

DIRECT USE OF GEOTHERMAL ENERGY FOR FOOD SECURITY

Towards achieving Kenya's BIG4 Agenda

Eng. Johnson. P. Ole Nchoe

Managing Director & CEO

GEOHERMAL DEVELOPMENT COMPANY LTD

REYKJAVIK, ICELAND, APR. 24, 2018

LOCATION OF KENYA

Kenya's Location in Africa



De-risking Geothermal Development in Kenya

- Geothermal exploration and appraisal
- Fast track development of geothermal resources
- Support the Government of Kenya in funds mobilization for geothermal development

Funding

- Support private sector participation
- Sell steam to power producers

Power Plant

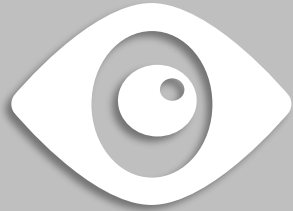
Capacity Development

- Develop human resource capacity in geothermal sector
- Provide consultancy services

Direct Use

- Promote direct uses of geothermal energy

GDC VISION AND MISSION



Vision

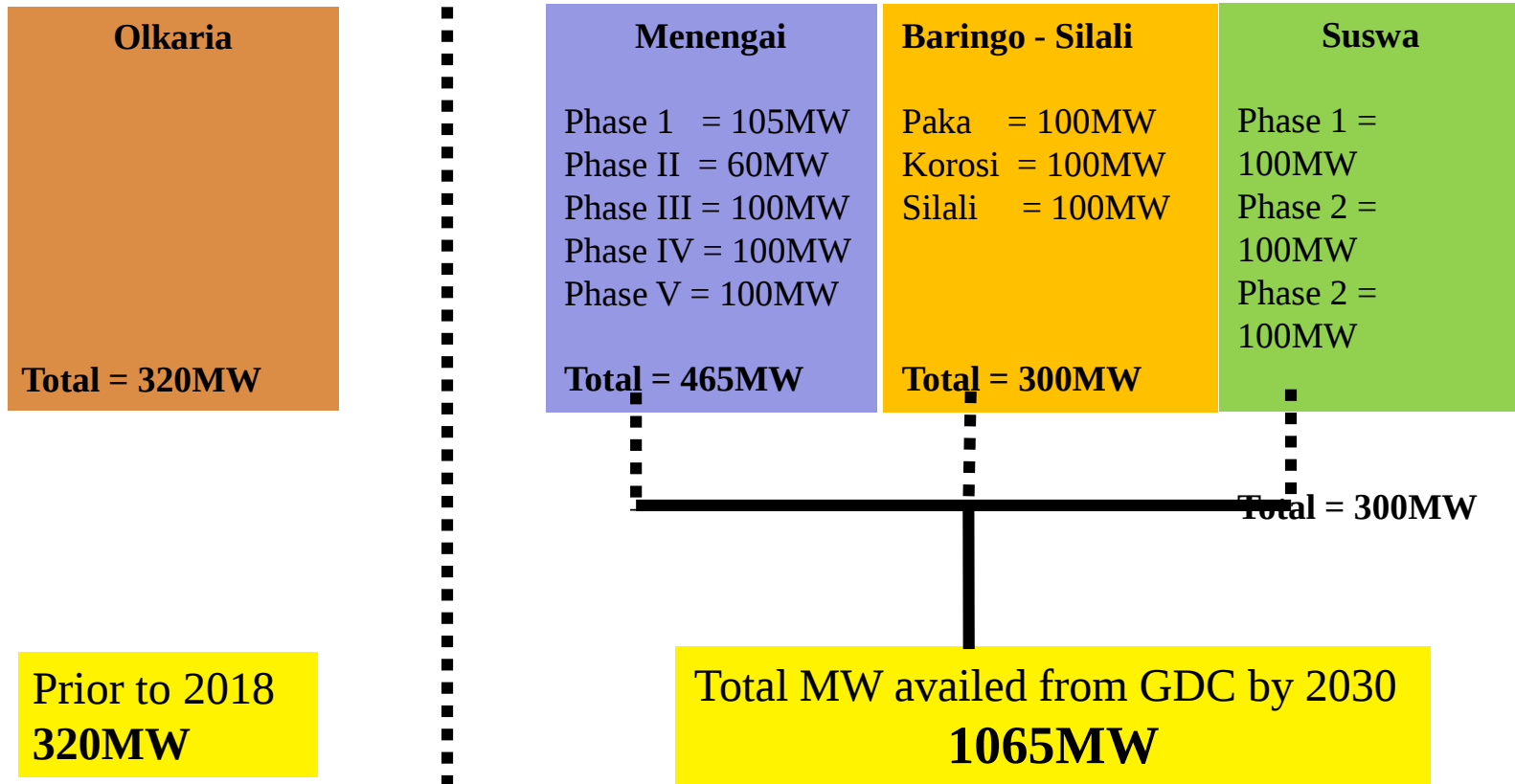
Lowering the cost of
Power in Kenya



Mission

To develop 1065MW from
geothermal resources by 2030⁴

GDC DEVELOPMENT PLAN



1. Introduction

- The Big4 Agenda of the Government of Kenya (GOK) for the next five 5 years are:
 - 1. Food Security
 - 2. Affordable Healthcare for all
 - 3. Affordable Housing
 - 4. Manufacturing
- Geothermal energy – lowest tariff in Kenya.
- Therefore geothermal will be key enabler for BIG4
- Direct Use will support pillar No. 1 on Food Security.

Introduction (cont'd.)

- Kenya's population is 49 Million (KNBS, 2018)
- Third of population lives in Urban centers; number is rising.
- Climate change is affecting food production.
- Need for smart food production technologies.



2. CURRENT STATUS OF DIRECT USES OF GEOTHERMAL ENERGY IN KENYA

Current status *(cont'd.)*

- Kenya has a huge potential for direct uses but currently direct use application are minimal.
- Only 23MWt being utilised at:
 - ✓ Oserian Greenhouse heating
 - ✓ Eburru pyrethrum drying -
 - ✓ Bogoria Spa
 - ✓ Menengai Demo Projects
 - ✓ Water harvesting in Eburru and Suswa

Oserian Green Houses

- Private investor
- Cut Roses Green house heating ~50 hectares,
- Injection of CO₂ to aid in photosynthesis,
- iv) Fumigation of soils and sterilization of liquid recycled plant fertilizers



Eburru Produce Dryer

- A community project
- Uses geothermal **heat to dry** farm produce: pyrethrum, vegetables, and cereals.
- Geothermal steam comes from a shallow well
- The steam is also **condensed** and used as domestic water



Lake Bogoria Spa

- Water from a hot spring is used to warm a swimming pool at the hotel

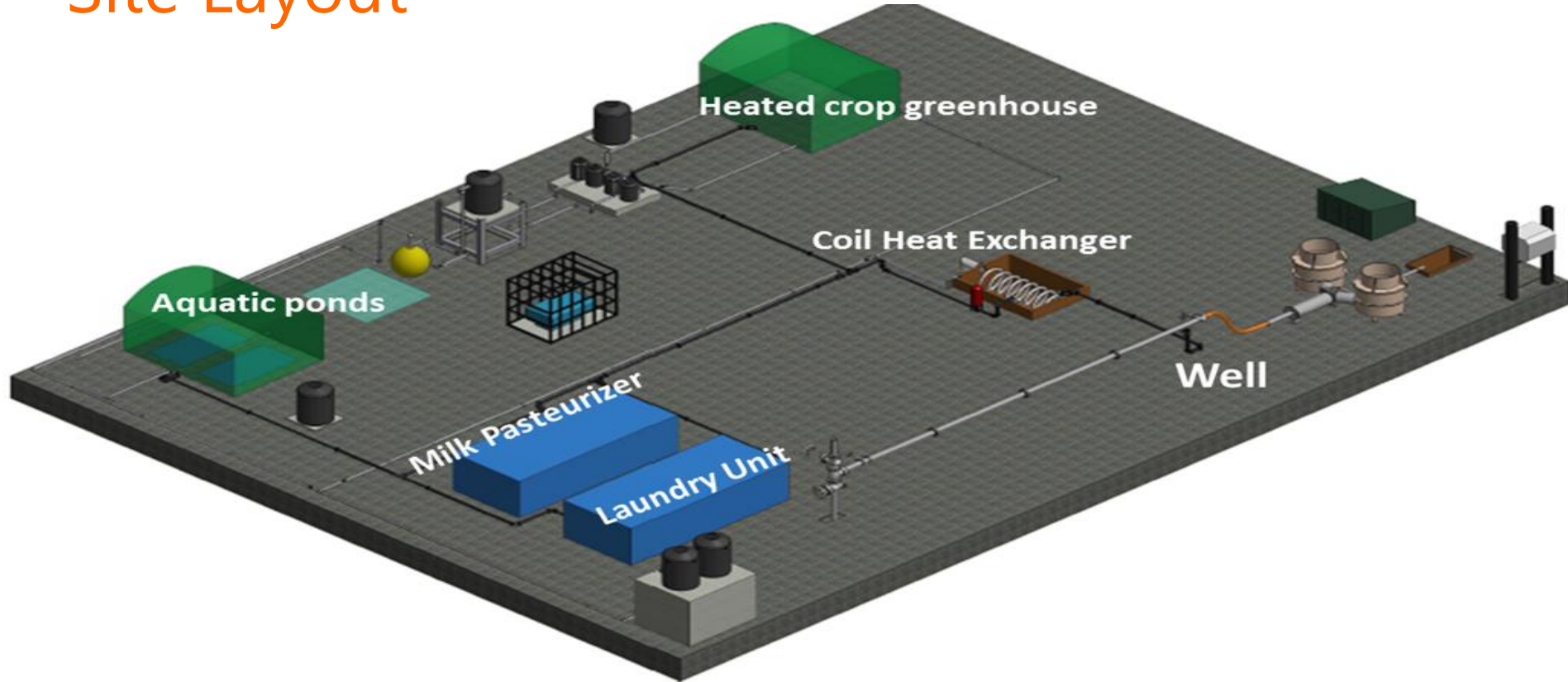


Menengai DU Demo Projects

- Commissioned in 2015 to showcase the DU technology and it's benefits
- Consists of **four** demo projects
 1. Two (2) 8m by 24m heated greenhouse
 2. A 150 liters batch milk pasteuriser
 3. Two (2) 6m by 5m by 1m heated fishponds
 4. A cloth laundry and dryer units
- This projects were supported by Power Africa & USAID.

Menengai DU Demo Projects (Cont'd)

Site Layout



VI_(a) - Heat Source

- 40 ton/hr of brine and 20 ton/hr of steam at 1.6 bar produced from MW03.
- Brine heats fresh water to 80° C.
- Heated fresh water used to provide energy and water for DU applications



VI_(b)-Heated Greenhouse

- A greenhouse measuring 8m by 24m
- Hot fresh water used to heat a hydroponics greenhouse to regulate temperature and humidity
- Benefits: early maturity, higher productivity, reduced incidences of diseases, higher returns.



VI_(c)-Heated Aquaculture

- Two fish ponds each measuring 6m by 5m by 1m.
- Hot fresh water used to heat water in a fish pond
- **Benefits:**
 1. Increased metabolism in fish,
 2. high feed conversion,
 3. faster maturity,
 4. higher returns.



VI_(d) - Geothermal Milk Pasteuriser

- Batch pasteurizer with a capacity of 150 litres/batch
- Hot fresh water used to pasteurize raw milk
- Benefits: Reduced cost of thermal energy.



VI_(e)-Geothermal Laundry

- Consists of a washing machine and a modified laundry dryer
- Hot fresh water used to wash and supply energy to dry clothes
- Benefits: Reduced cost of thermal energy.



3. Direct Use & Food Security

Using Geothermal Direct use For Food Security in Kenya

- To enhance growth in agricultural production
- To process/add value to agricultural produce
- Preservation to reduce post-harvest losses





ENHANCING GROWTH

Greenhouse Farming

- Energy to Enhance productivity in greenhouses/acreage
- Water for irrigation (Condensate)
- CO₂ to enhance photosynthesis



Fish farming

- Energy to enhance growth of fish
- Water for the fish ponds(Condensate)





PROCESSING & VALUE ADDITION

Meat Production & Processing

- Energy for processing meat and other agricultural products
- Water for irrigating pastureland
- Watering animals



Milk Production & Processing

- Energy for processing milk and milk products.
- Water for irrigating pastureland
- Targeted for Loita Plains (Narok County) and Baringo-Silali. (Baringo & Turkana Counties)



Honey Processing

- Energy for processing of honey
- Targeted for the Baringo-Silali Geothermal Project (Baringo & Turkana Counties).



PRESERVATION & STORAGE



Post-Harvest Preservation

- Energy for drying agricultural produce to minimize post-harvest losses.
- Targeted for Menengai Geothermal Project (Nakuru County).



Cold Storage & Refrigeration

- Energy for refrigeration to extend shelf life of produce



4. STRATEGIES FOR DU EXPANSION IN KENYA



Marketing of Concept & Technology

- a. Exhibitions
- b. Presentation and conference papers
- c. Demonstrations
- d. Publicity in the media
- e. Pitching to policymakers & investors

GDC set Up DU demo project - 2015

- To Showcase the technology
- Education
- Data collection
- Marketing to potential investors

Establish Industrial Parks

A centralised place where industries will utilise geothermal energy and by-products

- **For Menengai-**

- ✓ Development concept is ready
- ✓ Feasibility study is planned and funds to be mobilized

- **For Other Prospects**

- ✓ Industrial park will be part of prospect development from the initial project conception.

B. Set up industrial parks Near Geothermal field (ii)

Purpose to GDC

- i. Market for geothermal energy and by-products to potential investors
- ii. Earn revenue

Purpose to Investors

- For commercial investment in Direct Use applications
- Cheaper reliable energy for investors
- Green energy
- Raw materials for industries

Benefit to local communities/Governments and investors

- De-centralisation of industries from major cities
- Creation of labour
- Incentives from county governments

Community Engagement & PPP

- Undertake DU projects jointly
- Provide technical support
- Source for grant from Development partners for community projects
- Provide employment where possible
- Provide geothermal energy and by-products for community benefits

5. Next Step



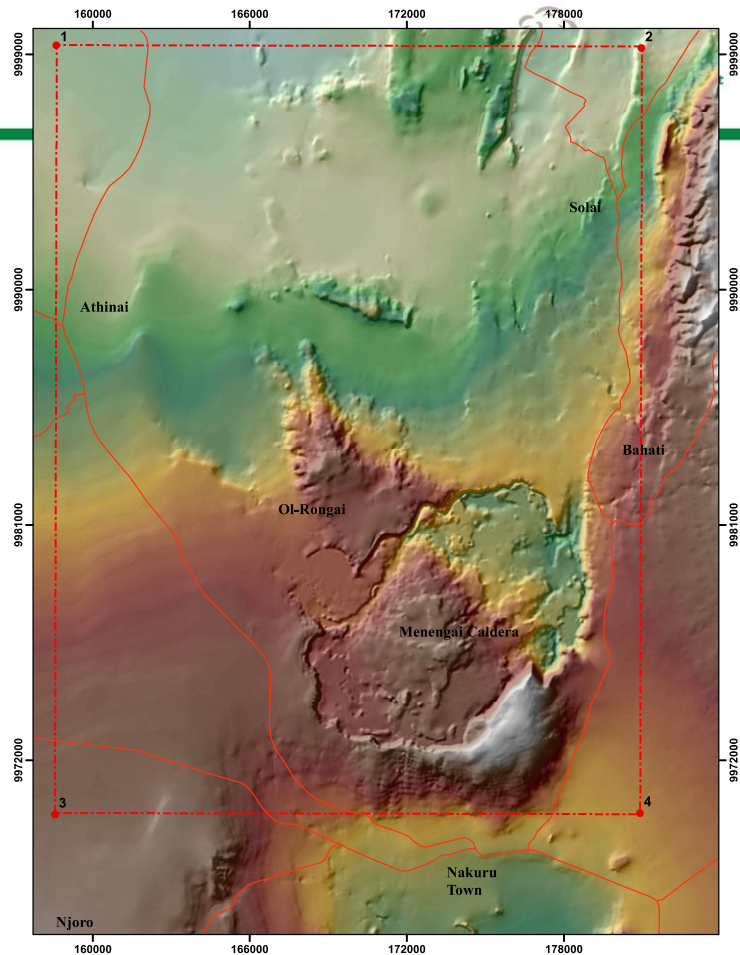
- Private investment encouraged.
- Establish Industrial/ Heat parks near geothermal projects.
- Establish large greenhouses at Loita Plains near Maji-Moto, Menengai and Baringo Silali geothermal Projects.
- Support communities to venture into direct uses.

Next steps (cont'd.)

Project Areas

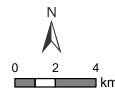
MENENGAI GEOTHERMAL PROJECT

Targeted acreage
500 ha



Legend

- Menengai licence area (656.41 Sq km)
- Roads



Boundary coordinates (m)

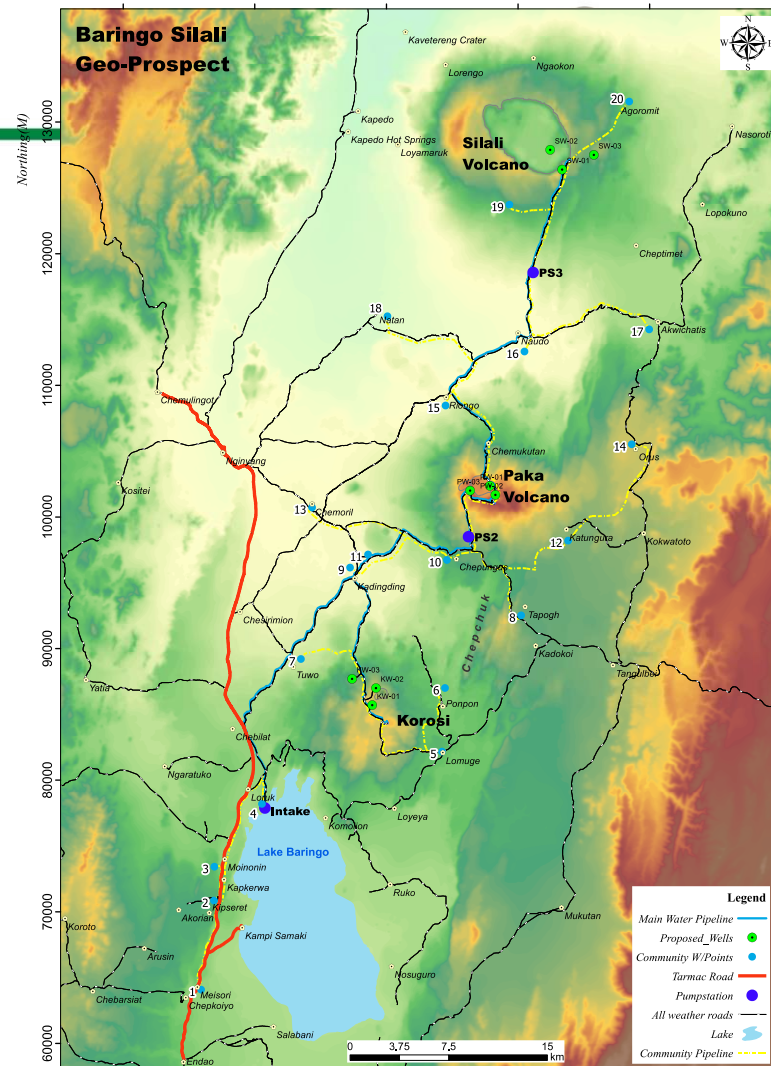
1: E158609.0 N9999356.7 2: E180964.0 N9999254.4
3: E158557.8 N9969942.3 4: E180912.8 N9969993.4
(UTM_Arc1960_Zone 37S)

Next steps (cont'd.)

Project Areas

BARINGO-SILALI GEOTHERMAL PROJECT

Targeted acreage
1,000 ha



Next steps (cont'd.)

Project Areas

**(NAROK &
KAJIADO)**

Targeted
acreage
1,000 ha



GDC Team at Maji Moto spring



Conclusion

- Vast potential to utilize geothermal energy by-products for food security in Kenya.
- Massive opportunities for private investors, researchers and donors to venture into direct uses of geothermal.
- All pilot projects shall have been tested by November this year and so the GOK and GDC are ready for business.

Partners



Main financier.



MINISTRY FOR FOREIGN
AFFAIRS OF ICELAND

Demo Project – drying of cereals; capacity building (drying technology); Feasibility Study (drying of cereals).

USAID
FROM THE AMERICAN PEOPLE

Capacity building; Feasibility Study, Pilot Projects at Menengai.



Capacity Building



GEO-HEAT CENTER

Oregon Institute of Technology – Capacity building

Private Sector Participation

- Kenya has established a robust Public Private Partnership framework. For details please visit: www.pppunit.go.ke
- You can also visit GDC website: www.gdc.co.ke
- Ministry of Energy: www.energy.go.ke
- Also get more information from: www.keninvest.go.ke



THANK YOU



Green Energy for Kenya