

Renewable Energy in a Petroleum-Dominated Society

Geothermal in the Middle East

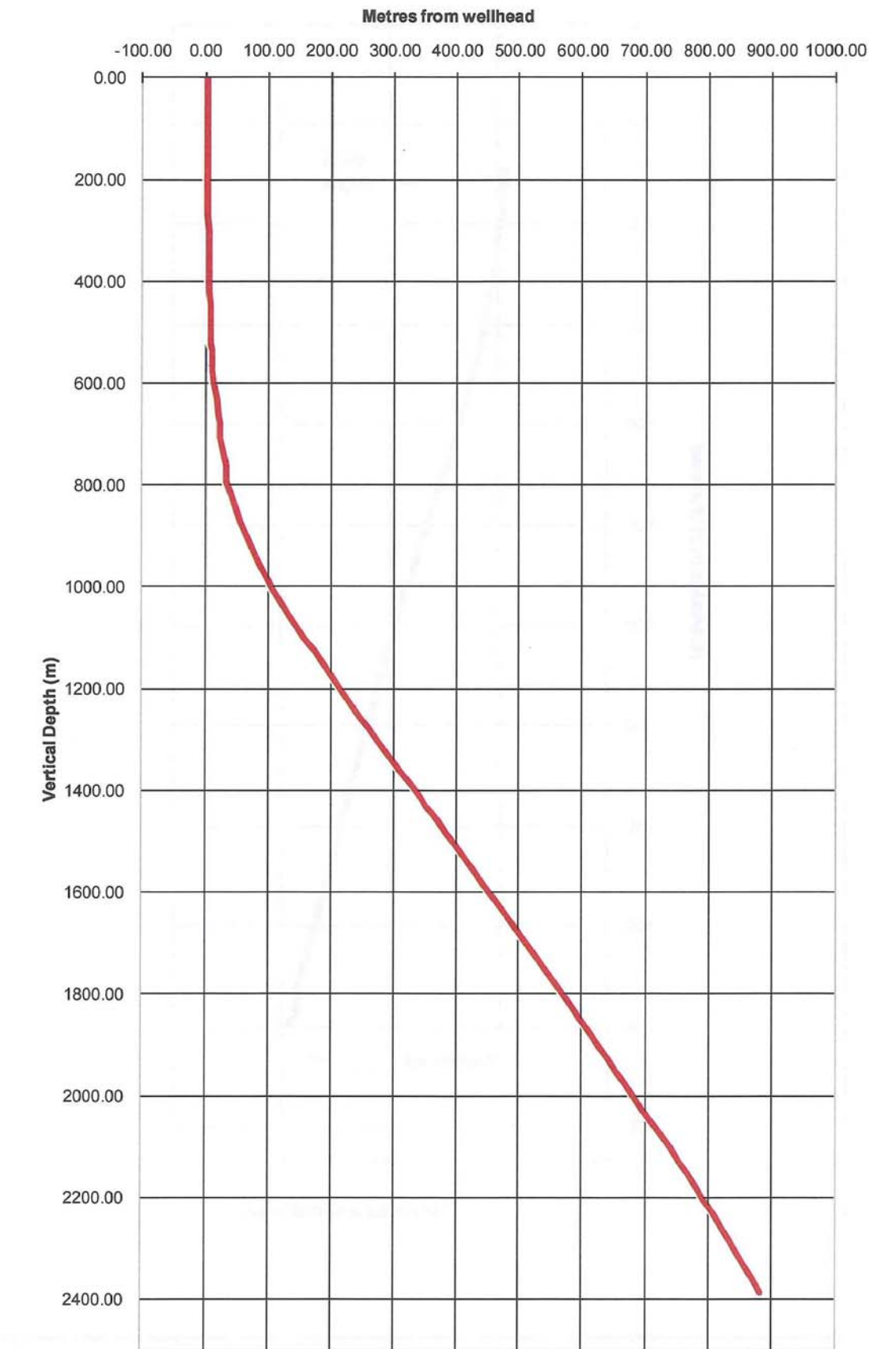
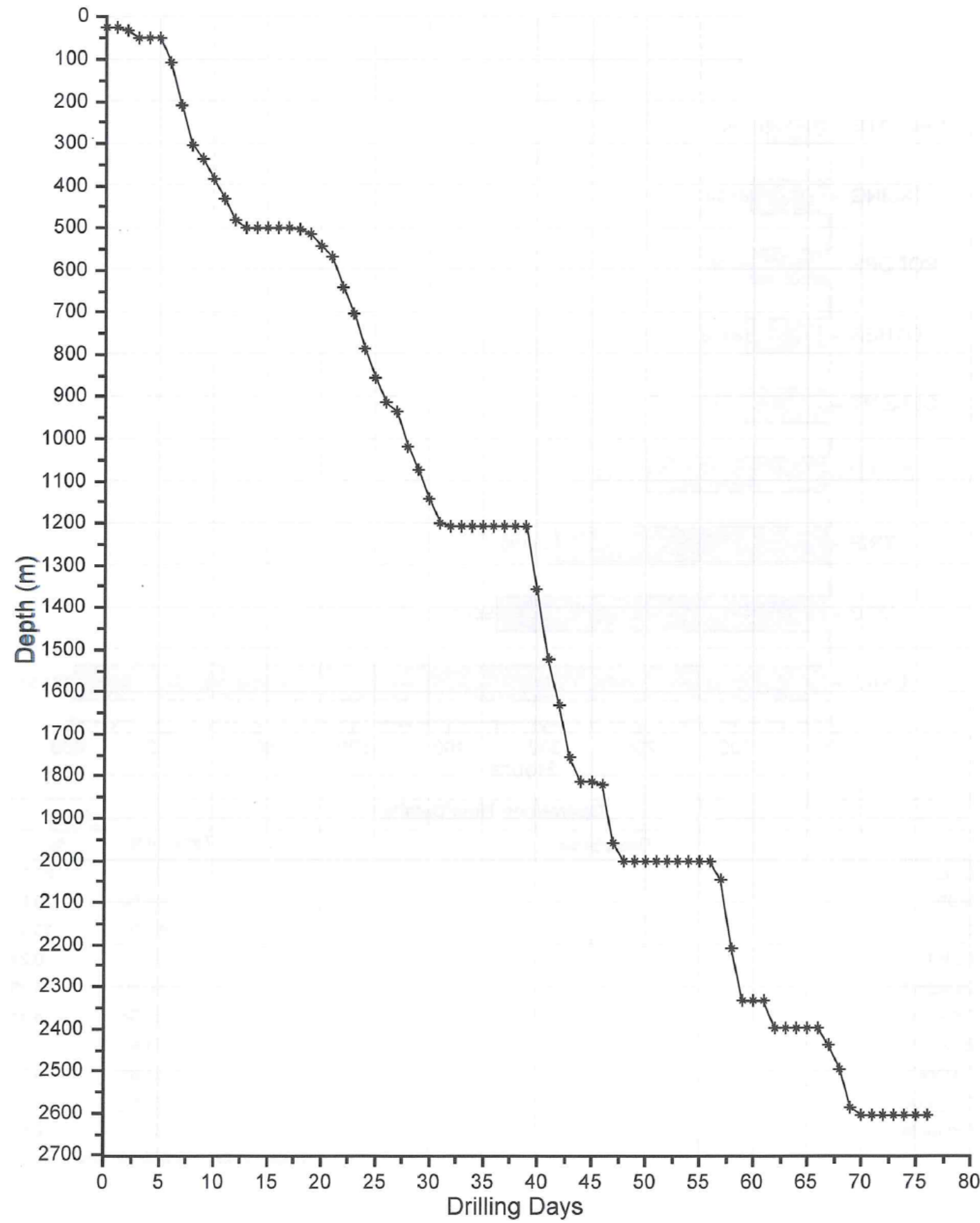
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A pair of geothermal wells (injection and production) were installed in the middle east. The geothermal reservoir consists of a high –salinity limestone formation aquifer about 375m thick and about 2150m deep.

The wellheads are drilled adjacent to each other, then diverged such that the bottoms are about 1700m apart. The first and second wells were drilled vertically to depths of 550m and 350m, respectively, then directionally kicked at 2° per 30m in opposite directions, to a final nominal inclination of 30°.

Drilling and completion for the first well lasted 76 days, largely delayed due to slower than expected drilling rates and rig breakdowns, with a total cost of US\$8,282,661. Drilling and completion for the second well lasted 50 days with a total cost of US\$6,818,441.

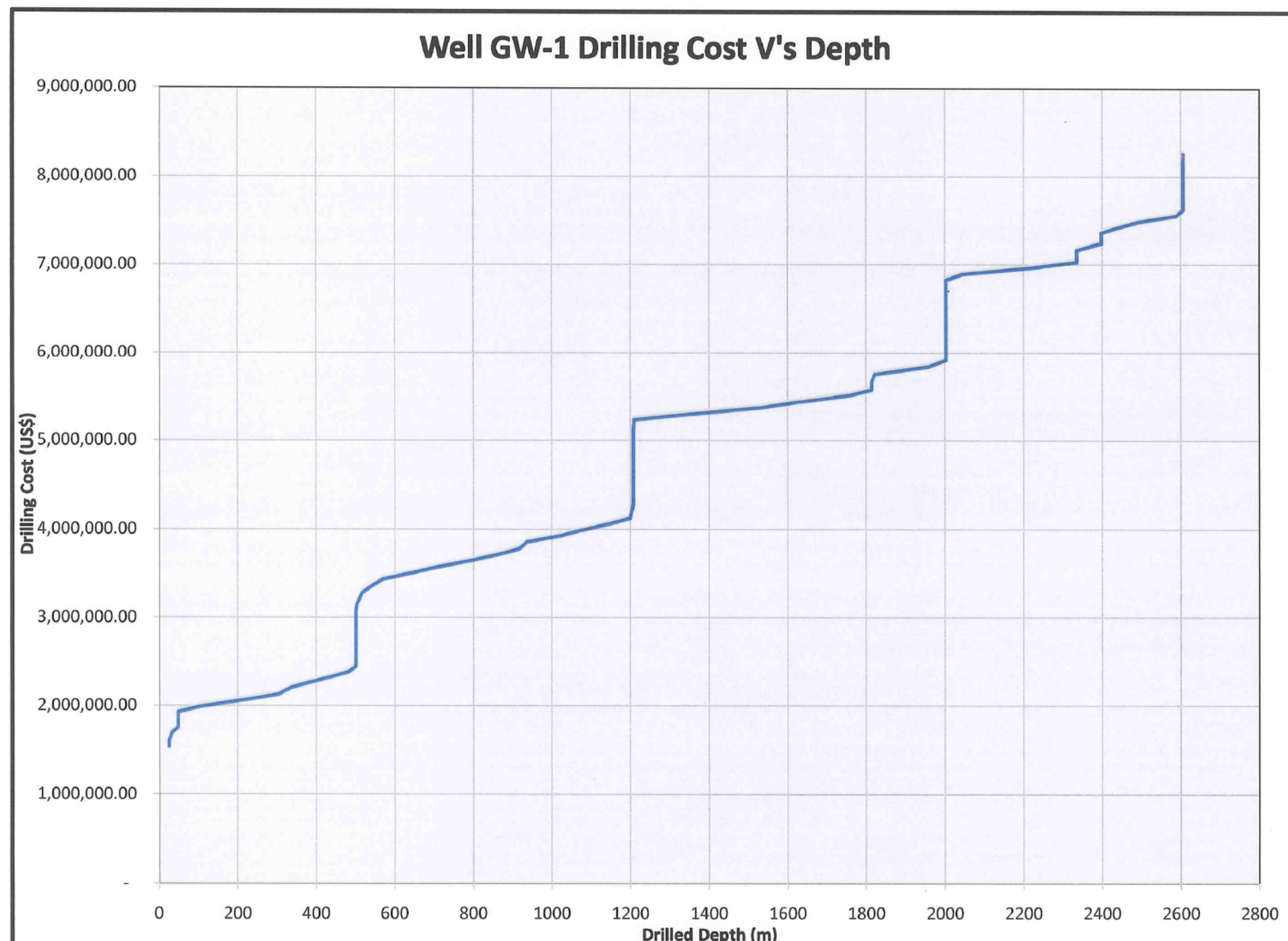
Preliminary estimates indicate a flowrate of 100 liters per second (about 55,000 barrels of water per day) with water temperature at the wellhead ranging from 90 to 95°C. Flow is from reservoir pressure.. *Figures presented on this poster are for the first geothermal well only.*



Description	Time (hrs)	%
DRILL	791.50	37.9%
MOB	351.00	16.8%
TRIP	289.00	13.8%
DOWN	192.67	9.2%
CEMENT	90.50	4.3%
Other Activity	89.58	4.3%
BOPOPS	84.00	4.0%
CASING	84.00	4.0%
EVALUATE	67.00	3.2%
PROBLM	51.50	2.5%
Total Time:	2,090.75 hrs	

Hole & Casing Details	Surface Casing	Intermediate Casing	Anchor Casing	Production Casing	Slotted Production Liner
Hole Size (inches)	36"	26	17½"	12¼"	8½"
Hole Depth (metres MD RT)	50	500	1200	2000	2640
Casing and Liner Details	30", API 5L X-52, ERW	20", K-55, R3, ERW	13 3/8", L-80, R3, Seamless	9 5/8", L-80, R3 Seamless	7", L-80, R3, Seamless
Weight	234.00 lb/ft.	133.00 lb/ft.	68 lb/ft	47 lb/ft	26 lb/ft
Grade	X-52	K-55	L-80	L-80	L-80
Threads & Collars	Welded	Buttress	Buttress	Buttress	Buttress
Approximate No. of Joints	4	40	96	124	98
Perforation	-	-	-	-	220 x 15 mm dia holes per metre. 1 metre blank at each end.
Setting Depth (m MD)	47	498	1198	450 to 1998	1973 to 2640
Casing Cementing	Cemented back to surface.	Cemented back to surface.	Cemented back to surface	Cemented back to hanger.	Not cemented.
Drilling Fluids	Brine based Mud	Brine based Mud	Brine based Mud / Polymer	Brine based Mud / Polymer	Aerated Brine water with polymer sweeps as required.

Item Description	Item Costs (US\$)	Section Cost (US\$)
Drill Site Preparation Costs		\$ 637,797.93
Drilling Water Supply System		\$ 97,394.00
Rig & Equipment Mob / Demob / Move		\$ 795,100.00
MATERIALS		\$ 2,077,144.66
Casings	\$ 776,888.72	
Casing Accessories	\$ 145,993.30	
Wellhead Equipment	\$ 94,857.46	
Drilling Mud Materials	\$ 357,428.54	
Drill Bits	\$ 140,625.00	
Thread Compounds	\$ 378.00	
Cementing Materials	\$ 233,100.16	
Fuel	\$ 327,873.48	
Drilling Services Contractor		\$ 2,724,056.02
Cementing Services		\$ 79,100.29
Directional Drilling Services		\$ 148,117.48
Mud Logging Services		\$ 154,617.96
Mud Engineering Services		\$ 118,950.97
Aerated Drilling Services		\$ 328,271.64
Rental Drilling Tools		\$ 206,049.94
Wireline Services		\$ 280,844.70
Miscellaneous Services		\$ 11,247.30
Inspections, Drill String Hard Banding, Replacement, and LIH		\$ 37,272.00
Geothermal Specialist Consultants		\$ 586,696.00
TOTAL COST		\$ 8,282,660.89



The data presented on this posted is for demonstration purposes only. The wells described herein are currently in the production testing phase. Once the resource has been successfully confirmed, data will be published for public use.