



Country Models for Geothermal Development

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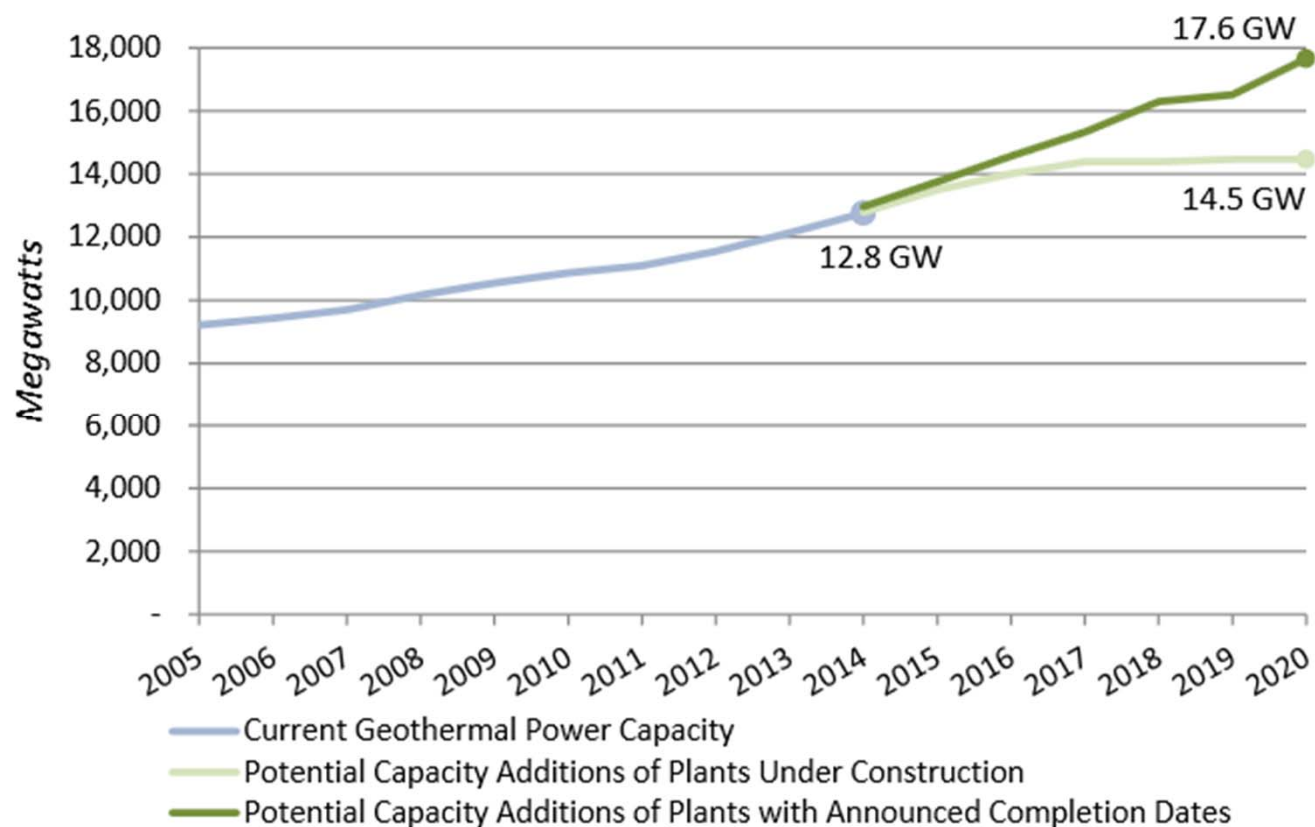
Country Models for Geothermal Development

1. What are the **financing structures and instruments** you have been working with?
2. What is the **minimum role of the government** in supporting geothermal exploration?
3. **Can the private sector perform exploration in all countries** with geothermal potential? What are the specific factors justifying a more proactive role from the government?
4. How do you **involve private actors in countries that have little track record in private participation** in the electricity sector?
5. What have been or remain the principal **challenges associated with the financing models** of geothermal power plants?
6. How do **debt finance needs change** throughout the different phases of development of the project?
7. How can the **optimal public-private geothermal development model** for a given country be identified?

- **Patrick Avato**, Program Leader, Clean Energy and Cities , Europe & Central Asia, and **Kruskaia Sierra-Escalante**, Head, Blended Climate Finance, International Financial Corporation (IFC)
- **Amanda Lonsdale**, Senior Geothermal Advisor, Power Africa
- **Enrique Nieto**, Director of Sustainable Projects, S.N.C., Mexico
- **Ariel D. Fonda**, Chief, Geothermal Energy Management Division, Department of Energy, Philippines

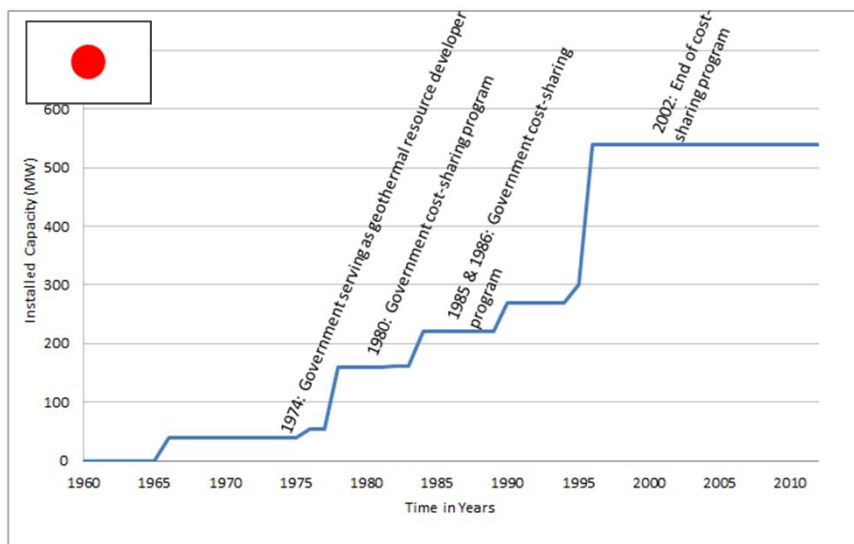
International Geothermal Development Trend: Slow and Steady

Global Geothermal Installed Capacity

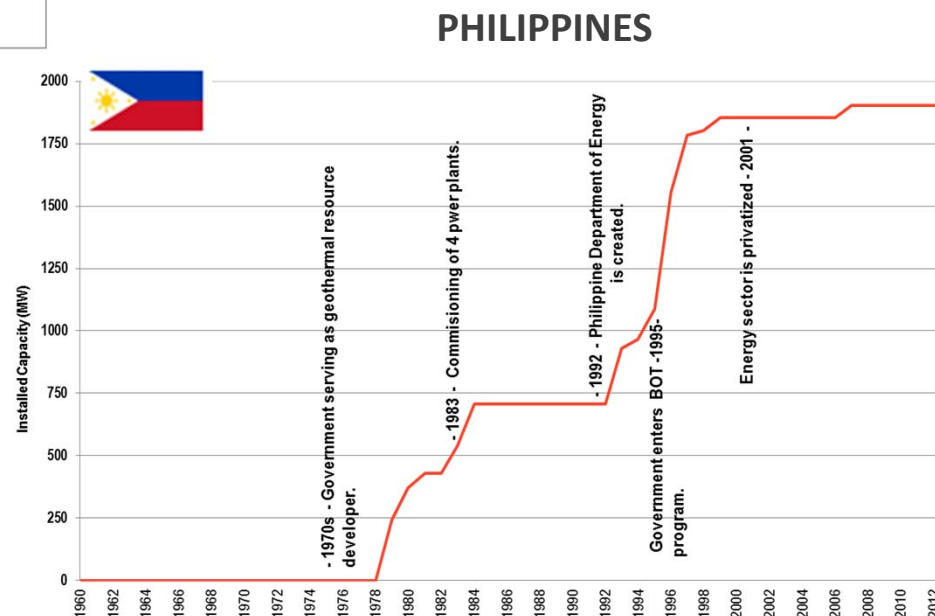


Source: Geothermal Energy Association, 2015

Geothermal Power Capacity Development in Two Countries

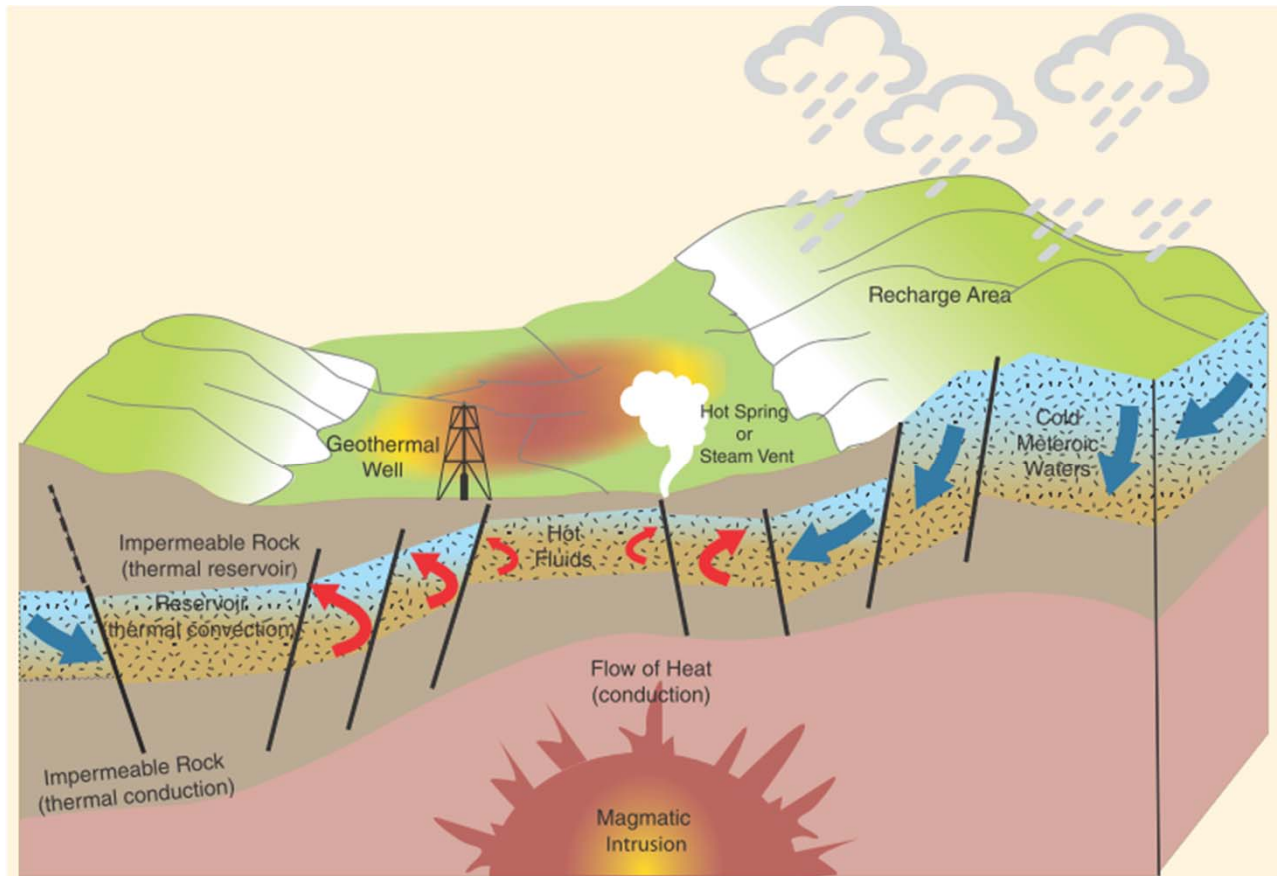


JAPAN



Source: ESMAP / World Bank, *Analysis of Risk Mitigation Strategies for Geothermal Projects*, forthcoming.

Why has the geothermal development been slow?



Not so risky

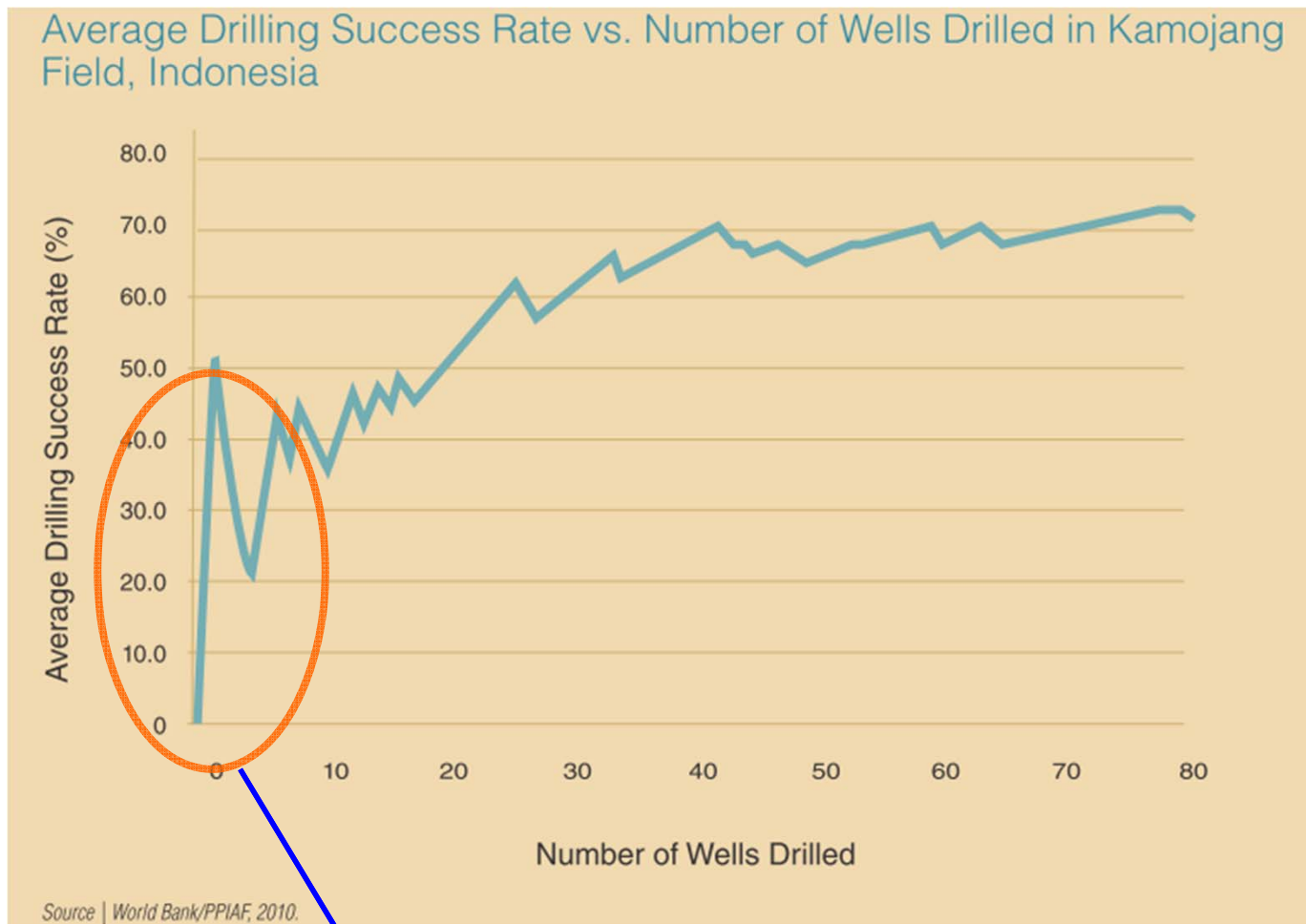
Once the steam is confirmed, the risk is close to conventional thermal power plants.

Very Risky

Unknown geology and cost of drilling make underground steam exploration very risky.

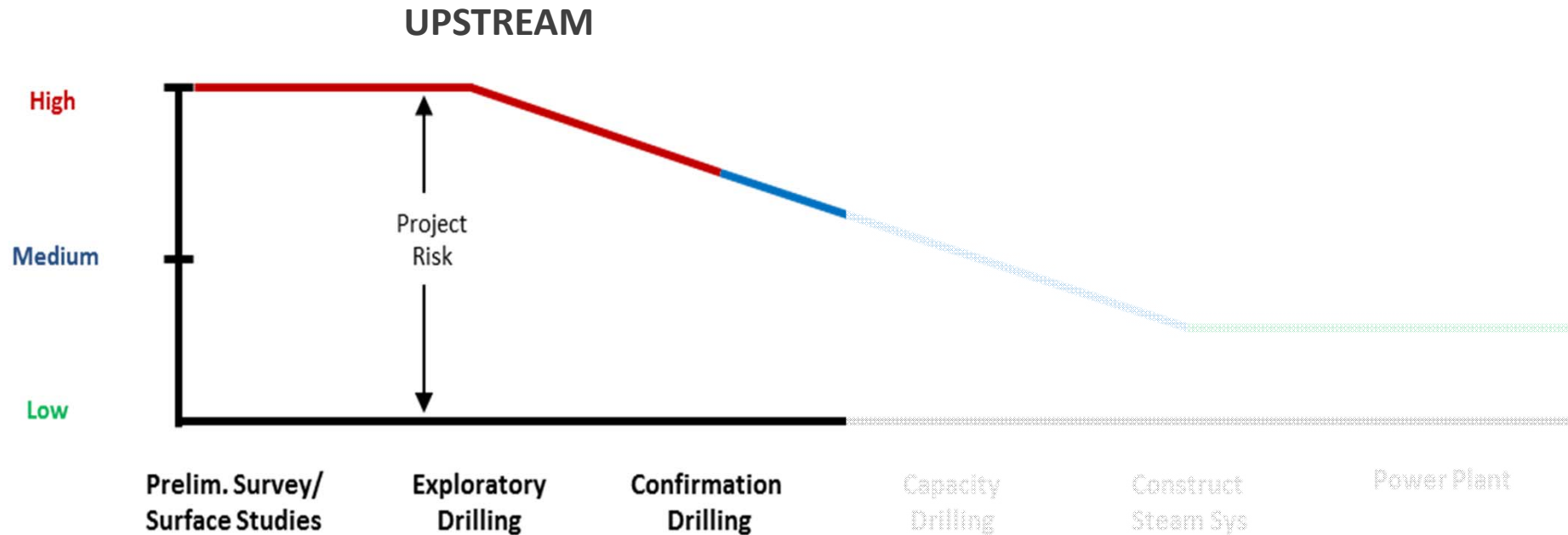
Source: ESMAP (2012) Geothermal Handbook: Planning and financing Power Generation

Drilling success rate follows the number of trials



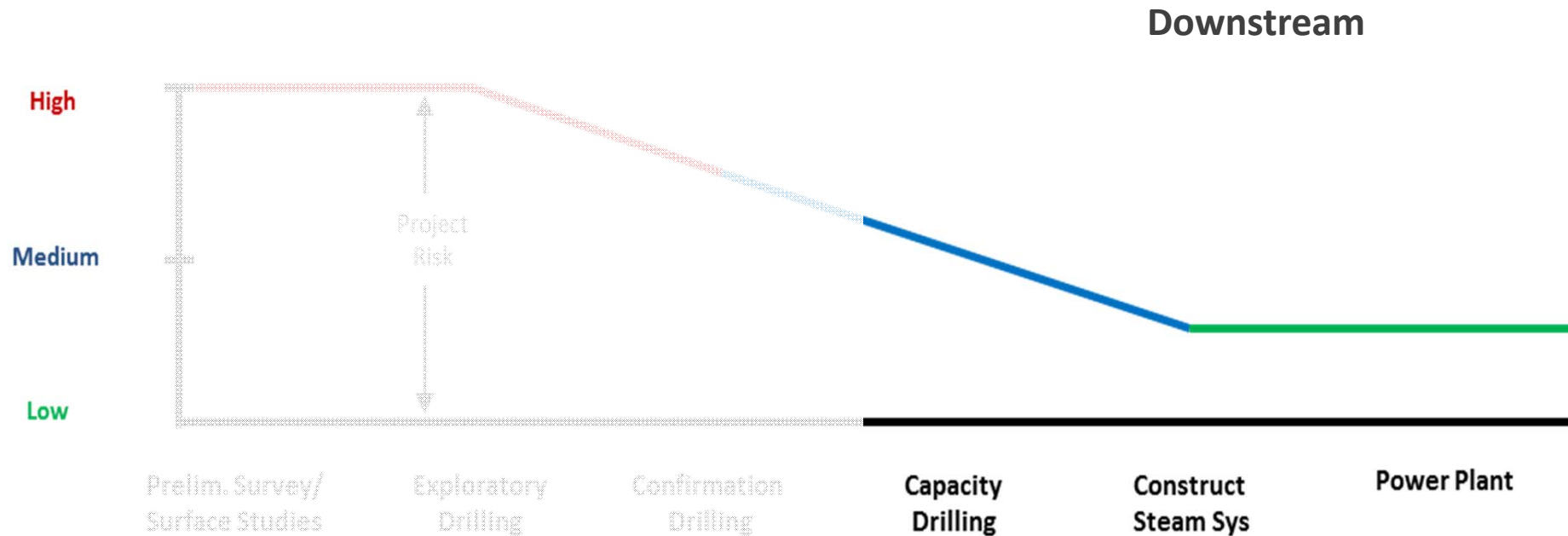
Riskiest at the beginning

Upstream geothermal development is costly and risky



- Identifying and confirming suitable geothermal resource requires costly drillings
- In particular, exploratory drillings are risky as it does not guarantee confirmation of suitable resource

Downstream geothermal development is less risky



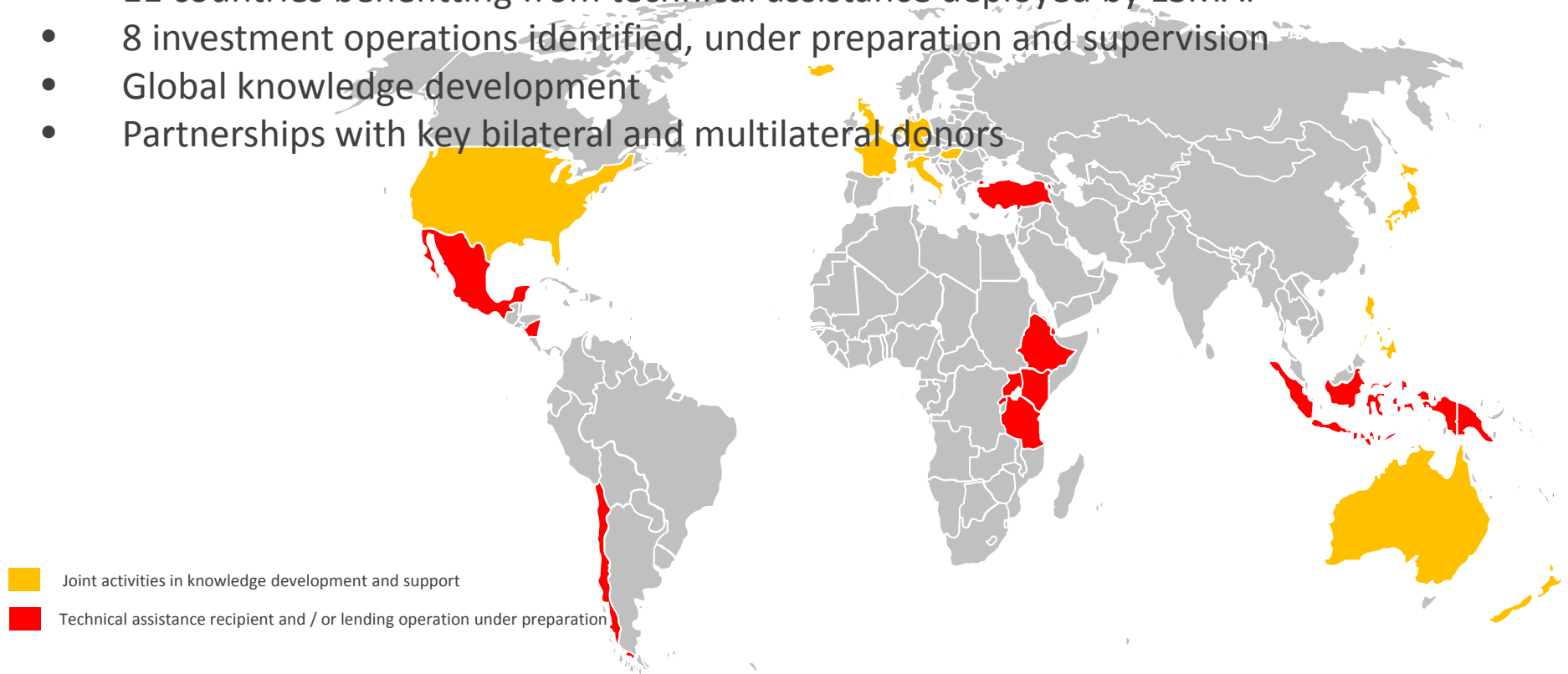
Once the availability of suitable geothermal resource and steam is confirmed, the project risk is lower and commercial financing is potentially available. Quality of investment climate key.

Availability of concessional funding critical for developing countries



Global Geothermal Development Plan

- US\$235 million raised for Clean Technology Fund
- US\$7.5 million raised for ESMAP
- 11 countries benefitting from technical assistance deployed by ESMAP
- 8 investment operations identified, under preparation and supervision
- Global knowledge development
- Partnerships with key bilateral and multilateral donors



Public support instruments critical in all countries successful in developing geothermal energy

GOVERNMENT AS DEVELOPER

Government explores and develops the resource, with limited or no private participation

Costa Rica, El Salvador, Guatemala, Nicaragua, Mexico, Indonesia, Philippines, New Zealand, Iceland, Turkey, Ethiopia, Kenya

COST-SHARED DRILLING

Government shares some portion of drilling costs and risks with private developer; or fully undertakes exploration drilling and testing of first wells

Japan, United States, Australia, Eastern Africa, Turkey

EARLY STAGE FISCAL INCENTIVES

Exemption from taxes and import duties related to exploration

United States, Mexico, Turkey, Philippines, Indonesia

SUBSIDIZED INSURANCE

Subsidized insurance premium to reduce risk exposure

Germany, efforts underway in Turkey and Mexico

Source: ESMAP / World Bank, *Analysis of Risk Mitigation Strategies for Geothermal Projects*, forthcoming.

Country Models

Vertically integrated state-owned entity

- *EEPCO Ethiopia*
- *KenGen Kenya (pre-reform)*
- *Costa Rica*

Unbundled state-owned entities vertically splitting responsibilities

- *Pertamina and PLN, Indonesia*

Municipal entities with public support

- *Iceland*
- *Turkey*

Public Developer model

Unbundled Tolling Agreements (Energy Conversion Agreement)

- *Original arrangement in Leyte, Mindanao Philippines (PNOC-EDC (toller) supplying steam to private power plant developers in BOT*
- *Zunil I, Guatemala*
- *GDC Kenya*

Integrated Joint Ventures

- *LaGeo, El Salvador*

Sequential investment

- *Turkey, Djibouti*

Public capital support to exploration (cost-share drilling)

- *Japan, United States, France*

Public Private Partnership

- *Chevron, Philippines*

Private Developer model

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Thank You.

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