Geothermal Development Facility for Latin America (GDF)

Technical Assistance Forum (TAF) 2024

December 2024

Version 3.0

Agenda TAF, 2024

- Introduction
- GDF Projects Update
- Financial Update
- Conclusions and Lessons Learned

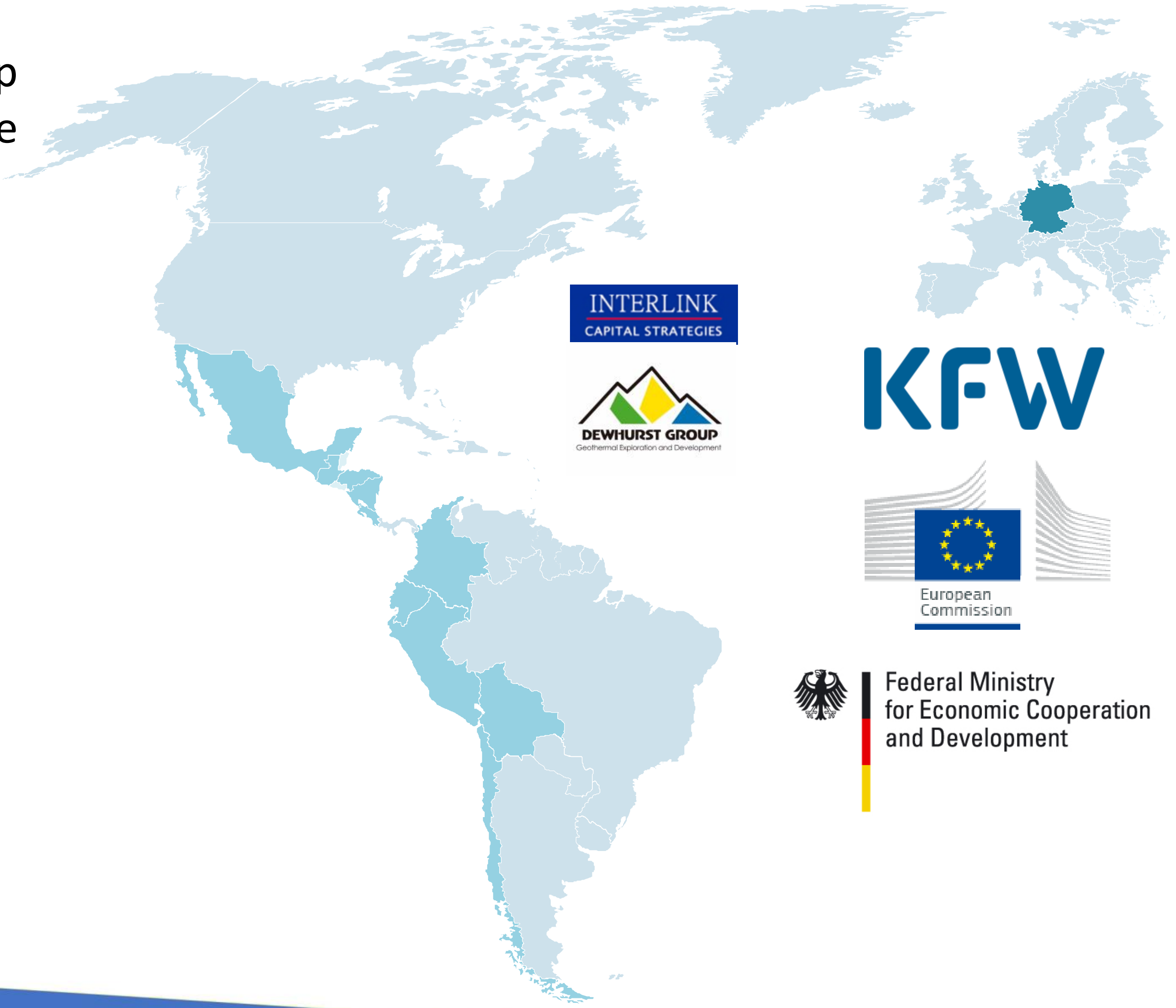
Introduction: What is GDF?

GDF Latin America

GDF is an early-stage risk mitigation fund to help offset the disproportionate risk involved in the early stages of geothermal development.

- IDA Fund Management, LLC
    - Dewhurst Group, LLC
    - Interlink Geothermal, LLC

Region	Country
South America	Bolivia
	Chile
	Colombia
	Ecuador
	Peru
Central America	Costa Rica
	Guatemala
	Honduras
	Nicaragua
	El Salvador
North America	Mexico
Total	11



INTERLINK CAPITAL STRATEGIES

DEWHURST GROUP
Geothermal Exploration and Development

KFW

European Commission

Federal Ministry for Economic Cooperation and Development

GDF Application Summary

Application Process

Expression of Interest

- Surface Studies and Confirmation Drilling: Same Documentation

Call for Proposals

- SS
- CD: more extensive application including drilling plan

Grant Agreement Negotiations

- Monitoring Phase
- Project Completion

Geotérmica el Porvenir, Confirmation Drilling, Guatemala

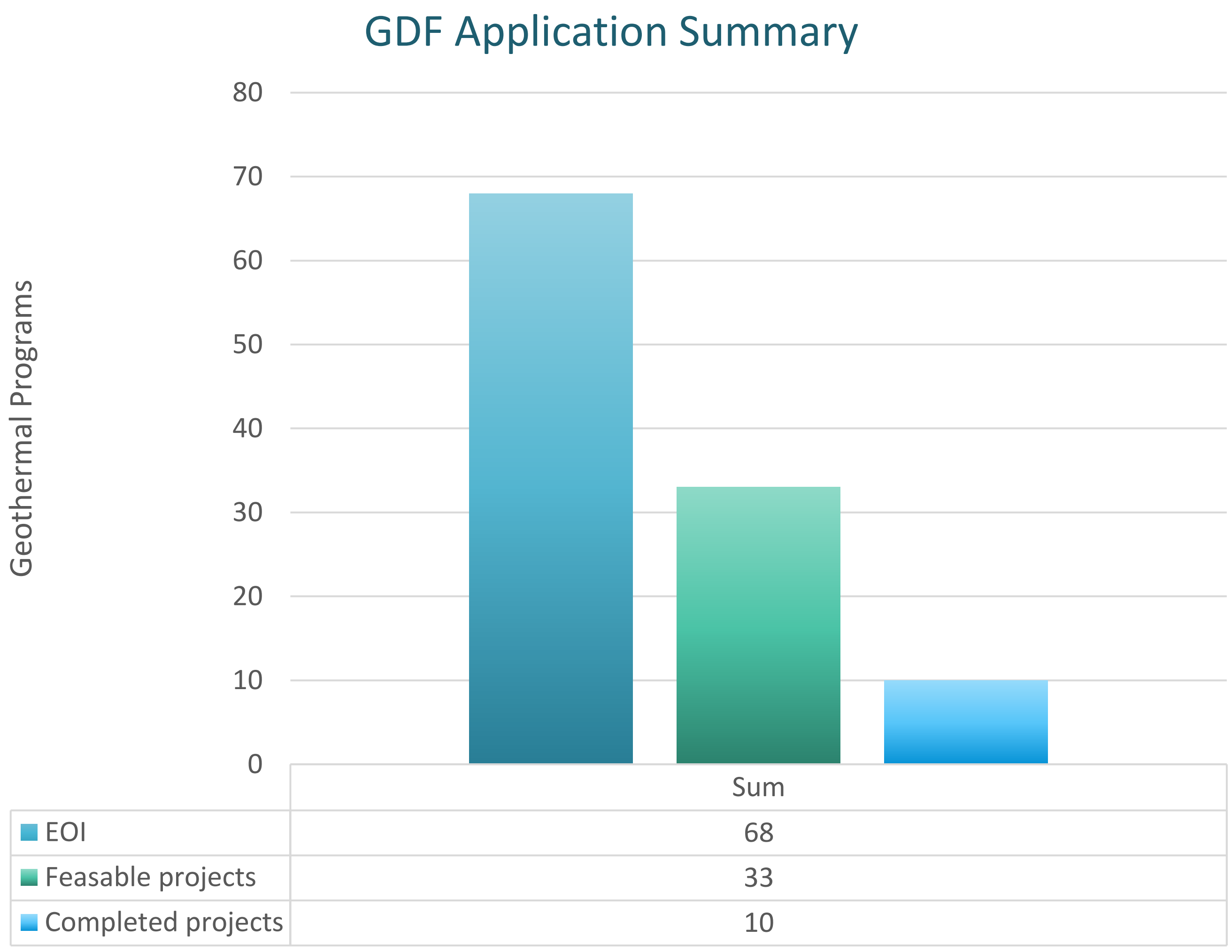
GDF Application Summary

Results to date

- For the Eleven countries in the region since 2016, 68 programs showed interest in the Expression of Interest phase

- 33 programs have enough quality work to be considered commitments for geothermal development

- 10 programs had used direct GDF support

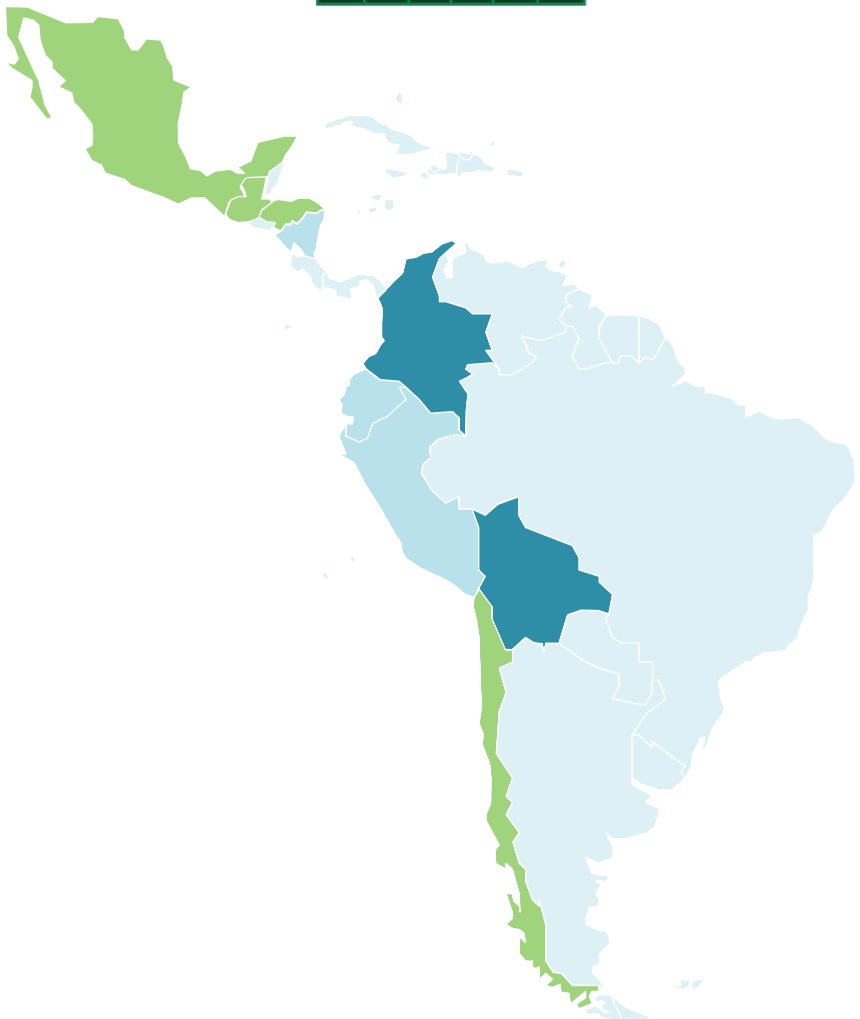


GDF Application Summary

Implementation Process

- 6 Completed projects
  - 6 Surface Studies
- 4 Active GDF projects
  - 2 Surface Study grant and
  - 2 Confirmation Drilling grants

Region	Country	Active GDF projects	Completed projects
South America	Bolivia	-	1
	Chile	1	2
	Colombia	-	1
	Ecuador	-	-
	Peru	-	-
Central America	Guatemala	1	1
	Honduras	1	1
	Nicaragua	-	-
	El Salvador	-	-
North America	Mexico	1	-
Total		4	6



Countries with active projects: Mexico, Guatemala, Honduras, and Chile.

Countries with completed projects include Colombia and Bolivia. Additionally, projects have been completed in Chile, Guatemala, and Honduras; however, there are currently active projects in those countries as well.

Environmental And Social

Considerations

- All applicable national environmental, occupational health & and safety and social laws and regulations
- IFC Environmental and Social Performance Standards
- Environmental and Social Impact Assessment (ESIA)
- Environmental and Social Management Plan (ESMP)
- Stakeholder Engagement Plan (SEP)
- Gap analysis submitted and confirmed

Key aspects from the first moment of any application and during the life of the implementation

1. Buena Vista Project, Chile
2. Educational Campaign performed by the Grantee, Paipa, Colombia

GDF Projects Update

Completed Surface Studies Projects

- Condor Paipa, Colombia
- Geocomayagua, Honduras
- Mariposa Project, Chile
- Buena Vista Project, Chile
- Geotérmica el Porvenir, Guatemala
- Campo Geotérmico Empexa, Bolivia

Fieldwork, Colombia
Fieldwork, Bolivia

GDF Projects Update

Active Projects

Transmark

- Cachapoal Project
- Chile

Surface Studies Grant

- Early exploration
  - MT Survey
  - Geological Survey
  - E&S Studies

Cachapoal, Project Area

GDF Projects Update

Active Projects

ENEE

- Namasigue Project
- Honduras

Surface Studies Grant

- Early exploration
  - MT Survey
  - Topographic Survey
  - Stakeholders Engagement

ENEE is conducting fieldwork in the Project Area.

GDF Projects Update

Active Projects

Geotermica El Porvenir

- GDF Grantee since 2018
- Part of the Second Call of Proposals of GDF

Surface studies grant

- Early exploration
  - TG wells
  - Environmental compliance

Confirmation Drilling

- Initially through a Surface Study program, and then advancing to the Confirmation Drilling phase
- Commercial size wells/ 2,000 m

GDF Projects Update

Active Projects

GDF Latin America

Centavito Project

- GDF Grantee since 2023

Confirmation Drilling

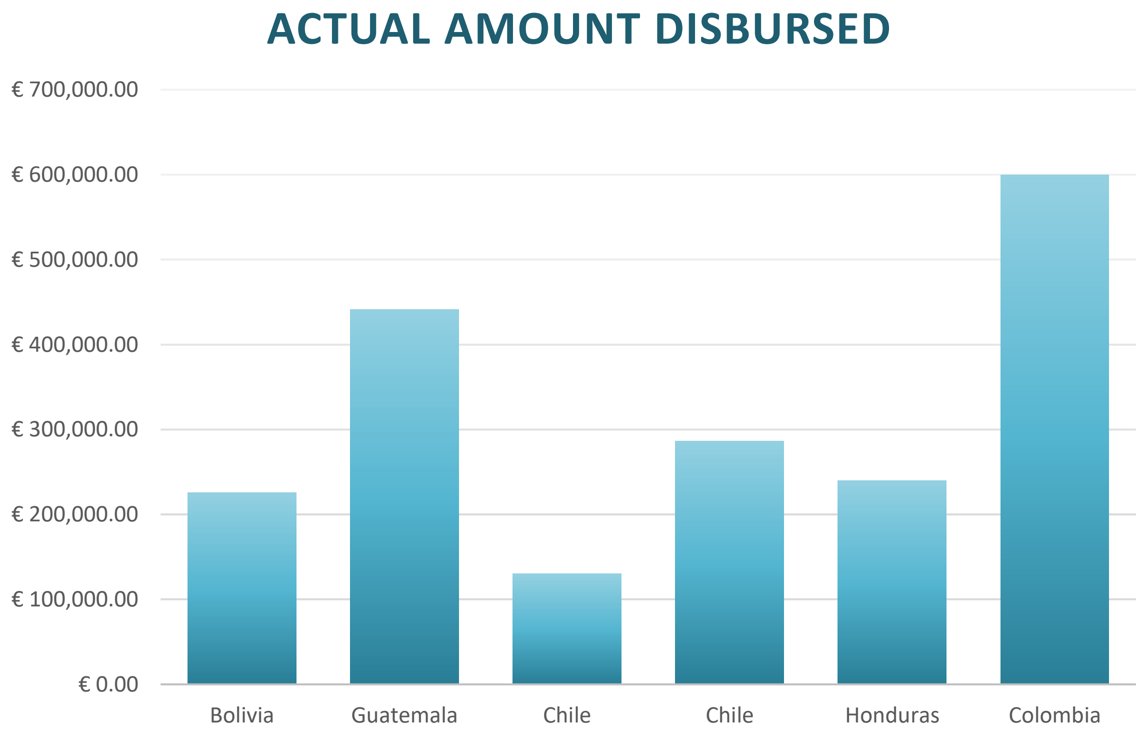
- Well-targeting and civil works
- Well pad and access roads

Financial Update

Results to date

- About $ 2 Million Euros in support of Surface Studies programs as part of initial exploration (100% grant – no payback required)

Completed Projects			
GDF Call	Project Name	Country	Actual Amount disbursed
Call 1	Campo Geotérmico Empexa	Bolivia	€ 226,013.00
Call 2	Geotérmica El Porvenir	Guatemala	€ 441,331.80
Call 2	Buena Vista Project	Chile	€ 130,116.45
Call 2	Mariposa Project	Chile	€ 286,324.00
Call 5	GeoComayagua Geothermal Project	Honduras	€ 240,080.00
Call 7	Condor Paipa	Colombia	€ 600,000.00
Total			**€ 1,923,865.25**

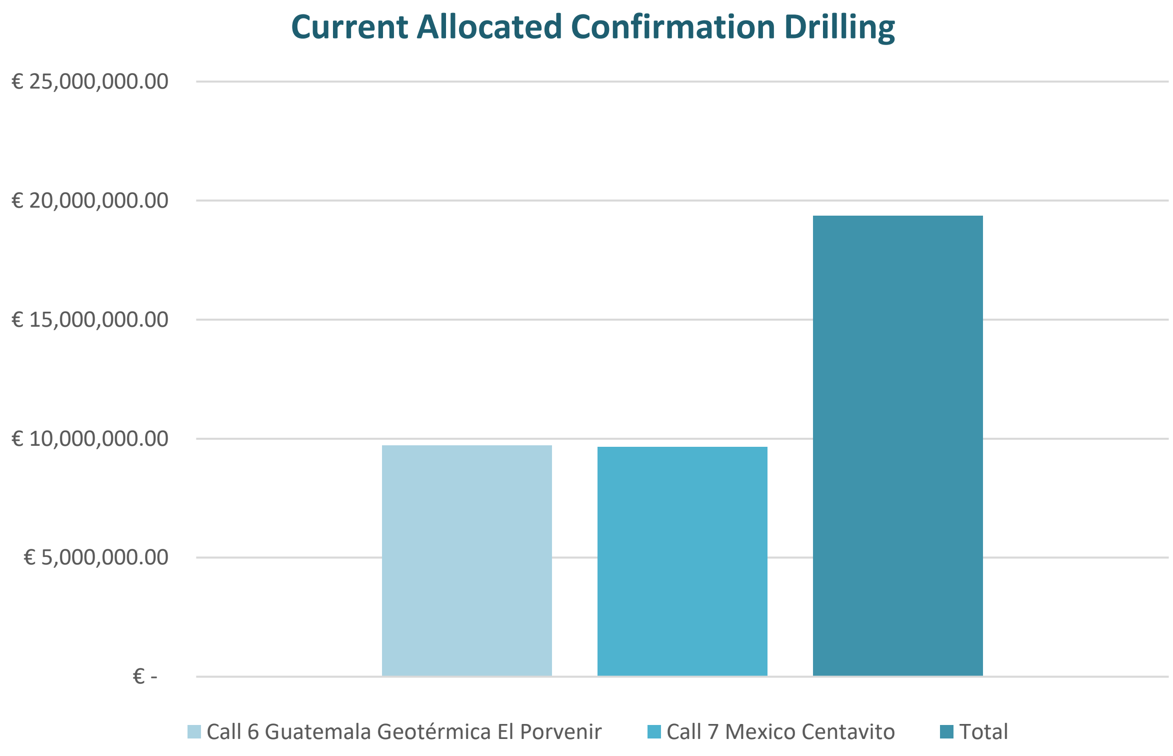


Financial Update

Results to date

- Approximately 20 Million Euros allocated on Confirmation Drillings

Current Allocated Confirmation Drilling			
GDF Call	Country	Project Name	Actual Amount disbursed
Call 6	Guatemala	Geotérmica El Porvenir	€ 9,709,290.00
Call 7	Mexico	Centavito	€ 9,654,053.00
Total			€ 19,363,343.00



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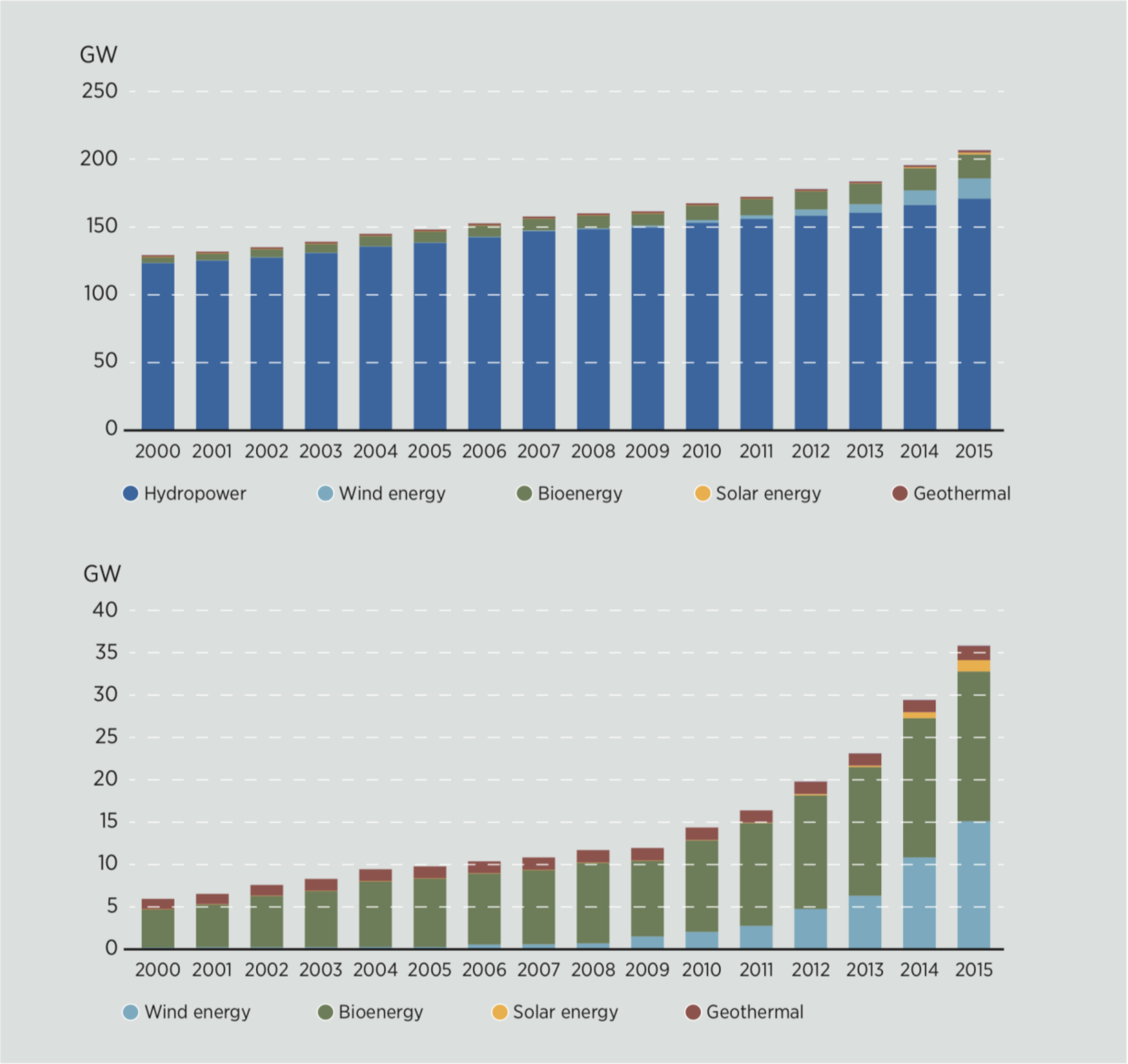
Where are we going?
2020 CIO Perspective
2024 CIO Perspective

TAF DATA
An Inconvenient Truth

2024
This presentation was from Geolac 2020 – Virtual due to Covid
Wordy – hoping it was forwarded within ministries

Installed Renewable Power Capacity in LATAM, 2000-2015

Figure 2.3 Installed renewable power capacity in Latin America, 2000-2015; all technologies (top) and excluding hydropower (bottom)



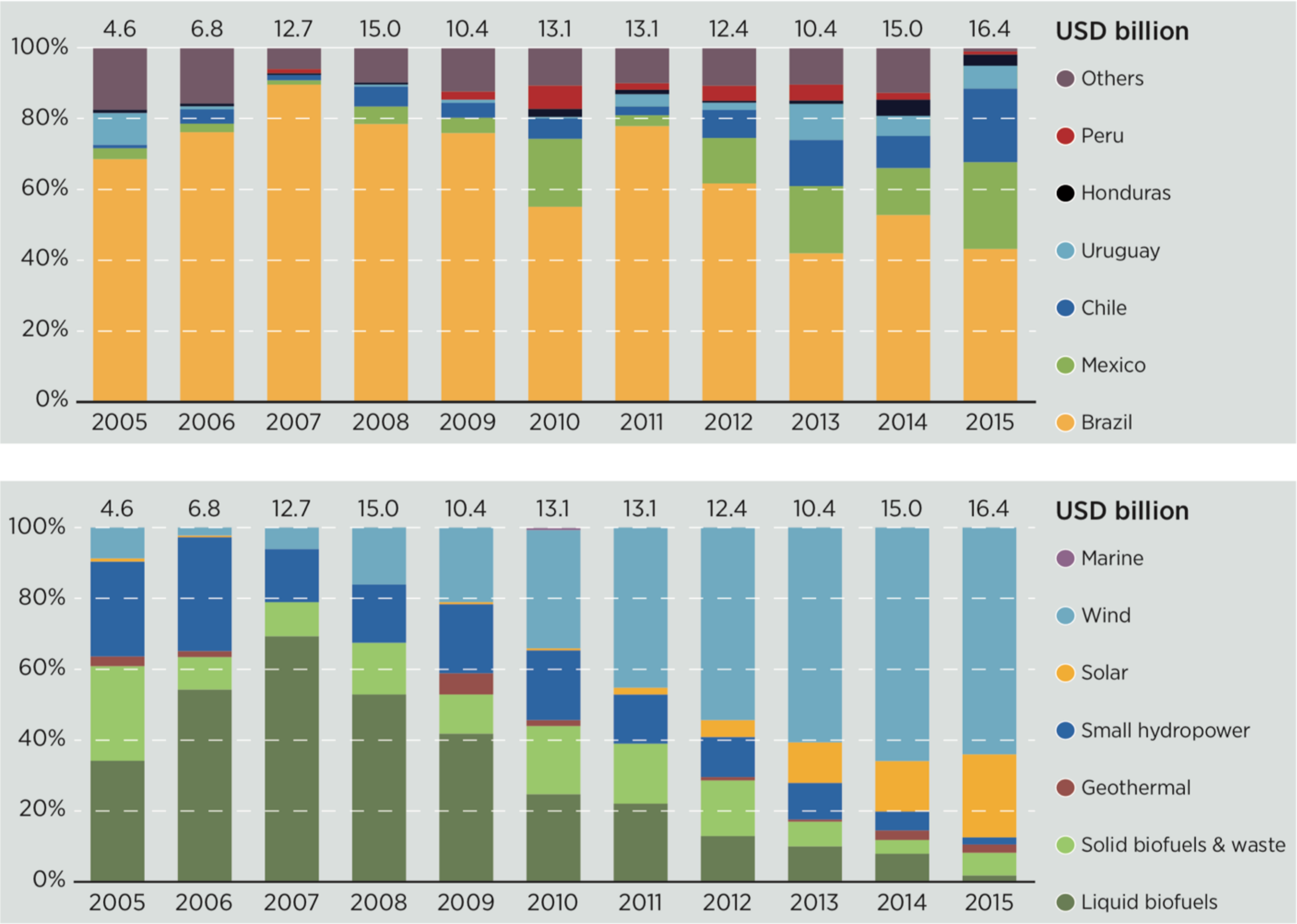
Note: Bioenergy includes solid and liquid biofuels and biogas.
Source: IRENA, 2016a

Investment in Renewable Energy by Country (top) and Technology (bottom), 2010-2015

The data on is through 2015, we know the trend has only continued

2024 – Money is moving but geothermal is inconsequential

Figure ES.1 Investment in renewable energy, 2010-2015: by country (top) and by technology (bottom)



Source: Bloomberg New Energy Finance, 2016

Geothermal Energy Plants Installed Across GDF Countries

ONLY 5 OF THESE PROJECTS WERE INNITIATED ON A GREENFIELD RESOURCE IN THE LAST **10 YEARS** (EXPLORATION DRILLING)

OPTIMIZATION AND EXPANSION ON MANY OF THE "OLDER" SITES, MOST NOTABLY AZUFRES AND HUMEROS (+175), DID OCCUR IN THE LAST 10 YEARS

2018(?) 1666 MW Total
2024 1827 MW Total

Geothermal Energy Installed Per GDF Country			
Country	**Plant**	**MW**	**Projected**
Bolivia			
	Laguna Colorado		Proj. 100 MW
Chile	1	48	
	Cerro Pabellon	48 MW	
Ecuador	*Chachimbro	0	Proj 50 MW
Peru	None	n/a	
Colombia	None	n/a	
Costa Rica	2	207	
	Miravalles	165 MW	
	Las Pailas	42 MW	
El Salvador	2	204	
	Ahuachapan	95 MW	
	Berlin	109 MW	
Guatemala	2	69.2	
	Amatitlan	25 MW	
	Zunil	24 MW	
Honduras	1	38.00	
	Plantanares	38 MW	
Nicaragua	2	150	
	Momotombo	78 MW	
	San Jacinto	72 MW	
Mexico	5	950	
	Domo San Pedro	26 MW +10	
	Cerro Prieto	578 MW	
	Las Tres Virgenes	10 MW	
	Loz Azufres	241 MW	
	Los Humeros	95.6 MW	

Total Installed Capacity Across GDF Countries

Installed Capacity per GDF Country					
Country	Total Installed Cap	Hydro Electric	Fossil Fuels	Nuclear	Other renewable sources (Geothermal)
Bolivia	2.7 GW	18%	76%	-	7% (0%)
Chile	24.53 GW	26%	59%	-	15%(0.1%)
Ecuador	8.19 GW	54%	43%	-	2% (0%)
Peru	14.73 GW	35%	61%	-	4% (0%)
Colombia	16.89 GW	69%	29%	-	2% (0%)
Costa Rica	3.584 GW	64%	18%	-	18% (5.5%)
El Salvador	1.983 GW	23%	49%	-	29% (10%!)
Guatemala	4.605 GW	31%	41%	-	28% (1.5%)
Honduras	2.546 GW	25%	40%	-	34% (1.5%)
Nicaragua	1.55 GW	9%	56%	-	35% (10%!)
Mexico	72 GW	17%	71%	2%	9% (1.3%)

2024 – GDP Growth, Population Growth, Increased Standard of Living?

QUESTION 1 -
The data is clear, years of repetitive rose-colored optimism doesn't result in geothermal being developed despite development finance institutions ongoing presence - what are you and your organizations going to TRY TO DO DIFFERENT to improve the situation????

2024 – No country has done anything different (words are not actions) …. except El Salvador!

https://www.reuters.com/world/americas/el-salvador-mined-nearly-474-bitcoins-adding-state-crypto-holding-last-three-2024-05-14/

1.5 MW x 4 Years x 8760 Hours Year x $100 MWh = 5.25M
5.25 <<<<< 474 x 100,000 = 47.4 M USD

QUESTION 2 - I personally believe in many if not all of the 11 GDF countries, geothermal is the lowest cost form of baseload power for NEW PROJECT development in many if not all of these countries - Renewable or otherwise - with the exception of domestically produced natural gas. I recognize your organization tend not to advocate for one technology over another but do you see anything else that is more likely to provide stable and economical provide baseload power and if so why?

2024 – Geothermal remains lowest cost form of baseload power

QUESTION 3 -
In the prior two sessions of TAF (2018 and 2019) we politely pointed out that policies across all GDF countries do very little if anything to differentiate intermittent from firm power and that policy setting entities need to recognize this and take concrete action to change this -
Do the ministries need to ask for technical assistance support or can you provide it even if they don't ask? Are you waiting for them to ask? How do we break through on this issue?

2024 – Countries policy/ministries do not differentiate firm from intermittent

QUESTION 4

We as GDF have seen over 50 detailed applications from public and private projects in which none of them clearly demonstrate a country policy that differentiates the value of firm/baseload power from intermittent power. ((It is possible national power companies are not including information on this in the applications but in general it is very unclear that even with national power companies that the value of firm power is quantified.)) Arguably some countries have attempted to **qualitatively** differentiate firm power from intermittent, do any of you believe ANY GDF country that differentiates firm from intermittent **quantitatively**? Do you agree this is a fundamental problem?

2024 – Qualitative strategies are useless. Greenfield baseload power isn't being developed.

QUESTION 5

In GEOLAC someone eloquently pointed out that geothermal has a development cycle that is much larger than an election cycle and, therefore, elected officials have very little incentive to focus on geothermal for their successors to claim the benefits of a successful geothermal strategy. Given that reality, doesn't it fall on the development finance institutions to make the emphatics case for a long-term view as providers of both short and long- term development support? If not the DFI's who is better suited to drive a long-term view that transcends political cycles?

2024 – Most Ministries have no incentive to set policy because of political cycles. Focus on easy FAST solar and wind wins.

QUESTION 6

It's come up multiple times in prior GEOLACs that there is an obvious correlation and PROBABLE low hanging fruit development opportunity between mining operations that designed to operate 24/7/365 for 20+ years! and geothermal resources which may be nearby.

WHY HAS THIS NOT HAPPENED ?

2024 – Still no active co-development of extractive mines OR value added processing
With same long term capex opex cycles….(Exception El Salvador and crypto)

QUESTION 7
In order to strongly encourage a renewable firm power policy to evolve IN PARALLEL with an intermittent policy, should DFI's only consider funding intermittent power if the are funding firm power in parallel?
HOW DO DFI'S WANT TO ADDRESS THIS?

2024 – DFI's are also at faults because they don't force intermittent and firm power at the same time.
"Fund X if you do Y simultaneously" or "Fund X wind/solar and Y geothermal in same project financing scheme"

QUESTION 8
The GDF took a position after 4 CfP rounds and I subsequently outlined my perspective on the position in an interview where I received some vehemently positive and vehemently negative feedback - take a free shot at me, the GDF or the activities of DFI's.

Note – A link to the interview and position paper are on www.gdflac.com news

2024 – Interview from 2020 is here now
https://www.thinkgeoenergy.com/interview-lack-of-understanding-and-relevant-policy-holding-back-geothermal-in-latin-america/

“Truths” at the end of 2024….

1) In GDF countries Geothermal is the lowest cost form of baseload/ firm power for “greenfield addition”
* LNG is noise at best
* DOMESTIC natural gas (Bolivia, Mexico, Peru?) are wins.
* Hydro debate – ESIA impact

2) Using just ‘active’ volcano analysis 20GW of geothermal potential in the GDF target countries.

3) Solar and wind are so cheap, install as much as grid can handle.
* Batteries solve problems but do not reduce at scale firm power cost from intermittent sources.
* Thank the Chinese for every panel (DJT needs to learn this one)

But Firm Power Matters

Top 10 Reasons why geothermal power may **NEVER** expand materially in Latam

Lowest Cost, Sovereign, Resilient just wont matter

Why?

10)Change Agents aren’t really Agents of Change

* Definition of Insanity - Same discussions, approaches, strategy expecting a different outcome?

* We – collectively – are insane

9) Political Cycles

Democratic election cycles don’t have long horizons

All cost upfront and over 5 to 7 years makes it unlikely an official will be around to claim the win

Fund short term things = claim wins

8) Enron doesn’t exist

Large Portfolio Theory

Capital Intensity

Entity capable of absorbing high percentage and dollar losses for larger successful gains

Enron actually needed larger and larger deals

7) Technology Advancement Steam Hunter

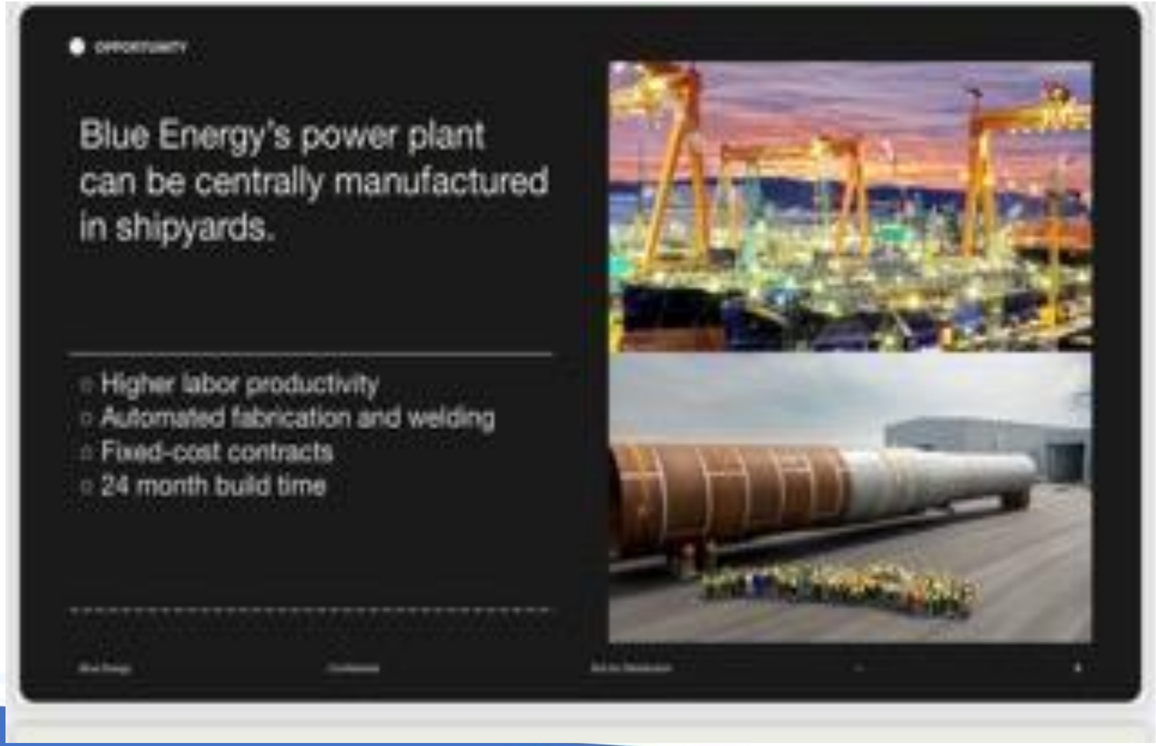
Nexxus of High Temps and Steam

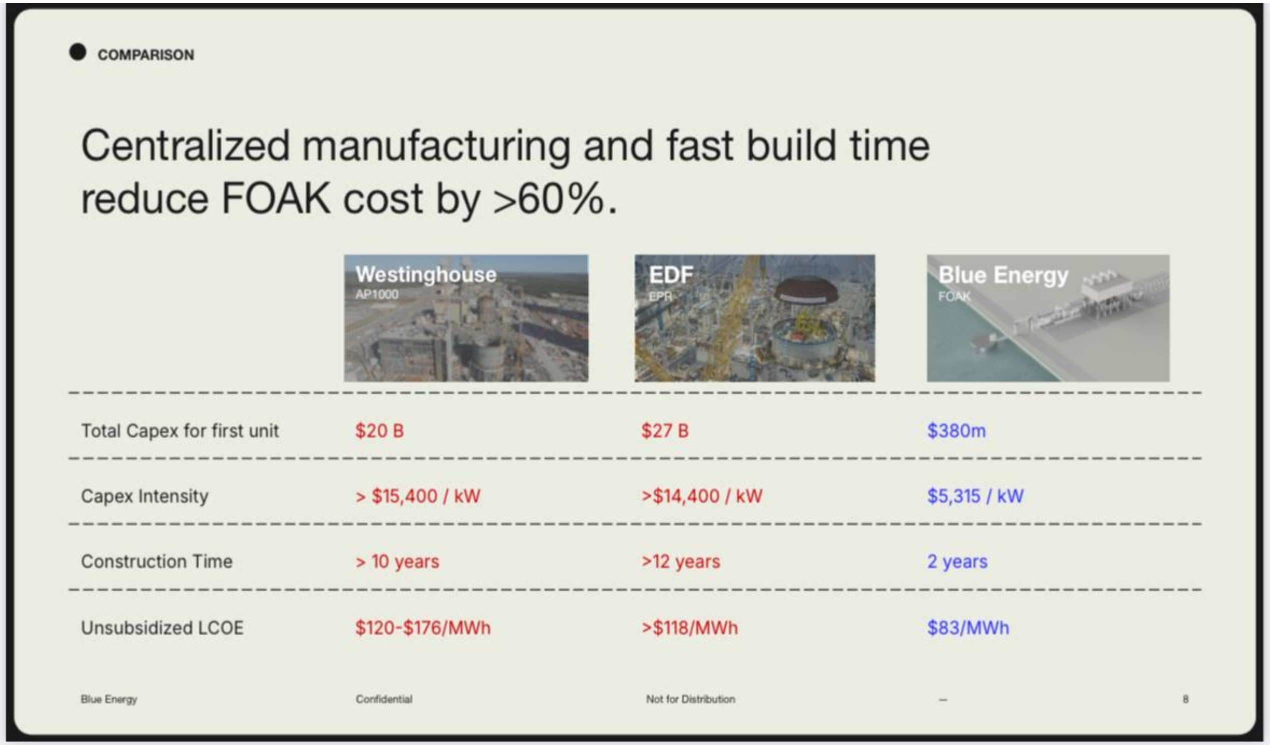
No technology to find Nexxus other than drilling

Non Invasive Certainty Tools simply do not exist……

6) Nuclear may be a true alternative

SMR's on Ship – Address both COST AND TIME





	Westinghouse AP1000	EDF EPR	Blue Energy FOAK
Total Capex for first unit	$20 B	$27 B	$380m
Capex Intensity	> $15,400 / kW	>$14,400 / kW	$5,315 / kW
Construction Time	> 10 years	>12 years	2 years
Unsubsidized LCOE	$120-$176/MWh	>$118/MWh	$83/MWh

5) Fungibility

Money moves where it makes the most sense

Risk and Reward

Category Agnostic…….And “Money Never Sleeps”

4) Shinny Objects Distract US– AGS/EGS

Address portfolio theory by removing “discovery” risk (a positive)

BUT AGS/EGS Strategies often are often LIES OF OMMISSION

- Physics matters
- Path of least resistance matters
- Surface areas matter
- Resonance times matter
- Parasitic loads matter
- Cycling impact - 30 days v 5 years
- Convection matters
- Capex per mw matter

May make sense in certain situation but not critical path in LATAM

High Enthalpy Flash Power is STILL Low Hanging Fruit with ANY diversification/portfolio theory OR removal of Exploration Risk/Exploration Cost Mitigation

3) Shinny Objects - Again

Renewable Hydrogen

Even if the hydrogen is “free” to make it comes with real costs

May make sense in certain situation but not critical path in LATAM

High Enthalpy Flash Power is STILL Low Hanging Fruit with ANY diversification/portfolio theory OR removal of Exploration Risk/Exploration Cost Mitigation

2) GDFLA Hasn't Worked

Must Note – NOTHING else has worked either

GCF allocation to Mexico of more than 10 Years has still yet to be deployed

Some real players applied to and were awarded grants. They subsequently withdrew because on inaction at the country level to enact policy that differentiate firm from intermittent…..or they wouldn't repay the grant upon success.

Ironically, The last two calls (Call 6 and Call 7) resulted in awards where drilling has occurred. These are both 9.8M Euro

Too Little, too late – There will be no call 8

The GDFLA will terminate unless a development finance entity takes over the intitiative and can justify a longer time horizon.

KfW – the GDF sponsor is willing to advocate internally and to their funding entities (EU and the German Government for a transition of the GDFLA to another qualified sponsor.

1) Ministries

Ministries MUST establish policy that differentiate in quantitative ways firm power from intermittent power

Turkey FIT’s worked

If above doesn’t happen - solving any of the 9 other issues probably will not matter in any material way.