

**Integrated energy and fibre production by a
sulphur-free and carbon dioxide neutral process,
EFPRO**

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**BIO-ENERGY
ENLARGED PERSPECTIVES**

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Objective of the EFPRO project

- The main objective is to increase the production of **green electricity** in the production of chemical pulp from European hardwoods, especially birch and eucalyptus
- This target is obtained by adopting a new sulphur-free chemical pulping process

Participants in the EFPRO project

- Coordinator:
UPM-Kymmene Corporation (UPMK) [Finland](#)
- Partners:
Andritz Corporation (AAC) [Finland + Austria](#)
Centre Technique de l'Industrie des Papiers,
Cartons et Celluloses (CTP) [France](#)
Instituto de Investigaç o da Floresta e Papel
(RAIZ) [Portugal](#)
Siemens AG (SIEMENS) [Germany](#)

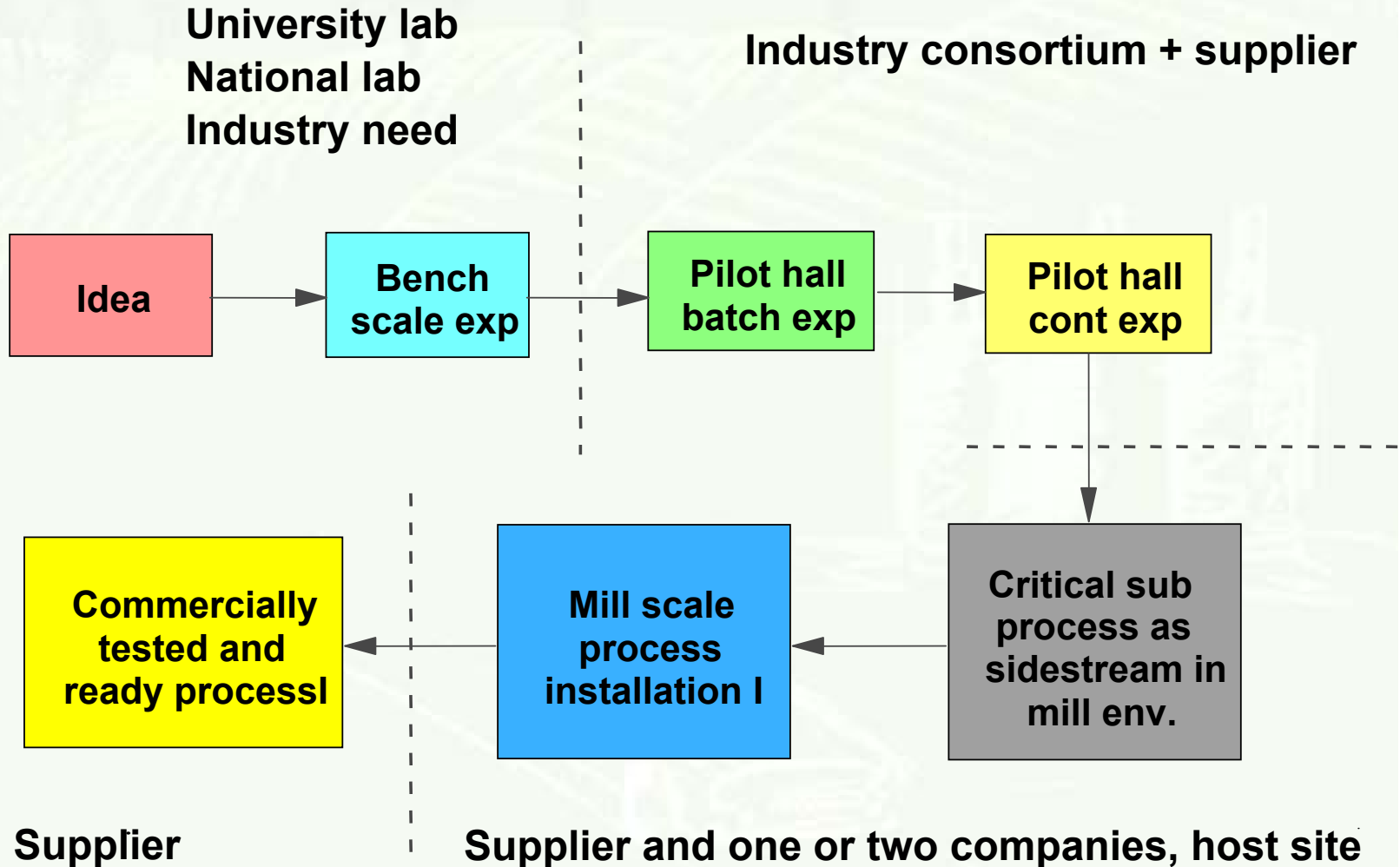
Structure of the EFPRO project

1. Laboratory and pilot scale work to provide pulping spent liquors for studies on energy production, and to confirm good papermaking properties of the pulps
2. Laboratory and engineering work to study energy production and recovery of chemicals from the spent liquors provided in phase 1.
3. Feasibility study on energy production and recovery of cooking chemicals, mainly provided in phase 2.

Key results to be obtained

- The main result is a detailed techno-economical description of energy production and recovery of cooking chemicals as part of a sulphur-free pulping process. (This result is still a pilot scale result, not ready for industrial scale decision making.)
- Another expected result of the project is optimised cooking and bleaching conditions to reach high quality pulp for paper making.

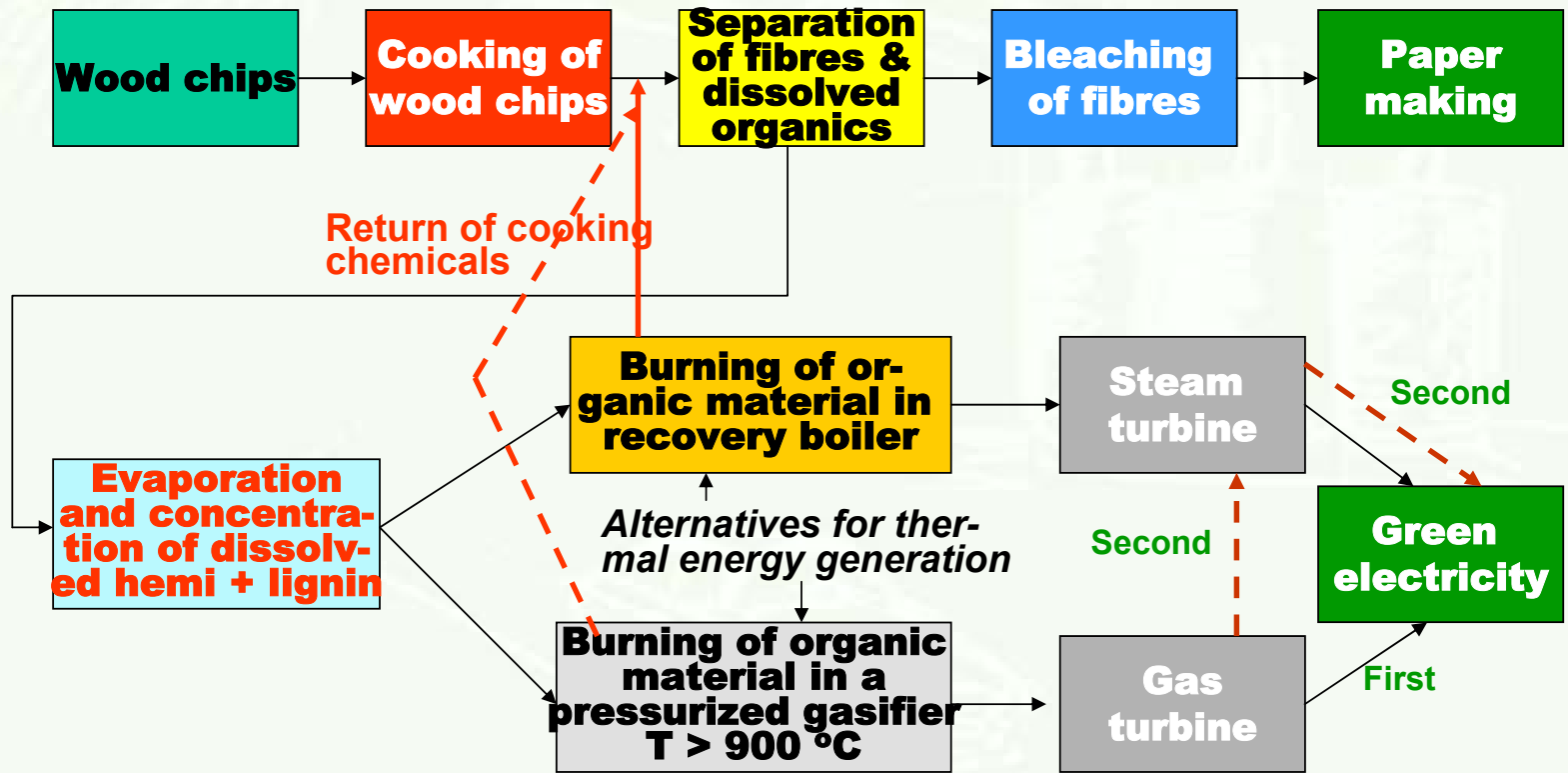
Specifics of new process development



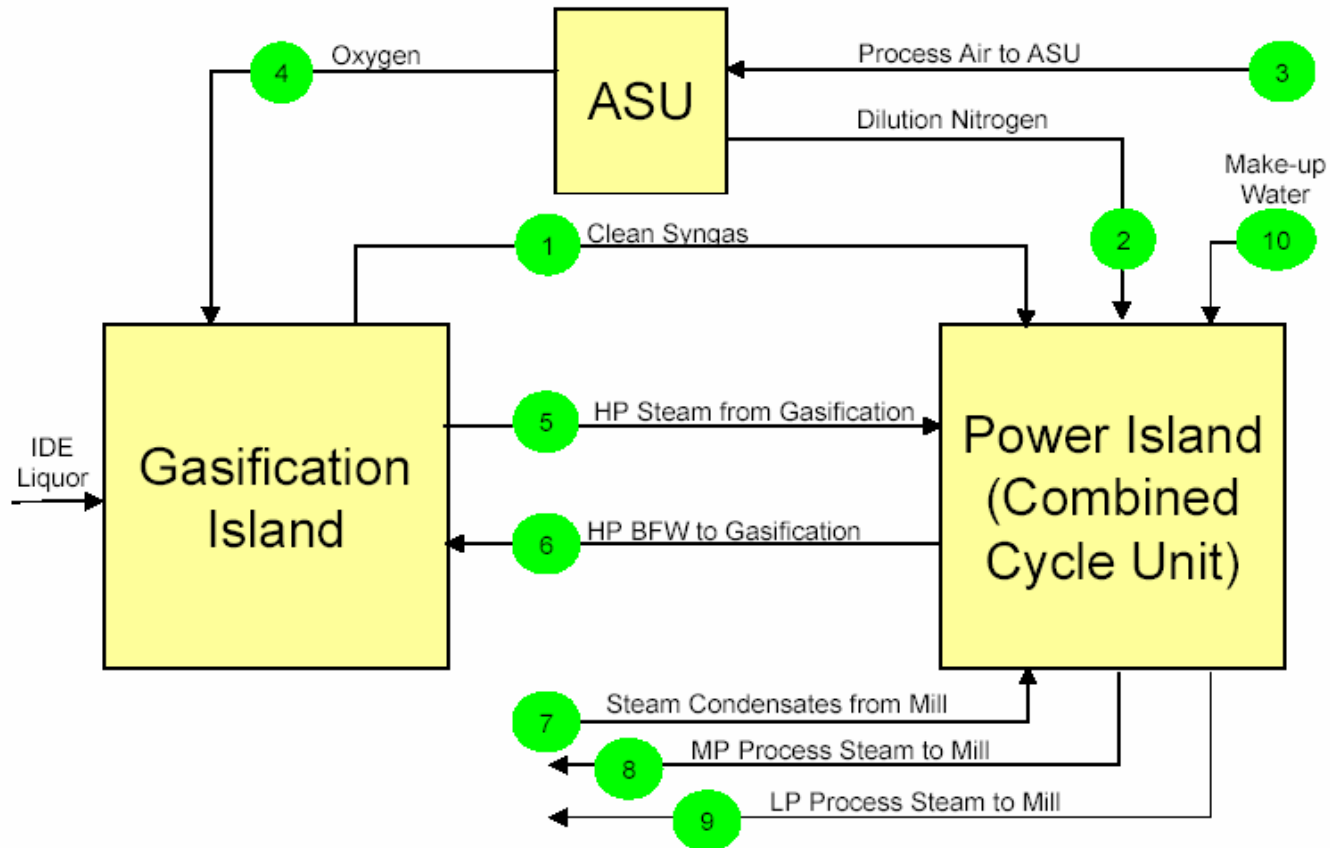
Situation today

- A modern chemical pulp mill produces excess electricity with steam power about 350 to 500 kWh per ton pulp produced
- Theoretical excess electricity production could be about 1500 – 1750 kWh per ton pulp utilizing gasification and gas turbine plus steam turbine for residual heat after the gas turbine
- Going into higher solids firing of the concentrated spent cooking liquor, more electricity in comparison to the reference case can be made

Schematic process description



Integrated Gasification Combined Cycle (IGCC) Concept



- Oxygen blown gasifier – high temperature
- Fully integrated Air Separation Unit (ASU)
- V94.2K gas turbine

Decisions for the selected process concept

Gasifier island

DEVELOPMENT STATUS (KRAFT)

- Pilot stage, atm. gasifier in operation
- Pressurized gasifier in design status

DECISION BASICS

- Physical & chemical properties (reactivity comparable to Kraft)
- Reduced emissions (no sulphur)
- beneficial melting behaviour
- Gas turbine requirements for NO_x
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CONCEPT

- Molten phase gasification
- Oxygen blown, AR = 0.325
- T = 950 °C; p = 25 bar
- 3 stage gas washing

Power island

DEVELOPMENT STATUS

- IGCC power plants in commercial operation (coal, asphalt)

DECISION BASICS

- Increase net efficiency by integrated ASU
- Combustion chamber matched with GT for syngas
- robust and proven concept (in commercial operation)

CONCEPT

- Integrated Air Separation Unit
- V94.2 K gas turbine for syngas
- Waste heat boiler (2 p levels)
- Industrial steam turbine

Future Challenge – plant size of pulp mills

Robust Gas Turbine to handle syngas from gasification



SIEMENS V94.2K



requirements in gas input and NOx target



fixing plant size of IGCC

Production line size
of pulp mill
in Europe today
250 Tt/a to 700 Tt/a



Future Challenge
for pulp producers
to ensure
green electricity from gasification

mill size > 1 Mio tons/year

Capable of generating 220 MW bioelectricity (gas + steam)

Research needs

Gasification

International pre-competitive agenda of Black liquor gasification:

- Modeling (e.g. species release at high temperature and pressure)
- Material research, including refractory
- Pilot plant pressurized gasification
- Melting behaviour

EFPRO:

- gasification behaviour of spent liquor via experimental work
- hot gas cleaning
- larger continuous pulping pilot for testing recovery of pulping chemicals in both thermal energy alternatives and for testing technical solutions for recovering the ethanol for new cooking
- investment analysis of the whole concept in order to find out if it is economically feasible for large scale commercialisation

Linkage to the web site

www.efpro.net

Thank you!



Questions?