

The status of geothermal direct use, with a focus on agriculture and agro-industry sectors.

Sigurjón Arason, Professor, University of Iceland
Chief Engineer, Mátis ohf.

Unlocking Geothermal Investments in Central America: Strengthening Enabling Policy and Regulatory Frameworks

21-22 August 2017 – San Salvador, El Salvador



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Food and Agriculture Organization of the United Nations

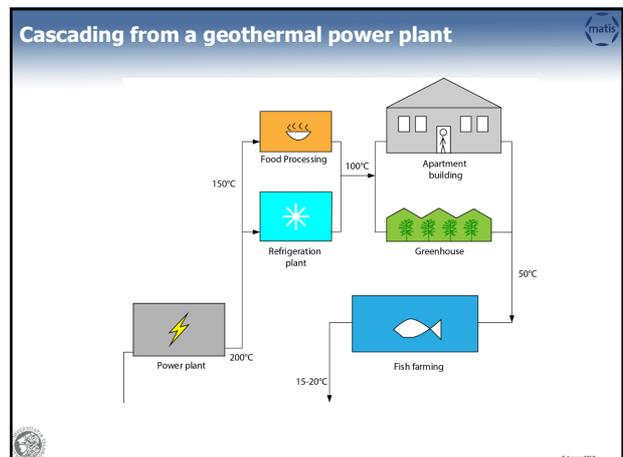
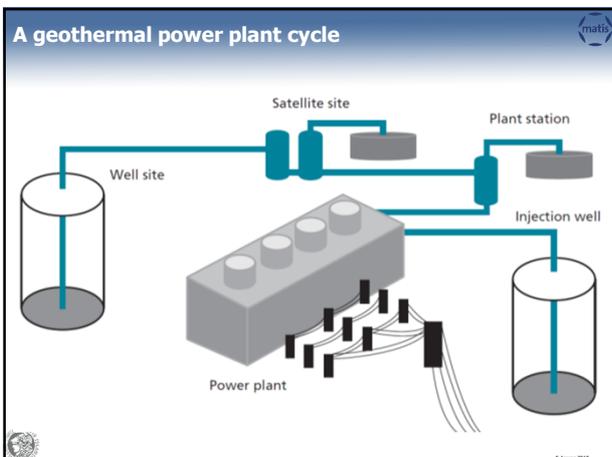
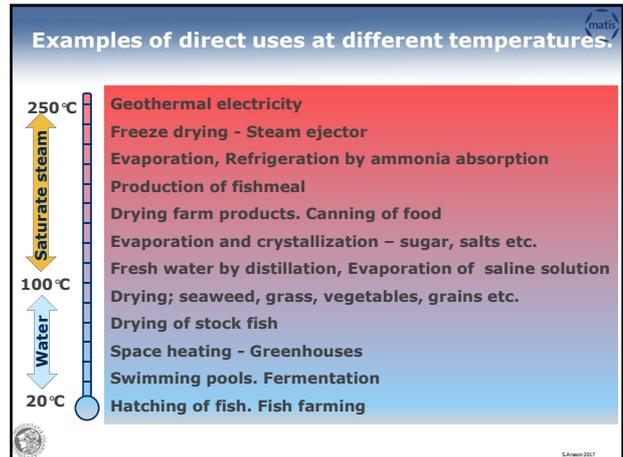
Uses of Geothermal Energy in Food and Agriculture

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Arason, S.,
Gissurarson, M.,
Pálsson, P. G.

<http://www.fao.org/3/a-i4233e.pdf>



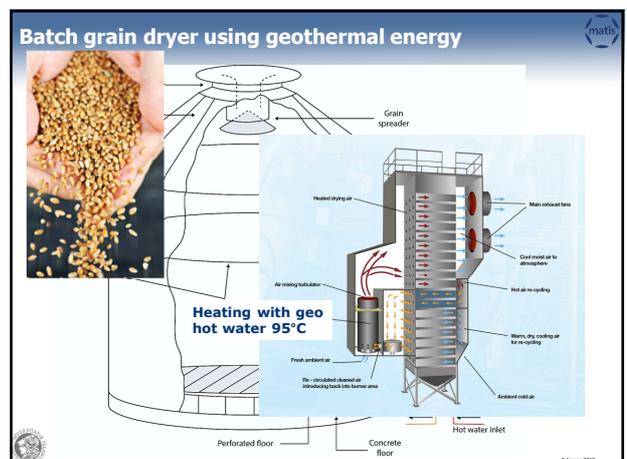
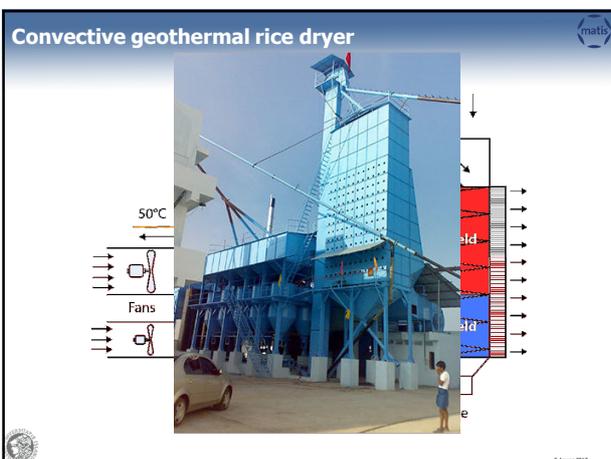
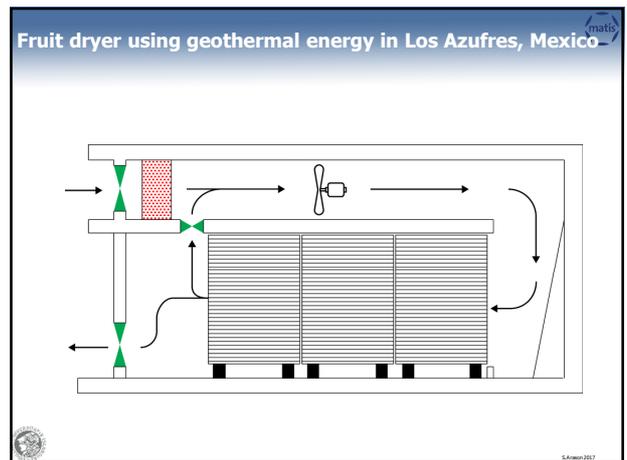
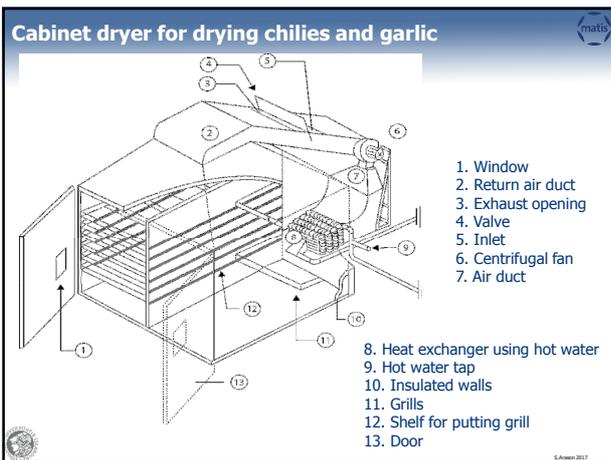
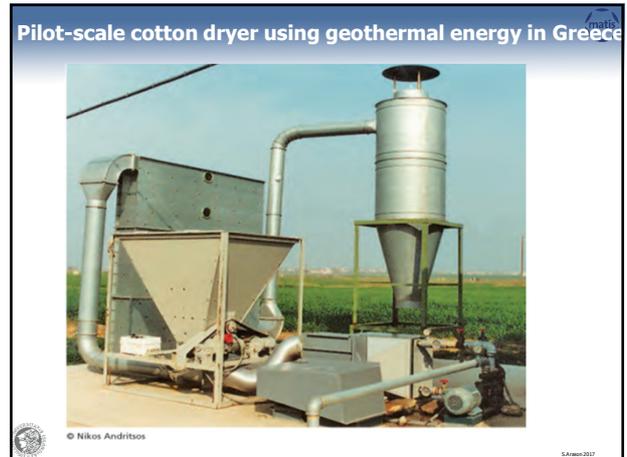

Uses of geothermal energy in food and agriculture
Opportunities for developing countries



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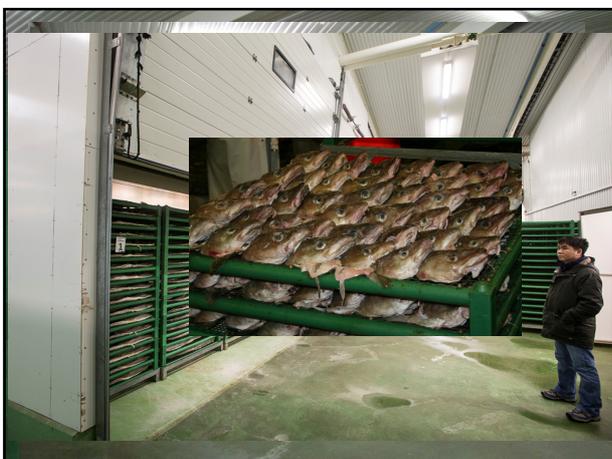
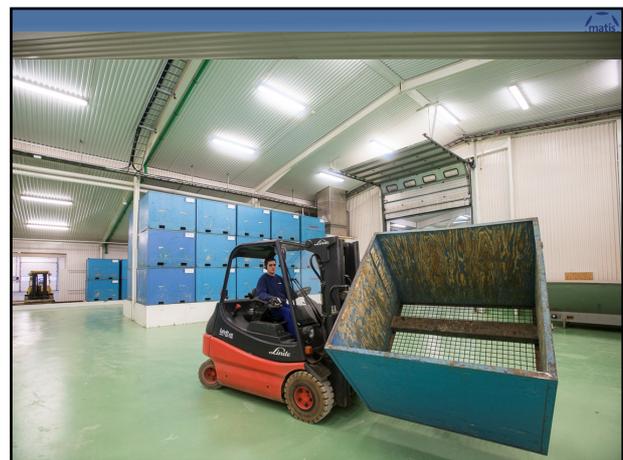
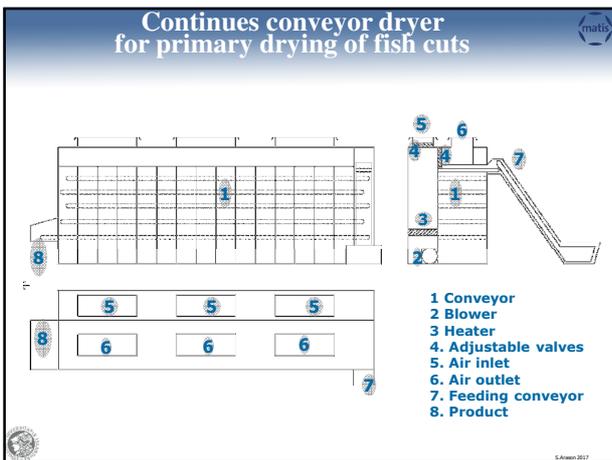
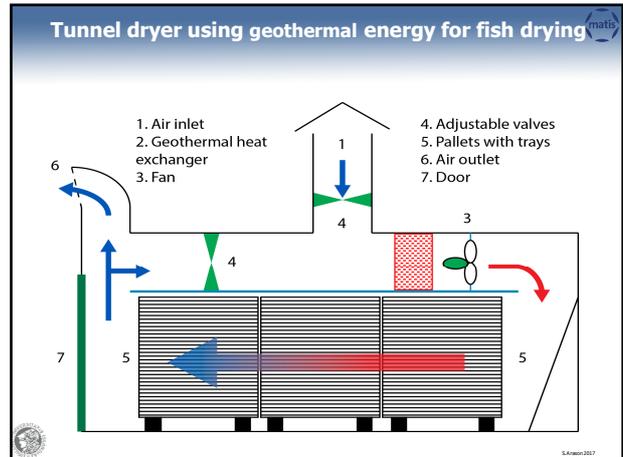
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The developing indoor drying of fish in Iceland

- The first companies in this field were founded 39 years ago and now there are more than fifteen companies with over 100 big dryers.
- In the fishing industry, geothermal energy has mainly been applied to indoor drying of cod heads, small fish, stock fish, salted fish, seaweed and other products.

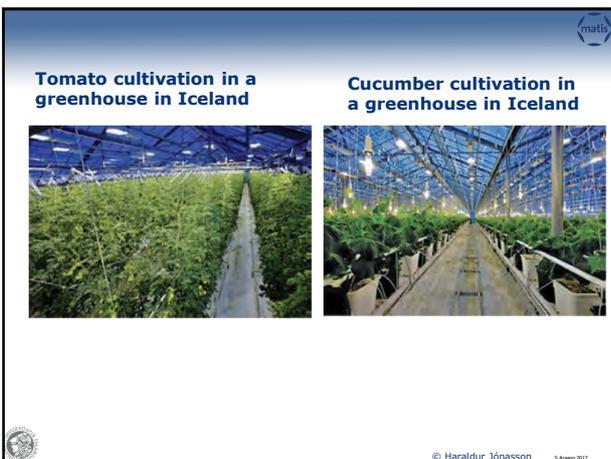
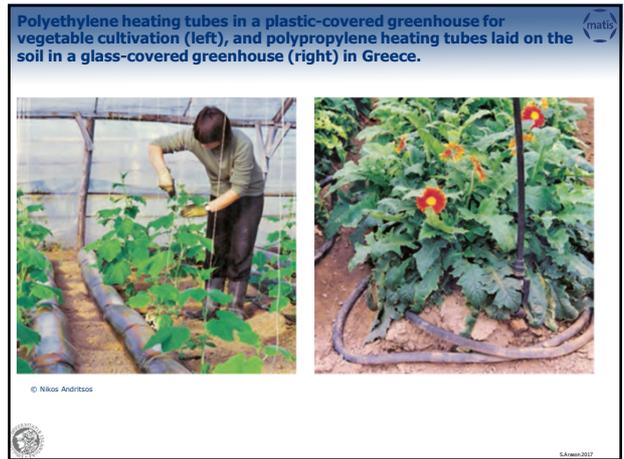
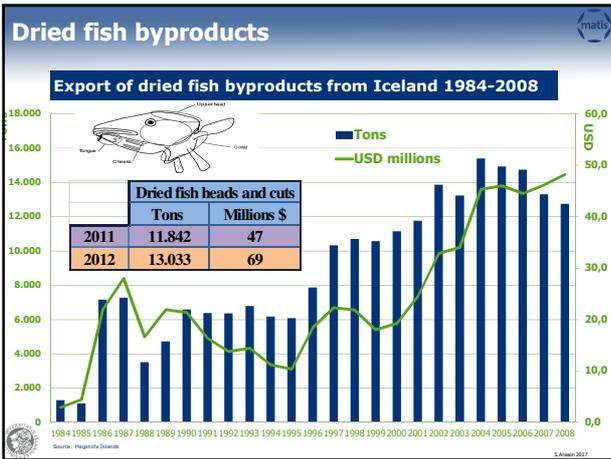
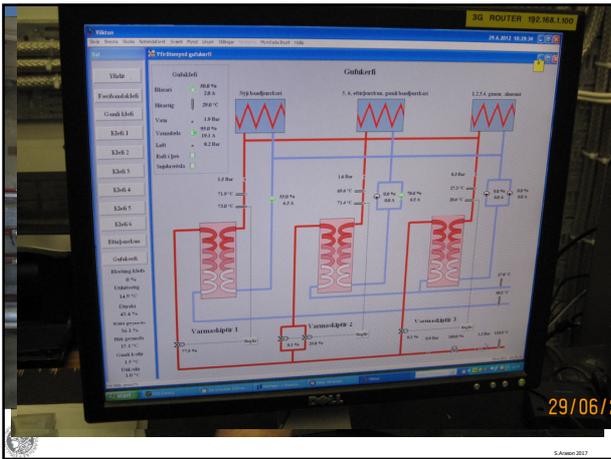


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ORF Genetics Ltd. is a global leader in the manufacturing of plant-made recombinant proteins in Greenhouse.

BIOEFFECT® is Icelandic skin care brand, based on 10 years of biotechnology research by ORF Genetics.

Endotoxin-free Growth Factor – Paradigm Shift

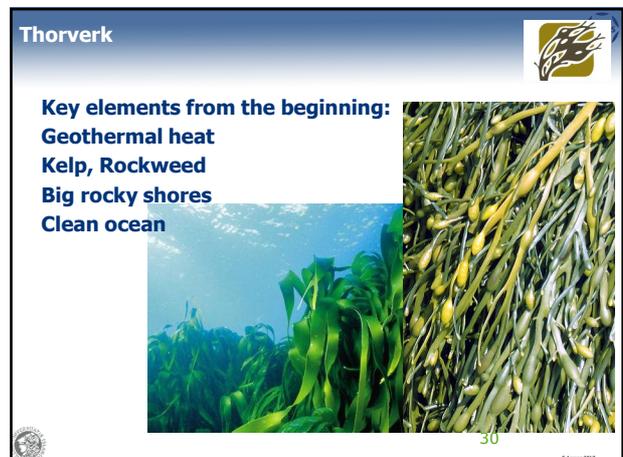
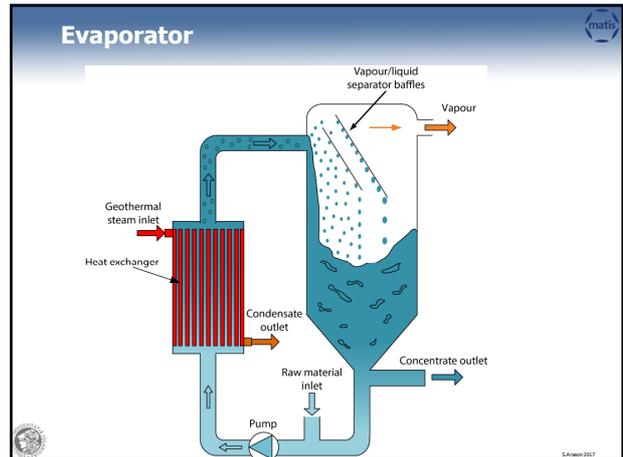
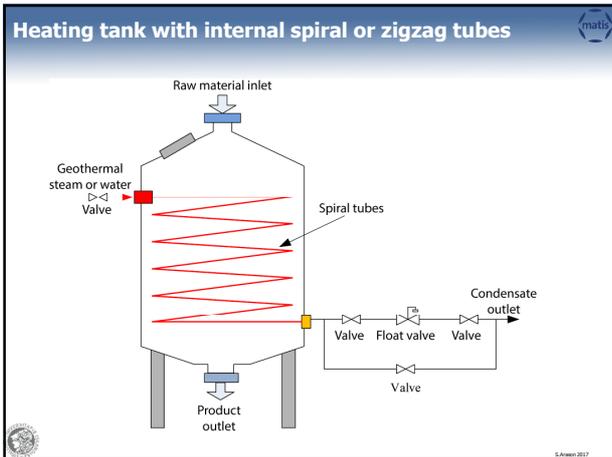
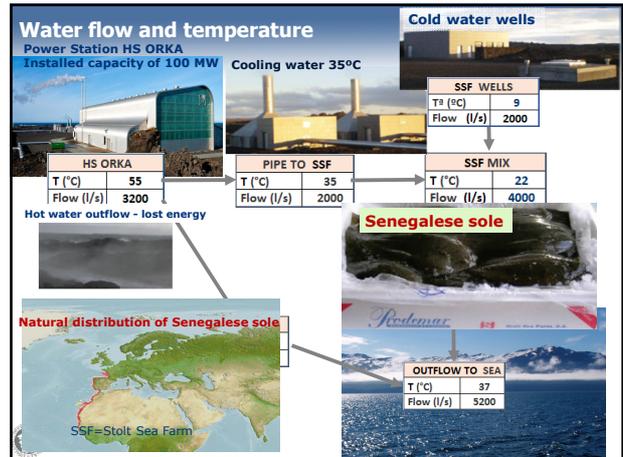
ORF Genetics offer stem cell research high-grade, animal free and endotoxin free growth factors under the ISOKine™ brand.

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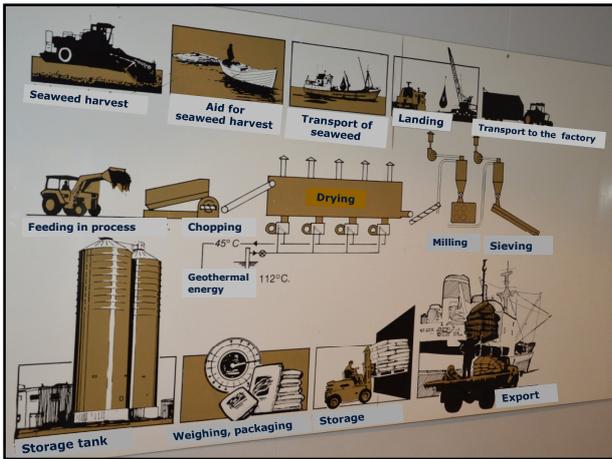
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Products

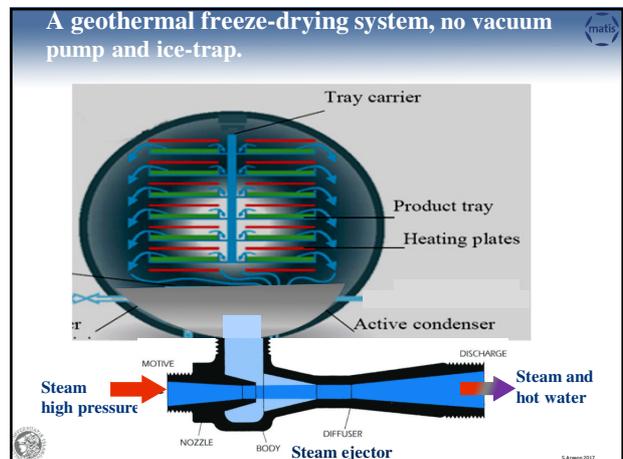
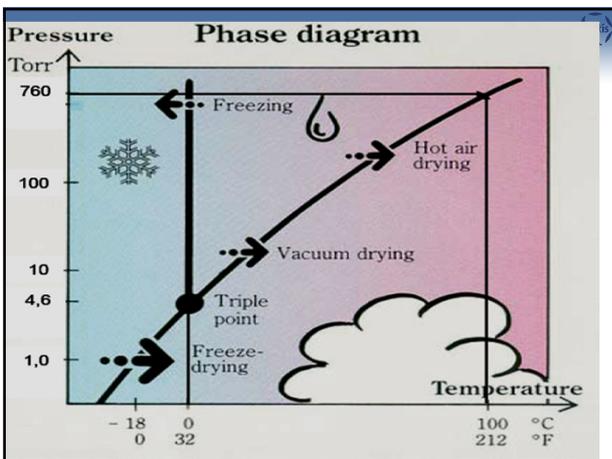
- Products are: meal of seaweed, organic
- Sold all over the world
 - Fertilizer, feed, food
 - For production of alginates for
 - Food
 - Beverages
 - Cosmetics
 - Medicine

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What is Freeze Drying?

Freeze-drying is a three-step process that begins with **freezing**. Next the food is placed in a **vacuum** chamber under low heat. The frozen water crystals evaporate directly from ice to water vapor in a process called **sublimation**. The food is nitrogen sealed for storage to prevent contamination from water or oxygen

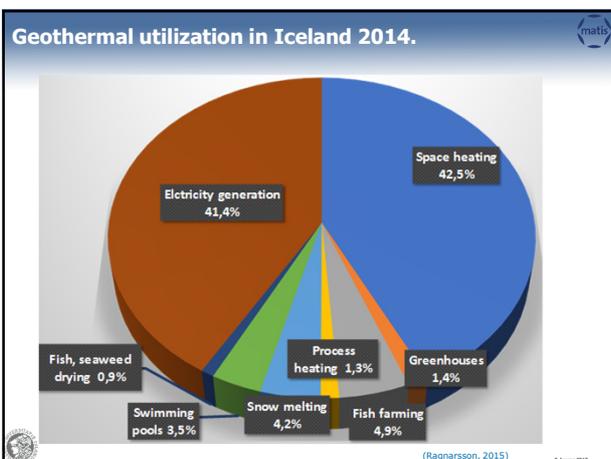
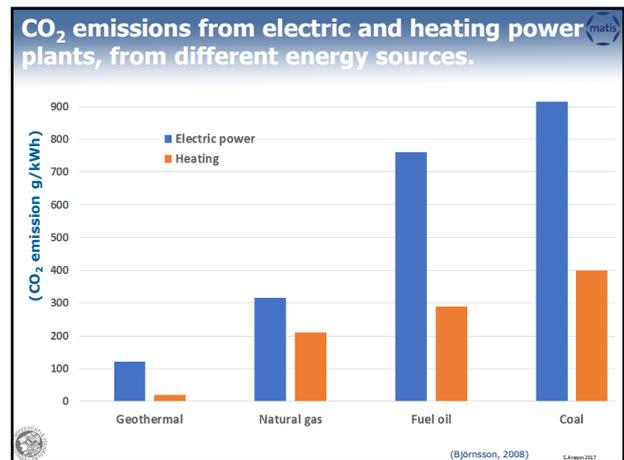
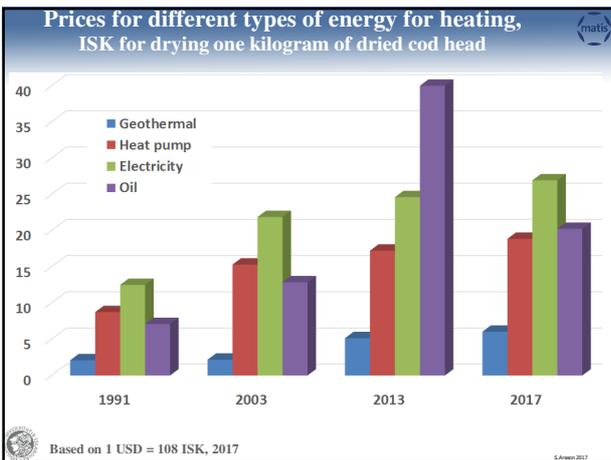
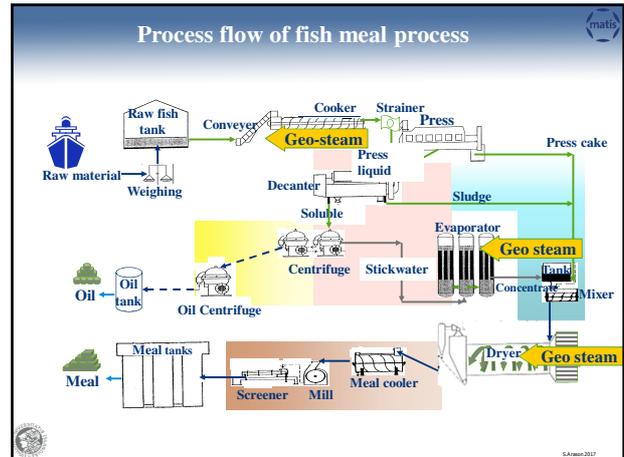


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Conclusions

- ✓ Increasing interest in "green" and "renewable" energy sources
- ✓ Geothermal direct-use is in main cases replacing fossil fuels and thus reducing greenhouse gas emissions
- ✓ Geothermal can make a major contribution to the world energy needs
- ✓ Geothermal heat pumps are the fastest growing direct use of geothermal energy –available anywhere for heating and cooling
- ✓ Low temperature combined heat and power plants using the binary cycle for power and cascading for space heating is gaining popularity
- ✓ However, "geothermal" is not well known and the benefits generally unknown –it needs to be promoted better

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Fact of Global food system

The value Chain

Present

- market pull
- long term
- chain oriented

Keyword: Collaboration!

- Collaboration between research institutes, seafood industry, service industry, universities
- Multidisciplinary projects
- Tradition for M.Sc. Projects Ph.D projects becoming common
- The industry sees benefits in collaborative research

Mátis

- Mátis is a research and science community based on strong research infrastructure and collaboration, to maximize impact of investment in research and innovation
- We provide our partners with support for increased value creation, food safety and public health.
- We play a leading role in holistic approach to sustainable use of the bioeconomy, specifically the blue-bioeconomy and have participated in policy making for the Icelandic government and foreign constituents.

Co-operation

Our specialists work with:

Food processing plants, fishing plants, fishing companies, slaughterhouses, dairies, farmers, regulatory agencies, research institutions, universities

all over the country and all around the world

A few of Mátis' business partners

Muchas Gracias Thank you Takk fyrir