



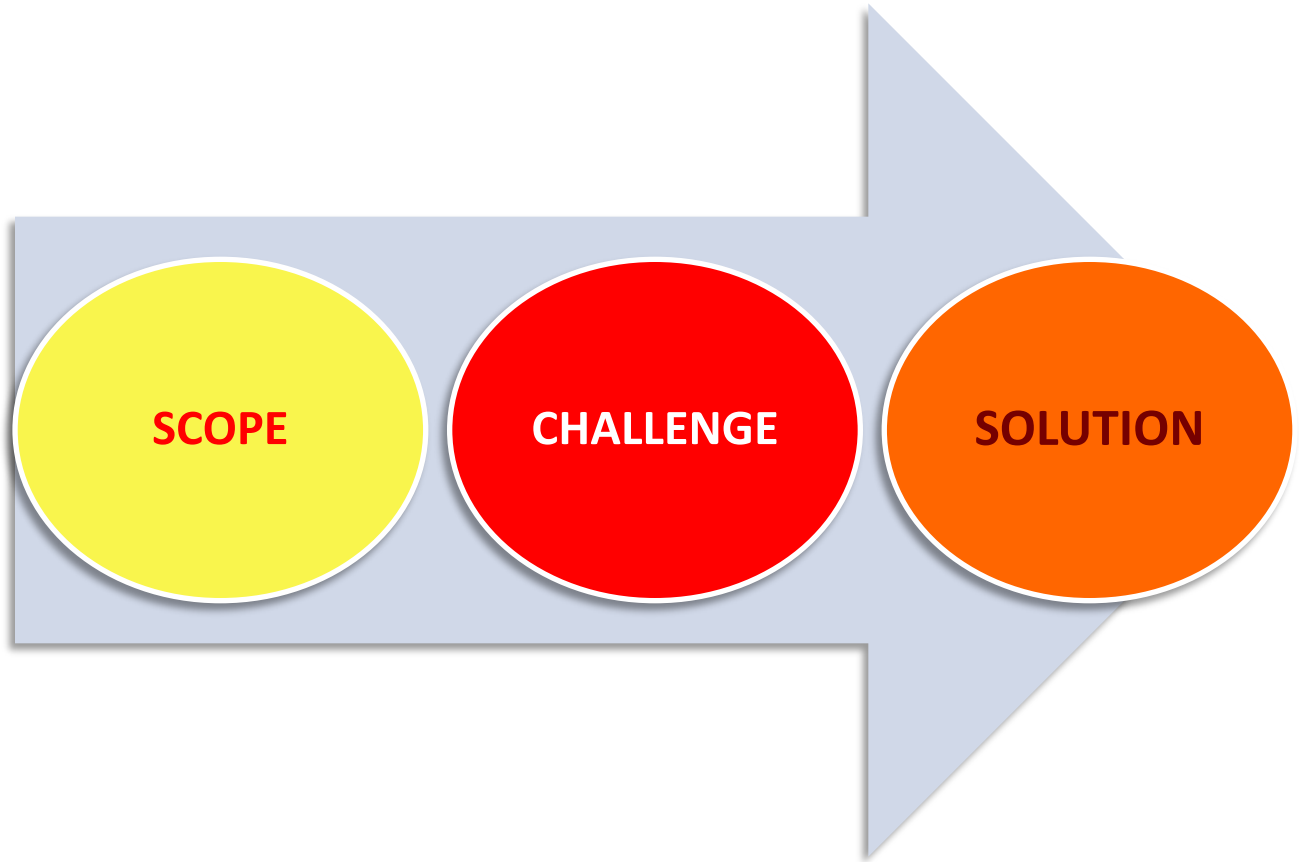
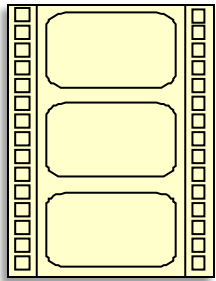
# Global Geothermal Development Plan


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Knowledge Exchange Forum with Bilateral Agencies  
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# The Global Geothermal Development Plan





**Geothermal:**  
A Global Coalition Needed for Clean,  
Reliable and Green Energy

# Geothermal (hydrothermal) is wonderful ...

- **Geothermal energy = strong energy security benefits**
  - Renewable
  - Low operational costs
  - Long lifetime
  - Dispatchable nature (24/7)
  - (often) Least cost @ US cents 8-12 per kWh
- **Geothermal energy = additional development benefits** from heating and cooling (canning, drying, etc.)
- **BUT,**
  - Long project lead time means that terms of financing tend to determine the final price outcome
  - Significant risks (resource, regulatory)
  - 11GW installed worldwide, potential much larger

## Lessons learnt



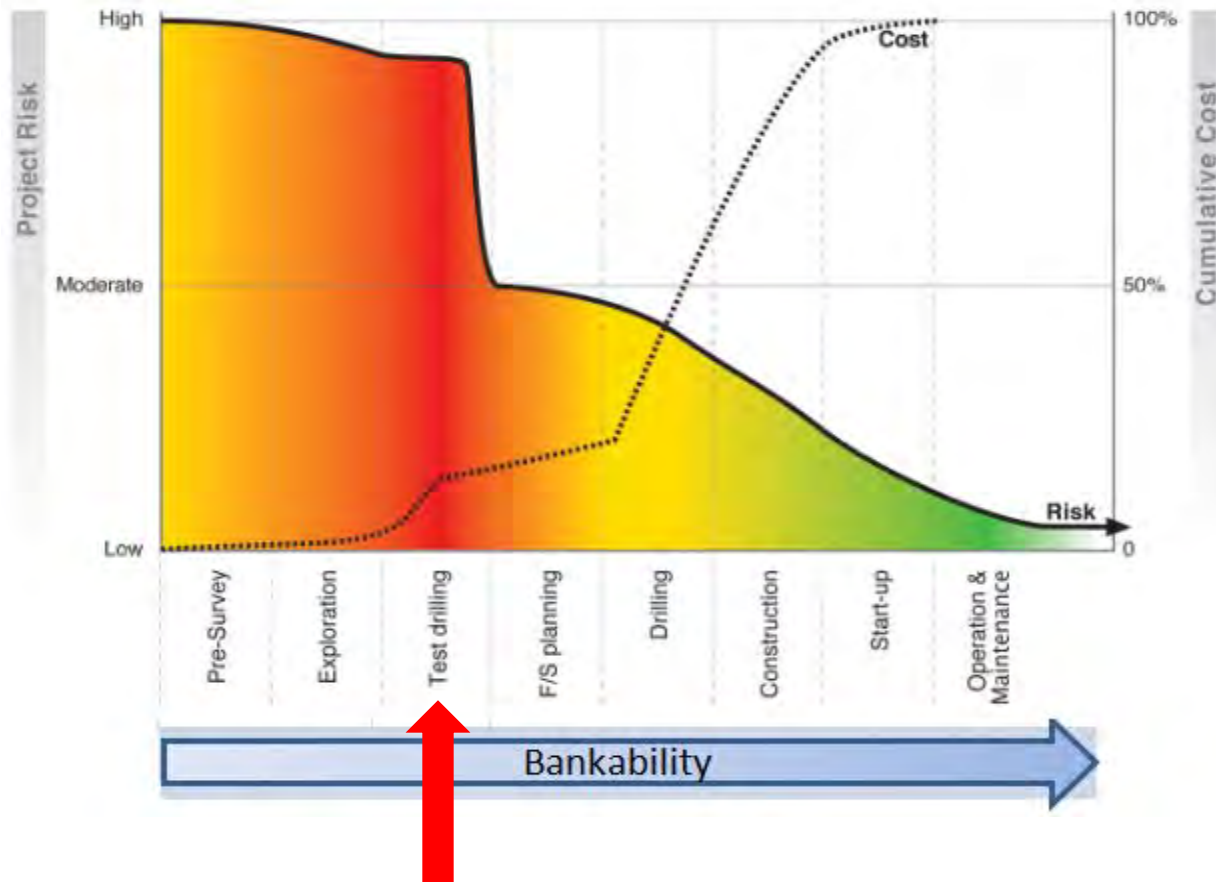
TECHNICAL REPORT 002/12

### GEOHERMAL HANDBOOK: PLANNING AND FINANCING POWER GENERATION



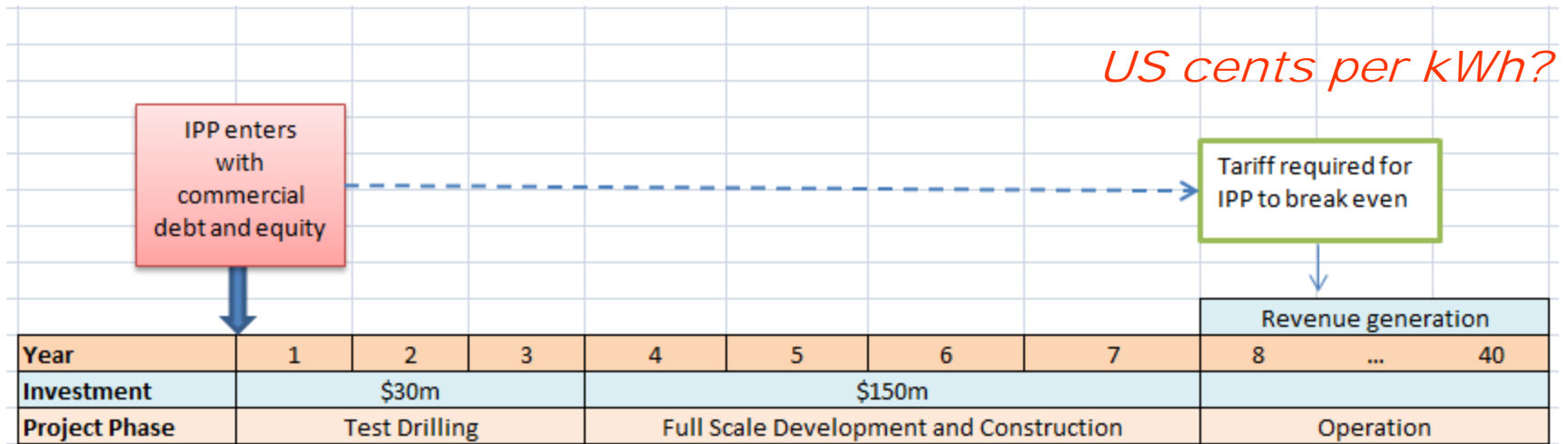
[http://www.esmap.org/esmap/Geothermal\\_Handbook](http://www.esmap.org/esmap/Geothermal_Handbook)

# Geothermal resource risk constrains scale-up



- Validating geothermal resource through test drilling is capital intensive and risky
- Commercial financing for test drilling is hard to find
- Private equity (and government support) are only capital to undertake test drilling

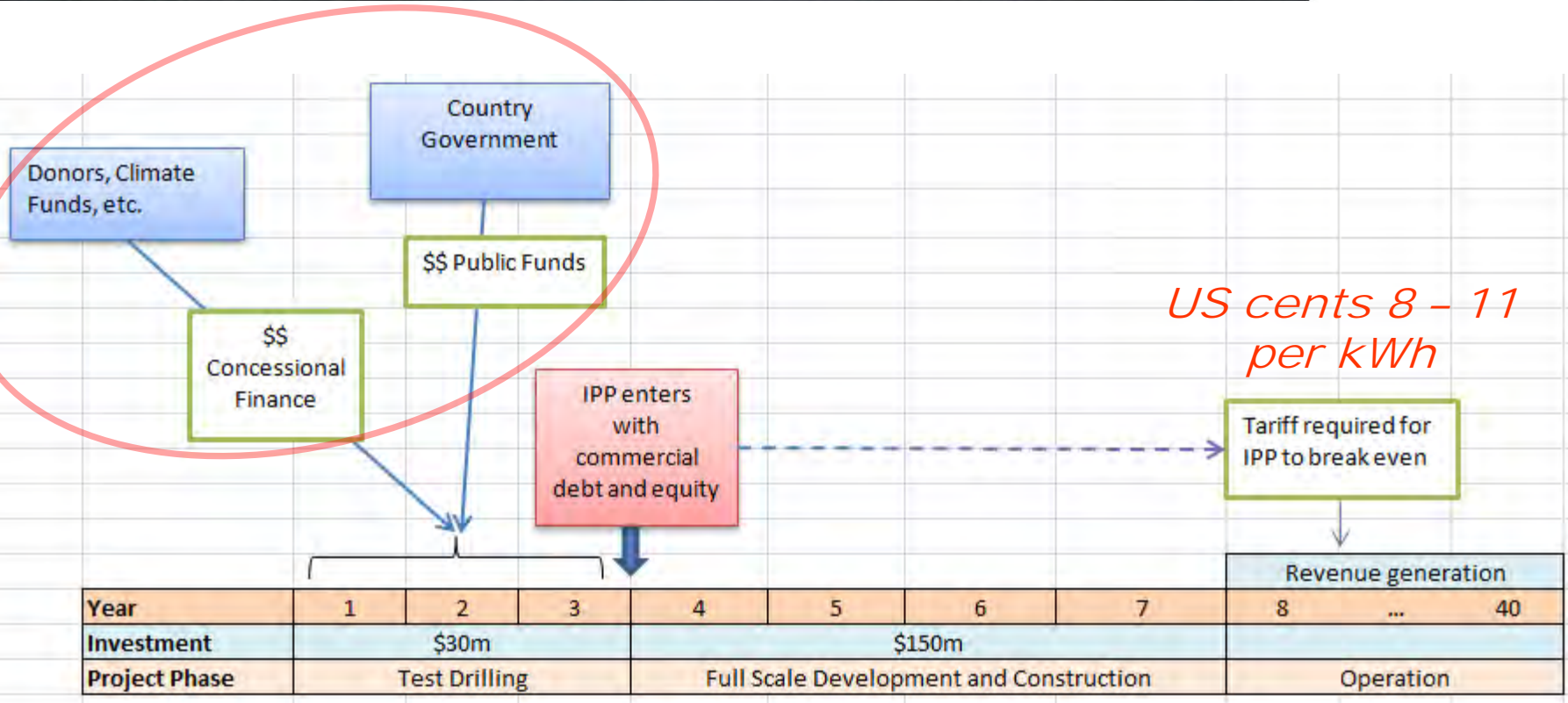
# Resource risk penalizes tariffs



Much higher levelized tariff required because:

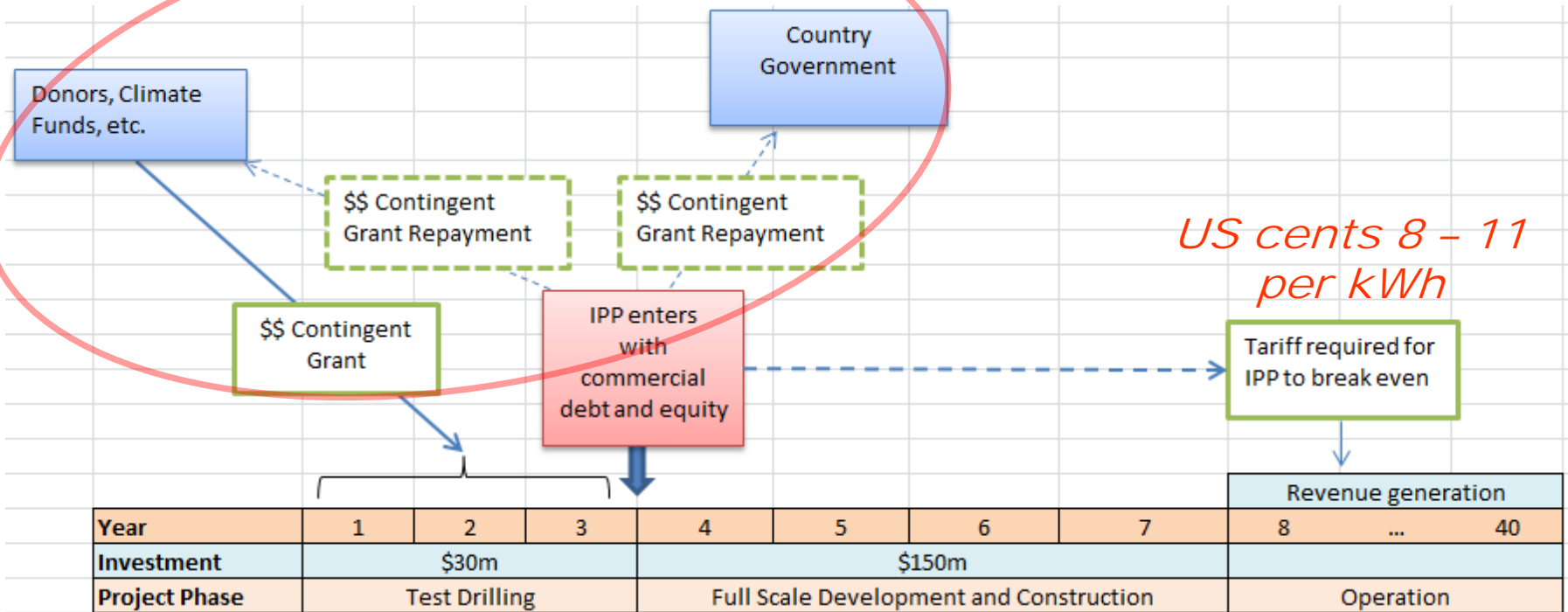
- Lead time is longer by 3 years
- Required rate of return on equity (Re) is higher (25%) due to high risk premium of early entry
- The \$30m cost of exploration (ie test drillings) is still ahead
- Result: levelized tariff **>14 US cents/kWh** (for 50 MWe power plant!)

# Scaling-up geothermal through innovative financing





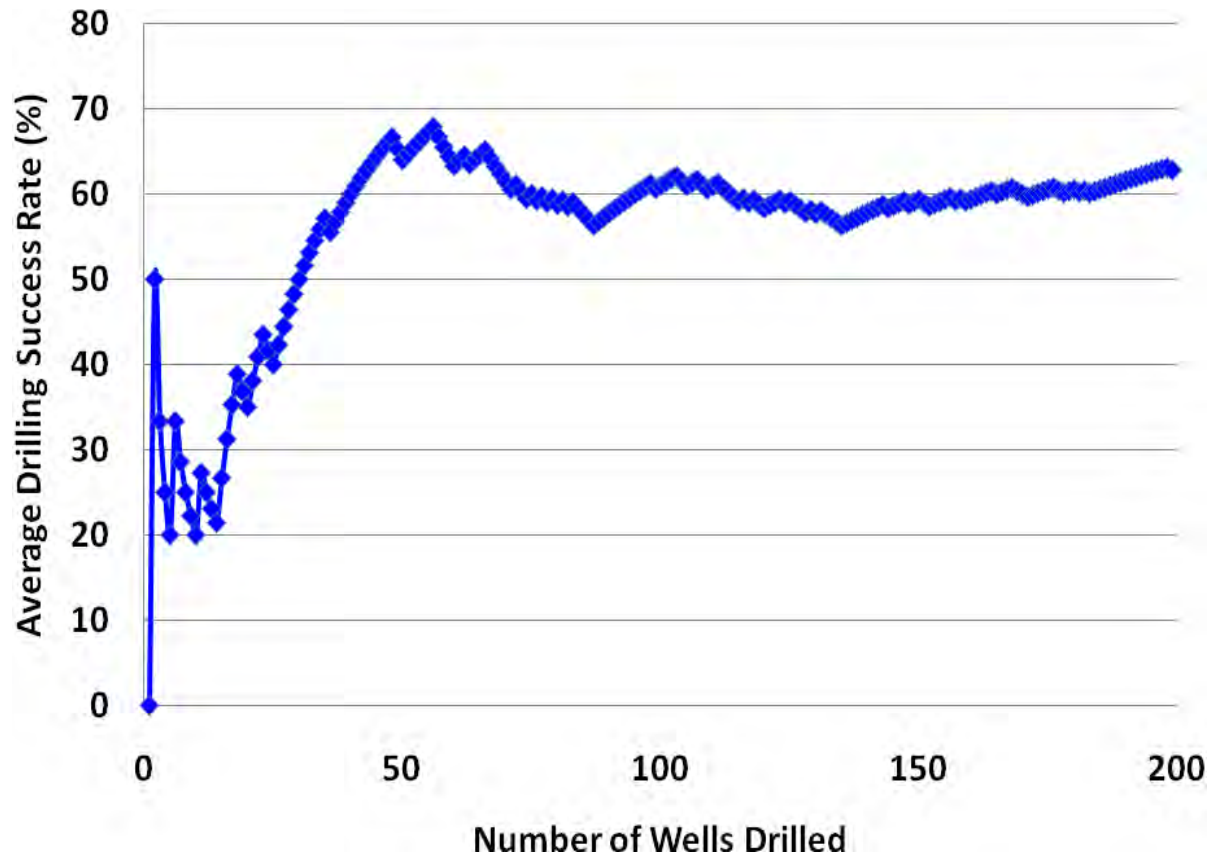
# Scaling-up geothermal through innovative financing



Required levelized tariff reduced because:

- Lead time is shorter by 3 years
- Required rate of return on equity (Re) is lower due to reduced risk
- Multi-year amortization of contingent grant / loans is possible
- Some of the exploration cost may be grant financed

# Resource risk mitigated: learning by doing



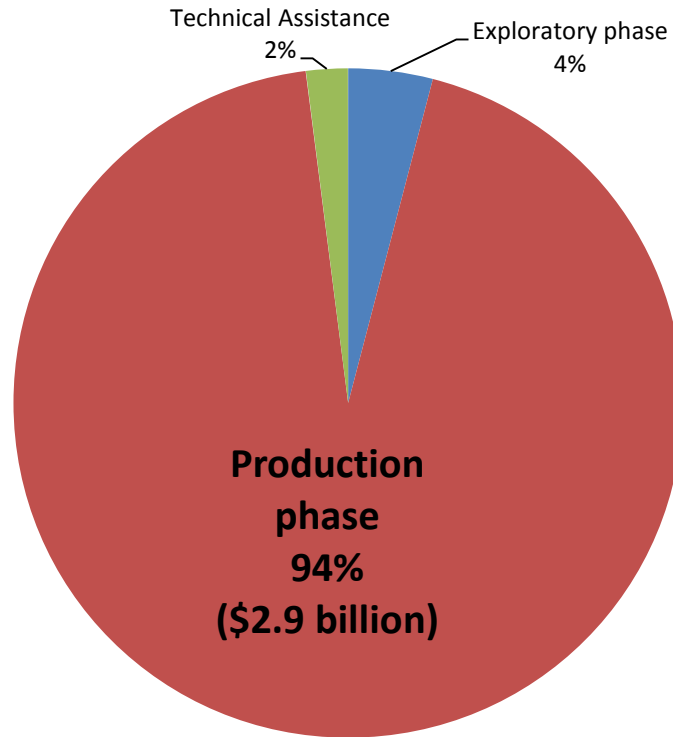
Average drilling success rate vs. number of wells drilled in Indonesia

Source: Sanyal & al. forthcoming 2012, ESMAP

# Are MDBs focusing on mitigating resource risks?

(well,... not really)

(Three Decades of Cumulative Multilateral Development Bank Lending for Geothermal Energy Development)

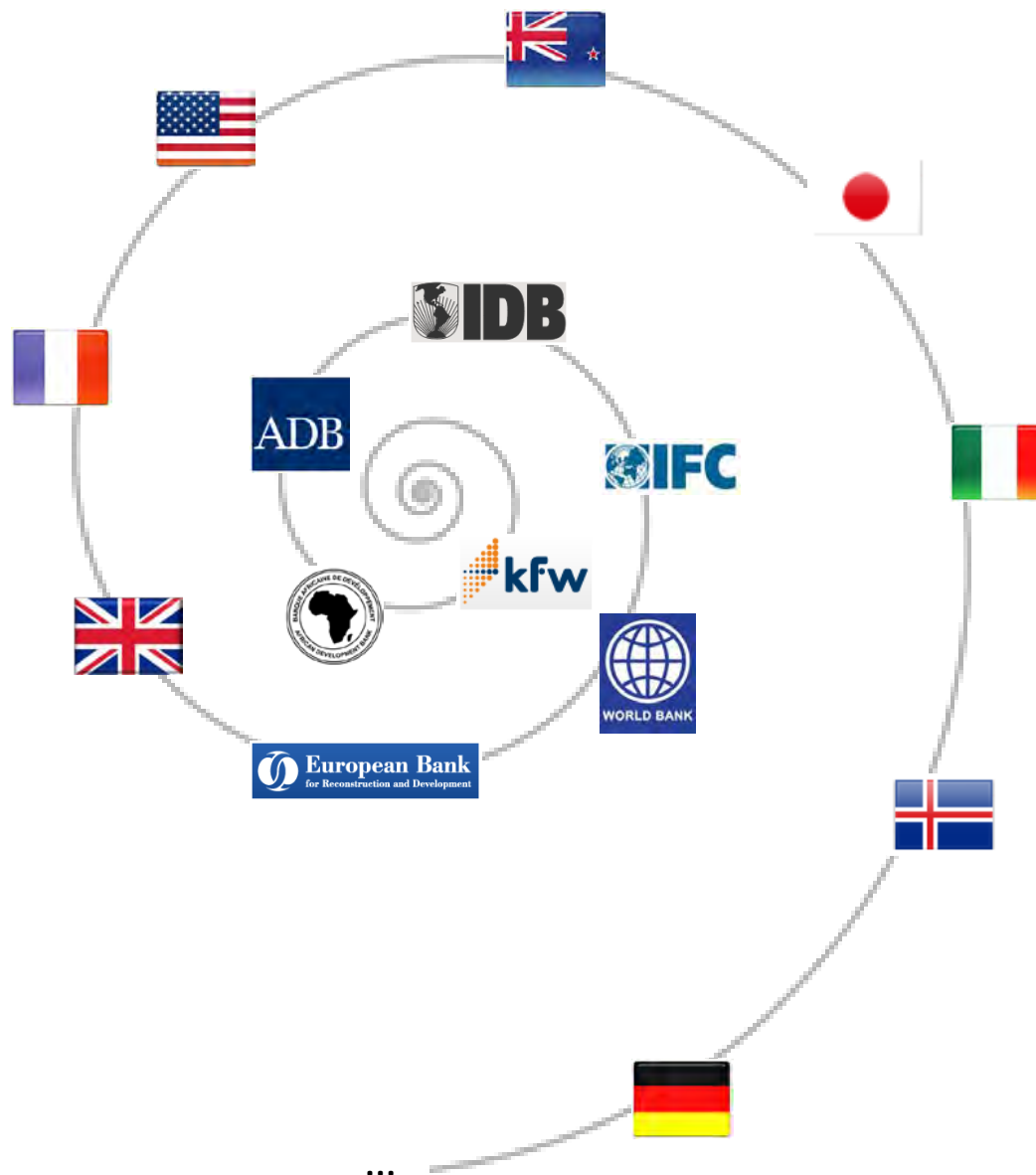


	Exploratory phase	Production phase	Technical Assistance	Total (\$ millions)
<b>World Bank</b>	117	1,544	48	<b>1,710</b>
<b>African Dev. Bank</b>	4	124	-	129
<b>Asian Dev. Bank</b>	-	554	3	557
<b>European Inv. Bank</b>	-	256	-	256
<b>Interamerican Dev. Bank</b>	3	403	11	416
<b>Total</b>	124	2,881	62	<b>3,068</b>

# Building a global coalition of funding agencies



Concept being developed in consultation with...



# Global Geothermal Development Plan (GGDP)

*Scaling-up geothermal by addressing the resource risk through sustained international effort*

**Raising \$500M**

initial 25 projects funded  
for large scale exploratory drilling activity  
(>100 wells)



## How Transformational?

- Expands reach of donors' support by diversifying risks across multiple investments
- Opens new areas for development by enabling riskier investments
- Catalyses investments in entire sector value chain by validating geothermal resources
- Triggers reduction in final costs of electricity by reducing the need for equity

# GGDP Design principles

Target resource risk to expand market for commercially viable projects

Design instruments focused on mitigating resource risk (primarily expenditures for test drilling programs and well testing activities)

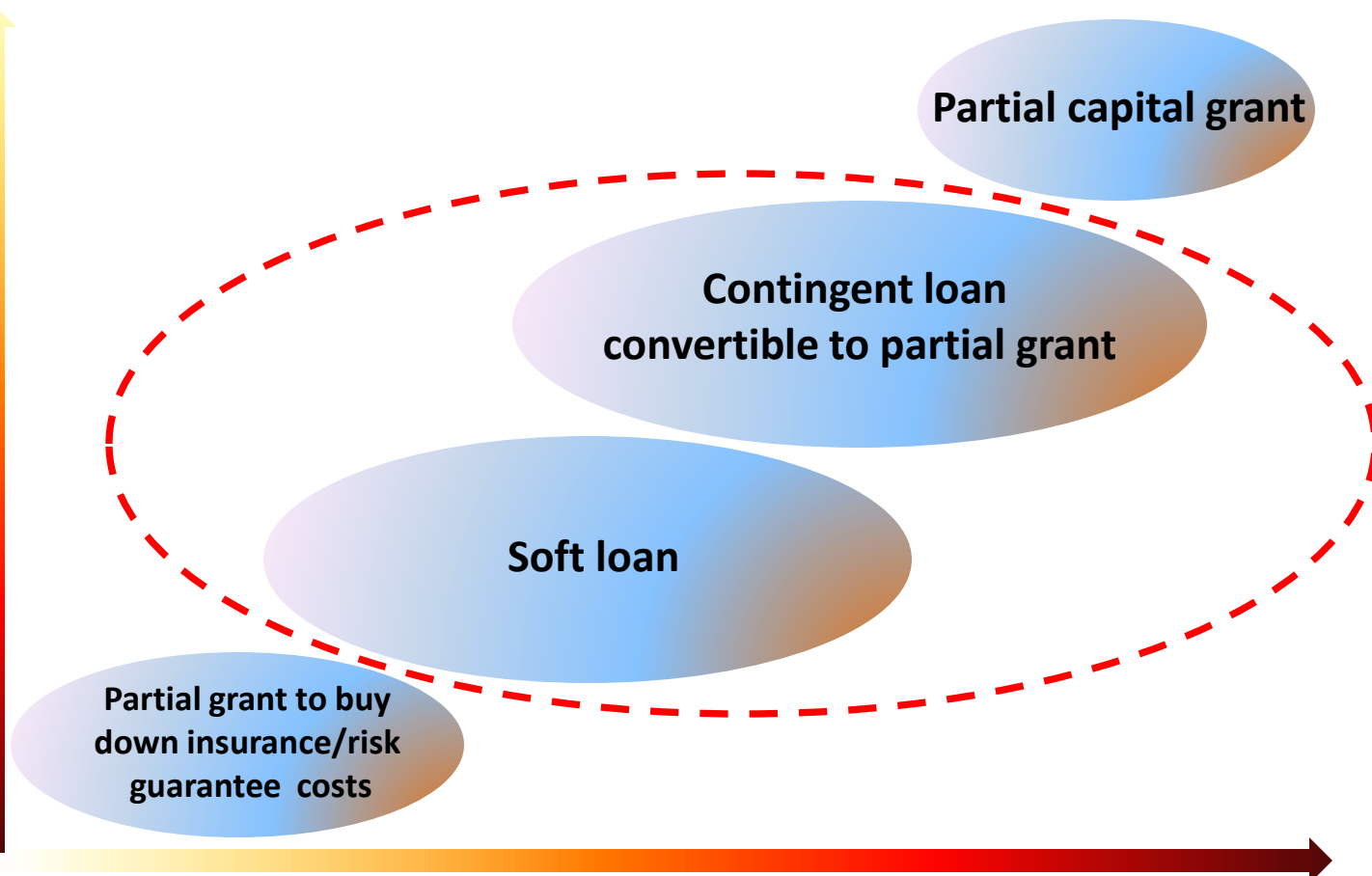
Deploy financial instruments to re-distribute resource risk between developers, donors and private sector (financiers, insurance companies, etc)

Optimize donor concessional resources by:

- Customizing the level of concessionality
- Utilizing existing MDB instruments to address other projects risks (political, credit, etc.) + MDB regular financing
- Pre-identifying a pipeline of investment-ready resource assessment projects (drilling programs) with diverse risk profiles

# GGDP Financial Instruments

*concessionnality*



**Partial capital grant**

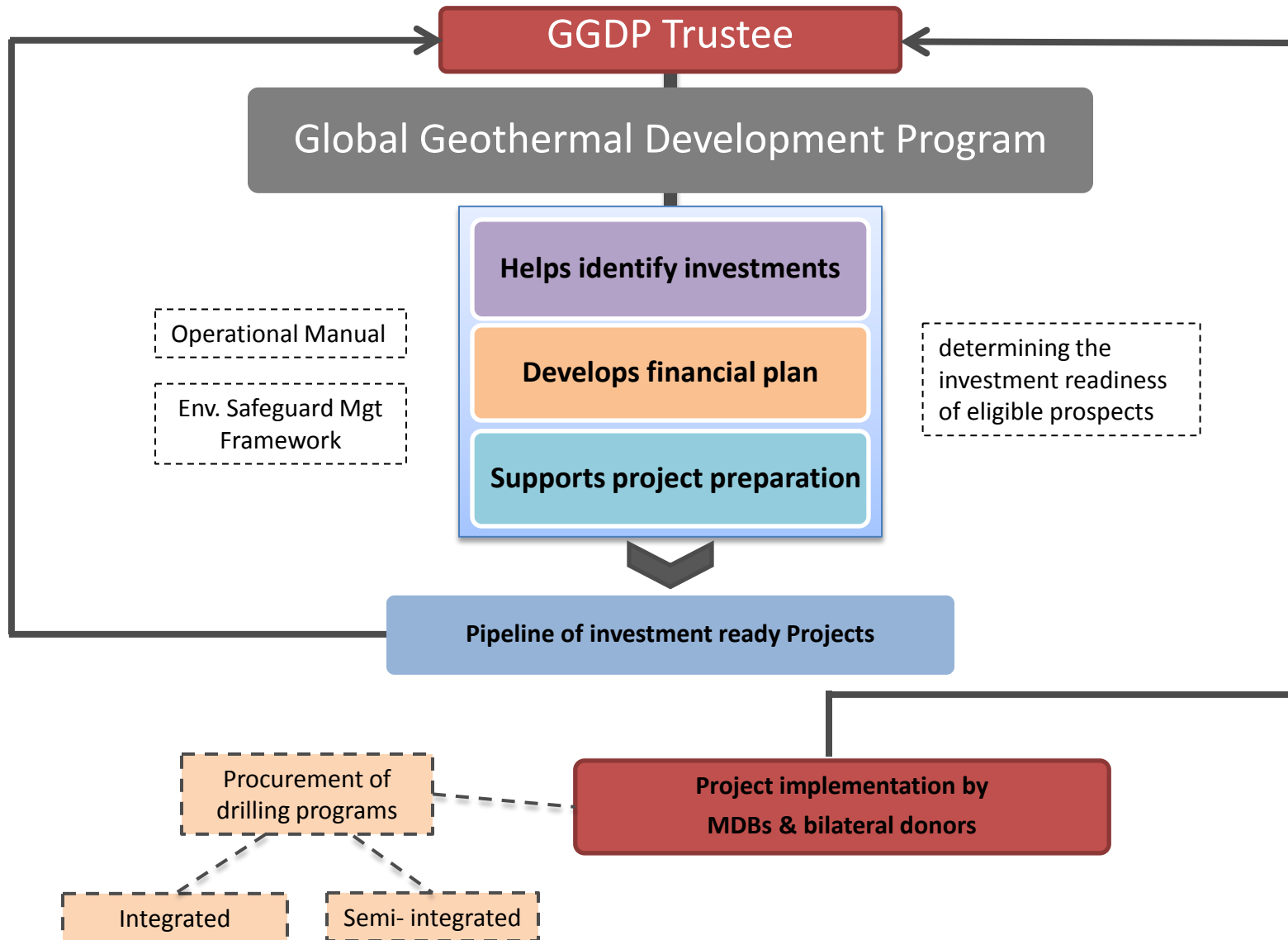
**Contingent loan convertible to partial grant**

**Soft loan**

**Partial grant to buy down insurance/risk guarantee costs**

*project total risk*

# GGDP Implementation Arrangements





# GGDP Results indicators

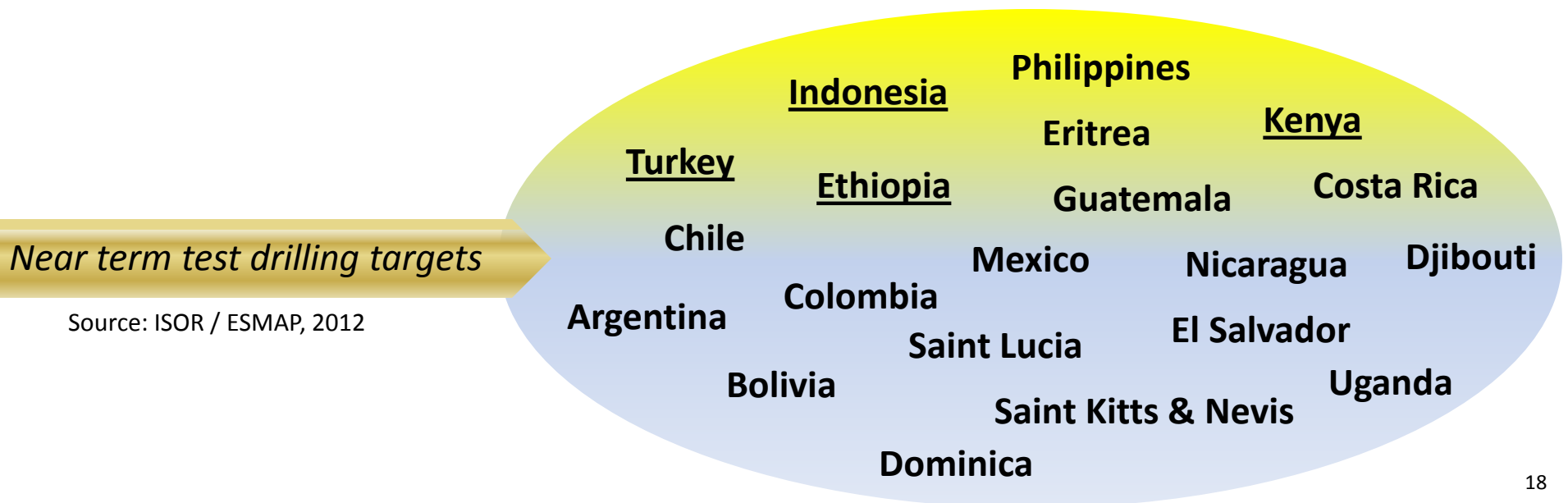
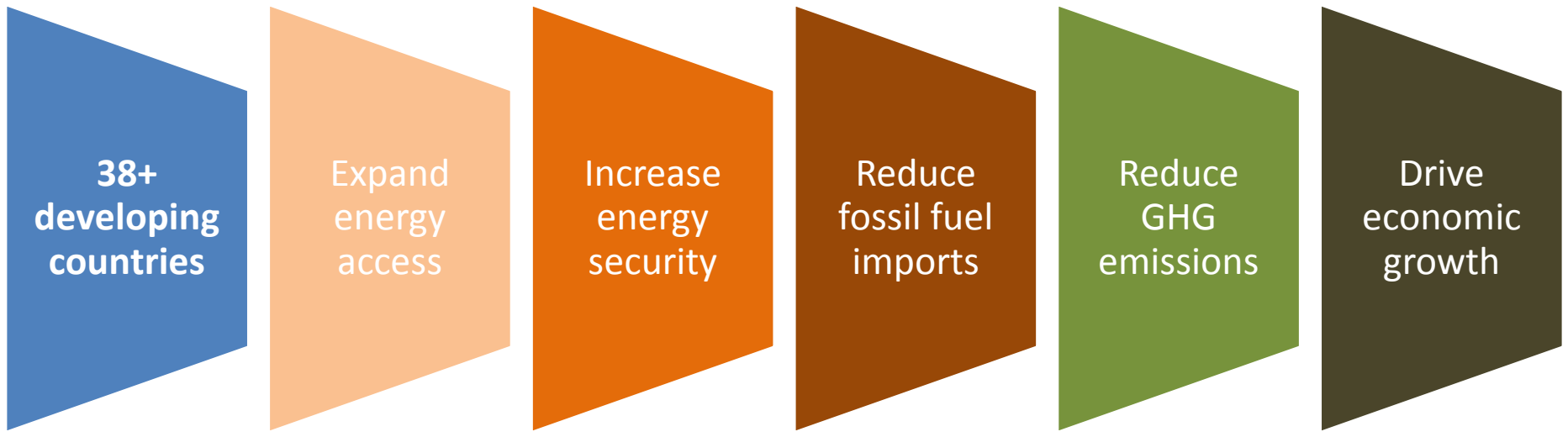
## Standard indicators for promotion of clean energy

- Tons of GHG avoided
- Leveraged capital for geothermal energy capacity development
- Reduction in levelized electricity tariff

## Geothermal resource assessment specific indicators

- Validating adequacy of resource base (commercial attractiveness of potential, MW)
- Validating adequacy of well productivity (>2-3MW)
- Validating acceptable levels of drilling cost per well (function of depth, size)
- Validating benign nature of fluid chemistry

# GGDP: country scope for a significant share of supply?





You are invited to join  
the preparation of the  
**Global Geothermal Development Plan**

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