

Algae for energy

Identification of the most promising
algal-based pathways in Austria

Maria Hingsamer, Gerfried Jungmeier, Kurt Könighofer,
Naomi Pena, Reinhard Rauch, Günther Bochmann,
Bernhard Drosig, Dina Bacovsky, Andrea Sonnleitner

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1. Project
„Algae – A future renewable energy source? – Current status and future perspectives for the Austrian energy system“
2. Selection of algal utilization for energy production in Austria
 - Algae species for energy production
 - Cultivation, harvesting and processing
 - Conversion technologies for energy production
3. Identification of the most interesting algal-based pathways for Austria
4. First project results

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Content of the project

Funded by:



**R&D Demand
Conclusions &
Perspectives**

Scenarios (2020/2050)

- Identification of algal-based energy pathways
- Possible role in the Austrian energy system

Assessment

- Technical
- Economic
- Environmental
- Energy economic

Basics of algae

- Algae species for energy production
- Productivity rates
- Environmental conditions

Production

- Cultivation methods
- Harvesting technologies
- Processing technologies

Conversion

- Biochemical
- Thermochemical
- Mechanical/chemical

Intended results

- Identification of promising technologies for algae production (cultivation, harvesting, processing, conversion technologies)
- Determination of potential role of algae in Austria's energy system with scenarios for 2020 and 2050
- Determination of potential of algae to reduce greenhouse gas emissions and substitute fossil energy
- Estimation of the future potential of algae to contribute to Austrian energy and climate targets
- Consideration of the possibility of CO₂-sequestration
- Identification of R&D topics

Project – key data

- Project partners:



bioenergy2020+

- Program:
3rd call „Neue Energien 2020“

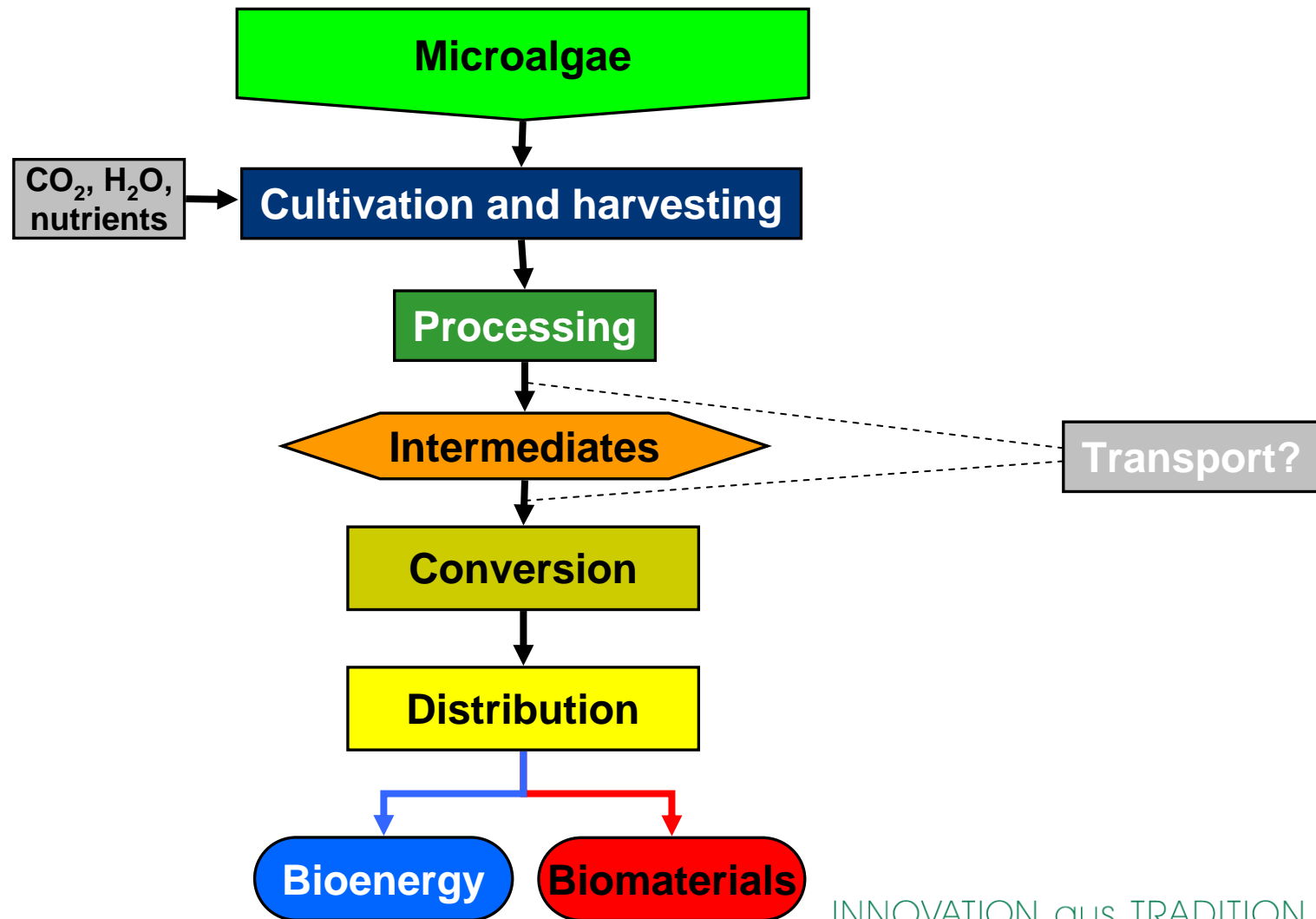
- Financing partner:



- Project duration:
18 month (May 2010 – October 2011)

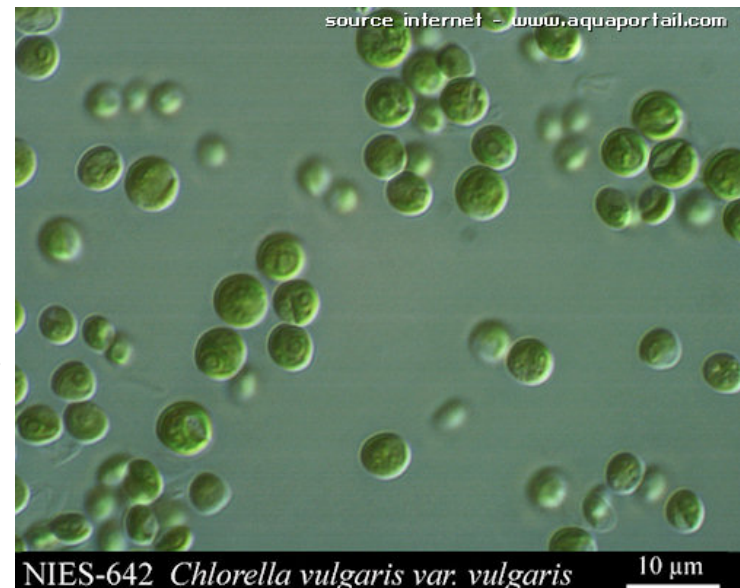
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Overview – Pathways biorefinery



Algae species for energy production

- Numerous algae species
Focus on microalgae
No consideration of macroalgae
- Selection of algae species for specified applications
Criteria e.g.
Productivity
Environmental conditions
Resistance
Harvesting possibilities



Source: <http://www.aquaportail.com/definition-4952-chlorelle.html>

Cultivation methods

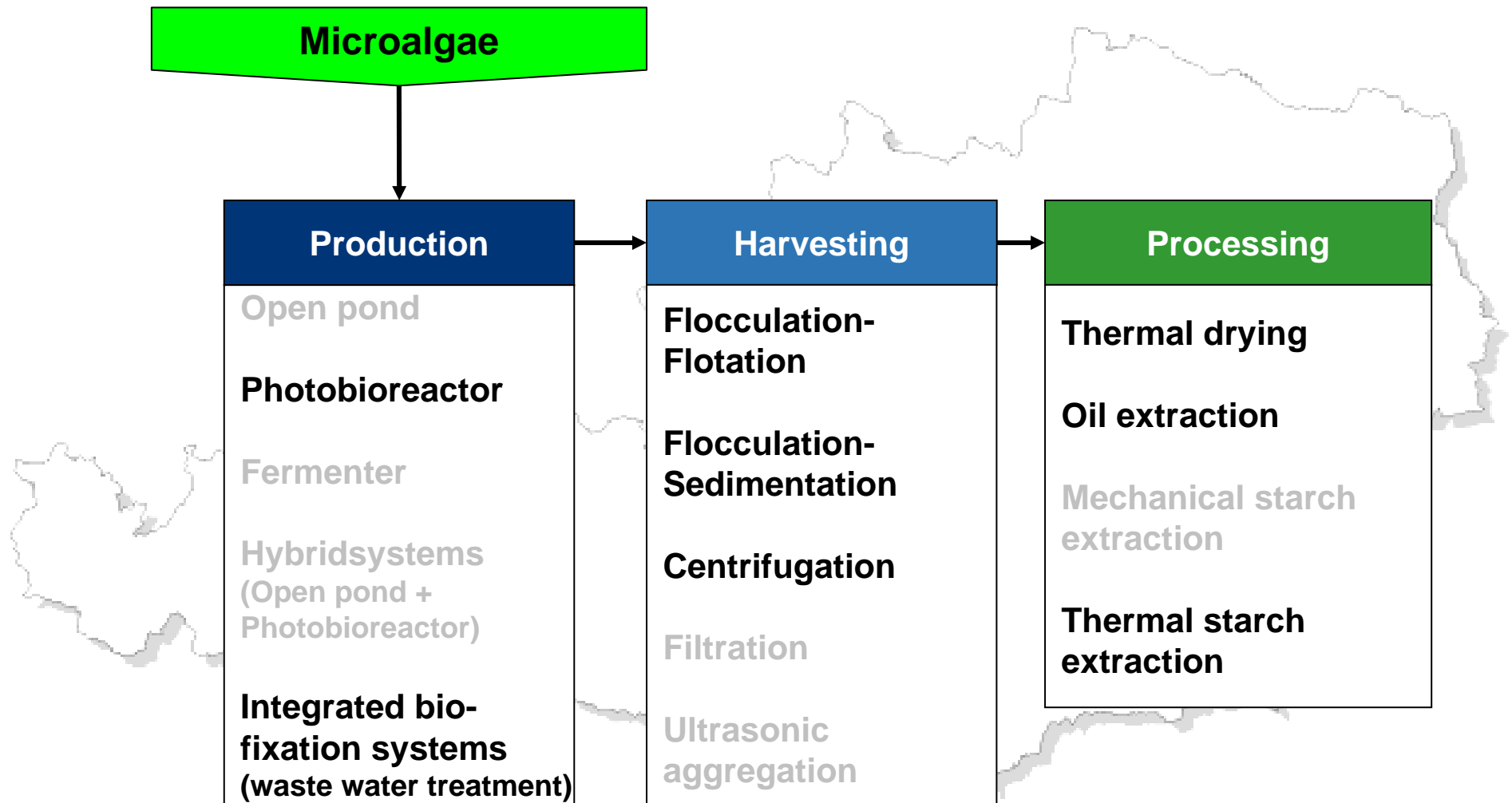
Inputs: water, CO₂, nutrients, “thermal comfort”
(heating, cooling)

- Open ponds
- Photobioreactors
- Fermenter
- Hybrid systems
- Integrated systems

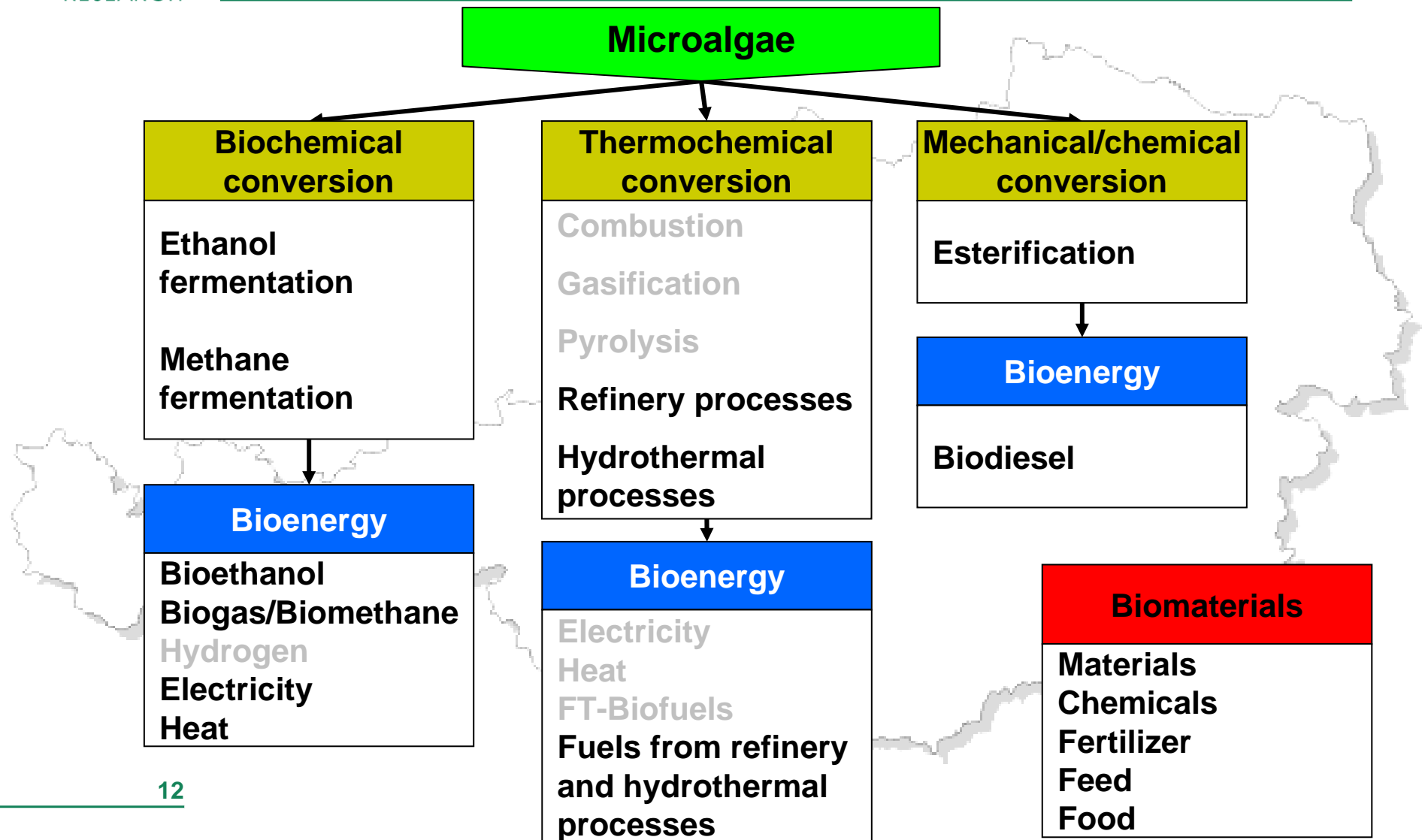


Source: U.S. DOE 2010. National Algal Biofuels Technology Roadmap. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Biomass Program

Production, harvesting and processing: selection for Austria



Conversion technologies: Selection for Austria



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4 groups of algae species

Oleaginous microalgae

Starchy microalgae

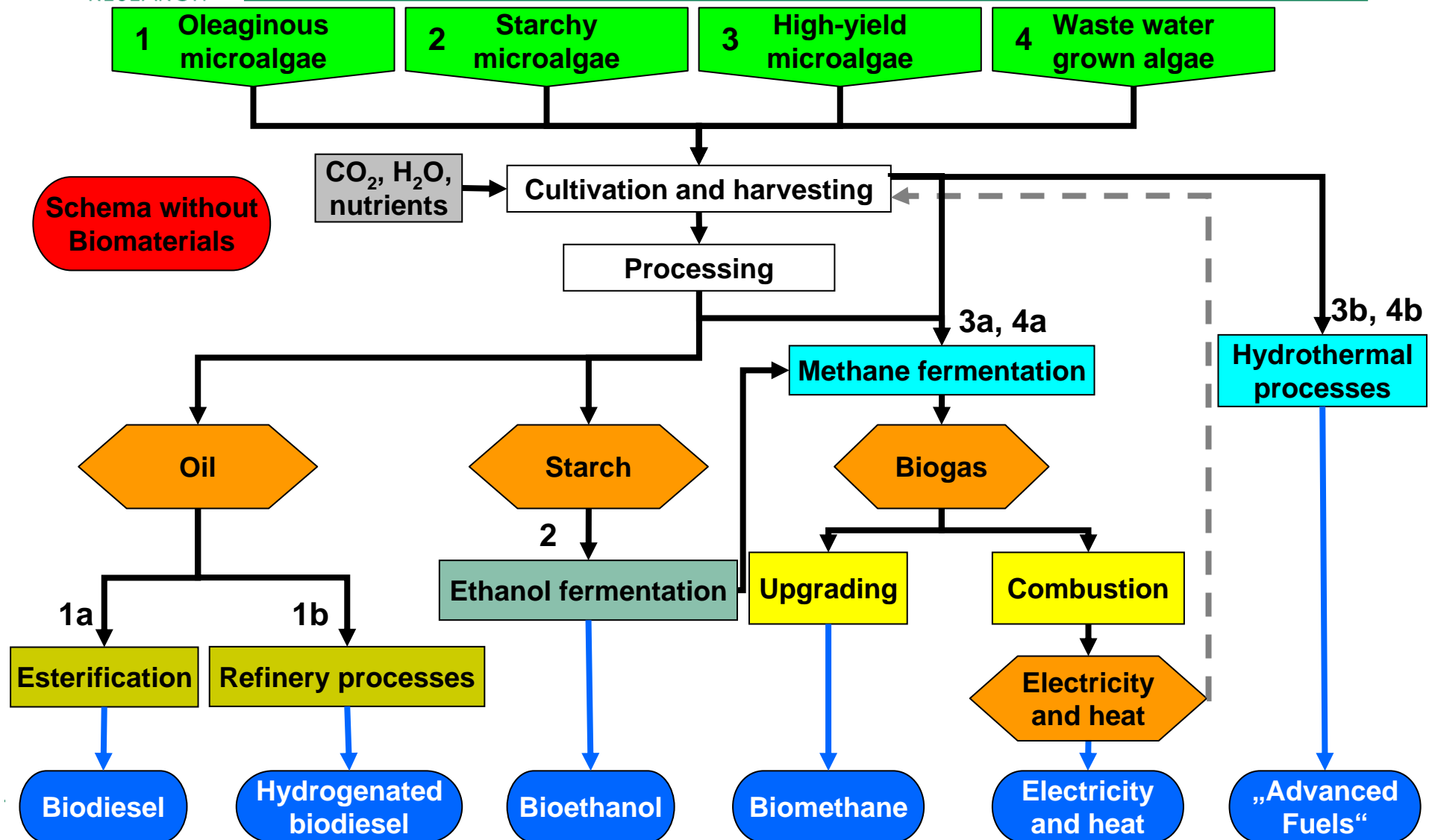
High-yield microalgae

Waste water grown algae

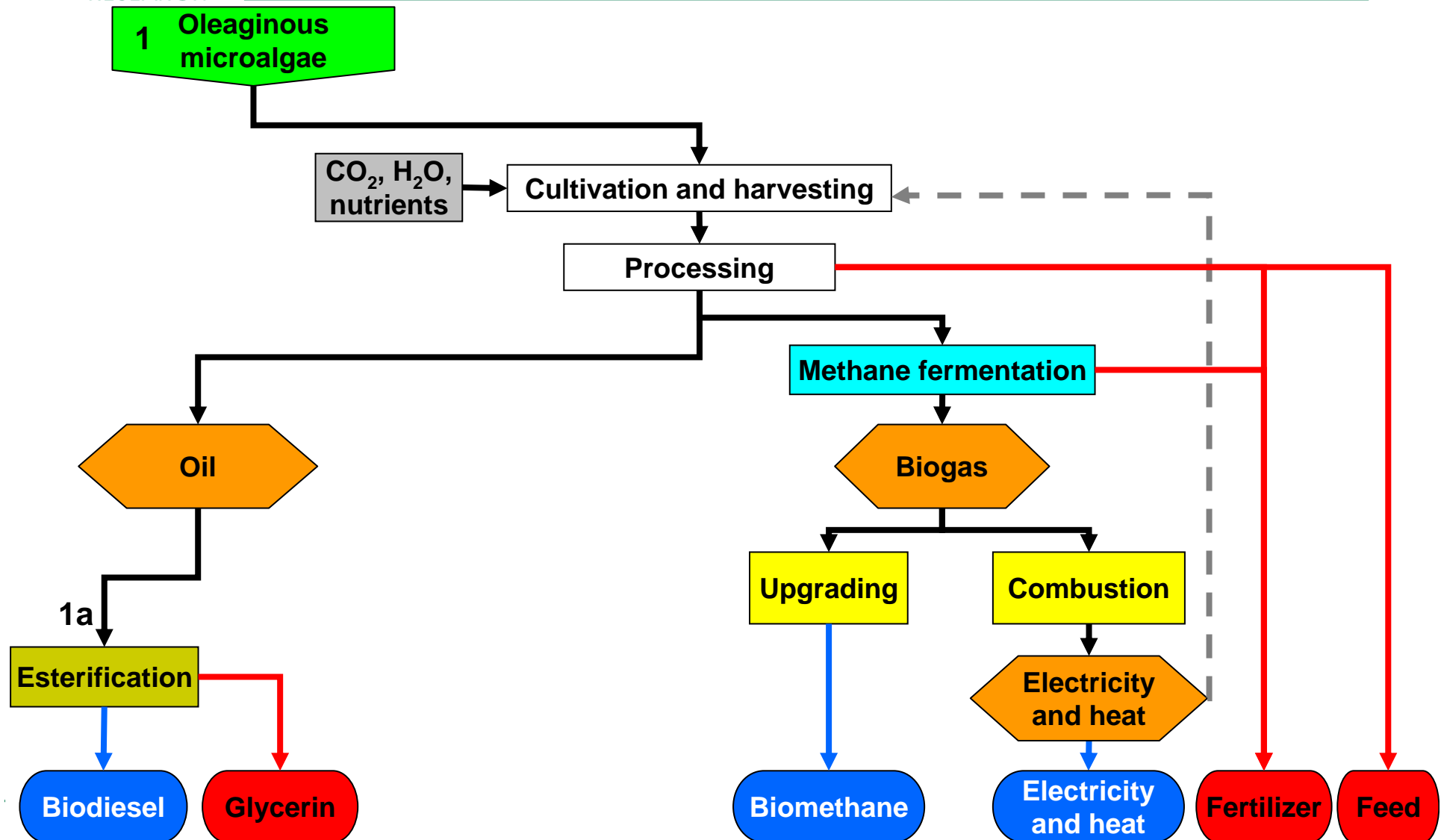
Groups of algal-based pathways biorefinery

Nr.	Algal group	Short term
1	Oleaginous microalgae	1a: Esterification 1b: Refinery processes
2	Starchy microalgae	2: Ethanol fermentation
3	High-yield microalgae	3a: Methane fermentation 3b: Hydrothermal processes
4	Waste water grown algae	4a: Methane fermentation 4b: Hydrothermal processes

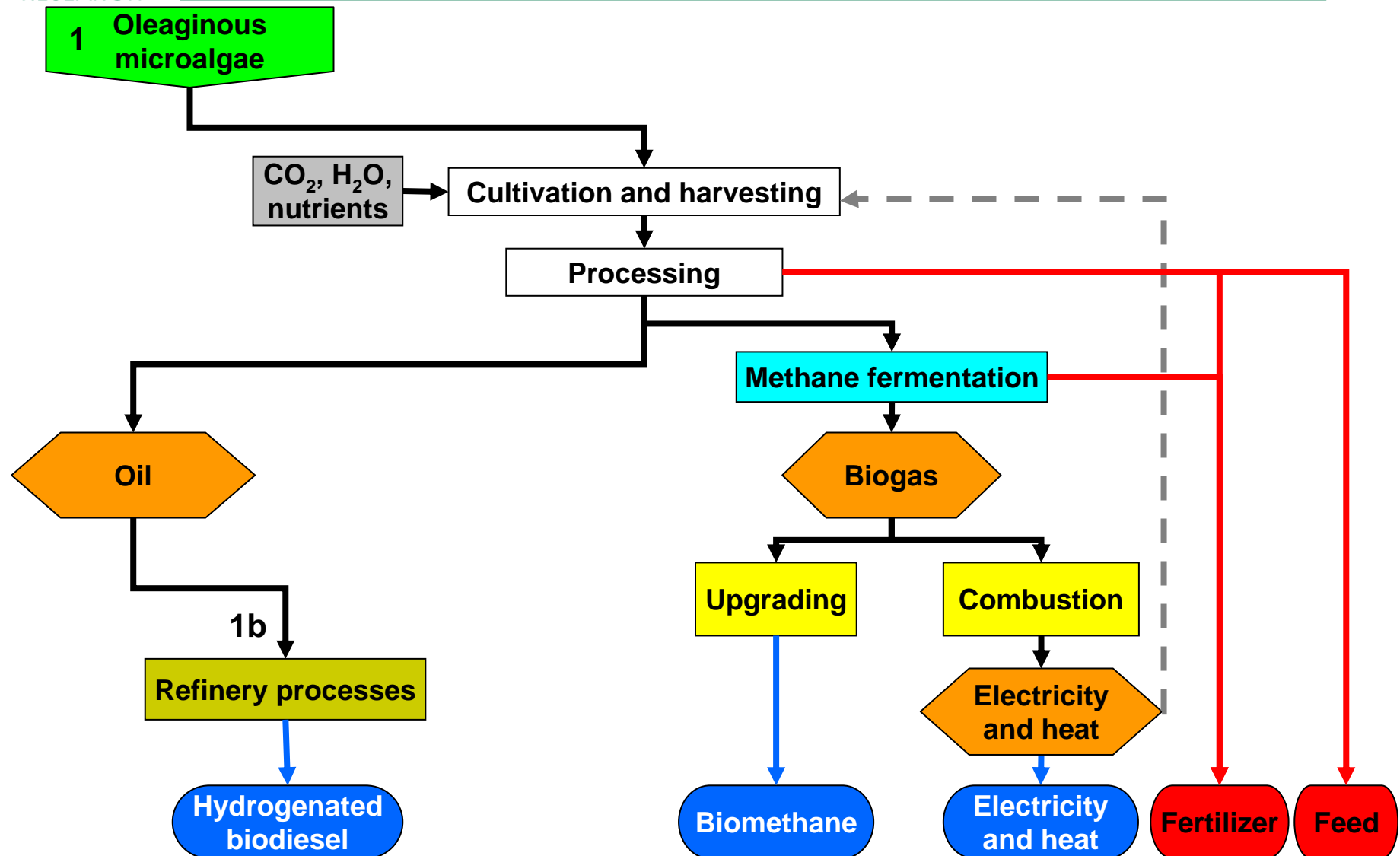
Identified algal-based pathway groups for Austria



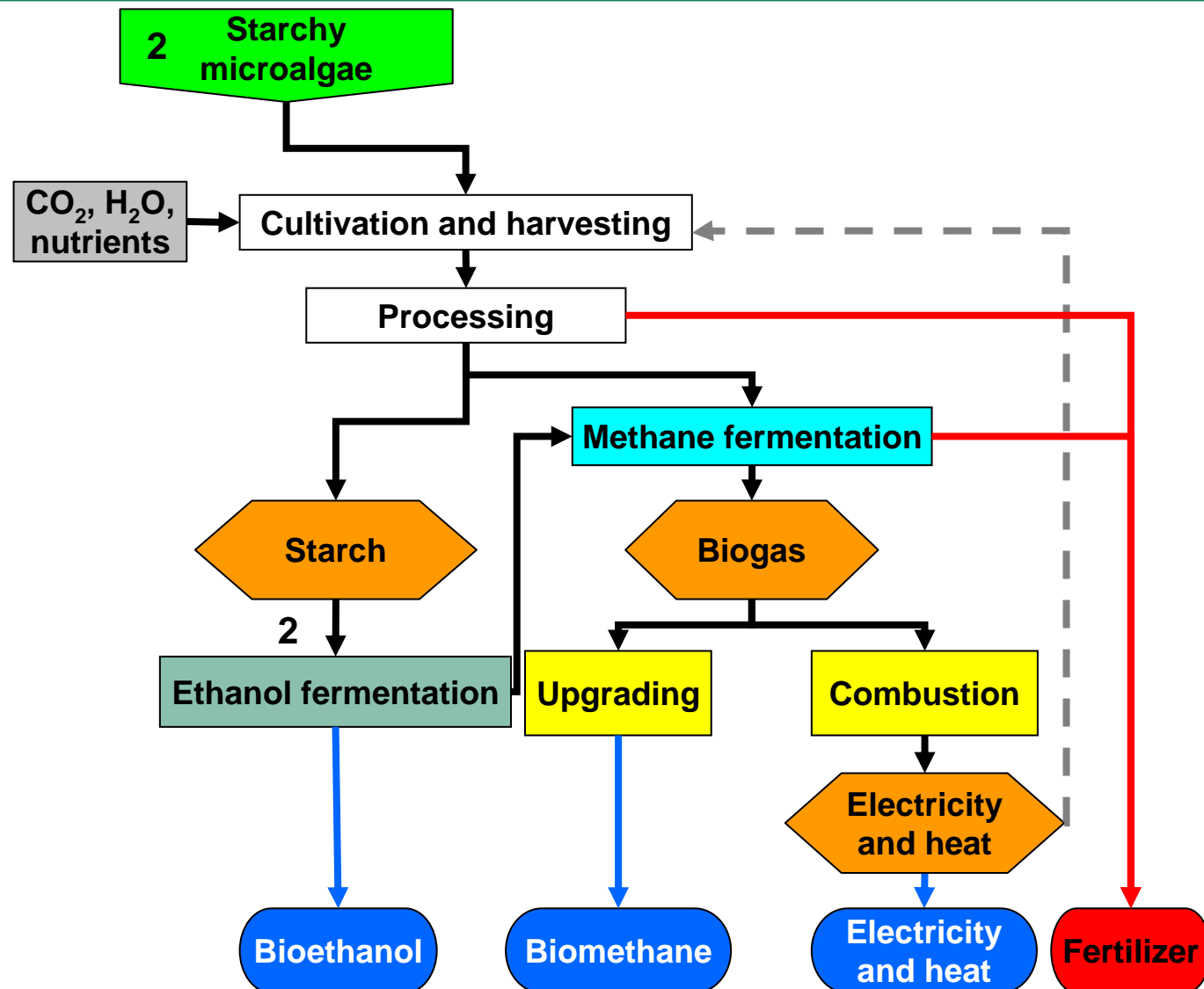
Algal-based pathway group 1a



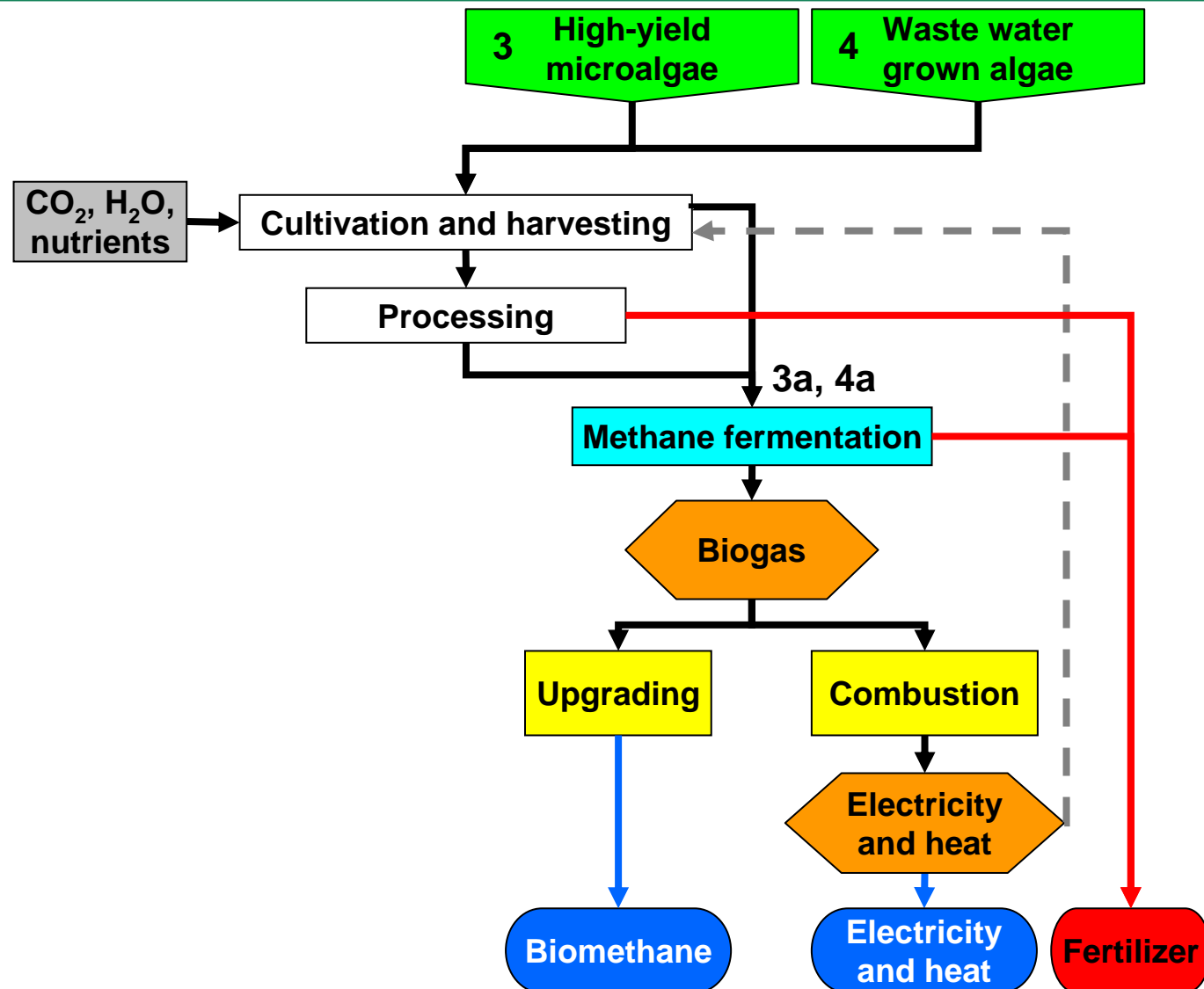
Algal-based pathway group 1b



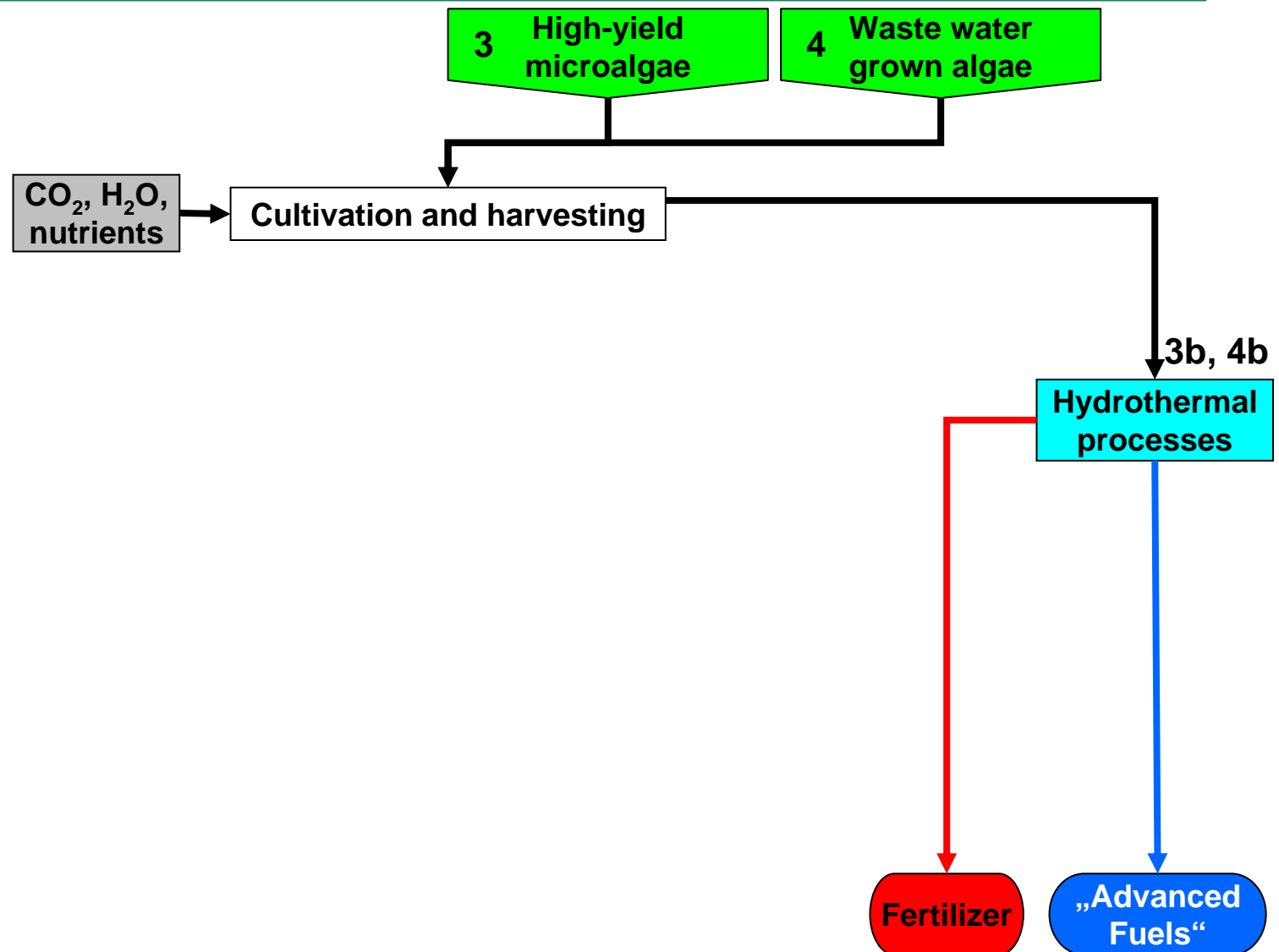
Algal-based pathway group 2



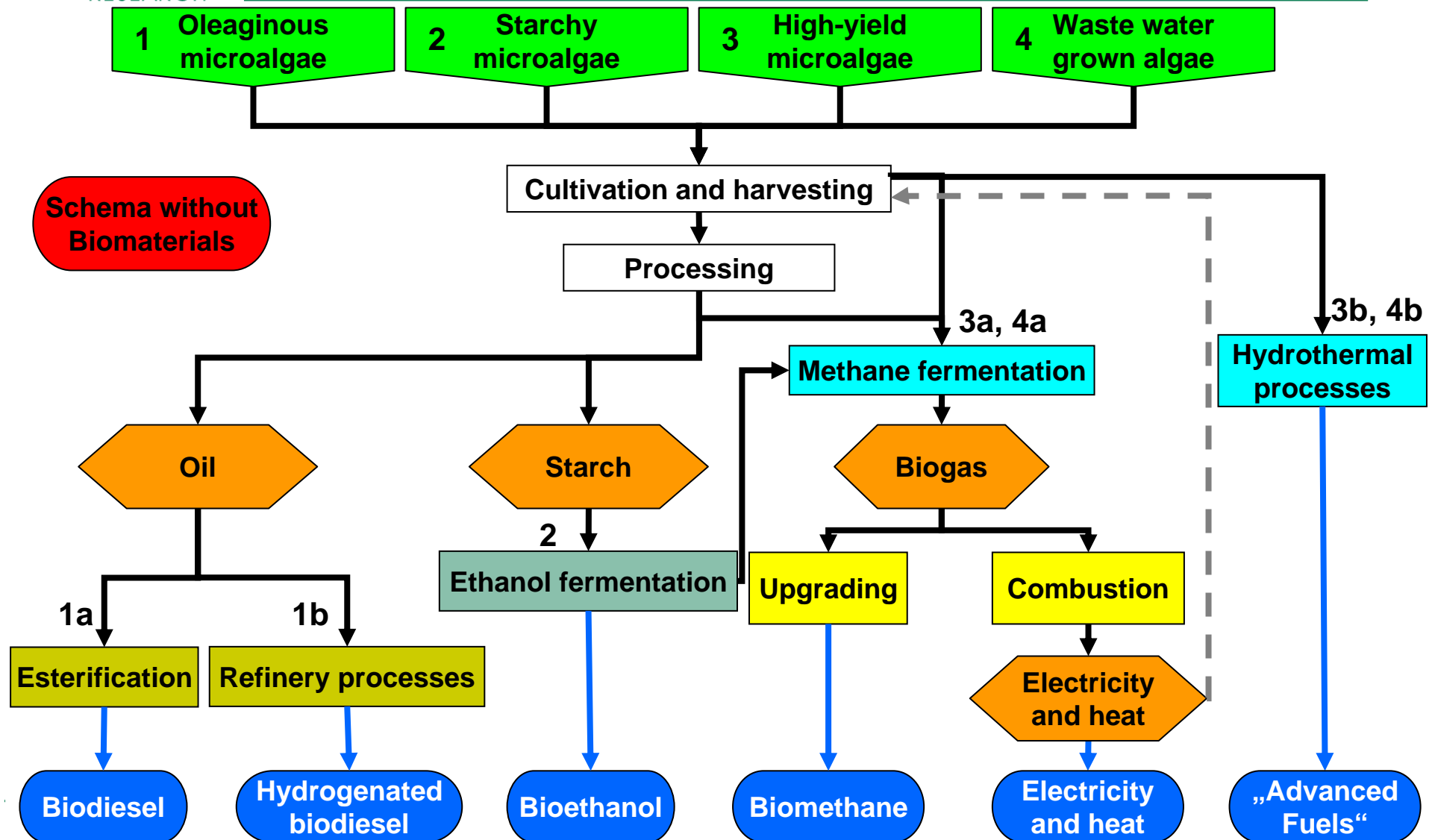
Algal-based pathway group 3a and 4a



Algal-based pathway group 3b and 4b



Identified algal-based pathway groups for Austria



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First project results

- mainly photobioreactors are relevant for Austria
- optimal and efficient use of algae: biorefinery for bioenergy and biomaterials
- long way to commercialisation
- key motivation for current R&D-activities: biodiesel from algae
- algae not suitable as fuel for combustion, gasification, pyrolysis
- siting: where CO₂ is available
- R&D demand: cultivation
harvesting
hydrothermal processes
- expert workshop on 16th March 2011: agreement on pathway selection for Austria
- next steps:
assessment: energy balance, average demand, costs, environment

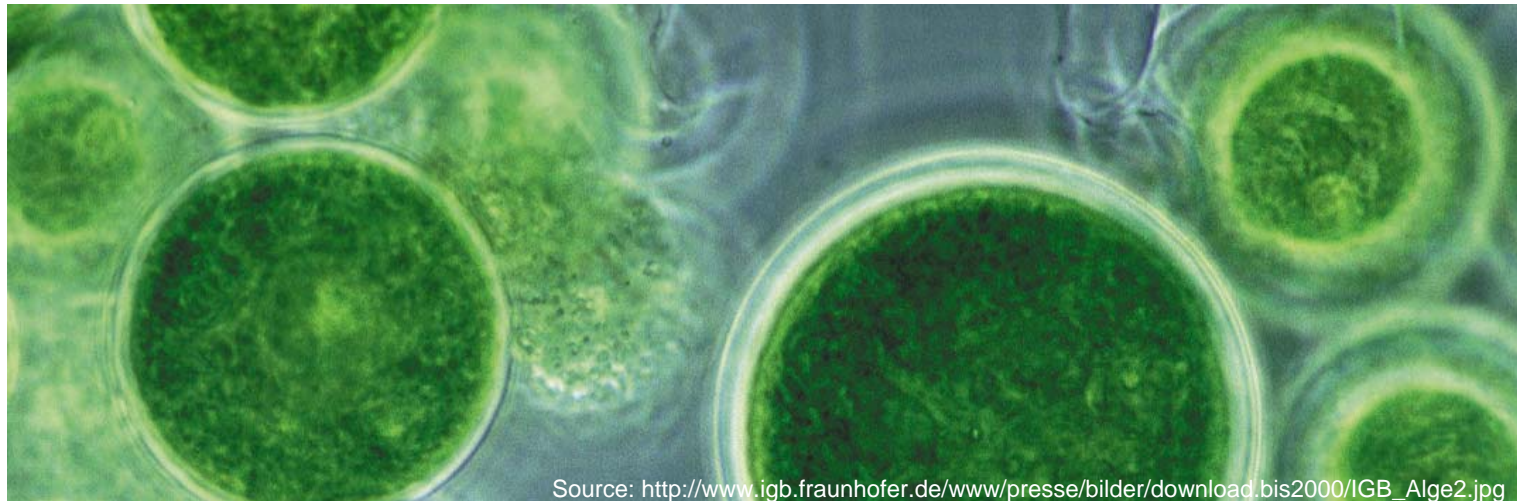
JOANNEUM RESEARCH Forschungsgesellschaft mbH



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www.joanneum.at



Source: http://www.igb.fraunhofer.de/www/presse/bilder/download.bis2000/IGB_Alge2.jpg



Maria Hingsamer
maria.hingsamer@joanneum.at
www.joanneum.at

Elisabethstraße 5/I
8010 Graz, Austria