



# Challenges to the Development of Geothermal Energy

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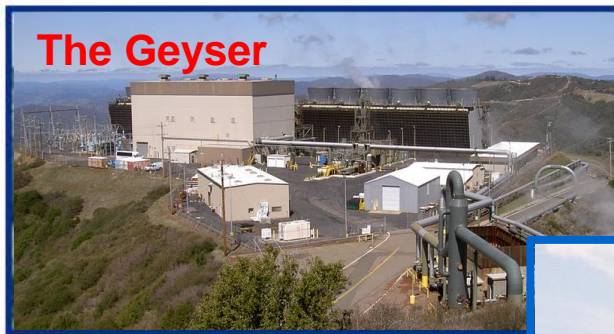
## The Challenges to Development

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# Introduction

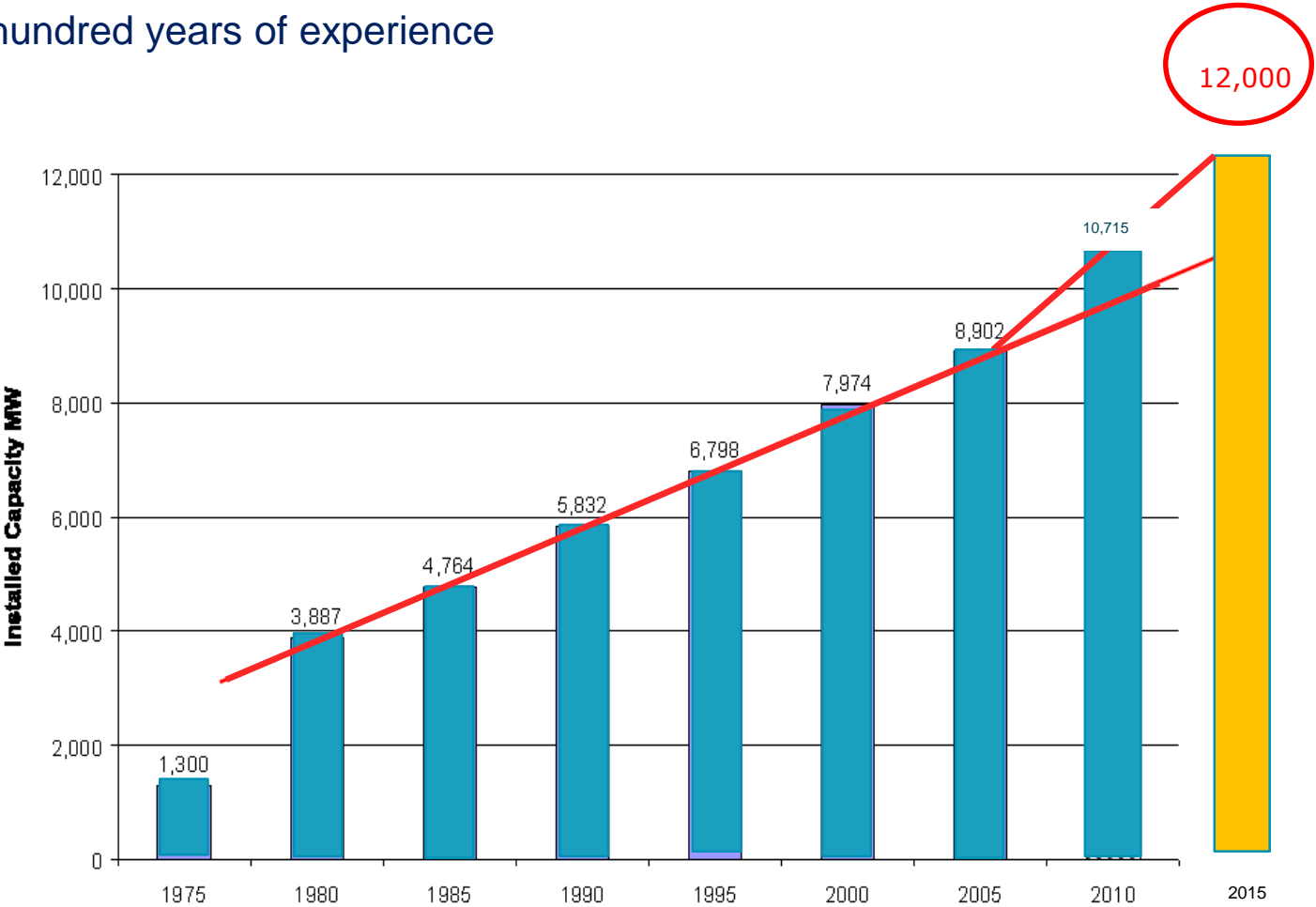
One hundred years of experience



- In 1904, the world's first geothermal energy experiment was carried out in Larderello.
- IN 1913, the first geothermal power plant (250 kW) began operations in Larderello
- In 1950, Italy was the only country to have developed geothermal technology and was producing 2 TWh/year.
- In 1958, New Zealand's first geothermal power plant (Wairakei) was opened.
- In 1960, The Geyser began operations with an 11 MW plant.
- In 1966, Japan opened its first plant (Matsukawa).

# Introduction

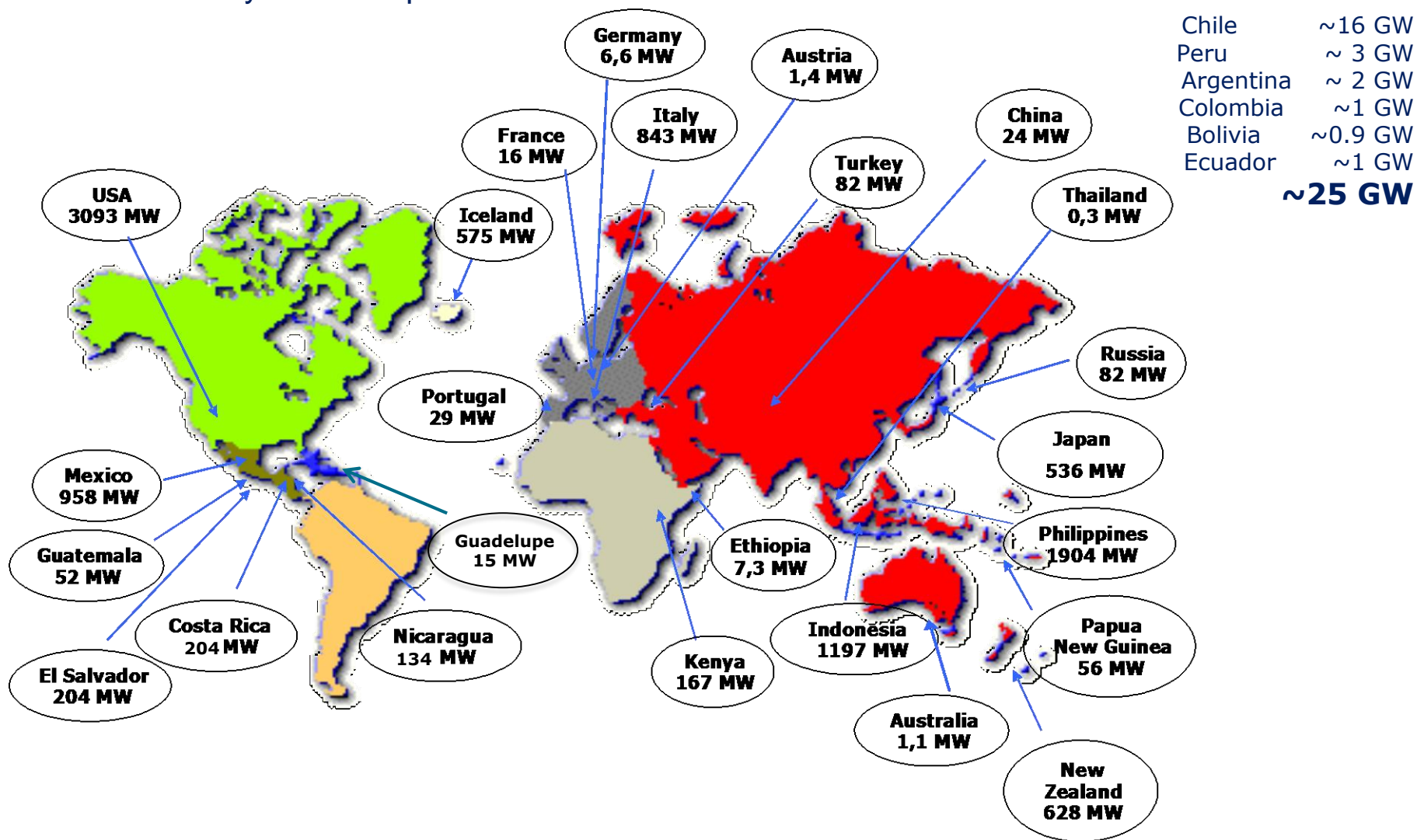
One hundred years of experience



Bertani et al., 2010 (WGC, 2010)

# Introduction

One hundred years of experience



## Introduction

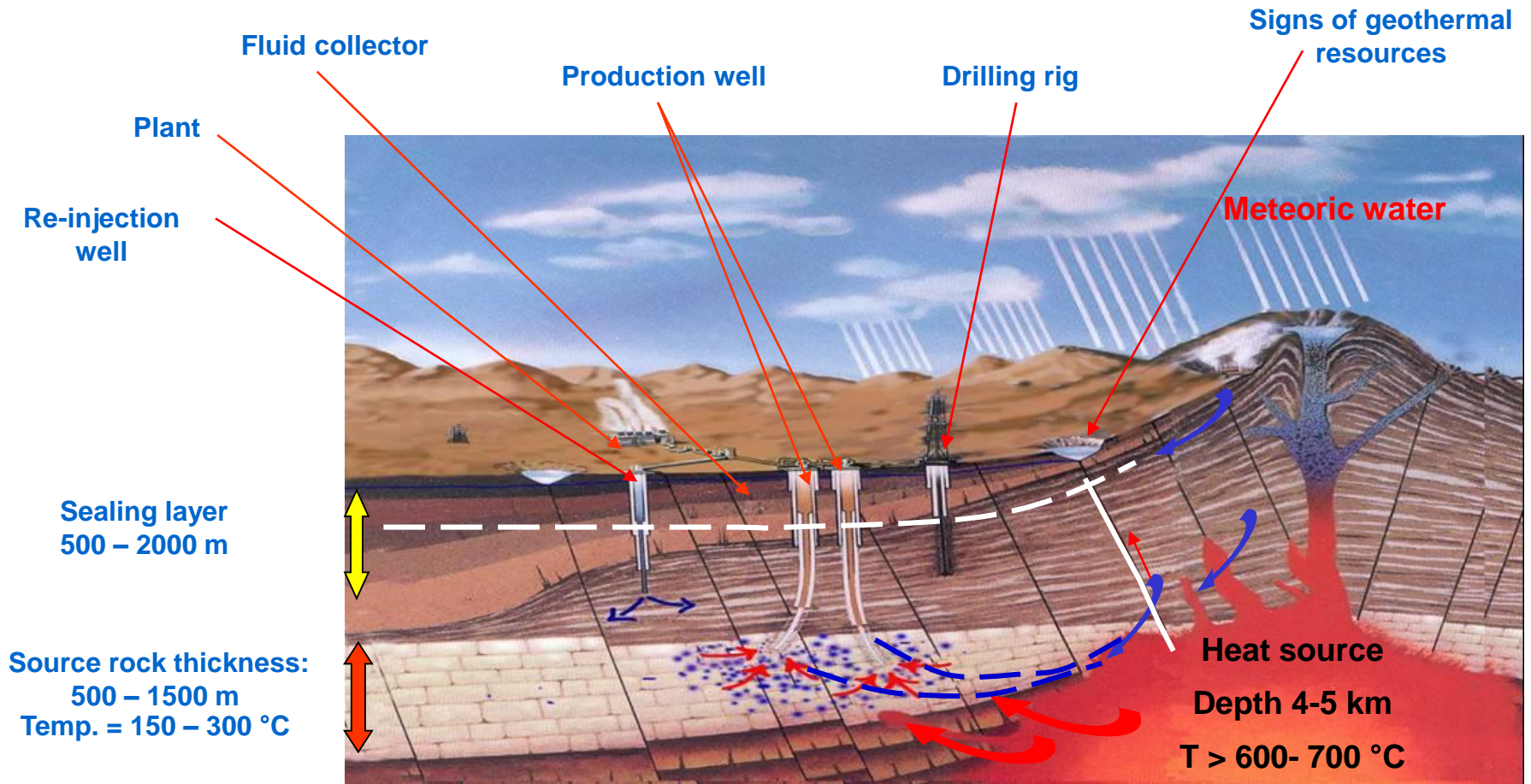
One hundred years of experience



# Geothermal Business



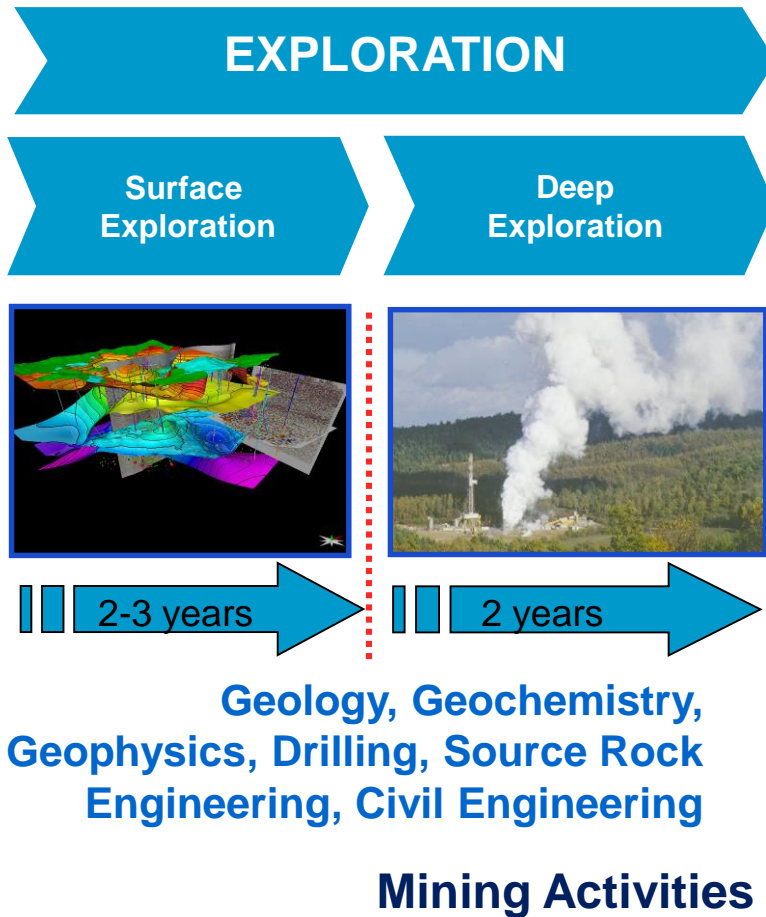
# Geothermal Business





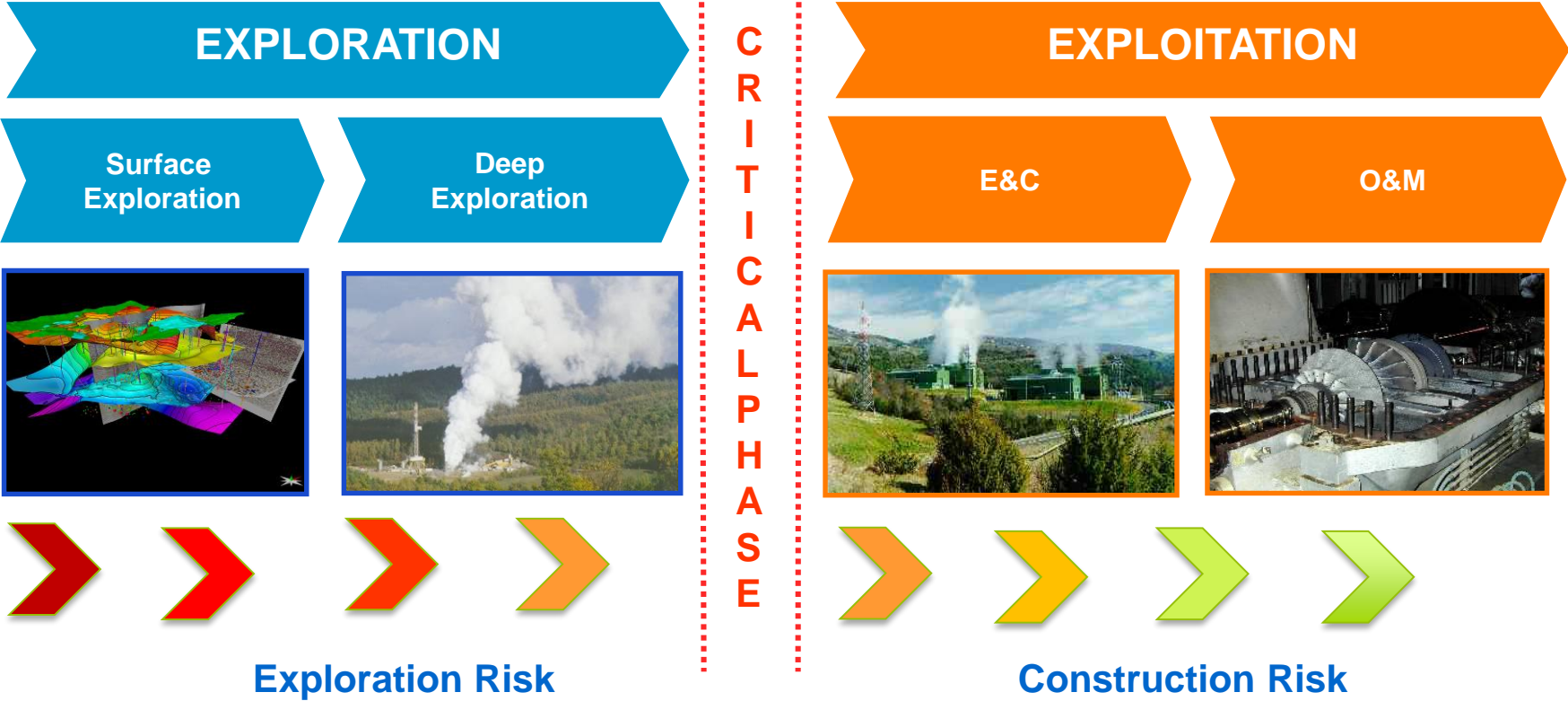
# Geothermal Business

Times and Activities



# Geothermal Business

## Technical Risks



# Geothermal Business

## Construction Risk

### Engineering and Construction

Engineering on the basis of 4-5 wells to be defined

- No. of production wells
- No. of re-injection wells
- Location of wells
- Materials to be used
- Chemical composition of the fluids

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Estimated in the system model

Analysis of the results to propose the best solutions

### Operations and Maintenance



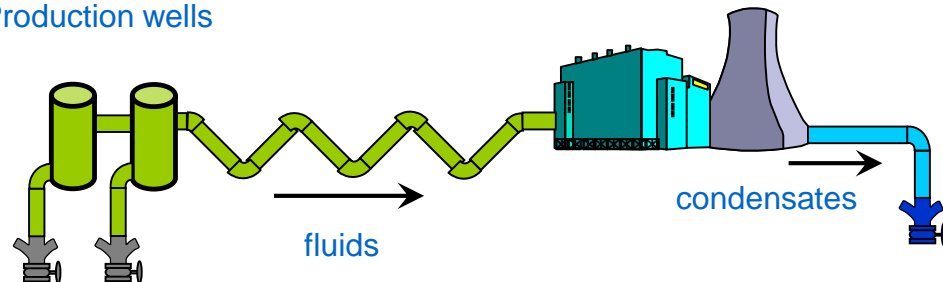
Production wells



Gathering



Power Plant



Continuous analysis to maintain system sustainability

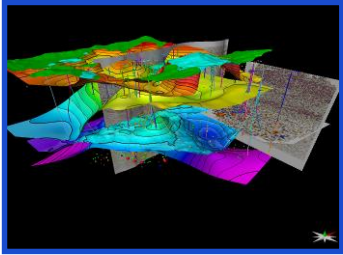
# Geothermal Business

Financial Exposure

## EXPLORATION

Surface Exploration

Deep Exploration



X

20X



## EXPLOITATION

E&C

O&M



100X



# Geothermal Business

## Operations

## Environment

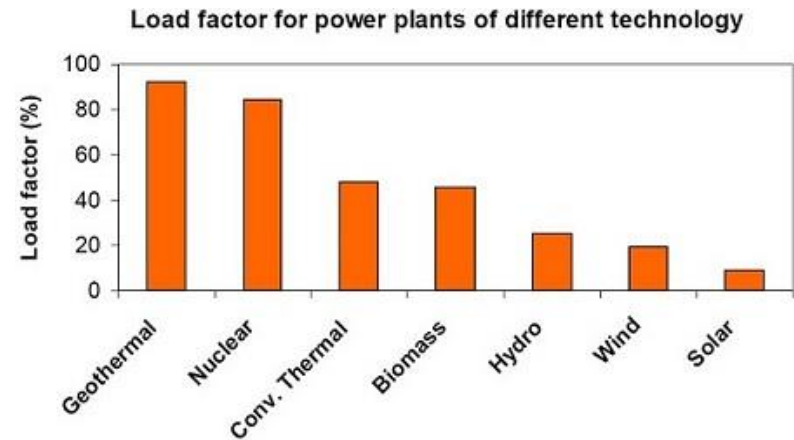
- low CO<sub>2</sub> emissions
- limited work zones

## Plant Factor

- greater than 90%
- not affected by seasons
- endless production if managed correctly

## Energy costs/prices

- competitive
- fuel-independent
- low OPEX



# Challenges to Development



# Challenges to Development

Geosciences  
Reservoir Engineering  
Drilling  
Construction Operation  
Laboratory  
Workshop

A wide range of skills



Long execution times



Risks  
(Exploration,  
Construction)



Significant  
Investments

# Challenges to Development

## IDB and Geothermal Energy

### Energy Innovation Centre

- Part of the Energy Division
- Catalyst of knowledge and best practices in the energy/technology sector

### Collaboration

- Internal (CCS, ENE, IFD, SCF)
- External (all national and/or international financial institutions)

### Focus

- In terms of regulation and policies
- In technical terms to define potential
- In financial terms (grants, geo-insurance, loans, etc.)

# Challenges to Development

## Regulation and Policies

### Definition of National Policies

Geothermal Energy Act covering:

- Exploration and exploitation work (form, times and mechanisms; see backup).
- Technical specifications of geothermal energy (e.g. re-injection, geothermal cycle and sustainability, see backup).
- Anti-speculation laws (as in Peru; see backup).

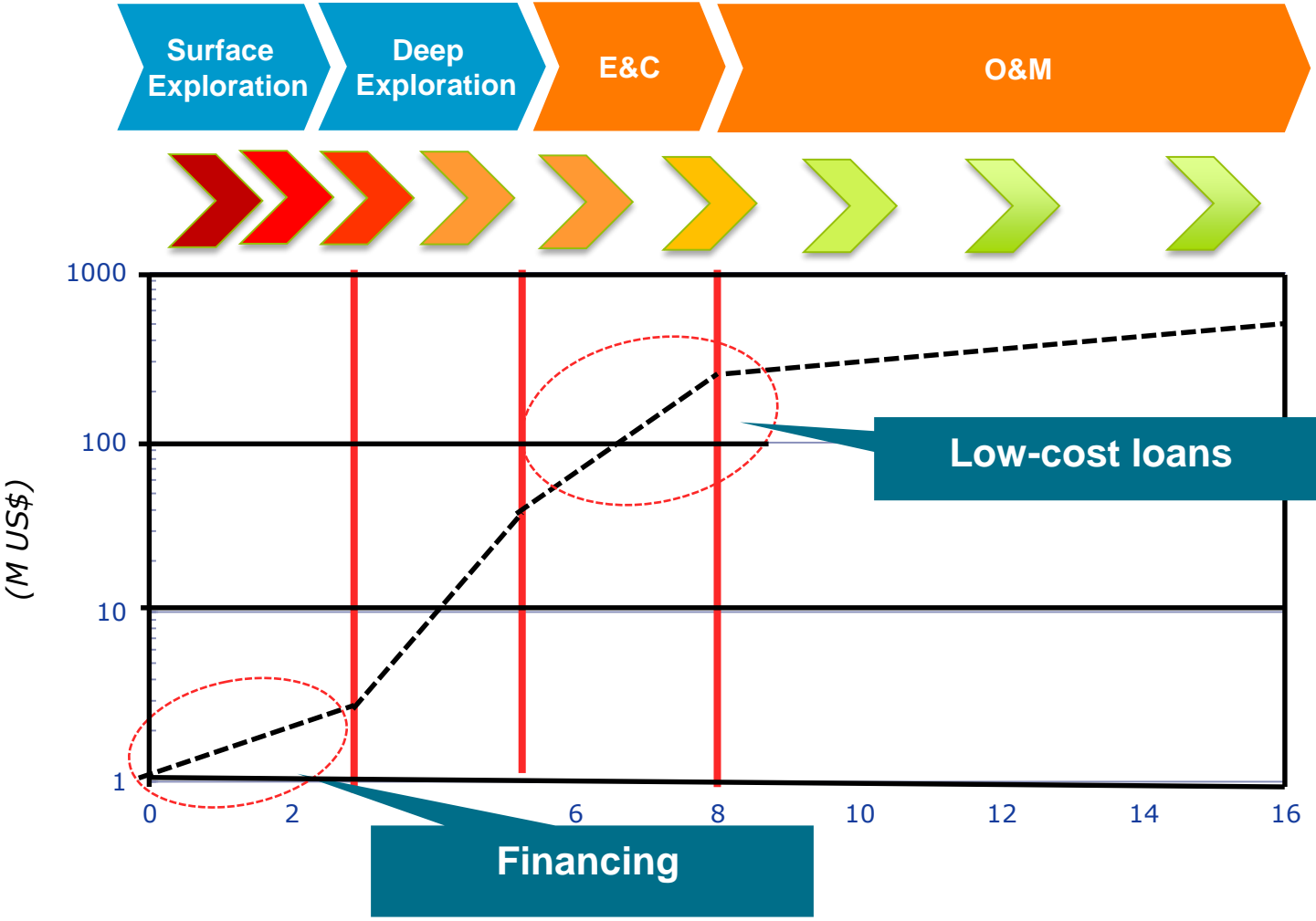


### **Stable Legal Framework**

- Limiting the risk to the technical stages
- Support for the exploration and development stage

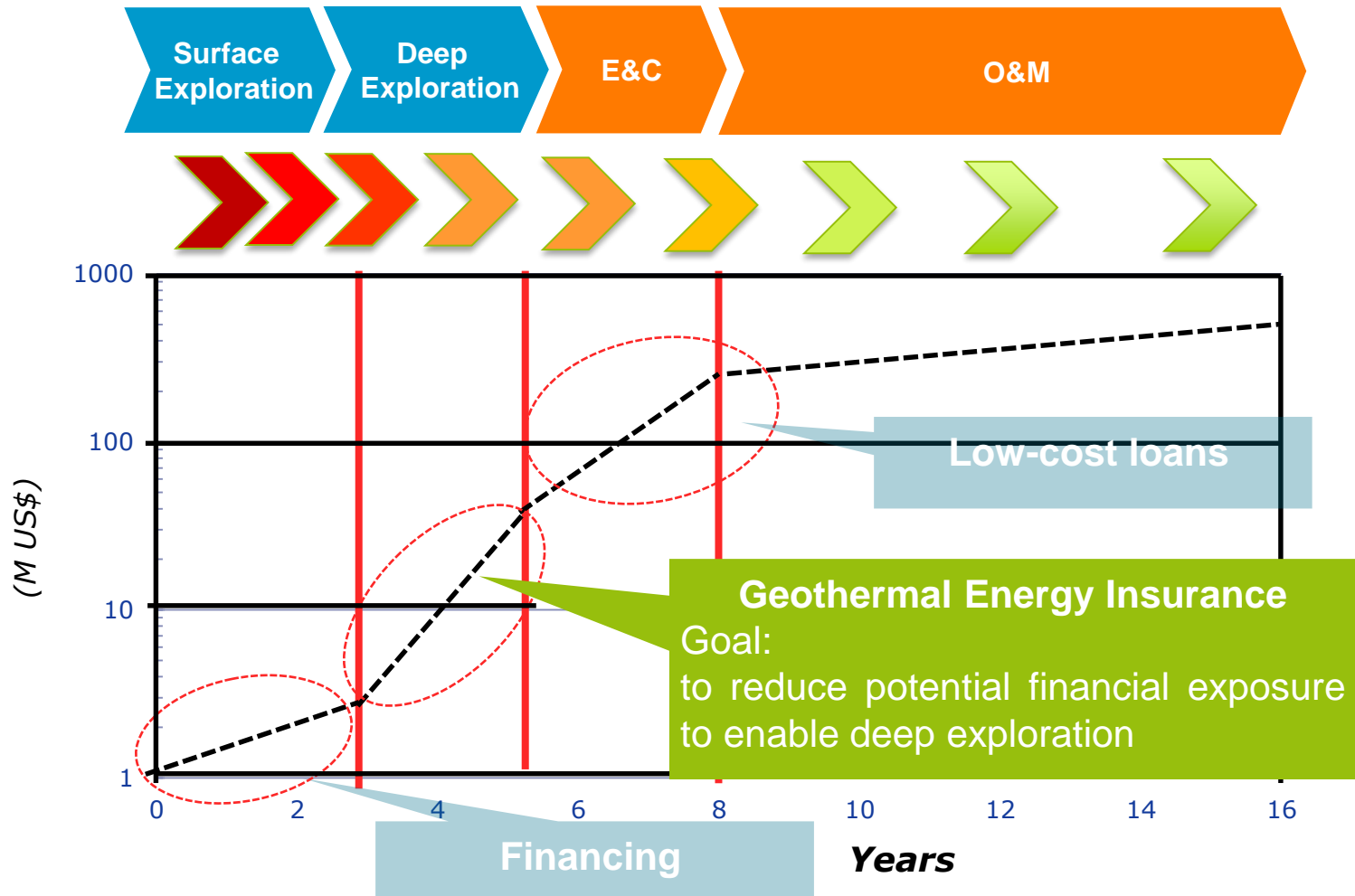
# Challenges to Development

## Financial Exposure



# Challenges to Development

## Financial Exposure

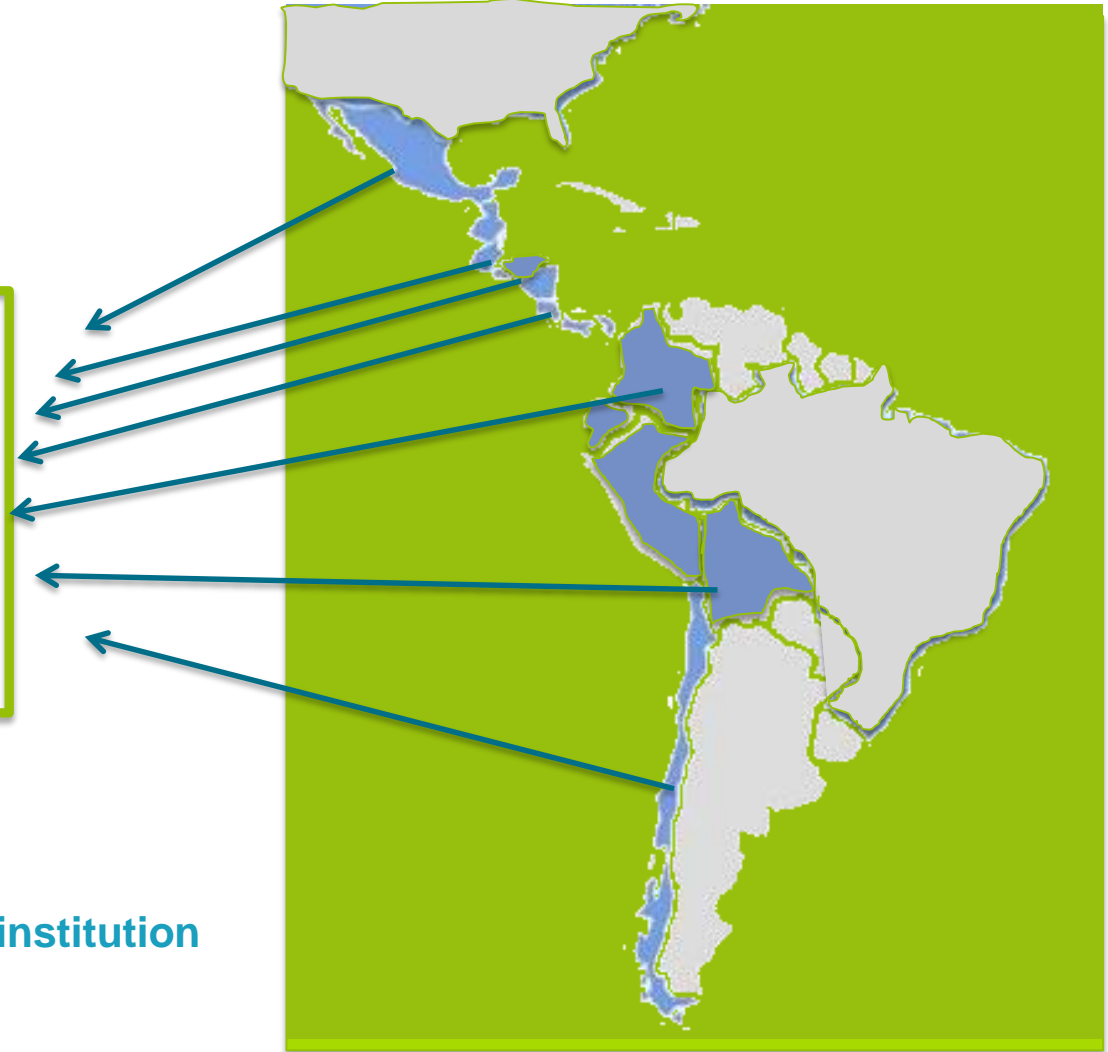


# Challenges to Development

## Technical Cooperation

### Project Portfolio

- 7 different countries
- Public and private
- PI evaluation of potential
- PI regulation
- PI risk mitigation
- PI financing
- PI training

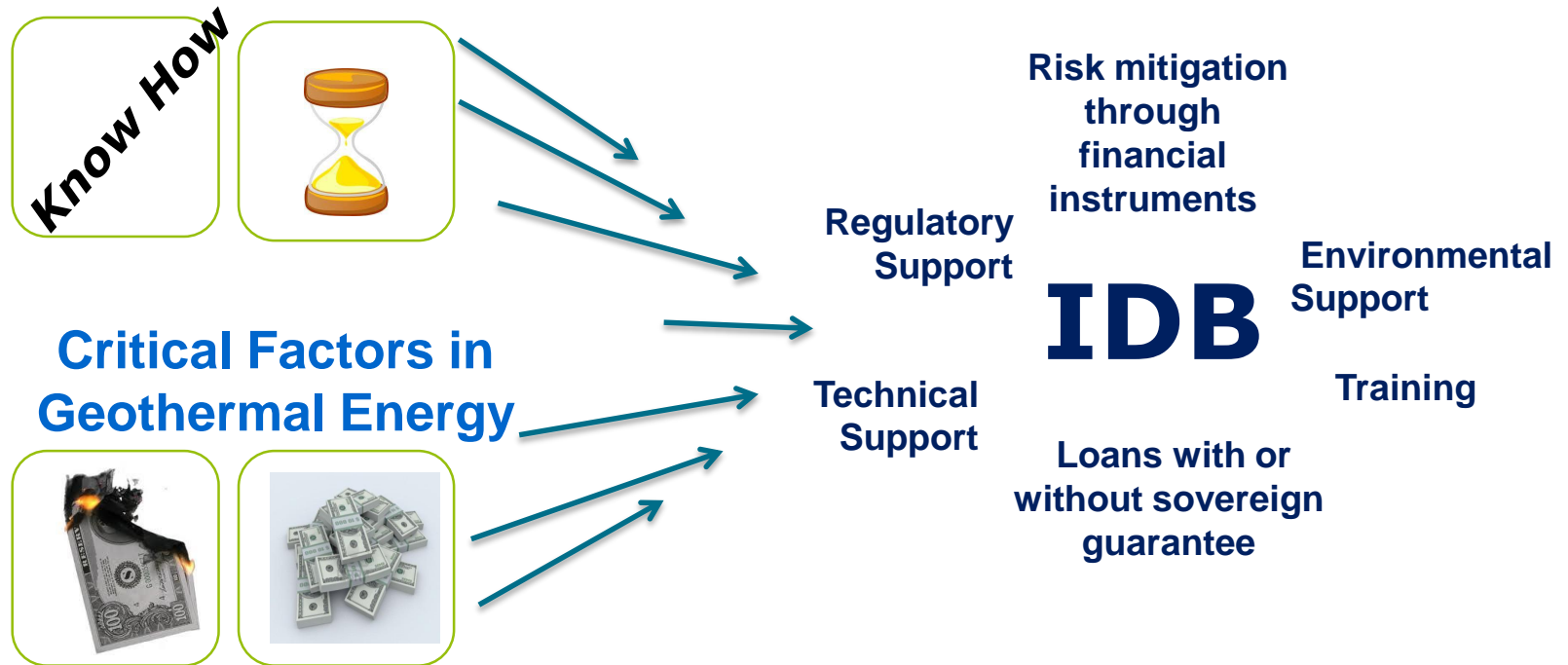


- Communicating with every institution
- With the countries

To provide different measures and solutions to different countries



# Conclusions



**Geothermal Energy** can make a **significant contribution** to **economic growth** by

- Diversifying the energy matrix
- Keeping prices under control
- Respecting the environment



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