Downstream Opportunities
Funding of diversified geothermal energy utilization and the food sector

Sigurdur G. Bogason
GEORG Geothermal Workshop 2018

Grand Hotel Reykjavík 15.11.2018
Contents

• Environmental limits and Food Systems

• FOOD → WATER → ENERGY NEXUS

• Opportunities
FOOD

Environmental limits and Food Systems
Recent article in NATURE by Springmann et al. presents a bleak picture:

- Compares 2010 status to forecasts in 2050 for food production:
  - GHG emissions $\rightarrow +190\%$
  - Cropland use $\rightarrow > 160\%$
  - Bluewater use $\rightarrow > 160\%$
Vertical gardens would drastically increase this land use efficiency for crops.

Geothermally heated large scale Vertical Gardens LED lighted?
Water Footprint → Greenhouse Gas Emissions

OECD (2017) http://dx.doi.org/10.1787/9789264279551-en
Energy efficiency of meat and dairy production

The energy efficiency of meat and dairy production is defined as the percentage of energy (caloric) inputs as feed effectively converted to animal product. An efficiency of 25% would mean 25% of calories in animal feed inputs were effectively converted to animal product; the remaining 75% would be lost during conversion.

- Whole Milk: 24%
- Eggs: 19%
- Poultry: 13%
- Pork: 8.6%
- Lamb/mutton: 4.4%
- Beef: 1.9%

If cattle were a country, they would rank third in greenhouse gas emissions.

Gigatons of CO₂ emissions per year

10.2 (China) > 5.3 (United States) > 5.0 (Republic of Cattle) > 2.5 (India)

Source: Meat conversion efficiencies - Alexander et al. (2016)  OurWorldInData.org/meat-and-seafood-production-consumption/  •  CC BY-SA
Food production consumes water and energy

Water footprint

- Global animal production requires about 2422 Gm$^3$ of water per year (87.2% green, 6.2% blue, 6.6% grey water).
- One third of this volume is for the beef cattle sector; another 19% for the dairy cattle sector.
- Most of the total volume of water (98%) refers to the water footprint of the feed for the animals.
- Drinking water for the animals, service water and feed mixing water account only for 1.1%, 0.8% and 0.03%, respectively.

Fig. 3. The EU28 WF$_{cons}$ for different product groups. Average for the period 1996–2005.
Data source Hoekstra and Mekonnen (2012).
Challenges drive need for solutions

To sustainably feed 10 billion people we need, e.g.

- New food production systems before 2050
- New way of using and recycling resources
- New distribution and logistics systems and relocation
- Merging of multidisciplinary expertise from sectors
  - Agri-food ✓
  - Energy ✓
  - Business ✓
  - Policies ✓
  - Social Sciences ✓
  - Economics and marketing ✓
  - Environmental Sciences ✓
  - and, ....... etc.

Geothermal Energy & future downstream opportunities?
H2020 projects can provide synergies

**VALUMICS** „UNDERSTANDING FOOD VALUE CHAINS AND NETWORK DYNAMICS“

- to provide decision makers throughout food value chains with a comprehensive suite of approaches and tools
- to evaluate the impact of strategic and operational policies
- enhance the resilience, integrity and sustainability of food value chains for

**DEEPEGS** „DEPLOYMENT OF DEEP ENHANCED GEOTHERMAL SYSTEMS FOR SUSTAINABLE ENERGY BUSINESS“

- Harnessing more deep geothermal power for electricity
- Resource park in Reykjanes
- Model for new ones around Iceland, in Europe and globally
- Need to move to extensive uses for the remaining heat

The VALUMICS project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 727243

The DEEPEGS project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 690771
Some synergy examples

To produce food inputs of energy and water are needed
Vertical farming using heat and electricity
Farming for high value nutraceuticals using geothermal heat and electricity

Algalíf, Reykjanes, Iceland - Already operational
Innovative farming using heat and electricity

4th Industrial revolution and Internet of Things for Foods
Land based aquaculture using geothermal heat and electricity
Land based aquaculture of Arctic char using geothermal heat and electricity
Industrial Hemp for food?

• Industrial hemp low in TCA <0.3% is an interesting crop option

• **How healthy is hemp grain?**
  • Hemp seed is the most nutritionally complete seed on the planet for human consumption.
  • Hemp seed contains 25% protein.
  • Contains a perfect ratio essential fatty acids (EFA's).
  • Hemp contains the most perfect ratio of EFA's for human consumption.
  • Hemp seed is also high in iron and calcium.
Industrial Hemp for food?

**Agricultural Benefits**
- Natural weed suppression
- Grown without pesticides or herbicides
- Pollen isolation
- Soil improvement in crop rotation
- Deep roots are natural soil aerator
Hemp / Cannabis farming in Canada
Different variety of the hemp plant to produce cannabis
Example from H2020

Upcoming deadline in February 2019
H2020

3 Pillar Structure

Excellent Science
- European Research Council (ERC)
- Future & Emerging Technologies (FET)
- Marie Skłodowska Curie Actions
- Research Infrastructures (RI)

Industrial Leadership
- Leadership in Enabling and Industrial Technologies (LEIT) – ICT, KETs & Space
- Access to Risk Finance
- Innovation in SMEs

Societal Challenges
- Health and Wellbeing
- Food Security, Sustainable Agriculture, Forestry, Marine, Maritime, Inland Water and Bio-economy
- Secure, Clean & Efficient Energy
- Smart, Green and Integrated Transport
- Climate action, Environment, Resource efficiency and raw materials
- Inclusive, Innovative and Reflective Societies
- Secure Societies

Spreading Excellence and Widening Participation, Social Sciences and Humanities (SSH) and ICT
- European Institute of Innovation and Technology (EIT)
- Joint Research Centre (JRC)
- EURATOM

80 Billion Euro
H2020 Energy-Water-Food

H2020 - LC-CLA-02-2019

Topic: Negative emissions and land-use based mitigation assessment

Land-based mitigation: Actions should provide a comprehensive analysis of various land-use based mitigation options at the global and regional level, assessing their potential and effectiveness in providing large-scale reductions of greenhouse gases, in the context of trade-offs and/or co-benefits in relation to other pressures and goals (e.g. food, energy and water security, biodiversity, air quality) and should analyse feedbacks between land-use based mitigation and climate change impacts. Actions should also improve current methodologies to estimate emissions and removals associated with land use measures, also by leveraging observations from GEOSS and in particular the Copernicus programme.

Funding: RIA of 5 – 7 Million Euro
Stage 1 Deadline: 19 February 2019
Stage 2 Deadline: 04 September 2019

Total funding available 22 M.€ → scope to fund 3-5 projects
H2020 has numerous funding lines

Challenges linking RES energy and food production:

- The opportunities often cut-across science fields and industrial sectors
- Need to think outside of the box to link your challenge to funding lines

- Arctic – climate change – tourism – energy – food

Smart Cities and Communities - Lighthouse project ➔ 5.02.2019 / 15-20 M.€
How does Bill Gates approach this?

Bill Gates launches €100M clean energy fund with EU backing

Limiting global warming needs urgent attention in wake of dire IPCC warnings, Gates says

By Eanna Kelly
Other funding (European Economic Area)

European Investment Bank
• Has funded Icelandic Energy Investment projects
  → 845 Million EURO
  • From 1996 to 2016

The European Investment Fund
• Arion Bank services loan guarantees in Iceland for SMEs
  - facility for up to 107 M.€
EU Emission Trade System (ETS) Innovation Fund is in the pipeline
Funding low-carbon innovation and energy sector modernisation

Several low-carbon funding mechanisms will be set up to help energy-intensive industrial sectors and the power sector meet the innovation and investment challenges of the transition to a clean economy.

These include two new funds:

- The **Innovation Fund** will support the demonstration of innovative technologies and innovation in industry. It will extend existing support under the NER300 programme. Total funding available will correspond to the market value of at least 450 million euros.

- The **Modernisation Fund** will support investments in modernising the power and energy systems, boosting energy efficiency, and facilitating a just transition in coal-dependent regions of 10 lower-income Member States.

In addition, the optional transitional free allocation under Article 10c of the EU ETS Directive will continue to be available to modernise the energy sector in lower-income Member States.
National and other funding mechanisms not to be forgotten!

In Iceland ➔ rannís

In Nordic Region ➔ Nordic Innovation

In Norway ➔ The Research Council of Norway

➔ In USA & Etc........
Thank you!

For more information please contact us via

- www.deepegs.eu
- www.facebook.com/deepegs/
- twitter.com/DEEPEGS_demo

Contact: sigurdur@georg.cluster.is

The DEEPEGS project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 690771