Powering Agri-food value chains with Geothermal Heat – Africa

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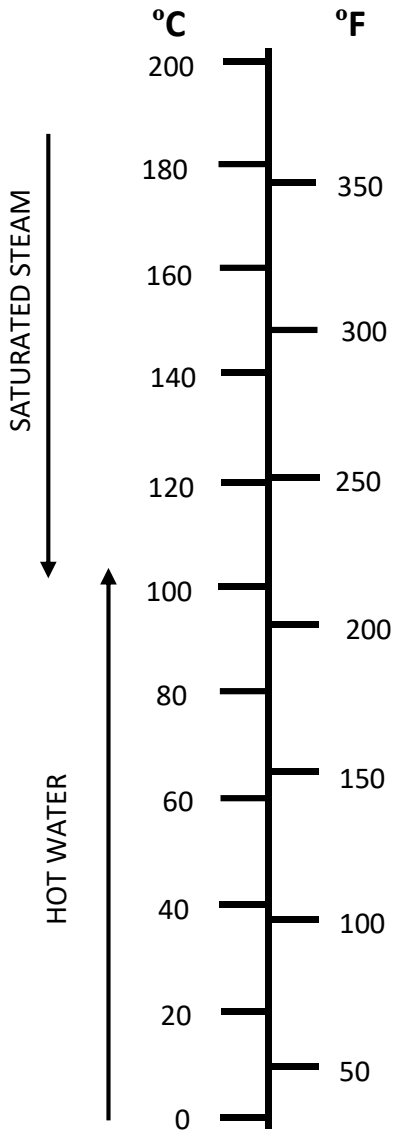
1. INTRODUCTION

- What constitutes the this CHAIN?
  - Planning and initialization
  - Seed selection
  - Planting/propagation/incubation
  - Tendering/care
  - Harvesting
  - Storage and preservation
  - Processing
  - Transportation
  - Marketing
  - Consumption

Introduction, cont'd….(2)

- Geothermal Heat?
  - Uses of geothermal heat depends on:
    - Temperature of the geothermal fluid,
    - Process energy requirement of the
    - Chemistry of geothermal fluid
    - Equipment used
  - DU for Agri-food applications requires a wide range of temperature (see Lindal diagram)
    - Lowest temperature requirements (heating growing environment eg soil, aquaculture and greenhouses etc) – from 30^{o}C
    - Value addition and preservation (milk powder, canning, refrigeration 180^{o}C



Refrigeration by ammonia absorption

Digestion in paper pulp

Drying of fish meal

Alumina extraction via Bayer's process

Canning of food

Evaporation in sugar refining

Evaporation

Drying and curing of cement block

Drying of agricultural products

Drying of stock fish

Space heating (buildings and greenhouses)

Cold storage

Air conditioning

Animal husbandry

Soil warming

Swimming pool heating, de-icing

Fish farming

CONVENTIONAL ELECTRICITY GENERATION

BINARY FLUID ELECTRICITY GENERATION

HEAT PUMP SPACE HEATING

Introduction, cont'd….(3)

- Key factors to be considered when determining a DU project:
  - Energy – Availability, Quality, Demand
  - Other resources and facilities
    - Raw material,
    - Technology and expertise
    - Market
    - Infrastructure development eg roads, electricity, communication
    - Location
  - Stakeholders
    - Involvement
    - Acceptance
    - Potential benefit
  - Others
    - Regulatory framework (environmental etc)

(GDC and USAID (2014)

2. GEOTHERMAL RESOURCES IN AFRICA

Twenty (20) countries have reported availability of geothermal energy in their countries

15 countries reported DU mainly in

- Spas (for Recreation, balneology, tourism) – mainly community based
- Others-drying (small scale community projects
- Greenhouse heating – the only commercial project in Africa

(*Lund and Toni, 2020 & 2015)*

3. VIABLE DU APPLICATION IN AFRICA

- African country's need to identify the viable applications for DU
  - ✓ Greenhouse heating at (*humidity control and growth enhancement*)
  - ✓ Food preservation
    - Drying
    - Pasteurization
    - Pre-cooking
    - Warehouse cooling
    - Chilling
  - ✓ Space and environment conditioning
    - Pools and Spas
    - space heating and cooling
  - ✓ Industrial processes
    - Process heating

4. DU AND AGRI-VALUE CHAIN IN AFRICA

- Most African Countries are rich in agriculture
- Most of the agricultural products have a short shelf-life e.g. Fruits, veges, pyrethrum, milk, meat (1 -3) days
- Most agricultural rich areas are characterised by poor infrastructure, low income, lack of electricity.
  - Resulting to high post-harvest losses
- Agricultural produce preservation and value addition is hence critical
- Geothermal DU offers an indigenous solution to agri-food value chain

Agri-value chain…cont'd

Most African countries have low to medium temperature geothermal resource ideal for DU.

High temperature resources can be used for DU through cascading.

Aquaculture – Pond heating and fish drying and pre-cooking

Horticulture - Greenhouse heating, vegetable drying, cold storage
Soil warming

Other agricultural products - Grain drying,
- pulp evaporation

Animal husbandly
– Milk pasteurization and chilling
– Meat processing and pre-cooking and canning
– Leather processing and tanning
– Poultry Brooders and hatcheries

5. BENEFITS OF AGRI-FOOD VALUE-CHAIN

i. Food security (quality and quantity)

ii. Enhanced revenue

iii. Local community empowerment e.g job creation, market for local products

iv. Energy utilisation efficiency (cascading)

v. Green energy utilization – (reduce global warming)

6. CHALLENGES AND HURDLES

i. Unavailability of DU structures (no institution is mandated to spearhead DU)
   - Lack of formal institutional framework (focus) for DU in many countries.

ii. Lack of expertise/knowledge and technical supports

iii. Lack of government support and policy guide

iv. Lack of financing

v. Nature of DU

7.0 WHAT SHOULD BE DONE

- Countries to mandate geothermal/Energy companies with DU promotion
- Enhance research and capacity building in DU in tertiary institutions of higher learning
- Support local communities through partnerships and financing
- Development partners to facilitate governments to uptake DU
- Develop government DU policy
- Awareness forums (like this one)

8. SELECTED PHOTOS

Some selected photos of Agri-Food value chain in Kenya

i. Eburru Crop dryer – Kenya (1930s)




ii-Heated Greenhouse

- Hot fresh water used to heat a hydroponics greenhouse to regulate temperature and humid

Iii Heated Aquaculture

- Geothermally heated fresh water used to heat fish pond – Kenya (2019)

iv-Geothermal Milk Pasteuriser

- 150-litres geothermally powered batch milk – Kenya (2015)

iv-Geothermal Milk Pasteuriser

- 6-tonnes geothermally powered batch grain dryer - – Kenya (2019)

Other Potential uses in Processing, value addition and preservation

Meat production & processing

- Energy for processing meat – washing, pre-cooking, canning and chilling

Honey Processing

- Energy for processing of honey

Cold storage & Refrigeration

- Energy for refrigeration to extend shelf life of produce

Hammam Maskhoutine, Algeria flowing channels of hot springs. Temperature up to 98° C and flow rate of 1650l/s.

THANK YOU

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