

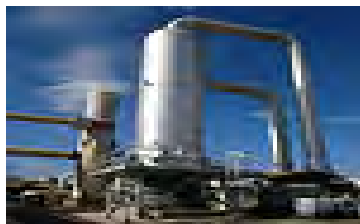


# Private Financing of Geothermal Development IFC's Global Experience

Global Geothermal Development Plan (GGDP) Roundtable  
November 19-20, 2013  
The Hague, Netherlands

# IFC's Geothermal Track-Record

IFC has invested in.....



- Six Transactions;
- 1,300MW in total;
- US\$400 million in
  - Equity
  - A&B Loans, etc.
  - Subordinated Loan,
  - Corporate-loan
  - Project-Finance Loan

# IFC's Geothermal Track-Record

## Power vs Geothermal

	Power	Geothermal	% Geothermal
# of Transactions	300	6	2%
MW invested	30,000	1,300	4%
US\$ billion <sup>*1</sup>	\$ 17.4	\$ 0.4	2%

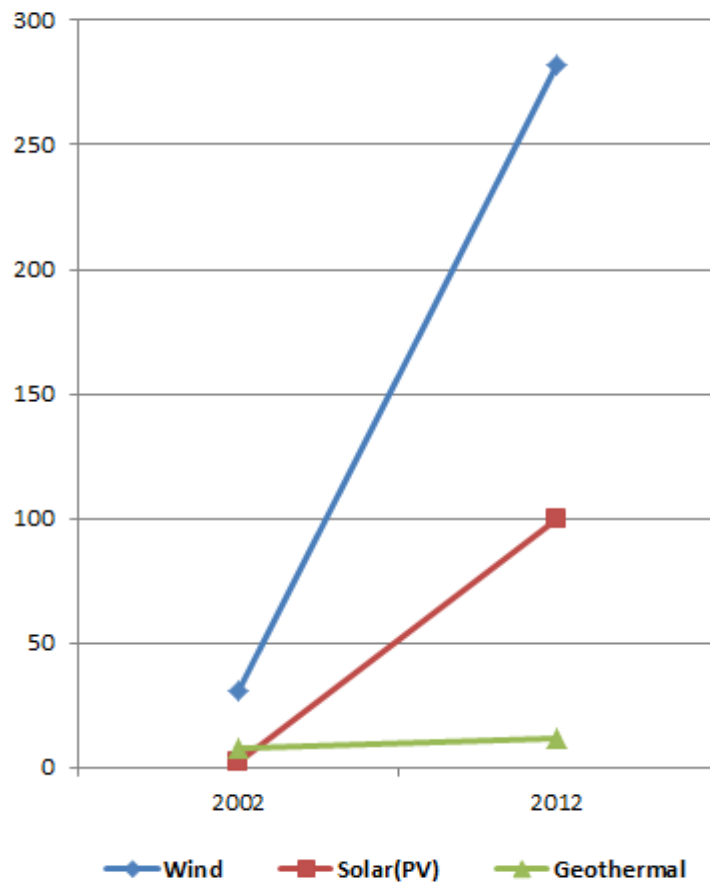
<sup>\*1</sup>: IFC's own and mobilized

IFC's Cumulative Power Commitments <sup>*1</sup>	
Hydro	17%
Wind	8%
Solar	4%
Geothermal	3%
Renewable Total	32%

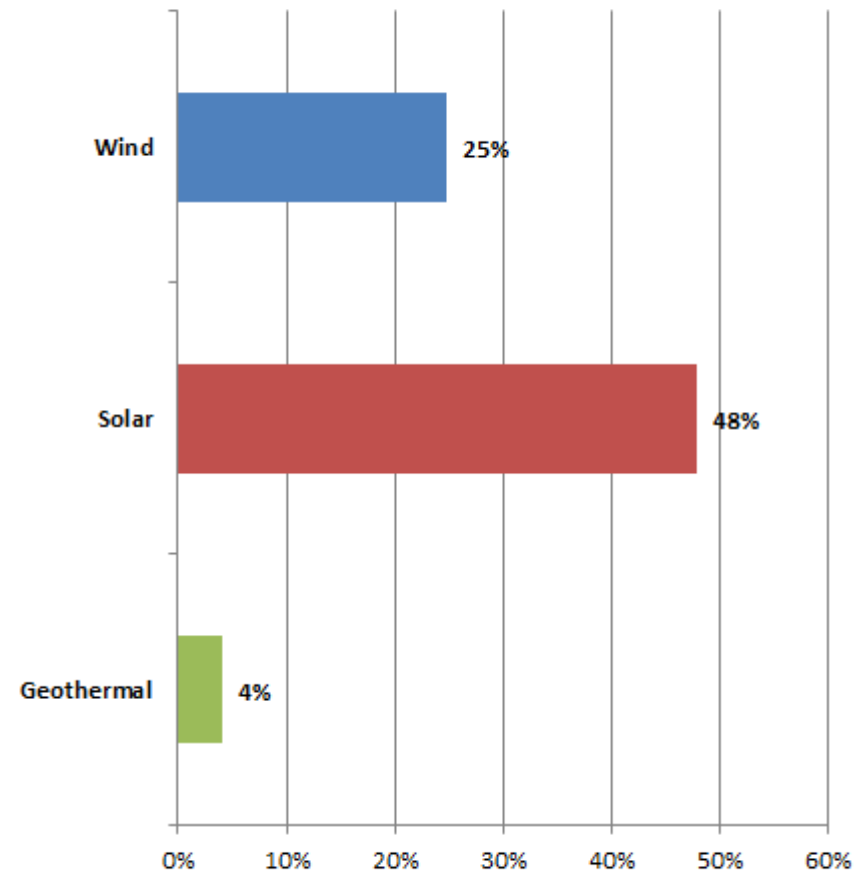
<sup>\*1</sup>: IFC's own account only, excluding IFC mobilization, in terms of US\$ invested

# Geothermal vs Wind and Solar

**GW Installed (2002 vs 2012)**



**CAGR(%) 2002-2012**



## Geothermal Challenge

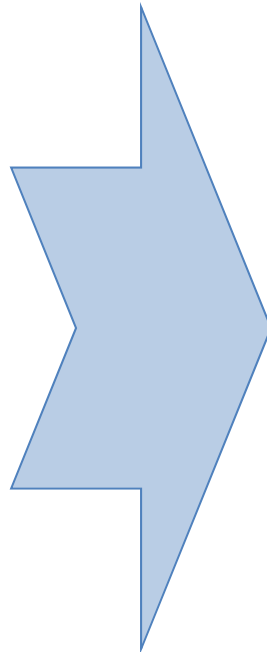
“Geothermal energy is a **low-carbon, reliable, renewable energy source** that has been in use for over 100 years”.

“Despite its **comparatively low cost relative to other power sources**, the uneven distribution of easily tapped geothermal resources around the world, combined with **high upfront costs** and **the risks attached to locating it**, have so far prevented the wider adoption of this high-potential power source”

From “Success of Geothermal Wells: A Global Study” by IFC, June, 2013

# “Geothermal Challenge”

From “Hollywood” Glamor..



To happy “family” relationships





# Resource Risk - Real or Imaginary?

## High Upfront Costs?

"Geothermal drilling is **more expensive (in cost/depth) than on-shore oil and gas drilling** (*because the harsher drilling conditions - heat and pressure, larger diameters required, and heterogeneous*)"<sup>\*1</sup>

"Drilling costs comprise some **35-40** percent of the total capital costs of a geothermal project most of which will be incurred in determining the size, location, and power capacity of the geothermal resource" <sup>\*2</sup>

## the risks attached to locating it?

"Overall, ...**78 percent** of wells drilled were successful....based on a survey of 2,613 wells drilled over the past four decades, accounting for about 71% of the Global Geothermal Capacity" <sup>\*2</sup>

".. the first well drilled in a field appears to average **50 percent**, ...the first five wells drilled is **59 percent**. This rises to **74 percent** during the Development Phase, to **83 percent** during the Operation Phase" <sup>\*2</sup>

<sup>\*1</sup>: From "Handbook of Best Practices for Geothermal Drilling" by John Finger and Doug Blankenship (except for italics in bracket), December 2010

<sup>\*2</sup>: "Success of Geothermal Wells: A Global Study, June 2013

## Resource Risk - Real or Imaginary?

“Effectively, a well’s success should be determined on the basis of **its return on investment (ROI)**: however, since the database on which **this report is based does not include cost data this has not been directly considered in determining well success**”<sup>\*1</sup>

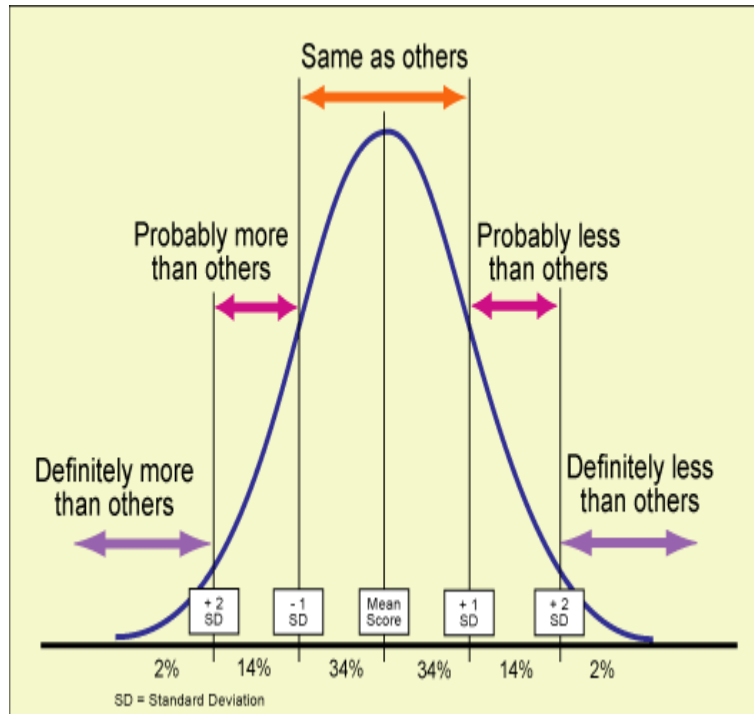


<sup>\*1</sup>: “Success of Geothermal Wells: A Global Study, June 2013



# Risk - what is Risk?

## Probability..



(Equity) Investor's Mind-Set ?

## And Possible Reality...

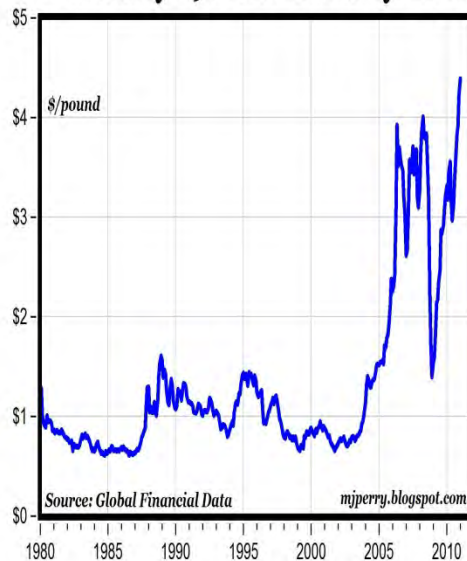


Banker's Mind-Set ?

# Upside Potential?

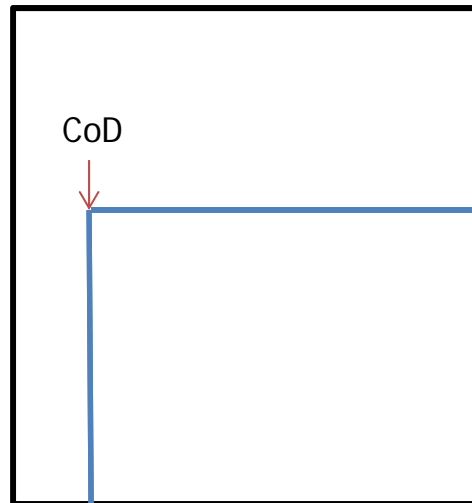
**Upside ?**

**High Grade Copper Prices  
January 1980 to January 2011**



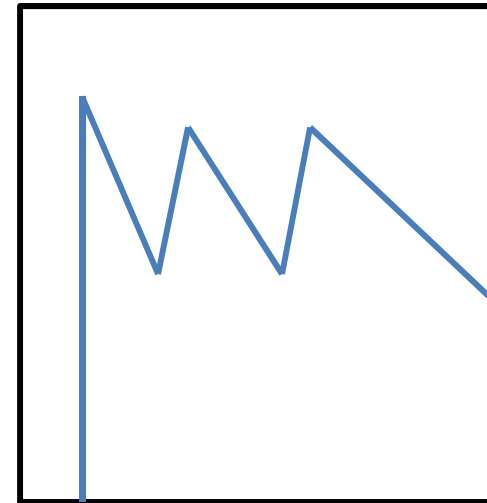
**Upside ??**

**Projected Revenue Thermal  
IPP under ECA<sup>\*1</sup>**



**Upside ????**

**Projected Revenue Geothermal  
IPP<sup>\*2</sup>**



<sup>\*1</sup>: Energy Conversion Agreement ("ECA")

<sup>\*2</sup>: Under "take-and-pay" with a must dispatch or "take-and-pay" with full-dispatch but LD for below threshold generation

## So What can an IFI do ?

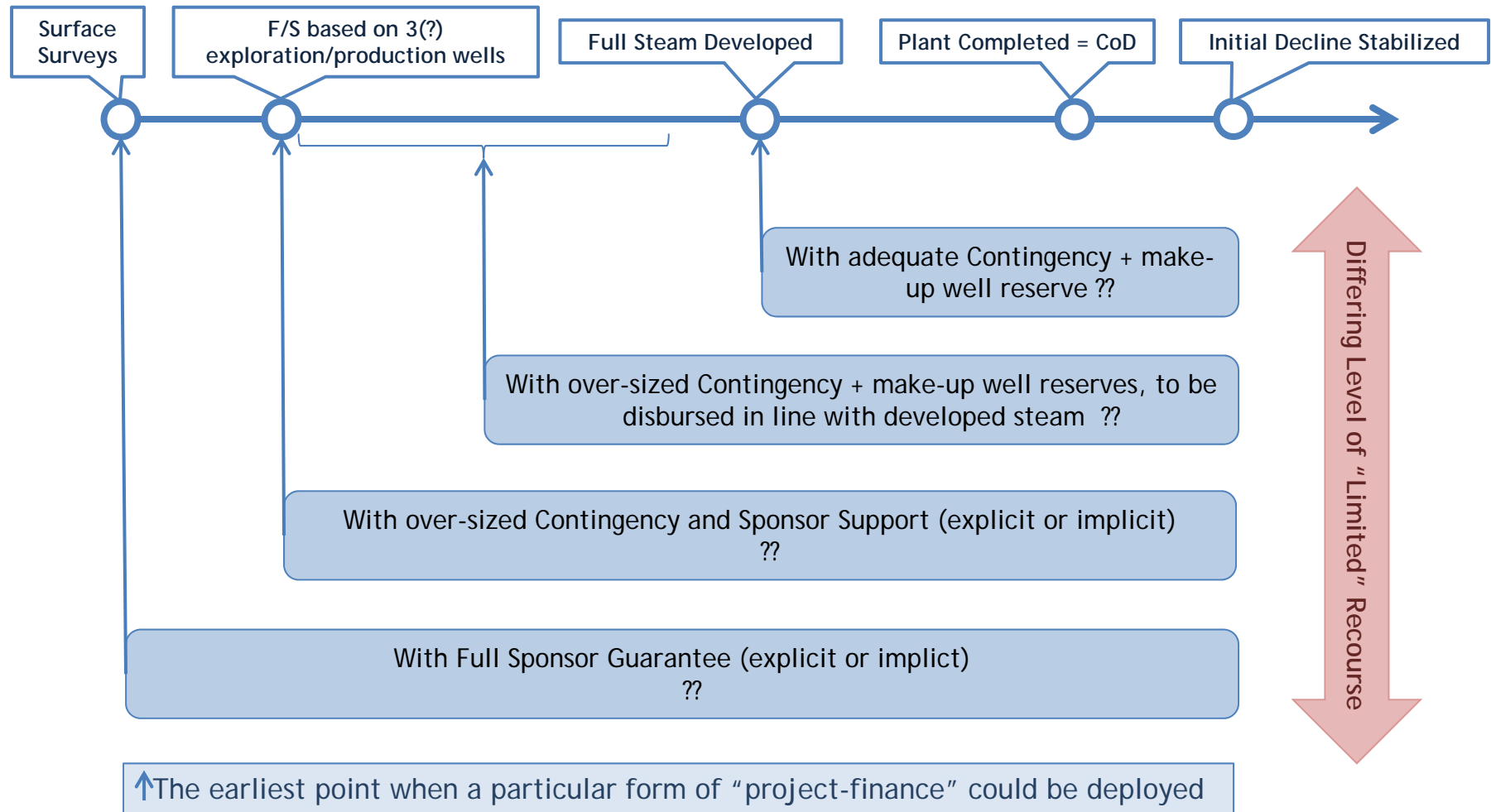


# IFC



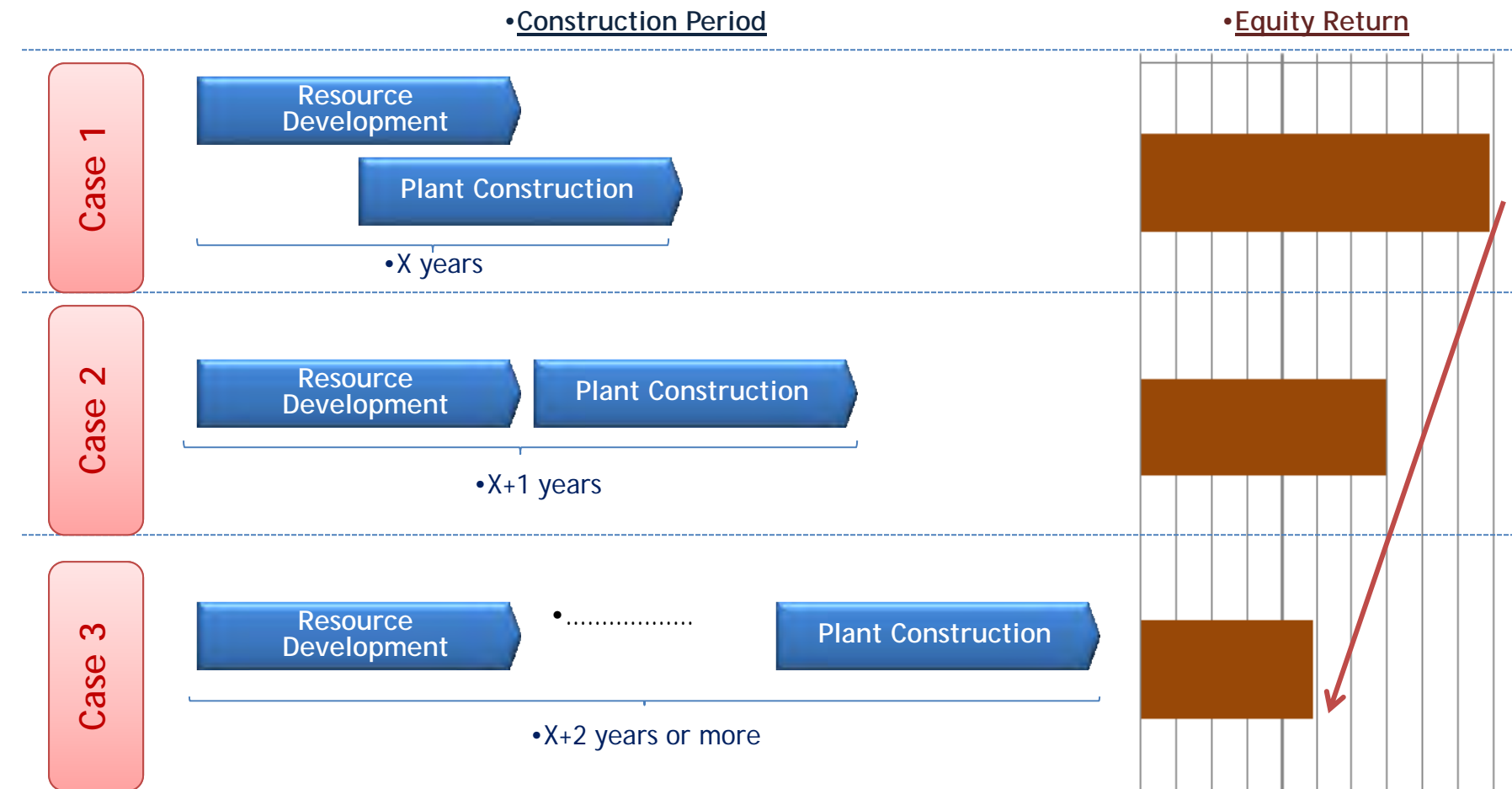


# Project Finance - "Limited" Recourse?





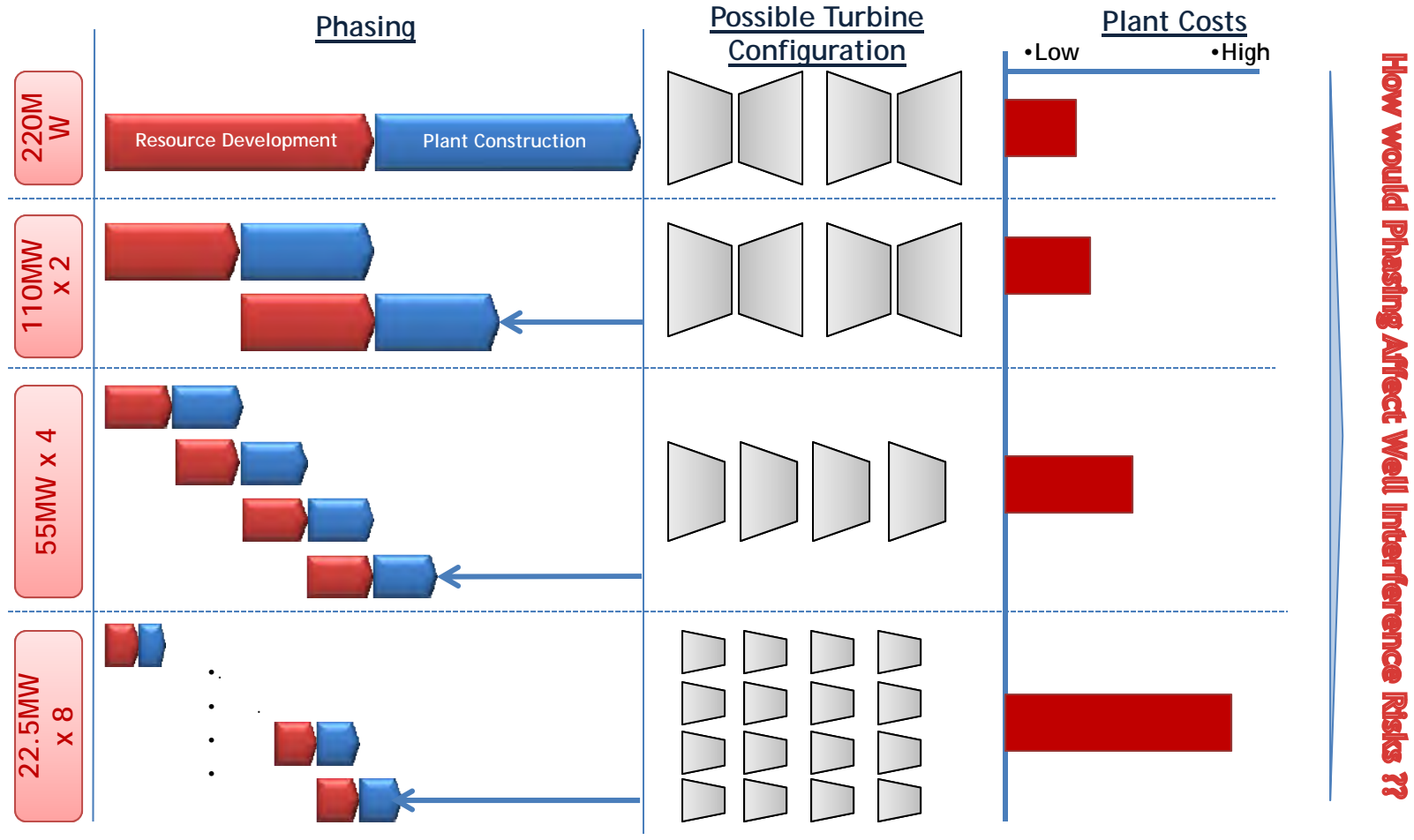
# Project Finance - All about Timing ?







# Project Finance - Phasing?

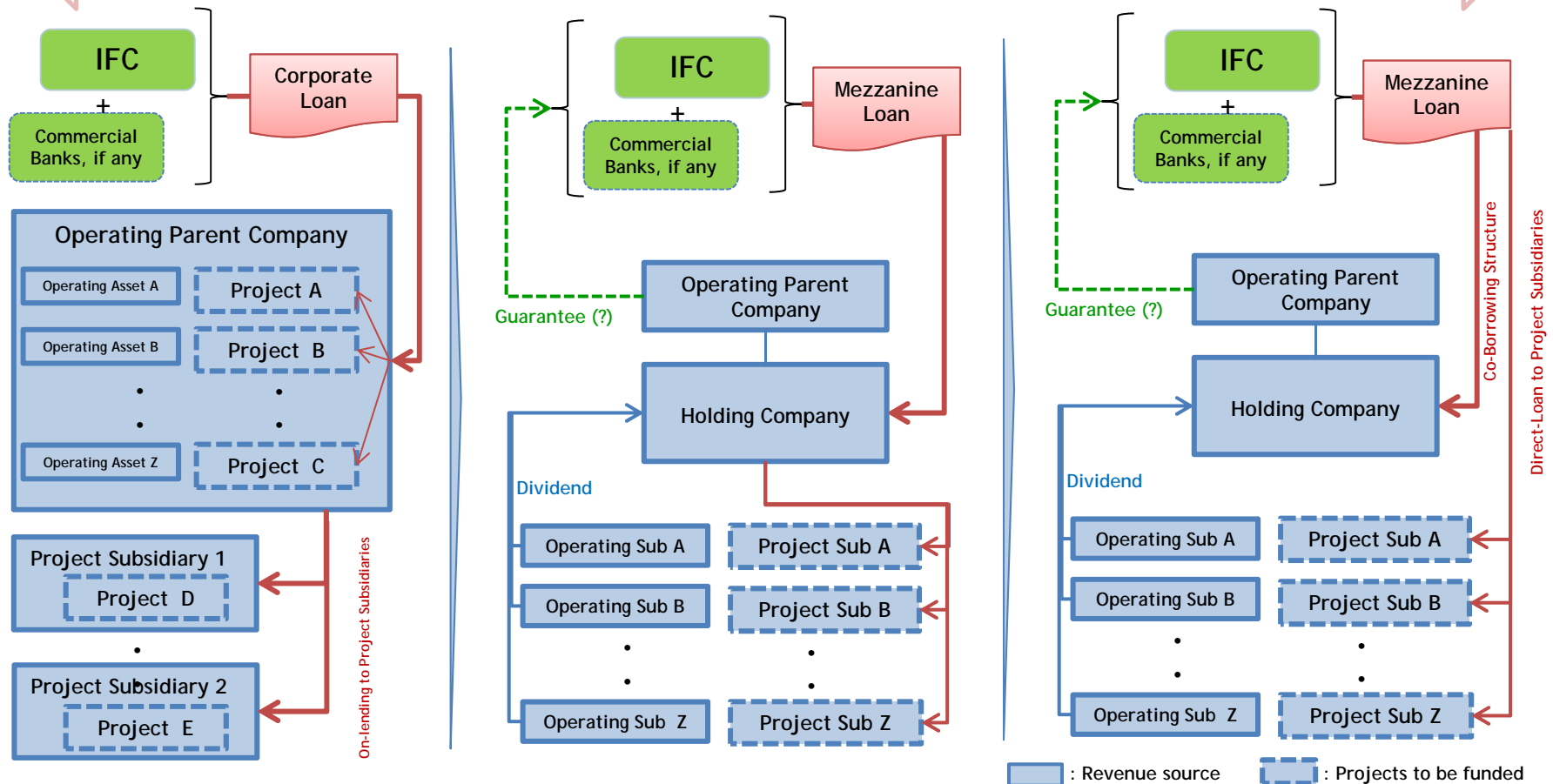


**Would Phasing Help Compress Total Construction Period??**



# Corporate Finance - Hybrid Structure ?

From Pure "Corporate" to "Mezzanine Hybrid" ??

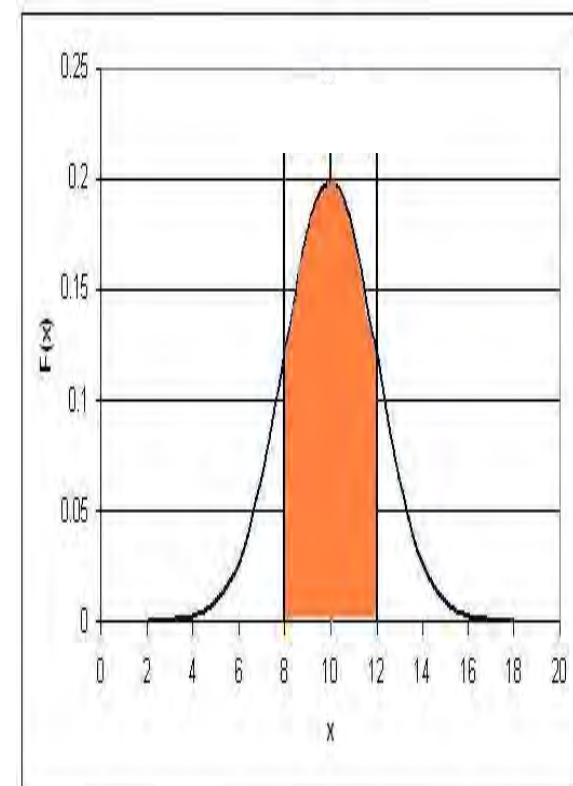
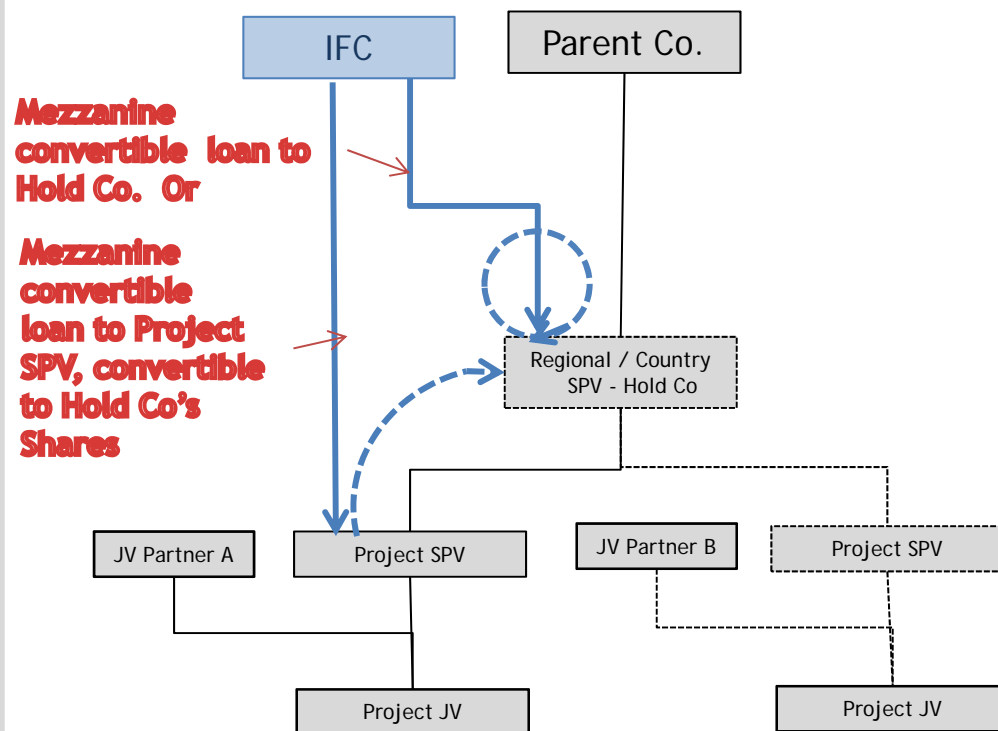




# Equity / Mezzanine Financing

Mezzanine Convertible Instruments to..

Mitigate Downside Risk (and forego some upside potential ?? .





# Exploration Funding Support + Insurance

Insured Event

## Thermal Output

- e.g. flow rate, draw down, reservoir temperature, steam
- determined project-specific
- for production well(s) and/or injection well(s)

Preconditions for coverage:

Successful completion of bore hole according to drilling contract

Accomplishment of all measures to stimulate the well according to drilling contract (e.g. acid job...)

Exploration funding against  
Geo-thermal Insurance ??



# Contingency Funding

## Drilling Contingency

- A subordinated / Mezzanine loan to fund cost-overruns in steam exploration/development;
- To be committed upfront but be disbursed when cost-overruns;
- If no cost-overruns, take-out the relevant equity used for steam development to improve a return on equity.

## Make-up Well Contingency

- A subordinated / Mezzanine loan to fund “make-up well drilling reserves” which may be required by project-finance senior lenders;
- To be committed upfront but be made available on and after CoD;
- May be drawn to take part of equity out, once steam is deemed to be stabilized and “make-up well” needs better quantified.



# Concessionary Financing

## Multiple Donor Sources

- Canada Climate Change Program ("CCCP")
- Climate Investment Fund ("CIF")
- Global Environmental Facility ("GEF")

## Track Record

- 24 Investment Transactions with \$182 million
- 20 Advisory Assignments with US\$16 million.

## For Climate Change Projects

- Beyond IFC Additionality;
- Avoids Market Distortion;
- Leads to Sustainability;
- Promotes Transparency

## Instruments

- Concessional Senior Debt;
- Concessional Subordinated Debt;
- First Loss in Risk Sharing
- Equity (with subordination in liquidation and distribution or capped upside)

## IFC Blended Concessional Finance

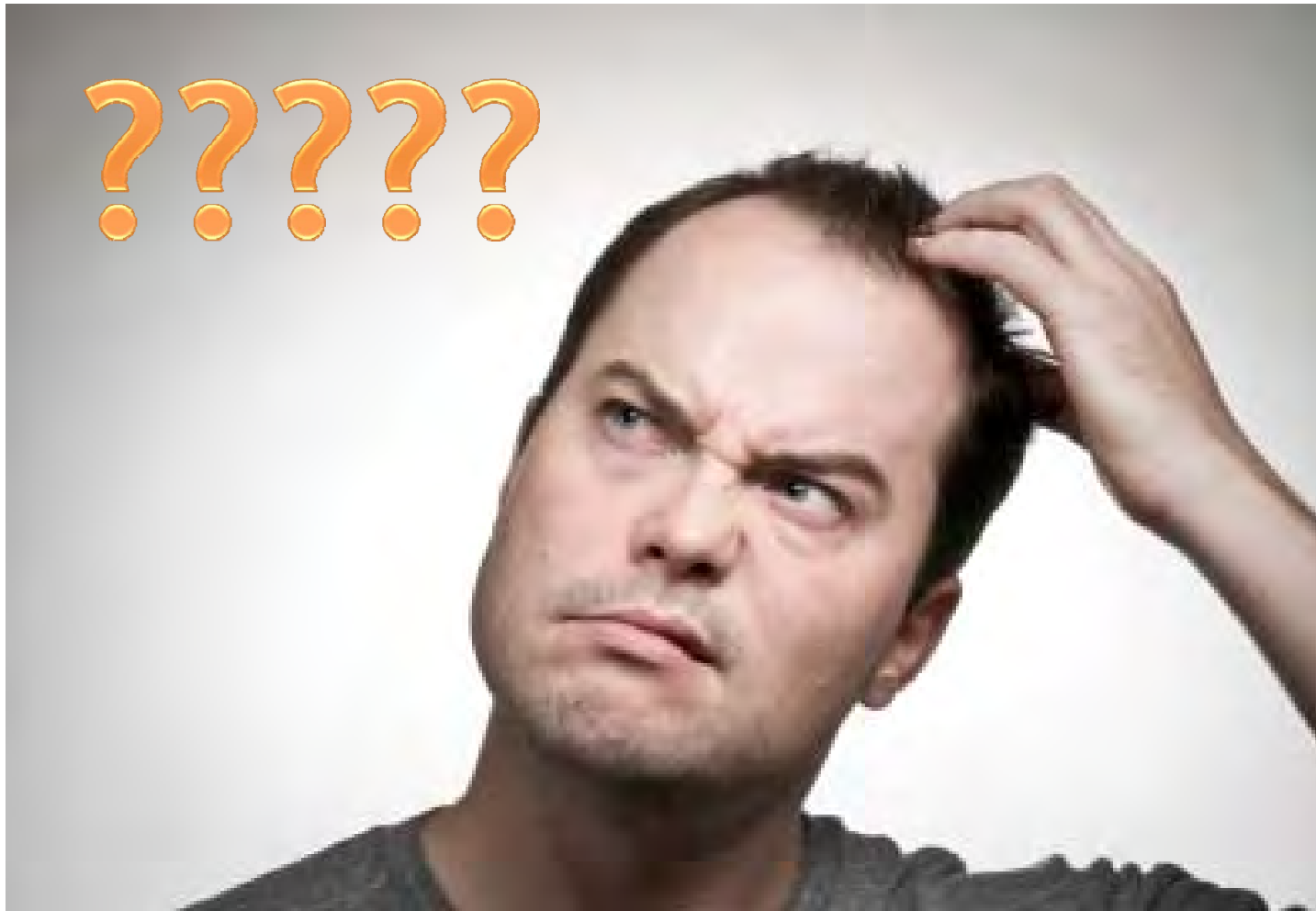
To be Blended with IFC's Financing (i.e. to be used as a combination of IFC's senior, subordinated/mezzanine loan and/or equity)



# IFC - Committed to do All we can to scale up Geothermal Investment.

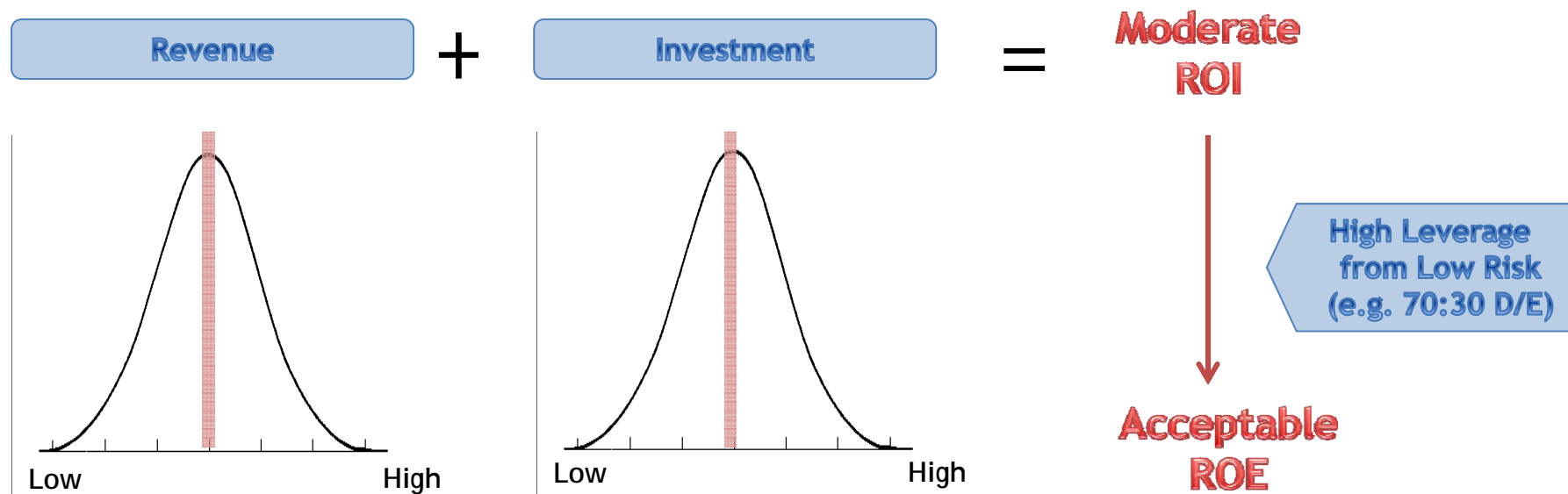


But a fundamental question remains: can private-sector do this all on itself??



## But a fundamental question remains...

Private-Sector Participation in Power Generation Projects such as IPPs originated in thermal power projects...

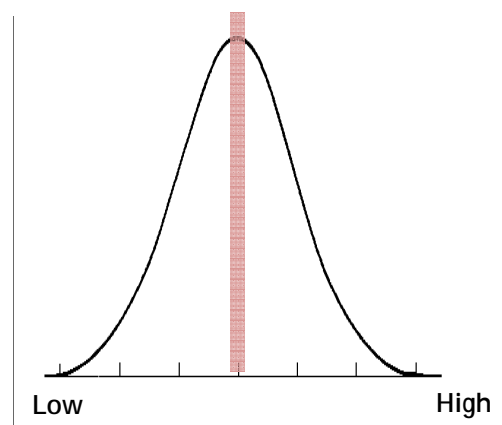


- Revenue stream contractually defined / fixed and thus no upside potential.
- Minimal investment uncertainty as project costs/construction period are largely contractually fixed under an EPC contract

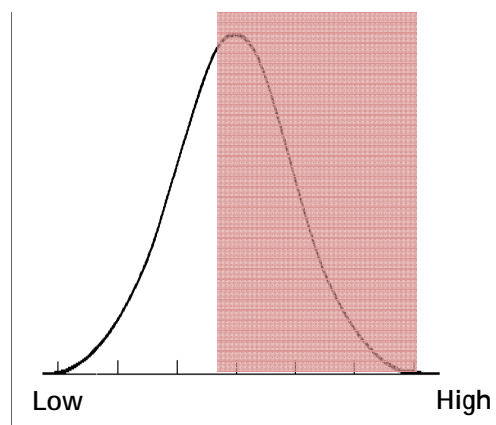
## But a fundamental question remains...

Geothermal projects have a risk profile fundamentally different from thermal power projects...

$$\text{Revenue} + \text{Investment} =$$



- Revenue stream contractually defined / fixed and thus no upside potential.



- Large uncertainty in drilling costs and time particularly during exploration and production drilling phases

**Moderate ROI as  
Downwards Price  
pressure from  
Thermal**

High Leverage  
from Low Risk  
(e.g. 70:30  
D/E)..But not  
low risk when  
“drilling Risks”  
exit

**Even after leverage,  
ROE would not be  
acceptable (given the  
risks and long  
gestation period)???**

## But a fundamental question remains...

Private-sector Participation in a Geothermal projects through a public tender...

### Just an example...

“A relatively small island grid or isolated grid whereby thermal generation (heavy fuel oil and diesel) is the predominant form of electricity generation (due to lack of scale and resource availability to use coal or gas)”

“The island (or the remote location) appears to have good geothermal resources, albeit small-scale..”

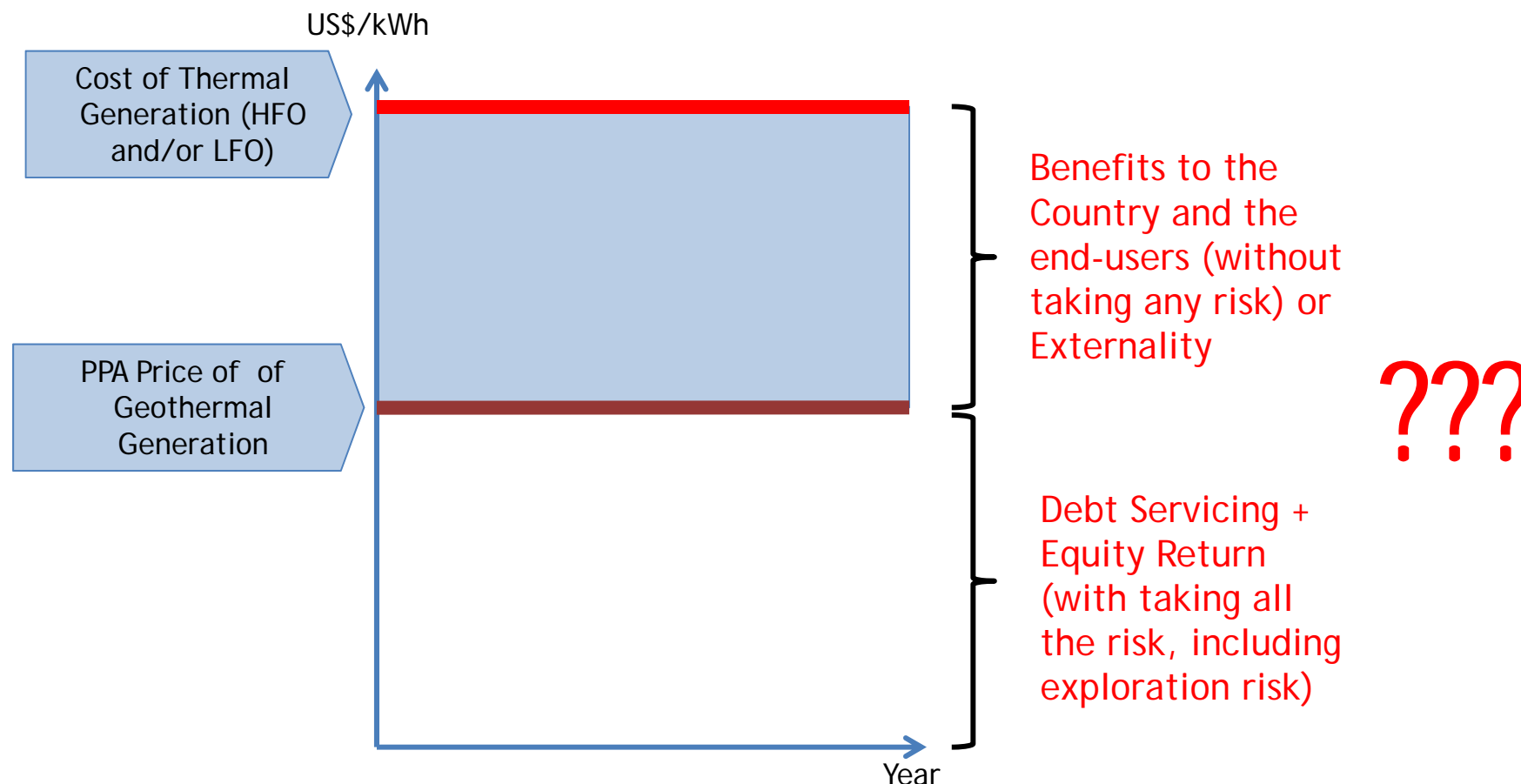
“So, the Government plans to have a public tender for a geothermal concession to select a private-sector developer to develop a geothermal field and construct and operate a power plant”

“So that the lowest bidder wins.. (in terms of the electricity cost per kWh).

Anything wrong???

## But a fundamental question remains...

Who are the beneficiaries of geothermal projects ??



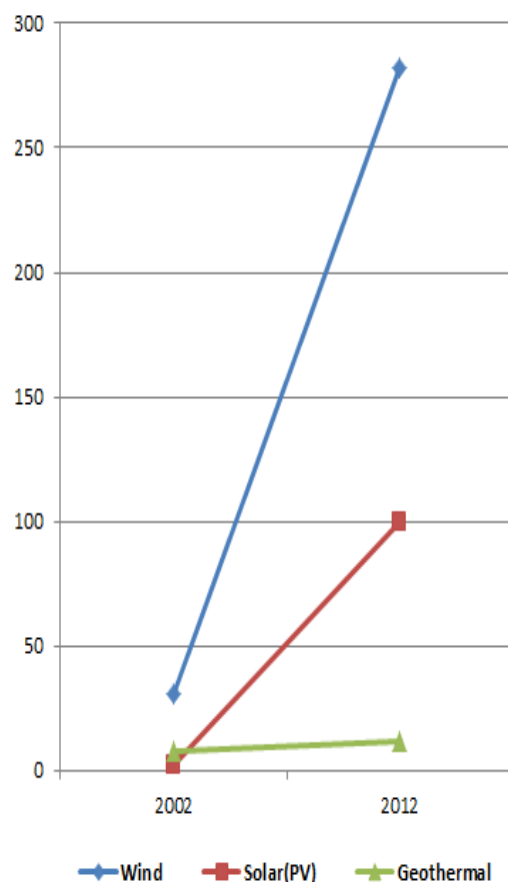


But a fundamental question remains...

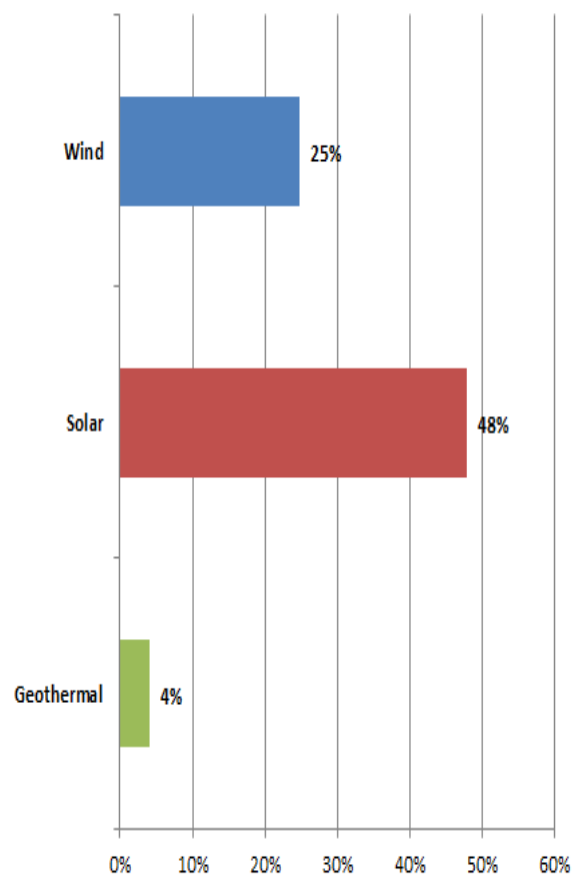
- ❑ FIT (Subsidy) is OK for Wind and Solar in expectation of future cost reductions from scaling-up / learning effects to reach the “Grid Parity” ...
- ❑ But, Geothermal is presumed to be already commercially competitive (“grid parity” is already reached) and technology is matured - no scaling-up / learning effects...???

## But a fundamental question remains...

GW Installed (2002 vs 2012)



CAGR(%) 2002-2012



- ❑ So, we have scaled up “intermittent” sources of power, which are available only for 20-30% of time,
- ❑ But not “base-loader” which can be available at 85-95% (or more) of time...