GDC'S GEOTHERMAL DEVELOPMENT STRATEGY FOR KENYA: PROGRESS & OPPORTUNITIES

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DURING THE

POWER AFRICA-AFRICA UNION COMMISSION GEOTHERMAL ROADSHOW
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GDC Geothermal Development Company

Powering the Vision

Introduction

- The provision of reliable and affordable electricity is indispensable to the social and economic development of any country.

- In Kenya, electricity is at th core of our national development agenda as enumerated by the Vision 2030.

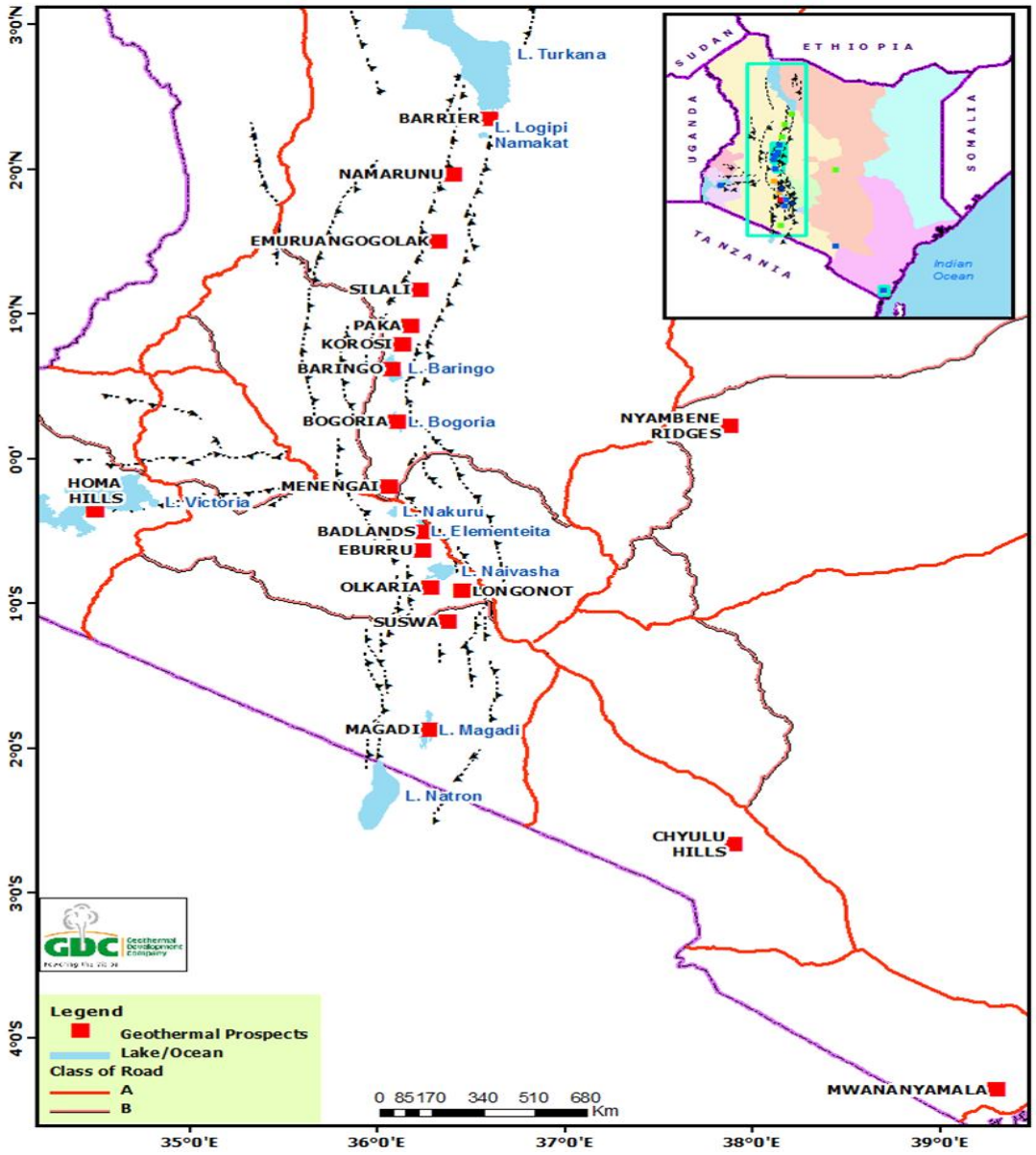
GDC OVERVIEW

OWNERSHIP	• GDC is a special purpose Company wholly owned by the GoK, Incorporated on 2nd December 2008
MAIN OBJECTIVE	• To facilitate the development of 5000 MW by 2030
CORE ACTIVITIES	• Prospect for geothermal resources and develop them for steam sale
POWER GENERATION	• Through competitive bidding, Steam will be offered to local and international investors who will put up power plants

GDC Mandate

Upfront Works	• Remove upfront risks • Reduce costs through infrastructural development, exploration works and production drilling
Direct Use	• Develop direct uses of geothermal
Capacity Development	• Develop human capacity • Manage public resources such as rigs • Provide consultancy services
Funding	• Support GoK in fund mobilization
Power Plant	• Support Private Sector entry • Sell steam to power producers

Geothermal in Kenya (10,000MW)



- Suswa,
- Longonot,
- Olkaria,
- Eburru,
- Menengai,
- Arus-Bogoria,
- Lake Baringo,
- Korosi,
- Paka,
- Lake Magadi,
- Badlands,
- Silali,
- Emuruangogolak,
- Namarunu
- Barrier
- Mwananyamala
- Homa Hills
- Nyambene
- Chyulu Hills

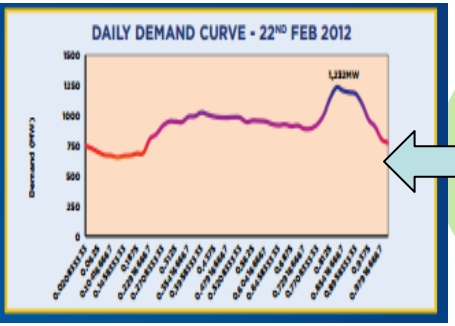
Kenya's Current Power Mix

SOURCE	Installed Capacity (MW)	Percentage
Hydro	816	40%
Thermal	651.4	31.5%
Geothermal	550.4	27%
Cogeneration	26	1.26%
Wind	5.3	0.27%
Isolated Grid	17	0.83%
Total	**2066.1**	100%

The plan is to make geothermal the base load owing to its abundance and availability

Electricity Landscape in Kenya

High Cost -~ KES 17.87



Peak Demand vs. Supply

Installed Capacity

2,066 MW

Low Base-Load Capacity

Slow rate of addition of clean & stable geothermal

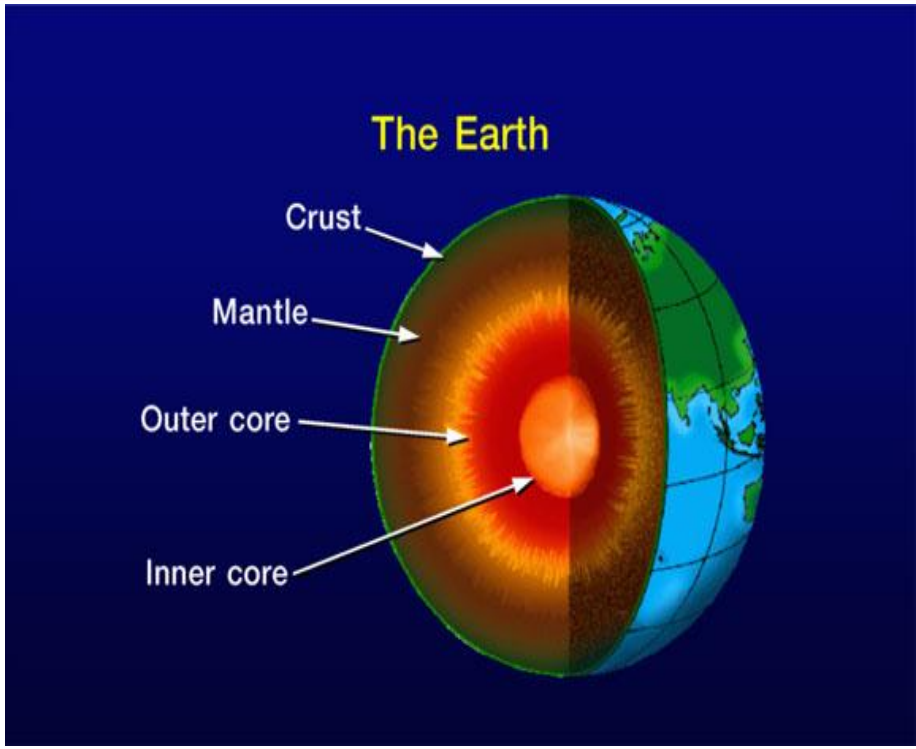
Expensive Thermal Plants

Kenya's Vision 2030 Vs Demand

- National Target: 23,000MW required
- Why: To achieve a **Newly industrialising Middle-Income** status
- GDC's Target: 5,000MW by 2030; 810MW by 2016

Why the Focus on Geothermal in Kenya?

- Climate change has made hydro power unreliable
- Geothermal is abundant – Kenya (10,000+MW)
- Green – no emissions
- Least cost source of power for Kenya



- Indigenous resource
- Not affected by adverse weather conditions
- High Availability (>95%)
- Cost of power can be predictable over the plant life
- Technology already successful in Kenya

Challenges of Developing Geothermal in Kenya - Long Gestation Periods

- **Started drilling in 1954**
- **45 MW Olkaria I (KPLC/KenGen)**
  - ✓ *Took 30 YEARS from 1955 to 1985*
- **105 MW Olkaria (KenGen) -Started 1986**
  - ✓ *Unit 1 & 2 -2003 (17 years)*
  - ✓ *Unit 3 -2009 (23 years later)*
- **280MW Olkaria IV & I (KenGen)– started 1998**
  - ✓ *Commissioning –December 2014 (16 years)*
- **100 MW Olkaria III (OrPower4) –Started 1998**
  - ✓ *48 MW Phase 1 -2009 (11 years)*
  - ✓ *72MW Phase 2 – 2014 (16 years)*

CURRENT GEOTHERMAL DEVELOPMENT STATUS

GDC Geothermal Development Strategy

Reduce Cost & Time

> Use own rigs to drill

> Modular Power plants for early development revenue

> Competitive bidding

Reduce Upfront Risks

> Undertake detailed exploration

> Exploratory drilling

> Conduct Feasibility Studies

5,000 MW by 2030

> At least 12 rigs in Kenya

> Drill at least 1,400 wells

Promote Direct Use

> Avail brine for heating

> Avail water

> Avail other products for Industrial uses

Sustainable geothermal Development

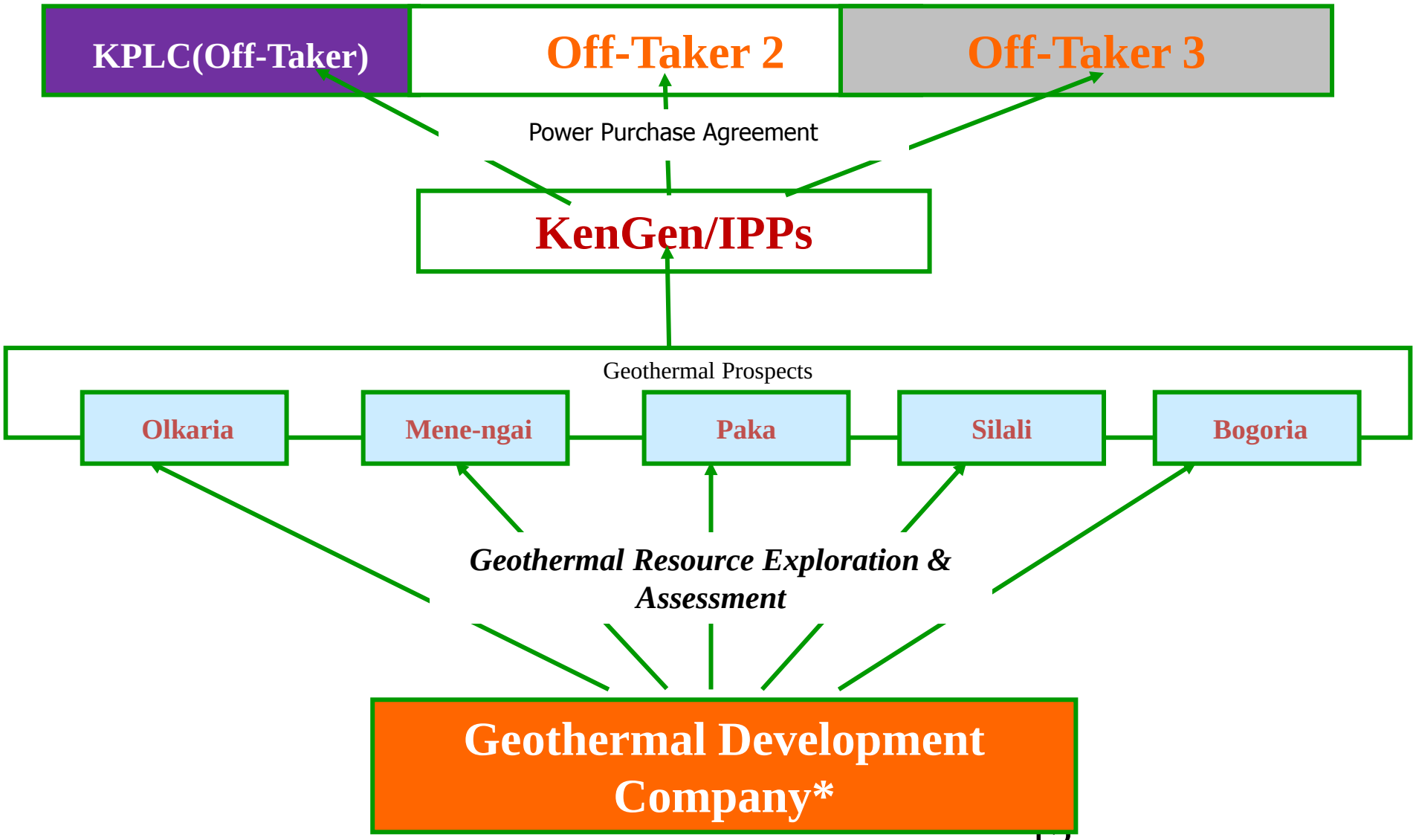
> Fundraising

> Manage the steam fields

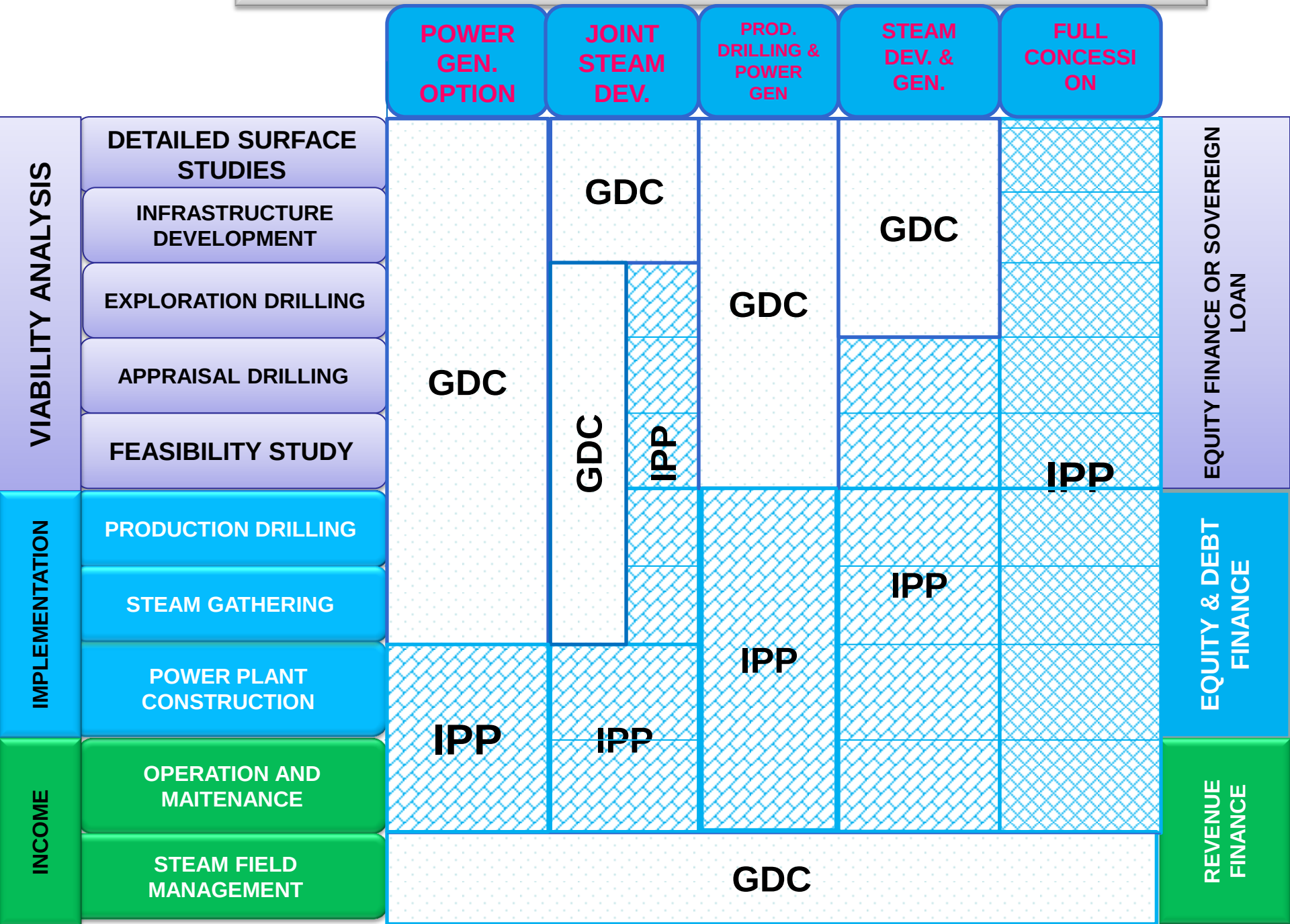
> Capacity building

>Seek local financing option

GDC's Role in Geothermal Development

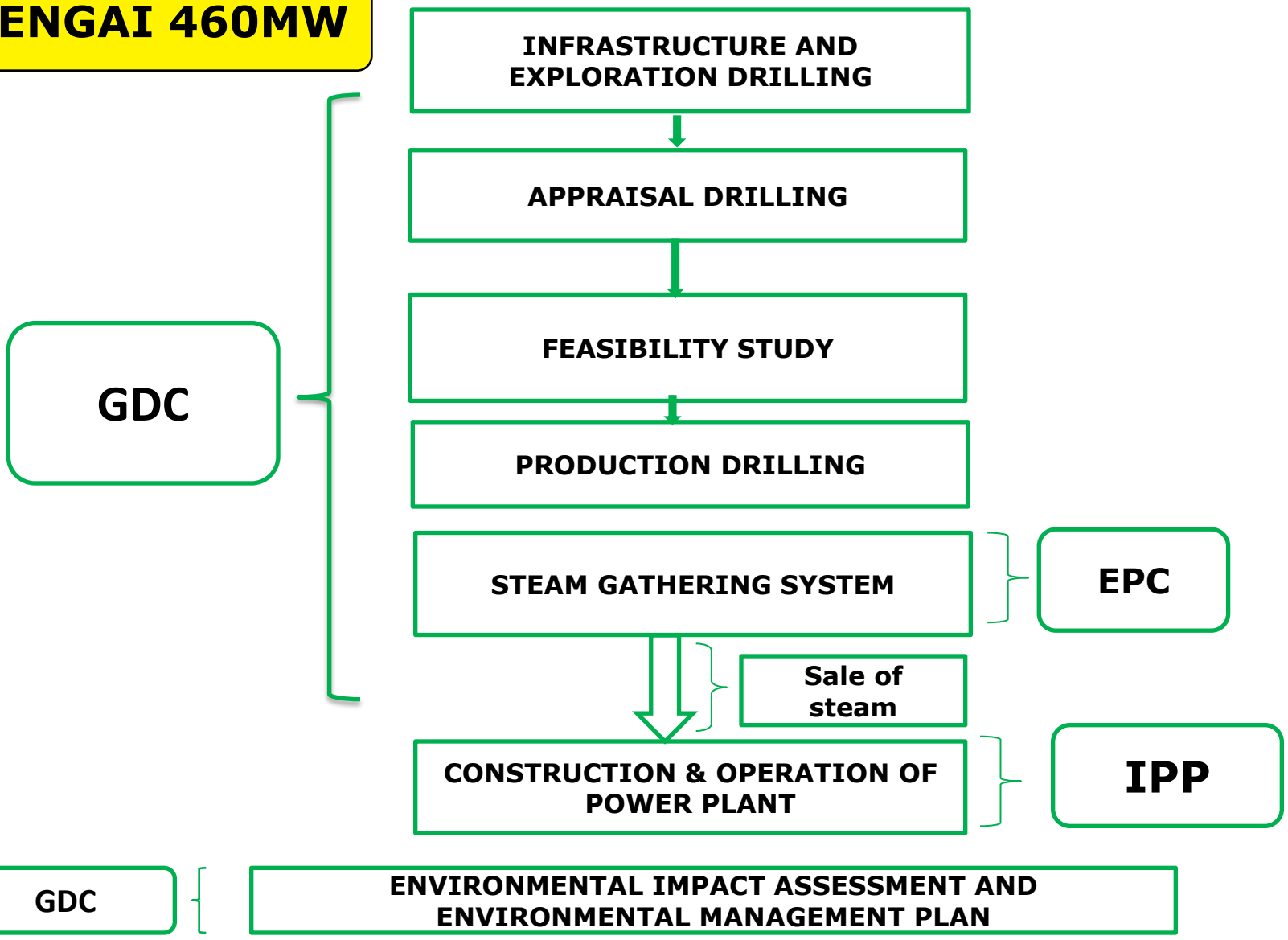


GDC's PUBLIC PRIVATE PARTNERSHIP - OPTIONS

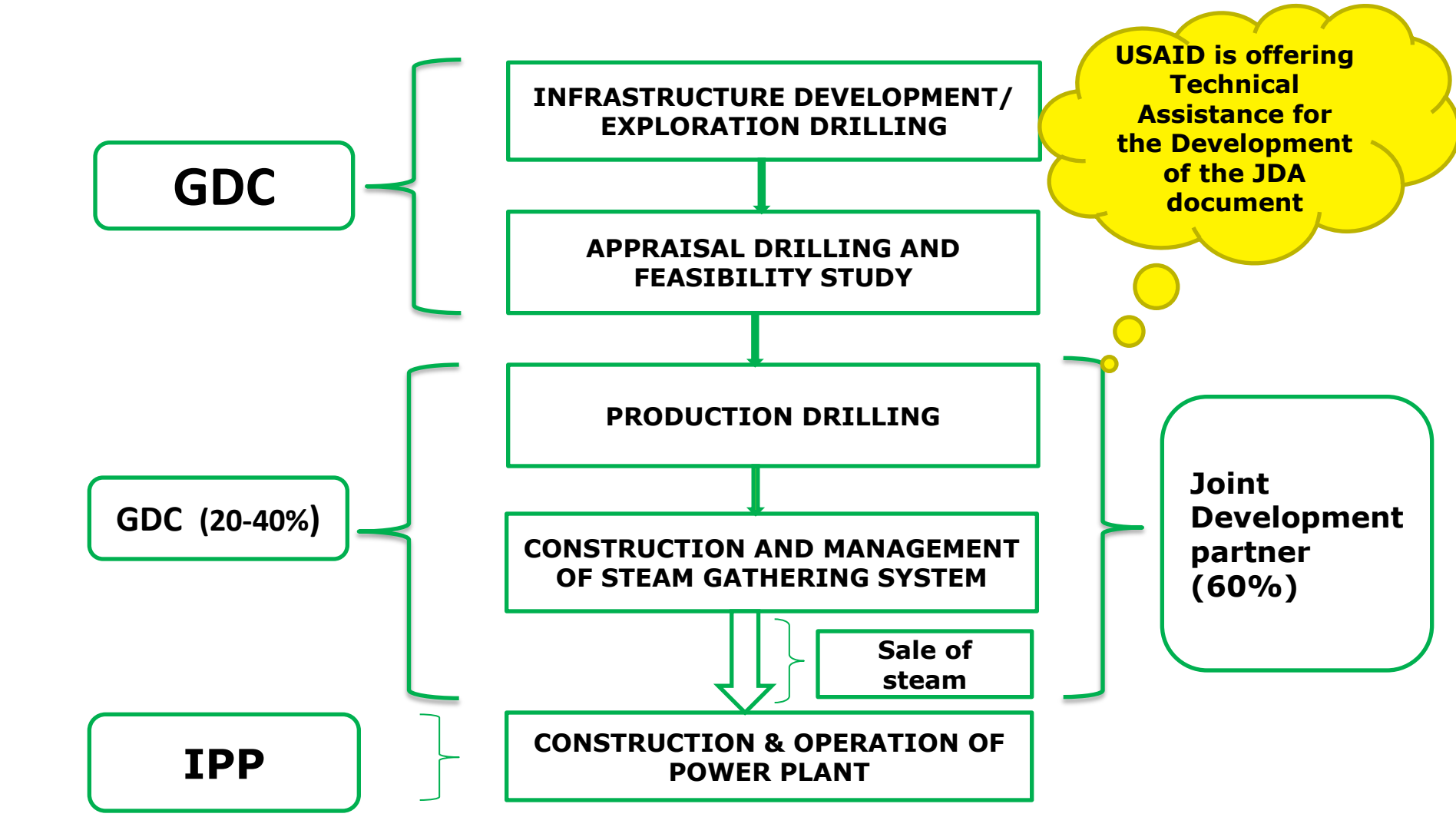


Development Model – Option I

MENENGAI 460MW



Development Model – Option II



Impact of the PPP options on tariffs

Example: A 50 MWe power plant

Scenario 1: IPPs Entering BEFORE Test Drilling ***14 – 17 US cents per kWh***

Investors prefer this option – RoI of approx.25%, hence better returns

Scenario 2: IPPs entering after Test Drilling (GDC has removed most of the upfront risks ***6.5 – 10.5 US cents per kWh***

Scenario II lowers tariffs thus reduces the cost of business and living costs (an RoI – 18%- still good hence a win-win approach for investors and the country

FUNDING STATUS

NO	PARTNER	Amount (MUSD)	PURPOSE	Status
1	**AFDB**	**120**	3 rigs, 90 wells materials, 1 wellhead, consultancies & training	Rigs and consultancies under procurement
2	**SREP**	**25**		
		15	Drilling services	Awaiting feasibility study report
3	**AFD**	**70**	2 rigs and business and strategic plan update	Rigs commissioned, business and strategic plans update ongoing
		100	Steam field, rig spares, drilling and pipeline consultancies	Pledged- Awaiting feasibility study report
4	**World Bank**	**2**	Feasibility study	Consultancy ongoing
		120	Steam field development	Pledged- Awaiting feasibility study report

FUNDING STATUS cont.

NO	PARTNER	Amount (MUSD)	PURPOSE	Status
5	**GRMF**	**6**	Drilling of 2 wells	Effective
6	**KfW**	**100**	Infrastructure development, Drilling services and consultancies	Committed
7	**USAID**	**3**	Capacity Building and technical assistance	Effective
8	**JICA**	**18.5**	Capacity building	Effective
		2	Master Plan	
9	**NDF**	**1.98**	Capacity Building	Awaiting agreement signing
10	**JSDF**	**0.03**	Community engagement for Menengai	Effective
11	**UNEP**	**0.5**	Capacity building, equipment, conceptual model for Silali	Effective

FUNDING STATUS Cont.

NO	PARTNER	Amount (MUSD)	PURPOSE	Status
12	**US Exim Bank**	**300**	Drilling equipment, wellheads, and materials	Pledge
13	**India Exim Bank**	**200**	Drilling services and materials, civil equipment	Pledge
14	**EIB**	**36**	Drilling services for Menengai	Complete
15	**USTDA**	**0.641**	Technical assistance	Complete
16	**PPIAF**	**0.05**	Financial management appraisal	Complete
17	**China Exim Bank**	**95.4**	Drilling of 26 wells at Olkaria	Complete

PROGRESS/SCORE CARD

Wells Drilled

- Olkaria – 59 wells
- Menengai – 25 wells

Steam available

- Olkaria – 409MW
- Menengai – 90MW

Drilling rigs

- 3 drilling rigs hired and have drilled at Olkaria
- 7 GDC owned drilling rigs procured.

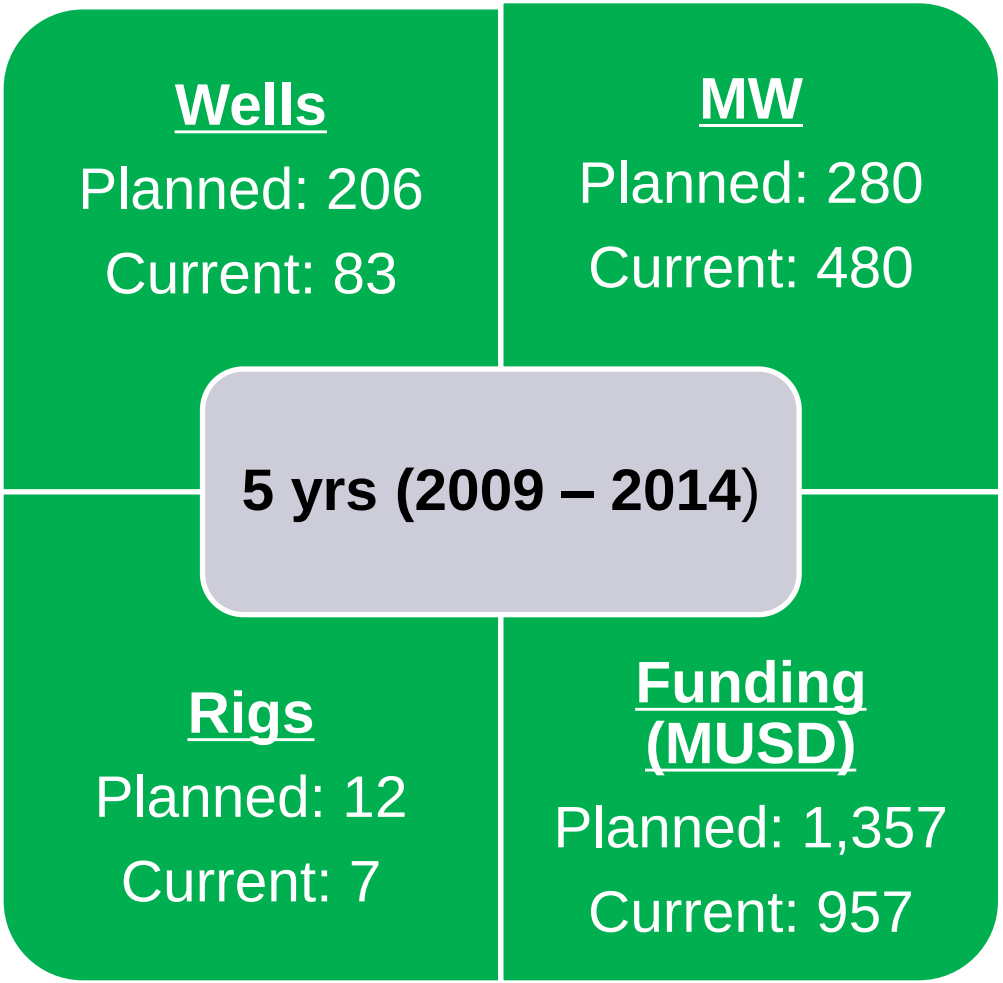
Funds raised (MUSD)

Commited

- GoK-445
- Development Partners-512

Pledges

- Development Partners-754



Planned Projects to Harness 810MW Plan

Project	Size	Commissioning
460MW MENENGAI	100MW	Dec 2014
	60MW	June 2015
	100MW	Dec 2015
	100MW	June 2016
	100MW	Dec 2016
150MW SUSWA	100MW	June 2016
	100MW	Dec 2016
200MW BARINGO-SILALI	100MW	June 2016
	100MW	Oct 2016

100MW MENENGAI PROJECT

- 3 IPP's already contrated to finance, procure and operate three modular power plants, on a build-own-operate basis, to be commissioned in Sept. 2015
  - Ormat International
  - Quantum Power EA
  - Sosian Energy
- PSSAs and PPAs submitted to ERC
- 2 IPPs have applied for generation licence from ERC

60MW MENENGAI PROJECT (30MW x 2)

- To be commissioned in Dec 2015
- Approval from PPP Secretariat obtained

- Tendering for 60MW closed

BIDS RECEIVED 60MW MENENGAI POWER PLANT SHORTLIST

NO.	FIRM	COUNTRY OF ORIGIN
1	Trans century Limited	Kenya
2	Power Machines OJSC	Russia
3	SOSIAN ENERGY CONSORTIUM	Kenya
4	Allan Dick &Co East Africa Ltd And Arabian Bemco Contracting Company Limited	Kenya/Saudi Arabia
5	Toyota Tsusho Corporation	Japan
6	Daewoo International	Korea
7	Lantech (Africa) Ltd/China National Cable Engineering Corporation	Kenya/China
8	Shandong Zhongkai Heavy Industry Group Co. Ltd	China
9	The Mirambo Energy Consortium	Tanzania

60MW MENENGAI POWER PLANT SHORTLIST...(2)

No.	Firm	Country of Origin
10	International Power S.A, Dubai Branch	United Arab Emirates
11	AEE Power S.A & GDA	Spain/Usa
12	Centum-SEDC JV	Kenya/China
13	Rocky Africa Limited	Kenya
14	Traxis Energy Consortium	Kenya/Denmark
15	Pisu & Company Limited	Kenya
16	Ormat Technologies Inc.	Usa
17	East Gate Power Limited	Kenya
18	Consortium Of Africon Limited, Punj Lloyd Limited, Oserian Development Company Limited	Kenya

SUSWA PROJECT

Potential – 750MW

- Development of 150MW by 2016
- ESIA in progress
- Community engagement ongoing
- Joint equity investors already invited to express interest for Joint development

300MW SUSWA JDA EOI SHORTLIST

1	GLOBELEQ	England
2	MAYIRA LTD/ PATH FINDER/ HARBEL ELETRIC	Kenya
3	FUJIAN INVESTMENTS	China
4	BINXIAN COAL LTD	China
5	RAM ENERGY	USA
6	INTERNATIONAL POWER S.SA-GDF SUEZ	Belgium
7	MARUBENI CORPORATION	Japan
8	ENEL GREEN POWER S.P.A	Italy
9	TRANS AFRICA POWER CONSORTIUM	Kenya
10	SOSIAN ENERGY Consortium	Kenya
11	SALWAN K LTD	Kenya
12	TOYOTA TSUSHO CORP	Kenya
23	RUSHYDRO INTERNATIONAL	Russia
24	TRANSCENTURY LTD	Kenya

300MW SUSWA JDA EOI SHORTLIST

13	CAPE GRACE INVESTMENTS	Kenya
14	CHINA MACHINERY COOPERATION	China
15	ENERGY DEVELOPMENT CORPORATION	Philippines
16	MITSUBISHI CORPORATION	Japan
17	MELEC POWERGEN & AMERICAN CAPITAL ENERGY & INFRASTRUCTURE	British Virgin Islands
18	DAEWOO INTERNATIONAL CORPORATION	Korea
19	TERRASOL PTY LTD	South Africa
20	ORMAT INTERNATIONAL INC.	U.S.A
21	CHINA STATE CONSTRUCTION ENGINEERING LTD	China
22	PX INTERNATIONAL/ CAMS/ FIELDSTONE/ PUNJ LLOYD/ RSM/ STANDARD MUTUAL	England
23	RUSHYDRO INTERNATIONAL	Russia
24	TRANSCENTURY LTD	Kenya

BARINGO-SILALI PROJECT

Potential – 3000MW

- 200MW to be developed by December 2016
- Environmental License and Land approval obtained
- Community engagement framework established
- GDC has advertised for equity investors to jointly develop the steam field with GDC

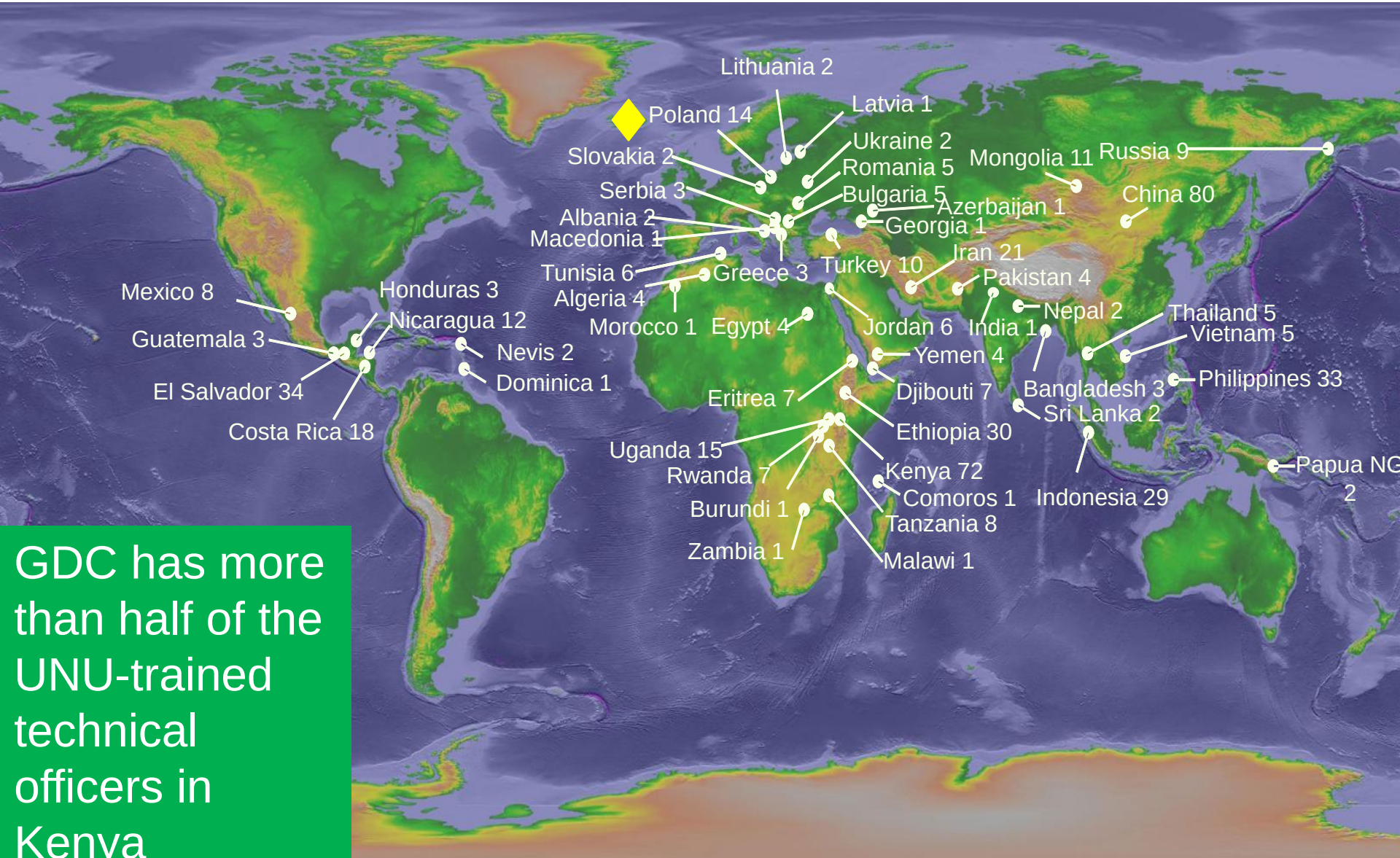
800MW BARINGO-SILALI JDA SHORTLIST

NO	FIRM	COUNTRY
1	RAM ENERGY	USA
2	SOSIAN ENERGY Consortium	KENYA
3	GREATWALL Drilling Company	CHINA
4	TERRASOL PTY LTD	SOUTH AFRICA
5	ORMAT INTERNATIONAL INC.	U.S.A
6	TRANSCENTURY LTD	KENYA

Capacity Building

- Carried out through Internal training, on- the job training, assistance by international geothermal institutions, consultancies and collaboration with well established geothermal companies for on-job training
- GDC has received support from the following institutions and partners in providing capacity building to its staff:
  - USTDA (USA)
  - UNU-GTP (Iceland)
  - University of Auckland (New Zealand)
  - University of Kyushu (Japan)
  - BGR (Germany)
  - NDF (Norway)
  - AFD (France)
  - AfDB

UNU Fellows in Iceland 1979-2012



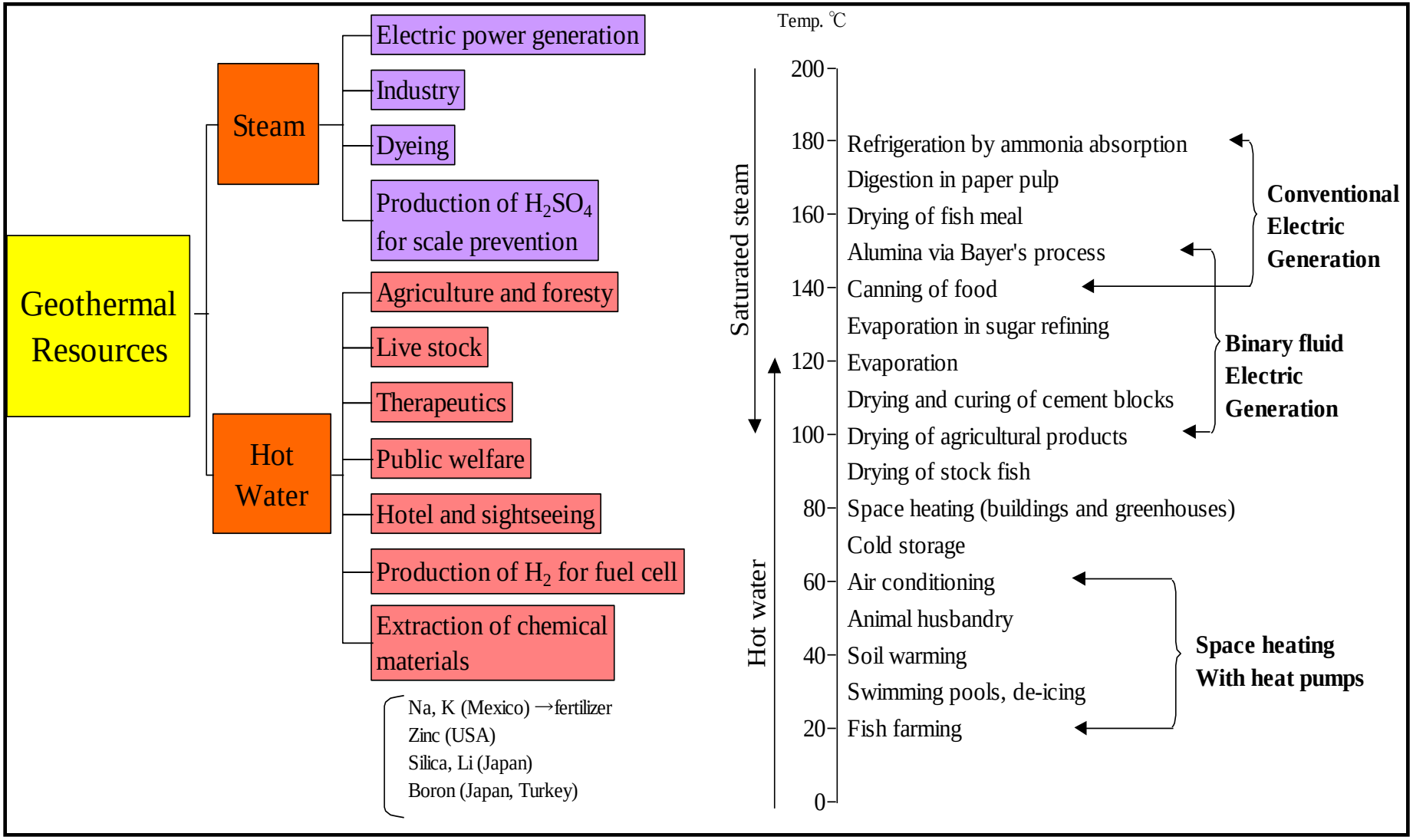
GDC has more than half of the UNU-trained technical officers in Kenya

Specialized Geothermal Training

Our technical staff have obtained specialized training at various institutions:

a) Institute for Geothermal Research, Pisa –Italy (Volcanology)
b) University of Kyushu, Japan (Resource Utilization)
c) University of Auckland, New Zealand (Theory)
d) US Universities(Duke –NC, Stanford, Rice -TX Berkley, Reno, Utah, Elpaso-TX) AfdB, WB Support
e) Internal drilling technology, Petro-Canada, Petroskill, Weatherford (Local)
f) UNU-GTP, Iceland(All round applied course)
g) UNU-GTP/GDC/KenGen Short Course in Kenya

Additional investment opportunities - direct use



THANK YOU

GDC Geothermal Development Company

Powering the Vision