



**UNIVERSITÉ  
DE GENÈVE**

**FACULTY OF SCIENCES**  
Department of Earth Sciences



**GE-RGBA**  
GEOENERGY  
RESERVOIR GEOLOGY  
AND BASIN ANALYSIS GROUP



**ETIP-DG**

European Technology & Innovation  
Platform on **Deep Geothermal**



# Towards a Geothermal Food Processing Future

Luca Guglielmetti, PhD

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# Agenda

- **Geothermal Energy in Food Processing**
- **Case Studies of Tasty applications**
- **Future Perspectives**

# FOOD PROCESSING

Food processing is any method used to turn fresh foods into food products

This can involve one or a combination of various processes

washing

chopping

pasteurising

freezing

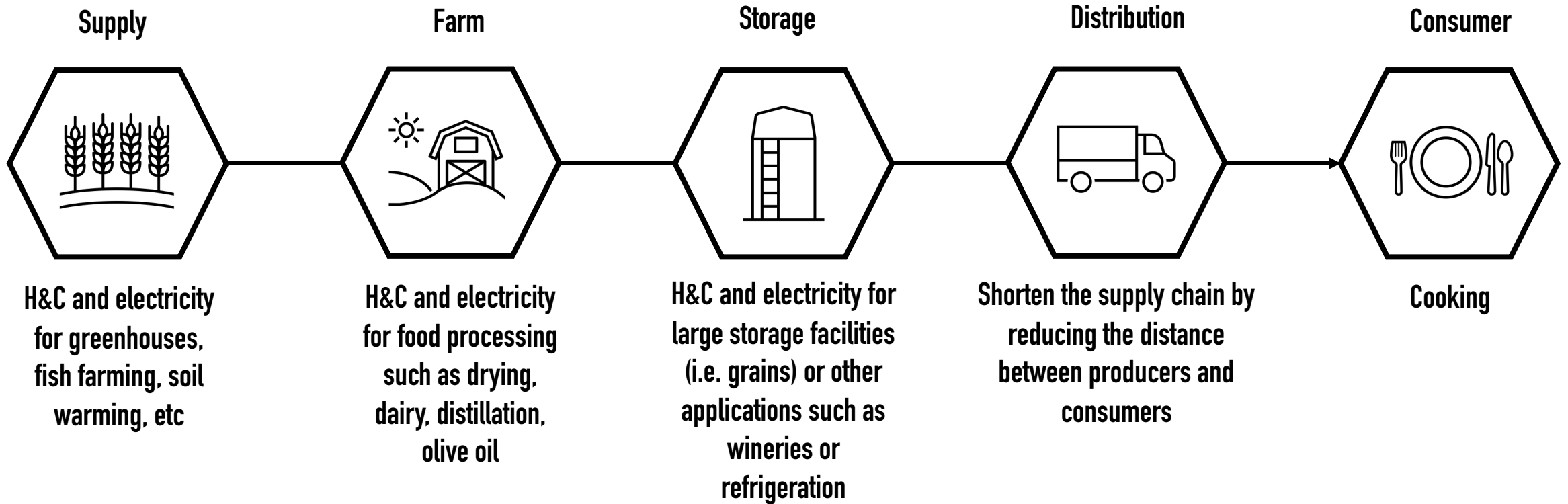
fermenting

packaging

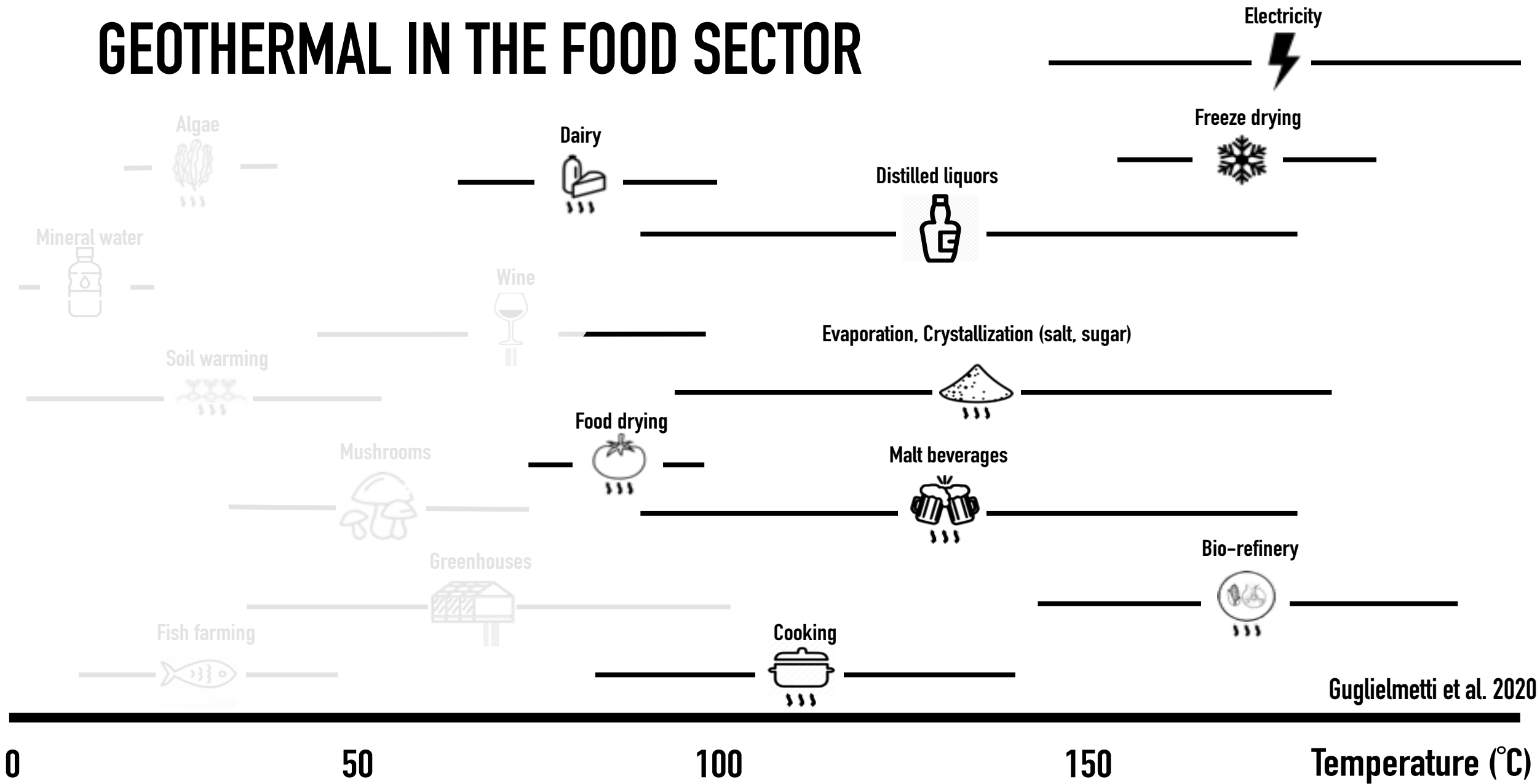
cooking

adding ingredients

# GEOHERMAL IN THE FOOD SUPPLY CHAIN



# GEOHERMAL IN THE FOOD SECTOR



Guglielmetti et al. 2020



# Cooking using fumaroles



Lanzarote

400–500°C



Azores

90–100°C



Credit: Industry Tap

Credit: Eat Drink Travel Magazine

# Baking using hot springs

Iceland  
90–100°C



For more geothermal cooking all over the world:  
<https://www.thinkgeoenergy.com/using-geothermal-energy-for-cooking-examples-from-around-the-world/>

Credit: Agrodolce

# Food Drying

Low to medium

temperature

geothermal resources can reduce energy consumption in the drying process,

The process consists of removing water contained in the product

below 20%

70°C–95°C





# Food Drying



**62°C from a 400m deep well**

**<56°C operating temperature**



**24–25 hours drying time**

To preserve maintain the nutritional characteristics, their flavor and natural aroma.



Credits: Geothermiki Hellas

# Dairy

## Milk pasteurisation

Geothermal hot water can be used for milk pasteurisation, while geothermal steam can be used for milk drying and ultra-heat treatment (UHT) processes.



**70-100°C**

# Pecorino Cheese in Tuscany

**180°C** from the plant  
**500m** pipe

**8-9% - 10k euros**  
savings/months on H&C bills

**138 tons CO2** saved/year  
worth **45k euros**



# Breweries

**0.7kg CO<sub>2</sub>eq/L**  
is the average GWP  
of standard brewing

**Micro-breweries are an expanding market globally.  
Geothermal micro-breweries are located in Iceland, Italy**

**STEAM from a nearby powerplant supplies all the brewery phases**

# Geothermal Brewery in Tuscany

**Super-heated water at 136°C**

**78°C mashing phase**

**82°C washing phase**

**230°C at 6bars**



**20'000 liters  
yearly production**

# Geothermal Brewery in Tuscany



GEOTHERMAL PILLS

<https://www.youtube.com/watch?v=gjoSSJ3V3fk>

<https://www.vaporidibirra.com/>

**0.1 kg/l GWP (kgCO<sub>2eq</sub>/y)**

Source: Peerdeman (2017)

**12 tons/year  
of CO<sub>2</sub>  
avoided**

# Geothermal Brewery in Tuscany

**100%  
Geothermal  
energy  
supply**



GEOTHERMAL PILLS

<https://www.youtube.com/watch?v=gjoSSJ3V3fk>

<https://www.vaporidibirra.com/>

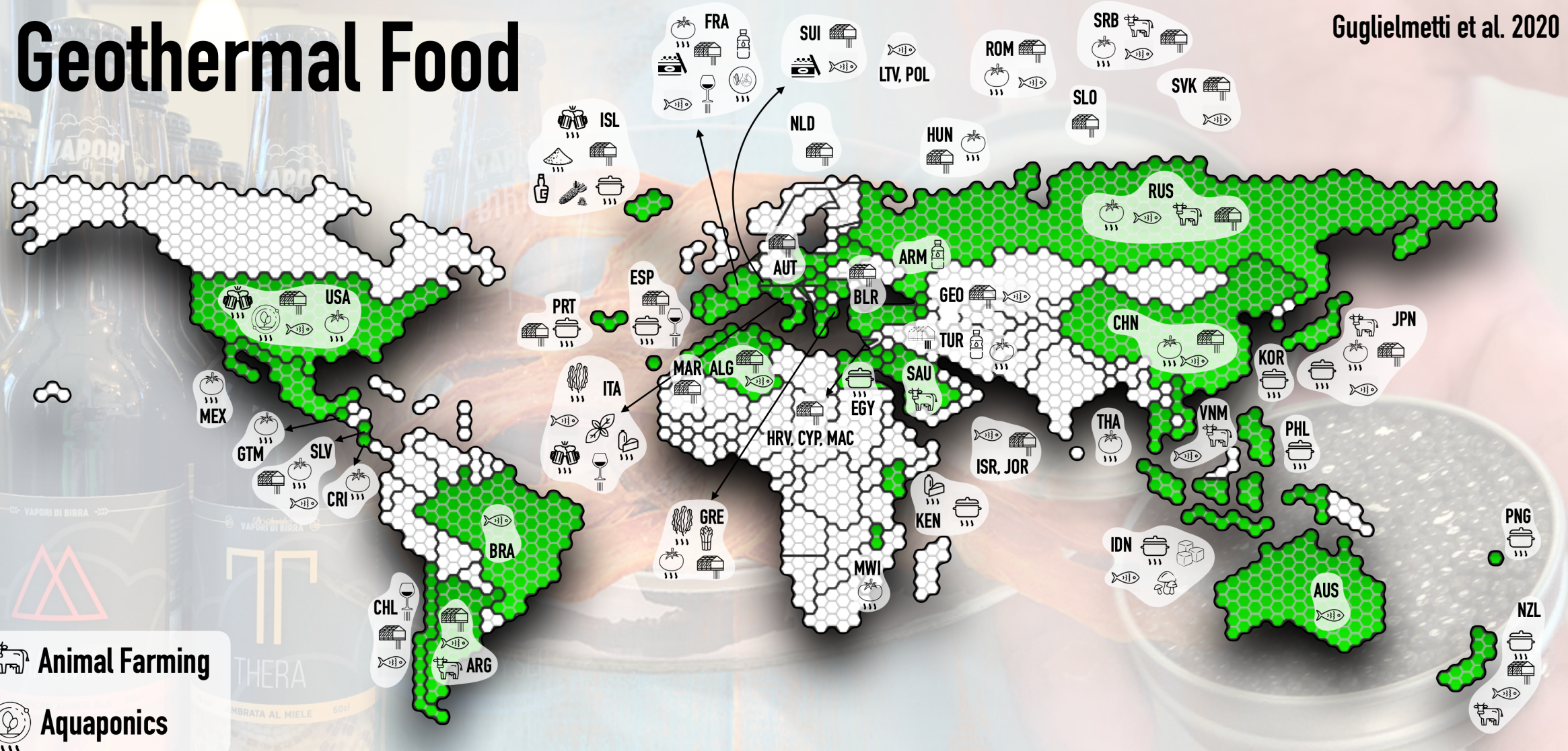
# Towards the future . . .

- **Cascade applications from existing plants but also tailor-made solution**
- **Integration to other renewables**
- **CO<sub>2</sub> recovery**
- **Alternative sources of protein**
- **Creation of Geothermal Food Communities**
- **Life Cycle Assessment**
- **Focus on SUSTAINABILITY**
- **Certificates can contribute to ensure the quality and provide incomes to the food industry**
- **The food sector would strongly benefit from geothermal**
- **Geothermal IS NOT the solution. It's part of it**



# Geothermal Food

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**Animal Farming**

**Aquaponics**

**Asperges**

**Basil**

**Cooking**

**Fish Farming**

**Greenhouses**

**Salt**

**Starch**

**Wasabi**

**Beer**

**Caviar**

**Dairy**

**Food Drying**

**Mineral Water**

**Spirits**

**Spirulina**

**Wine**

# References

- Monteiro C, Levy R, Claro R, et al. (2010). A new classification of foods based on the extent and purpose of their processing. *Cad Saude Publica* 26(11), pp. 2039–2049.
- Floros J, Newsome R, Fisher W, et al. (2010). Feeding the world today and tomorrow: the importance of food science and technology. *Comprehensive Reviews in Food Science and Food Safety* 9(5), pp. 572–599.
- Dwyer J, Fulgoni V, Clemens R, et al. (2012). Is ‘Processed’ a four-letter word? The role of processed foods in achieving dietary guidelines and nutrients recommendations. *American Society for Nutrition* 3, pp. 536–548.
- Weaver C, Dwyer J, Fulgoni V, et al. (2014). Processed food: contributions to nutrition. *The American Journal of Clinical Nutrition (AJCN)* 99(6), pp. 1525–1542.
- IRENA (2019). Accelerating geothermal heat adoption in the agri-food sector Key lessons and recommendations.
- Lindal, B. (1973). *Industrial and other applications of geothermal energy*. *Geothermal Energy*, 135–148.
- Lund, J. W., & Toth, A. N. (2021). *Direct utilization of geothermal energy 2020 worldwide review*. *Geothermics*, 90, 101915.
- Nguyen, M. Van, Arason, S., Gissurarson, M., & Pálsson, P. G. (2015). Uses of Geothermal Energy in Food and Agriculture: Opportunities for Developing Countries. In *Agriculture and Consumer Protection*.
- Peerdeman, C. (2017). *An Environmental and Economical Case Study of Local Beer Production in Tuscany – A Scenario Approach*



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