability is enhanced through use of so-called 'biotickets' which are Dutch tradable certificates to comply with biofuel requirements

- The profitability of the ECP is more influenced by the prices the products yield than the costs of resources
- The value of 'biotickets' do influence the profitability too a large extent therefore.

→ *The basic principle of the ECP, a multidimensional approach and strong process integration, seems to work.*

Profitability is higher and fluctuations in supply, demand and prices are being dampened out.



5 Further development options

- Coupling the ECP to the industrial heat exchange network presently under development on the site
- Greenhouses development close to the site, offers extra sources of biomass and an extra outlet for CO₂
- Chemical industry on site and in the surrounding region is developing biobased chemistry

→ an ECP will form a focal point and platform for further 'biobased industrial development'

6 Project references

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- Van Dael, M. et al, 'A techno-economic evaluation of an energy conversion park', *Applied Energy* 104 (2013) 611-622
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Conference papers

- ORBIT2012, Rennes, June 2012
 - Pelkmans L. et al, 'Valorisation of biomass waste streams in local energy conversion parks',
- 8th International Conference on Renewable Resources and Biorefineries RBB8 Toulouse 2012
 - Pieper, H. et al, 'A techno-economical evaluation of a biomass energy conversion park',
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 - Guisson, R., 'BioEnergy Conversion Park in the province of Limburg (Belgium), An economic viability check of a biomass utilization concept for bioEnergy',
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- CHISA Prague, August 2012
 - Márquez Luzardo, N., Venselaar, J, 'Biobased targeted chemical engineering education, role and impact of biobased energy and resource development projects'

7 Project websites

- www.ecp-biomass.eu (main information in Dutch)
- papers and documents directly through: www.bio-based.nl → projects → ECP project

8 Contact



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