



## MACON FIELDS OF BIOREFINERY EXPERTISE AND CASE STUDIES

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## COMPANY PRESENTATION – Macon Oy

### Biorefinery experts: Mikko Ahokas, Sanna Taskila

#### **Mikko Ahokas M.Sc. CEO**

Mikko is an expert with a versatile education and experience in environmental and process engineering. He is a M.Sc. in environmental science. Mikko has worked over 20 years in projects related to energy, bio- and circular economy, environmental technology, biofuels and engineering. Before becoming an entrepreneur Mikko has worked in leading positions in e.g. WSP Finland and St1 Biofuels. His special fields of expertise include: process and concept design, feasibility analysis, cash flow analysis, due diligence. Over 800 reference studies incl. scientific articles.



#### **Sanna Taskila D.Tech. Specialist**

Sanna has a doctor's degree in environmental engineering and bioprocesses. She was appointed a title of docent at the University of Oulu in 2019 on management of organic side streams. Sanna has over 15 years of experience in leading and financing bio- and circular economy related projects in the academy and companies. Her special fields of expertise include: resource efficiency, use of side streams, carbon footprint, market analysis, financial instruments, investment materials



# SUMMARY OF MAIN FIELDS OF EXPERTISE AND THEIR REFERENCE PROJECTS

\* To grow your business \* To reduce your business risks \*To safe your resources \*To make your business sustainable



## Raw material mapping and review

- Wood
- Straw
- Industrial and municipal side streams



## Market and technology reviews

- Hemicellulose and lignin
- Wood residues
- Side streams: industrial sludges, solid residues and flue gases



## Risk reduction

- Due diligence
- Feasibility assessment
- Legal services



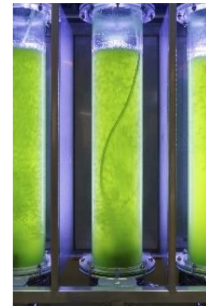
## Resource saving

- Energy reviews
- Water reviews
- Waste audits



## Assessment and reduction of environmental impacts

- Environmental impact assessment and permits
- Carbon footprint calculation
- Environmental Product Declaration, Sustainability criteria and End-of-waste



## Water treatment

- Water treatment solutions for large companies including food, forest, steel, mining and energy industries

# SUMMARY OF MAIN FIELDS OF EXPERTISE AND THEIR REFERENCE PROJECTS

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## Feasibility studies

- CHP
- Heat & Steam boilers
- Biogas



## Basic engineering

- Energy and mass balances
- Process simulation
- Electrical engineering
- Automation & instrumentation
- Cost estimation



## Field operation

- Site safety
- Project management
- Commission and startup
- Legal services



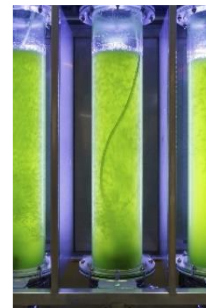
## EU Emission trading

- Energy plants



## Energy services

- Heat & steam systems
- Purification of flue gases
- Intensification, modernization and analysis of operation
- Solid recovered fuel (SRF) production plant design and economics



## Water treatment

- Water treatment solutions for large companies including food, forest, steel, mining and energy industries

## SELECTED REFERENCES IN CHEMICALS

### Reference Projects

REF 1

H<sub>2</sub>SO<sub>4</sub> & HNO<sub>3</sub> distillation unit (2 tn/h)

Ethanol distillation unit (0,7 Mtn/a)

Monochloroacetic acid plant (42 000 tn/a)

Ligning valorization

Oulu biorefinery, concept study

Haapavesi, wood biorefinery

Biowaste, ethanol plant

Whey, ethanol plant (Sweden)

Potato biorefinery, potato starch separation, active proteinase component.

Whey valorization plant, medical grade production line.

Carbon Sink concept.

Ash washing plant and salt recovery (Sweden) pre design

ADVEN

BUSINESS OULU

EVO



Heinola

fortum

naturpolis

Gasum



I&T

TEAM BOTNIA OY

## RAW MATERIAL MAPPING AND REVIEW

REF 1

**Reference customers:** Adven, Business Oulu, Fortum, Gasum, Heinola, Kuusamon EVO, Naturpolis, Suonenjoki, Tampere, Team Botnia, Turku

**CONTENT.** Macon has implemented large biomass and other raw material reviews for industrial and public organizations. We have conducted large industry-driven projects for nationwide mapping of biowaste in Finland and Sweden. We are currently conducting biowaste review for Kemi biogas plant, covering Finnish Lapland.

Macon has conducted biomass reviews for several Finnish regions, including Tampere (biowaste) and Kuusamo (biowaste), Heinola (straw), Suonenjoki (straw and wood residues) and Norske Skog (fish waste, pulp mill wastewater, Rotteros, pulp mill biogas, Turku (straw and wood residues). We have also conducted raw material mapping for Oulu New Biorefinery –project for Business Oulu (wood industry residues and sludges).

**REFERENCE CUSTOMERS.** We have worked with major Finnish companies in energy and circular economy. Our customers also include several Finnish cities such as Heinola, Oulu, Tampere and Turku.

ADVEN BUSINESS OULU

EVO

 Heinola

fortum

naturpolis

Gasum

I&T



TEAM BOTNIA OY

## MARKET AND TECHNOLOGY REVIEWS

REF 2

**Reference customers:** Adven, Business Oulu, Fortum, Heinola, High Metal, HSY, Kuusamon EVO, Naturpolis, Neste, NIHAK, Steel-kamet, Toholammin Kehityks

**CONTENT.** Macon has implemented comprehensive market and technology reviews for industrial customers. The target of such reviews is usually to find new business opportunities for existing products or services, or to find value for side streams.

Our recent customer projects have focused on lignocellulosic residues such as lignin and hemicellulose (large market and technology reviews), energy production residues (ash, biogas rejects), industrial flue gases (carbon dioxide capture and utilization), industrial equipment such as Mechanical Vapor Recompression evaporation (MVR), driers and mixers,

Large market reviews compose of defining product segments, business potential, geographical dimensions, relevant market players (partners, technology developers, R&D, competitors, end-users), market trends and drivers, and benchmark value chains.

Large technology reviews include description of company and review of technology's properties from all relevant aspects such as raw materials, products, side products, process economy, patents, environment, health and safety, automation, chemicals, water and energy consumption and waste.

**REFERENCE CUSTOMERS.** We have worked with major Finnish industries including Adven, VTT, Fortum, and several cities and municipalities.

ADVEN

HIGH  
METAL

HSY

NESTE

sma  
mineral

steel-kamet

fortum

EVO

BUSINESS OULU

Heinola

NIHAK

TOHOLAMPI

naturpolis

macon

## RISK REDUCTION

**Reference customers:** Adven, Gasum, Kuusamon EVO, Kemira, Sfttec, Puolangan kunta

REF 3

**CONTENT.** Macon has conducted more than 30 Due Diligence surveys and numerous SWOT analyzes of e.g. biogas plants and wastewater treatment plants. We offer extensive economic, legal, technical and environmental Due Diligence services.

Macon has provided technoeconomic feasibility assessments for customers ranging from startups to large industries. These include whey bioethanol plant, potato starch bioethanol plant, fertilizer production from biogas reject, Kuusamo Zero Waste Concept, Eneferm dry digestion biogas plant, brewery and malthouse, ash treatment facility, and refuse derived fuel plant.

Complementing our risk management services, Macon customers are provided high-level legal advising especially on matters related to enterprise and environmental law.

**REFERENCE CUSTOMERS.** We have worked with large Finnish companies including Adven, Gasum and Kemira, and several other clients.





## RESOURCE SAVING

Reference customers: Adven, Espoo, Konecranes

REF 4

**CONTENT.** Macon is expert in services which target to saving resources such as energy, water and other raw materials. We identify critical factors (equipment and functions) in your company's energy consumption, and prepare an energy saving plan with suggestions for improved energy efficiency. We guide companies in energy and water efficiency, and in the assessment of their impact on carbon footprint. Our energy and water audits are conducted according to Motiva standard.

Macon has also conducted a large number of surveys on the use of side streams for a variety of companies. We can tailor concepts to utilize side streams in your company or in a larger entity of several stakeholders.

**REFERENCE CUSTOMERS.** We have conducted energy and water audits for large customers such as Adven, Espoon kaupunki and Konecranes.



## ASSESSMENT AND REDUCTION OF ENVIRONMENTAL IMPACTS

Reference customers: Adven, Gasrum, Kuusamon EVO, Kemira, Sftec, Puolangan kunta

REF 5

**CONTENT.** Environmental impact assessment and permit application processes are large and require a multidisciplinary expert group. Macon has successfully completed two large environmental impact assessment projects (EIA) for large customers (Wega, CIP, Adven and Jahotec). We have also assisted several customers in application of environmental permits (e.g. biogas plants, ash treatment).

In 2019, Macon launched a unique service which provides flexible, tailored and low-cost toolbox for companies and other organizations to calculate and reduce their carbon footprint. During the first 2 years nearly 300 companies and public organizations have used the Climate Indicator service. VSV Group has selected Macon as partner for carbon footprint calculation services to their customers.

Complementary to our services we also prepare Environmental Product Declarations, Sustainability Criteria and End-of-Waste documentation for our customers. For that purpose we use reknown OneClickLCA software.

**REFERENCE CUSTOMERS.** Our reference customers cover major industries, such as food and feed industry, bioenergy, construction, chemical production, forest and wood-based industries and waste management.



## WATER TREATMENT

Reference customers: Finn Spring, Hätälä, Oulun Energia, Outokumpu, SSAB, Terrafame

REF 6

**CONTENT.** Macon partners with OWA Group in advanced water treatment technologies. OWA Group proprietary technologies can be used to separate grease, oil, COD, BOD and many other contaminants from wastewater. The company also offers sludge treatment solutions which lead to utilization of sludge as fuel treated water can be discharged. We also offer our customers laboratory testing and piloting at the site to verify the functionality of the processes.

OwaEF/DAF flotation technology can be used to remove solids and other impurities from wastewater. A proprietary OWAKTM-pump enables creation of micro bubbles without costly dispersion systems. To maximize oxidation efficiency, OWA multiphase technology can be used to feed air and other gases with microbubbles into the wastewater.

OwaGtube can be used to separate water from sludge before transporting it to a disposal site. This avoids costly and environmentally burdensome water transport and can significantly reduce transport times.

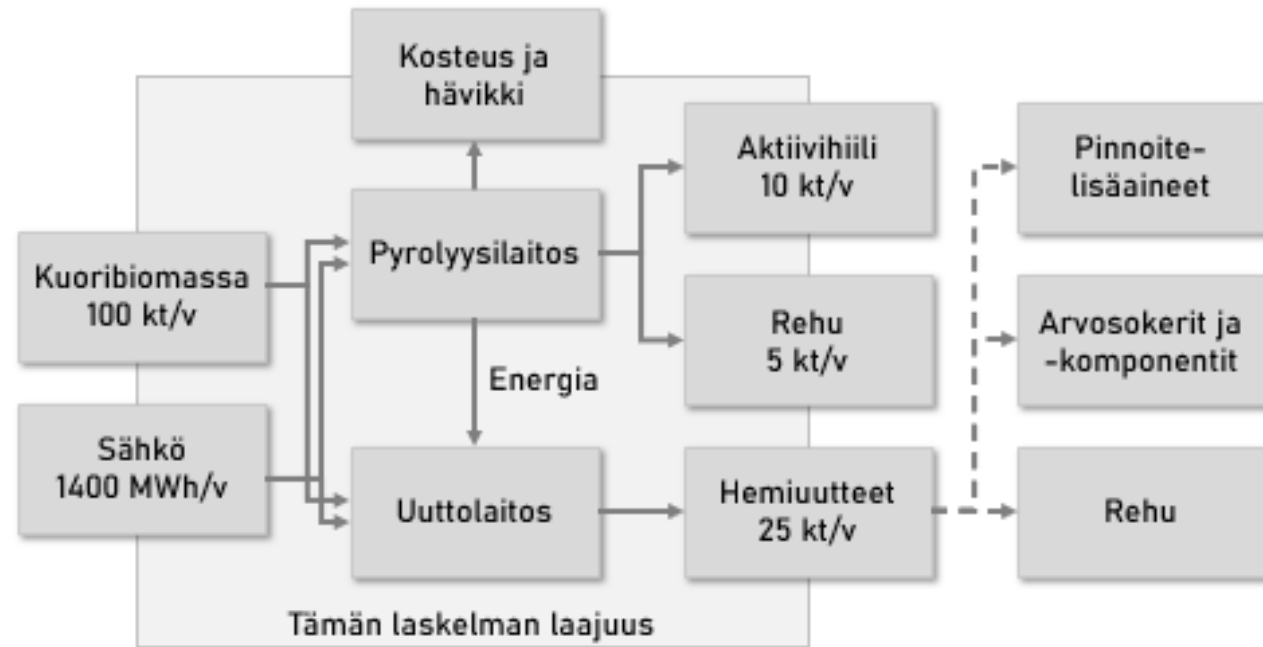
OwaMobile is a tailor-build sea container that contains setup according to our customer needs. Equipment can include e.g. sewage pumps, and facilities to manufacture, store and dose chemicals.

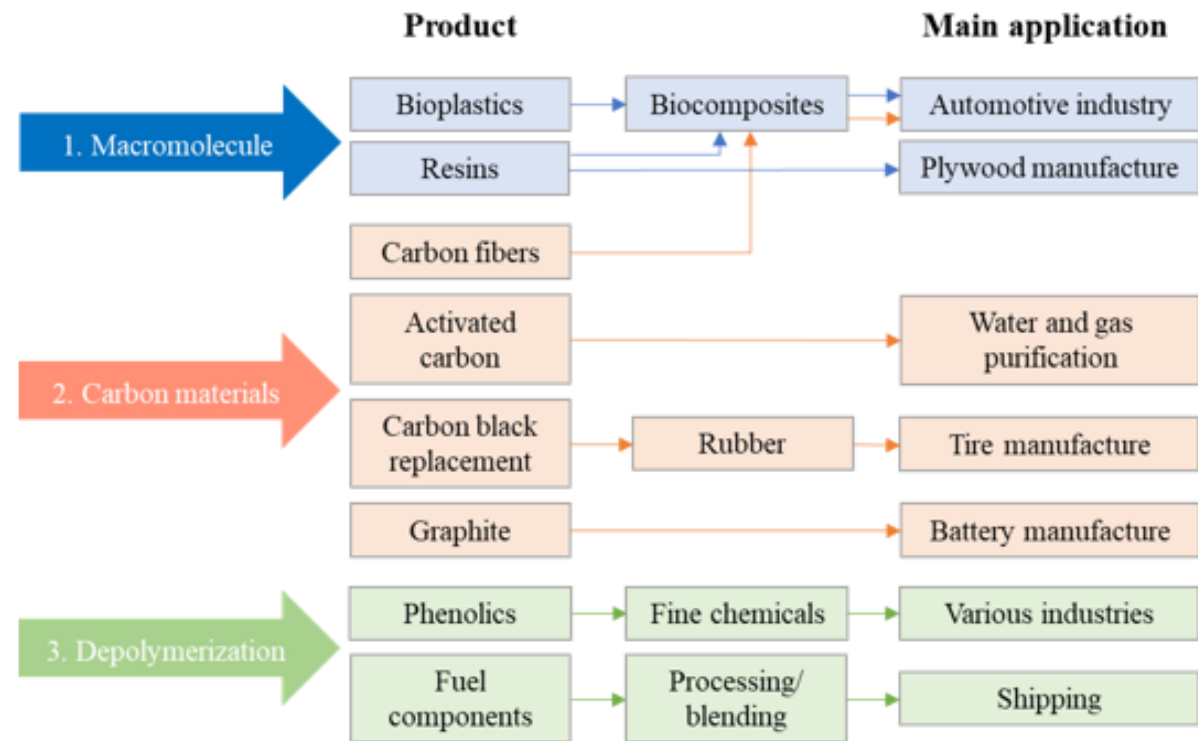
**REFERENCE CUSTOMERS.** We have worked with large Finnish companies including Finnspring, Outokumpu, SSAB and Terrafame. Oulu-based company Hätälä has used OWA Group expertise for comprehensive utilization of side streams.



Indicative feasibility calculation for a  
Fast Pyrolysis Bio Oil  
plant investment

## Pyrolyysi- ja uuttolaitoksen yleiskuva





**Figure 2 Principal value chains from lignin to products.**