FINANCING GEOTHERMAL DEVELOPMENT IN THE ANDES

Understanding Key Challenges in Financing Geothermal Energy & Role of Public Finance

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Powering the Vision

Introduction

KENYA

- Location: Eastern part of Africa
- Area: 582,646 Km2
- Population (2014): 44.8 million
- GDP (2014): US$ 60.9 Billion
- Economic Structure (2005-2012):

  Agriculture (27.2%), Services (54.4%), Industry (18.4%

KENYA Vs Andean Countries

DETAILS	STATISTICAL DATA					
Details	**Kenya**	**Bolivia**	**Colombia**	**Chile**	**Ecuador**	**Peru**
Land Area (Sq. KM)	582,646	1,083,300	1,109,500	743,542	248,360	1,280,000
Population in Millions (2014)	44.8	10.5	47.7	17.8	15.9	30.7
Population Density	76	10	43	24	64	24
GDP in U$ Billions (2014)	60.9	34.1	377.7	258.1	100.5	202.9
GDP per Capita (Current U$)	1,359.4	3,235.8	7,903.9	14,528.3	6,322.3	6,550.9
% GDP Growth Rate (2014)	5.3%	5.4%	4.6%	1.9%	3.8%	2.4%
Inflation (%)	6.9%	5.8%	2.9%	4.4%	3.6%	3.2%
Life Expectancy - years	62	67	74	80	76	75
Electricity Installed Capacity (MW)	2,295	1,649	14,611	18,160	5,384	9,705
Access to Electricity - %	32%	90.5%	97%	99.6%	97.2%	91.2%
CO2 Emissions (Metric Tonnes/Capita)	0.3	1.6	1.6	4.6	2.4	1.8
Renewable Energy proportion (% of total)	75.15%	33.76%	79.55%	36.45%	54.87%	55.23%
CO2 Emmissions from Heat & Electricity (% of Total)	18.7%	28.6%	22.6%	46.9%	26.6%	33.1%
Electricity Power Consumption (GWH)	7,768	6,456	49,385	63,990	19,020	35,688
Electricity Power Consumption (KWH/Capita	160	663	1,150	3,810	1,282	1,211
Income Level	Lower Middle	Lower Middle	Upper Middle	High	Upper Middle	Upper Middle

Source: World Bank Data and Kenyan sources

Why Renewed Interest on Geothermal?

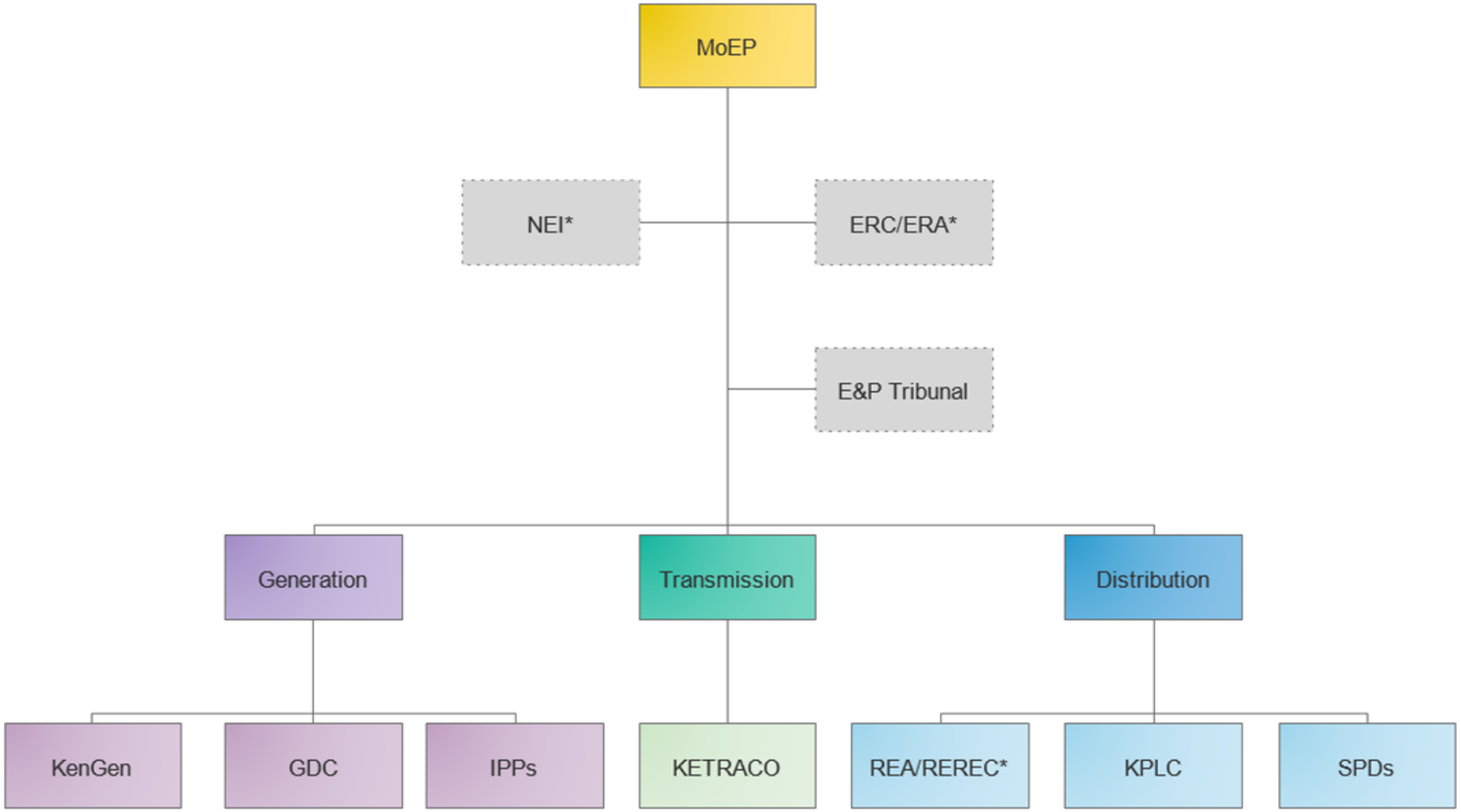
- Abundance Natural Renewable Resource
- To support Sustainable Economic Development
- To support growing Electricity Demand – Energy access & Economic Growth
- Climate Change Considerations
- Reduce cost of doing Business and Increase Country's Investment attractiveness
- Energy Reliability

KENYA ENERGY SECTOR

OVERVIEW

- Energy Sector liberalized in 1997
- Unbundling of the energy sector into entities that are more focused on the development of different energy sources;
  - Generation; Transmission
  - Distribution; Regulatory
- Created an enabling environment with clearly defined roles for all players
- Energy Act and Geothermal Act with associated regulations enacted;
- A Special Purpose company Geothermal Development Company created to facilitate accelerated geothermal development

INSTITUTIONAL SET-UP

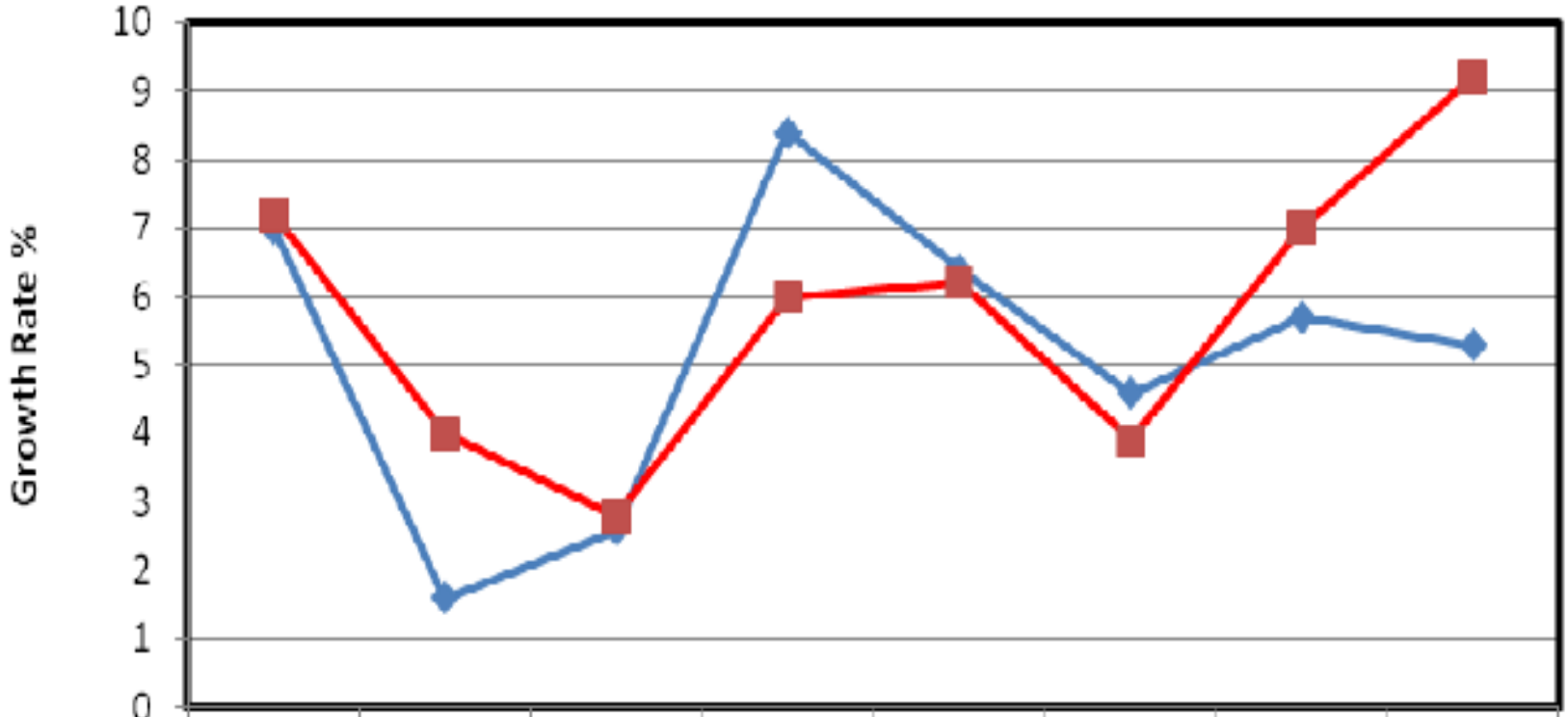


*Will be established after the implementation of the Energy Bill 2015.

ENERGY MIX in MW – November 2014

Developer/ Source	Hydro	Geothermal	Thermal	Co-gen	Wind	Total	%
KenGen	821	493	230		26	1,570	68%
IPPs	6	100	551	38	-	695	30%
Emergency			30			30	1%
Total	**827**	**593**	**811**	**38**	**26**	**2,295**	**100%**
Contribution	**36%**	**26%**	**35%**	**2%**	**1%**	**100%**	

GDP and Electricity Demand



	2007	2008	2009	2010	2011	2012	2013	2014
GDP	7	1.6	2.6	8.4	6.4	4.6	5.7	5.3
Elec	7.2	4.0	2.8	6.0	6.2	3.9	7.0	9.2

Planned Generation – 2013 - 2017

Source	Type	Planned addition (MW)	%
	Hydro	24	
	Geothermal	1,646	
	Wind	630	
	Co-Generation	18	
Renewables	**Sub-Total**	**2,318**	**42%**
	LNG	1,050	
	Coal	1,920	
	Thermal	250	
Fossil Fuels			
	Sub-Total	**3,220**	**58%**
	Total	**5,538**	

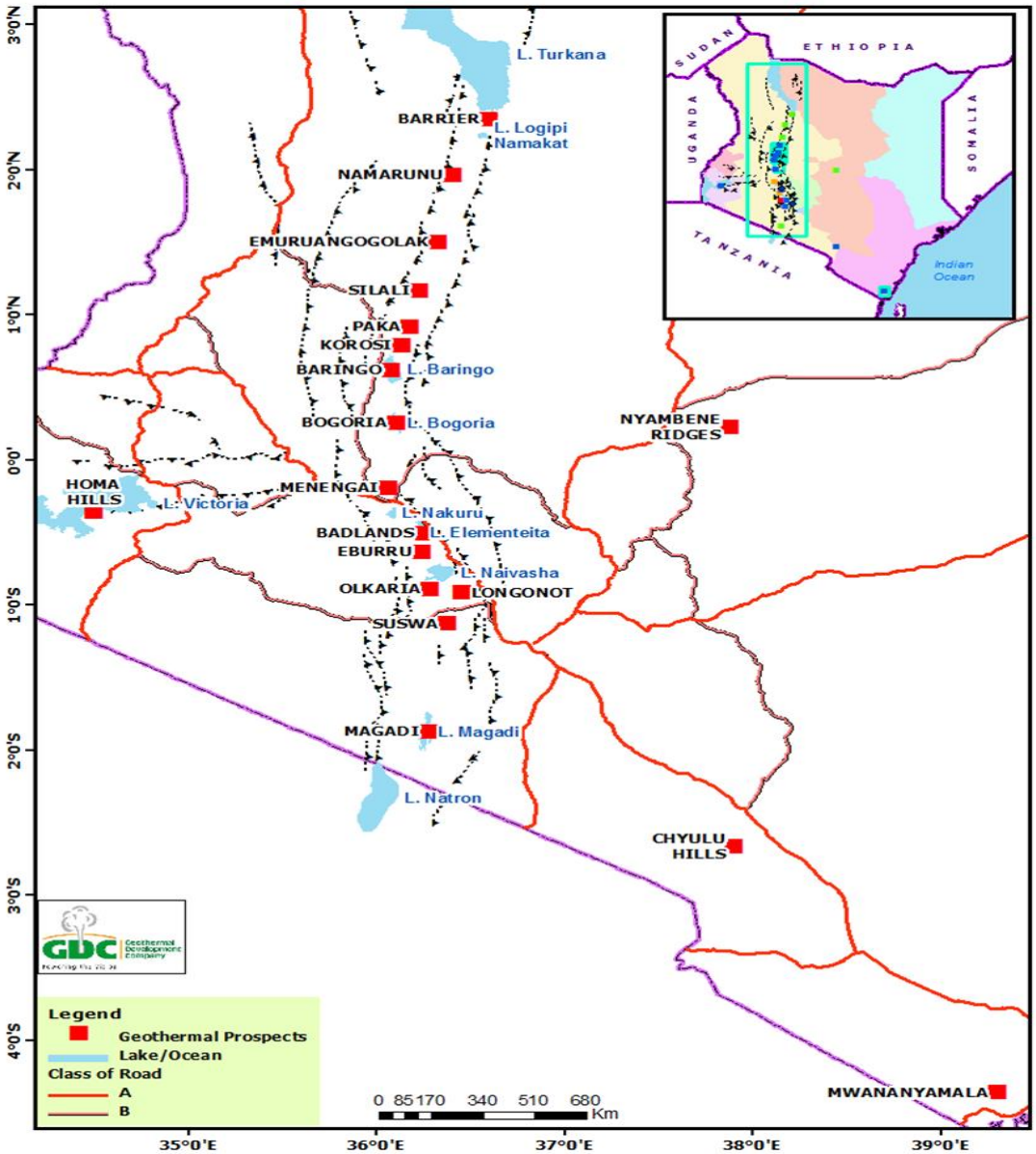
GEOTHERMAL ENERGY

Geothermal Ranking – Top 10 Countries

	County	Capacity (GW)
1	USA	3.525
2	Philippines	1.915
3	Indonesia	1.380
4	New Zealand	0.970
5	Mexico	0.813
6	Italy	0.769
7	Iceland	0.665
8	Kenya	0.600
9	Japan	0.517
10	Turkey	0.405

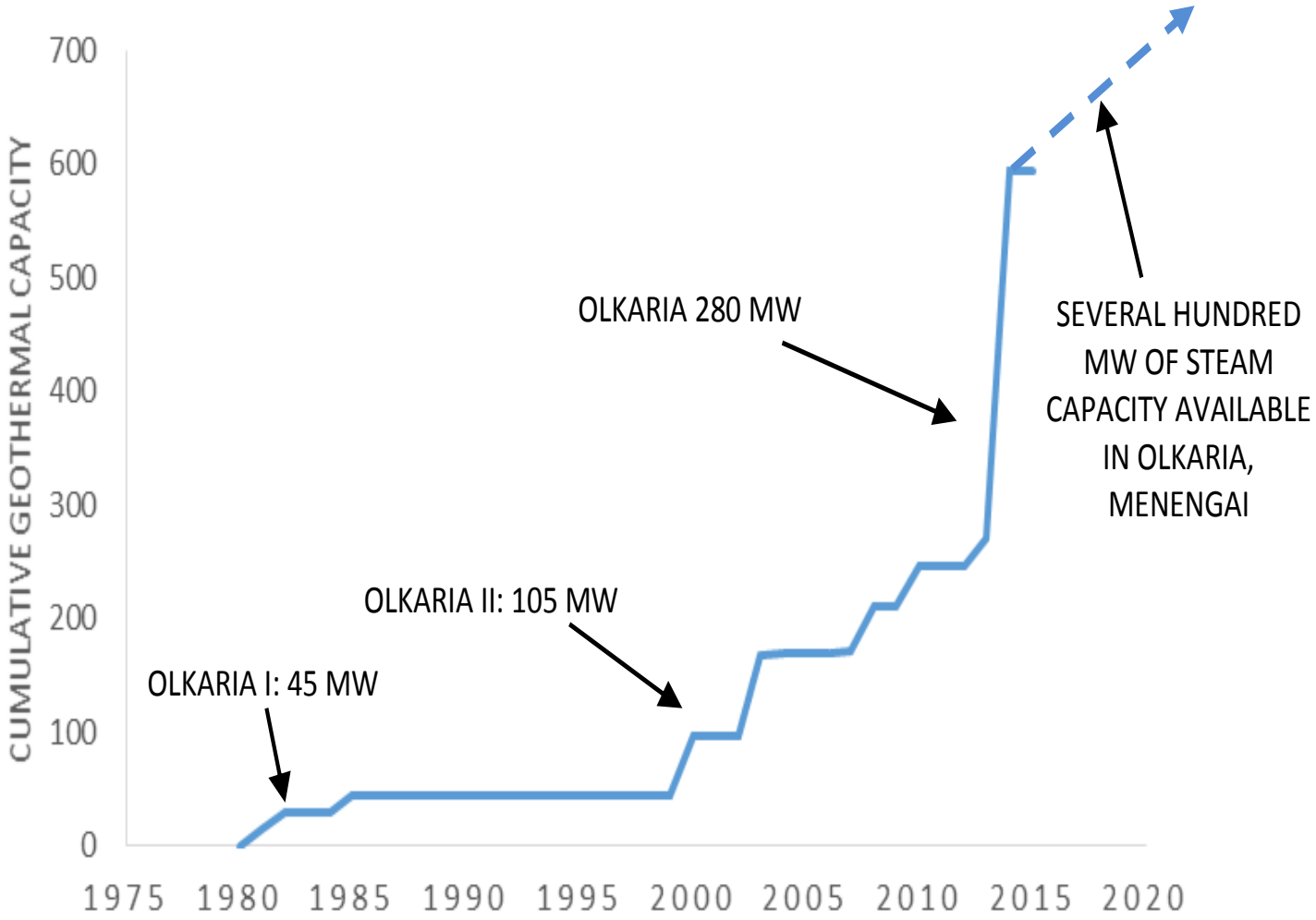
Source: International Renewable Energy Agency, 2015

Geothermal in Kenya



- 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 Geothermal Development Path



Current capacity:	**594 MW**	**Ambition to 2030:**	**5530 MW**
Technical potential:	10,000+ MW	Investment required per MW installed:	4-6 million USD
Ambition to 2017:	1,500 MW	Feed-in-Tariff for 35-70MW geothermal:	8.8 US cents per kwh

Geothermal Benefits

Geothermal power is proven to deliver a multitude of development and climate benefits. The recently (2014) commissioned KenGen 280 MW plant delivered:

- End-user tariff reduction of 30%: Kenyan family that used to pay 1000 KSHs per month now pays 700 KSHs
- Total savings for Kenya of 24 million USD per month
- Estimated 1,800 construction jobs, 476 permanent jobs
- 1.3 million metric tons of CO_2eq per year GHG savings
- Suppressed demand decrease from 300 MW to 100 MW
- Increased energy security and climate resilience

GEOTHERMAL CONTRIBUTION TO COST REDUCTION

Average Fuel Cost Component (Thermal Power Plants)	• 23 U$/KWH
Geothermal Steam Cost	• 2 – 3.5 U$/KWH
Cost Reduction (USCents/KWH)	• 21- 19.5 U$/KWH
% Cost Reduction	85% - 91%

Phases of Development

GDC

- Resource Exploration
  - Prospecting
  - Detailed Surface Exploration
  - Exploration Drilling & Well Testing

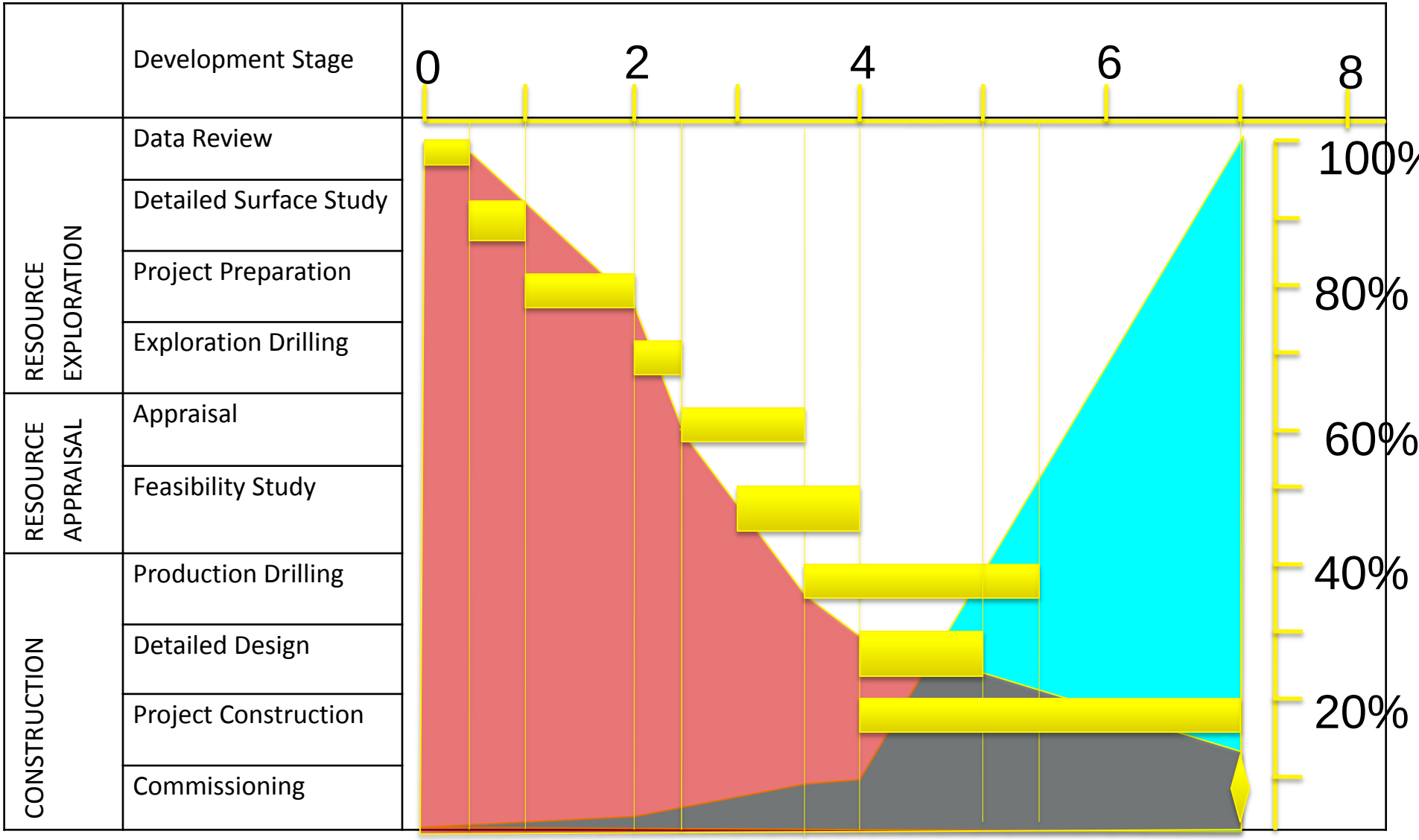
GDC

- Resource Assessment, Planning & Field Development
  - Appraisal Drilling
  - Feasibility Studies
  - Production Drilling
  - Steam Gathering System Construction

IPPs

- Power Plant Development & Operations
  - Financing
  - ESIA for Power Plant Development
  - Power Plant Construction & Operations
  - Substation & Transmission Line,

Project Phase Versus Risk Profile



GEOTHERMAL DEVELOPMENT VALUE CHAIN

VIABILITY ANALYSIS

DETAILED SURFACE STUDIES
FIELD GEOSCIENTIFIC STUDY
BASELINE ENVIRONMETAL

INFRASTRUCTURE DEVELOPMENT
MAIN ACCESS ROAD AND PADS
DRILLING WATER SUPPLY
LAND ACCESS RIGHTS

EXPLORATION DRILLING
RIGS MOBILIZATION
3 WELLS DRILLING & TESTING

APPRAISAL DRILLING
ADDITIONAL WELL PADS
6 WELLS DRILLING & TESTING

FEASIBILITY STUDY
RESOURCE SIZING
ENVIRONMENTAL SCOPING
FINANCIAL & ECONOMIC ANALYSIS

US$ 100 MILLION

EQUITY FINANCE OR SOVEREIGN LOAN

IMPLEMENTATION

PRODUCTION DRILLING
ADDITIONAL WELL PADS
DRILLING &TESTING ADDITIONAL WELLS

STEAM GATHERING
DESIGN AND ESIA
PIPELINE CONSTRUCTION

POWER PLANT CONSTRUCTION
PLANT DESIGN
CONSTRUCTION & COMMISSIONING

US$ 3 M/MW

EQUITY & DEBT FINANCE

INCOME

OPERATION AND MAITENANCE
OPERATION AND MAINTANANCE (O & M)

STEAM FIELD MANAGEMENT
SURFACE EQUIPMENT
RESERVOIR MANAGEMENT
MAKE UP WELLS

US$ .07-0.11/KWh

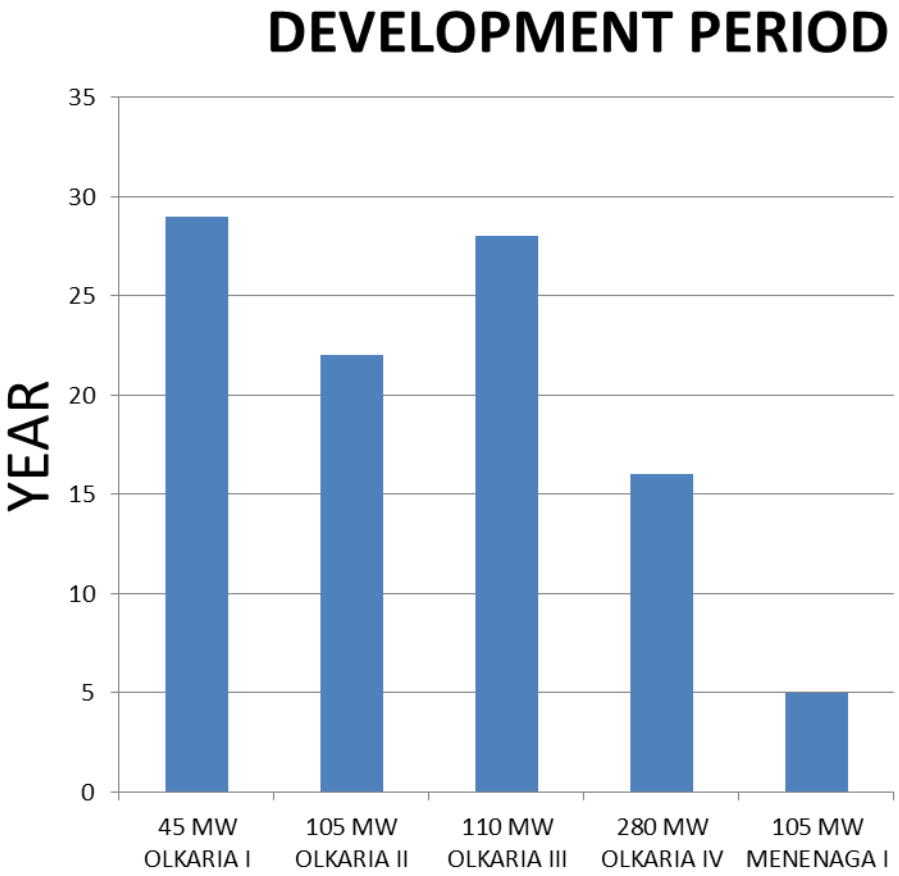
REVENUE FINANCE

GEOTHERMAL DEVELOPMENT EXPERIENCE

Historical development Record – 17 Years

Developer	Field	Development Period		Duration (Years)	MW	MWYEARS	Average Development Record
		From	To				
KPLC/KENGEN	Olkaria I	1955	1985	30	45	1350	
KENGEN	Olkaria Units 1, 2 & 3	1986	2009	23	105	2415	
KENGEN	Olkaria IV	1998	2009	11	100	1100	
ORPOWER 4	Olkaria III	1998	2013	15	280	4200	
					530	**9065**	17 Years

HISTORICAL DEVELOPMENT OF GEOTHERMAL IN KENYA



NB: FROM YEAR OF DRILLING OF FIRST WELL

GEOTHERMAL DEVELOPMENT COMPANY LIMITED (GDC)

Lessons from Past Experience

The Government recognized that;

- Geothermal can play a leading role; transform EA into a green economy region
- Successful geothermal projects elsewhere can be replicated in other potential areas in the region
- Stands to benefit from blending of exchequer, concessional, climate funds and private sector
- Geothermal can have a transformative impact when used directly in rural areas and for power generation.
- High early stage resource risks must be addressed to;
  - *Reduce High up-front investment costs*
  - *Accelerated development pace*
  - *Attract investors*
  - *Reduce power tariffs*

Lessons from Past Experience

- Need for Human capacity in the region to drive a robust geothermal industry
- Need for Capital risk insurance for private investors
- Specific laws and regulations governing geothermal resources
- Need for applied research and development
- Awareness and information on geothermal potential and available technologies
- Need for dedicated institutions to;
  - *establish potential*
  - *identify targets*
  - *develop strategies with clear implementation plans*

GDC Mandate

Upfront Risks and Costs	• **Remove Resource risks and reduce costs** • *Help the government to think (develop strategies)* • *infrastructure, surface exploration and drilling*
Direct Use	• **Promote direct uses of geothermal** • *Industrial process heat, floriculture, aquaculture and others*
Capacity Development	• **Develop human capacity** • *Train a core team and manage public resources* • *Provide capacity base to support a dynamic industry*
Funding	• **Support GoK in fund mobilization** • *Technical input -policies, strategies and regulations* • *Develop projects to a bankable stage (feasibility)* • *Engage Investors and assess investment appetites*
Power Plant	• **Support Private Sector entry** • *Handle land and community issues* • *Facilitate local licensing* • *Evaluate and recommend technologies to IPP's* • *Facilitate 5,000MW steam to IPP/KenGen by 2030*

KEY CHALLENGES

Key Financing Challenges

Financing

- Quantity of financial flows- Inadequate and irregular disbursement of funds;
- Quality of financial flows - Loan Processing cycle, Fund Disbursement cycles, Foreign Exchange risks
- Financial Track record of Developers - lack of track record/weak balance sheet affects quality and quantity of funds
- Country's debt ceilings and competing infrastructure needs

Infrastructure

- Geothermal Resources found in remote and hard to reach areas
- Development and improvement of existing infrastructure e.g. roads and water at the resource sites costly
- Grid connection

Key Challenges

Land and Community Issues

- Communal Land ownership, boundary disputes
- Protracted negotiations
- Compensation, Benefit Sharing, Resettlement

Human Capacity Challenges

- Matching the human capacity building ahead of drilling campaign
- Availability of the required mix of technical and soft skills

Private Sector Contracting Challenges

- Long process for Contracting, Negotiations and Financial Close
- Requirement by Lenders of IPPs for payment and Sovereign guarantees

Procurement Challenges

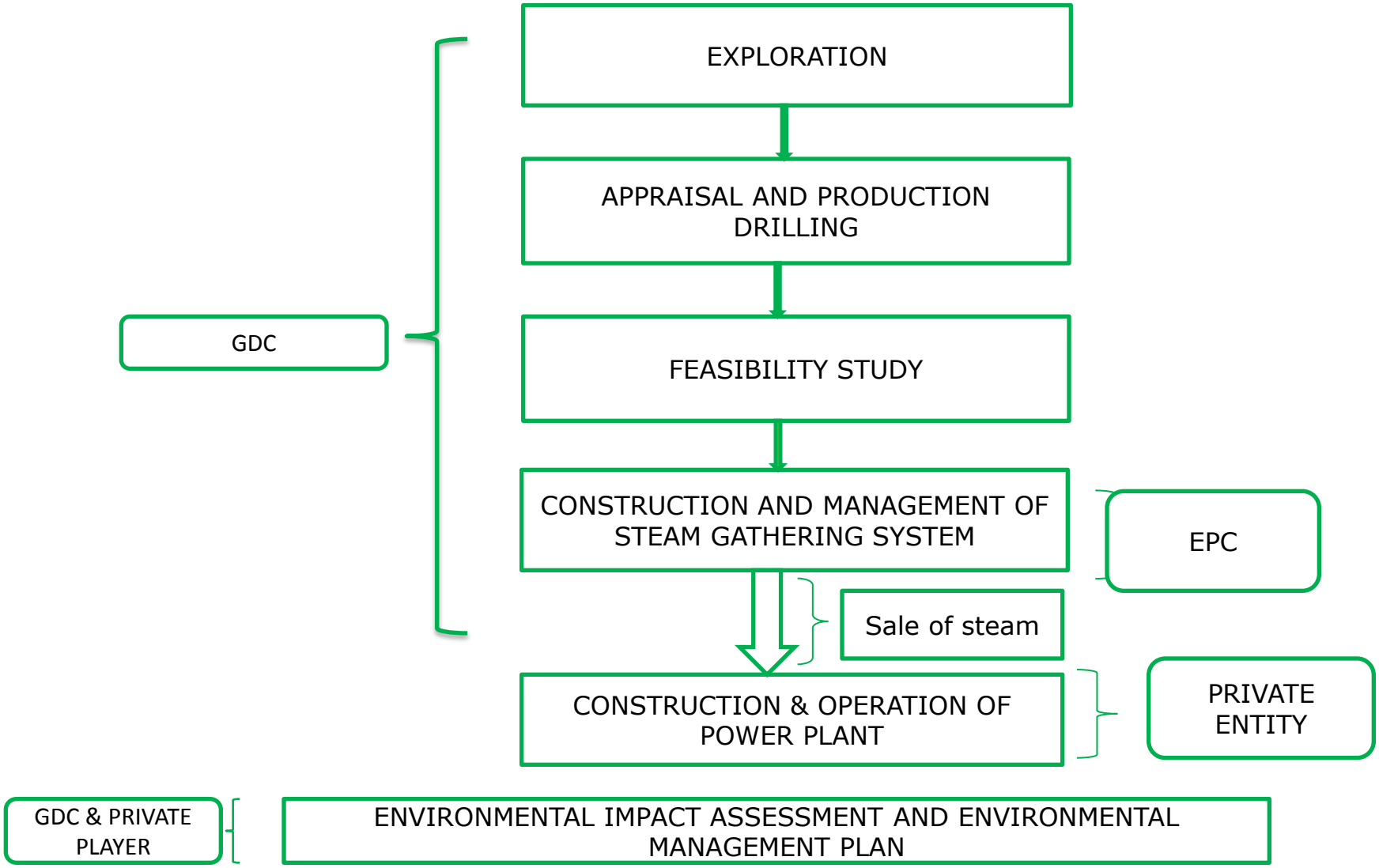
- Most requisite materials, tools and equipment not available locally
- Long Lead times for procurement of requisite materials, tools and equipment

Development Program

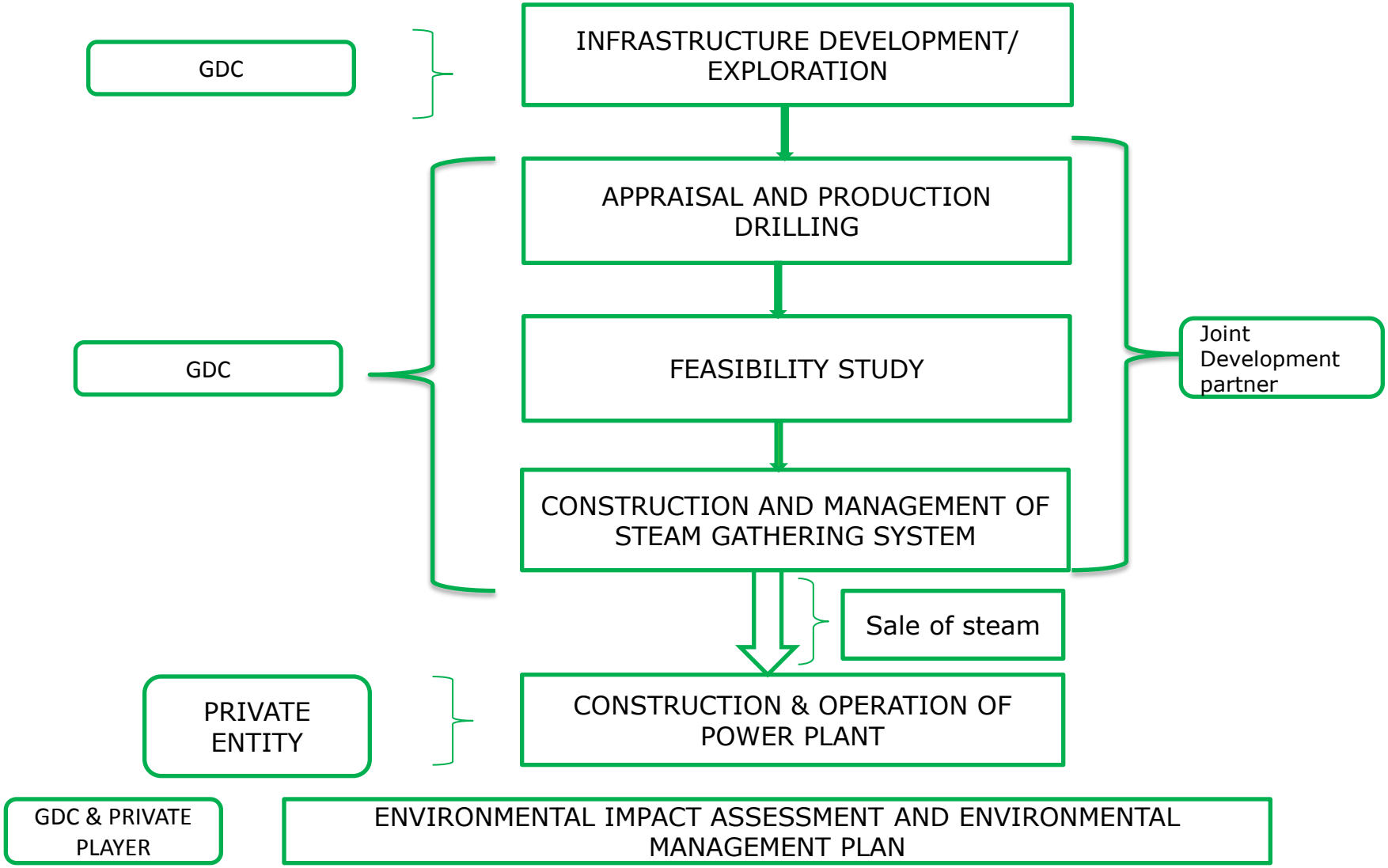
- Ability to maintain the project timelines and budgetary controls
- Capacity to manage reservoirs and steam fields

ROLE OF PUBLIC FINANCE

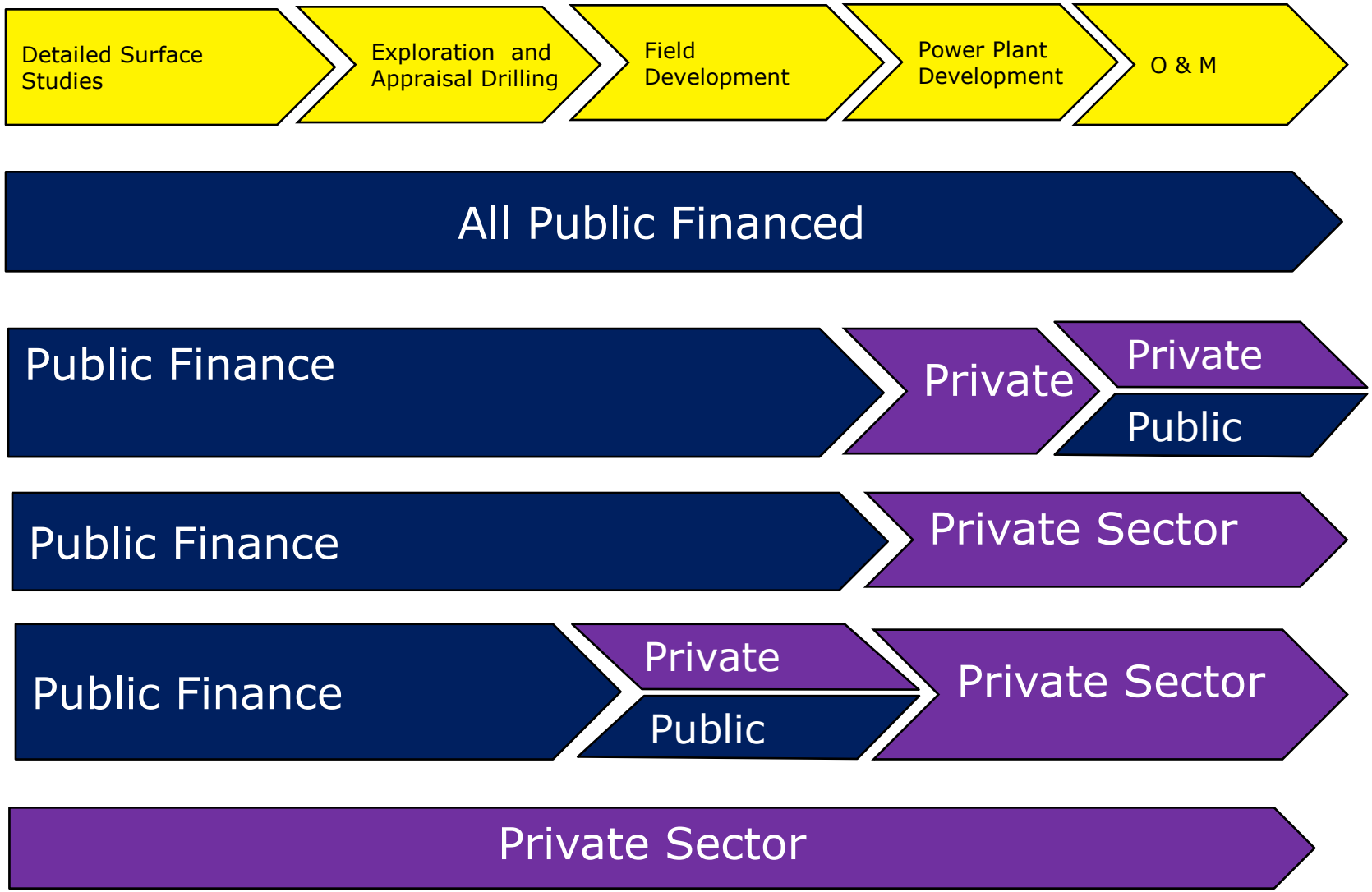
Development Model – Option I



Development Model – Option II



Role of Public Finance



DEVELOPMENT STATUS

Project	SIZE	Developer	Nature of Entity	Current status
Olkaria I - IV	493 MW	KenGen	Public/Private	Complete - Generating Electricity
Orpower IV	100 MW	Ormat	Private	Complete - Generating Electricity
Olkaria I unit	70 MW	KenGen	Public/Private	Drilling completed, procurement of contractor for plant construction
Olkaria V	140 MW	KenGen	Public/Private	Drilling complete, Sourcing financing for power plant construction
Olkaria VI	140 MW	KenGen	Public/Private	Drilling completed, request for proposals for power plant construction
Olkaria VII	140 MW	KenGen	Public/Private	Drilling to be completed
Menengai phase 1	400 MW	GDC	Public	Driling started in 2010 Drilling ongoing Power Plant Development for first 105 MW already contracted to IPPs scheduled for commissioning in 2017
Baringo-Silali phase 1	200 MW	GDC	Public	Detailed surface studies, Well siting and ESIA done. Drilling financing secured for Exploration Drilling , Drilling Services Contracted procured, Infrastructure development almost complete
Suswa phase 1	150 MW	GDC	Public	Detailed surface studies, well sitting, ESIA, and stakeholder consultation completed
Akiira One	140 MW	Akiira Geothermal Limited	Private	Drilling yet to commence
Longonot	140 MW	AGIL	Private	Drilling yet to commence
Suswa	??	WalAm	Private	Concession revoked

Public Finance Tools

Public Finance Strategy	Comment	Examples in Kenya
Government Participation in geothermal development	• Government take upfront risk and increases investor appetite • Attracts Private Sector Capital	Geothermal Development Company
Fund-Raising & Financial Leverage	• Government access to Concessional Financing • Government access to Grants • Government access to Low interest loans	Financial support from Multilateral and Bilateral Institutions such as: • World Bank • African Development Bank • KfW • French Development Agency • EIB • JICA • USAID • USTDA • US-EXIM • Italian Development Fund • Exim Banks

Public Finance Tools

Public Finance Strategy	Comment	Examples in Kenya
Taxation Exemptions	• Could Reduce Project cost by up to 30%	• VAT and Import Duty Exemption on geothermal equipment • Tax exemption on donor financing for geothermal activities
Feed-in-Tariffs	• Ensures predictability to investor • Investment security • Affordable to off- taker	• FiT in Tariff policy for geothermal projects of up to 10 MW • FiT Tariff for geothermal projects of 35-70 MW
Financial Guarantees	• Enhances bankability of Project • Increases investors appetite by reducing risk	• Partial Risk Guarantees • Letters of Support
Capacity Building	• Short Course in Geothermal at UNU-GTP • Scholarships	Africa Geothermal Centre of Excellence – to be established and managed by GDC

THANK YOU

GDC Geothermal Development Company

Powering the Vision