

## DOCKETED

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# Ormat Nevada Inc. RETI 2.0 Plenary Meeting

March 16, 2016



*McGinness Hills, Nevada, US*



*Green energy you can rely on*

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For a discussion of such risks and uncertainties, please see risk factors as described in the Annual Report on Form 10-K filed with the securities and exchange commission on February 26, 2016.

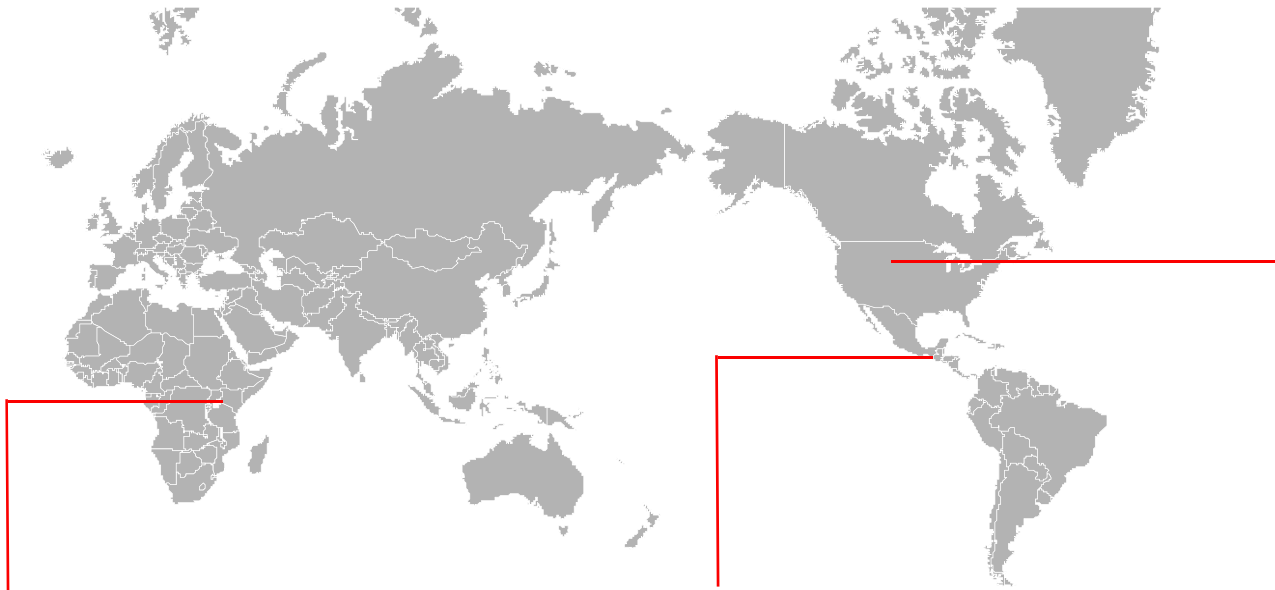
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# Ormat Global Operation - Nearly 700 MW



Kenya	139 MW
Olkaria III Plants 1-4	139

Guatemala	43 MW
Amatitlan	20
Zunil	23

California	181
Imperial Valley	152
Mammoth Lakes	29

United States	515 MW
Nevada (6 sites)	243
California (4 sites)	181
Hawaii	38
North & South Dakota, Minnesota, Colorado Montana & Colorado (REG <sup>1</sup> ) (10 power plants)	53

<sup>1</sup> REG- Recovered Energy Generation  
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# Cost and Value of Geothermal Power

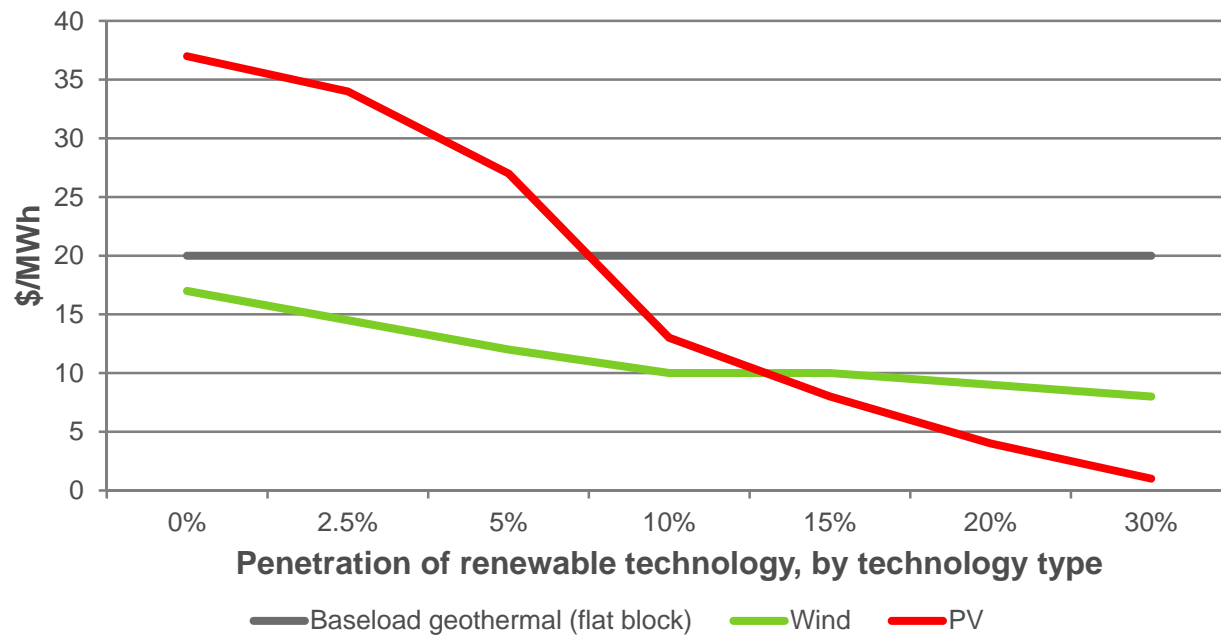
- Cost of new Ormat geothermal projects is \$4,000-\$4,500/kW
- Cost assumptions in the current RPS Calculator are wrong
- Levelized PPA prices dropped from >\$100/MWh to ~\$80/MWh
- Trend is continuing
  - Cost reduction: exploration, development, power plant CAPEX, O&M
- Provides a range of operational benefits which will be needed in high renewable penetration scenarios

# Binary Geothermal Technology is Flexible

- Dispatchable resource provides a range of operational benefits:
  - Fast ramping for a range of services:
    - Multiple cycles / day
    - 30% of nameplate / minute
- Most current and future operational services could be supplied with precise operational control:
  - Real-time economic dispatch and flexible ramping reserves
  - Regulation up and down within a wide range
  - Spinning reserve and frequency response reserve
  - Voltage regulation
  - Qualifies as flexible capacity under current CPUC rules

# Baseload Geothermal Provides Sustained Capacity Value

- As solar PV penetration increases, incremental solar capacity ratings and value decline (in the absence of mitigating measures); geothermal ratings remain stable



Source: illustration based on results in Mills and Wisser, *Changes in the Economic Value of Variable Generation at High Penetration Levels*, LBNL, 2012; value shown is based on avoided CT in long-term supply equilibrium



# Dispatchable Geothermal Case Study: 38 MW Puna Geothermal Venture

- Big Island, Hawaii
- Dispatchable energy
- Automatic Generator Control (AGC) remotely and automatically controlled by HELCO System Operator
- Dispatch: 22 ~ 38 MW
- Ramp rate up or down: 2 MW / minute
- Spinning reserve at all times: 3 MW

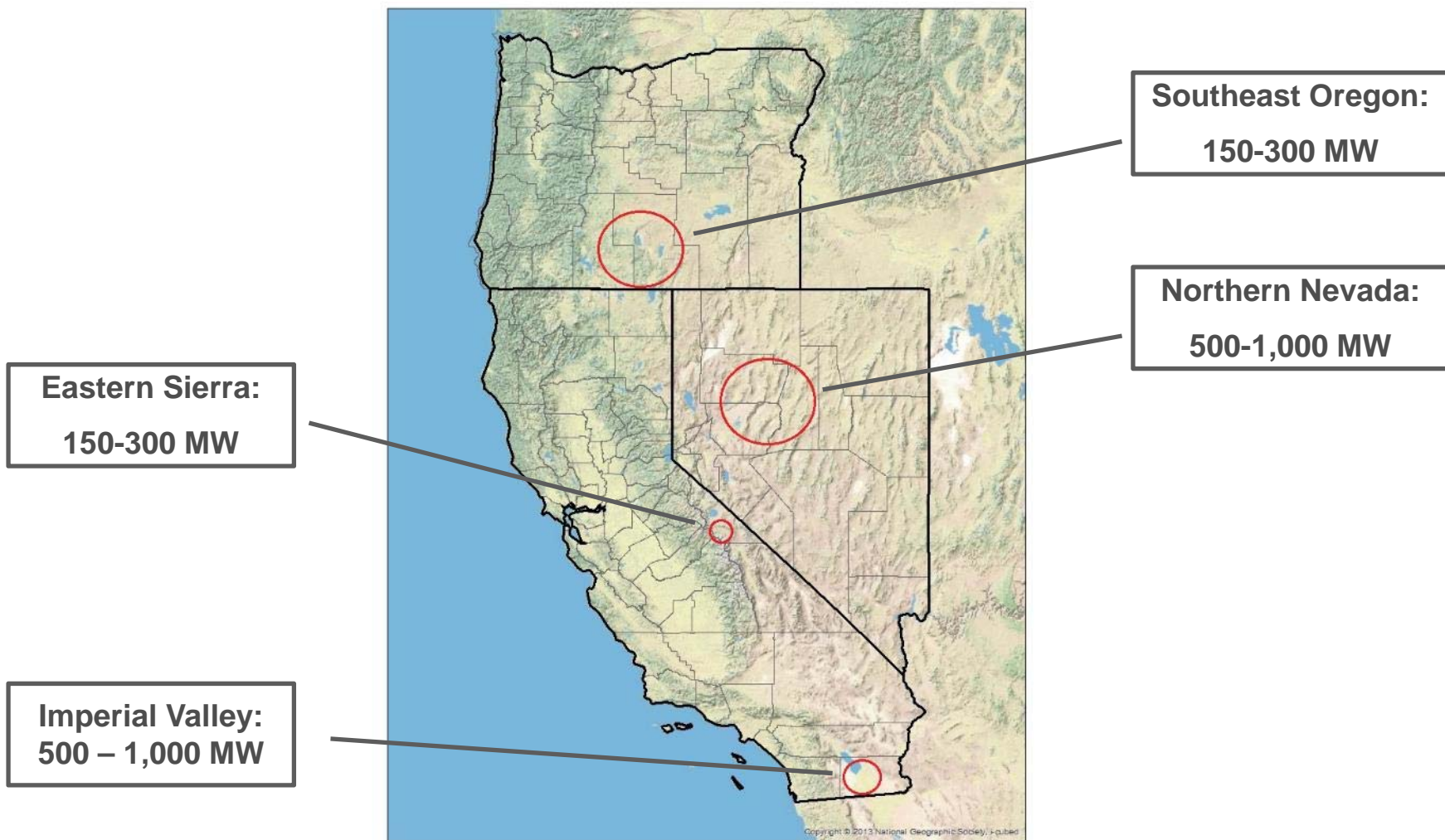




# The Value of Resource Diversity

- Multiple independent studies show the benefit of a diverse portfolio with a meaningful geothermal component, e.g.
  - E3, *Investigating a Higher Renewables Portfolio Standard in California*, 2014
  - NREL, JBS Energy, GE Energy Consulting, *Low Carbon Grid Study 2030*, 2016
- These studies have not examined additional benefits of flexible geothermal operation

# Main Potential for Incremental Development



Source: GeothermEx – *Geothermal Inventory* 2004; GEA – 2014 Annual US & Global Geothermal Power Production Report, Ormat estimates

# How it Works

