# Ormat's Geothermal Projects in Imperial County Imperial Valley Renewable Energy Summit





Green energy you can rely on

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#### Introduction

Market leader with proven track record in the geothermal sector

Our mission is to become a leading global renewable energy provider



50

Years of experience



595

\$million Revenue in 2015

Own & Operate nearly

700<sub>MW</sub>



1,060

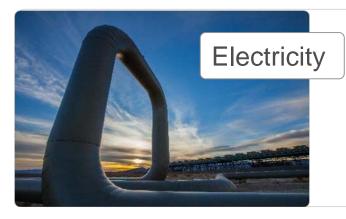
Employees



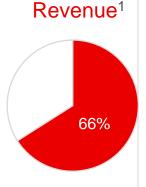


# **Business Segment Overview**

The only vertically integrated player with a balanced business model

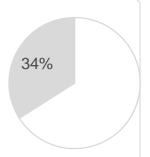


- Owns & operates 697 MW
- Sells firm & flexible electricity
- Fully contracted





- Technology leadership
- Sells geothermal and REG<sup>2</sup>
  power plants as well as other
  products to 3<sup>rd</sup> parties
- Provides EPC<sup>3</sup> services





# Why Geothermal



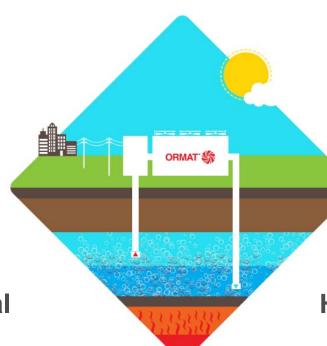
#### Renewable

- Supporting legislation
  - Growing demand



#### Global growth potential

 Estimated 10X the installed capacity





#### Competitive

- Firm & flexible
  - Cost effective



#### **High entry barriers**

- Niche market
- Capital intensive
  - Expertise



# 35 Years of Pioneering Power Plants

From a 2 kW power unit at a hot spring of 120°F (48.9°C) in Alaska (1979)...

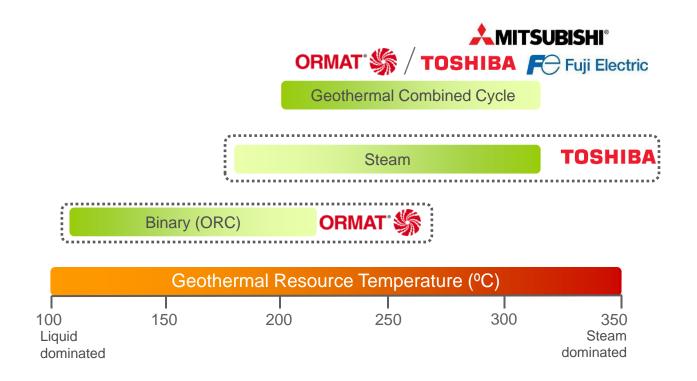


.... to a 100 MW power plant at a high enthalpy resource of 382°F (194.4°C) in New Zealand





# Solutions For All Geothermal Resources – New Collaboration with Toshiba





# Geothermal Green Field Development Process



Exploration



Project Development



Engineering & Procurement



Manufacturing



Field Construction



Operation

Multi-Discipline Expertise

#### 3 years

- Site Identification
- Lease agreement
- Permitting
- Exploration
- Initial field development & well testing

#### 2 years

- PPA
- Plant design
- Completion field development & equipment manufacturing
- Plant permits
- Gathering system and plant construction

- Testing and start up
- Acceptance test
- Commercial operation

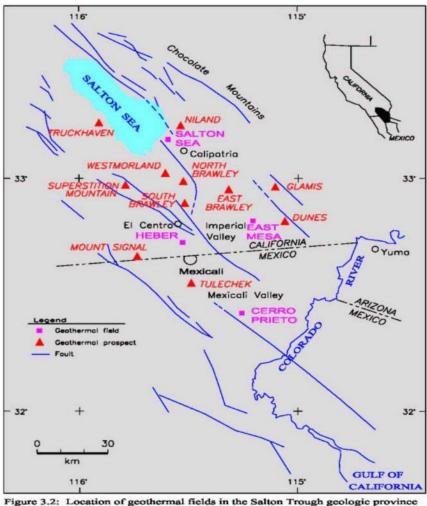


# Imperial Valley: San Andreas Step Over Basin Along Fault System





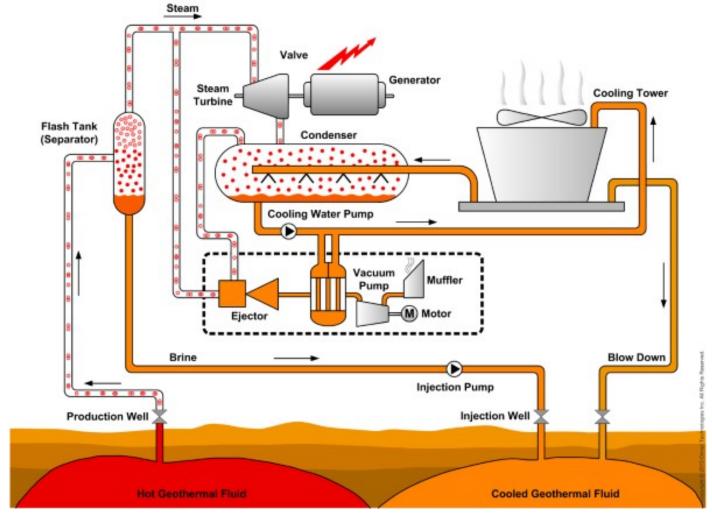
# Imperial Valley and Mexican Geothermal



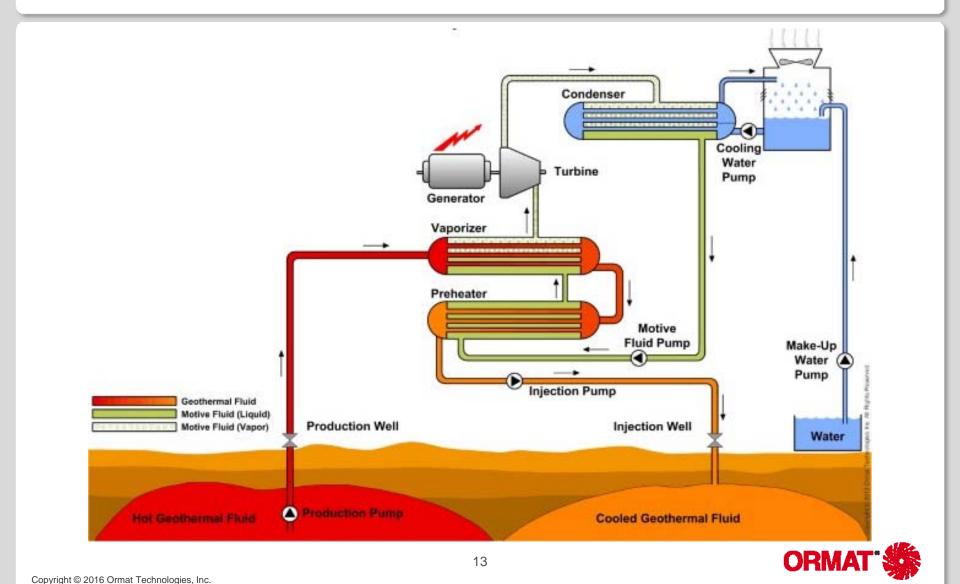




### Geothermal Flash Power Plant



# Water-Cooled Binary Geothermal Power Plant



# **Heber Facility Summary**

The 92 MW Heber Complex has been sustainably operating since 1985. It includes:

- Heber 1 and Gould 1
- Heber 2
- Heber South and Gould 2





## Ormesa Geothermal Projects Facility Description

The 42 MW Ormesa Complex has been sustainably operating since

1987. It includes:

- Ormesa I
- Ormesa II
- GEM 3





# North Brawley Geothermal Facility Description

The North Brawley consists of 5 Ormat Energy Converters and generates 18 MW since March 2011



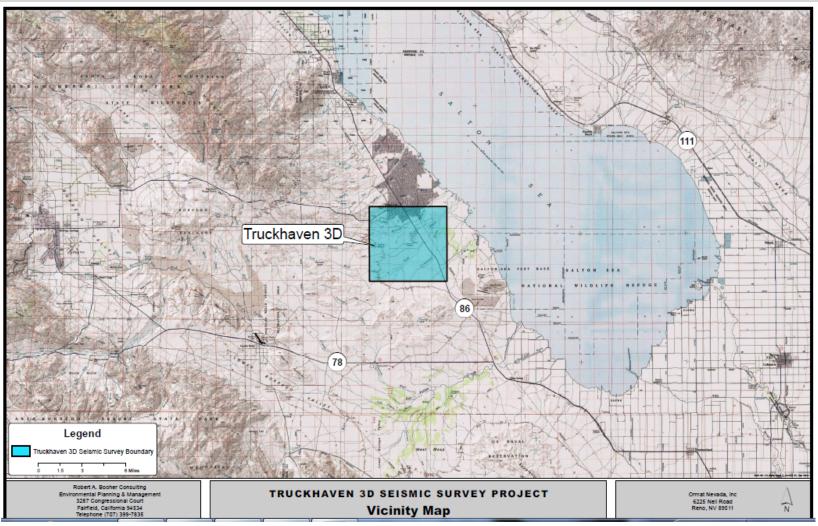


# History of Truckhaven

- Imperial County EIR Phillips Petroleum's "Truckhaven Prospect Geothermal Exploration Wells" Westec Services, Inc. 1981
  - Phillips Truckhaven 1 1982: 8093 feet
  - IAE 2008: 7139 feet
- Geothermal Overlay Zone for Imperial County's "Final Programmatic Environmental Impact Report Renewable Energy & Transmission Element Update" July 2015



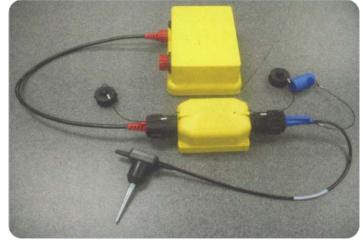
# Seismic Survey Area





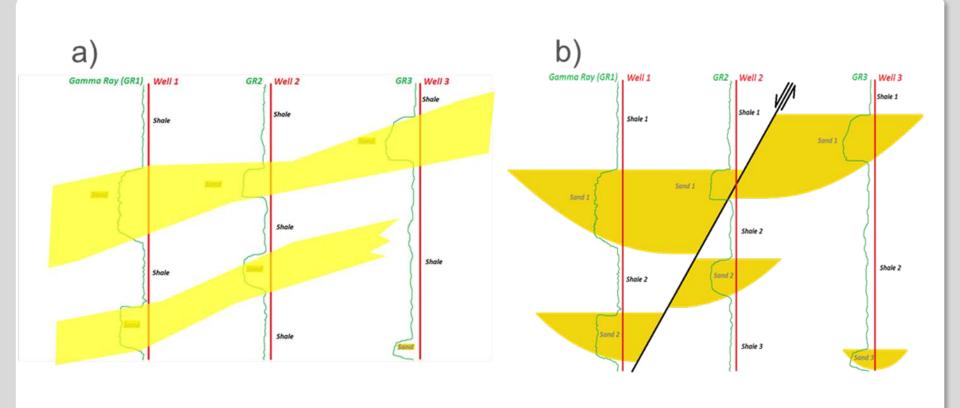
# Recording System: Vibroseis and Geophones





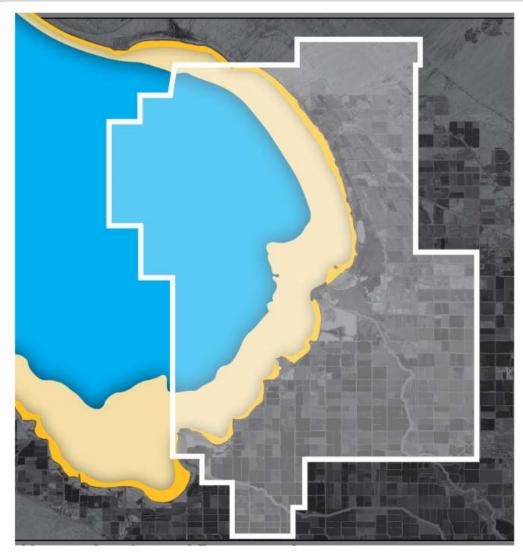


# Cartoons Illustrating Possible Reservoir Complexity





### Salton Sea Known Geothermal Resource Area





#### Salton Sea KGRA Statistics

- Estimated potential additional 2000 megawatts
  (Enough power for 1.5 million homes (750 mw/household)
- Current generation from 11 power plants (~300,000 homes)
  - Cal Energy 10 power plants: 327 mw
  - Energy Source 1 power plant: 50 mw



# Ormat's Core Competencies in the Imperial Valley

- Plant operations and maintenance
- Plant upgrades and repowering
- Wellfield development and sustainable management
- Reservoir management
- Centralized regional operation
  - Shared resources
  - Efficiencies



# **Economic Impact in Imperial County**

- 139 full time employees
- Ormat's >200 MW > \$1 Billion investment in Imperial County
  - New projects will continue to add to this base
- Property Taxes paid to Imperial Valley = \$ 2.4 Million in 2015-16
  - Sales taxes increase the Valley's income due to local purchases including hotel tax



# **Environmental Benefits of Binary**

- 100% injection of all geothermal fluids
- No geothermal emissions
- Motive Fluid is a hydrocarbon versus a refrigerant



# Questions?

