Kompendium från HåBiMet-seminarium den 31/1 – 2025

HåBiMet består av tre projekt inom det strategiska innovationsprogrammet Impact Innovation. HåBiMet syftar till att utreda vad som hindrar en hållbar marknad för metallurgiskt biokol från att växa fram i Sverige, samt vilken sorts insatser som skulle kunna främja den. De tre projekten adresserar utmaningar från olika perspektiv; tekniskt, socialt, och policymässigt. Detta stödjer Sveriges övergång till fossilfria produktionsmetoder och främjar samverkan mellan olika industrier för att minska klimatpåverkan.

HåBiMet utförs inom Impact Innovation-programmet Swedish Metals & Minerals, en gemensam satsning av Energimyndigheten, Formas och Vinnova

Detta kompendium innehåller presentationer från det Nulägesseminarium som anordnades i projektet den 30/1 – 2025. Seminariet syftade till att ge en överblick av kunskapsläget kring användning och produktion av biokol för metallurgisk användning, samt för vissa andra tillämpningar. Kunskapsutbytet fungerade som grund för det fortsatta samarbetet i projektet. Seminariet och kompendiet är indelat i tre block:

Seminarieblock 1 – Överblick, biomassa och metallurgi

I. **Planetens gränser och systemtransformationen** – *Anna Steorn och Louise Hård af Segerstad (Albaeco)*
II. **Biomassa och produktionsarealer, olika produktionsprocesser för biokol, samt försörjning från jordbruksbiomassa** – *Elisabeth Wetterlund (LTU), Erland Nylund (Swerim)*
III. **Outlook biomassa i energisektorn** – *Johnny Kjellström (Svebio)*
IV. **Tekniska försök biokol i metallurgi** – *Chuan Wang, (Swerim)*

Seminarieblock 2 – A**nvändning av biokol och tekniska erfarenheter**

V. **Typiska fällor, fel, krav och önskemål biokol i metallindustrin** – *Gunnar Ruist (GRu konsult)*
VI. **Biokol i marken – en introduktion** – *Cecilia Sundberg (SLU)*
VII. **Upparbetning av HTC** – *Yu-Chiao Lu (KTH)*
VIII. **Användning av biokol i metallindustrin och dess tekniska specifikationer**– *Konstantinos Rigas*
IX. **Höganäs erfarenheter med biokol** – *Ryan Robinson*
X. **Biokol för ferrokrom** – *Ludvig Ånnhagen*

Seminarieblock 3 – Möjligheter och policy

XI. **Samproduktion biokol-fjärrvärme** – *Mikael Karlsson, (Energiforsk)*
XII. **Hur policys och marknadseffekter påverkar priser** –*Robert Lundmark (LTU)*

Compendium from HåBiMet seminar on 31/1 – 2025

HåBiMet consists of three projects within the strategic innovation program Impact Innovation. HåBiMet aims to investigate what prevents a sustainable market for metallurgical biochar from emerging in Sweden, and what kind of initiatives could promote it. The three projects address challenges from different perspectives; technically, socially, and policy-wise. This supports Sweden's transition to fossil-free production methods and promotes collaboration between different industries to reduce climate impact.

HåBiMet is carried out within the Impact Innovation programme Swedish Metals & Minerals, a joint initiative by the Swedish Energy Agency, Formas and Vinnova

This compendium contains presentations from the Current Situation Seminar that was organized in the project on 30/1 – 2025. The seminar aimed to provide an overview of the state of knowledge regarding the use and production of biochar for metallurgical use, as well as for certain other applications. The exchange of knowledge served as a basis for the continued collaboration in the project. The seminar and compendium are divided into three blocks:

Seminar block 1 – Overview, biomass and metallurgy

I. **Planetary Boundaries and System Transformation** – *Anna Steorn and Louise Hård af Segerstad (Albaeco)*
II. **Production processes for biocarbon & producing areas for biomass / *Supplying biocarbons to the steel industry from agricultural residues*** – *Elisabeth Wetterlund (LTU), Erland Nylund (Swerim)*
III. **Outlook biomass in the energy sector** – *Johnny Kjellström (Svebio)*
IV. **Technical trials biochar in metallurgy** – *Chuan Wang, (Swerim)*

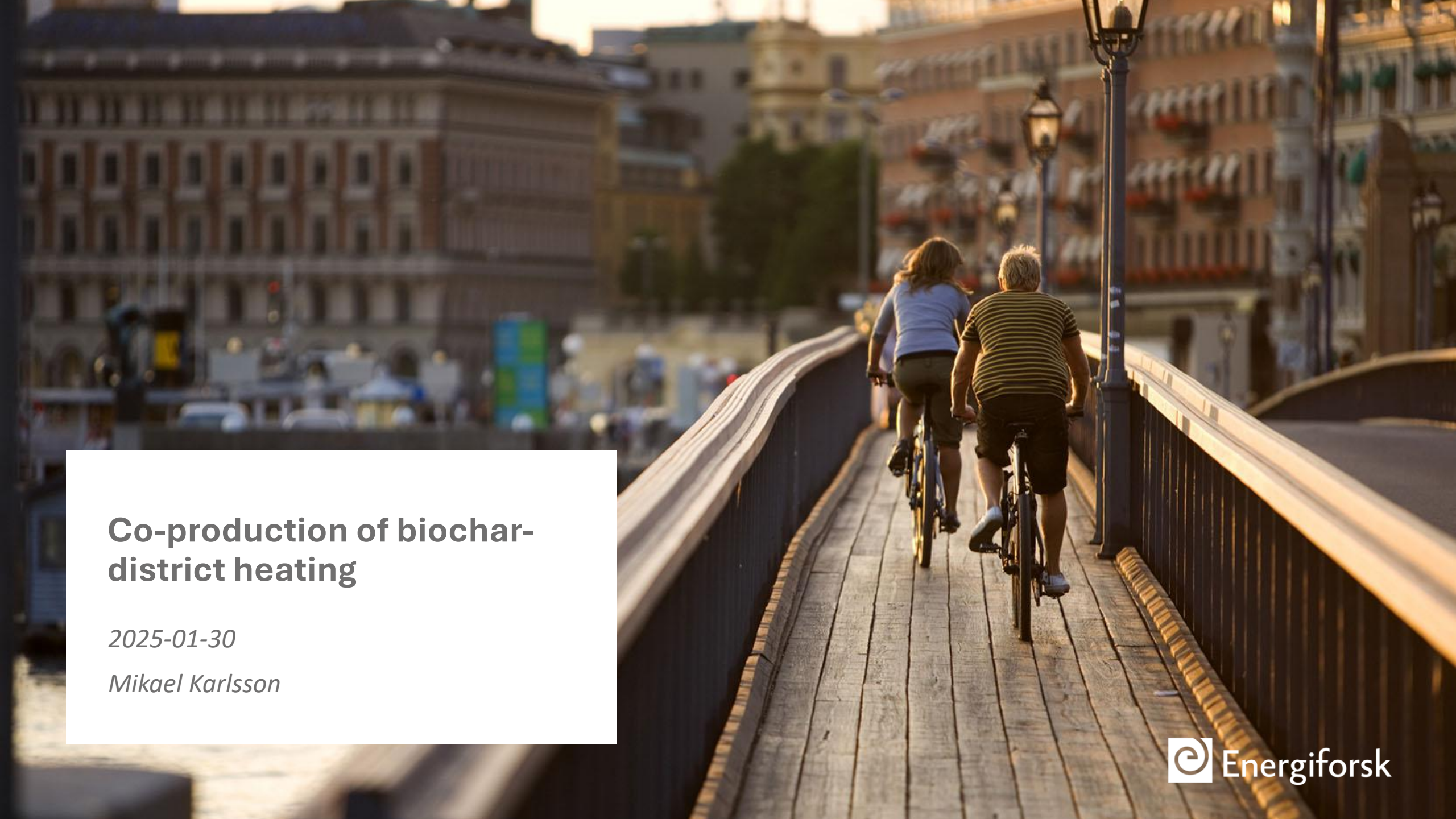
Seminar block 2 – Use of biochar and technical experiences

V. **Position, requirements and wishes biochar in the metal industry** – *Gunnar Ruist (GRu consultancy)*
VI. **Biocarbon in the ground – an introduction** – *Cecilia Sundberg (SLU)*
VII. **HTC upgrading** – *Yu-Chiao Lu (KTH)*
VIII. **Utilizing biocarbon in the metallurgical industry and its technical specifications** – *Konstantinos Rigas (Envigas)*
IX. **Höganäs' experiences with biocarbon**– *Ryan Robinson*
X. **Biocarbon for ferrochrome** – *Ludvig Ånnhagen*

Seminar block 3 – Opportunities and policy

XI. **Co-production of biochar-district heating** – *Mikael Karlsson, (Energiforsk)*
XII. **How policies and market effects affect prices** – *Robert Lundmark (LTU)*

Block 3 – Möjligheter och policy



Co-production of biochar-district heating

2025-01-30

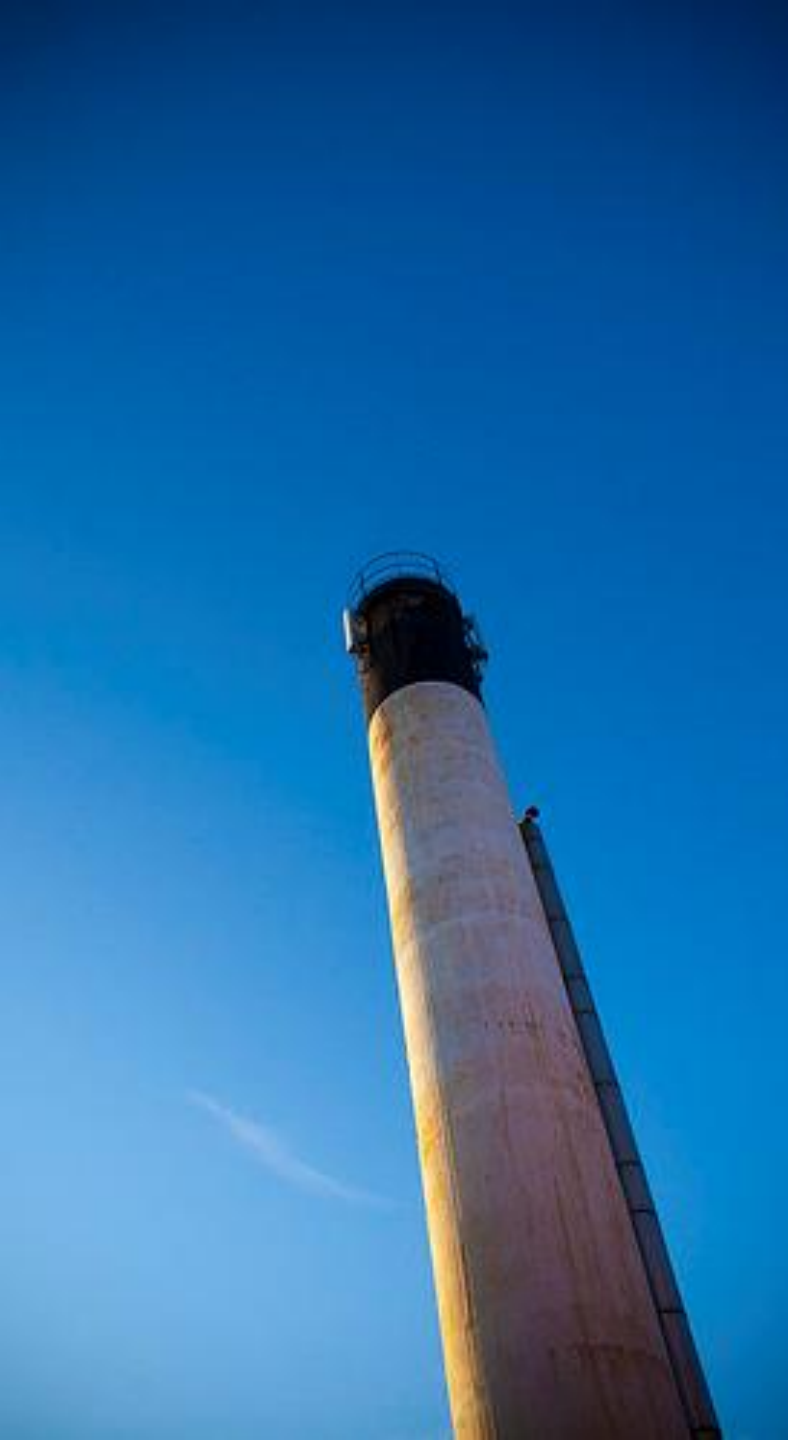
Mikael Karlsson

Energiforsk

Biochar + district heating = true

- Production facilities are available.
- Can new business be created for a pressured industry?
- Is it possible to produce the qualities that the metal industry needs?
- Or can the metal industry adapt its needs to what is technically possible with existing plants?

Energiforsk



What might a typical district heating production plant look like?

- Baseload boiler – A wood chip boiler that will handle most of the base load during the year
- Medium load boiler – Pellet boiler that handles summer operation and the increased load during the winter months
- Peak load / reserve – Bio-oil boiler that takes shorter power peaks as well as loss of base load or medium load.

Energiforsk

Example from E.ON

- The following slides are from a presentation that Johan Wiman, E.ON did at Energiforsk's Värmekluster a while ago.
- I have been approved to show this during the workshop but I have not yet been told if it can be included in the "final report".
- Preliminary signals indicate that E.ON may be able to collaborate with the project.

Energiforsk

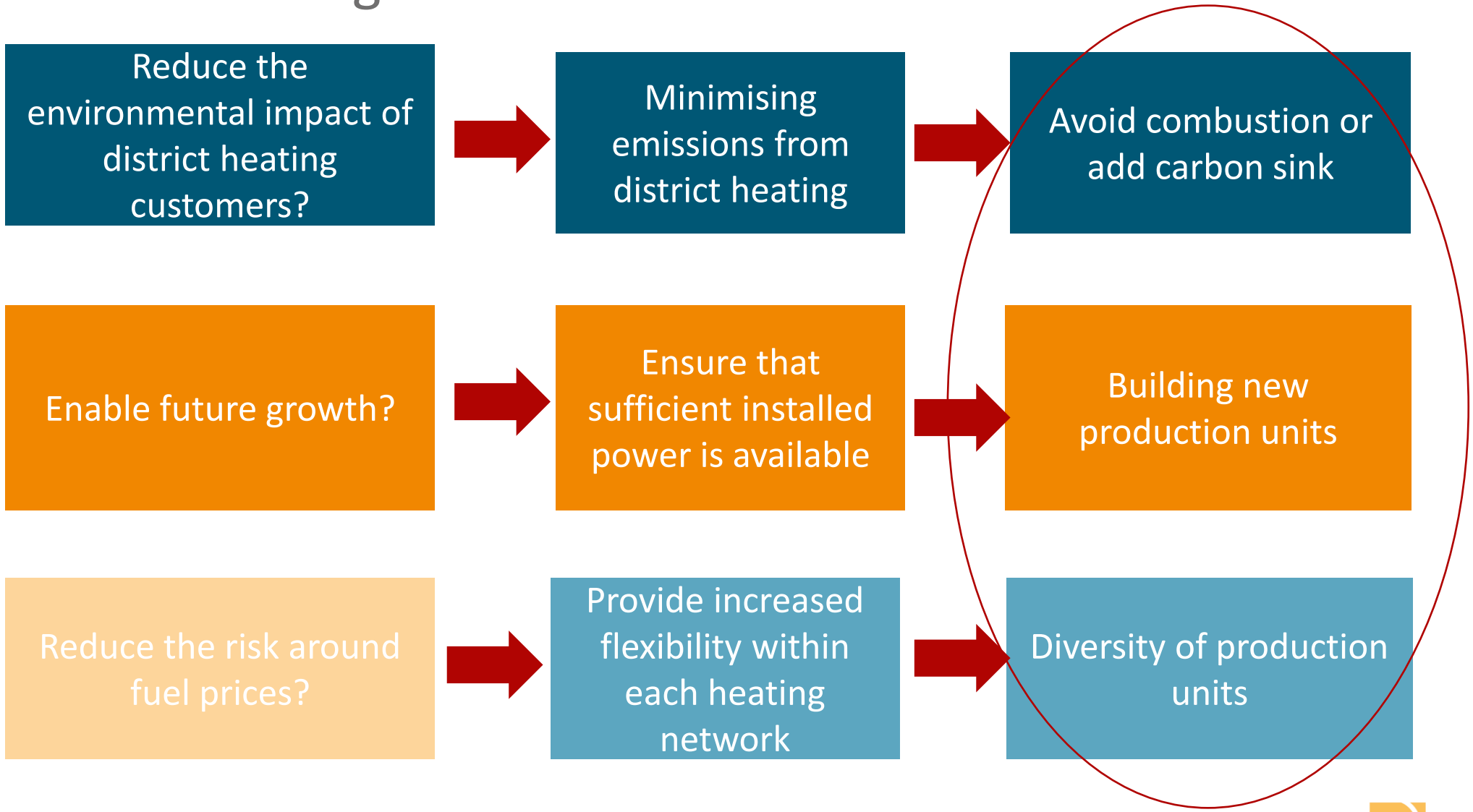
Challenges

Customers' wishes for reduced climate impact
Current customers have a high environmental focus

High potential new connection
About 20% growth over the next 15 years

Current energy market
High fuel costs and reduced availability

Idéer till lösningar



Prof of Concept

Idéstudie

Performed test operation

Verified flexibility of heat production

Bio carbon – Quality not yet verified

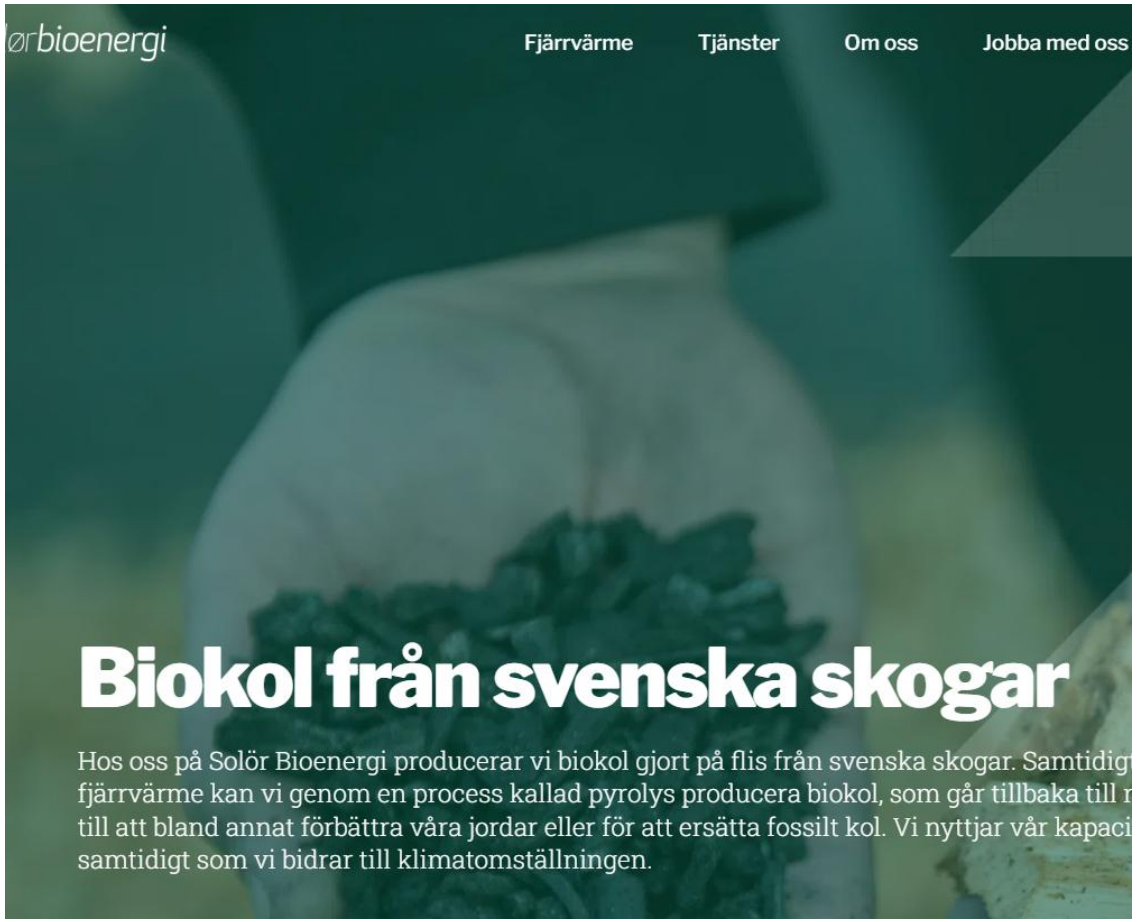
Next steps

Full year of operation with full flexibility on medium-load boiler.

Verifying results in another facility

Doing longer test drives

Examples of DHC companies that produce biochar



- SolörBioenergi
- >100 District heating plants
- Currently produces biochar in 4 plants.

Energiforsk

Thanks and questions!

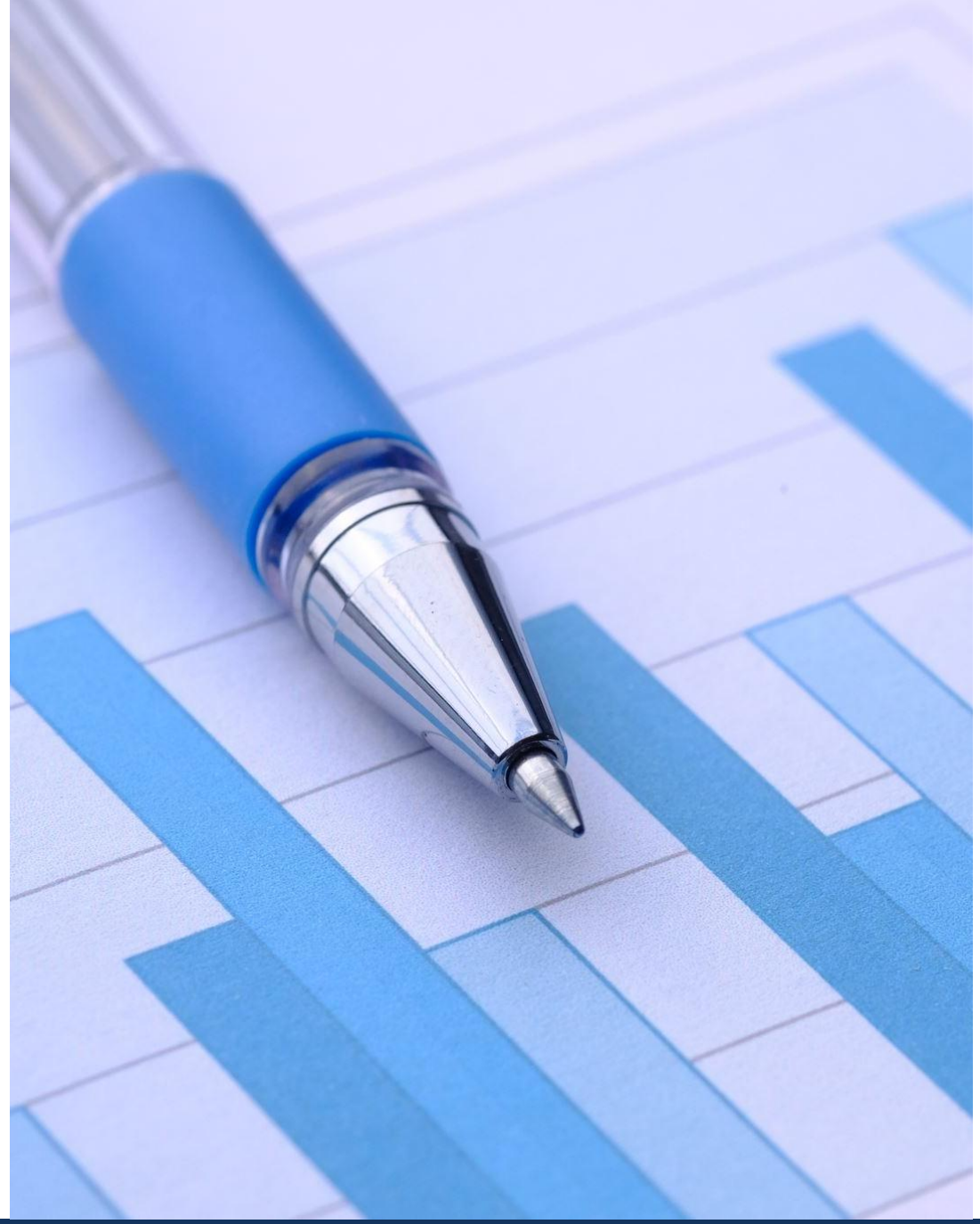
Energiforsk

Policies, markets and prices

The conditions for a large-scale production of industrial grade biochar

The concept of a market

- An **economic market** is any structured system where buyers and sellers engage in the exchange of goods, services, or resources.
- Resources are **scarce**, there are not sufficient resources to ensure that **all activities** get **all the resources** they want.
- Scarce resources are distributed based on achieving the highest level of **welfare** possible based on the resources available.
- Market **delineation** along product and geographical dimensions.



System perspective on markets

- Highlights how changes in **interrelated market** can lead to resource strain, price adjustments, availability, and long-term sustainability.
- Market changes in one area can cause ripple effects across other sectors, requiring a systemic view to fully understand **cascading impacts**.

Criteria for market establishment

- A clear, identifiable demand for the new product
- Differentiate itself from existing alternatives
- Economic viability with reasonable returns on investment
- Regulatory frameworks should support or at least not hinder the market
- The technology behind the product should be viable and scalable
- Infrastructure for distribution, logistics, and supply chain management
- Risk mitigation strategies
- Understanding the competitive landscape

Biochar market development

Challenges remain that need to be addressed for biochar

- **Economic competitiveness**: Biochar is often more expensive than fossil fuels, requiring continued subsidies and support.
- **Market establishment**: Transaction costs and barriers must be reduced and include multiple market participants.
- **Technological development**: There is a significant need for research and development of more efficient biochar processes.
- **Regulatory adaptation**: Policies must remain flexible to support innovation without creating barriers.

Market barriers for biochar

Technological

- High-cost processing (e.g., advanced pyrolysis technology).
- Slow adoption rates (e.g., hesitations due to process uncertainties).
- Capital intensive production (e.g., significant investment, scaling limitations).
- Unclear process optimisation (e.g., biochar properties and quality)
- Competing decarbonization technologies (e.g., hydrogen-based or CCS/CCU)

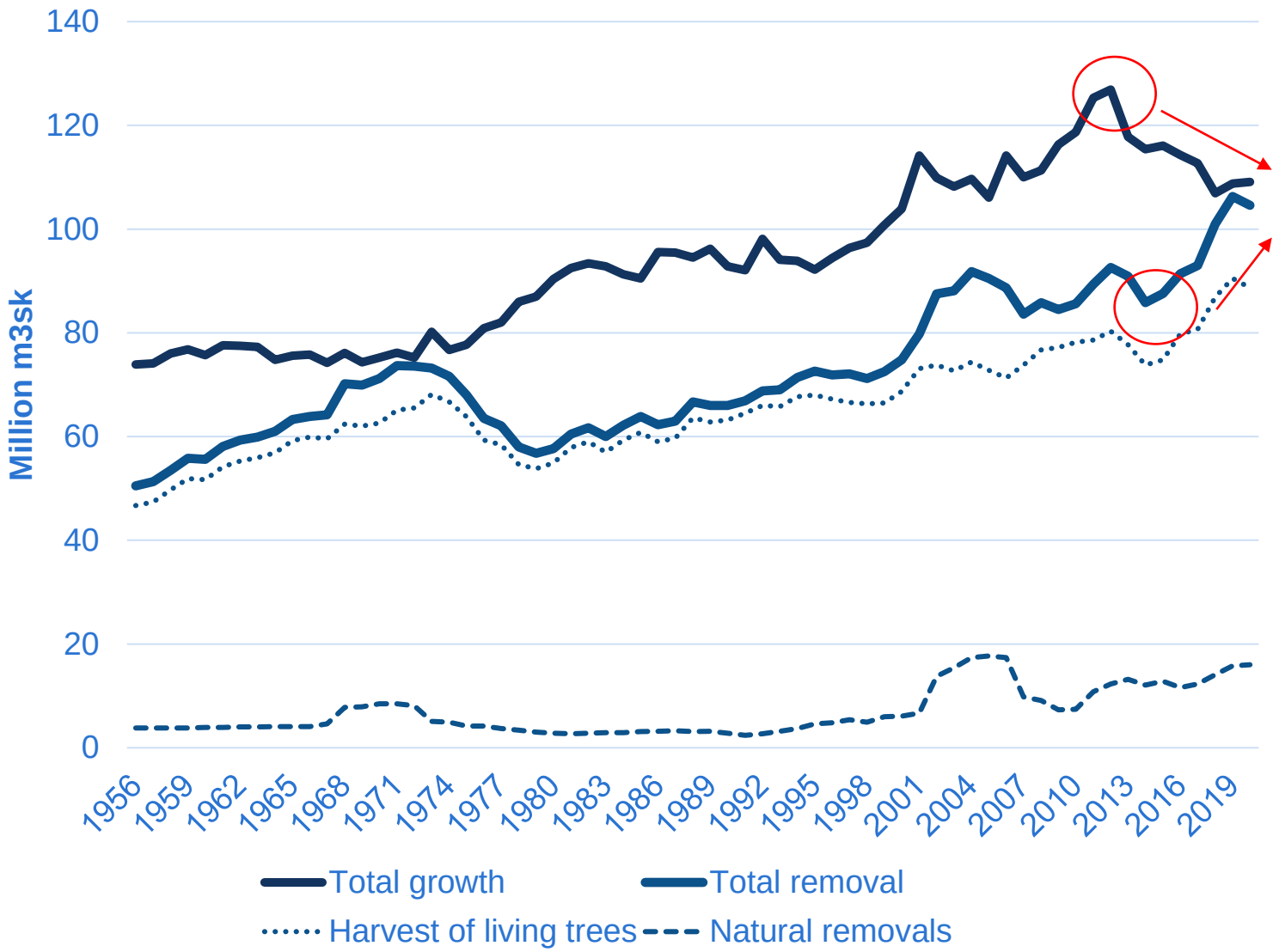
Economical

- Unclear policy frameworks (e.g., regulations and incentives are still developing).
- Unfamiliarity and lack of knowledge (e.g., about biochar’s benefits and applications).
- Consistent biomass supply (e.g., leading to high costs).
- Biomass competition (e.g., limits the availability at competitive prices).
- Low-cost import alternatives (e.g., biochar production elsewhere).

Key factors for biochar market development

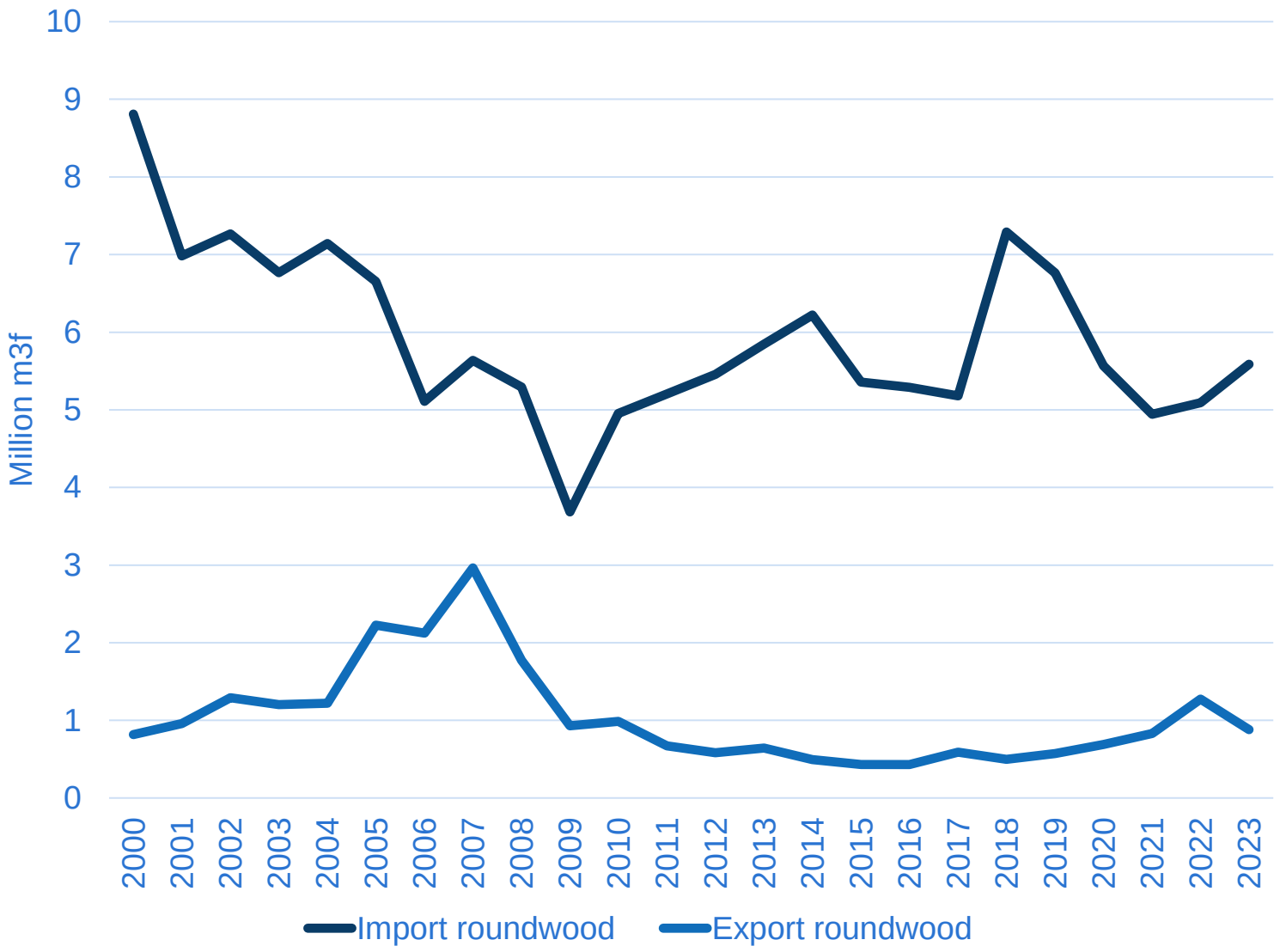
- Policy support
- Industrial initiative
- Resource availability
- Market growth

Biomass feedstock



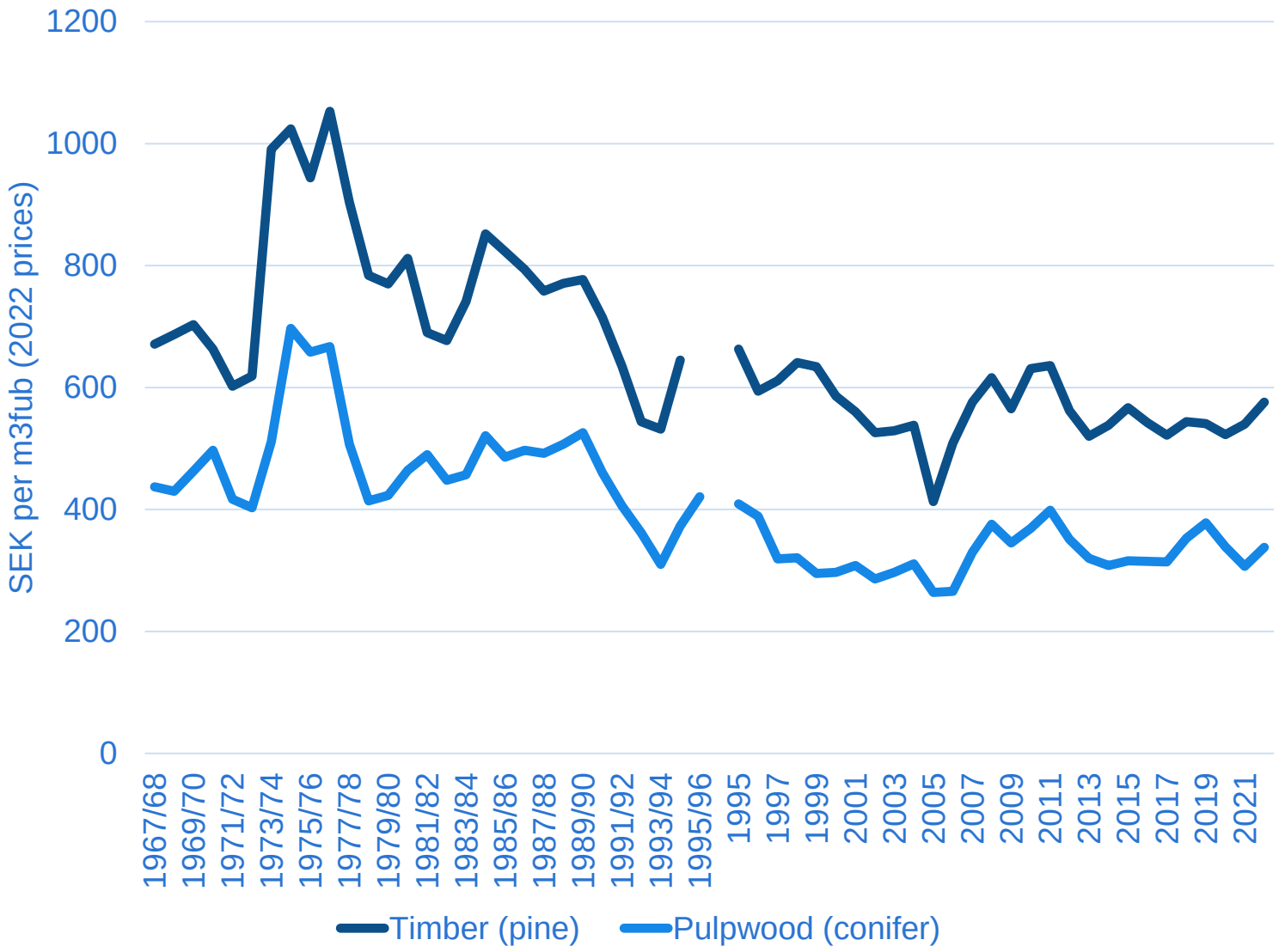
Annual growth and removals (Sweden)

Source: Riksskogstaxeringen (Table 3.30)



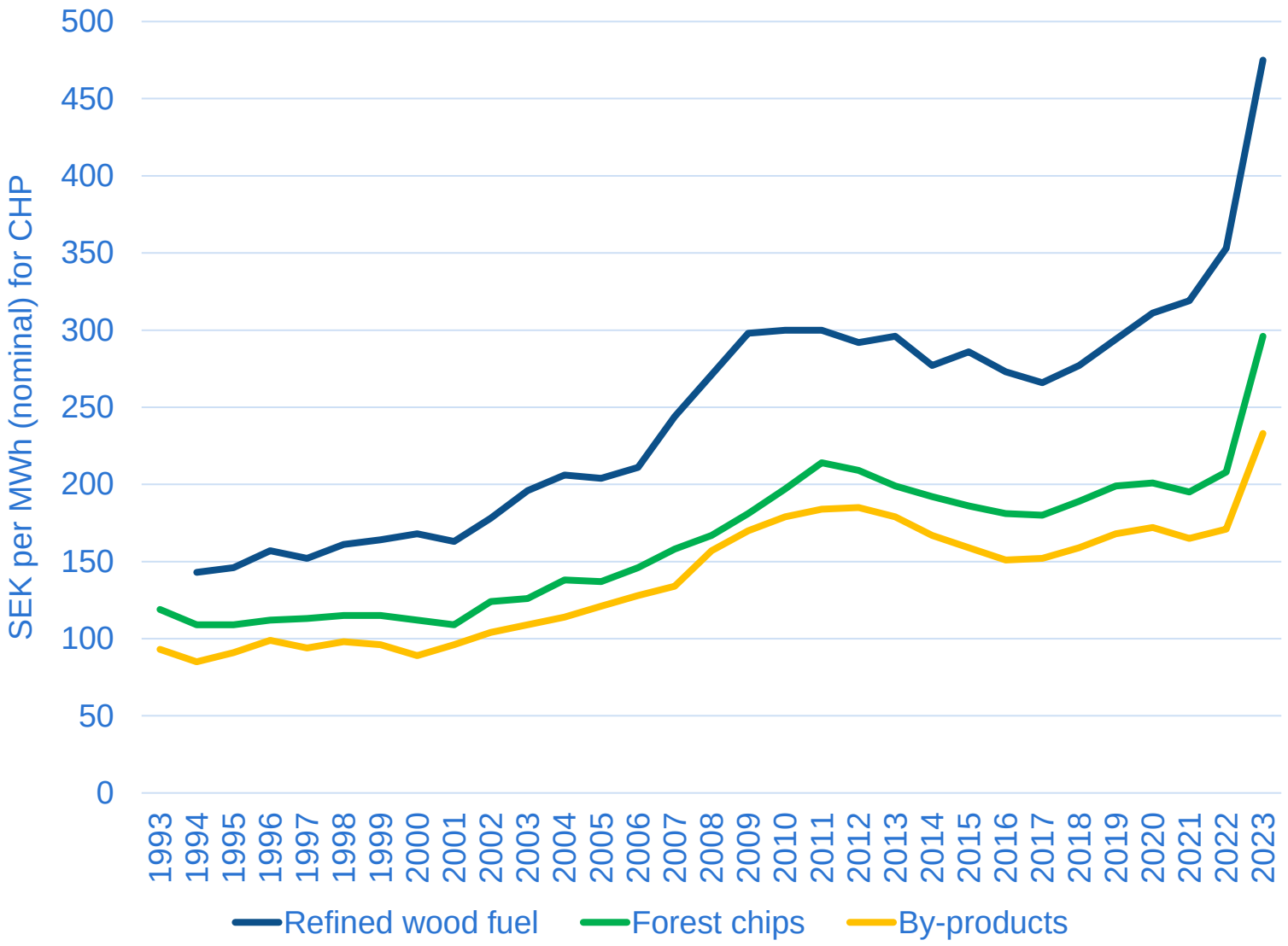
Trade with roundwood (Sweden)

Source: SCB (Kombinerade nomenklaturen, KN)



Roundwood prices

Source: Skogsstyrelsen



Wood fuel prices

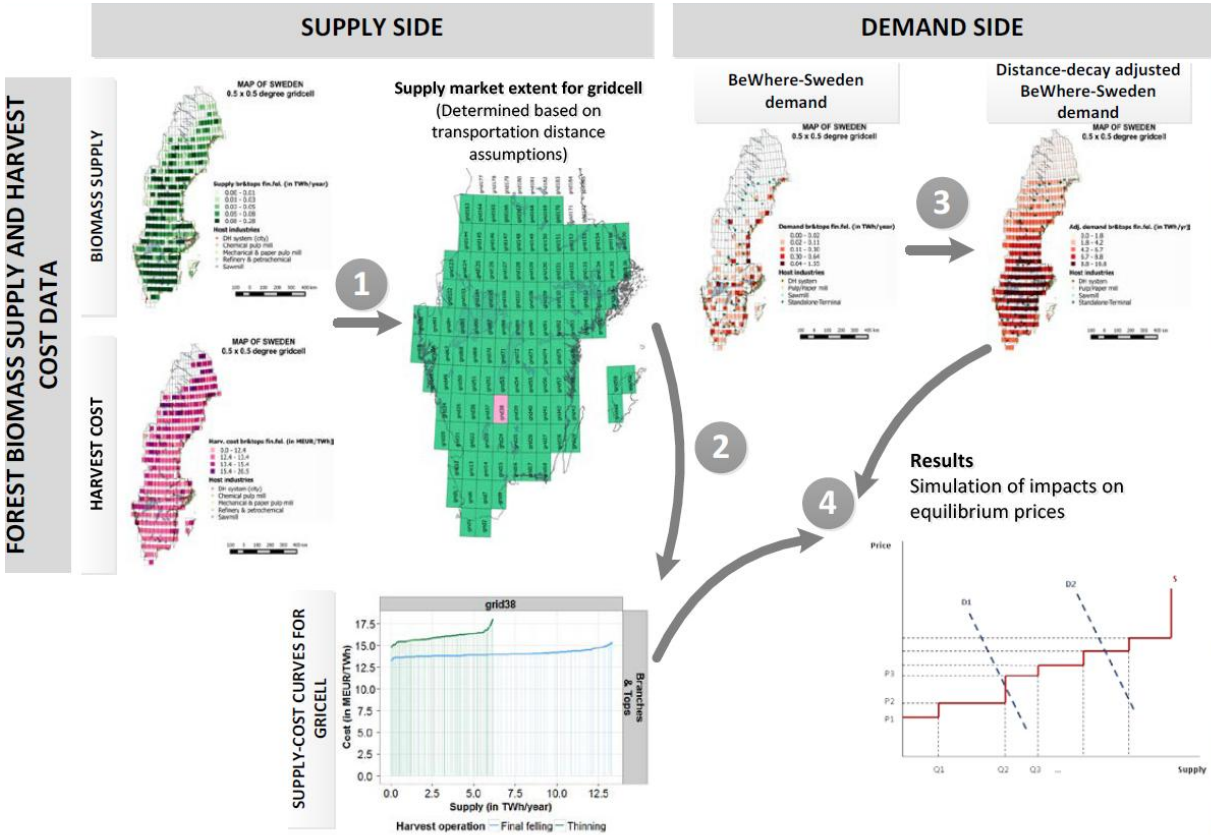
Source: Energimyndigheten

Modelling results

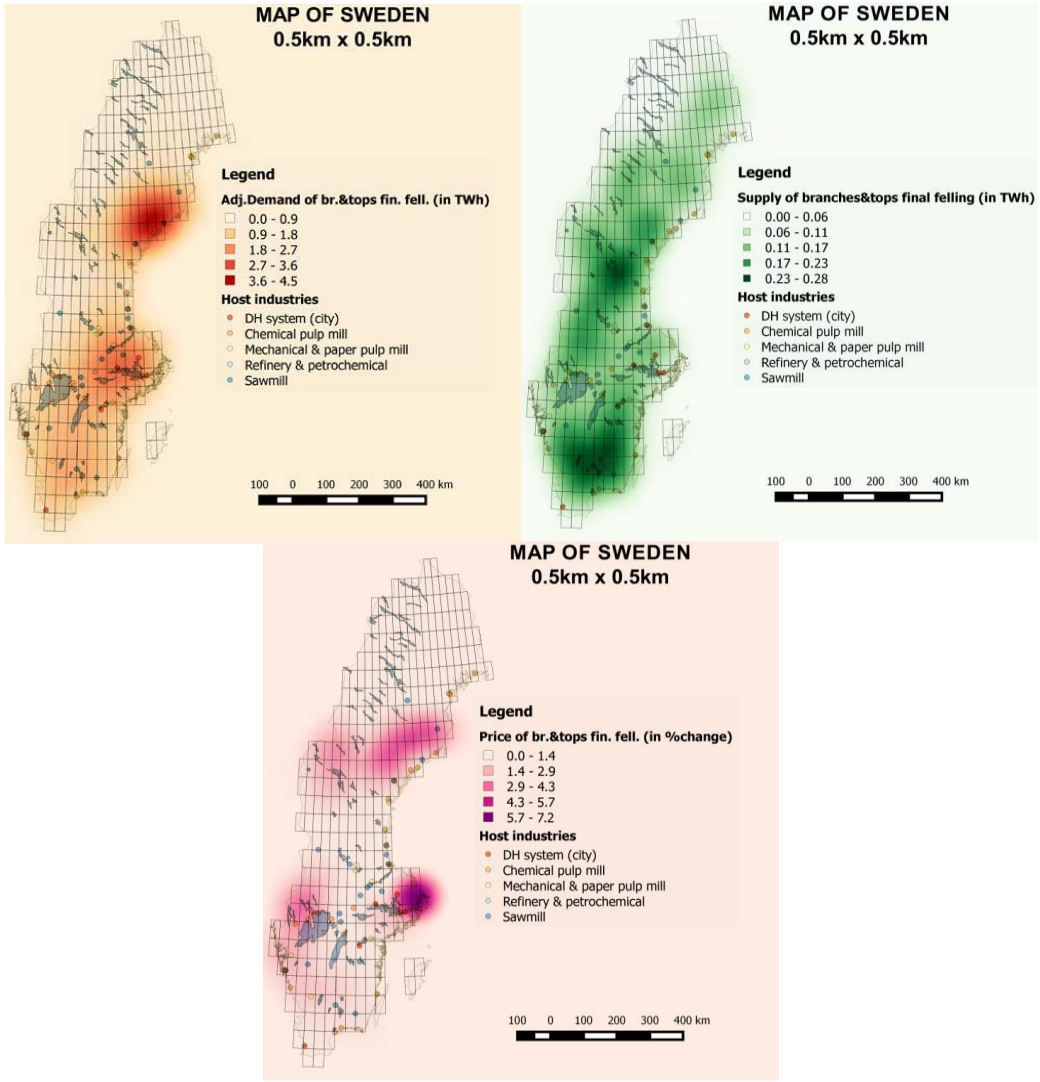
Examples from previous research projects

Spatial Price determination model

Spatial pricing of multi-market heterogeneously distributed resources

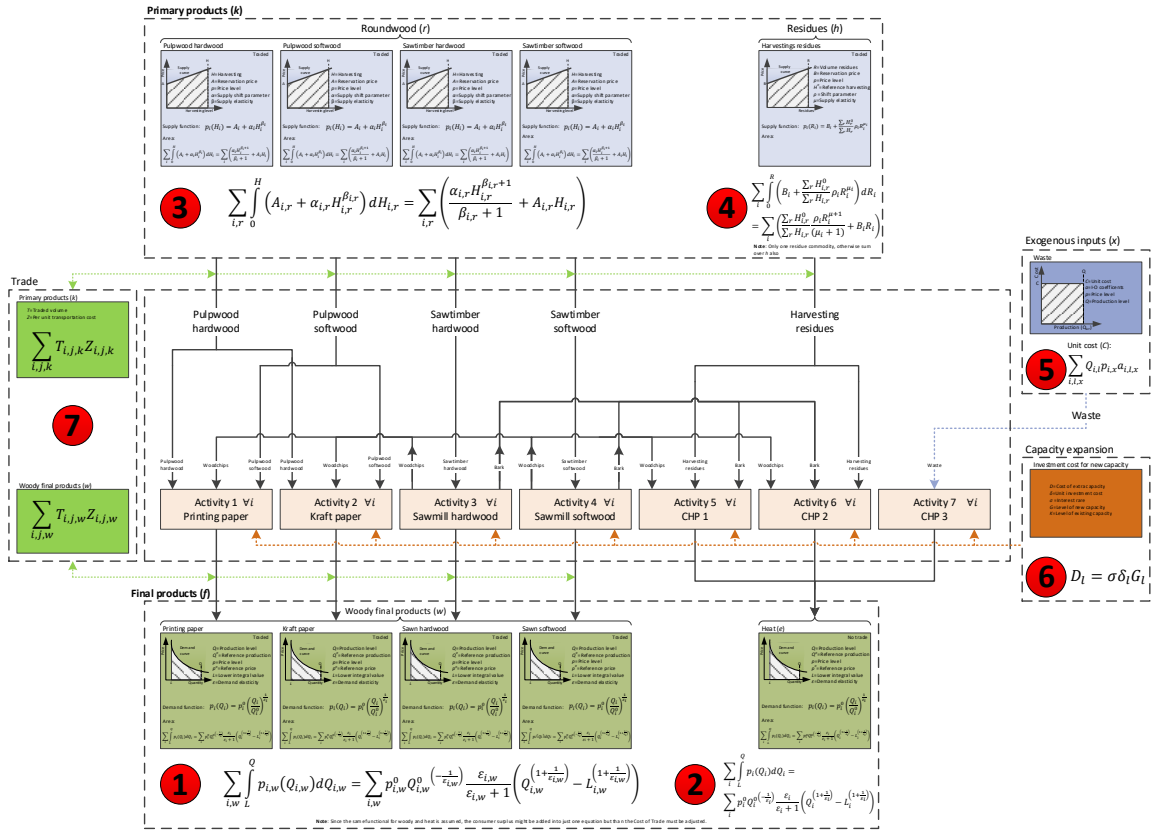


Branches & tops, final felling, 10 TWh



Regional price-determining market model for forest resources

Explicitly consider the conditions and the possibilities for a **transition of the mining and metals industry** towards increased biomass-based production and identify and quantify the **price-affecting local and regional market changes.**



… and the results

- Price effects varies, e.g., a 10% demand increase by the mining and metal industries will have a **17-24% price increase** effect on harvesting residues, bark and industrial by-products (Olofsson, 2019b).
- An efficient forestry sector (increased supply) can **reduce the price effect by up to 25%** (Lundmark, et al., 2020).
- Market forms (i.e., “level” of competition and price-settings behaviours) affect the price effect. The **price of timber (pulpwood) will be reduced by 12-28% (3%)** if the level competition is reduced (Olofsson, 2020).

- Carbon sequestration, recreation, biodiversity and cultural expressions, when accounted for, will also **have a price effect on woody biofuels.**
- Necessary to **increase the supply** of woody biofuels to reduce the price effect.
- Significant spatial variations in demand structures suggest that **decision-makers can affect regional prices**.

Uncertainty

- Types of uncertainties:
  - -Parametric uncertainty.
  - -Structural uncertainty.
- With increased ease of computations, it is now possible to include stochastic elements in the models.
- Uncertainty, especially about price variations, is important to policy-makers.
- Incompleteness of markets:
  - -Availability of futures markets.
  - -Availability of insurance markets.
  - -Availability of contingent markets.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