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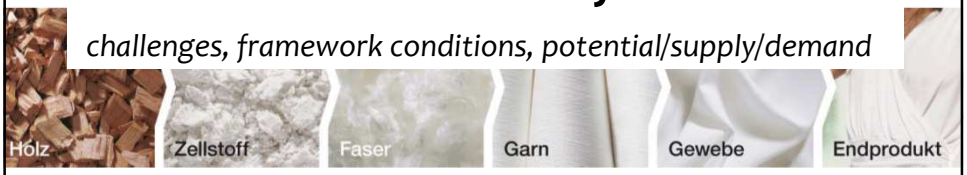
Bundesamt für Umwelt BAFU / Federal Office for the Environment FOEN
Abteilung Wald / Forest Division

NFP 66 Dialogplattform «Novel ways in bio-refining of wood»

Biorefining – A forestry perspective form a Federal authority

challenges, framework conditions, potential/supply/demand



NFP 66 Workshop II, 5.2.2016, at HAFL Zollikofen

Alfred W. Kammerhofer
Head of Timber Industry & Forest Management Section, Forest Division, FOEN

Contens

We all understand the term biorefining still not the same

- There is no uniform understanding. The system boundaries are characterized fluently, different definitions.
- Example German Government: has set a definition for its Roadmap biorefineries.
- Example International Energy Agency IEA has also set a definition.
- => The most striking difference is the consideration betwixt the exclusion of engineered wood (!).
- => This can trigger equally fears as well as hopes (for example, inc. or excl. energy, engineered wood).
- How should we deal with it? Who are the players in the industry biorefinery who are the contact persons and who are the involved party?

We all understand the term biorefining still not the same

German Federal Government's Biorefinery Roadmap:

- «A biorefinery is characterised by an explicitly integrative multifunctional overall concept that uses biomass as a diverse source of raw materials for the sustainable production of a spectrum of different semi finished goods and products (chemicals, **materials**, bioenergy incl. biofuels), whilst including the fullest possible use of all raw material components."
- The co-products can also be food or feed.
- Different processes and technologies are integrated for this purpose.»

We all understand the term biorefining still not the same

The ***International Energy Agency IEA*** has also it's own definition of Biorefinery (in the IEA Task 42):

- »Biorefinery is the sustainable processing of biomass into a spectrum of marketable products (food, feed, materials, chemicals) and energy (fuels, power, heat).» [1,2]
- In the case of wood, it must be clarified on a case-by-case basis which parts of the tree respective the stemwood, are most suited for use as biomass for biorefinery, and when it makes more sense to prior the material utilization.

Previous lessons learned 1

Source: NFP 66 Workshop 10.12.2015, Prof. Marechal, Prof. von Rohn, Prof. Paten, Prof. Dyson, Dr. Rhyner, Dr. Biollaz, Dr. Hora

Generally

- Out of wood/biomass can be produced a lot of chemical products.
- The sugar unit is the basis for the chemical utilization and wood is very suitable.

Previous lessons learned 2

Source: NFP 66 Workshop 10.12.2015, Prof. Marechal, Prof. von Rohn, Prof. Paten, Prof. Dyson, Dr. Rhyner, Dr. Biollaz, Dr. Hora

about technology

- Processes must be adapted to the available resources and not vice versa.
- Technology allows a flexible production modification, and so it is possible to react to market changes.
- Worldwide a lot of energy is produced from biomass and the EU or Switzerland could export efficient technologies.
- Multi-use concepts (for example, heat-power-chemicals) appear to be promising.

Previous lessons learned 3

Source: NFP 66 Workshop 10.12.2015, Prof. Marechal, Prof. von Rohn, Prof. Paten, Prof. Dyson, Dr. Rhyner, Dr. Biollaz, Dr. Hora

about economy 1

- Biorefining is a business, if existing industries are using biomass for there productions.
- Switzerland could – for example – export this efficient technology (platform chemicals).
- Such factory should be based on a major product; the by-products can then develop gradually.
- Market access is critical: works "greenfield" of producers which no market access for these products had (for example, chemical and biotechnology industries to petrochemical based) is very difficult.

Previous lessons learned 4

Source: NFP 66 Workshop 10.12.2015, Prof. Marechal, Prof. von Rohn, Prof. Paten, Prof. Dyson, Dr. Rhyner, Dr. Biollaz, Dr. Hora

about economy 2

- Swiss chemical and biotechnology industries are very active in EU biorefining funding projects (for example D, S, F, I).
- Chemical industry in Switzerland has been highly successful in producing high-priced products (from relatively simple raw materials/substances) and commercialize them worldwide very successful.
- The Fraunhofer-Institut für Holzforschung - Wilhelm-Klauditz-Institut WKI (Dr. Hora, Resource efficiency, secondary raw materials, bio-economy) has developed a model determine the break-even-point and sensitivity analysis can be performed.

Previous lessons learned 5

Source: NFP 66 Workshop 10.12.2015, Prof. Marechal, Prof. von Rohn, Prof. Paten, Prof. Dyson, Dr. Rhyner, Dr. Biollaz, Dr. Hora

about resource

- Hardwood is easier to use than softwood, beech is particularly suitable.
- Guaranteed resource supply is a must and a critical moment. Such factories require guaranteed delivery of the raw material on a weekly basis (!). Without a supply guarantee no factory can operated.
- Not only wood out of the forests, but also used wood/matured timber/recycled wood and residual wood (from wood processing; esp. at hardwood) are also biomass sources.
- From the perspective of Swiss for forest owners and forest operators, the potential of this technology is possible a medium term of 5-10 years.

... resulting question 1

about technology

- Is there still potential for optimization in the yield in the existing cascade?
- Make it sense to tread a strong resource like wood which gives a good usable material for constructive forms, to use it for biorefining, if we also could use fast-growing plants (probably with much lower costs)?
- Is it be possible that an integral conceptual design for biorefinery factories could bring up synergies from upstream and downstream production steps? e.g. Sawmill - planing mill - cellulose - fiber - micro cellulose - biorefining?

... resulting question 2

about economy 1

- Currently there is a use-competition bitwixt material-us and energetic-use. Will now also come biorefinery to this use-conpetiton?
- What is the energy demand for biorefining? Is this justified? Can this be reduced by a wise cascade use?
- Have biofuels a stabil future, when electric vehicles increase?
- How should a production be designed so that all synergies are ideal used and a complete utilization of wood is possible?
- Which chemical products can we technically and with economically produce form wood/biomass? Economically in terms of market is existing or demand for market structure exists.

... resulting question 3

about economy 2

- Location issues (size and price of real estate)?
- Biorefining have a high potential for the chemical and biotechnology industries. Also in Switzerland?

... resulting question 4

about resource

- Which ranges can be usefully used for biorefining, e.g. crown, branches, trunk, bark, residual wood from the sawmill industry, used wood (matured timber)?
- What will be the consequences for the forest as a ecosystem, when demand for wood out of the forest for biorefining will become too high?

Contens

1. Previous lessons learned and resulting questions
2. Framework conditions and frameword changes
   a. Casdace and conflicting use
   b. Climate change
3. Existing potentials
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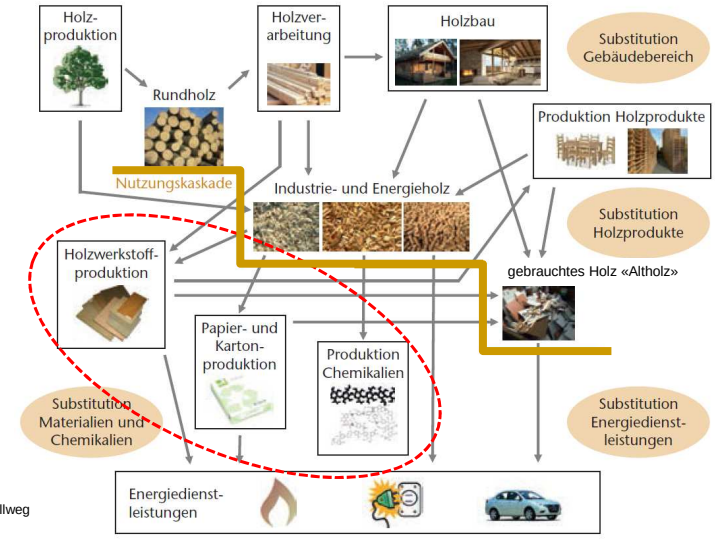
Potential of the resource wood

Where is the position of biorefining in the cascade?



Source S. Hellweg (angepasst)

Added value comparison

Source: Ernst Basler & Partner, Interface (2013): Inländische Wertschöpfung bei der stofflichen und energetischen Verwendung von Holz. On behalf of FOEN.

Direct an indirect added value of substantial and energetic use of wood in billion CHF (base year date 2010) (Figure 10/11, p. 32)

	substantial direct	substantial indirect	energetic direct	energetic indirect	Rate direct	Rate indirect
Total	5.3	2.9	0.77	0.22	7 : 1	13 : 1
Total	8.2		0.99		8 : 1	
Total	9.19					

Further framework for Switzerland

some trigger

in the forests:

- Close to nature silviculture, forest residues (branches, crown / tops, needle / leaf), sorting

Existing value-added chain:

- Logs – Sawmill – glued products – wood construktion (sustainable and energy efficient building)
- Debarking - process heat
- Incision – residual-wood/sawdust – board/engineered wood
- residual-wood – energy-wood/chips – paperfiber/ wood-energy
- Available industrial land and landprices (!)

Forest and the climate change
challenge

- Veränderung im Klima führen grundsätzlich zu Veränderung im Wald
- Holzarten können sich verändern
- Verbreitungsgebiete verändern sich (grösser, kleiner)
- Zuwachs verändert sich

Exmeple beech and sweet chestnut:

WSL Modellierung von Wachstumsgebieten anhand sog. «Klimahüllen» für Verdeutlichung eines möglichen Einflusses des Klimawandels auf den Wald

➢ Interaktive Karte der WSL (je Baumart)
http://www.wsl.ch/lud/portree/present.ehtml

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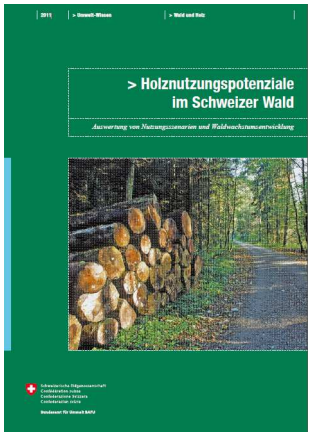
Potential wood utilization in Swiss forests

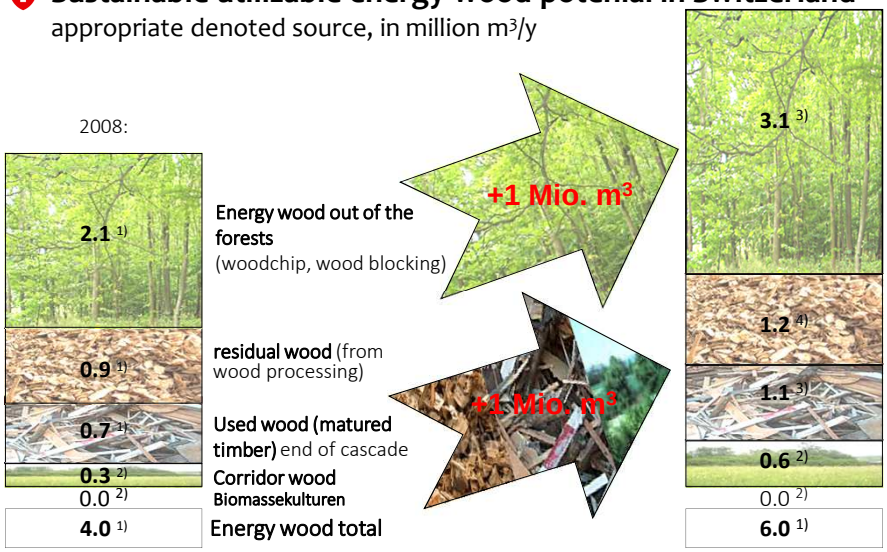
In den Schweizer Wäldern wächst mehr Holz nach, als geerntet wird.



- Datengrundlage: Ergebnisse des Landesforstinventars 4b (2009-2013)
- Modelle: Massimo (Waldbewirtschaftungs-modellierung), HeProMo (Holzerntekosten-modellierung), Zwiebelschalen-Modell (nutzbares Potenzial)
- Berechnet wurden:
  - das Holznutzungspotenzial für die Jahre 2017 **bis 2046** (3 Dekaden) und die Waldentwicklung **bis 2106**
  - 5 Nutzungsszenarien:
    - A: Basis (konstanter Vorrat)
    - B: Vorratsanstieg (konstante Nutzung LFI3-4b)
    - C: Hoher Zuwachsleistung
    - D: Grosse Nachfrage nach Nadelrundholz
    - E: Grosse Nachfrage nach Energie- und Chemieholz
  - Resultate nach Baumarten, Sortimenten und 14 Wirtschaftsregionen

Sustainable utilizable energy-wood-potenial in Switzerland

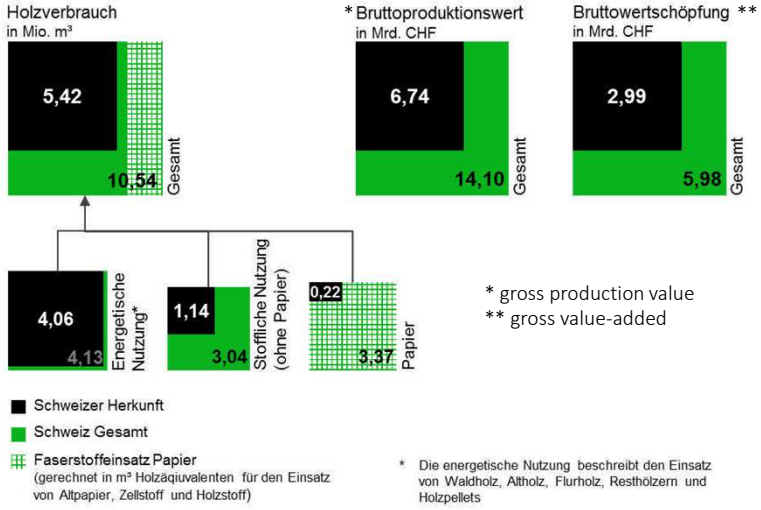
appropriate denoted source, in million m³/y



1) Jahrbuch Wald und Holz 2010: Holzfluss in der Schweiz, 2008 (BAFU, BFS)
2) Energieholzpotenziale ausserhalb des Waldes, 2009. Studie im Auftrag des BAFU und des BFE
3) Ressourcenpolitik Holz 2008 + Holznutzungspotenziale im Schweizer Wald, 2011 (BAFU)
4) Schätzungen BAFU

Wood use (demand) in Switzerland

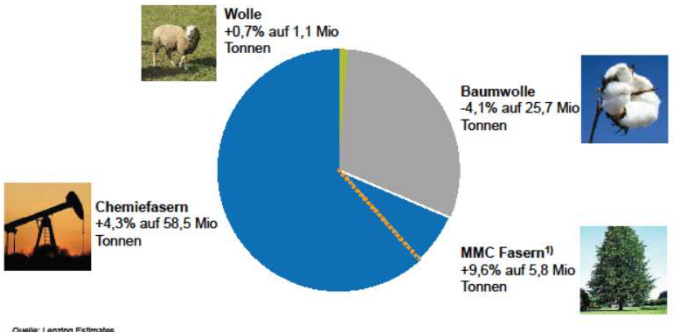
Deamnd and value-addet from wood in Switerland, 2011
(Sourde: On behalf of FOEN, Branchenanalyse Wertschöpfungskette Wald & Holz, 2014)



Exempel: Fiber textile market

World production of fiber 2013 (Quelle Lenzing AG)

Weltweite Faserproduktion 2013: +1,6% auf 85,4 Mio Tonnen
Man-made Cellulosefasern 2013: +9,6% auf 5,8 Mio Tonnen



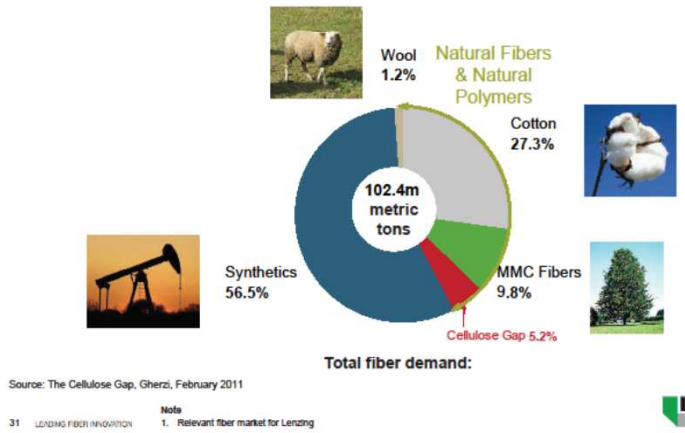
Quelle: Lenzing Estimates
1) Man-made Cellulosefasern (MMC) wie Viscose, Modal und TENCEL®, sind in dem Anteil „Chemiefasern" (58,5 Mio to) enthalten

7 LEADING FIBER INNOVATION

LENZING

Exempel: Fiber textile market

The global Fiber market 2020 (Quelle Lenzing AG)



Source: The Cellulose Gap, Gherzi, February 2011

Note
1. Relevant fiber market for Lenzing

31 LEADING FIBER INNOVATION

LENZING

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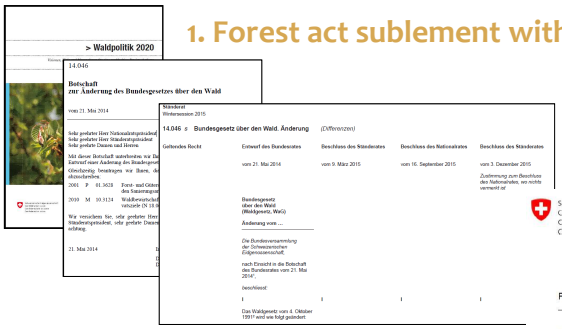
Was der Bund macht



1. Forest act sublement with wood

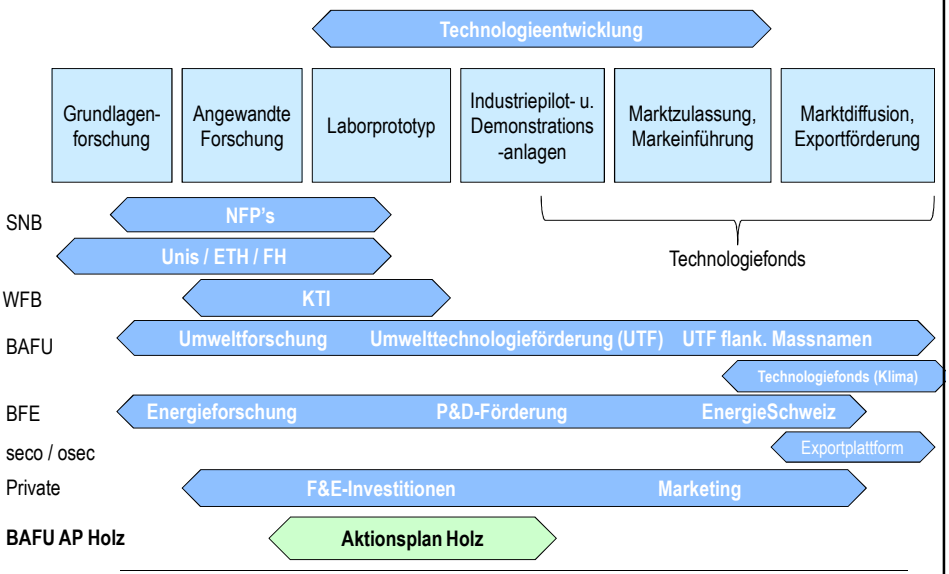
2. Ressourcenpolitik für Holz aktualisieren

3. Holz mit dem Nationales Forschungsprogramm NFP 66 fördern

Ressource Holz
Nationales Forschungsprogramm NFP 66

Was der Bund macht

4. innovative Projekte fördern



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Fazit

1. Is Biorefining an issue for Switzerland – as technological development site and/or as a production site?
2. Under which conditions in Switzerland a Biorefining factory could work and which new use competition could be the consequences?
3. What opportunities and challenges would bring biorefinery for forest owners, forest operators, the forest itself and the forest authorities with it?

Questions and discussion