Drilling Down on Geothermal Potential: An Assessment for Central America

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Geothermal Energy Training
World Bank, July 11, 2012

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Geological Formation

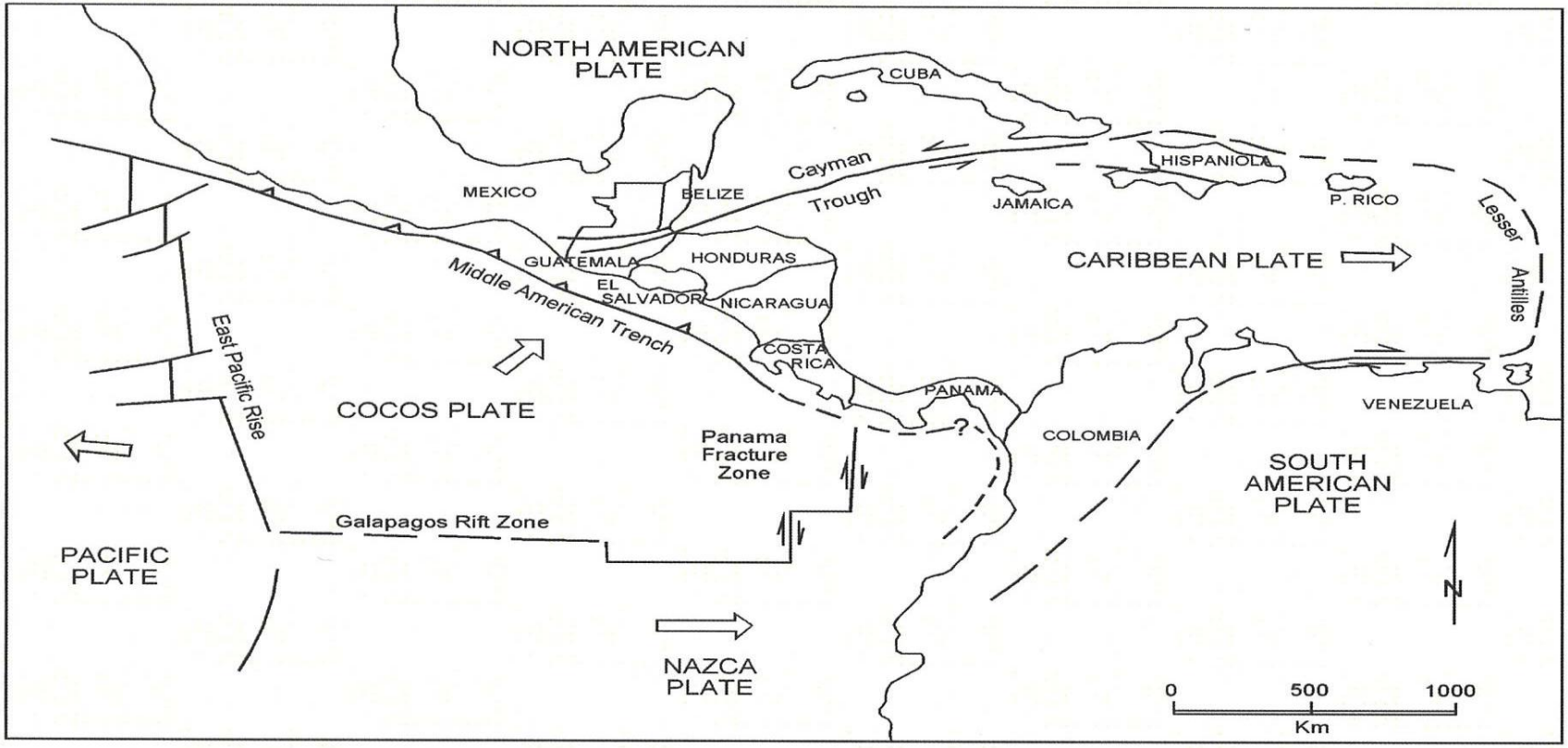
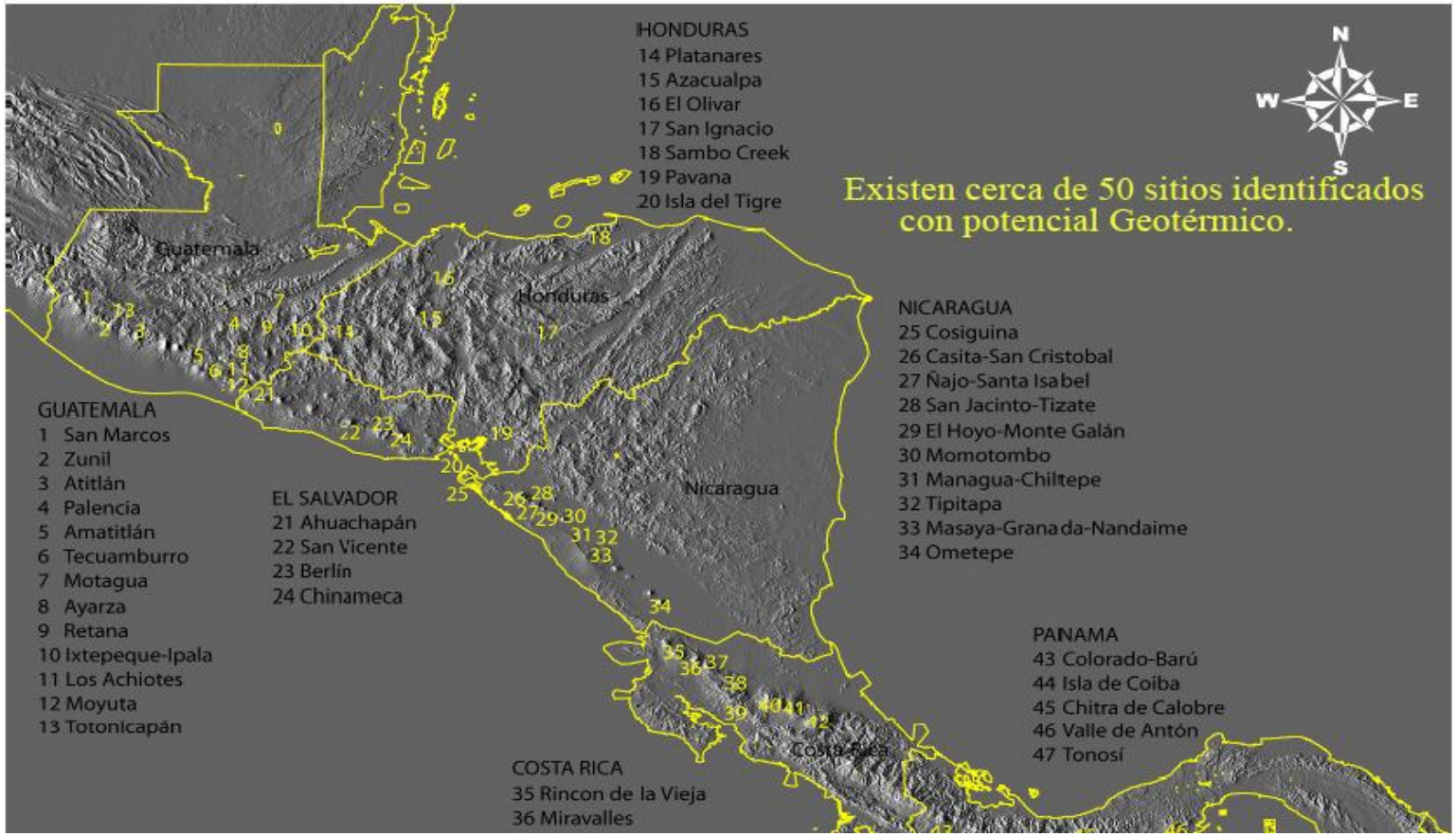
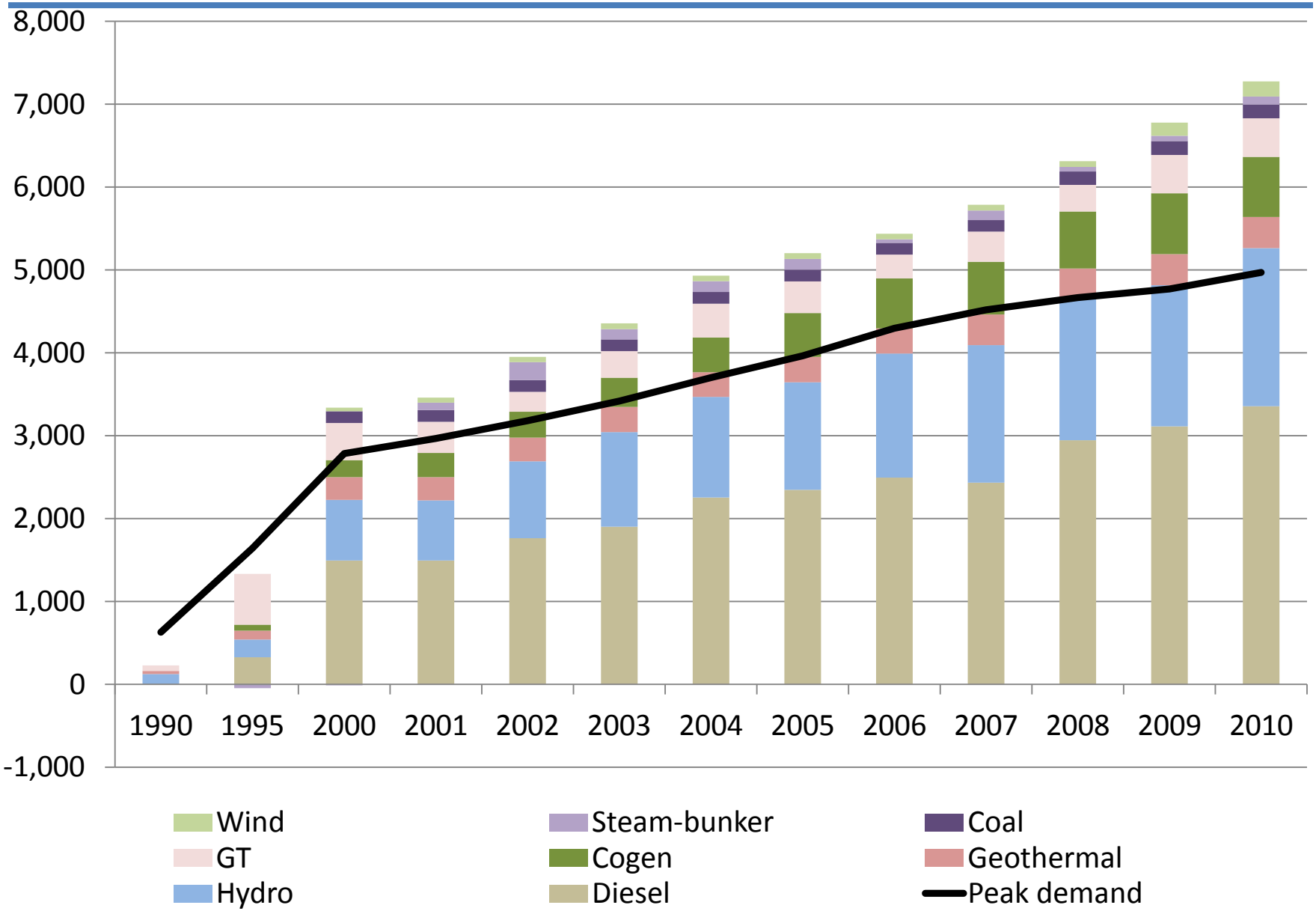


Figure 2 – Crustal Plates of the Caribean Region

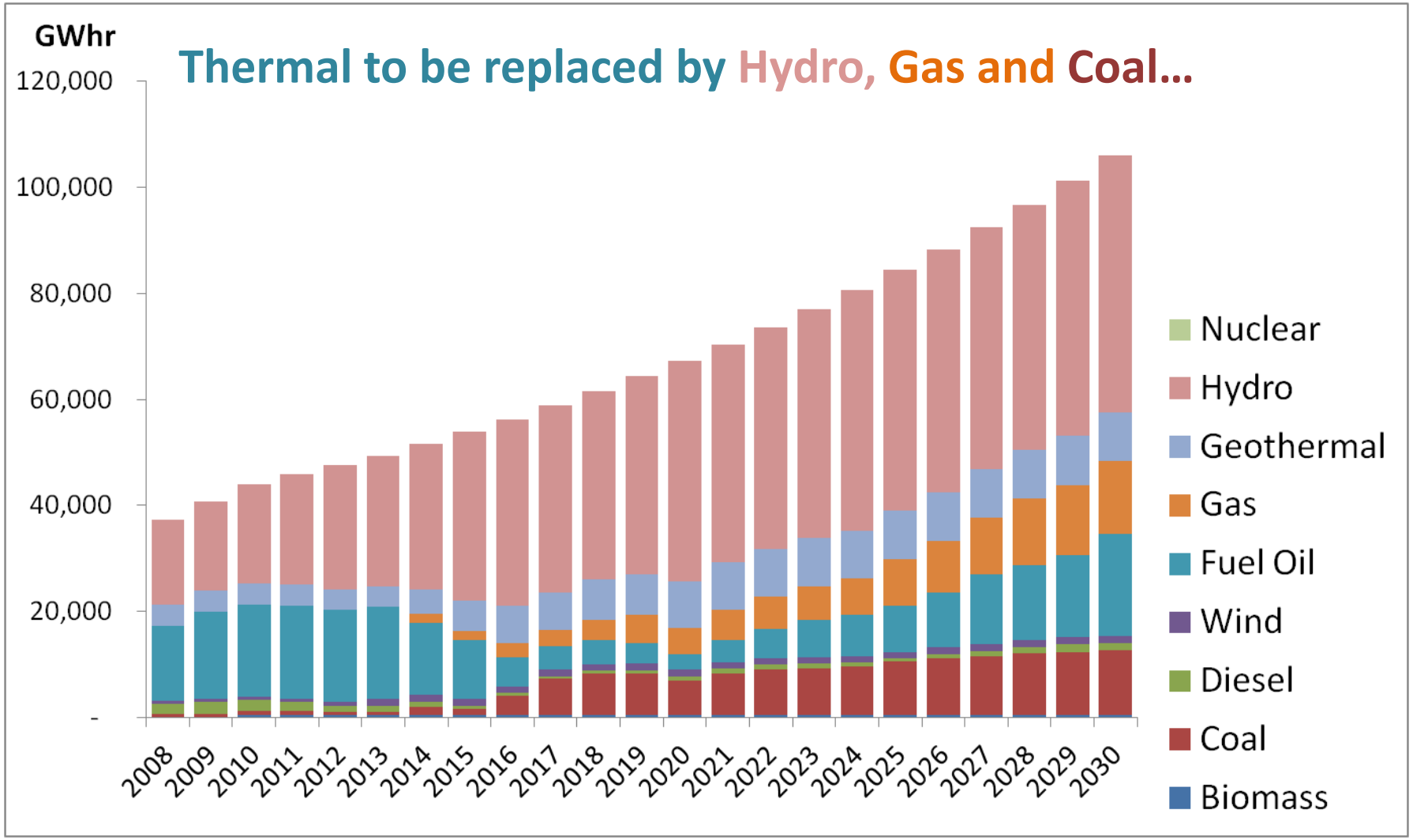
Potential Geothermal Sites



Central America: net added capacity (MW), 1985-2010



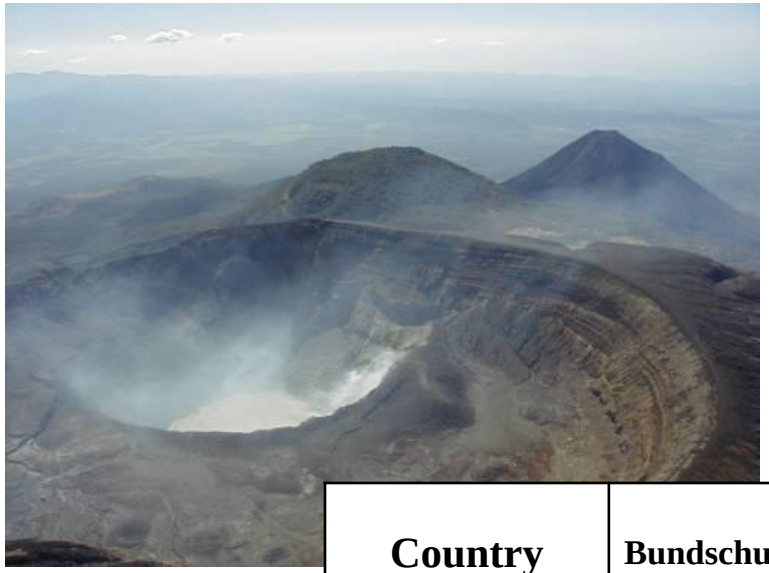
Projection of Power Generation by Source/Technology, 2008-2030



Installed Geothermal Capacity in Central America (2008)

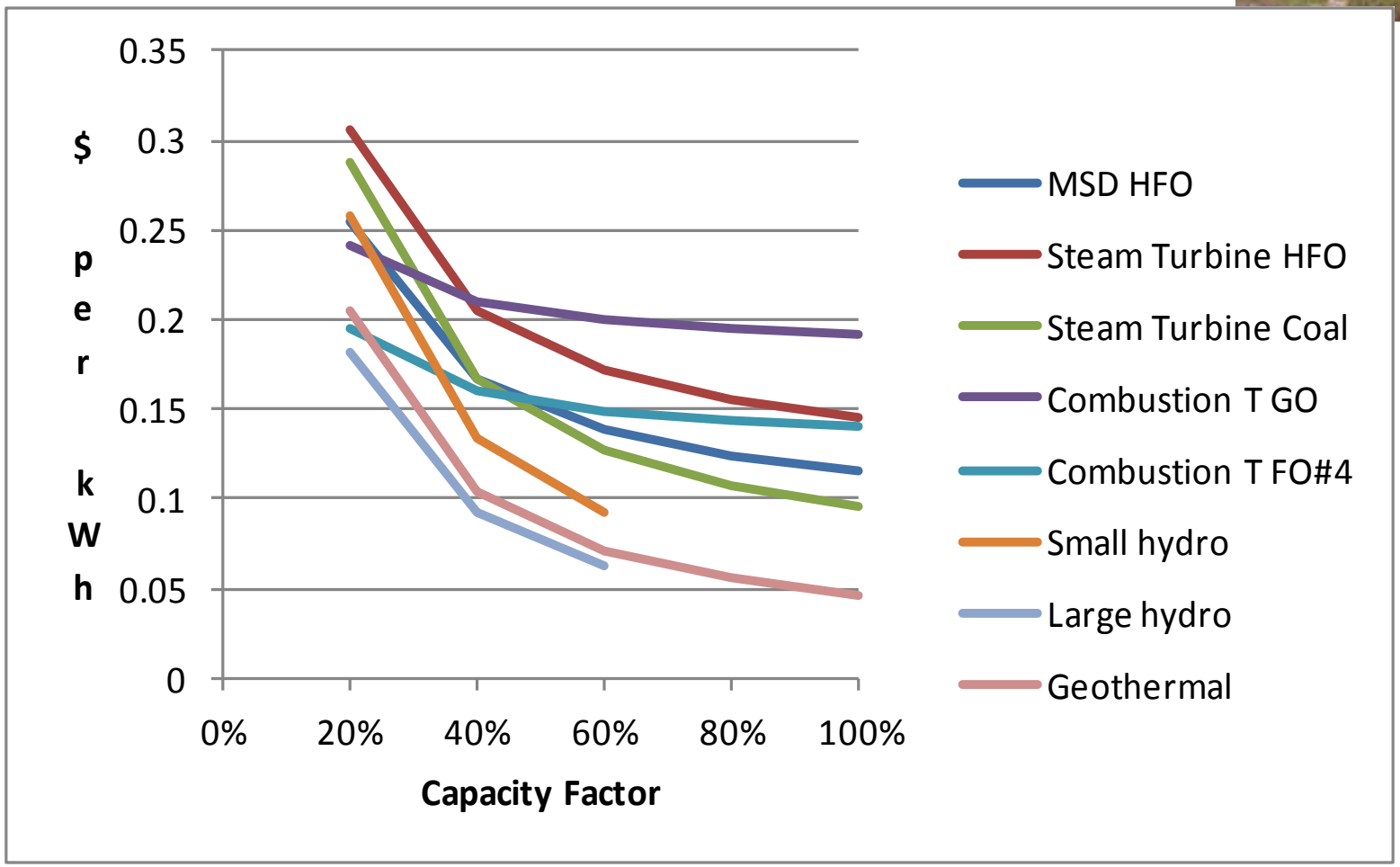
Country	Geoth. (MW)	Site	Owner	Plant Factor	% of Gross Supply (GWh)
Costa Rica	165	Miravalles	ICE	79	12%
El Salvador	109.1	Berlin	La Geo	90-94	24%
	95.1	Ahuachapan	La Geo	90-94	
Guatemala	24	Zunil	INDE/ORMAT	62.5	3.4%
	20	Amatitlán	INDE/ORMAT	98	
Honduras	0				
Nicaragua	70	Momotombo	ORMAT Momotombo Technologies, SA	43	9.3%
	10	San Jacinto Tizate	Ram Power	97	
Panama	0				0
Total	493.2				7.9%

Estimated Geothermal Potential in Central America



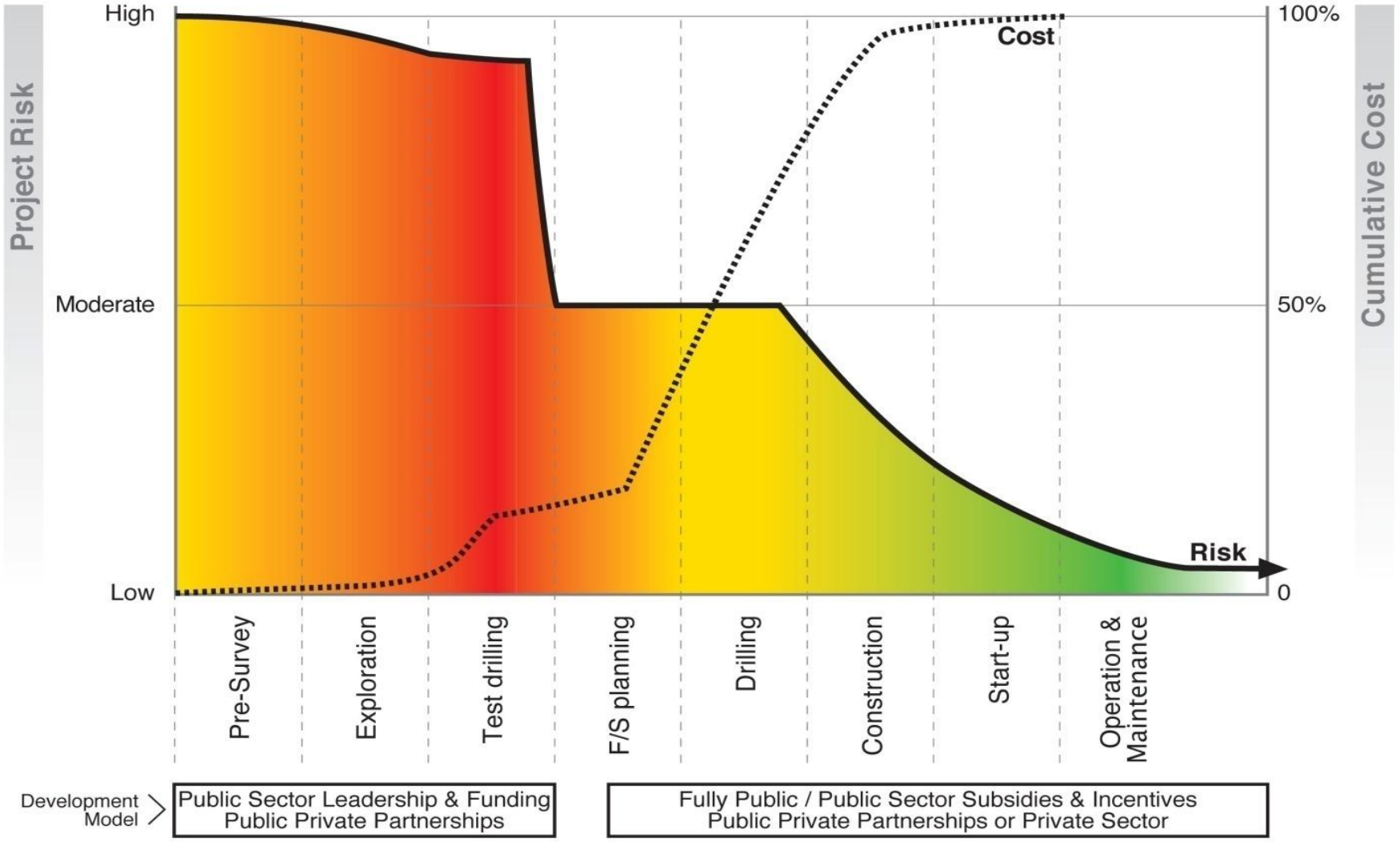
Country	Bundschuh, 2000	JBIC, 2006	Guzman, 2009
Costa Rica	2,900	750	900
El Salvador	2,210	362	700
Guatemala	3,320	480	1,000
Honduras	990	122	100
Nicaragua	3,340	992	1,200
Panama	450	42	n/a
Total	**13,210**	**2,748**	**3,900**

Screening Curves: Levelized Cost



Why has Geothermal not Been Developed More in the Region?

Barrier No. 1 – Resource Risk



Who Assumes Associated Risks?

100% by Public Sector	**Risks shared by public and private sectors** •Risk Mitigation Funds •Support to IPPs •Separation of steam and power production •Public-Private Partnership	100% by Private Sector via Concession

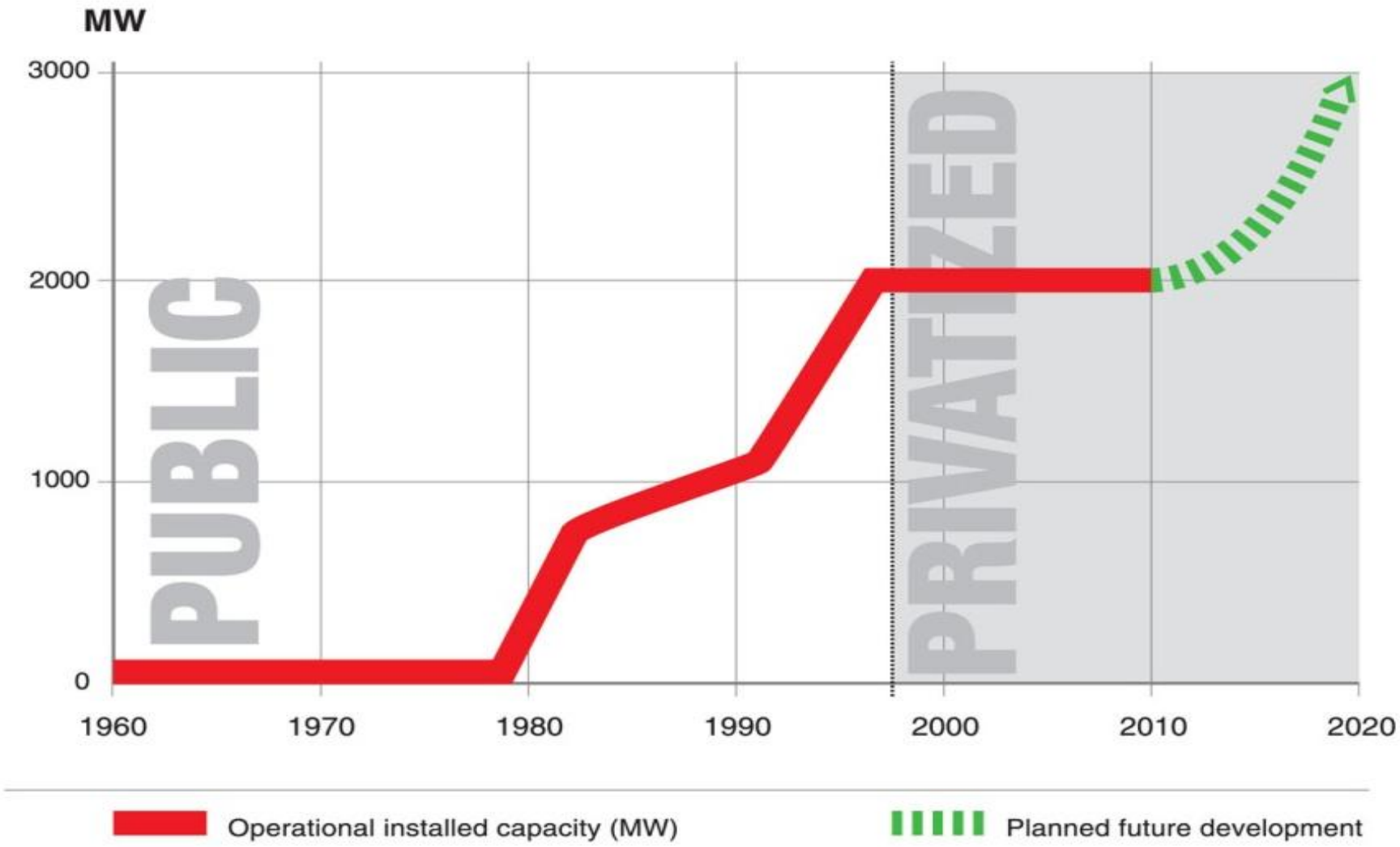
Business Models Adopted in the Region

Costa Rica: the State take the entire resource and project development risks and receives the benefits of the project

El Salvador: the Government forms a joint venture with a strategic partner through LaGeo

Guatemala, Nicaragua and Honduras: concessions provided to public or private companies

Case of the Philippines in Geothermal Development



Other Barriers

Country Readiness Assessment for Central America

	Ranking	Upfront Risk	Resource Inventory	Integrated Power Planning	Legal/ Regulatory	Social and Environmental
Costa Rica	2	H	M	H	M	L
El Salvador	1	H	M	H	S	M
Guatemala	4	M	M	M	M	M
Honduras	5	L	L	L	L	M
Nicaragua	3	M	S	S	H	M
Panama	5	L	L	L	L	L

A = high (favorable); S= substantial; M= medium; L= low

WB Follow-up Activity (1): TA in Costa Rica

Context

-Geothermal are competitive to thermal generation as baseload

-Potential geothermal sites are located inside the protected areas

Objective of the study – Assess:

(a) whether the net benefits of geothermal electricity production at a particular site would justify the negative impacts caused; and

(b) how much and what kind of compensation would be necessary to offset the negative impacts.

Scope of the study:

1) Footprint of geothermal development
2) Likely impacts of geothermal development in protected areas
3) compensation schemes available for geothermal development

WB Follow-up Activity (2): Regional Geothermal Inventory

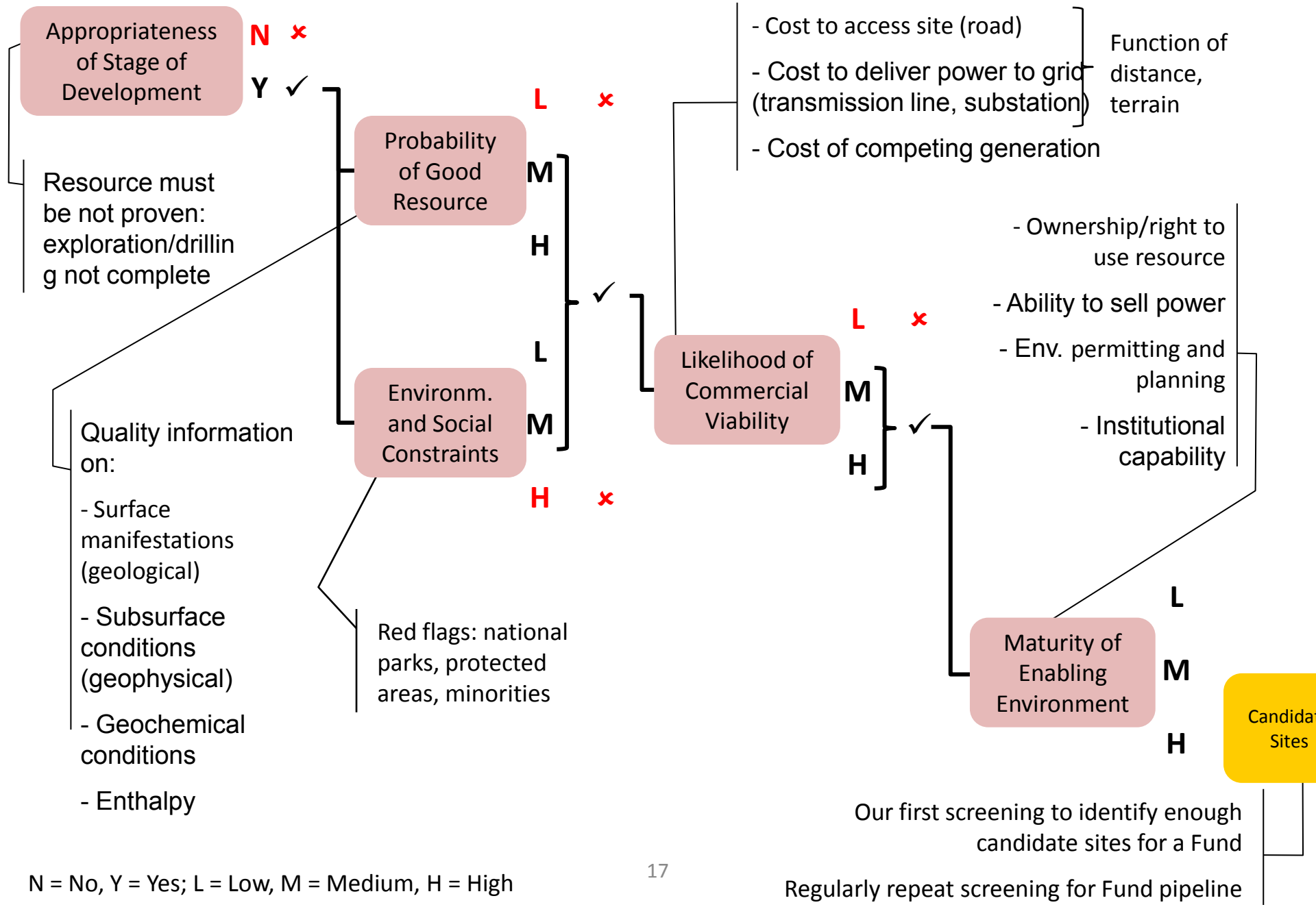
Objective:

To assess the country/site readiness in participating in a possible geothermal resource risk fund

Eligible stage of development:

- Reconnaissance
- Exploration

Screening Methodology to Identify a Pipeline of Candidate Sites

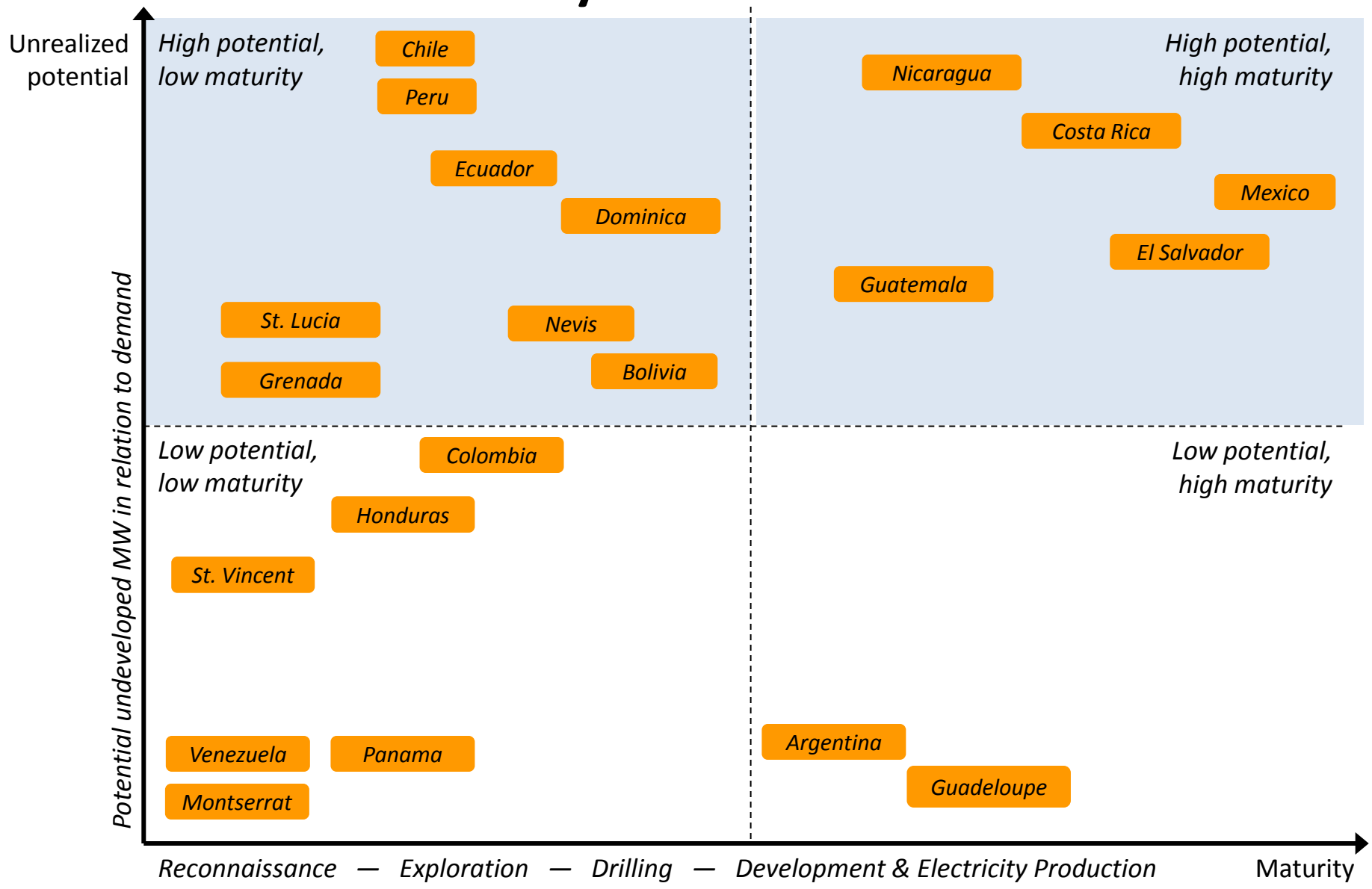


N = No, Y = Yes; L = Low, M = Medium, H = High

Summary of Prioritized Sites

Country	# of sites prioritized (31)	Probability of Good Resource	Environm. and Social Constraints	Likelihood of Commercial Viability	Maturity of Enabling Environm.
Chile	6	M-H	L-M	Medium	High
Guatemala	4	High	Low	Medium	Medium
Nicaragua	4	M-H	Low	Medium	Medium
Peru	4	High	L-M	Medium	Medium
Ecuador	3.5	M-H	Low	Medium	Low
Costa Rica	3	High	Low	Medium	Low
Mexico	3	M-H	Low	Medium	Medium
El Salvador	2	High	Low	Medium	Medium
Colombia	1.5	M-H	Low	Medium	Medium

Country Assessment



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