

NUMERICAL SIMULATION EXPERIENCE

Types of Simulation Conducted:

GeothermEx has conducted three-dimensional numerical simulation of more different reservoirs than any other organization in the world - 46 to date. Our experience includes numerical simulation of all categories of geothermal systems:

- Single-phase water systems
- Single-phase steam systems
- Two-phase (water and steam) systems
- Two-phase systems with CO₂ gas
- Hyper-saline brine systems
- Systems with magmatic heat transfer
- Single porosity and dual porosity systems

Examples of Reservoirs Simulated by GeothermEx

Reservoir	Country	MW Capacity	Year	Model Type*
Central Plain	Jordan		2006	2D, W
Tiwi, Luzon I.	Philippines	330	1983-1985 1997	3D, 2P 3D, 2P
MakBan, Luzon I.	Philippines	400	1997	3D, 2P
Kokubu, Kyushu I.	Japan		1986-1987	3D ,2P, M
Hakkoda, Honshu I.	Japan		1986-1987	3D, 2P, M
Minami Aizu, Honshu I.	Japan		1986-1987	3D, W
Niseko, Hokkaido I.	Japan		1986-1987	3D, W, M
Okuaizu, Honshu I.	Japan	55	1986-1989	3D, 2P, G
Yanaizu-Nishiyama, Honshu I.	Japan	55	2001-2002	3D, DP, 2P, G
Takigami, Kyushu I.	Japan	25	1986-1992	3D, W
Onikobe, Honshu I.	Japan	12.5	1988-1989	3D, 2P
Uenotai, Honshu I.	Japan	25	1988-1993 1996 2002-2003	3D, 2P

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Reservoir	Country	MW Capacity	Year	Model Type*
Ohtake, Kyushu I.	Japan	12.5	1992-1993	3D, 2P
Germencik	Turkey	47.4	2007	3D, W, G
Wasabizawa, Honshu I.	Japan		1997-1998	3D, 2P
Lihir Island	Papua New Guinea		1987-1991	3D, 2P, G
Kawerau	New Zealand	20	2006	3D, 2P
Cooper Basin (EGS project)	Australia		2006	3D, 2P
Olkaria	Kenya	140	2005, 2008	3D, 2P
Ribeira Grande / Pico Vermelho	Azores, Portugal	14	2002-2003, 2008	3D, 2P, TR
Wayang Windu	Indonesia	220	1995	3D, 2P
Mofete, Naples	Italy		1986-1987	3D, 2P
Latera, N. Latium	Italy	30	1985-1987	3D, 2P, G
Cerro Prieto	Mexico	620	1989-1993 1998-1999 2005	3D, 2P 3D, DP, 2P
Las Tres Vírgenes	Mexico	10	2003	3D, 2P
Los Azufres	Mexico	93	2003	3D, 2P, G
Los Humeros	Mexico	35	2003	3D, 2P. G
Zunil	Guatemala	27	1989 1993 1995-1996 2003	3D, 2P
Amatitlan	Guatemala	25	1995	3D, 2P

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Miravalles, Guanacaste Province	Costa Rica	175	1996-1998 2001-2002	3D, 2P 3D, 2P, CL
Las Pailas, Guanacaste Province	Costa Rica		2003	3D, 2P, CL
The Geysers, California (entire field)	United States	2,200 installed (current generation ~1,000)	1991-1992 1998 2000; 2005	3D, DP, 2P, TR, Pipe
The Geysers, California (GGC Area)	United States	245	1988	3D, 2P
The Geysers, California (NCPA Area)	United States	220	1988	3D, 2P, DP, Pipe
The Geysers, California (Aidlin Area)	United States	25	2001-2002	3D, DP, 2P, G
East Mesa, California (Ormesa I)	United States	30	1986-1987	3D, W
East Mesa, California (Ormesa II)	United States	20	1987-1988	3D, W
East Mesa, California (Ormesa IE)	United States	10	1988	3D, W
East Mesa, California (Ormesa IH)	United States	10	1989	3D, W
East Mesa, California (GEMPLP)	United States	47	1992-1994	3D, W
Heber, California	United States	80	1992-1994 1999 2001; 2004	3D, W
Coso Hot Springs, California (LADWP Leasehold)	United States		1986-1989	3D, 2P
Coso Hot Springs, California (CECI Leasehold)	United States	268	1988-1991, 2006	3D, 2P, G, TR
Salton Sea, California (Magma Lease)	United States	152	1987-1989 1993-1994	3D, HSB
Salton Sea, California (Unocal Lease)	United States	80	1993, 1995	3D, HSB
Salton Sea, California (Entire field)	United States	280	1996-1999 2003; 2006	3D, HSB, MIN

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Reservoir	Country	MW Capacity	Year	Model Type*
Roosevelt Hot Springs, Utah	United States	25	1985-1986 2001; 2005, 2007	3D, W
South Brawley, California	United States		1992	3D, HSB
Mammoth (Long Valley), California	United States	37.5	1989-1992 1995-1996 1998-1999 2001	3D, W
Desert Peak, Nevada	United States	10	1991	2D, W
Desert Peak, Nevada (EGS project)	United States		2003-2004	3D, DP, W
Soda Lake, Nevada	United States	15	1991	2D, W
Steamboat Springs, Nevada	United States	37	1995;1997 1999; 2001 2002-2003 2005- present	3D, 2P
Stillwater, Nevada	United States	15	1991; 2004, 2005	3D, W
Beowawe, Nevada	United States	15	1998 1999; 2006	3D, W
Dixie Valley, Nevada	United States	60	1999 2002; 2005, 2007	3D, 2P, TR
Puna, Hawaii	United States	30	1993-1994 1996 1998-1999 2001-2003; 2006	3D, 2P

* Model Types:

2D	2-Dimensional	CL	Includes NaCl concentration
3D	3-Dimensional	HSB	Hyper-Saline Brine
DP	Dual Porosity	TR	Includes Tracer Transport
W	Single Phase Water	M	Includes Magmatic Heat Transfer
2P	Two Phase (Water+Steam)	MIN	Includes Mineral Recovery
G	Includes Gas	PIPE	Includes Pipeline Network