

Geothermal Power -- 2012

An overview of the status and outlook for geothermal power around the world.

Karl Gawell, GEA

Geothermal Power Has Progressed in the US since 1922



1922 - First Electrical Generation From Geothermal Steam in the U.S.

The Geysers, California, Today



The Geysers, comprising 45 square miles along the Sonoma and Lake County border, is the largest complex of geothermal power plants in the world.

Geothermal Power Has Grown Steadily Since 2006

The 2005 Energy Policy Act:

- Provided new geothermal power plants the same tax incentive as wind projects – the production tax credit (PTC) -- a tax credit of \$0.02 (US) per kilowatt hour produced during each of the first ten years of production.
- Established a new federal leasing program, including set-aside funds for necessary pre-leasing reviews and conducting lease sales.

New U.S. Geothermal Power Plants and Plant Expansions since 2006 include:

- Beowawe, NV
- Blue Mountain, NV
- Bottle Rock Power, CA
- Burdette Power Plant, NV
- Chena Hot Springs, AK
- Desert Peak, NV
- East Brawley, CA
- Electratherm Coproduction
- Galena II, NV
- Galena III, NV
- Heber South, CA
- Hudson Ranch 1, CA
- OIT, OR
- Puna Expansion, HI
- San Emidio Expansion, NV
- Raft River, ID
- RMOTC, WY
- Salt Wells, NV
- San Emidio, NV
- Steamboat II, NV
- Stillwater, NV
- Thermo/Hatch, UT

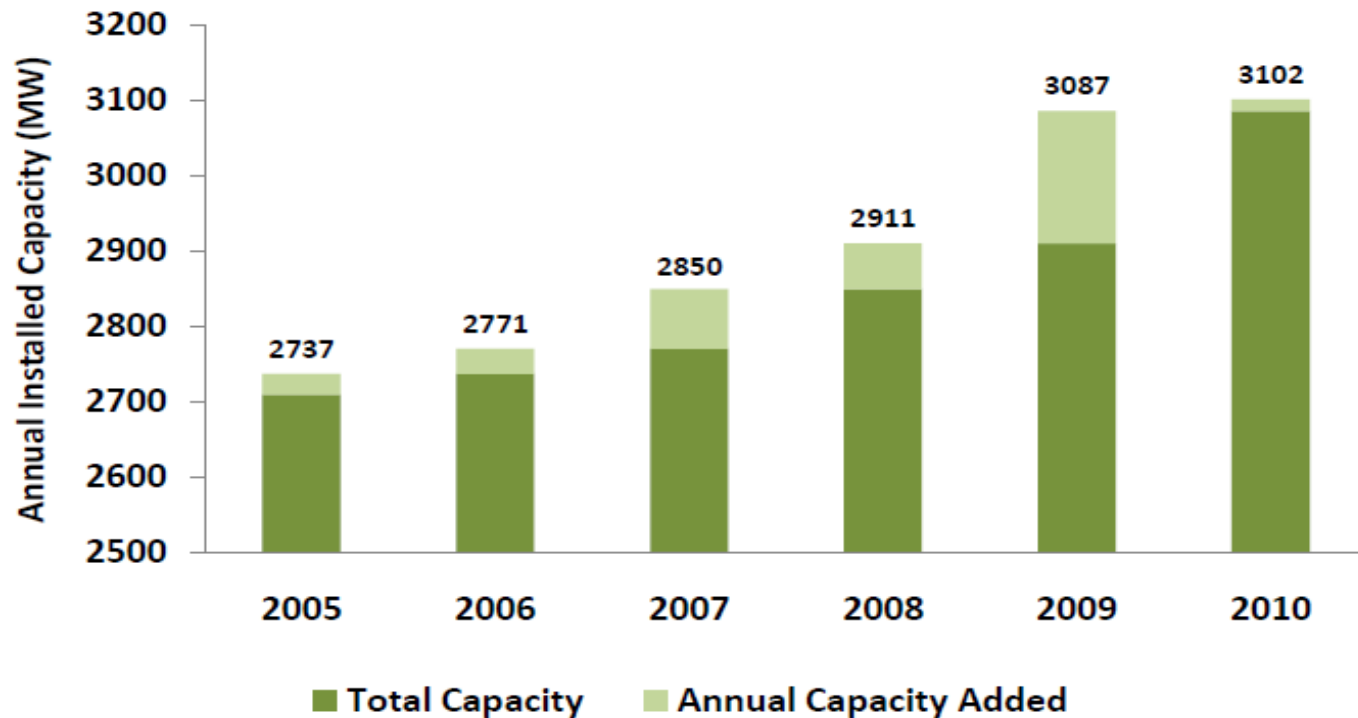
Geothermal projects completed since 2006 include

- new flash power plants
- re-developed flash power plants
- expansion of hybrid power plant
- new solar/geothermal hybrid plant
- binary (ORC) power plants
- distributed power generation with building heating system, and
- co-produced power from oil/gas wells.

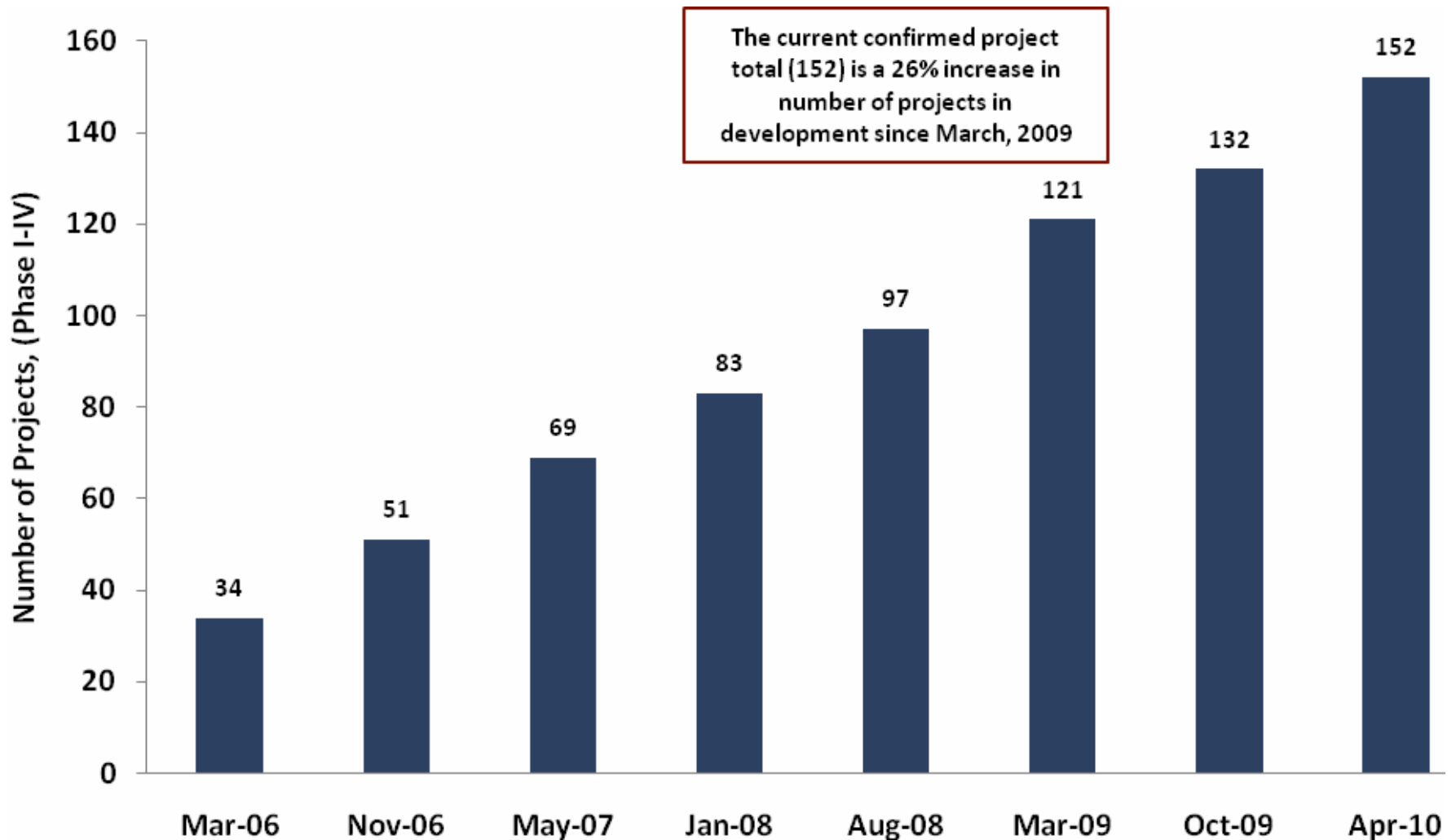
US Installed Capacity

- **Geothermal Capacity Additions in 2010: 15 MW, Nevada**
- **Annual 2010 addition (15 MW) down from 2009 (176 MW)**
 - **Economic Downturn made project financing more difficult**
 - **Permitting process delaying some projects**

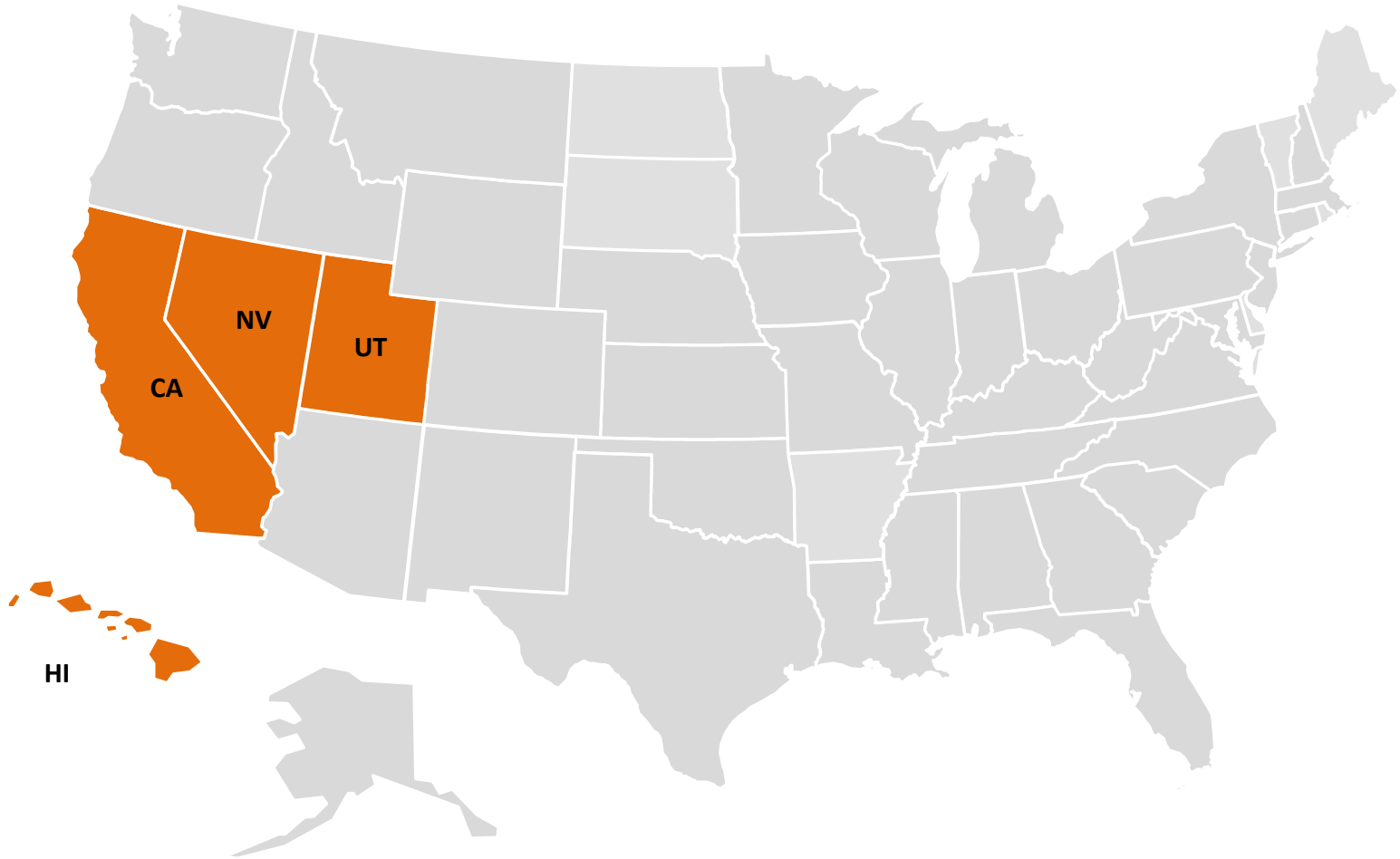
Figure 8: Total Installed Capacity 2005-2010



The Number of New Projects Has Been Accelerating Since 2006

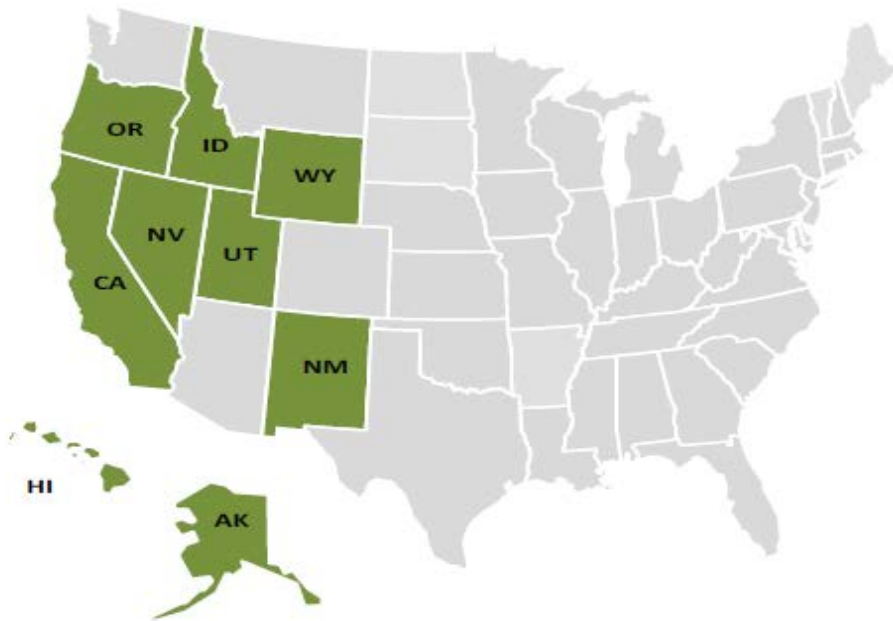


States w/Capacity, 2005

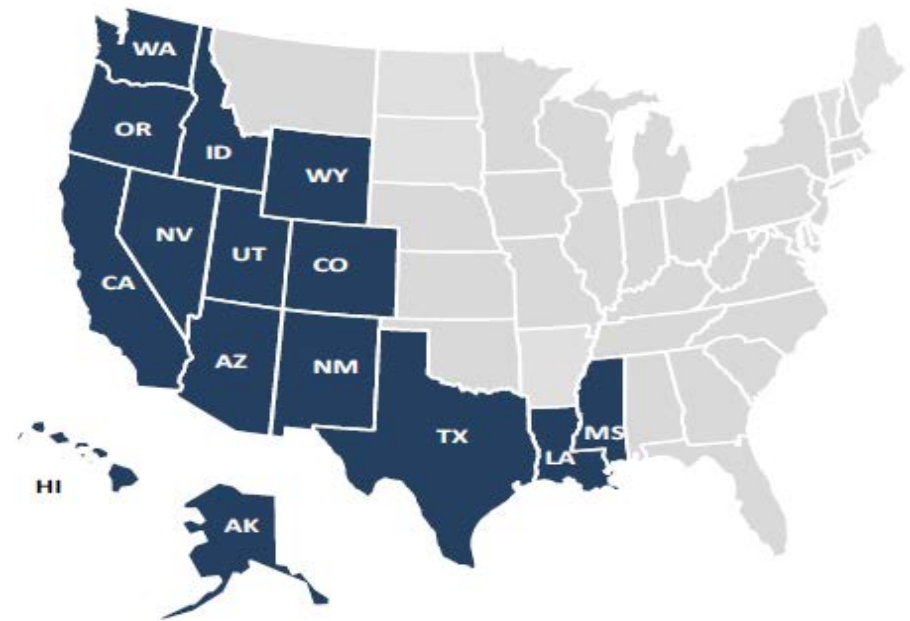


States w/Capacity vs Development, April 2011

Geothermal Capacity Online



Geothermal Capacity in Development



Alaska: Chena Hot Springs

- *Commissioned July, 2006*
- *1 system, 2nd unit in Dec 06*
- *Lowest geothermal temp in world <165°F*
- *Drivers: Off-Grid, sustainable geothermal power and heat, for multiple applications*



California: Hudson Ranch 1



California: North Brawley Power Plant



Hawaii: Puna Expansion



Puna Expansion, Hawaii, U.S., 8 MW, 2011

Photo courtesy of Ormat Technologies, Inc.

Idaho: Raft River Power Plant



Nevada: Blue Mountain Faulkner No 1 Power Plant



Nevada: Burdette Power Plant - Reno



Nevada: Desert Peak



Nevada: Galena III



Galena III, NV, U.S., 26.7 MW, 2008 (Air-cooled OEC)

photo courtesy of Ormat Technologies, Inc.

Nevada: Stillwater Power Plant



Nevada: Stillwater Solar-Geothermal Project



Nevada: Salt Wells Power Plant



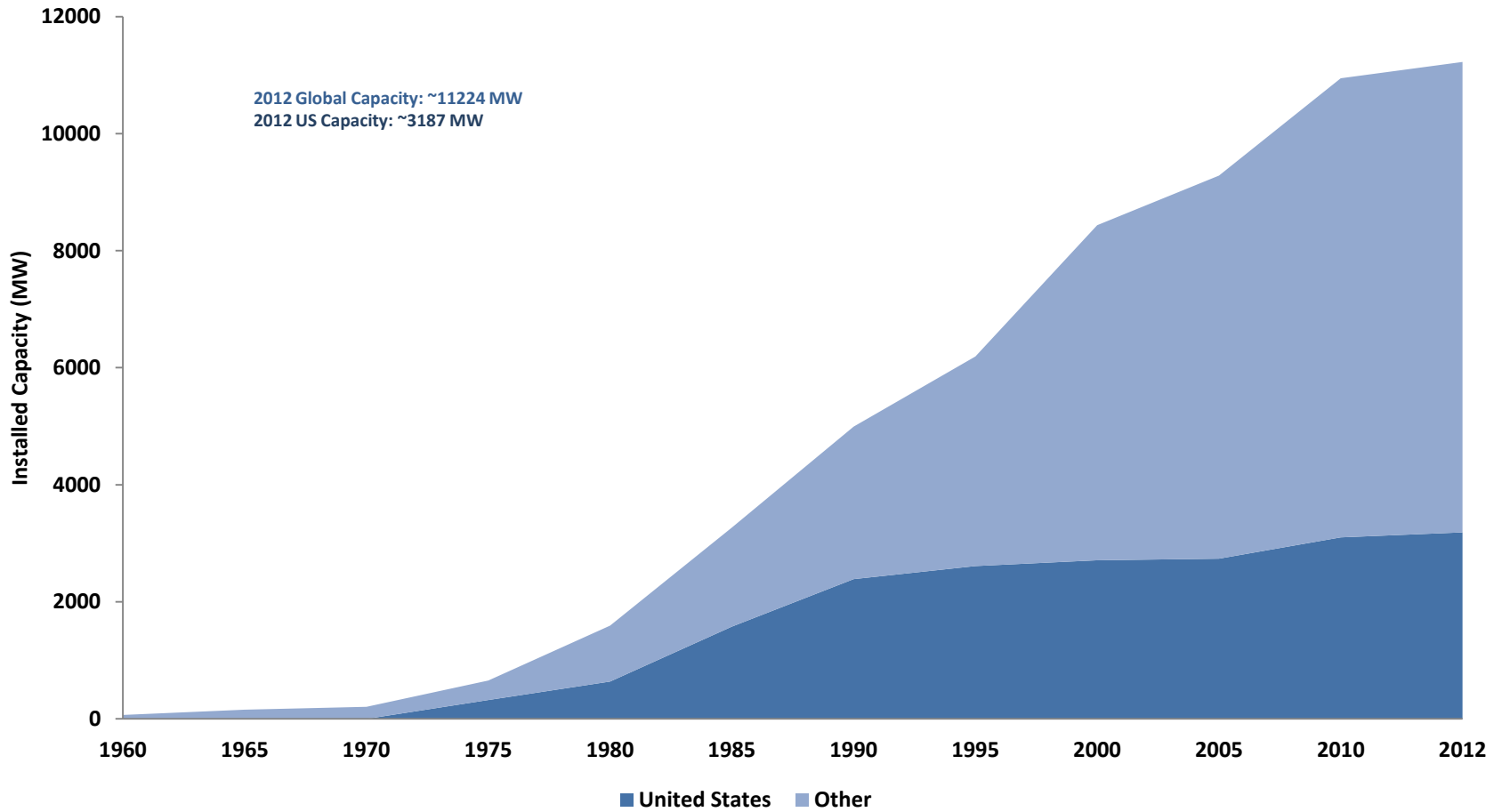
Oregon: Oregon Institute of Technology



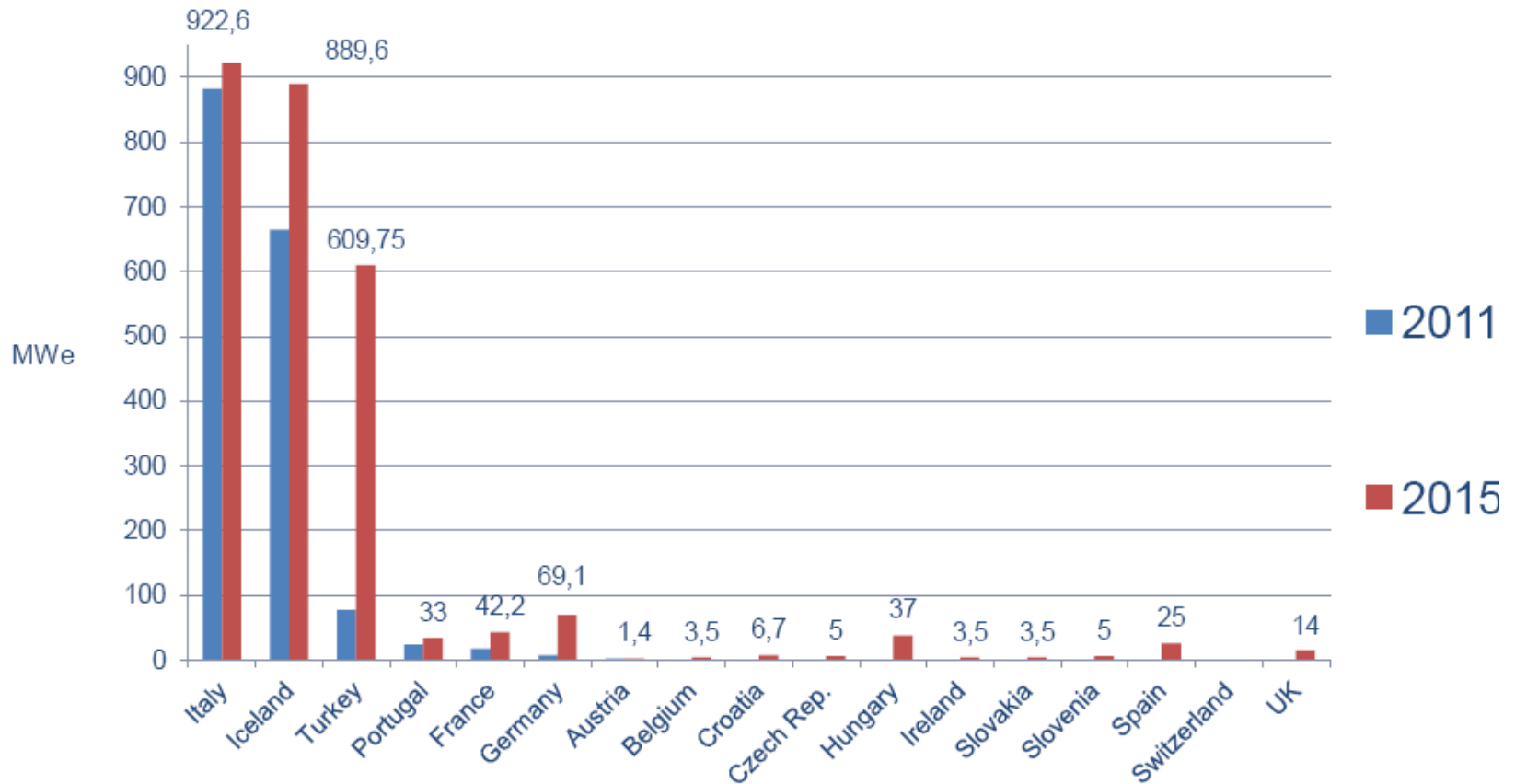
Utah: Raser Thermo No 1 Power Plant



World Market Context



Europe: Countries with production, expected future production

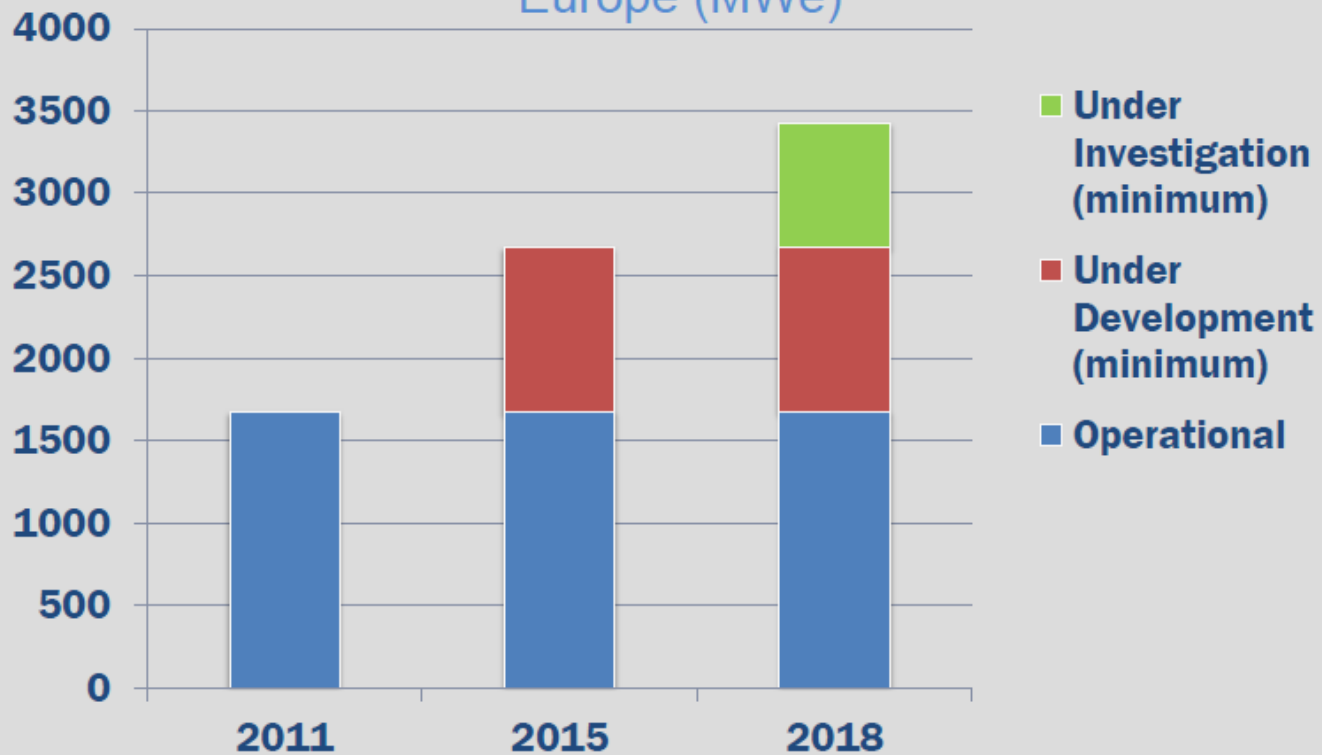


European Expectations:



Looking to the future...

Installed Capacity of **Geothermal Electricity** in Europe (MWe)



Africa

- Countries Producing Geothermal Power (Country/MW)
- Ethiopia, 7
- Kenya, 209

Status of African Countries Expressing Interest (UNEP)

Countries	Reconnaissance	S. Detailed	Detailed	Drilling	Feasibility	Power Development	Remark
Burundi	X	-	-	-	-	-	-
Comoros	X	-	-	-	-	-	-
DRC	X*		-	-	-	-	Not functional
Djibouti	X	X	X	X	-	-	-
Eritrea	X	X	X	-	-		-
Ethiopia	X	X	X	X	-	X	7.2 MWe
Kenya	X	X	X	X	-	X	209 MWe
Rwanda	X	X	X	-	-	-	-
Tanzania	X	X	X	-	-	-	-
Uganda	X	X	X	-	-	-	
Zambia	X*	-	-	-	-	-	* Not F. plant 200KW

African Countries Expressing Interest, GEA 2010

- Algeria
- Comoros Islands
- Djibouti
- Ethiopia
- Madagascar
- Kenya
- Rwanda
- South Africa
- Tunisia
- Yemen
- Zambia

Central America and the Caribbean

- Countries Producing Geothermal Power (country/MW)
- Costa Rica, 208
- El Salvador, 204
- Guatemala, 52
- Mexico, 958
- Nicaragua, 124

Readiness for Geothermal Development (WB)*

*not including Mexico

	Ranking	Upfront Risk	Resource Inventory	Integrated Power Planning	Legal/Regulatory	Social and Environmental
Costa Rica	2	H	M	H	M	L
El Salvador	1	H	M	H	S	M
Guatemala	4	M	M	M	M	M
Honduras	5	L	L	L	L	M
Nicaragua	3	M	S	S	H	M
Panama	5	L	L	L	L	L

A = high (favorable); S= substantial; M= medium; L= low

Central American Countries Expressing Interest, GEA 2010

- Costa Rica
- Dominica
- El Salvador
- Guadeloupe (France)
- Guatemala
- Honduras
- Montserrat
- Netherland Antilles
- Nicaragua
- St. Kitts and Nevis

Asia and the Pacific

- **Countries Producing Geothermal Power (country/MW)**
- Australia, 1
- China, 24
- Indonesia, 1222
- Japan, 535
- New Zealand, 768
- Papua New Guinea, 56
- Philippines, 1904
- Russia, 82
- Thailand, 0.3

Asia/Pacific Countries Expressing Interest, GEA 2010

- Armenia
- Australia
- China
- Fiji
- Georgia
- India
- Indonesia
- Iran
- Japan
- Nepal
- New Zealand
- Papua New Guinea
- Philippines
- Samoa
- Taiwan
- Thailand
- Turkey
- Vanuatu

South America

- Countries Generating Geothermal Power:
None

South American Countries Expressing Interest, GEA 2010*

- Argentina
- Bolivia
- Chile
- Columbia*
- Peru

(*added since 2010 report)

For More Information:

Geothermal Energy Association

<http://www.geo-energy.org/>

202-454-5264

karl@geo-energy.org