



Geothermal Exploration and development in Kenya

Cyrus Karingithi
cwkaringithi@gmail.com
ckaringithi@kengen.co.ke

Olkaria Geothermal Power Project, Naivasha, Kenya

Disclaimer:

No part of this report may be circulated, quoted, or reproduced for distribution without prior written approval from KenGen. All the information contained herein was prepared for information to the German Parliamentarians visiting Kenya



OVERVIEW OF POWER SUB-SECTOR TODAY

Geothermal Development Company(GDC) established in 2009 to accelerate Geothermal Resource Assessment

~75% Market Share

Ministry of Energy & Petroleum
(responsible for policy matters)

Generation

Energy Regulatory Commission (ERC)
(responsible for regulating the energy sector)

Transmission & Distribution

KenGen
1630 MW

EPP
(30MW)

IPPs
(488MW)

RURAL
(9MW)

UETCL
(Imports)

Kenya Power

KETRACO

REA

IberaAfrica
(108MW)

Orpower 4
(127MW)

Rabai (89MW)

Tsavo (74MW)

Mumias (26MW)

Thika (87MW)

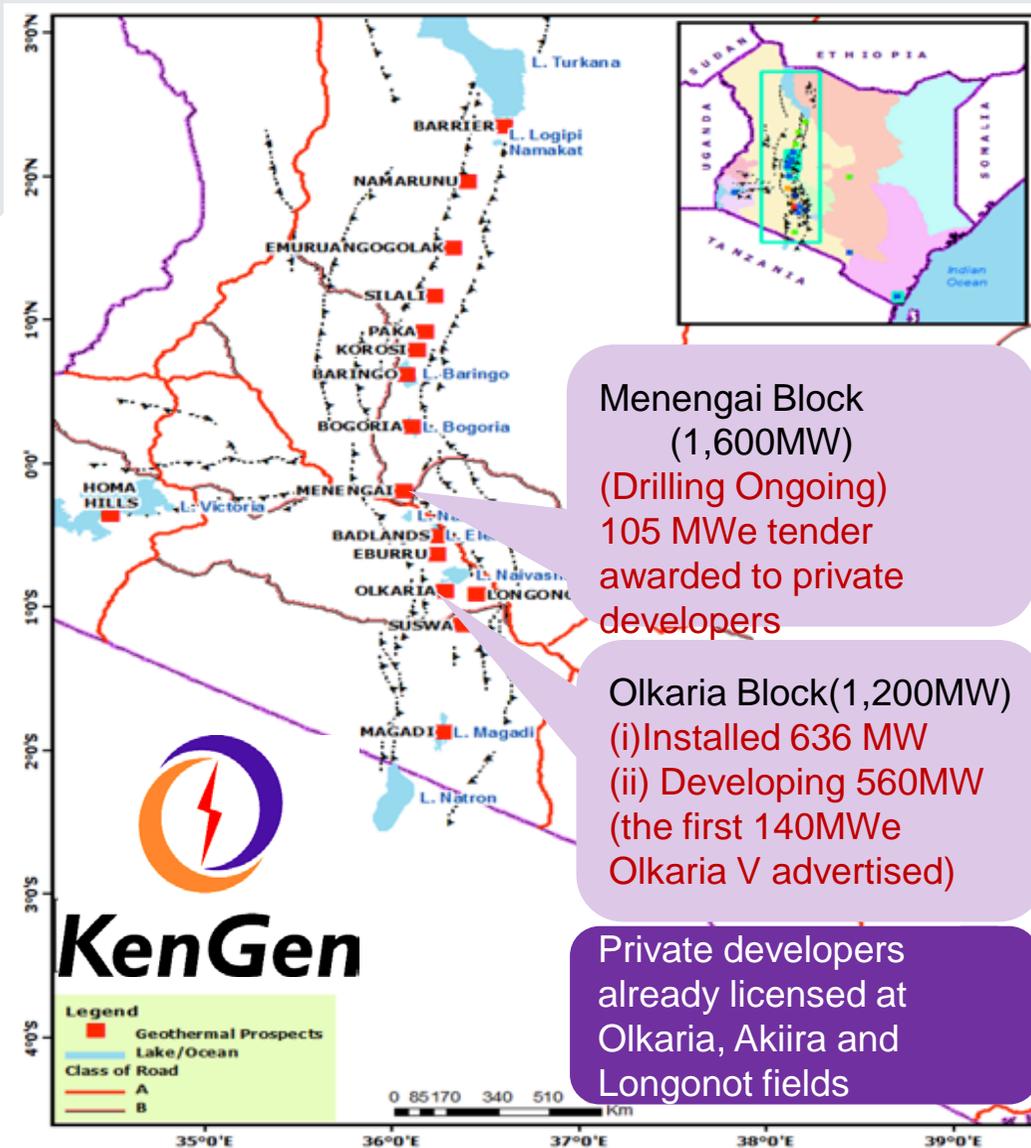
Upcoming
(938MW)

Customer

- Wind (510MW)
- Thermal (163MW)
- Geothermal (247MW)
- Biomass (18MW)

New Energy Bill being enacted to align the sector to the New Constitution...

GEOHERMAL POTENTIAL IN KENYA



Menengai Block
(1,600MW)
(Drilling Ongoing)
105 MWe tender
awarded to private
developers

Olkaria Block(1,200MW)
(i) Installed 636 MW
(ii) Developing 560MW
(the first 140MWe
Olkaria V advertised)

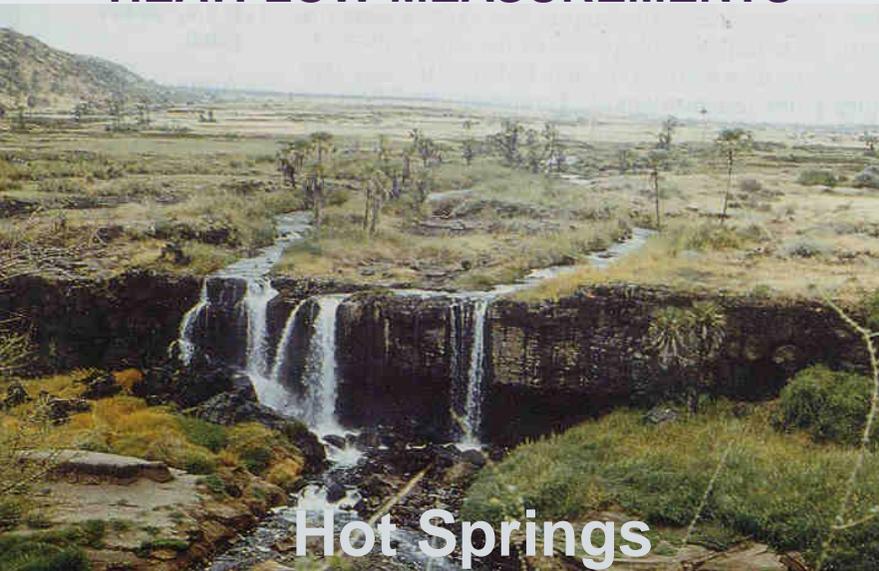
Private developers
already licensed at
Olkaria, Akiira and
Longonot fields

> 10,000MW in over 23 sites

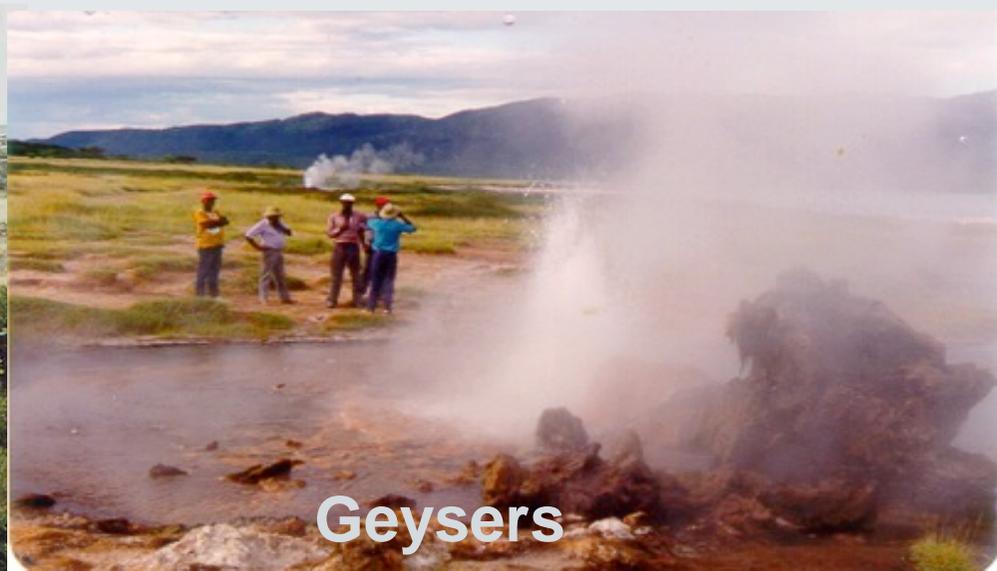
- Suswa,
- Longonot,
- **Olkaria,**
- Eburru,
- Menengai,
- Arus-Bogoria,
- Lake Baringo,
- Korosi,
- Paka,
- Lake Magadi,
- Badlands,
- Silali,
- Emuruangogolak,
- Namarunu
- Barrier
- Mwananyamala
- Homa Hills
- Nyambene Ridges
- Chyulu Hills

GEOLOGY, GEOCHEMISTRY, GEOPHYSICS, ENVIRONMENT STUDIES

HEATFLOW MEASUREMENTS



Hot Springs



Geysers



Fumaroles



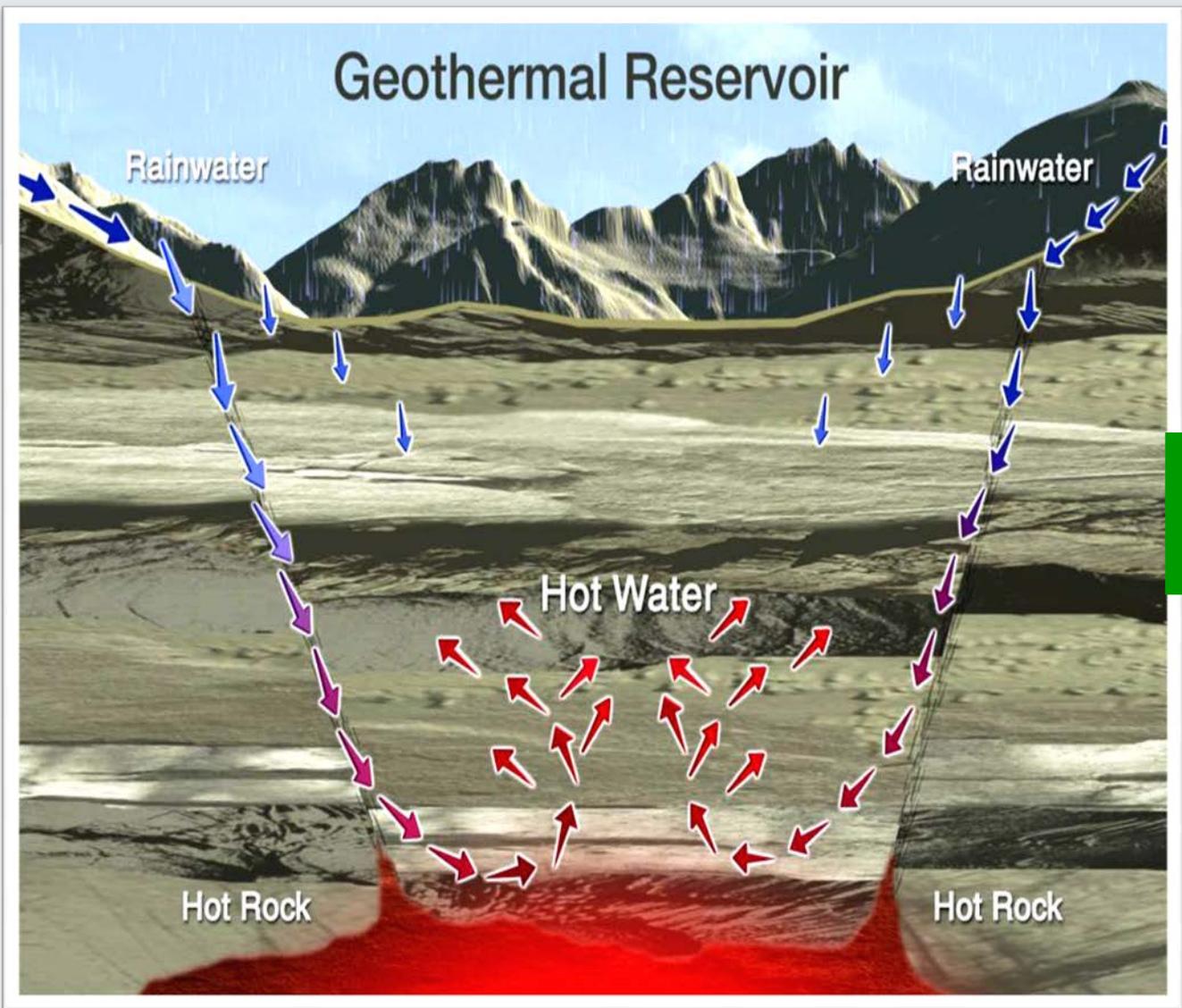
Hot Ground



Sulfur

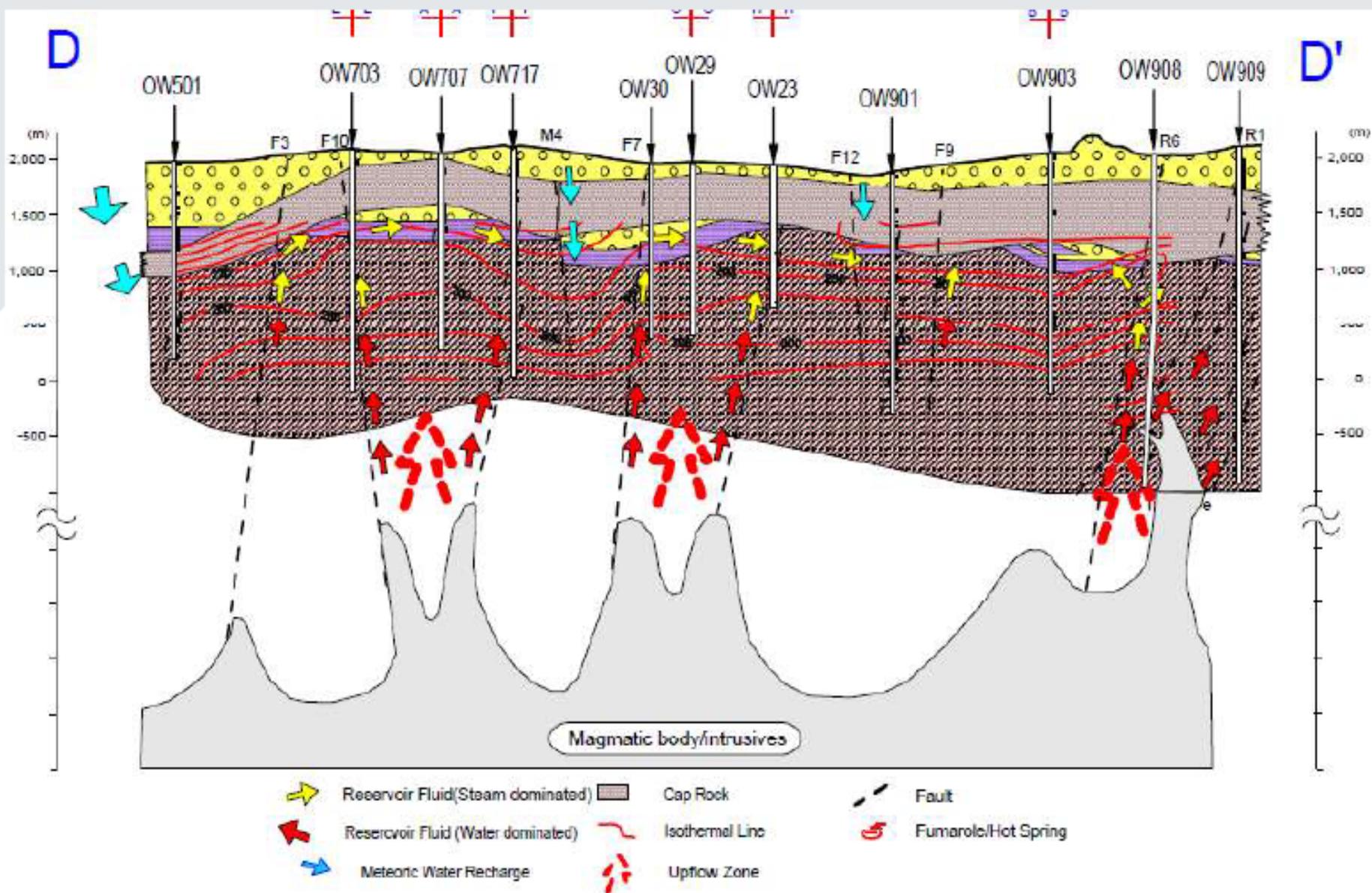


3 Geothermal Conceptual Model



- Geothermal Energy is “heat from the earth”.
- A hole (well) is drilled to an average 3km to tap the steam underneath.
- Geothermal power is the conversion of energy from that steam to electricity.

A model of the reservoir in Olkaria





▶ DFIs SUPPORT – 210MW

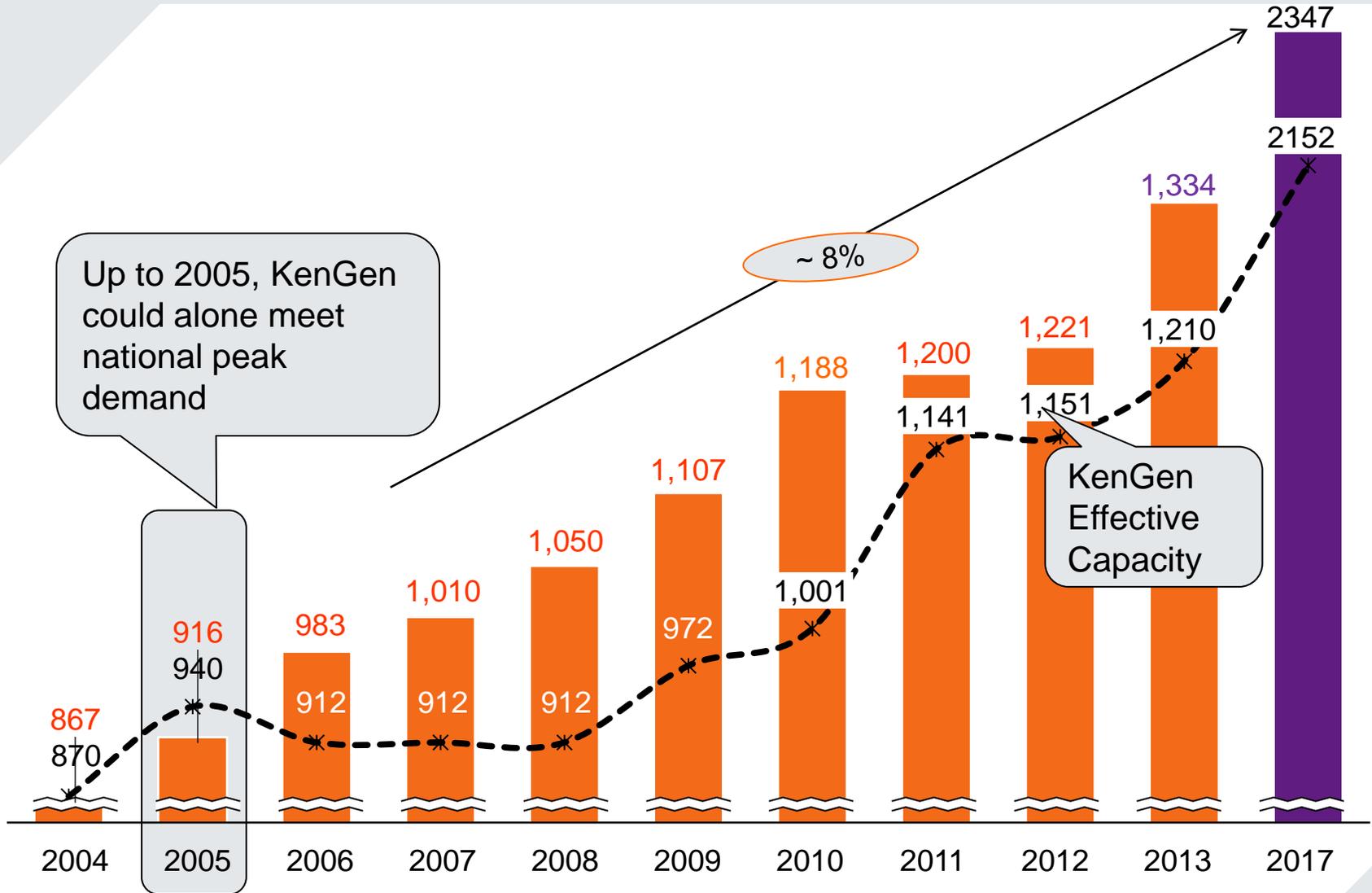
- ✓ No resettlement needed
- ✓ All NEMA approvals granted

NATIONAL PEAK DEMAND



+ Suppressed peak demand

Peak Demand (MW) – approximately 8% growth

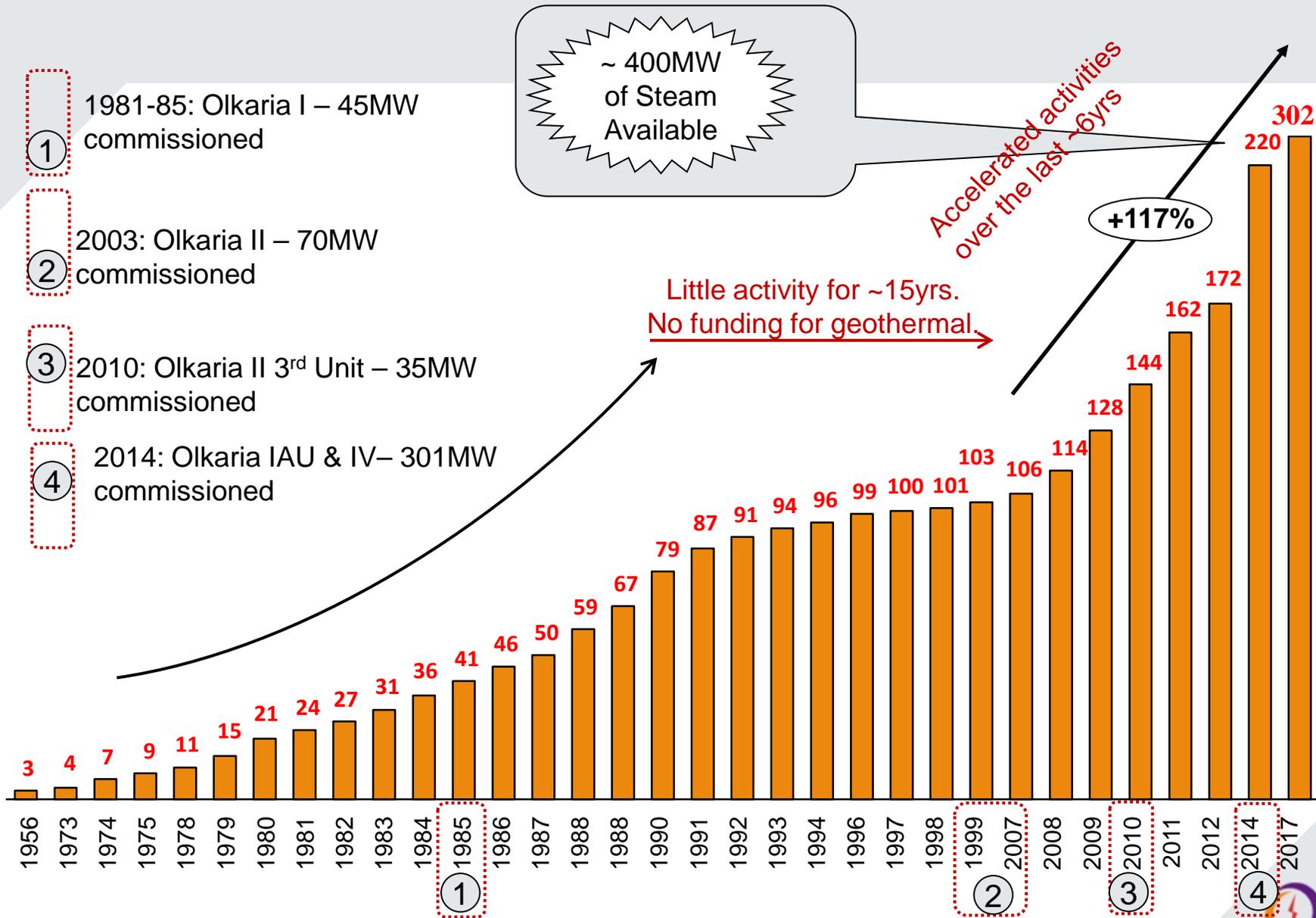


Up to 2005, KenGen could alone meet national peak demand

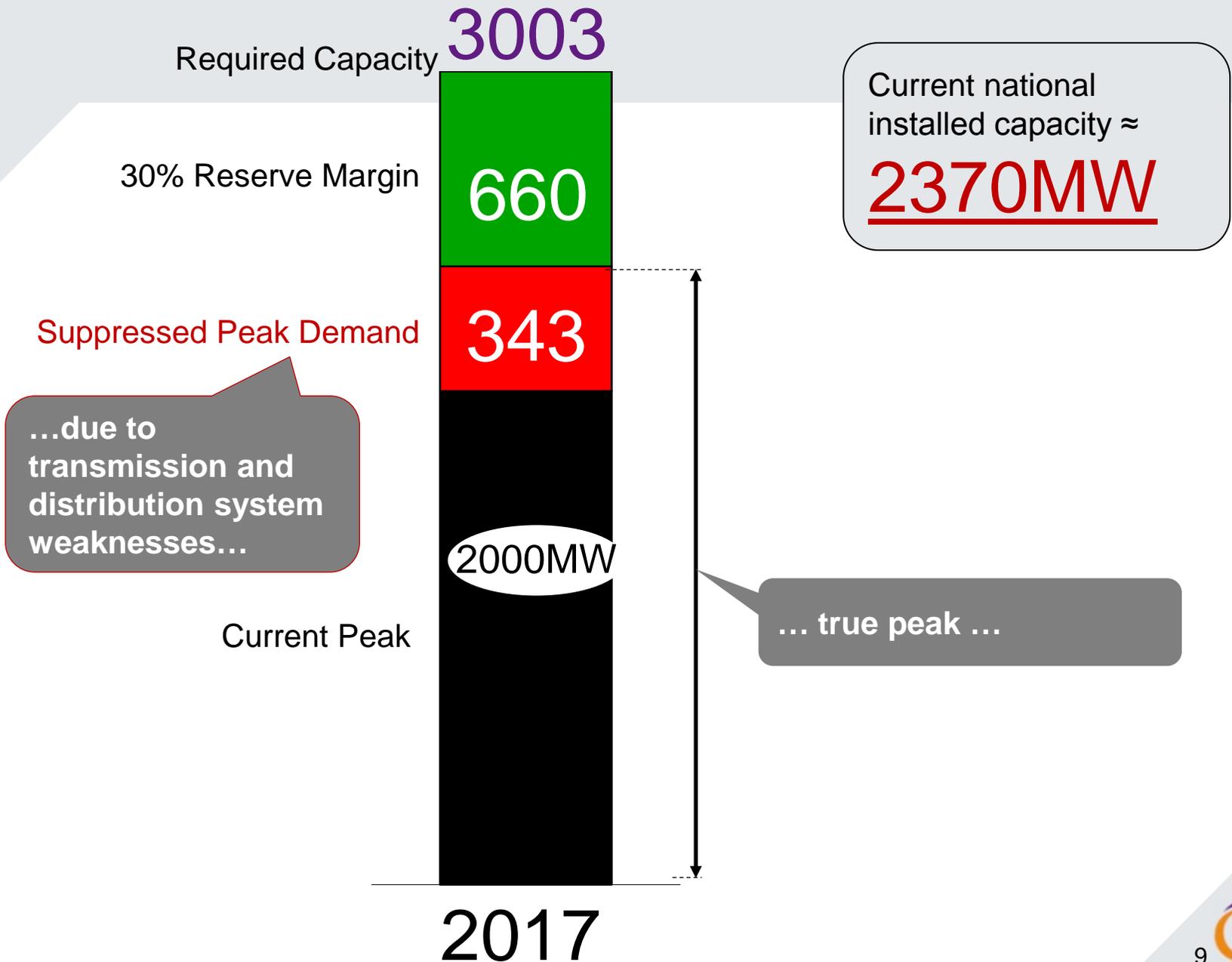
~ 8%

KenGen Effective Capacity

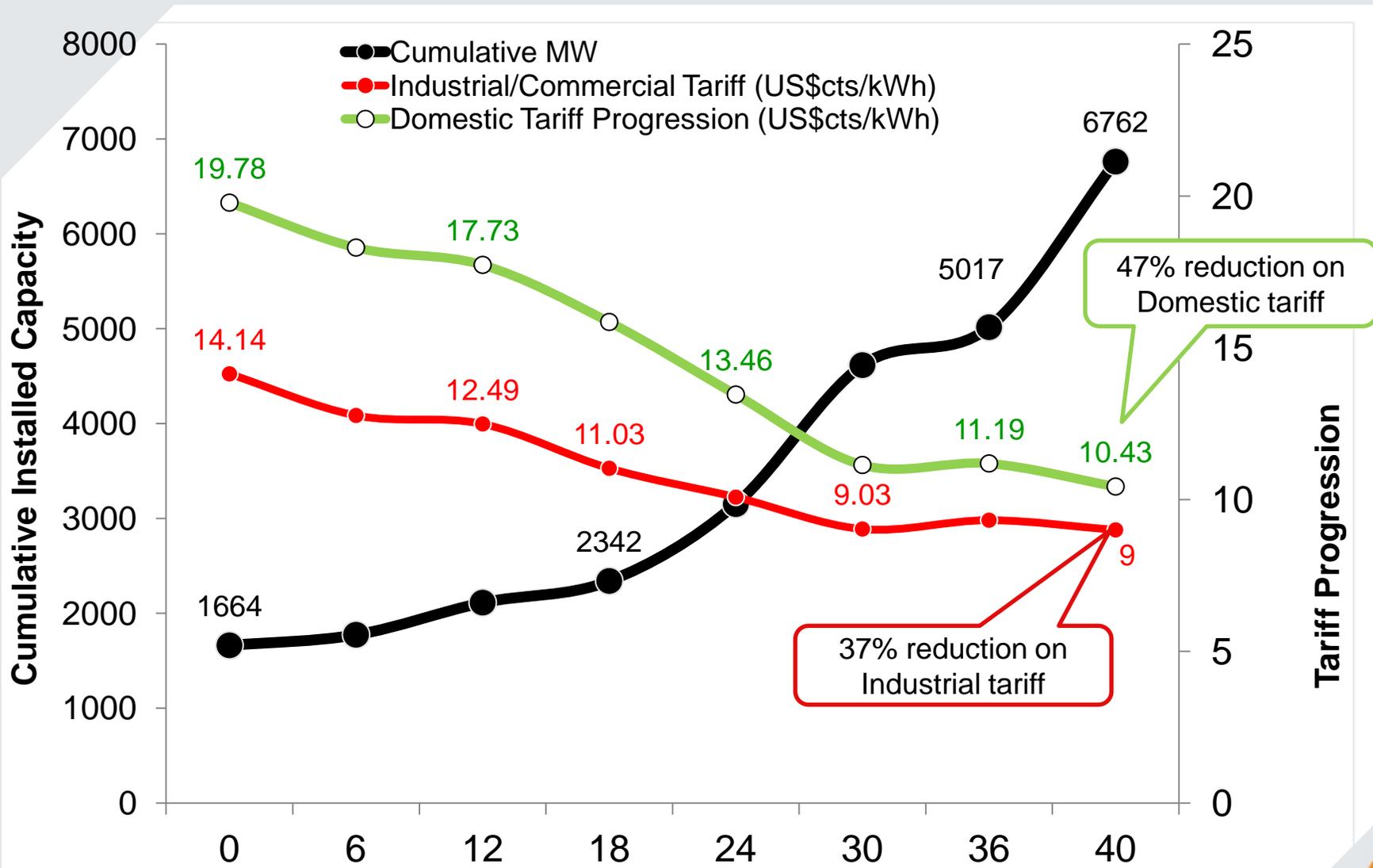
KENYA'S GEOTHERMAL JOURNEY FROM 1956 to DATE



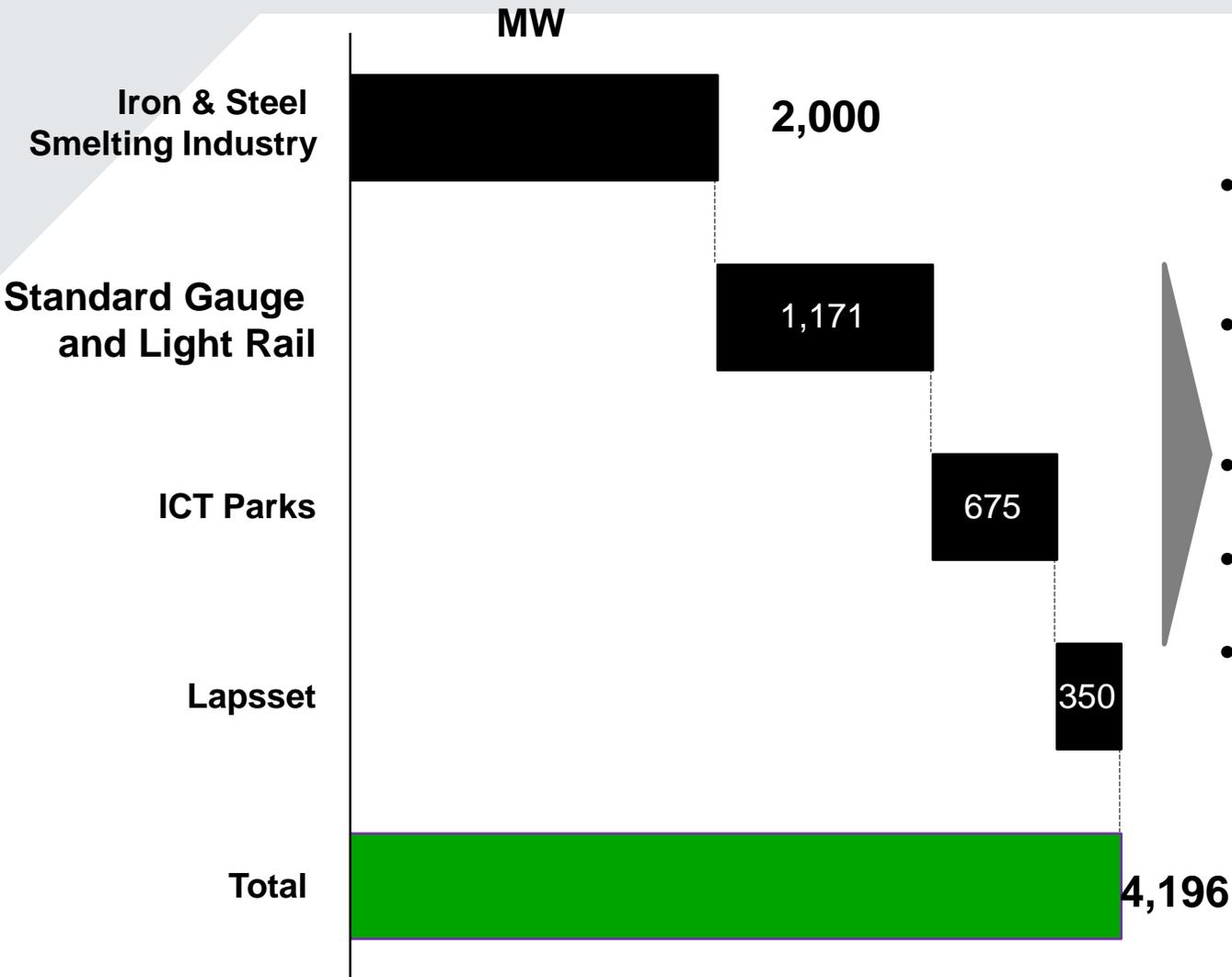
CURRENT TRUE PEAK DEMAND



GOVERNMENT TARGET ON TARIFF EVOLUTION WITH NEW CAPACITY THAT WILL DISPLACE FUEL COMPONENT:



POWER DEMAND DRIVERS BY YEAR 2017/18



- Economic activities in counties
- Mining and Process industries
- Irrigation
- Electrification of Rail;
- Powering resort cities and new economic zones.





40-MONTH GOVERNMENT 5000+MW STRATEGY

NEW CAPACITY ADDITIONS (MW)								
TIME IN MONTHS	6	12	18	24	30	36	40	TOTAL
Hydro	24	-	-	-	-	-	-	24
Thermal	87	163	-	-	-	-	-	250
Geothermal	90	176	190	50	205	150	785	1,646
Wind	-	-	20	60	300	250	-	630
Coal	-	-	-	-	960	-	960	1,920
LNG	-	-	-	700	350	-	-	1,050
Co-Generation	-	-	18	-	-	-	-	18
Total	201	339	228	810	1,815	400	1,745	
Cumulative Additions		201	540	768	1,578	3,393	3,793	5,538

61% is Renewable Capacity and KenGen is a key player in this strategy...

KENGEN: A LEADER IN POWER GENERATION IN THE REGION

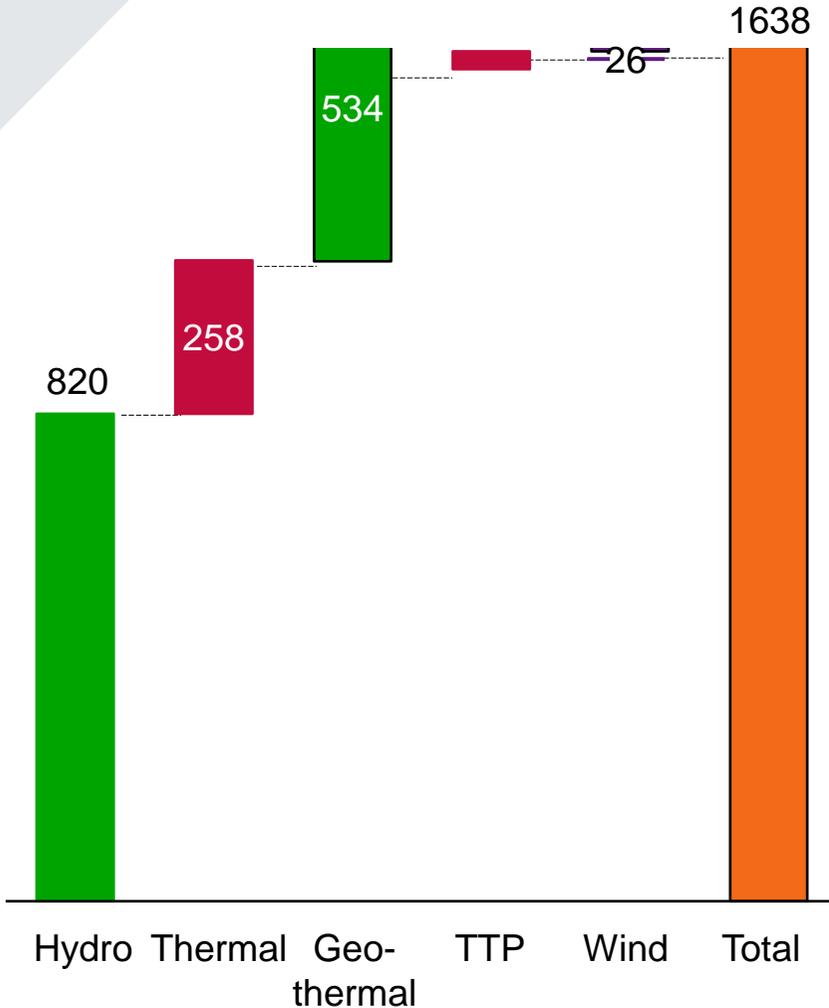
- In our 63rd Anniversary;
- 74% Government-owned
- ~70% installed capacity market share
- ~80% sales market share
- Nairobi Securities Exchange member since 2006
- ~ 1,630MW (~ 84% from Green Sources);
- ~ 2,400 Staff Compliment;
- ~ US\$ 3.67 billion Asset Base;
- ~ US\$ 360 million Annual Turnover;
- An ISO 9001:2008 & ISO 14001:2004 Company



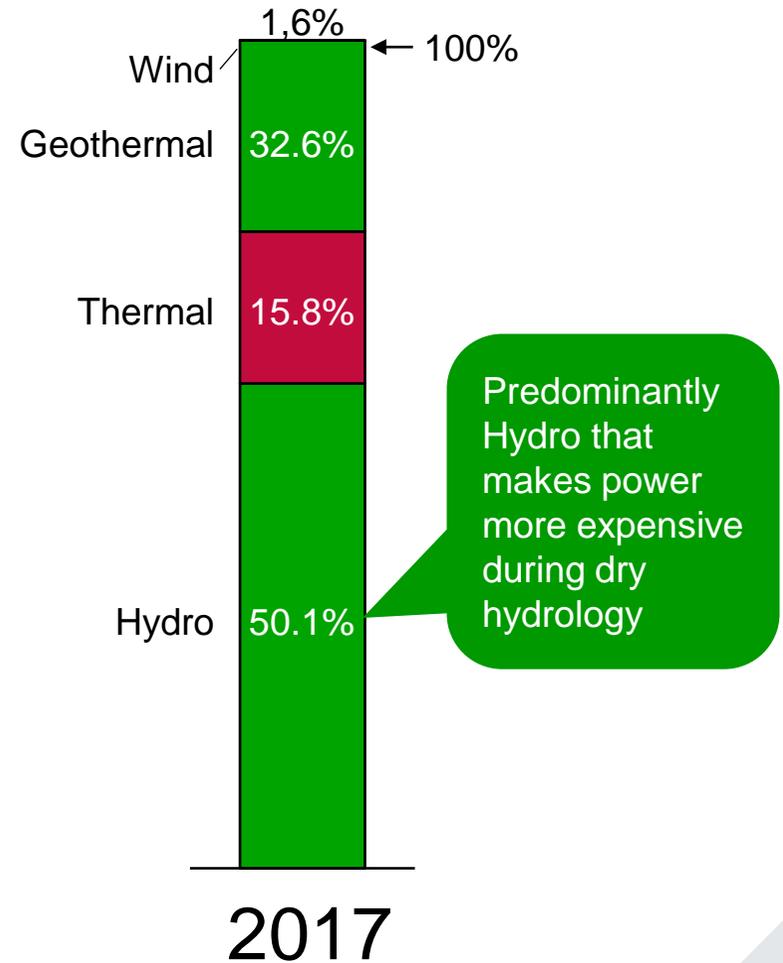
OUR GENERATION PORTFOLIO



Generation Portfolio (MW)



Generation Portfolio (%) – excludes TTP*

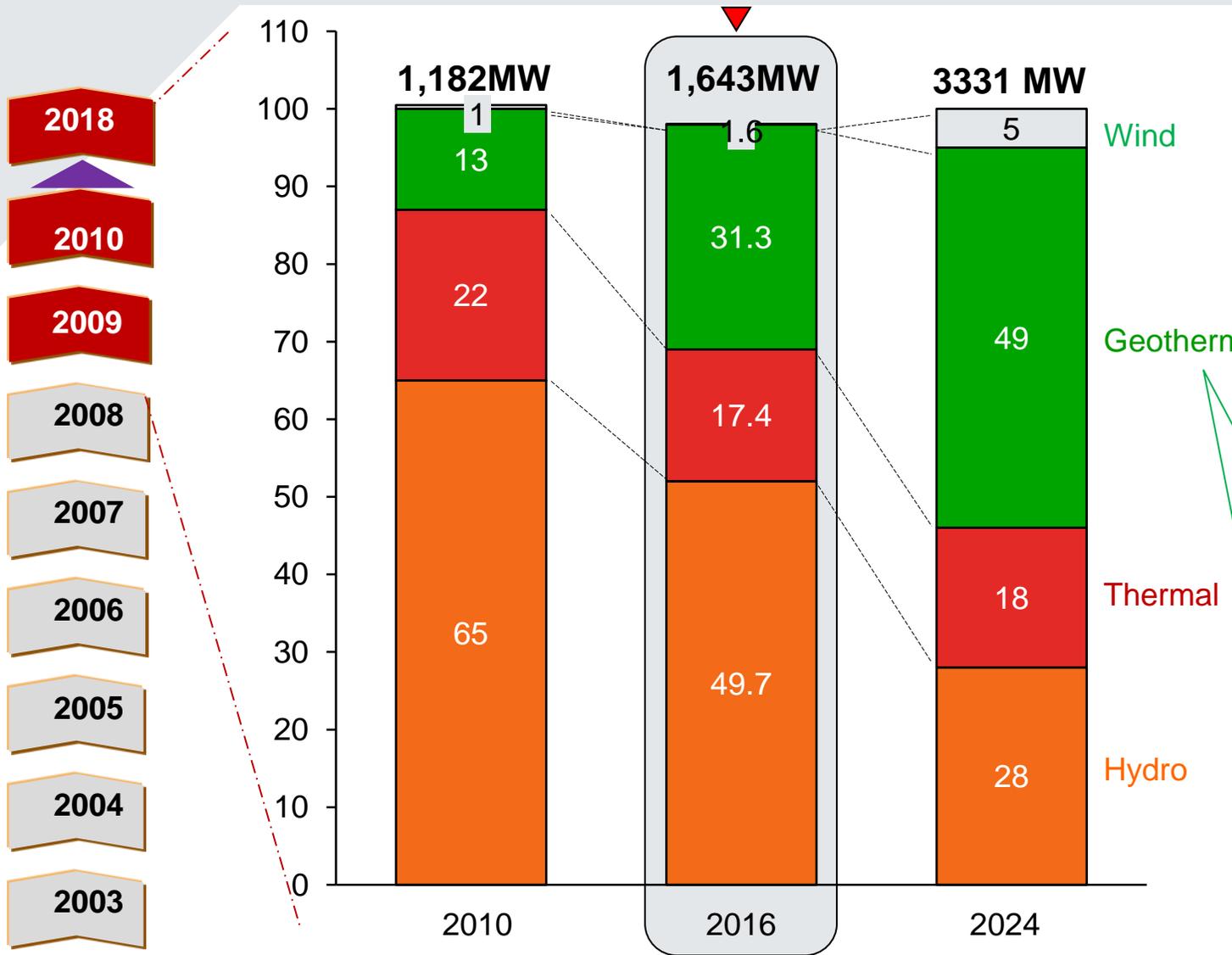


TTP* - Temporary Thermal Power

A GREEN KENGEN WITH GEOTHERMAL BASE-LOAD CAPACITY



Generation Mix Movement



- A green KenGen by 2018 with ~50% of installed portfolio from geothermal...
- Carbon credits will also boost revenues

OUR STRATEGY TO 2030



KenGen Today
~ 1,638MW

Great company

Horizon 1
(2008-2012)

Horizon 2
(2013-2018)

Horizon 3
Beyond 2018

10 yrs+

5-10 yrs

Next 5 yrs

Explore expansion opportunities

Stabilise situation in Kenya

Create sustainable power growth in Kenya

- Drive expansion beyond Kenya
- Establish a strong African footprint
- Leader in technology and innovation

- Improve efficiency to boost supply
- **Deliver ongoing projects timely**
- Manage peak demand and emergency power
- Prioritise and kick-start future projects

- Deliver optimal future projects on time and budget (e.g., geothermal, wind)
- Grow supply ahead of demand to establish reserve margin
- Optimise project portfolio

While stabilizing supply, KenGen must prepare for sustainable growth in future

Good company

Time

Capacity addition

~500MW

>1,500MW

Year 2030

Total Capacity

KenGen 2007 (918MW)

~1,500MW

~3,000MW

~9,000MW

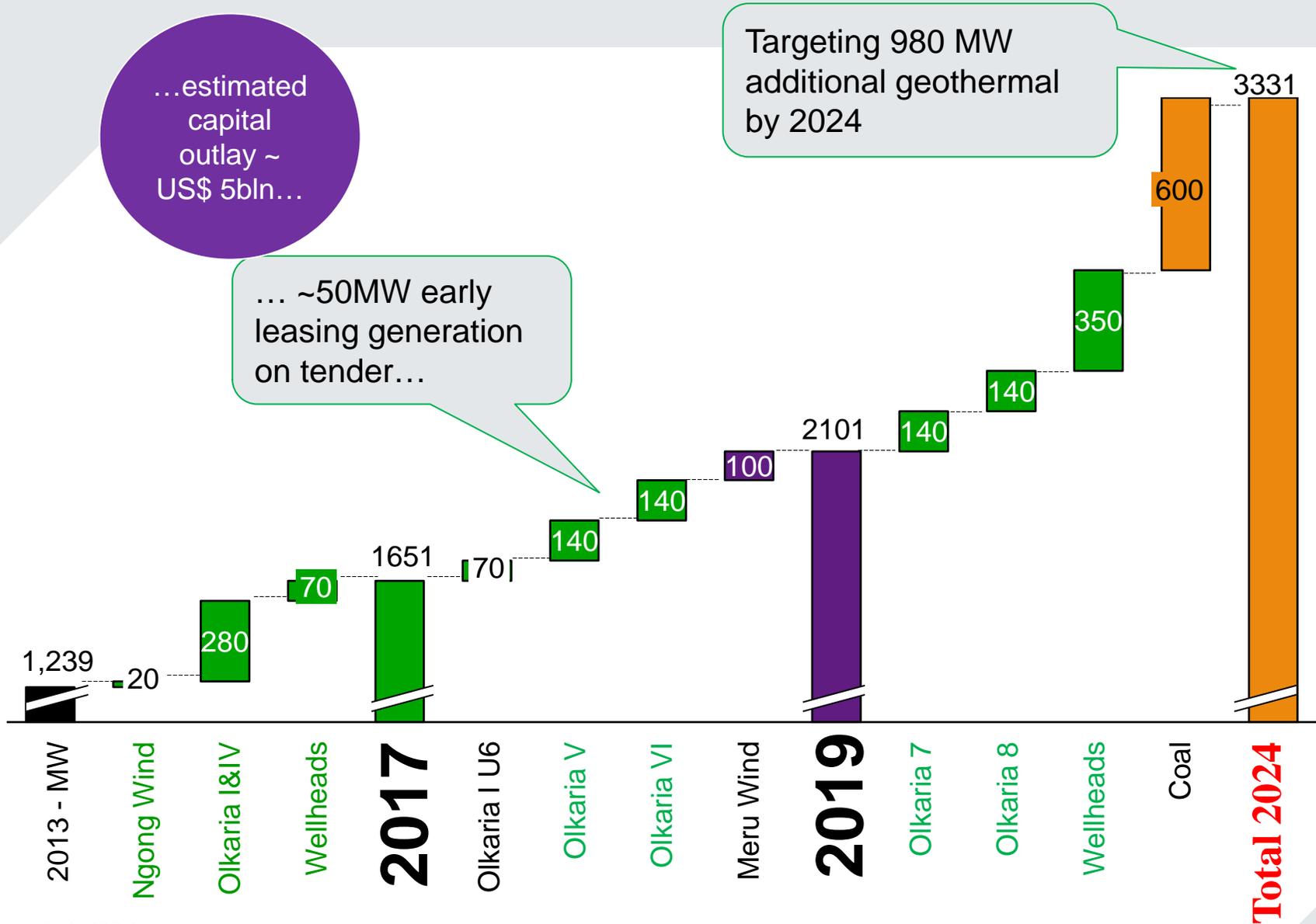
OUR GROWTH STRATEGY



...estimated capital outlay ~ US\$ 5bln...

... ~50MW early leasing generation on tender...

Targeting 980 MW additional geothermal by 2024



COMMITTED GEOTHERMAL PROGRAMME



No.	Plant	Capacity (MW)	Estimated Cost MUS\$	Comm year	Status
1	Olkaria IV unit 1&2	150	491	2014	Commissioned
2	Olkaria I unit 4&5	150	491	2014	Commissioned
3	Wellhead	83.5	130	2016	Commissioned
4	Olkaria I Unit 6	70	194	2020	Construction to start 2018
5	Olkaria V	158	491	2020	Construction started 2017
6	Olkaria VI	140	491	2021	Drilling & JV Partner/Financing
	Sub-Total	751.5	2,165		





OLKARIA I&IV 300MW PROJECT: Utilizing a Cross-Continental Collaboration both engineering and financing

Tariff ~ 7 Uscts/kWh. One of the most competitive renewable project in Kenya

Olkaria I&IV 300MW Geothermal Project (September 2014)

Multi-financing (KenGen, GoK, EIB, AfD, KfW, JICA, IDA ~ US\$ 1 billion)

Steam Field Development
[Lot A – IDA, KfW, KenGen]
US\$ 138m

Sub-station & Transmission
[Lot C - EIB, KenGen]
US\$ 27m

Power Plant Construction
[Lot B1&B2 KfW, JICA, AfD, EIB KenGen]
US\$382m

Consultancy & Administration
[Lot Zero – KfW, KenGen]
US\$30m

Local Infrastructure & RAP
[Lot D – IDA, KenGen]
US\$36m

Geothermal Steam Drilling – [GoK, KenGen]
(June 2007- Aug 2012) **~US\$330m**

- 1 Kenya (GoK)
- 2 New Zealand (SKM)
- 3 China (Sinopec)
- 4 India (KEC)
- 5 Kenya (Local Companies)
- 6 S.Korea (Hyundai) & Japan (Toshiba/ Toyota Tsusho)

Olkaria IV: 150MW – Commissioned



OLKARIA IV GEOTHERMAL POWER PLANT

CAPACITY : 2 x 70MW STEAM TURBINE GENERATOR
CONSTRUCTION PERIOD : DEC. 2011 TO JUN. 2014



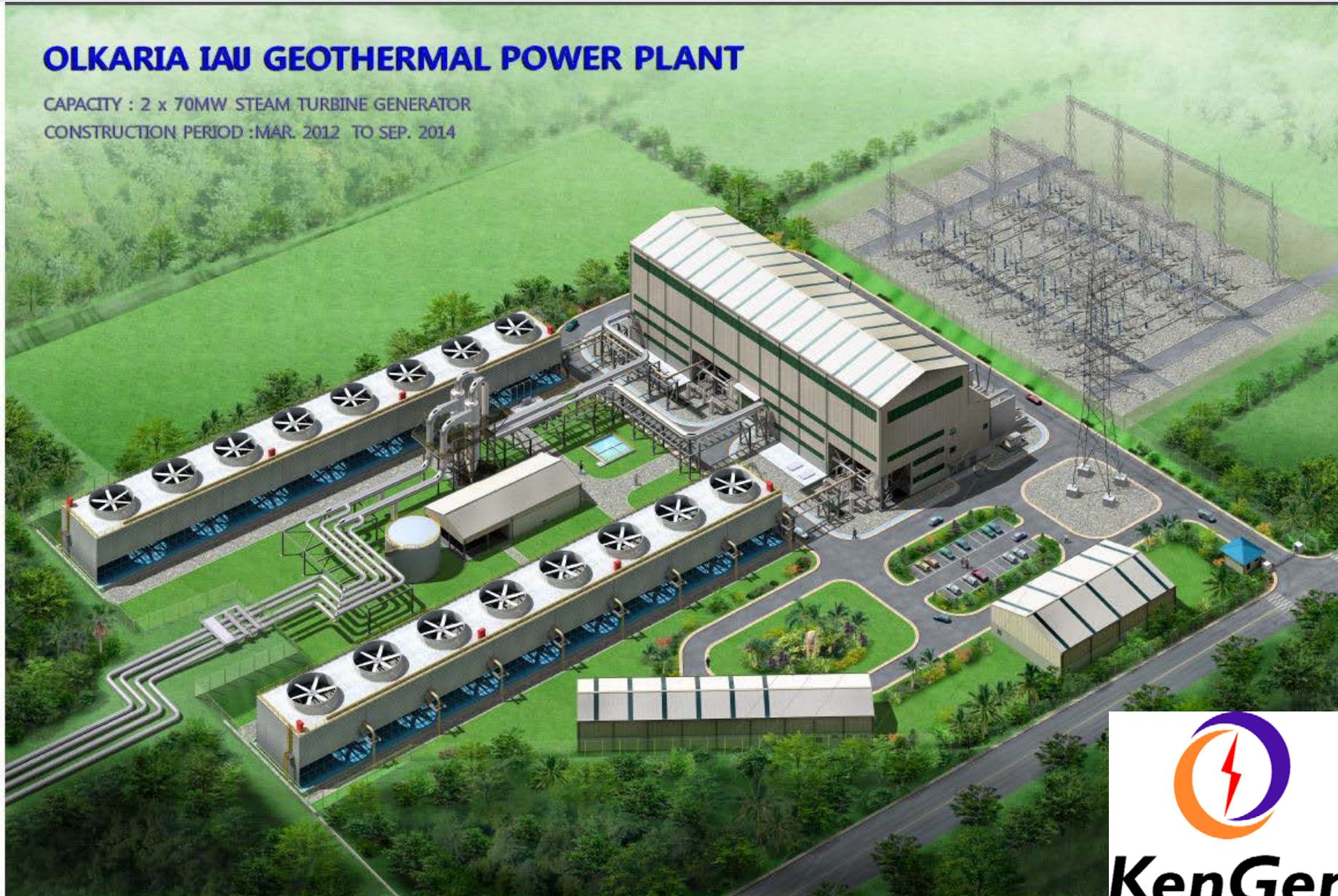
Olkaria I UNIT 4 & 5: 150MW – Commissioned



OLKARIA IAU GEOTHERMAL POWER PLANT

CAPACITY : 2 x 70MW STEAM TURBINE GENERATOR

CONSTRUCTION PERIOD : MAR. 2012 TO SEP. 2014



KenGen



New Discoveries: 30 MW Well (among the largest Geothermal Wells in the World)

Direct Cash Savings by Striking one 30MW Well

USD 35 Million!





Stakeholder Management

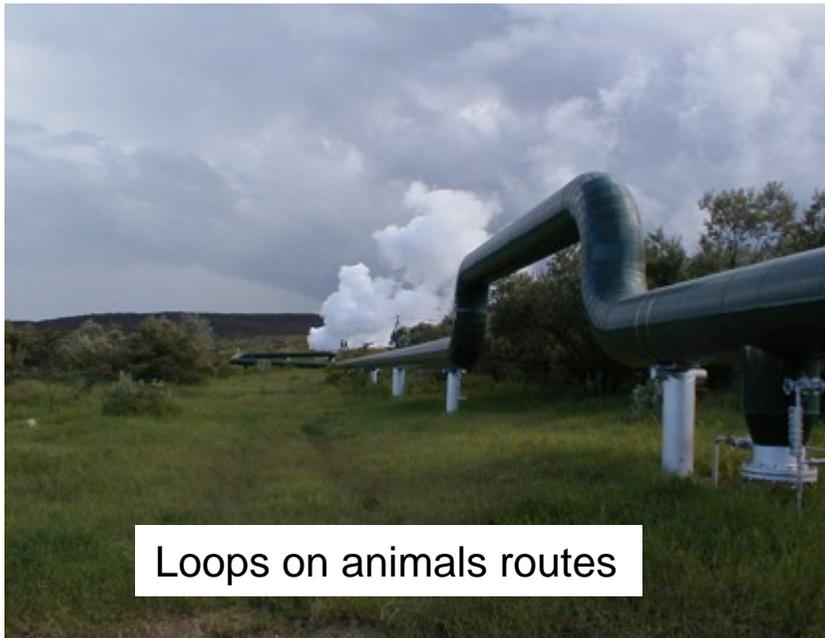
- Creating mechanisms to deal with local community issues
- Environmental & Social Impact Management
- Dealing with regulatory authorities and government institutions



KenGen/PARK INTERACTION



- Hells Gate National park since 1984
- KWS-MoU since 1994
- ESIA's always undertaken
- Mitigation measures implemented continuously



Loops on animals routes

Meeting between Consultants,
KenGen and KWS



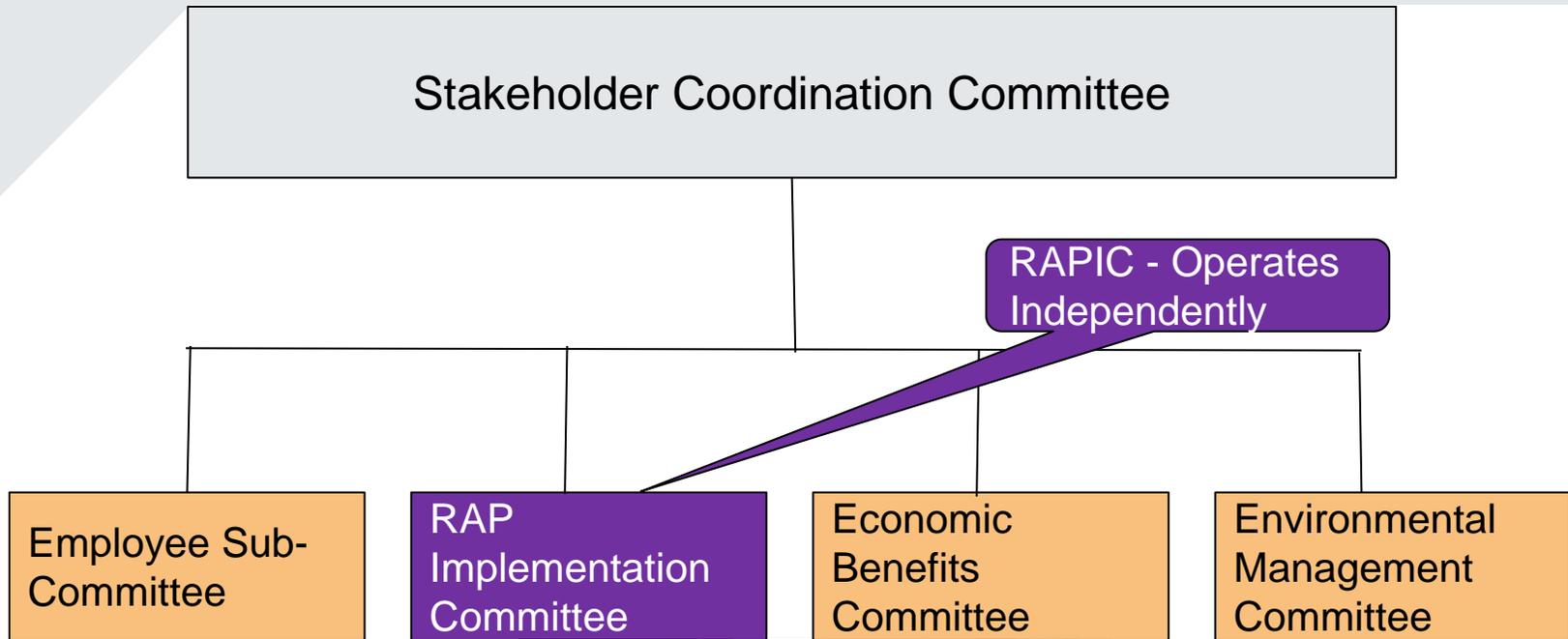


1. Elaborate Resettlement Action Plan (RAP) and all inclusive Stakeholder Committees
2. Education
3. Health
4. Water
5. Transport
6. Roads
7. Environmental conservation

Built Schools



STAKEHOLDER MANAGEMENT



TRANSFORMING LIVES



TRANSFORMING LIVES





Old School



TRANSFORMING LIVES



New School



KENGEN OLKARIA GEOTHERMAL SPA



THE ONGOING WELLHEAD 70MW PROJECT...



Wellhead Generation



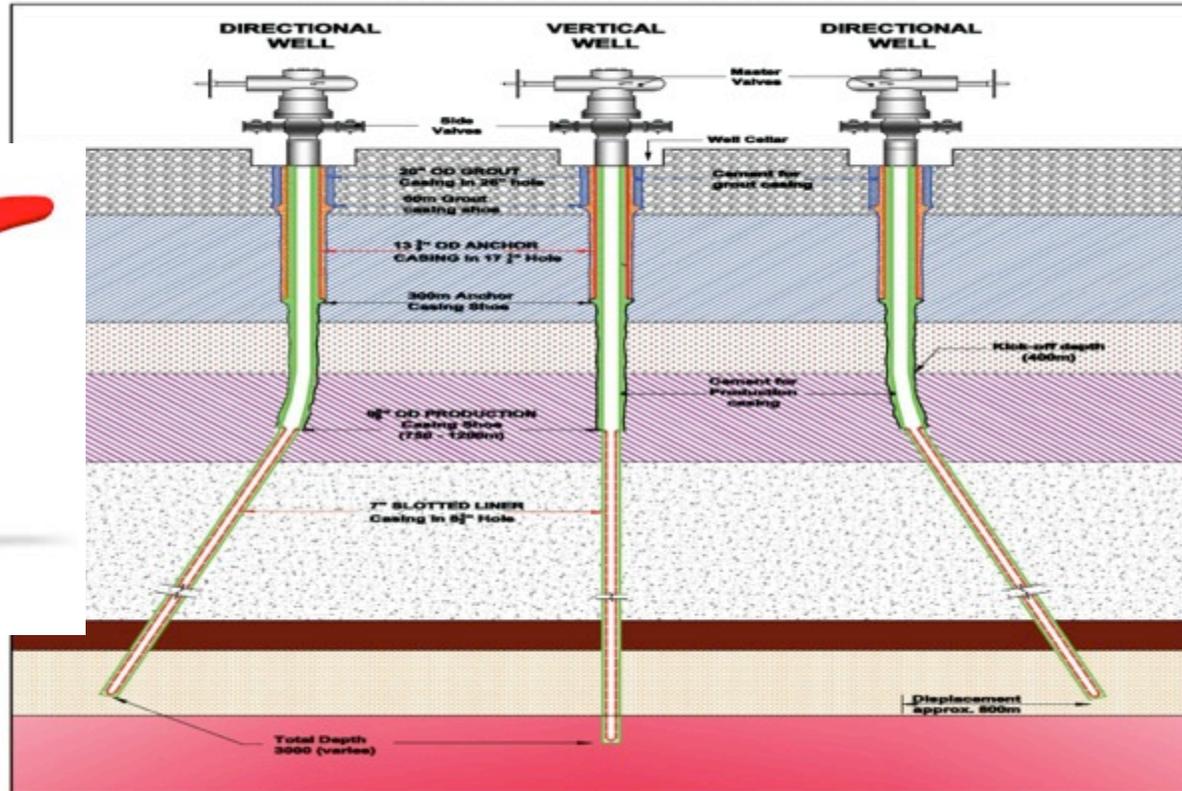
OUR INNOVATION IN GEOTHERMAL



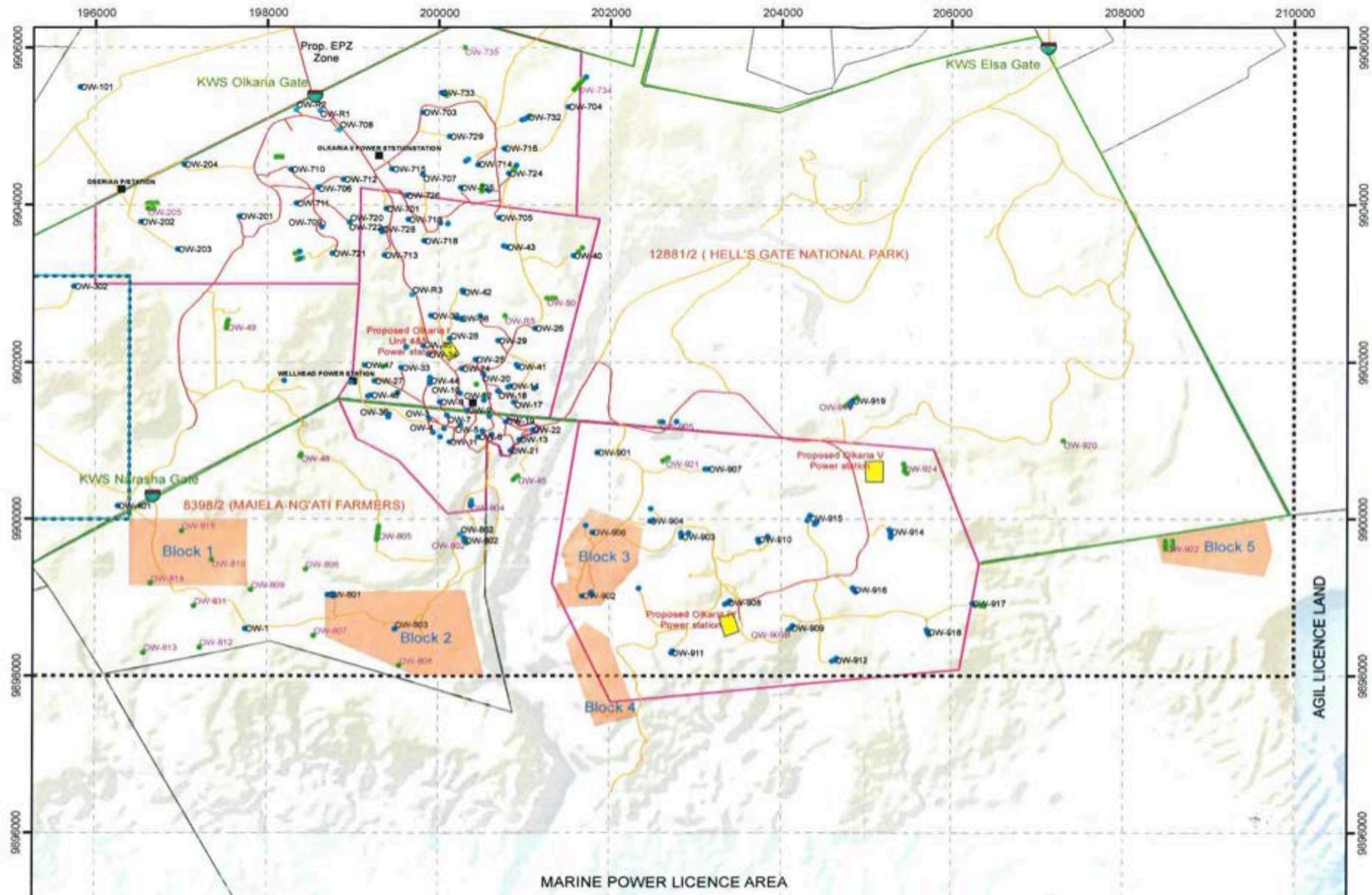
Directional Drilling

- This reduces drilling cost by optimizing time, civil and rig-move expenses.

TYPICAL OLKARIA WELLS PROFILE



PROPOSED KenGen INDUSTRIAL PARK



OLKARIA IAU GEOTHERMAL POWER PLANT

CAPACITY : 2 x 70MW STEAM TURBINE GENERATOR

CONSTRUCTION PERIOD : MAR. 2012 TO SEP. 2014



THANK
YOU.

God Bless Kenya



KenGen

