



f3 – Swedish Knowledge Centre for Renewable Transportation Fuels

Biorefineries in Sweden: Perspectives on the opportunities, challenges and future

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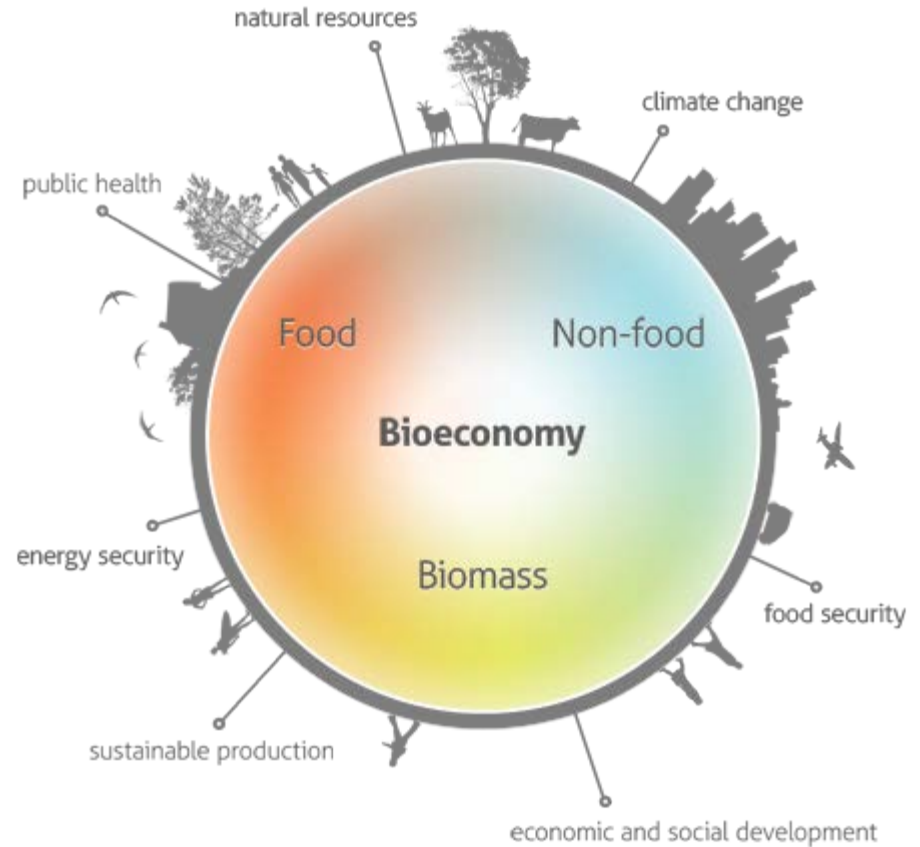
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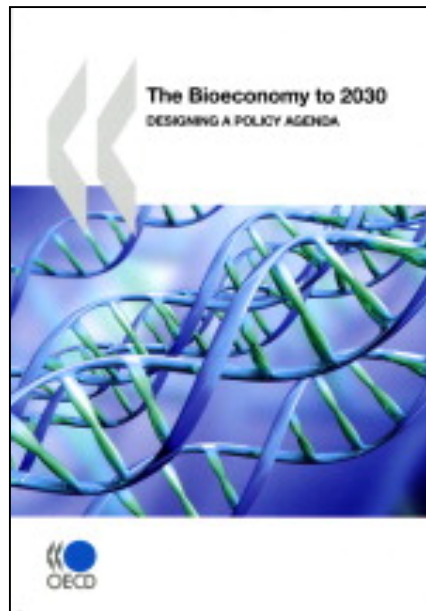
What is the bio-economy?

- A bio-economy refers to an economy where the basic building blocks for materials, chemicals, and energy are derived from renewable biological resources.
- Biofuels
- Biorefineries
- Biotechnology
- Connecting sectors and finding synergies!



Growing interest!

The bio-economy concept is attracting increasing political, business, public and scientific attention. This is exemplified by the OECD policy agenda in 2009, and the US and EU strategies and visions in 2012.





Emerging challenges?

- **Biomass** – significant availability or competition for resources? Land use.
- **Sustainability** – how to define, how to measure? Social and environmental.
- **Visions** – electric vehicles and biofuels, co-exist?



Biorefineries in Sweden

- Pulp and paper industry in Sweden has been stagnating so potential to diversify activities.
- Good prerequisites for a bioeconomy due to its natural geographic conditions, industry, and infrastructure.
- Developed a bioeconomy strategy and piloted several biorefinery projects.
- Deployment of biorefineries has been slow, not reached commercial scale.



Key questions

- Which factors facilitate and hinder the development and deployment of biorefineries in Sweden?
- What changes are necessary to accelerate the transition toward biorefineries?
- Interviews with associations, industry, and academia, agencies → policy makers

Political and legal aspects

- Stable, long-term, targeted policies with clear and ambitious goals in Sweden (and the EU) are critical for supporting the development and deployment of biorefineries.
- *“In general the policies are aimed at...biofuels, bioenergy or bioproducts and have **problems handling integrated concepts** such as biorefineries of different types”.*

Economic and raw material aspects

- Sweden boasts excellent natural conditions for large-scale biorefining, but uncertainties for investors amplified by high investment costs for biorefinery facilities are undermining the bioeconomy.
- *“EU policies are not sufficient to promote widespread development of integrated biorefineries as the limitation of the biofuels target to 2020 does not provide **sufficient investor security** for the production of advanced biofuels within integrated biorefineries, and **incentives and/or production targets for bio-based products** (e.g. high value chemicals) from integrated biorefineries are lacking”.*



Social and cognitive aspects

- There is a significant debate over the sustainability of feedstocks for biorefineries, varied public perceptions of bio-based products and bioenergy in general, and uncertainty on the future of how the bioeconomy should or could develop.
- *“The media wants to have something like: ‘Here is the winner, here is the best one’ – otherwise there will not be anything... There are advocates for different things, and also **advantages and disadvantages of different pathways**, and this hinders the development”.*

Technology and infrastructure aspects

- Sweden has an established industry and infrastructure in the forestry and bioenergy sectors, which provide a strong foundation for biorefineries, however, integration of biorefining processes into existing plants and systems is challenging and support is lessening.
- *“Policy makers are fond of supporting the ‘**next thing**’, which right now is **electric vehicles and fuel cells**. It is not popular to support gasification of forest biomass any longer, as it is not considered to be a novelty”.*



Action points

- **Commitments** – establish targets and policies that drive the transition
- **Contradictions** – improve alignment on visions, goals, and activities
- **Capacity** – build up infrastructure and competences to harness the potential
- **Collaboration** – develop cooperation across sectors and between actors



Further information

Voytenko & McCormick (2016) Biorefineries in Sweden: Perspectives on the Opportunities, Challenges and Future. BioFPR.

Staffas, Gustavsson & McCormick (2013) Strategies and Policies for the Bioeconomy and Bio-based Economy: An Analysis of Official National Approaches. Sustainability.

McCormick & Kautto (2013) The Bioeconomy in Europe: An Overview. Sustainability.

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Bioeconomy strategies

- There at least five points about the bio-economy strategies and visions that demand critical attention:
 - **Sustainability focus:** Sustainability is not heavily emphasized and it is over shadowed by economic growth.
 - **Measures of success:** Few measures are presented in the documents, but the importance of measures is highlighted.
 - **Scarcity of resources:** This is only mentioned in a few of the documents.
 - **Consumption patterns:** It is not addressed except in some of the documents, like Sweden.
 - **Stakeholder interaction:** This is acknowledged in the documents as critical, but needs increased efforts.