

Opportunities to increase the use of geothermal for food production

GEOforFOOD webinar 29 June 2021

Helga Gunnlaugsdóttir
Sveinn Aðalsteinsson



Orkídea – about us

- Orkídea is an innovation promoter – a cooperation in S-Iceland funded and supported by Landsvirkjun Power Ltd., Association of S-Iceland Municipalities, Agricultural University of Iceland and Ministry of Fisheries and Agriculture
- S-Iceland is by tradition a source of food produced using renewable energy (hydro, geothermal)



Photo: Páll Jökull Pálsson

Food security is an urgent global problem

- Need to be able to feed 9 billion people by 2050, this will require 60 % increase in food production.
- Shortage of natural resources i.e. 70 % of global fresh water, 50% of global habitable land and 30 % use of global energy production are already consumed in making our food.
- Increasing unsustainable global demand for meat and animal products
- 25-30% of global greenhouse gas emissions are related to food production
 - **Need to seize opportunities to increase the use of geothermal for food production**

Electricity from geothermal sources used for food production

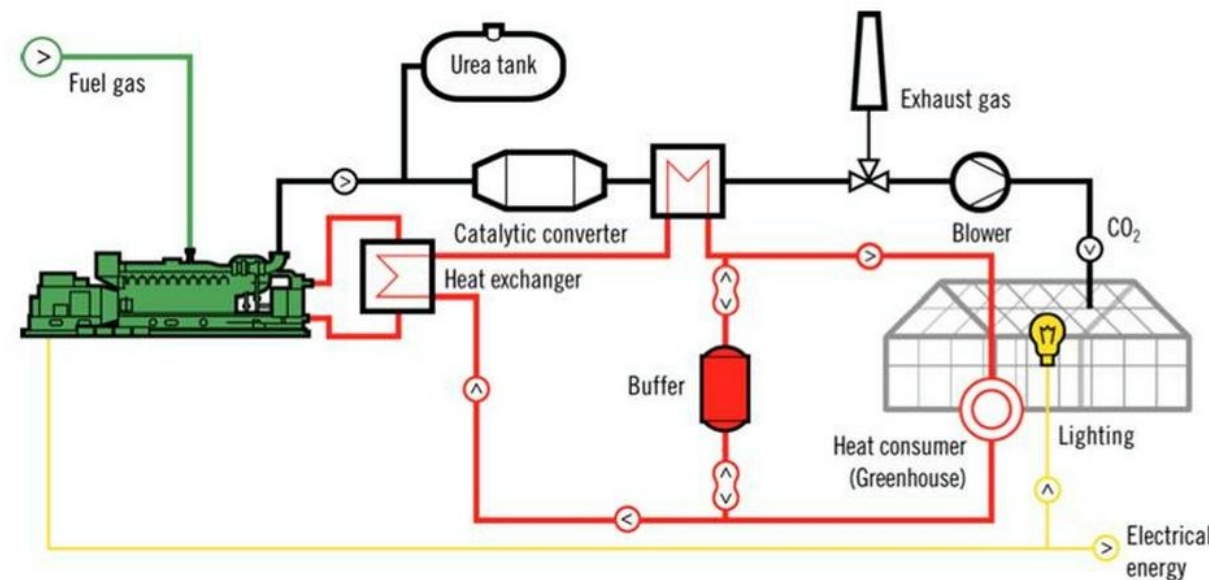
- Use direct geothermal steam to generate electricity for e.g. growth lights and production of hot water for heating of greenhouses
- Binary Cycle turbines to generate electricity using secondary fluid/vapor and heat exchanger
- Waste heat from geothermal power plants can be used in sequential food production processes e.g. aquaponics
- Use CO₂ from geothermal steam to produce purified CO₂ for use in e.g. greenhouses to stimulate growth and increase yield

Geothermal instead of fossil fuels in horticulture - challenges

- Energy transition means less CO₂ is produced in CHPs (Combined Heat and Power)
- CO₂ must therefore be added from other sources which may be expensive – and retained as possible in the growth environment
- Heating & cooling techniques could be used for retaining CO₂ and heat in greenhouses

ENERGY ELECTRICAL INTEGRATORS CORP

RENZO.PIOVESAN@EEICORP.U



Geothermal & Precision agriculture

- **Vertical Farming;** growing crops in vertically stacked layers indoors – usually incorporating precision agriculture techniques such as irrigation systems, climate control and lighting methods
 - **Hydroponics** – growing plants without soil
 - **Aquaponics** – growing fish & plants together in one place



Aquaculture – onshore

- Shift towards technically advanced land-based systems for high value seafood
- Facilitated by Recirculating Aquaculture Systems (RAS)
- Energy and water intensive
- Geothermal water provides advantages for farming warm-water species e.g. sole, abalone, bass, shrimp
- Warmer water enables fish to grow all year round

Advantages :

- ✓ Improved control of living conditions and optimisation of production
- ✓ No direct discharge to the ocean
- ✓ Pathways to circularity as waste products can be processed and used as agricultural fertilizer

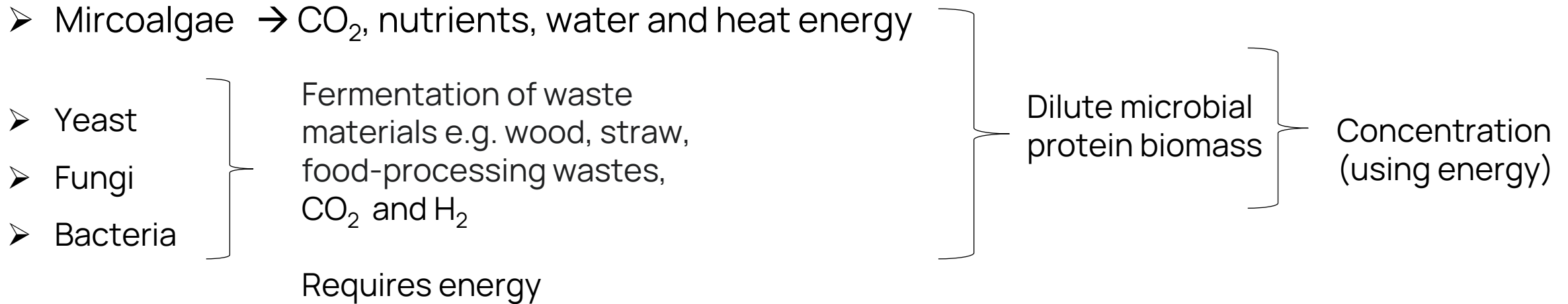


Aquaponics

- Circular production system based on combining RAS with a horticulture production system
- Nutrient rich aquaculture wastewater is fed to hydroponically grown plants - nitrifying bacteria are essential for converting ammonia into nitrates
- Energy and water intensive
- Difficult to optimise for both cultures



Production of single cell proteins (SCP)



Advantages of SCP production:

- ✓ High growth rate of microorganisms
- ✓ Much lower water footprint than agricultural food production
- ✓ High protein content (30–70%) in the dry mass
- ✓ Production is independent of seasonal and climatic variations
- ✓ Consistent product profile



We want to hear from you 😊



Sveinn Aðalsteinsson sveinn@orkidea.is
PhD in Plant Physiology



Helga Gunnlaugsdóttir helga@orkidea.is
PhD in Food Engineering

www.orkidea.is



orkidea@orkidea.is

Austurvegi 56 – 800 Selfoss