GEOTHERMAL DEVELOPMENT IN KENYA: UPDATE AND THE ROLE OF UNU-GTP IN CAPACITY BUILDING

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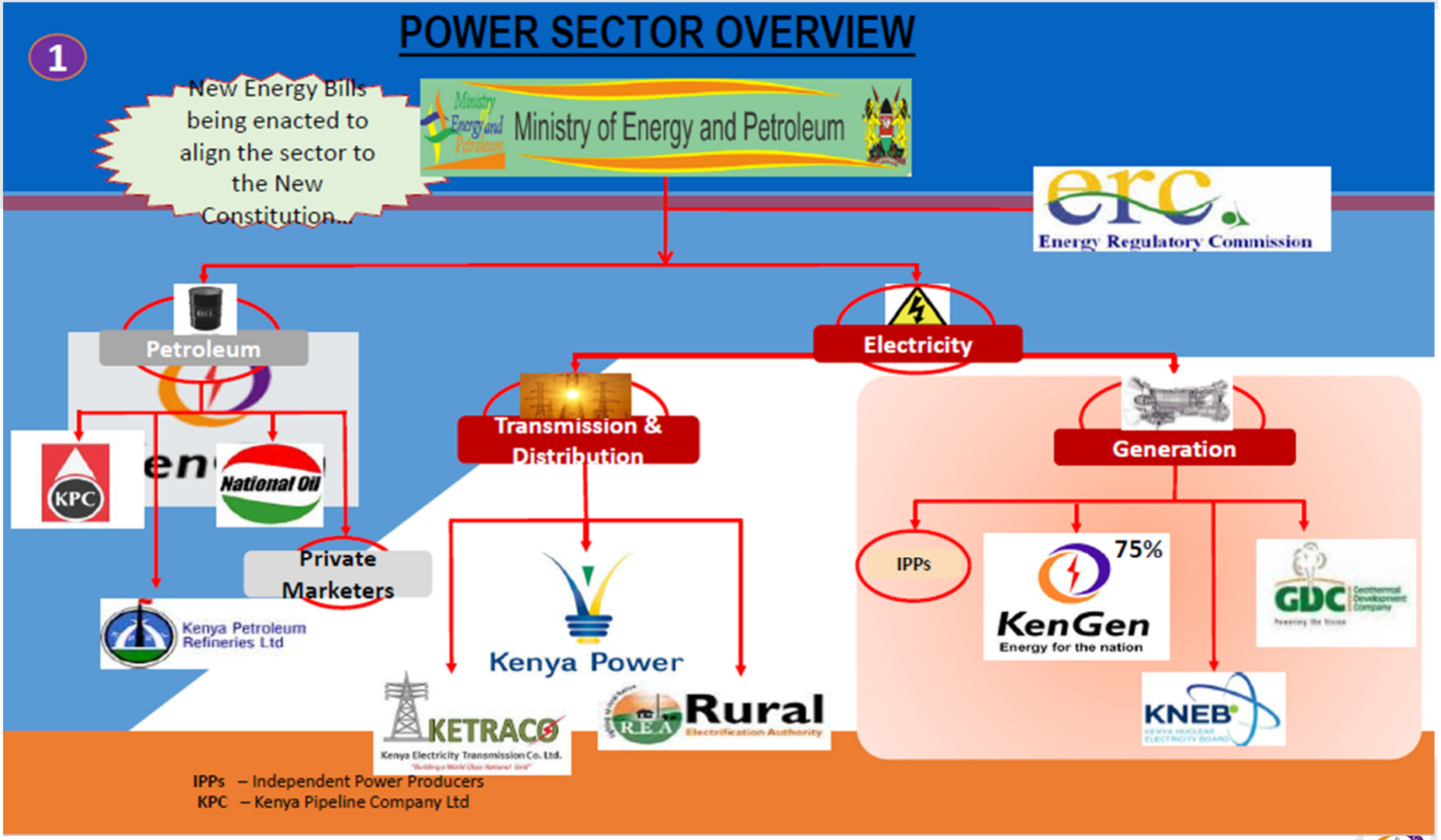
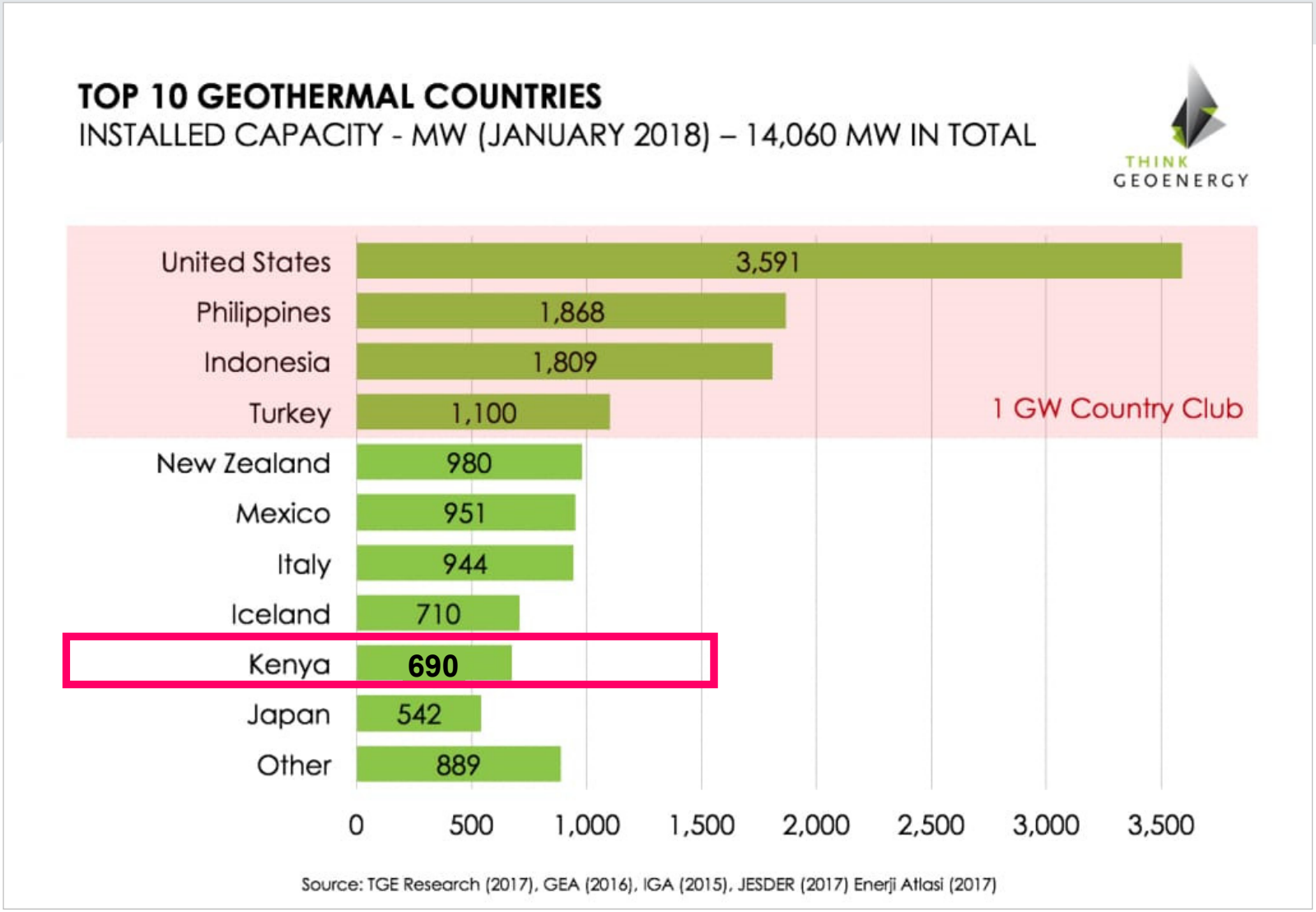
OUTLINE

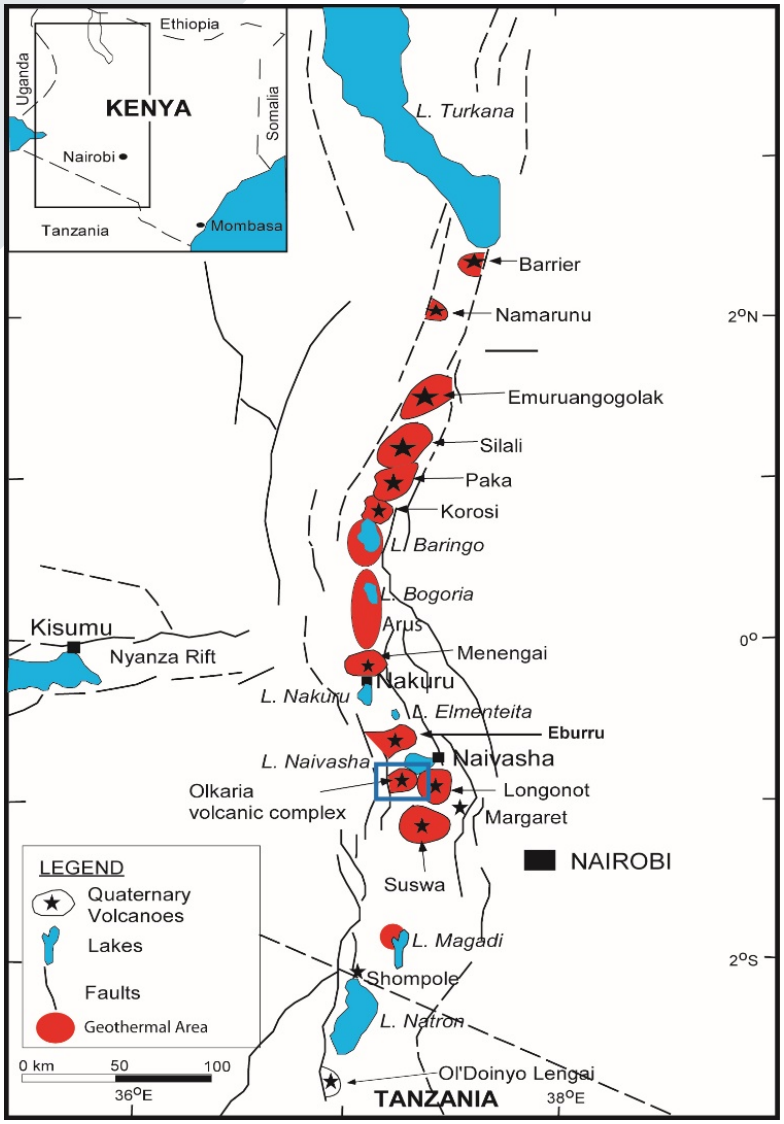
- GEOTHERMAL ENERGY IN KENYA
- GEOTHERMAL DEVELOPMENT JOURNEY
- GEOTHERMAL STATUS AND UPDATE
- CAPACITY BUILDING BY UNU-GTP
- CONCLUSION


POWER SECTOR OVERVIEW
1
New Energy Bills being enacted to align the sector to the New Constitution...
Ministry of Energy and Petroleum
erc
Energy Regulatory Commission
Petroleum
Electricity
Transmission & Distribution
Generation
KPC
National Oil
Private Marketers
Kenya Petroleum Refineries Ltd
Kenya Power
KETRACO
Kenya Electricity Transmission Co. Ltd.
REA
Rural
Electrification Authority
IPPs
75%
KenGen
Energy for the nation
GDC
Geothermal Development Company
KNEB
IPPs – Independent Power Producers
KPC – Kenya Pipeline Company Ltd

KENYA'S POSITION IN TOP 10 GEOTHERMAL COUNTRIES



GEOTHERMAL POTENTIAL IN KENYA



- Kenya's geothermal potential in excess of 10 GWe
- Endowed within the Kenyan Rift
- Over 23 geothermal fields/prospects
- Installed capacity: 690 MWe
- Direct utilization

INSTALLED CAPACITY

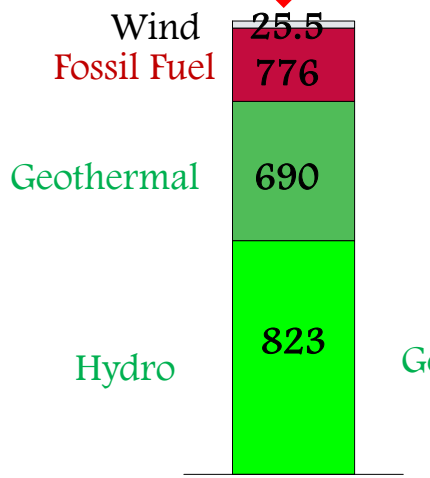
2314
National Installed Capacity

1615MW
KenGen's Total Installed Capacity

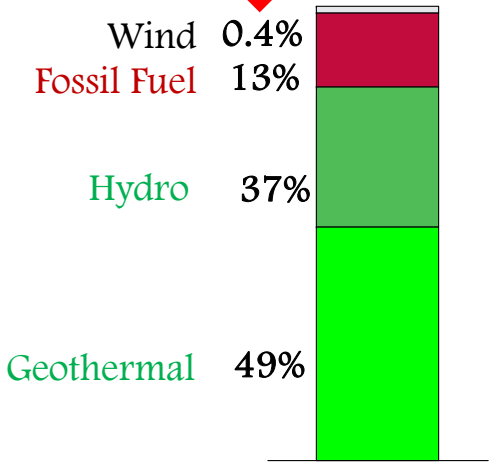
690 MW
Kenya's Installed Geothermal Capacity

>70%
KenGen's Market Share

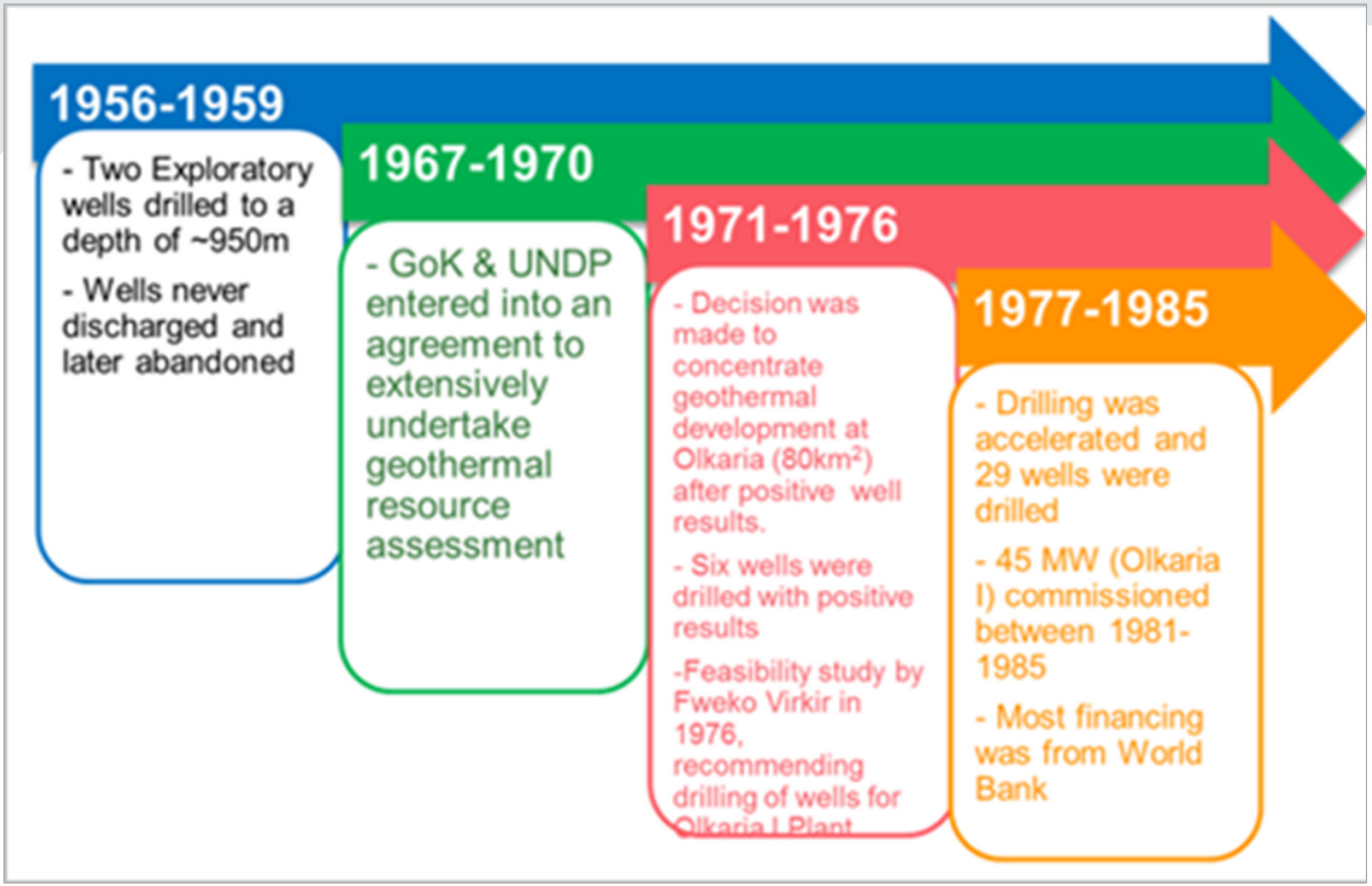
Installed by mode (MW)



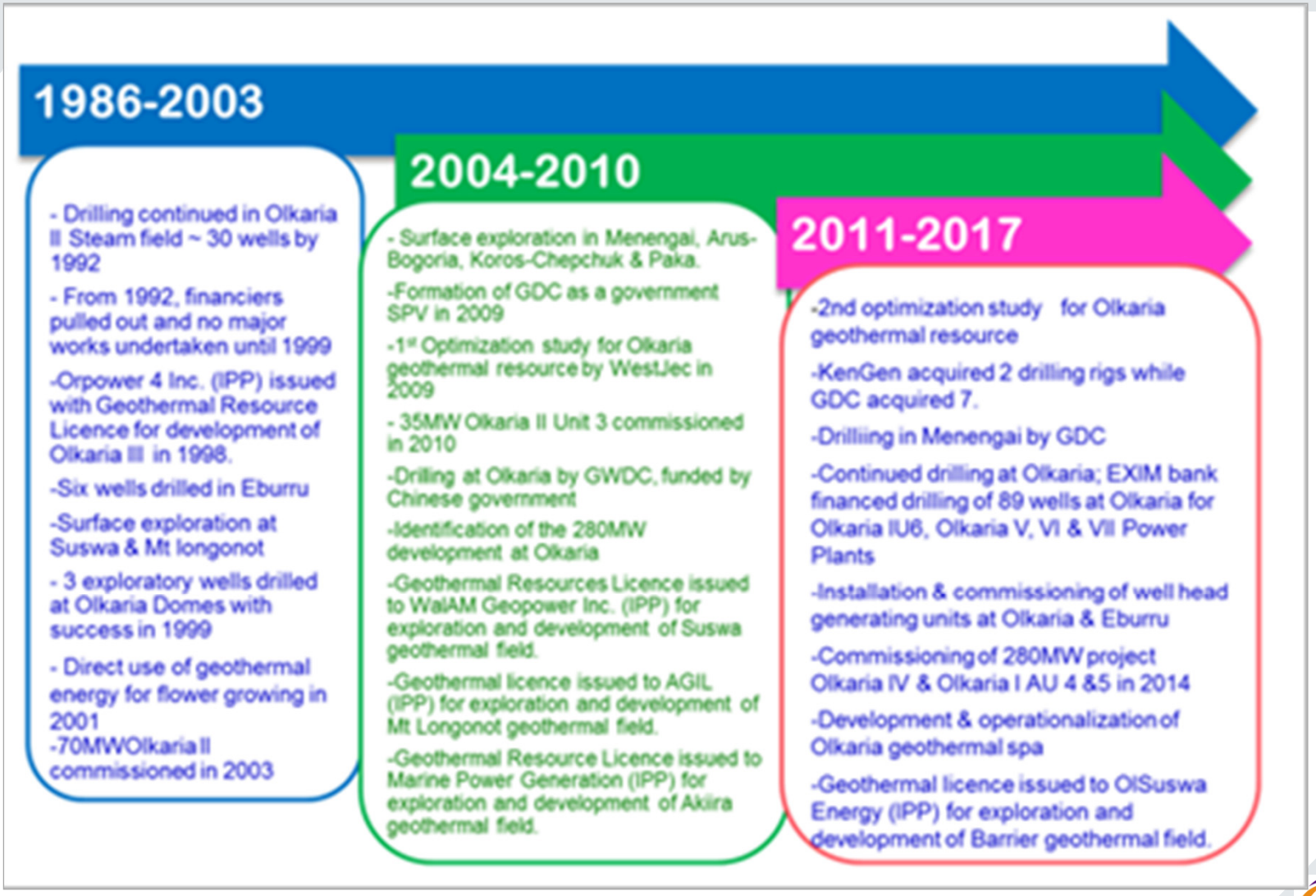
Consumption by mode%



Geothermal Development Journey (1956-1985)



Geothermal Development Journey(1986-2017)



Geothermal Development Milestones: Olkaria

OLKARIA I POWER PLANT (45 MW)

COMMISSIONED IN 1981-1985

INSTALLED CAPACITY : 45 MW

OLKARIA II POWER PLANT

UNIT 1 & 2 COMMISSIONED IN 2003

UNIT 3 COMMISSIONED IN 2010

INSTALLED CAPACITY : 105MW

KenGen

OLKARIA IV POWER PLANT

COMMISSIONED IN 2014

INSTALLED CAPACITY : 150MW

KenGen

WELLHEAD TECHOLOGY POWER PLANTS

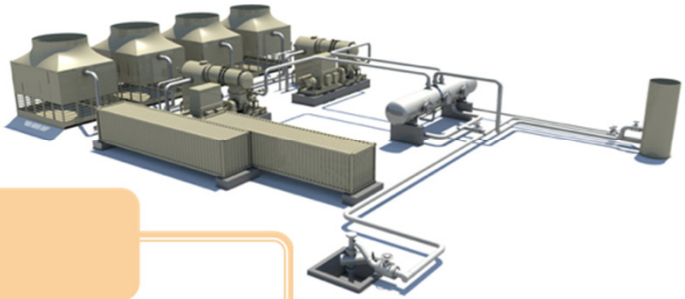
GEOTHERMAL WELLS

Olkaria

OW-37, OW-39, OW-39, OW-43, OW-914, OW-915, OW-919, OW-905

Eburru

EW-01



NO. OF UNITS: 16

INSTALLED CAPACITY: 83.5MW

KenGen

OLKARIA I AU (UNIT IV&V) POWER PLANT

COMMISSIONED IN 2015

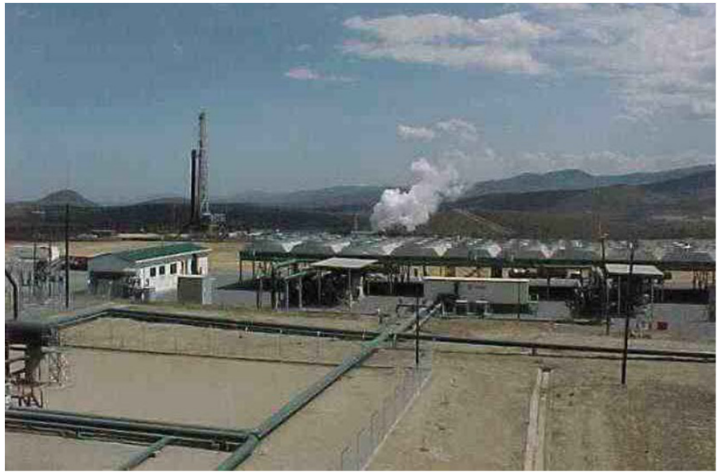
INSTALLED CAPACITY : 150MW

KenGen

Geothermal Development: Eburru

- 6 exploration wells drilled (1989 to 1991)
- EW-01 under production.
- 2.4 MWe Well head Plant (Jan, 2012)
- Plans to put up a 25 MWe plant
- Geoscientific studies commenced-2016-2017

Geothermal Development: Orpower



- Granted generation license in 1998 for the Olkaria West Field
- About 9 wells had been drilled by KPC (KenGen's) predecessor ~ 1983
- 1999 KenGen retested some of the wells in Olkaria West
- Ormat Pilot Plant commissioned in July 2000 (12 MWe)
- 9 more wells drilled for both appraisal and production (36 MWe expansion)
- Drilling continued from 2011 to date
- Capacity 160 MWe

Geothermal Development: GDC

- Established in 2008 Special Purpose Vehicle (SPV) to accelerate development of geothermal resources
- Geothermal Power plants:
  - ➢ It is under development
  - ➢ 3 IPP contracted
    - (i) Sosian Energy,
    - (ii) Ormat technology and,
    - (iii) Mauritius based Quantum Power
  - ➢ Capacity - 35 MW each

KEY PLAYERS IN GEOTHERMAL SECTOR

No.	PLAYER	FIELD/PROSPECT
1	KENGEN	Olkaria& Eburru
2	GDC	Menengai, Suswa, Bogoria-Arus-Silali
3	Orpower	Olkaria III
4	GDC	Suswa
5	Marine Power Generation	Akiira field
6	KAISHAN Group	Suswa South-Magadi Shombole area
7	Africa Geothermal International Ltd (AGIL)	Longonot
8	Olsuswa Energy Ltd	Barrier

GENERAL STATUS OF GEOTHERMAL FIELDS, PROSPECTS AND THEIR POTENTIAL

FIELD/PROSPECT	STATUS UPDATES (Stages of Development)
OLKARIA	Production& Monitoring stage
MENENGAI	Production drilling ongoing, Steam gathering system &Transmission line construction. Contract for 35MW awarded to Sosian Energy Group
EBURRU	Generation stage Detailed exploratory work in 2016-2017 Plans underway for expansion
SUSWA	Detailed surface studies completed by 2013. Awaiting exploration drilling
LONGONOT	Surface exploration studies done and exploratory wells sited. Awaiting exploration drilling
AKIIRA	Exploration drilling of 2 wells done.
ARUS-BARINGO-SILALI	Surface exploration done. Installation of waterline near completion for exploration drilling to commence.
BARRIER	Detailed geoscientific studies on schedule after signing of MOU with the Turkana county government
OTHER PROSPECTS	Preliminary surface exploration done

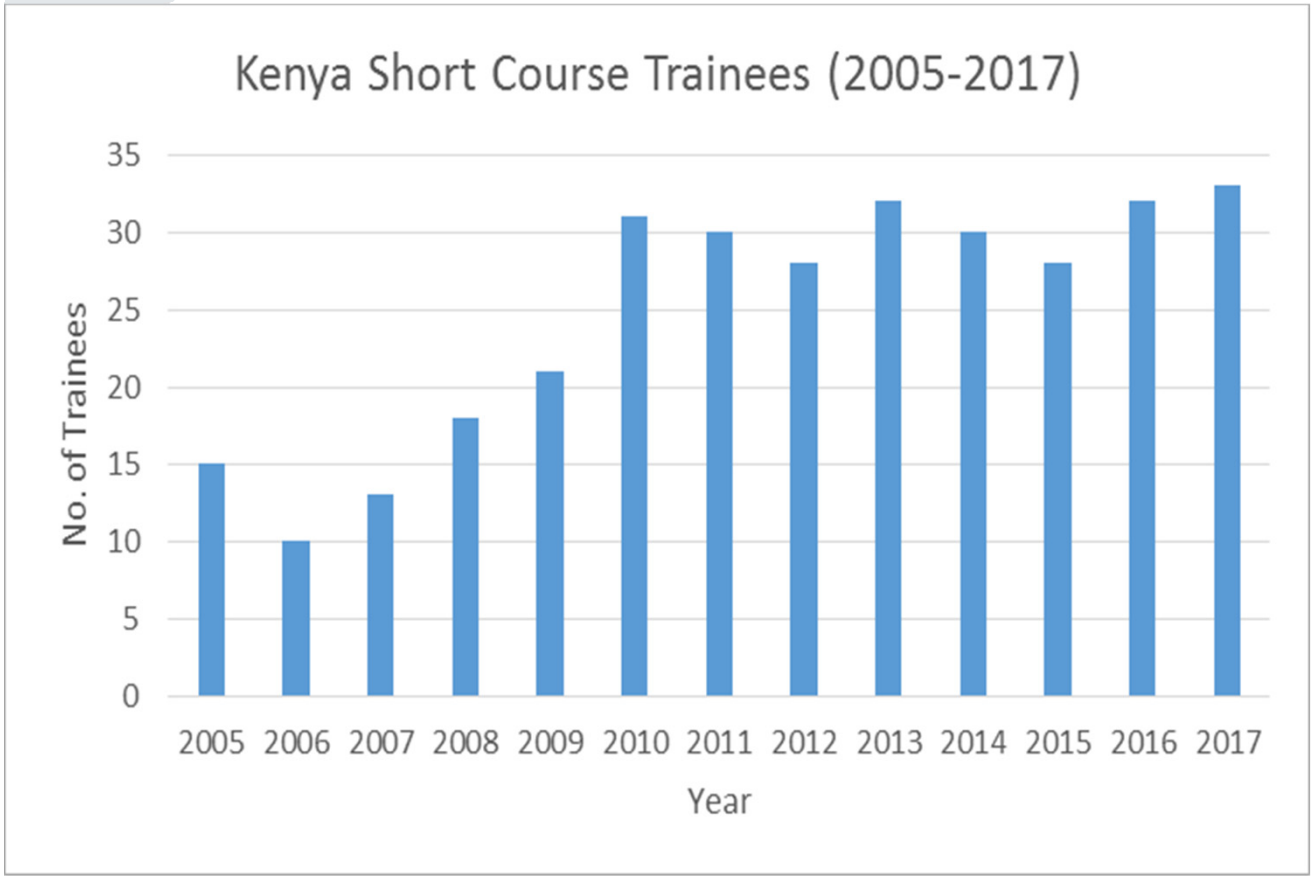
STATUS OF GEOTHERMAL FIELDS, PROSPECTS AND THEIR POTENTIAL CONT.

No.	FIELD/PROSPECT	ESTIMATEDPOTENTIAL	TARGET OUTPUT
1	OLKARIA	823 MWe	OLK 1 UPGRADE 7MWe by 2019
			OLK Tapping units 60 MWe by 2019
			OLKV 158 MWe by 2019
			OLK 1AU6 70 MWe by 2019
			OLK Modular plants 108 MWe by 2019
			OLK VII, VIII & IX 140 MWe each -2019
2	MENENGAI	1600 MWe	100 MWe by 2018
3	EBURRU	70 MWe	25 MWe by 2020
4	SUSWA	750 MWe	150 MWe by 2018
5	LONGONOT	200 MWe	70 MWe by 2018
6	AKIIRA	200 MWe	70 MWe by 2018
7	ARUS-BARINGO-SILALI	3000 MWe	100 MWe by 2018
8	OTHER FIELDS(KENGEN)	UNDER PROSPECTING	1000 MWe by 2025

DRIVES OF ACCELERATED GEOTHERMAL DEVELOPMENT IN KENYA

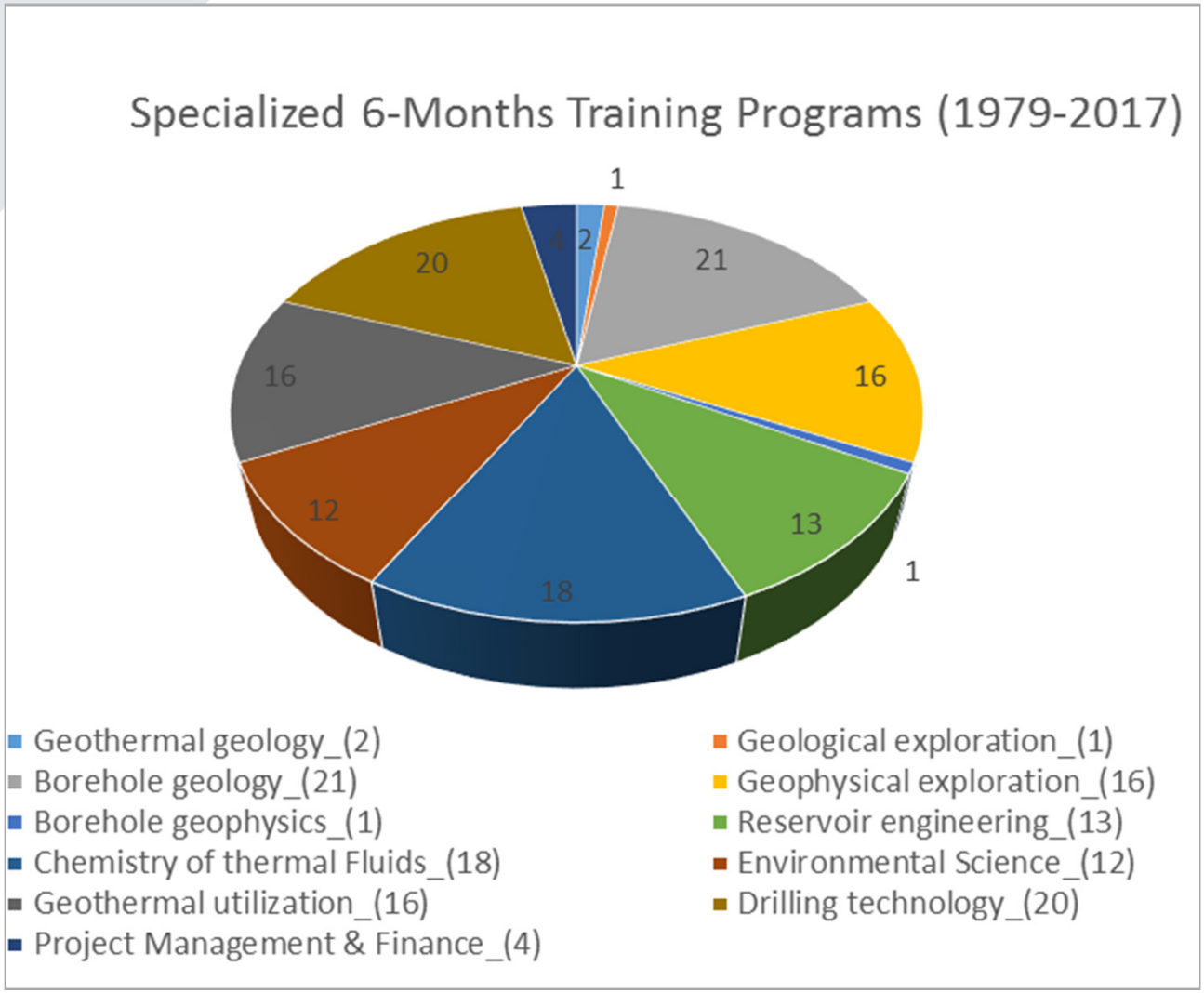
- The continuous collaborative capacity building between the Icelandic UNU-GTP and Kenyan institutions
  - Short course, 6-months, MSc a and PhD programs
- Government strategies, regulatory and policy framework
  - The 40-months challenge for addition of 5,000 MWe with geothermal contributing 1,646 MWe
- Global focus on renewables energy

UNU-GTP-KENGEN-GDC CAPACITY BUILDING: SHORT COURSE TRAINING



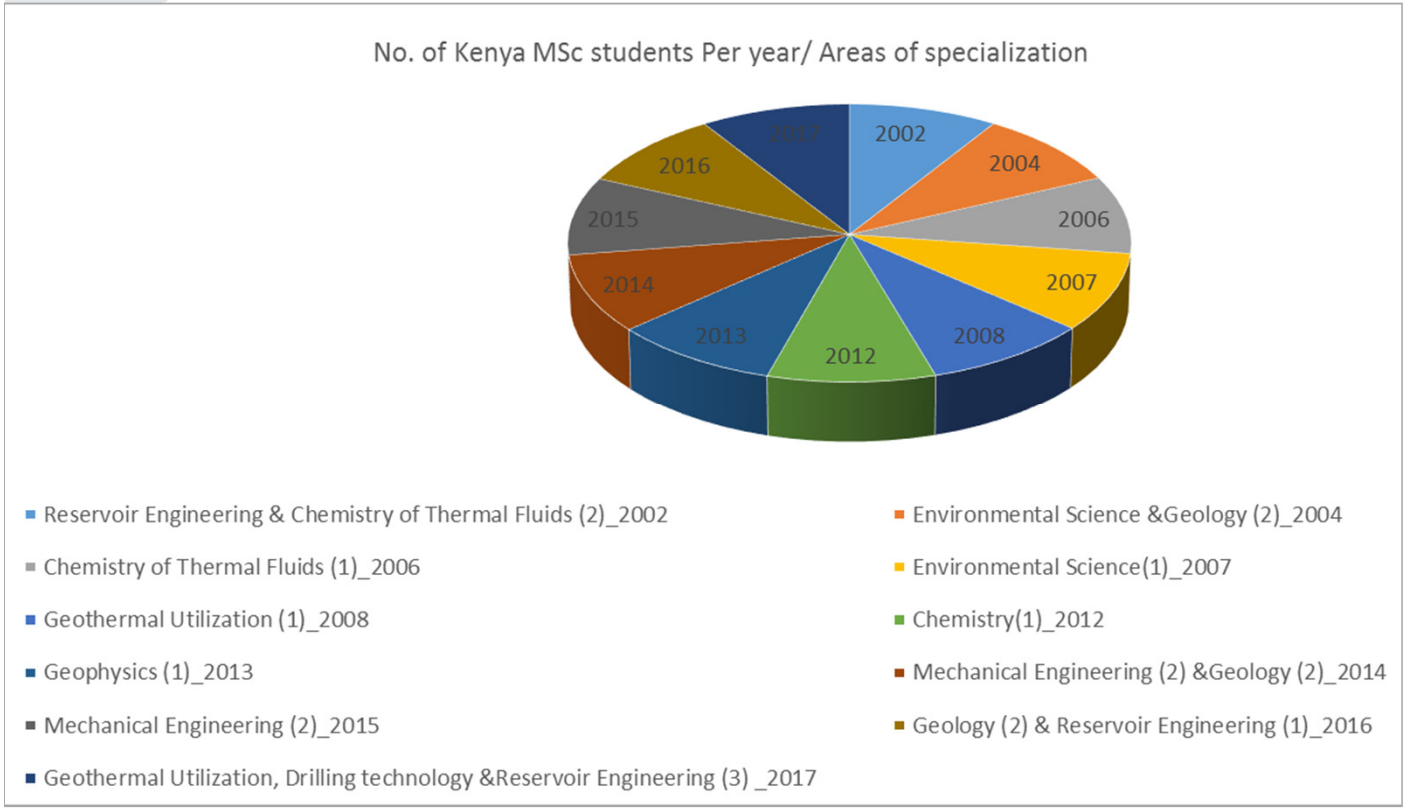
- ✓ Training initiated in 2005
- ✓ 321 number of trainees to date
- ✓ 3 week course program
- ✓ Average of 30 trainees per year

UNU-GTP CAPACITY BUILDING: 6 MONTHS PROGRAM



- ✓ Training initiated in 1979
- ✓ Total of 124 graduates
- ✓ 11 areas of specialized training
- ✓ Borehole geology with highest no. of graduates (21)

UNU-GTP CAPACITY BUILDING: MSC PROGRAMS



- ✓ Training initiated in 2002
- ✓ Total of 21 graduates
- ✓ 8 areas of specialized training
- ✓ Geology with highest no. of graduates (5)

Additional contributions of UNU-GTP and Iceland Organizations and Government

- ✓ Customized trainings in Kenya
- ✓ Workshops for Decision-Makers for various countries of E-Africa
- ✓ Advisory services in support of establishment of Africa Geothermal Centre of Excellence (AGCE) in Kenya with assistance of UNEP - Africa Rift Geothermal (ARGEO)
- ✓ Financings- through ICEIDA of Iceland and the Nordic Development, Iceland Ministry of Foreign Affairs

CONCLUSION

- Acceleration of geothermal development in Kenya has largely been achieved through investing in human capital.
- The contribution of UNU-GTP of Iceland towards these achievement cannot be overemphasized.
- Enabling environment through support Government of Kenya in terms of policy formulation and enactment that triggers geothermal development and,
- Financial support from development partners

ACKOWLEDGEMENTS

- Director of UNU-GTP-Ludvik Georgsson and Ms. Málfrídur Ómarsdóttir at UNU-GTP for providing the training data
- KenGen support UNU-GTP 40 year anniversary in recognition of its crucial role in capacity building for geothermal development in Kenya