Electricity Generation from Geothermal Resources on the Fort Peck Reservation in Northeast Montana

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DOE Tribal Energy Program Review

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US Department of Energy Tribal Energy Program

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BOZEMAN
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Crow Reservation
Northern Cheyenne Reservation
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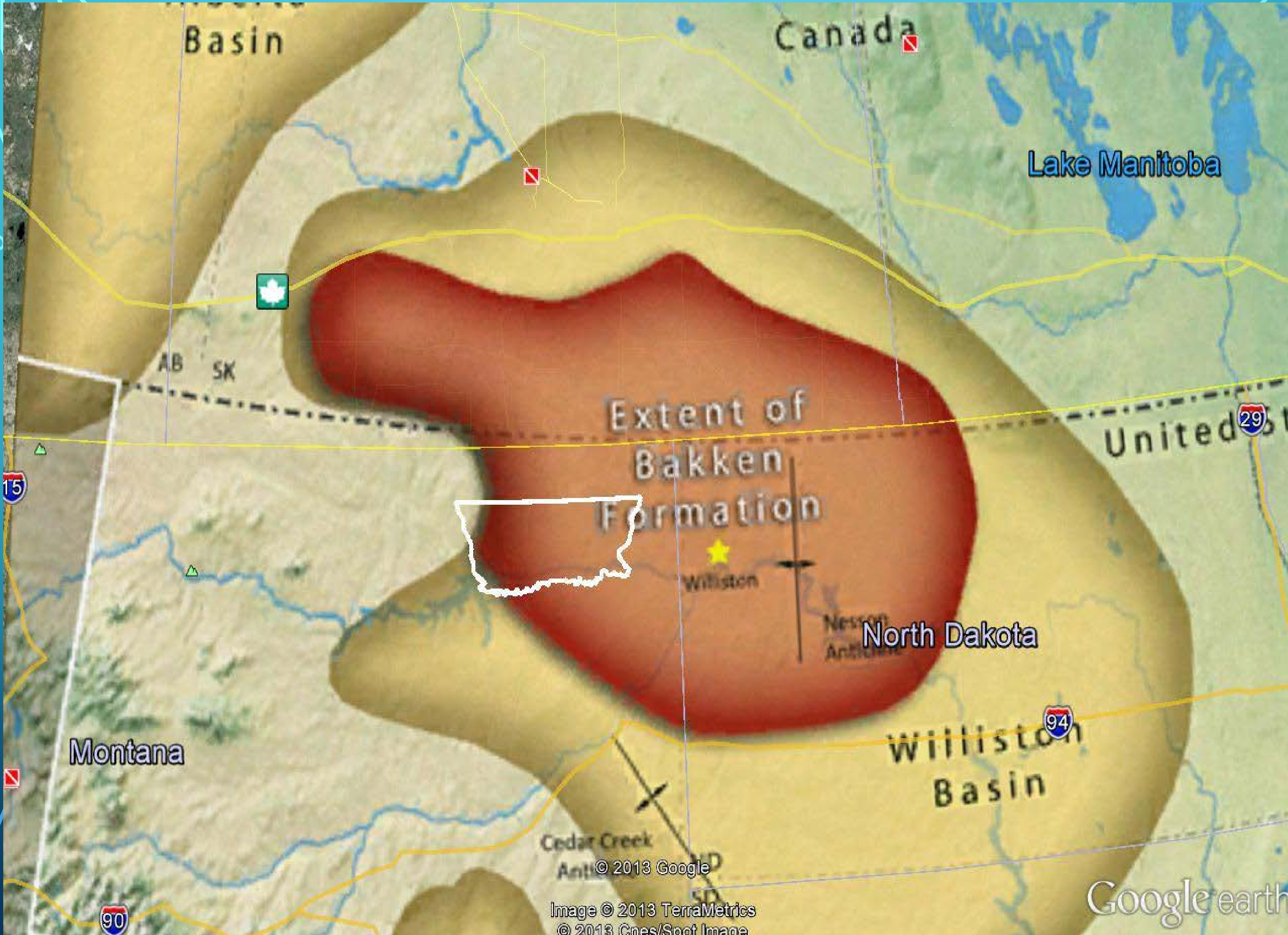
Plentywood
Scobey
Harlem
Fort Peck Indian Reservation
Fort Belknap Indian Reservation
Malta
Poplar
GLASGOW
Brockton
Frazer
WOLF POINT
Fort Peck Lake
SIDNEY
Circle
Jordan
GLENDIVE



Basin
Canada
Lake Manitoba
AB
SK
Extent of
Bakken
Formation
Williston
Nesson
Anticline
North Dakota
United
29
15
Montana
Williston
Basin
94
Cedar Creek
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90
Google earth

WHY IS THIS AREA IMPORTANT?

- COPRODUCED OIL AND GAS WELLS
- HIGH TEMPERATURE WATER – many wells over 200 F
- LARGE EXTENT – and GETTING BIGGER with MORE DRILLING
- EASY ACCESS – Wells completed, on Tribal Lands – more control over geothermal
- MADISON FORMATION – hottest water – is intercepted when drilling through to Bakken

Dirt and Rock

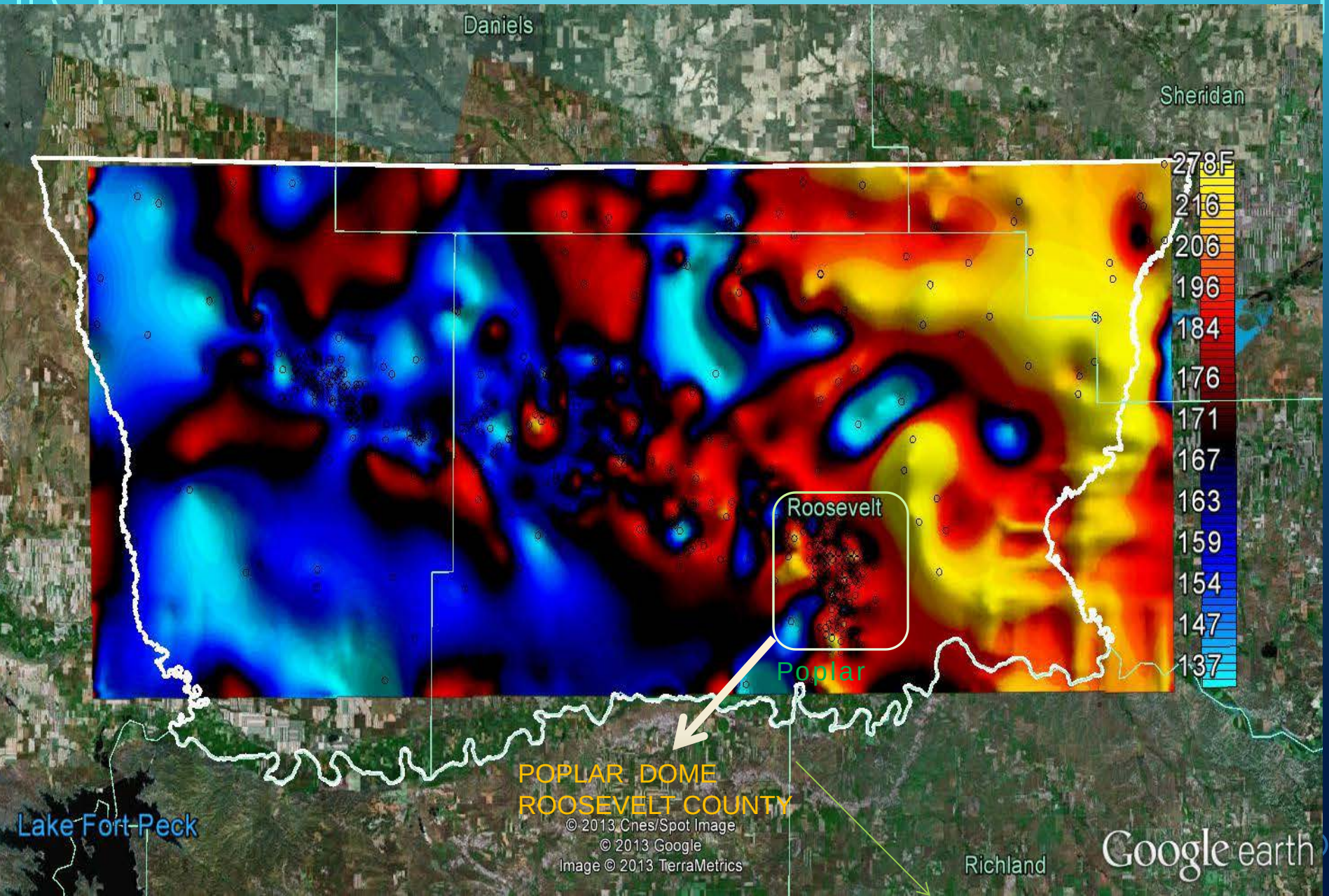
Madison Formation (water)

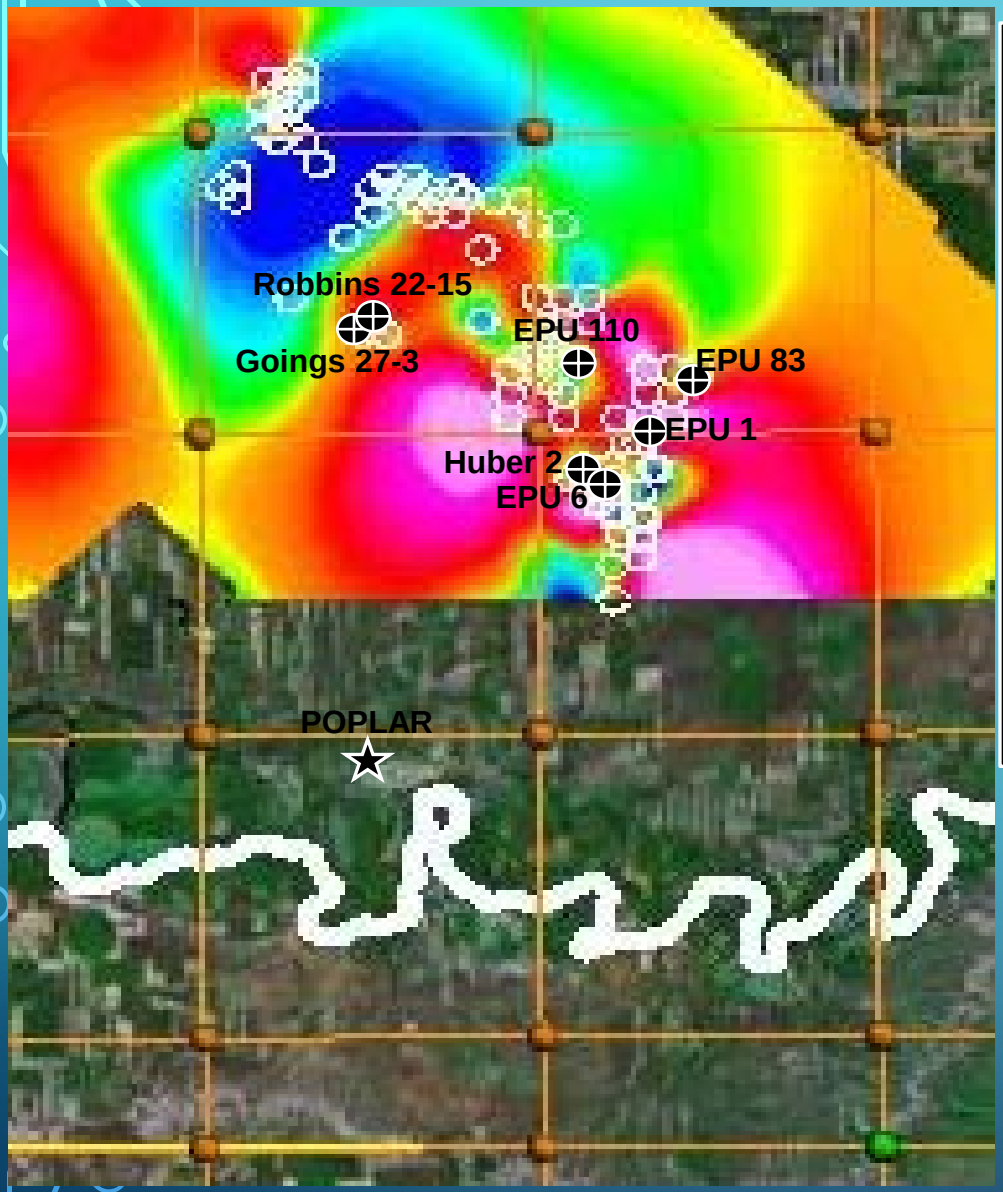
Bakken Formation (oil)

DATA ANALYSIS

- 760 bottom hole temperatures
- Precise location of drill holes
- Flow rates for existing wells
- Reinjection well locations
- Infrastructure near best wells
- Land Status – identify favorable land
- Formation thickness
- Airborne magnetometer and EM data
- Surface geology and structure map

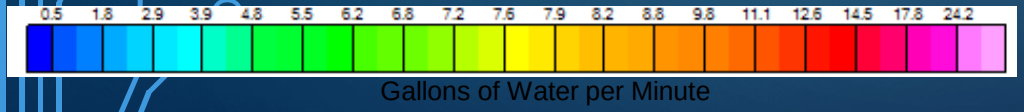
BOTTOM HOLE TEMPERATURES



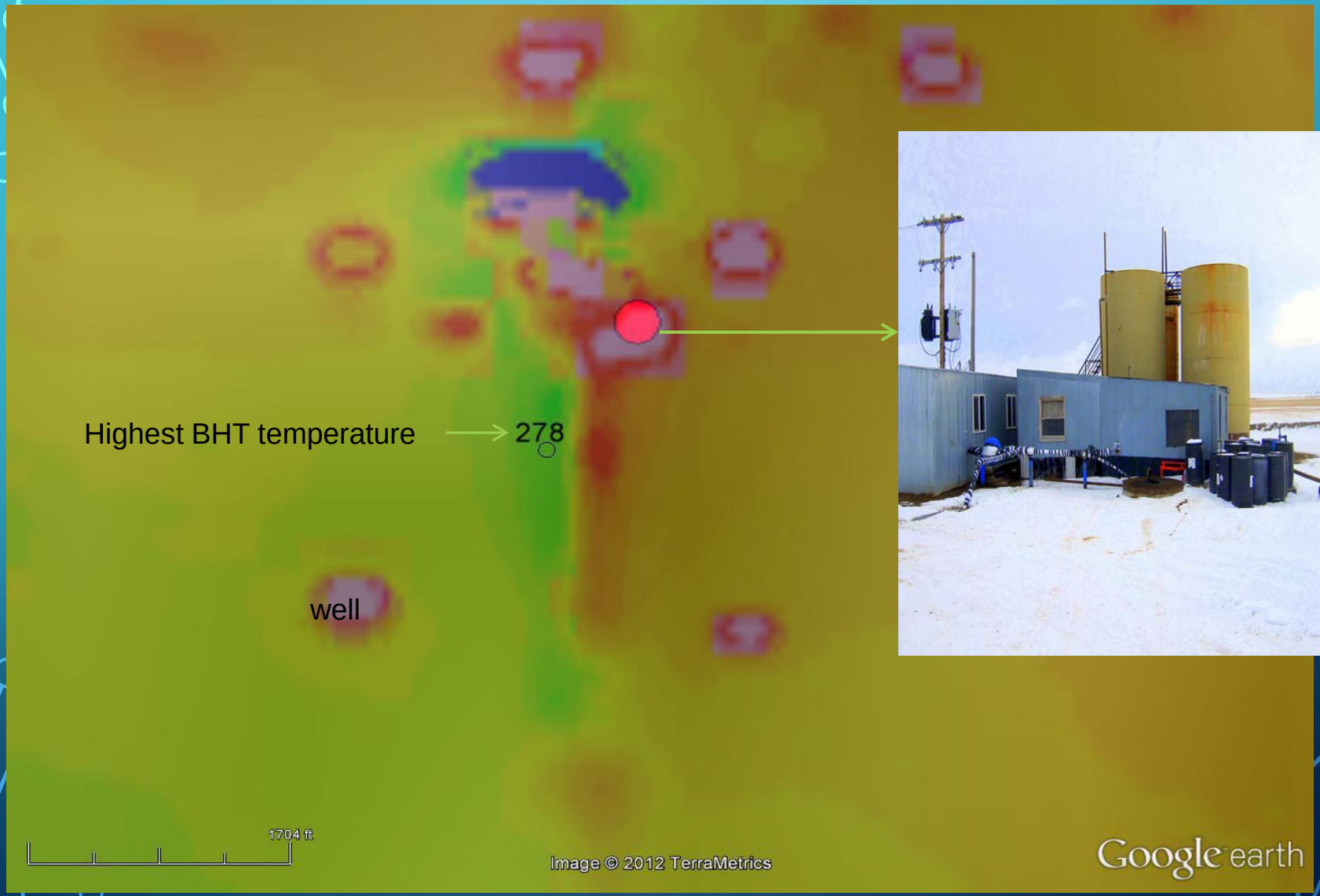


Field with BHT > 200 F

EPU 6 :	209 F
Goings 27-3 :	218 F
Robbins 22-15:	219 F
Huber 2 :	224 F
EPU 110 :	227 F
EPU 83 :	230 F
EPU 1 :	278 F



AIRBORNE MAGNETICS OF POPLAR DOME WELLS AND INFRASTRUCTURE



Re-injection well and storage facility

Results

- Evaluated large amount of new drill hole data available due to Bakken exploration

- Confirmed one of highest geothermal well temps recorded in Montana: 278 F !

- Compiled nearly 90 Bottom Hole Temperatures (BHT) equal or greater than 200 F

- Identified important new areas of geothermal potential on Fort Peck Reservation

Electrical Generation

New binary cycle turbines on the market in the last 12 months can use lower temperature and flows to produce electricity—feasible for Fort Peck Reservation.

DOE-funded binary cycle turbine scheduled to go online in spring of 2014 using waste heat from North Dakota oil well.

Payback may be long, due to low cost of natural gas.

Greenhouse heating with waste hot water from binary turbine is a possibility.

ACCESS ENERGY 125XLT BINARY UNIT

ELECTRATHERM 4010 LOW TEMP UNIT

ELECTRATHERM® 4020

4020 Evaluation

Inputs		
200.0	°F	Hot Water Inlet Temperature
100.0	GPM	Hot Water Flow Rate
800.0	kWth	Available Thermal Power
63.0	°F	Cold Water Inlet Temperature
Yes		Derate

->>
Click to Calculate
->>

Outputs*			Imperial Units of Heat	
42	kWe	Gross Power Output		
2	kWe	Internal Parasitic Load		
40	kWe	Net Power Output		
599	kWth	Thermal Power into GM	2.04569	MMBTU/hr
201	kWth	Remaining Thermal Power	0.68645	MMBTU/hr
158	°F	Hot Water Exit Temperature