

Document of
The World Bank

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Report No: PAD1325

PROJECT APPRAISAL DOCUMENT

ON
PROPOSED INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
LOANS

IN THE AMOUNT OF US\$150 MILLION
TO TÜRKIYE SINAI KALKINMA BANKASI A.Ş. (TSKB)
WITH THE GUARANTEE OF THE REPUBLIC OF TURKEY

AND
IN THE AMOUNT OF US\$[TO BE CONFIRMED]
TO TÜRKIYE KALKINMA BANKASI A.Ş. (TKB)
WITH THE GUARANTEE OF THE REPUBLIC OF TURKEY

AND A
PROPOSED CLEAN TECHNOLOGY FUND (CTF) GRANT

IN THE AMOUNT OF US\$ 40 MILLION

TO THE
REPUBLIC OF TURKEY

FOR A

TURKEY GEOTHERMAL DEVELOPMENT PROJECT

August 17, 2015

Energy and Extractives Global Practice
Turkey Country Unit
EUROPE AND CENTRAL ASIA

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CURRENCY EQUIVALENTS

(Exchange Rate Effective {Date})

Currency Unit =
= US\$1
US\$ = SDR 1

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AFD	<i>Agence Française de Développement/</i> French Development Agency
CAD	Current Account Deficit
CPS	Country Partnership Strategy
CTF	Clean Technology Fund
EBRD	European Bank for Reconstruction and Development
EMRA	Energy Market Regulatory Authority
GDEU	General Directorate of External Relations and EU Affairs
GDRE	General Directorate for Renewable Energy
GDP	Gross Domestic Product
GoT	Government of Turkey
FI	Financial Intermediary
IFIs	International Financial Institutions
KfW	<i>Kreditanstalt fuer Wiederaufbau/</i> German Development Bank
MENR	Ministry of Energy and Natural Resources
MTA	General Directorate of Mineral Research and Exploration
MW	Mega-Watts
MWe	Mega-Watts electric
MWt	Mega-Watts thermal
RSM	Risk Sharing Mechanism
TA	Technical Assistance
TSKB	<i>Türkiye Sinai Kalkinma Bankasi A.Ş./</i> Industrial Development Bank of Turkey
US\$	United State Dollars
PDO	Project Development Objective

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**TURKEY
GEOTHERMAL DEVELOPMENT PROJECT**

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PAD DATA SHEET

Turkey

Turkey Geothermal Development Project (P151739)

PROJECT APPRAISAL DOCUMENT

EUROPE AND CENTRAL ASIA

0000009261

Report No.: PAD1325

Basic Information			
Project ID P151739	EA Category F - Financial Intermediary Assessment	Team Leader(s) Shinya Nishimura, Pierre Audinet	
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints []		
	Financial Intermediaries [X]		
	Series of Projects []		
Project Implementation Start Date 04-Jan-2016	Project Implementation End Date 31-Dec-2021		
Expected Effectiveness Date 29-Jan-2016	Expected Closing Date 31-Dec-2021		
Joint IFC: No			
Practice Manager/Manager Ranjit J. Lamech	Senior Global Practice Director Anita Marangoly George	Country Director Stephen George Karam	Regional Vice President Cyril E Muller
Borrower: Türkiye Sınai Kalkınma Bankası A.Ş. (TSKB)			
Borrower: Türkiye Kalkınma Bankası A.S. (TKB)			
Responsible Agency: Ministry of Energy and Natural Resources			
Contact: Yusuf Yazar	Title: Director General, General Directorate of Renewable Energy	Telephone No.: 90-312-295-5010	
	Email: yyazar@yegm.gov.tr		
Project Financing Data(in USD Million)			
[X] Loan	[] IDA Grant	[] Guarantee	
[] Credit	[X] Grant	[] Other	
Total Project Cost:	227.50	Total Bank Financing:	150.00
Financing Gap:	0.00		

Financing Source		Amount								
Borrower		37.50								
International Bank for Reconstruction and Development		150.00								
Clean Technology Fund		40.00								
Total		227.50								
Expected Disbursements (in USD Million)										
Fiscal Year	2016	2017	2018	2019	2020	2021	2022	0000	0000	0000
Annual	0.20	39.20	73.80	73.55	36.85	3.90	0.00	0.00	0.00	0.00
Cumulative	0.20	39.40	113.20	186.75	223.60	227.50	227.50	0.00	0.00	0.00
Institutional Data										
Practice Area (Lead)										
Energy & Extractives										
Contributing Practice Areas										
None										
Cross Cutting Topics										
[X] Climate Change										
[] Fragile, Conflict & Violence										
[] Gender										
[] Jobs										
[] Public Private Partnership										
Sectors / Climate Change										
Sector (Maximum 5 and total % must equal 100)										
Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %						
Energy and mining	Other Renewable Energy	80		100						
Energy and mining	General energy sector	20		100						
Total		100								
<input type="checkbox"/> I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.										
Themes										
Theme (Maximum 5 and total % must equal 100)										
Major theme	Theme	%								
Environment and natural resources management	Climate change	50								

Financial and private sector development	Infrastructure services for private sector development	50
Total		100
Proposed Development Objective(s)		
The Project Development Objective is to scale up private sector investment in geothermal energy development in Turkey.		
Components		
Component Name	Cost (USD Millions)	
Risk Sharing Mechanism for Resource Validation	40.00	
Loan Facility for Resource Development	187.50	
Systematic Operations Risk- Rating Tool (SORT)		
Risk Category	Rating	
1. Political and Governance	Moderate	
2. Macroeconomic	Moderate	
3. Sector Strategies and Policies	Low	
4. Technical Design of Project or Program	Substantial	
5. Institutional Capacity for Implementation and Sustainability	Substantial	
6. Fiduciary	Substantial	
7. Environment and Social	Moderate	
8. Stakeholders	Moderate	
9. Other		
OVERALL	Substantial	
Compliance		
Policy		
Does the project depart from the CAS in content or in other significant respects?	Yes []	N [X] o
Does the project require any waivers of Bank policies?	Yes []	N [X] o
Have these been approved by Bank management?	Yes []	N [] o
Is approval for any policy waiver sought from the Board?	Yes []	N [X] o
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	N [] o
Safeguard Policies Triggered by the Project	Yes	No

Environmental Assessment OP/BP 4.01		X		
Natural Habitats OP/BP 4.04		X		
Forests OP/BP 4.36			X	
Pest Management OP 4.09			X	
Physical Cultural Resources OP/BP 4.11			X	
Indigenous Peoples OP/BP 4.10			X	
Involuntary Resettlement OP/BP 4.12		X		
Safety of Dams OP/BP 4.37			X	
Projects on International Waterways OP/BP 7.50			X	
Projects in Disputed Areas OP/BP 7.60			X	
Legal Covenants				
Name	Recurrent	Due Date	Frequency	
Condition for Effectiveness (see Financing Agreement)	X		CONTINUOUS	
Description of Covenant				
The Operations Manuals for Component 1 and Component 2 have been executed on behalf of the Contingent Recovery Grant and Loan Recipients. A Project Implementation Unit has been established within MENR, in form, mandate and capacity satisfactory to the IBRD.				
Conditions				
Source Of Fund	Name	Type		
N/A				
Description of Condition				
N/A				
Team Composition				
Bank Staff				
Name	Role	Title	Specialization	Unit
Shinya Nishimura	Team Leader (ADM Responsible)	Senior Financial Analyst	Senior Energy Specialist	GEEDR
Pierre Audinet	Team Leader	Senior Energy Economist	Senior Energy Economist	GEEES
Salih Kemal Kalyoncu	Procurement Specialist	Senior Procurement Specialist	Senior Procurement Specialist	GGODR
Ayse Seda Aroymak	Financial Management Specialist	Senior Financial Management Specialist	Senior Financial Management Specialist	GGODR

Adam Shayne	Counsel	Lead Counsel	Lead Counsel	LEGLE	
Almudena Mateos Merino	Team Member	Energy Specialist	Energy Specialist	GEEES	
Ayse Yasemin Orucu	Team Member	E T Consultant	Energy Specialist	GEEDR	
Esra Arikan	Safeguards Specialist	Senior Environmental Specialist	Senior Environmental Specialist	GENDR	
Regina Oritshetemeyin Nesiama	Team Member	Operations Analyst	Operations Analyst	GCCCI	
Selcuk Ruscuklu	Team Member	Team Assistant	Team Assistant	ECCU6	
Thrainn Fridriksson	Team Member	Energy Specialist	Energy Specialist	GEEES	
Zeynep Durnev Darendeliler	Safeguards Specialist	Social Development Specialist	Social Development Specialist	OPSOR	
Extended Team					
Name	Title	Office Phone		Location	
Ben Mescher	Power Engineer (Consultant)			Annapolis	
Miklos Antics	Geothermal Drilling (Consultant)			Roissy	
Locations					
Country	First Administrative Division	Location	Planned	Actual	Comments
Consultants (Will be disclosed in the Monthly Operational Summary)					
Consultants Required? Consultants will be required					

I. STRATEGIC CONTEXT

A. Country Context

1. **Turkey's economic development in the post 2001 period has resulted in impressive economic achievements.** After a banking crisis in 2001, the country embarked on a concerted path of structural reforms supported by strong fiscal consolidation, strengthened banking supervision, and a shift to a flexible exchange rate regime with an independent central bank responsible for inflation targeting. Per-capita income almost tripled in less than a decade, and Turkey is now an upper middle-income country with the world's 17th largest economy. After a swift rebound from the recession in the Global Economic and Financial crisis in 2008-09, concerns over Turkey's vulnerability to tightening global liquidity as well as domestic political uncertainty have dented investor appetite; as a result, economic growth slowed since 2012. Election-related uncertainties, geopolitical developments and concerns over the government's handling of corruption allegations dampened confidence and weakened private demand in 2014. Thus, despite robust exports and supportive government spending, GDP growth slowed to 2.9 percent in 2014. Exchange rate pass-through and higher food prices pushed inflation to 9.5 percent by mid-2014, almost twice the central bank's target rate, but the 12-month inflation rate slowed to 7.6 percent in March 2015. Moderate growth and exchange rate depreciation reduced external imbalances, and the current account deficit (CAD) narrowed to below 5.4 percent of GDP in January 2015, from close to 10 percent in 2011.

2. **Economic activity is expected to remain subdued in the first half of 2015, limiting the full year growth rate to 3.0 percent in 2015.** Households and corporates are expected to postpone their spending decisions due to political uncertainty until the June elections. Fiscal policy will remain accommodative and growth supportive until the General Elections, but expected to be partially reversed afterwards. The absence of strong import demand from European Union and geopolitical problems in the region will limit export performance throughout 2015. In our baseline scenario, we forecast private spending to recover in the second half of 2015, when the political uncertainty is resolved, as households and corporates carry out their postponed spending. The contribution of net exports is expected to turn negative again, as the recovery after General Elections will boost real import demand while export growth remains moderate. The weaker than expected performance in the second half of last year will carry over into this year, combined with slower than expected growth until the elections, will limit annual growth rate in 2015, despite the expected recovery in the second half of 2015. The expected strong recovery in the second half of this year is likely to continue in the first half of 2016, however. Thus, we project growth to marginally rise to 3.0 percent in 2015 and accelerate to 3.9 percent by 2016. For 2017, we expect growth to slow down towards its new potential growth rate. The fall in oil prices will contribute to reducing Turkey's current account deficit to 4.4 percent of GDP in 2015. Accordingly, the external financing requirement is expected to decline to about US\$200 billion in 2015, from US\$220 billion in 2014. In addition, we expect inflation to slow to 7.0 percent in 2015, thanks to the fall in oil prices.

3. **Over the medium-term, Turkey's growth prospects depend on private investment spending and productivity growth.** Persistent investment weaknesses lowered Turkey's GDP growth in the aftermath of the Global Financial Crisis. Pursuing a credit-driven consumption-based

growth strategy to boost economic growth is no longer a viable option for Turkey. Households and corporates are now more leveraged compared to the early 2000s, and the banking sector's room for supporting high rates of credit growth is markedly diminished, given that the loans-to-deposit ratio stands at about 115 percent. In addition, profitability in the banking sector almost halved since the pre-crisis period, as indicated by return-on-assets and return-on-equity ratios. Restoring investor and consumer confidence will hinge on the government's determination to address the economy's structural bottlenecks through supply-side reforms. Strong reform signals would revitalize private investment spending and boost TFP growth. Higher GDP growth is needed to continue Turkey's convergence process. Most notably, new reform momentum is much needed to improve the quality of education and to upgrade skills. Boosting productivity growth and creating enough high productivity jobs to accommodate Turkey's rapidly rising labor force are critical to create shared prosperity in Turkey.

B. Sectoral and Institutional Context

4. Maximizing exploitation of domestic primary energy resources and securing reliable and affordable energy to a growing economy in an environmentally sustainable manner has been, and remains, the Government of Turkey's core energy policy priority. The Electricity Sector Security of Supply Strategy (2009) and the National Renewable Energy Action Plan (2014) identified a target of increasing the share of electricity generated from renewable energy to 30% of the total 100 GW installed power generation by 2023 (including wind, hydro, solar and geothermal). The 2005 Renewable Energy Law, a major milestone, established purchase guarantee and Feed-in-Tariff mechanism for electricity produced from renewable energy sources. The government also facilitated access to renewable energy financing provided by International Financial Institutions (IFIs) such as World Bank Group and EBRD, as well as Bilateral Institutions (such as AFD and KfW).

5. In this context, the Government of Turkey (GoT) has set a target of developing 1,000 MW of geothermal by 2023 (National Renewable Energy Action Plan, 2014) and has put in place a supportive legal framework to facilitate geothermal development. A critical milestone was the Geothermal Law of 2007, which set out the rules and principles for effective exploration, development, production and protection of geothermal and natural mineral water resources. The Law also clarified the right of economic use of subterranean resources, which rests with the provincial authorities, and the applicable environmental regulation in project development, including proper land reclamation after use. The licensing procedures were also clarified under the law: four-year exploration licenses can then be followed by thirty year exploitation licenses which are issued to developers – public and private alike – by provincial authorities where the geothermal sites are located. In addition, for the production of electricity, thirty year energy generation licenses (power) are issued by the Energy Market Regulatory Authority (EMRA). Finally, the 2010 amendment to the Renewable Energy Law established a feed-in tariff of 10.5 US\$ cents per kWh for geothermal power, for a 10 year period from the commissioning date; with an additional 2.7 US\$ cents per kWh to reward the use of locally produced equipment.

6. Besides the enhanced regulatory framework, the exploration activities conducted by the General Directorate of Mineral Research and Exploration of Turkey (MTA) have been a critical driver behind geothermal development in the country. Established in 1935, MTA has been

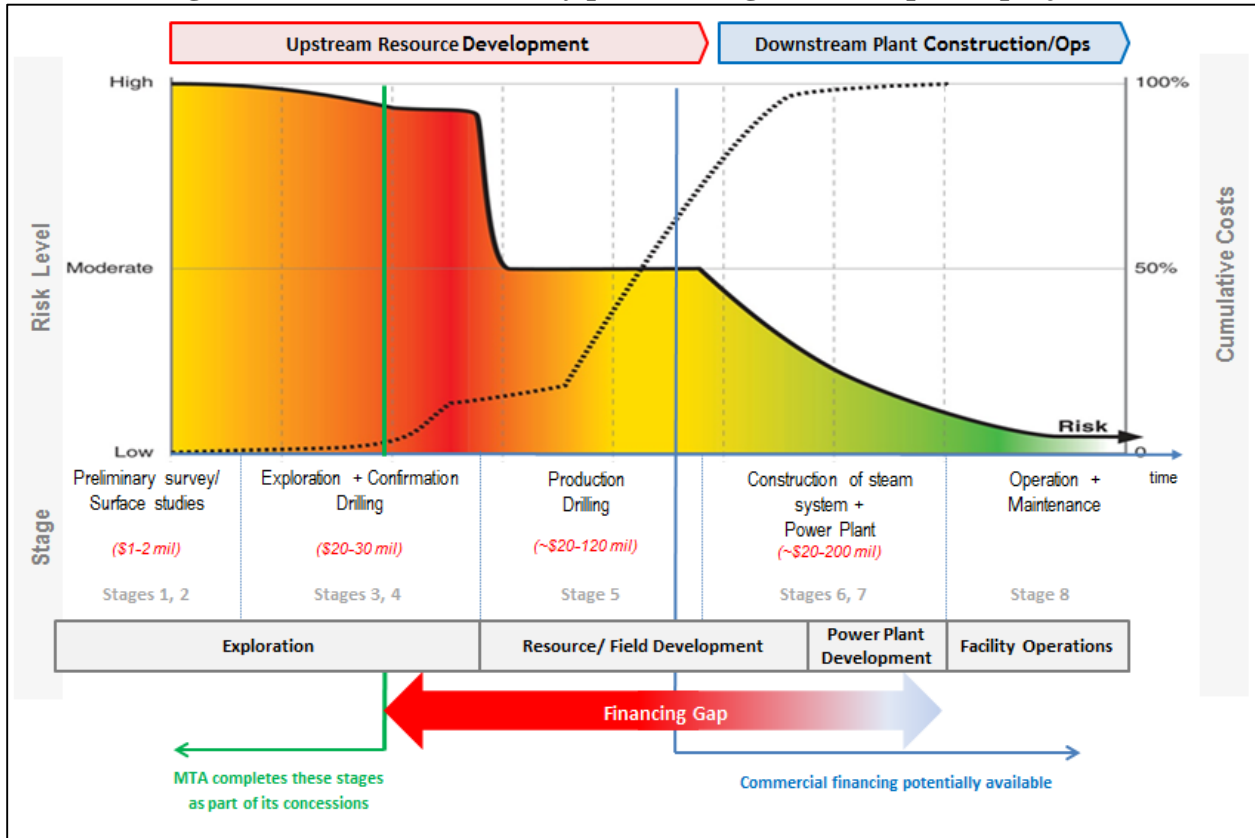
responsible for the exploration and mapping of geothermal resources in Turkey and has traditionally been the main institution advancing the development of geothermal utilization. MTA prioritized 25 sites, out of a total of 190 geothermal sites discovered, which were deemed suitable for electricity production. Those 25 sites were subsequently explored, mostly by MTA performing additional surface exploration and drilling exploratory wells, and then developed by private sponsors. As of January 2015, geothermal generation capacity in the country had reached a total of 410 MWe. All the MTA prioritized sites and current installations are located in the provinces of Aydin, Denizli (Menderes graben¹) and Manisa (Gediz graben), and had been explored to different degrees by MTA, which had mitigated the associated resource risk. Thermal applications (i.e. greenhouses, drying and cooling, district heating and spas), with a total of 2,880 MWt installed as of January 2015, are not concentrated in any particular geographic area.

7. Despite the critical role played by MTA in development of the sector, it no longer has the resource and mandate to undertake extensive geothermal exploration drilling, particularly in the central or eastern provinces, which remain largely unexplored and where geothermal surface manifestation exist. A significant share of the expected geothermal market expansion is in those provinces. Moreover, while 72% of 1,799 active geothermal exploration licenses have been issued to the private sector since 2007, there has been no substantial increase in exploration activities. The significant slowdown in new geothermal exploration activities is due to the following factors:

- a) Inappropriate risk allocation – Since MTA has very limited additional geothermal exploration activities planned, the entire exploration risks in licensed areas that have received little or no previous investments by MTA are now to be taken on fully by the private license holders. However, except for a few of them, many of the exploration license holders have limited technical/geological expertise and financial capacity for taking on such risks. License holders are expected to take on significant capital expenditures and exploration risks that cannot be commercially mitigated since no financing is usually available for the early phases of geothermal development (see Figure 1). Yet this initial investment is the only way to confirm the presence of a source of geothermal energy and validate its commerciality (i.e. a level of productivity measured as MW of energy per well sufficient to ensure a positive return on investment).

¹ A graben is a geological landscape feature where a block of rock has dropped down relative to its surroundings due to extension of the crust. Grabens are elongated depressions, bounded by two approximately parallel faults on each side. Large grabens appear in nature as kilometers long, flat valleys bordered by steep sided hills or mountains. Faults are where geothermal activity can be found.

Figure 1: Risk and bankability profile of a geothermal power project



Source: ESMAP, 2012, *Geothermal Handbook*, Technical Report 002/12, Washington.

- b) Lack of commercial debt financing – Due to the above mentioned risk profile, no commercial debt or equity is available to finance the exploratory or resource development phases (see box 1 below) and, worldwide, developers rely on their own equity. The same is true for the geothermal market in Turkey, where commercial financing is often only available after power plant construction and onward, except in the rare instances when retroactive finance of some production/ capacity drilling expenditures has been provided. For instance, it is not uncommon for project developers to finance 40 - 50% of total capital expenditure of a geothermal power plant before having access to any kind of commercial financing. The developer's own equity capital is then immobilized and at risk for 4-5 years before any cash flow can be generated from sales of electricity. With little support for the riskiest stage of the project development, many exploration license holders are not able to complete the exploration stage.

Box 1: Phases of geothermal development

The development of a geothermal power project is commonly broken down in the four phases summarized below:

I. Exploration Phase – This phase establishes the location, size and quality of the geothermal reservoir; activities conducted include surface exploration, followed by exploration and confirmation drilling.

II. Resource/Field Development Phase – This phase includes the drilling of the wells which will be used to mobilize the geothermal resource from the reservoir and confirm the precise volume available for commercial energy production; activities conducted are capacity drilling (also called production drilling).

III. Power Plant Development Phase – This phase consist on the final design, procurement and construction of the power plant that utilizes the geothermal energy identified in Phase II; including steam gathering systems, power house, equipment to connect the power plant with the electricity grid.

IV. Facility Operations Phase – This phase includes the operation and maintenance of the steam gathering systems and the power plant.

C. Higher Level Objectives to which the Project Contributes

8. The Project is consistent with the Country Partnership Strategy (CPS) for the FY12-15 period, approved by the World Bank’s Executive Board on February 21, 2013. The CPS has three main strategic objectives and pillars: Strategic Objective 1 – enhanced competitiveness and employment; Strategic Objective 2 – Improved equity and public services; and Strategic Objective 3 – deepened sustainable development. The Project will support the Strategic Objectives 1 and 3. Controlling the growth of demand and import of energy, which lead to worsening current account deficit, through increased utilization of domestic energy sources including renewable energy is one of the pillars of the Government Policy as well, as reflected in MENR’s 2015-2019 Strategic Plan. The project would also provide developers' with access to longer term credit than is usually available to them, facilitating the development of the geothermal market.

9. Increase in renewable energy capacity in Turkey has also been identified in Turkey’s first National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), the National Climate Change Strategy and Action Plan, and other government programs, as a crucial component for energy security and climate change mitigation in Turkey.

10. More specifically, the National Renewable Energy Action Plan (2014) identifies the provision of financial support to the private sector for geothermal exploration activities as one of the key measures for achieving the geothermal target. Moreover, it indicates that “the GoT, in collaboration with the Turkish financial sector and international financial institutions focused on

economic development will consider enabling mechanisms that mitigate capital risk to support geothermal exploration and drilling activities.”

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

11. The Project Development Objective is to scale up private sector investment in geothermal energy development in Turkey.

12. This will be achieved by reducing the risks taken on by the private sector in the exploratory phases, and by providing access to long-term financing for resource development phases.

B. Project Beneficiaries

13. The project beneficiaries will be private sector investors in geothermal development in Turkey, as well as the citizens of the Republic of Turkey who will benefit from the associated economic and employment opportunities from increased geothermal development. The global community will also benefit from the experience of the Risk Sharing Mechanism, which will contribute to designing similar mechanisms to stimulate geothermal exploration in other markets.

C. PDO Level Results Indicators

14. The achievement of the Project Development Objectives (PDO) will be measured using the following indicators:

- a) Private capital mobilized (US\$, core indicator).
- b) Generation capacity of Renewable Energy constructed under the Project (MW, Core indicator).
- c) Potential CO₂ emissions reduced or avoided over the lifetime of the project (measured in tCO₂/yr).

III. PROJECT DESCRIPTION

A. Project Components

15. The proposed project envisages two components: (a) Component 1 will establish a Risk Sharing Mechanism for Resource Validation, to support the exploration and confirmation drilling stages. International experience shows that mechanisms that reduce the resource risk by using public support to help share the risk at these stages are the most cost effective way to ensure significant scaling up of investment; (b) Component 2 will set up a Loan Facility for Resource Development to provide financing to the resource development stage and to the power plant development phase. Financing with a long maturity period and technical training for the participating Financial Intermediary (FI) is expected to incentivize them to take more risk at earlier development stages than they would do under usual market conditions.

16. The geothermal fluids in the Menderes and Gediz grabens in the Aegean region, where most of the current geothermal power development is concentrated, are characterized by high CO₂ content. Such areas exist elsewhere around the world but constitute a rare occurrence, explained by specific local geological conditions. Though there is no global consensus as to whether CO₂ emissions from geothermal power plants are anthropogenic or not, the Project will take a conservative approach to potential CO₂ emissions of the investments supported by the Project, to ensure that the average emission factor for the Turkish electricity grid would not be surpassed. To this effect, the Project will not support investments with estimated net emissions above the grid emission factor for 2014, i.e. 583 g/kWh.²

17. The Project will encourage investments outside of the Menderes and Gediz graben areas by providing additional risk coverage from the RSM (60% instead of 40% for investments in Aegean region). However, to help accelerate private sector investment in geothermal energy in Turkey, it is indispensable to maintain the market momentum in the Menderes and Gediz grabens. Beneficiaries from RSM will be able to operate in those areas, but the RSM will also include a clause that will terminate the RSM agreement with a beneficiary if CO₂ content in a well that is part of the coverage is found to be superior to a given level. Under component 2, investments using geothermal resource with high CO₂ content may be supported, only if technologies that either capture, process and/or reinject the CO₂, such as closed binary plant or CO₂ processing plant for industrial/agricultural and beverage applications, are utilized to reduce the CO₂ emissions below grid emission factor. The team is now exploring the possibility to allocate CTF Loan from Turkey Investment Plan endorsed by CTF TCF in 2009 in Component 2 to promote the CO₂ capture/utilization technologies.

18. Details of both components are elaborated below.

Component 1: Risk Sharing Mechanism for Resource Validation US\$ 38 million CTF contingent recovery grant, US\$ 1.8 million CTF grant)

Subcomponent 1.1: Risk Sharing Mechanism for Resource Validation (US\$ 38 million, CTF contingent recovery grant)

19. This component aims to promote private sector development of renewable geothermal energy projects in the early stage geothermal exploratory and confirmation drilling stages by sharing the risk of failing to validate a geothermal resource among two parties: the administrator of a Risk Sharing Mechanism (RSM), capitalized by a CTF contingent recovery grant, and the geothermal developer (i.e. the beneficiary). In case a well fails to yield outputs at a level of well productivity pre-agreed between the RSM and the beneficiary, the RSM will cover a pre-defined percentage of the drilling expenditures incurred by the beneficiary. As said above, this percentage will be 40 percent for projects located in the Aegean region and 60 percent in those located elsewhere in the country, which will encourage exploration in new areas, where the resource risk

² See also Section VI. B. Technical section of Appraisal Summary for more details. The grid emission factor is defined as a combination of the emission levels of power plants both in existence and under construction. Combined margin emission factor for technologies with capacity factor higher than 50% = [(0.50 x operating margin) + (0.50 x build margin)]; UNFCCC: Methodological tool to calculate the emission factor for an electricity system (October, 2013).

is generally higher given that limited or no previous exploration activities have been carried out by MTA.

20. The RSM will screen potential beneficiary applications based upon a clear and pre-defined set of technical, financial and corporate eligibility criteria to ensure that potential beneficiaries have carried out the appropriate surface exploration studies and have the necessary technical and financial capacity to complete the resource validation process (i.e. exploration and confirmation drilling) they plan to undertake. Selected beneficiaries will apply a pre-established well testing methodology, which will provide the results (i.e. temperature and flow) against which success and failure will be determined.

21. In case of failure, the RSM will cover the agreed percentage of the beneficiaries' drilling program expenditures (60 or 40% depending upon the location of the concession as explained above). In the case of success, the beneficiary will be required to contribute to the RSM a "success fee" of 10 percent of the planned incurred expenditures, as a way to reduce the rate of depletion of the RSM capital and maximize the number of projects to be supported. This percentage has been established to balance on the one side the capacity of the RSM to revolve its funds around the largest number of projects and on the other side, the willingness to pay of beneficiaries. The capacity of the RSM to revolve its funds is influenced in large part by the expected success rates to be achieved, currently estimated at 55% in the Exploration Phase in Turkey. The Operational Manual for this component specifies all the application and eligibility requirements and the well testing protocols, provides details of the RSM terms, and defines a specific list of eligible expenses to be covered by the RSM.

22. The General Directorate of Renewable Energy (GDRE) and the General Directorate of External Relations and EU Affairs (DGEU) of the Ministry of Energy and Natural Resources (MENR) will be the implementing agency for the RSM.

Subcomponent 1.2: Technical Assistance for GDRE (US\$ 1.8 million, CTF grant)

23. This sub-component will be included to address capacity building needs required to successfully implement the component. This support will include:

- a) Capacity strengthening of the geothermal team at the GDRE to supervise implementation of the RSM. This will include short trainings to cover geosciences, exploration, reservoir engineering, and principles of drilling. Other areas of training will include planning and budgeting, accounting, financial reporting, external auditing, funds flow, internal controls, procurement, and environmental and social safeguards.

Consultancy support to GDRE to facilitate implementation of the RSM. GDRE will hire a consultant to establish and operate the RSM, and to help ensure that MENR is technically capable take over RSM operations before the end of the project. The "RSM Consultant" will provide specialized financial and geothermal expertise to the RSM, specifically regarding interpretation of surface exploration data, development of conceptual models, drilling and testing, and assessments of development and business plans provided by potential beneficiaries. The RSM consultant will carry out detailed design of the RSM, prepare the required draft legal documents beneficiary agreements, forms and websites, and be responsible for its implementation on a day to day basis and prepare the GDRE

team to eventually taking over the management of the RSM. The RSM consultant will carry out the first two application rounds semi-annually for the RSM, evaluating applications, negotiating contracts with successful applicants, monitoring drilling progress, verifying drilling and well testing results, and assessing whether the success criteria were met. MENR is dedicating specialized staff for this purpose. The Operational Manual for this component will clearly define the responsibilities of MENR and its consultant. Also, as GDRE has not previously implemented a Bank project, it will need to hire a consultant to support financial management. Activities under this sub-component will thus include hiring of short term financial management specialist and a financial audit firm.

Component 2: Loan Facility for Resource Development (US\$ 187.5 million total; US\$ 150 million IBRD loan, US\$ 37.5 million TSKB co-financing)

24. This component aims to address the financing gap that license holders face today in the resource development stages of geothermal project development by providing debt financing to encourage and support both license holders and financiers investing in (i) the capacity/production drilling stage and (ii) the steam gathering and power plant construction stage.

25. The Project will capitalize a credit line to financial intermediaries (FIs) with an IBRD loan, which will be co-financed with FIs' own resources. The FIs will on-lend at market rates, but offer longer tenors than currently available in the market, to geothermal developers at the capacity drilling stage and at the construction stage. FIs shall provide co-financing to the Facility from its own resources, while a minimum equity contribution of 25 percent will be required from geothermal developers (i.e. the sub-borrowers). The requirements and conditions for the Facility, including eligibility of sub-borrowers and projects, will be clearly outlined in a separate Operational Manual to be adopted by the FIs for this component. Once the capacity drilling stage is completed, the borrower (i.e. the project sponsor) shall be required to publicly disclose basic information about its potential project. The information will be disclosed through the project website that will be created for the RSM. This disclosure is intended to expand the financing opportunities of the project sponsor and to avoid market distortion through limits on access to information. The details of the disclosure will be included into the loan agreement between the financial intermediary and the sub-borrower.

26. The Loan Facility will be open to any geothermal development that has reached the capacity drilling stage, regardless of whether it benefited or not from the Risk Sharing Mechanism under Component 1. Once the capacity drilling is completed, the FI may proceed to provide additional funds to the sub-borrowers for the construction of the geothermal facility.

27. The team has identified the Industrial Development Bank of Turkey (TSKB), as a financial intermediary with the technical capacity and experience in renewable energy development. A share of TSKB's co-financing for this component will be dedicated to capacity strengthening on geothermal specific technical support. Specifically, this will include support of consultants for technical assessment, due diligence and monitoring of investments, who would be available to TSKB's team on a needs basis. These consultants are expected to ensure that TSKB is adequately

equipped to effectively assess the technical risk of loan applications during project implementation.

28. The team is also exploring the possibility of the Development Bank of Turkey (TKB) joining the project as a second financial intermediary, as strong interest was expressed by TKB. This would serve to further expand the capital market for geothermal investments. The IBRD loan amount to TKB will be confirmed by appraisal, based upon an assessment of TKB's investment pipeline. The project appraisal document will be revised as necessary once the proper due diligence and approvals are completed and the proposed IBRD loan amount is confirmed.

29. In addition, as mentioned in Section III A., the team is exploring the possibility of allocating US\$ 48 million Loan from CTF Investment Plan (endorsed January 30, 2009; revised and updated November 12, 2012) for the FIs to finance the additional costs of sub-borrowers' investments in CO₂ capture/processing technologies. A revision to Turkey's CTF Investment Plan will be presented to CTF once the CTF loan amount is confirmed. The allocation between beneficiary FIs (TSKB and TKB) will be determined by the needs of individual sub-borrowers.

B. Project Cost and Financing

30. The project will be financed by a US\$38 million contingent recovery grant and a US\$2 million grant from the Clean Technology Fund (CTF), an IBRD loan of US\$ 150 million, and TSKB co-financing of US\$37.5 million. The CTF contingent recovery grant will be provided to the Republic of Turkey, Undersecretariat of Treasury with the Ministry of Energy and Natural Resources as the Implementing Agency. The IBRD Loans will be provided to the Turkish Industrial Development Bank (TSKB) and the Turkey Development Bank (TKB), with the guarantee of the Republic of Turkey. If the RSM resources have not been exhausted by the tenth year following the project start date, the remaining balance will be returned to CTF, unless agreed differently. For example, an alternative could be to leave the balance in the RSM, if the pilot is successful and the Government decided to expand its operation to continue as a revolving mechanism.

31. CTF contingent recovery grant resources to support projects under the RSM will be administered through a Designated Account (DA) at the Central Bank or at a commercial Bank and by direct payments from the Trust Fund Account. The DA account will receive the "success fees" paid by Beneficiaries (i.e. project sponsors) in case of successful drilling. The Trust Fund Account will make direct payments to Beneficiaries in case of drilling failure. Preliminary calculations put a reasonable target in using the total CTF resources in about 20 exploration drilling projects over the Project implementation period, their revolving nature will however be determined by the success/failure rates of projects.

32. A management fee equivalent to 0.5 percent of the total grant amount (US\$200,000) will be charged, to be capitalized from the grant proceeds, following grant effectiveness, and upon confirmation from Turkey's Treasury.

Table 1: Breakdown of project components and financing plan (in US\$ million)

Project Components	Project cost	IBRD	CTF	TSKB	% IBRD + CTF Financing
1. Risk Sharing Mechanism for Resource Validation	40.0		40.0		100%
2. Loan Facility for Resource Development	187.5	150.0	0	37.5	71%
Total Costs	227.5	150.0	40.0	37.5	
Total Project Costs					
Front-End Fees	-	-	-	-	-
Total Financing Required	227.5	150.0	40.0	37.5	89%

C. Lessons Learned and Reflected in the Project Design

33. The design of the project draws upon knowledge gathered as part of the Global Geothermal Development Plan³ and the lessons learned from several geothermal investment projects. Among the investment projects financed by the World Bank, the project drew lessons from the African Rift Geothermal Development Program (ARGeo) – 2006; Djibouti Geothermal Power Generation Project – 2013; and the Geothermal Energy Development Program (GeoFund) – 2009. In addition, an analysis of geothermal projects and risk sharing programs in several countries including the United States, Germany, Iceland, Philippines, Kenya, Ethiopia, East Africa (i.e. the KfW-AUC Geothermal Risk Mitigation Facility) informed the design of this project. Some of the lessons learned include:

- a) Compared to other measures (direct public investment, tax and capital incentives, subsidized commercial insurance), cost sharing mechanisms such as the Risk Sharing Mechanism proposed in this project have demonstrated the most cost-effective way to scale-up investments in exploration of geothermal energy and ultimately to catalyze investments in geothermal power generation capacity.
- b) These mechanisms need to be adequately funded so that risks can be spread among a portfolio of projects
- c) Adequate due diligence in project and sponsor selection is essential to avoid fast depletion of available resources.

34. A capable Financial Intermediary is needed to adequately implement the Loan Facility for resource development. TSKB and TKB have been identified as the only FIs with adequate experience and capacity to implement and take on the risk associated with the capacity drilling activities to be supported by the project.

³The Global Geothermal Development Plan was formally announced by World Bank Group Managing Director Sri Mulyani in Reykjavik (Iceland), on March 6, 2013. The Global Geothermal Development Plan (GGDP) is an ambitious initiative by the World Bank's Energy Sector Management Assistance Program (ESMAP) and other multilateral and bilateral development partners to scale up the use of geothermal power.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

35. On behalf of the Republic of Turkey, the Ministry of Energy and Natural Resources (MENR) will assume overall implementation and fiduciary responsibility for the implementation of Component 1. Within MENR, a Project Implementation Unit (PIU) will be set up within the General Directorate of Renewable Energy (GDRE), which will be responsible for the implementation and supervision of the RSM activities. GDRE has no prior experience or relevant fiduciary capacity for project implementation purposes. General Directorate of External Relations and EU Affairs (GDEU) will provide fiduciary support to GDRE. MENR will provide adequate budgeting, personnel and other necessary resources throughout the implementation of the entire RSM process to ensure continuity. In addition, GDRE will establish a RSM Technical Committee to provide technical, review, and advisory role to facilitate the implementation of the RSM. The Technical Committee will be chaired by GDRE and will include representatives from MTA, MENR General Directorate of Mining Affairs/MENR (MIGEM), and other relevant agencies with the technical capacity to make recommendations to the GDRE management regarding selection of RSM Beneficiaries and acceptance of claims for unsuccessful wells.

36. A consultant firm (“RSM consultant”) will be hired to provide support to the GDRE in implementing and managing the RSM. The RSM consultant will carry its work on behalf of MENR and under the supervision of GDRE. The consultant will be required to provide specialized financial and geothermal expertise to the RSM, specifically regarding the assessment of the corporate, financial and technical eligibility of applicants, as well as the interpretation of surface exploration data and conceptual models presented, proposed drilling and testing plans and protocols, assessments of development and business plans, and monitoring and reporting of all activities undertaken by the selected beneficiaries. A financial management consultant will be hired to support fiduciary capacity in MENR GDRE and GDEU to design and implement project financial management arrangements including project budgeting, accounting reporting and auditing.

37. TSKB has been identified as the Financial Intermediary (FI) that will implement of Component 2. TSKB has with adequate experience and capacity to implement and take on the risk associated with the capacity drilling activities to be supported by the project. This is based on TSKB’s technical strength, track record in renewable energy development and significant experience in implementing national and World Bank policies in environmental and social safeguards. The fiduciary capacity in TSKB is satisfactory and the systems currently utilized in the implementation of the Renewable Energy project will be utilized for the Turkey Geothermal Development Project. The team has also initiated discussions with TKB, which is also a development bank with the capacity and experience in renewable energy, on participation to the project.

38. Sub-borrowers will be approved by TSKB based on compliance with its Operational Manual, which covers aspects such as eligibility, safeguards compliance, monitoring requirements, etc. Sub-loans will be provided to eligible subprojects. The interest rate will be equal to the costs of IBRD funds to TSKB plus a risk-adjusted spread based on the risk classification of the sub-borrower and the subproject passed onto the sub-borrower along with an appropriate spread to

cover the TSKB's administrative costs. Sub-loans from IBRD will have a maturity of not less than 4 years.

B. Results Monitoring and Evaluation

39. In collaboration with the PIU (GDRE), GDEU will be responsible for results monitoring and evaluation (M&E) activities for Component 1, including the submission of semi-annual implementation progress reports to the World Bank. Most of the required data will be furnished by the reports generated by the RSM consultant based on the data to be regularly provided by the RSM Beneficiaries. For Component 2, TSKB will be responsible for reporting and assessing implementation progress.

C. Accountability

40. Communities and individuals who believe that they are adversely affected by a World Bank supported project may submit complaints to existing project-level grievance redress mechanisms or the World Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address pertinent concerns.

41. Project affected communities and individuals may submit their complaint to the World Bank's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of World Bank non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond.

42. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service, please visit <http://www.worldbank.org/GRS> For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org

D. Sustainability

43. The proposed Risk Sharing Mechanism is a pilot that, if successful, could be expanded with additional resources from the Government or other sources for ongoing support to the riskier phases of geothermal project development in Turkey. In addition, lessons learnt from the institutional and operational set up would inform other countries considering risk sharing schemes for the promotion of geothermal development.

44. The proposed project has the potential to contribute to the reduction of costs through expansion of the geothermal industry operating in Turkey, including local providers. It will also contribute to the improvement of industry practices, including technical, contractual, environmental and social, required both by the RSM and the Loan Facility.

45. Sustainability will also be ensured by avoiding market distortions and ensuring that FIs will gain appropriate returns from investments made under the IBRD loan. FIs will thus follow their pricing policy according to market rates. The only significant market advantage for FIs will derive from the long tenure of the IBRD loan, which will allow FIs to provide long-term financing without taking on significant maturity risks. In addition, the analysis of the Turkish geothermal

market has shown that no other financiers are willing to provide financing for capacity drilling, which will receive the majority of funds from the Loan Facility. Also, in order to expand the financing opportunities of the project sponsor and to avoid market distortion through limits on access to information for power plant construction projects, project sponsors benefitting from the Loan Facility for capacity drilling will be required to publicly disclose basic information about their projects.

46. Sustainability will also be enhanced by ensuring that both GDRE and FIs staff develop strong technical capacity to appropriately identify, evaluate and monitor the projects. Capacity building already provided during project preparation and technical assistance available during project implementation will help address this issue. In addition, FIs pioneering experience is expected to generate valuable knowledge on risk management in geothermal projects and thus encourage other private banks to consider the provision of financing from the early capacity drilling stage.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

47. The overall risk of the project is rated as Substantial due to substantial technical, institutional capacity, and fiduciary risks.

- a) The technical risk is “Substantial.” The drilling stages of geothermal exploration, especially exploration and confirmation drilling, but also capacity drilling, are high risk by nature and this risk cannot be commercially hedged. In addition, the track record of risk sharing schemes in other markets is mixed. Although the Team has consulted with various stakeholders and has incorporated mitigation measures in the Project design, the high risk nature of the exploration stage itself may lead to unsuccessful wells which may deplete the Risk Sharing Mechanism sooner than expected.
- b) The institutional capacity risk is “Substantial.” GDRE does not have experience in the implementation and management of a program of the proposed scale. GDRE will establish a new PIU which will have no prior experience in managing and implementing a World Bank financed project. Although the RSM consultant will support the work of the PIU, internal approval procedures may face technical, bureaucratic or time constraints that put at risk implementation progress of the RSM.
- c) The fiduciary risk is “Substantial.” GDRE does not have any experience with World Bank fiduciary requirements and the current fiduciary capacity at the GDEU is limited. Additionally the Risk Sharing Mechanism will be the first such facility that will be managed by the MENR. The management of the mechanism especially registering the compensation and premium payments is considered risky from a fiduciary perspective.

Systematic Operations Risk- Rating Tool (SORT)	
Risk Category	Rating
1. Political and Governance	Moderate
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Low
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Moderate
OVERALL	Substantial

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

48. The project's economic impact is assessed based on benefit-cost analysis for both components of the project. Compared to other renewable energy and fossil fuel power sources, geothermal power systems have a much higher plant capacity factor which leads to higher levels of reliability as a power source. The economic benefits of the project are limited to significant quantifiable benefits and therefore the results regarding the economic net present value (NPV) and the economic internal rate of return (EIRR) should be seen as lower bounds relative to the actual economic benefits. Several economic benefits were not quantified as part of this economic analysis. These include indirect benefits from induced investments in spas, greenhouses and other secondary uses of geothermal heat, and new temporary and permanent jobs created in the communities where geothermal resources are developed.

49. The economic benefits quantified in the analysis were:
- Economic savings from avoided cost of imported fossil fuels, primarily gas.
 - Social value of avoided GHG emissions.

50. The economic costs of the project consist of tax exclusive investment costs, and the operating and maintenance cost associated with the project. The annual operating and maintenance costs include both fixed and variable costs, and were estimated to be US\$ 5.4 million. The economic analysis yielded an NPV equivalent to US\$452 million and EIRR of 29 percent. A summary of the results for the economic valuation of the project base case is presented below.

Table 2: Summary of economic benefit of reduced fossil fuel imports

NPV (US\$ million)	EIRR (%)	Average Annual savings (US\$/kwh)
452	29	34

51. Sensitivity Analysis: The high CO₂ content in some parts of Turkey significantly elevates the risk of geothermal exploration. A sensitivity analysis was conducted to determine the economic valuation of the project without any economic benefit from CO₂ reduction. The result of the analysis showed a healthy NPV of US\$ 244 million and EIRR of 22% without the additional benefits from CO₂ reduction. Details of the sensitivity analyses are provided in Annex 5.

52. Financial Analysis: From a financial analysis perspective, the purpose of the project will be two pronged. The project will finance the riskiest part of geothermal exploration with grants to developers to reimburse a percentage of their investment when the sub-project is considered a failure. The project will also provide loans to private sector developers to finance capacity drilling and construction of power plants. Due to the unique nature of the two components, the financial analysis of the project was conducted separately for component 1 and component 2.

53. In the analysis of the financial viability of component 1, six different scenarios were analyzed to cover the scope of possible drilling programs (3, 4, and 5 well programs) in the RSM. In the six scenarios, different assumptions were made about the cost of investment, characteristics of the drilling program (within and outside the Aegean Region), salvage value, and the probability of success. At the exploratory drilling stage, industry-wide the success rate is generally between 30 to 80 percent, depending on the existing geophysical evidence. For the present analysis of Component 1, a range of success rates from 80 to 30 percent were analyzed. As illustrated in Table 4 below, a probability weighted average of the NPV and IRR of the range of possible scenarios shows an IRR of 12% and a NPV of 1.37 million. Details of the assumptions for each scenarios and the methodology of the analysis can be found in Annex 6.

Table 4: Summary of Financial Analysis for the Risk Sharing Mechanism

Case Scenarios	Status	Well Program	Region	Market value of Concession	Probability of success	IRR	NPV
Scenario 1	Successful	4 Well	Aegean	20,000,000	80	16%	\$2,000,203
Scenario 2	Failure	3 Well	Aegean	8,000,000	70	15%	\$1,168,449
Scenario 3	Successful	3 Well	Not Aegean	17,000,000	60	18%	\$2,747,252
Scenario 4	Failure	4 Well	Aegean	12,000,000	50	14%	\$1,684,748
Scenario 5	Failure	4 Well	Not Aegean	6,000,000	40	5%	\$372,865
Scenario 6	Successful	5 Well	Not Aegean	19,000,000	30	4%	\$290,560
Probability Weighted Average						12%	\$1,377,346

54. To establish the financial viability of projects financed in component 2, a sample 30 MW project was analyzed. The total capital expenditure was US\$155,725,000, including the cost of the concession, capacity drilling, and plant construction. The base case assumes a debt-equity ratio of 75:25, 15 year loan term, 5.50% interest rate, success rate (hit ratio) of 70%, and a financial discount rate of 15%. Details of the assumptions are provided in Annex 6. A summary of the results of the analysis is presented below.

Free cash flow⁴ to Equity	
Return on equity (based on FCFE)	31%
Equity NPV (based on FCFE)	US\$ 51,975,579
Free cash flow to the Project (net income)	
IRR	17%
NPV	US\$17,048,450
Project IRR and NPV	
Project IRR	7%
Project NPV	US\$11,163,744

55. The free cash flow methodology analyzes the financial benefits from the perspective of equity investors while the Project IRR and NPV uses the project cash flows to determine financial viability.

56. Geothermal energy presently enjoys a feed-in tariff of 10.50 cents/kWh. The government of Turkey also provides an additional 2.7 cents/kWh when local equipment is used. The analysis takes a conservative tariff of 10.50 cents/kWh. A sensitivity analysis was conducted to determine the impact of reducing tariffs from 10.50 cents/kWh, progressively to 7.5 cents per kWh. The FIRR and NPV remain positive despite a reduction of the feed in tariff to 8.5 cents per kWh.

Table 3: Sensitivity of FIRR and NPV to Tariff changes

Tariff (c/kWh)	10.5	9.5	8.5	7.5
IRR	17%	16%	15%	14%
NPV	17,048,450	9,570,223	2,091,997	(5,386,229)

B. Technical

57. Both technologies for geothermal power generation and use of geothermal heat for direct applications are mature. Geothermal power plants have a track record of over 60 years of large scale implementation and are now in operation in 25 countries. Direct geothermal applications of geothermal energy are more wide spread and have a longer history. The total world-wide installed capacity for geothermal power production is currently about 12.5 GWe and the corresponding value for direct applications is about 70 GWt.

58. Significant resource risks are always inherent in geothermal energy development, as in essence, a geothermal energy project is a combination of two distinct activities: a geothermal energy mining activity (below the ground) and a geothermal heat exploitation activity (above the ground). The resource risk is highest at the initial stages of project development, before the first wells are drilled and decreases as more wells are drilled, each well providing further information about the nature of the reservoir, most importantly the temperature and permeability. The resource risk cannot be completely eliminated but geoscientific surface exploration studies and the resulting conceptual model of the geothermal system serve to inform decisions about drilling targets as to

⁴ Calculated as operating cash flow minus capital expenditures.

maximize the likelihood of successful drilling⁵. Similarly, careful lithological studies and well testing of each well drilled provide valuable information that can increase the probability of success in subsequent wells. Other risks, related to issues such as blow-outs, casing damage, destruction of permeability etc. can be largely mitigated by following established industry best practices for geothermal drilling⁶.

59. The Project will help to establish a high standard for the quality of geothermal surface exploration work in Turkey by requesting high quality exploration studies as a prerequisite to support under the RSM. This will include detailed geological, geochemical and geophysical surface exploration studies. A conceptual model of the geothermal system, consistent with the results of the exploration studies will also be part of the minimum requirements for support under the RSM along with drilling targets for the exploration wells based on the conceptual model. Furthermore, well design and well drilling and testing will have to be consistent with industry best practices. The RSM consultant will employ experienced geothermal specialists to validate the quality of exploration studies, drilling plans and well designs for projects supported by the RSM.

60. The Loan Facility for geothermal development will provide financing for capacity drilling and power plant construction. Projects financed by the loan facility will also be required to apply industry best practices, as described above for projects covered by the RSM. This will be ensured by the FIs engineering teams and by expert consultants that will be contracted when needs arise.

61. Several different geothermal energy conversion technologies can be employed in geothermal power plants. Most geothermal power plants already installed in Turkey are flashed binary (two phase) plants but two large condensing steam turbine plants are also in operation. These are both well-established technologies and there are local suppliers, and in some cases equipment manufacturers active in the country. Geothermal power plant operators have a good track record in Turkey with respect to operation and maintenance. The bulk of the growth of the geothermal power sector in Turkey in the next five years will involve flashed binary plants but some pumped binary plants are also expected to come on-line in the near future. There are, currently, no pumped binary plants in the country. However, this is a mature technology as well and is used successfully in several countries, notably in the United States. The equipment needed for pumped binary power plants is to a large degree the same as for flashed binary plants and the same manufacturers generally provide both. As a result, the technological risk related to geothermal power production can be considered minimal. The same applies to direct application of geothermal energy, e.g. for space heating or cooling or spas. Direct application of geothermal energy is technically much simpler than for power production and can be considered a well-established, mature technology as well.

C. Financial Management

62. MENR will be responsible for the implementation of the Clean Technology Fund (CTF) contingent grant funded Risk Sharing Mechanism, which will require close monitoring and strong implementation capacity. The GDRE within MENR has no prior experience or relevant financial

⁵ See Best Practice Guide for Geothermal Exploration, IFC, 2014.

⁶ See, e.g. Sandia National Laboratories Handbook of Best Practices for Geothermal Drilling (SAND2010-6048) and New Zealand Code of practice for deep geothermal wells (NZS 2403).

management (FM) capacity for project implementation purposes. FM responsibilities for this project will be assumed by GDEU, who has some prior experience with the implementation of the EU/IPA 1 Project. Since the financial management capacity at both GDRE and GDEU is limited, a financial management consultant will provide support to both General Directorates in project budgeting, accounting, reporting and auditing procedures. The roles and responsibilities of the departments and the internal control procedures will be further detailed in the project financial management manual (which will form a part of the project operations manual) that will be prepared before negotiations.

63. TSKB has extensive experience in implementing Bank financed projects and has acted both as a wholesale and a retail bank in previous projects. For the current Private Sector Renewable Energy and Energy Efficiency Project (where TSKB is the wholesale bank) the financial management arrangements of the project are fully integrated into the TSKB systems which allow the loans extended by TSKB to be followed-up from initial application to approval to monitoring through the system. REL II AF financial management arrangements are satisfactory to the Bank and the same systems will be utilized for the Geothermal Development Project.

D. Procurement

64. Procurement of goods, works and non-consulting services for the proposed Project will be carried out in accordance with the World Bank's "Guidelines: Procurement of Goods, Works and Non-Consulting Services under IBRD Loans and IDA Credits & Grants" dated January 2011 and revised in July 2014 (Procurement Guidelines); and procurement of consultant services will be carried out in accordance with the World Bank's "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011 and revised in July 2014 (Consultant Guidelines) and the provisions stipulated in the Loan Agreements (LAs). World Bank's "Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants", dated October 15, 2006 and revised in January 2011 (Anti-Corruption Guidelines) will apply to this Project.

65. The expenditures due to the procurement of goods, works, non-consulting and consulting services for exploration drilling activities by the Beneficiaries under Component 1.1 of the Project shall be done with due attention to economy and efficiency and in accordance with procedures which meet the requirements of paragraph 1.5 and 1.8 of the Procurement and Consultant Guidelines respectively. Such procurements will be reviewed and confirmed by the RSM consultant.

66. The procurement of Consulting Services under the Technical Assistance (TA) sub-component of Component 1.2 of the Project shall be carried out by MENR GDEU. The GDRE PIU will be responsible for the implementation of the consultancy contract with the RSM consultant.

67. Private Sector Commercial Practices will be followed for Goods, Works and Non-Consulting Services contracts in accordance with paragraph 3.13 of the Procurement Guidelines; and for Consulting Services in accordance with paragraph 3.13 of the Consultant Guidelines under Component 2 of the Project which provides a credit line to the geothermal concessioners for their geothermal energy investments, primarily for drilling activities. The procurement arrangements

under the resource development (credit line) investment lending sub-component will be conducted as agreed in the operational manual for TSKB.

68. An assessment of TSKB, MENR GDEU and GDRE has been carried out and concluded that TSKB has adequate capacity to oversee the procurement activities under the resource development investment lending sub-component of the Project. TSKB is familiar with World Bank procurement procedures through its experiences with implementing more than five similar credit line projects financed by the Bank. However, MENR GDEU has limited experience and capacity in carrying out its procurement through Bank's procurement procedures under TA sub-component of the Project. GDEU has been implementing two Bank financed projects through its already established PCU and developing procurement capacity with the support of the Bank procurement team. GDRE PIU will provide technical support to GDEU in the selection of RSM consultant, and also will act as the client's representative in the implementation of this contract. GDRE has no similar contract implementation experience. TSKB will maintain its existing Project Implementation Unit (PIU) which consists of more than 12 procurement and technical experts. The procurement risk associated with TSKB is low whereas the procurement risk associated with the GDEU is moderate. The contract implementation risk associated with GDRE is substantial. Given the size of the financing allocated to the MENR, the overall procurement risk is assessed as moderate for the project. A brief summary of the procurement arrangements is provided in Annex III including risk mitigation measures which have been discussed and agreed by TSKB, MENR GDEU and GDRE. The same assessments shall be conducted for TKB before Appraisal.

E. Social (including Safeguards)

69. The footprints of a geothermal power plants requires land acquisition for the power plant itself, multiple wells, the network of interconnecting pipework, a transformer station, electricity transmission lines to connect to the grid, access roads and administrative offices. Accordingly, the World Bank Operational Policy 4.12 on Involuntary Land Acquisition has been triggered.

70. Land acquisition occurs gradually, starting with only a few well areas (about 0.5 hectares each) for the exploration drilling and ending with the full footprint described above for a plant in operation. When developers are having well areas expropriated, remaining land of the owner may be left with "holes" and not viable for livelihoods or farming. Similarly, the lattice of interconnecting pipes (about 2 meters wide, installed above ground) can have a more significant impact compared to just the base area for land acquisition due to the impact on dividing farmers' plots and cutting off access for people, animals and machinery. The potential impacts of piecemeal expropriation on the livelihoods of farmers is assessed in the Resettlement Action Plan (RAP). In these cases, expropriation of all of the owner's land or other mitigation measures may be necessary.

71. In Turkey, the general practice is for the private developers initially to approach land owners through a willing buyer-willing seller process. This land acquisition is considered voluntary as the company has some flexibility for the siting of wells, and uses this power to avoid involuntary land acquisition where it can and to avoid impacts on residential plots. Barring voluntary sale, the private developer needs to apply to the Provincial Administration for expropriation procedures during the exploration and productions stages, or to EMRA and the Ministry of Finance during the generation stage. In short, expropriation will be conducted by multiple parties and at different times. Likely, when the developer is accessing World Bank

financing, some of the land acquisition will have been completed, for which the developer will conduct a social audit and a mitigation plan if necessary, and some of the land acquisition will take place during project financing, for which the developer will prepare a RAP outlining how the involuntary land acquisition will take place.

72. Since the sub-projects are not known at this time, two Resettlement Policy Frameworks (RPFs) were prepared by GDRE and TSKB in compliance with the policy. The Resettlement Policy Frameworks prepared by GDRE and TSKB outline in detail the expropriation procedures for geothermal development in Turkey, World Bank's OP 4.12 policy on involuntary resettlement, a gap analysis, steps to bridge these gaps and institutional responsibilities. The RPF has been consulted with key stakeholders on XXX and the final document has been disclosed on clients' websites on XXX and on Bank's Infoshop on XXX.

73. During project implementation, GDRE, with support of the RSM consultant, and TSKB will screen sub-projects for financing, ensure the preparation of a social audit and/or RAP as necessary by the private developer, and submit for World Bank review and clearance prior to financing of infrastructure. GDRE and TSKB will also oversee and supervise the implementation of these RAPs. TSKB fully understands the World Bank's social safeguards requirements and has high capacity to monitor social impacts thanks to a longstanding relationship with many international finance institutions. GDRE is currently not familiar with such safeguard policies. Accordingly, the RSM consultant will be required to possess capacity to support GDRE in the implementation of the RPF and to build capacity in GDRE if necessary. If needed, GDRE will hire short term consultants to perform its environmental and social safeguards responsibilities.

74. Additionally, in some of the Southwestern and Western areas of Turkey, especially if local communities were not adequately consulted, there have been cases of resentment, dissatisfaction and protest regarding power plants. Broad community support will be sought through timely consultations and sub-project level grievance redress mechanisms will be set up to resolve concerns as they arise. Both consultations and grievance mechanisms will take into account the different needs and concerns of men and women. Encouraging developers to implement community projects and / or use excess hot water for heating or tourism or greenhouse warming can also present opportunities for positive social impacts to surrounding communities.

F. Environment (including Safeguards)

75. In accordance with World Bank safeguard policy OP/BP/GP 4.01 (Environmental Assessment), the project has been assigned as Category FI (Financial Intermediary) with potential Category B sub-projects. The sub-projects are estimated to be Category B in nature since potential impacts of both Component 1 drilling activities and Component 2 activities are expected to be limited and be relatively easy to assess and mitigate through careful siting and good drilling and construction practices.

76. Since the exact footprints of the sub-projects are not determined yet, an environmental and social management framework (ESMF) has been prepared by the clients (GDRE and TSKB) to provide guidance for screening, assessing, conducting consultations, reporting and monitoring practices. The ESMF has been consulted with key stakeholders on XXXXX and the final

framework document has been disclosed on clients' websites on XXX and on Bank's Infoshop on XXX.

77. In addition to client, GDRE and TSKB will be the responsible parties for the implementation of ESMF. Same as social policies, GDRE is not experienced about environmental safeguard policies of World Bank. In that respect, GDRE will be supported by RSM consultant during implementation of ESMF. It is planned that the RSM consultant will be also responsible for reviewing the exploration applications from the project sponsors in line with national and World Bank requirements as defined in this FW. DGRE will be the final responsible party for the World Bank since they will be supervising the RSM consultant. On the other hand, TSKB has capacity for the implementation of ESMF as well as its good knowledge about World Bank safeguard policies. The PIU in the TSKB will be responsible for implementation of this ESMF for the capacity drilling and power plant establishment and operation activities.

78. The ESMF outlines the best practices in drilling, well management, and construction of power plants and associated infrastructure to be followed by the sub-borrower and the monitoring protocols to be followed for adequate supervision. The gaps between national environmental screening and assessment procedures and World Bank safeguard policies are also detailed in the ESMF for both Component 1 and 2. The ESMF provides guidance on risk screening of proposed sub-projects (including assessment of potential cumulative impacts), mitigation measures to reduce/manage potential adverse impacts.

79. The exploration and capacity drilling and construction activities (Component 1 and 2) may take place in rural areas which are potential natural habitats. Therefore, the policy is considered to be triggered to be on the safe side. But the sub-projects in critical habitats will not be eligible for financing. According to OP 4.04, the projects which do not create any significant adverse impacts on natural habitats and that are not placed in critical natural habitats will be eligible for financing. Issues related to natural habitats will be detailed in the sub-project environmental assessment documents.

Annex 1: Results Framework and Monitoring

Country: Turkey

Project Name: Turkey Geothermal Development Project (P151739)

Results Framework*

Project Development Objectives

PDO Statement

The Project Development Objective is to scale up private sector investment in geothermal energy development in Turkey.

These results are at | Project Level

Project Development Objective Indicators

Indicator Name	Cumulative Target Values						
	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Private Capital Mobilized (Amount(USD)) - (Core)	0.00	0.00	65	200	335	425	455
Generation Capacity of Renewable Energy (other than hydropower) constructed (i.e. Geothermal) (Megawatt) - (Core)	358.00	358.00	358.00	380.00	404.00	424.00	424.00
Potential CO ₂ emissions reductions (Tons/year)	0	0	97,639	260,371	423,102	553,288	650,927

*Results will be revised upward to reflect additional lending from TKB to be confirmed in Component 2.

Intermediate Results Indicators

Component 1	Cumulative Target Values						
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Exploration drilling projects supported under the Risk Sharing Mechanism (Number)	0.00	0	3	8	13	17	20
Volume of direct financing catalyzed by CTF financing (US\$) – (Core)	0.00	0	30	81	131	172	202
Geothermal resources confirmed through exploration drilling (electricity and heat) (MWe)	0.00	0	31	83	135	177	208
Potential CO ₂ emissions reductions (Tons/year)	0	0	0	26,037	42,310	55,329	65,093
Component 2							
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Geothermal resources developed through capacity drilling (Megawatt)	0	0	0	24	48	72	72
Capacity drilling projects supported by the Loan Facility (Number)	0.	0	1	2	3	3	3
Volume of indirect financing catalyzed by CTF financing (US\$)	0	0	0	18	69	88	175
Grievances registered related to delivery of project benefits addressed (%) (Percentage) - (Core)	0	0.	20	40	80	80	80
Grievances related to delivery of project benefits that are addressed (number) (Number - Sub-Type: Supplemental) - (Core)	1	0	2	3	5	7	7
Potential CO ₂ emissions reductions (Tons/year)	0	0	97,639	234,334	380,792	497,959	585,834

Indicator Description

Project Development Objective Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Private Capital Mobilized	The core indicator track the amount of direct financing (in the form of equity and/or debt) mobilized by private entities, using private funding, to finance investments within an IBRD/IDA operation or investments (PE, GE, RE, SF, and GU) directly linked to that operation.	Semi-annually	Project progress reports from DGRE, TKB and TSKB	DGRE, TKB and TSKB
Generation Capacity of Renewable Energy (other than hydropower) constructed	This measures the capacity of renewable energy (other than hydropower) constructed under the project. The TTL should specify the type of renewable power (i) wind; (ii) geothermal; (iv) solar; or (iv) other. For hydropower refer to code Hydropower (LH). The baseline value for this indicator will be zero.	Semi-annually	Project progress reports from TSKB	TKB, TSKB
Potential CO ₂ emissions reductions	Potential CO ₂ emissions reduced or avoided over the lifetime of the project (measured in tCO ₂ /yr)	Annual	Sub-project reports, MENR data	MENR, TKB and TSKB

Intermediate Results Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Exploration drilling projects supported under the Risk Sharing Mechanism	No description provided.	Semi-annually	Project progress reports from DGRE	DGRE
Volume of direct/indirect financing catalyzed by CTF financing (US\$) – (Core)	Capital invested by private sector investors who are beneficiaries of the program: Component 1 – cost of exploration drilling, Component 2 – cost of capacity drilling and	Semi-Annually	Project progress reports from DGRE, TKB and TSKB	

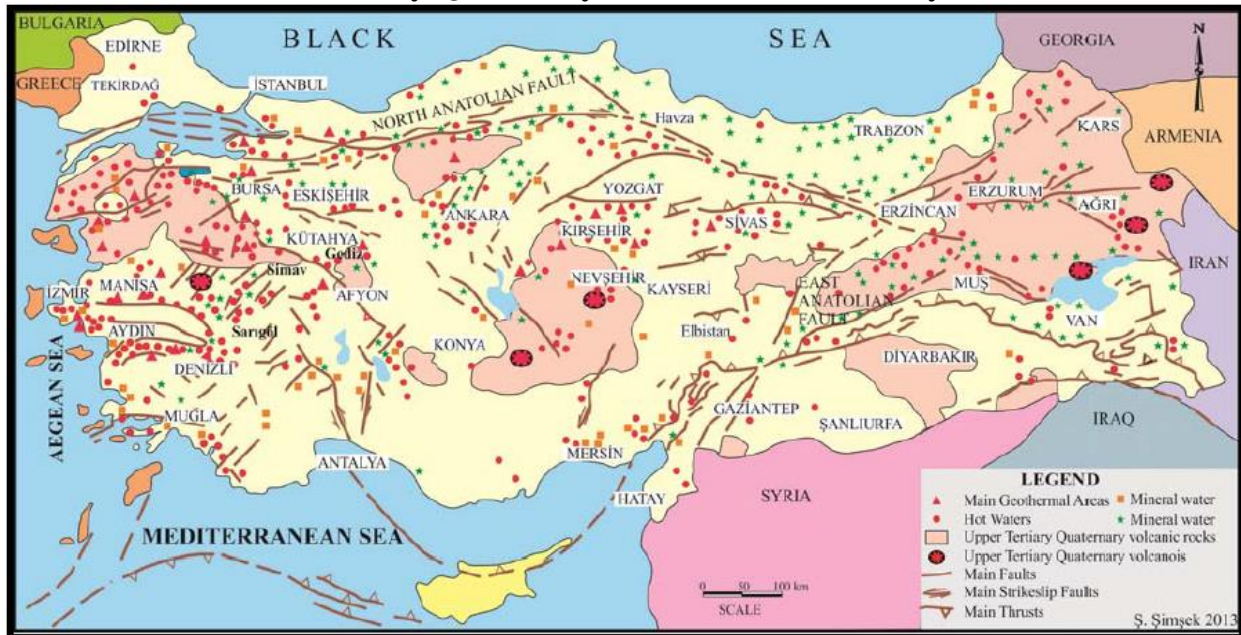
	construction of power plants (40% assumed to be attributable to Component 1)			
Capacity drilling projects supported by the Loan Facility	Capacity drilling (also called production drilling) happens at the Resource/Field Development Phase. At this stage, wells are drilled and used to extract the geothermal resource from the reservoir and confirm its commercial viability for energy generation production.	Semi-annually	Project progress reports from TKB and TSKB	TKB, TSKB
Geothermal resources (for electricity) confirmed through exploration drilling	Geothermal resources confirmed during the exploratory drilling which will take place under Component 1 of the project. This indicator covers resources confirmed for electricity. The baseline will be zero.	Semi-annually	MENR Reports	MENR
Geothermal resources confirmed (for heat applications) through exploration drilling	This indicator measures the geothermal resources confirmed during the exploratory drilling which will take place under Component 1 of the project. This indicator covers resources confirmed for heat applications and will be measured in MW(thermal). The baseline will be zero.	Semi-annually	MENR Reports	MENR
Geothermal resources developed through capacity drilling	This indicator measures geothermal resources developed during the capacity drilling in Component 2 of the project. The baseline will be zero.	Semi-annually	TKB and TSKB Reports	TKB, TSKB
Grievances registered related to delivery of project benefits addressed (%)	This indicator measures the transparency and accountability mechanisms established by the project so the target beneficiaries have trust in the process and are willing to participate, and feel that their grievances are attended to promptly. It is understood that local sensitivities and tensions will not allow grievance or redress mechanisms to be established in all projects.	Annual	MENR, TKB and TSKB Reports	MENR, TKB and TSKB
Grievances related to delivery of project benefits that are addressed (number)	No description provided.	No description provided.	No description provided.	No description provided.

Annex 2: Detailed Project Description
TURKEY: Geothermal Development Project

Geothermal Resources in Turkey

1. The active geology of Turkey is dominated by its location between the colliding Eurasian and African plates. This has resulted in wide-spread seismic and volcanic activity. The country-wide distribution of thermal sites in Turkey (see figure below) reflects how the geothermal activity mainly coincides with the major faults and also to some degree the recent volcanic regions.

Figure 2.1. Distribution of hot springs, main neotectonic structures and Tertiary/Quaternary volcanic rocks in Turkey



2. Geothermal resources in Turkey are used for power production as well as space heating and spa applications. The installed capacity of geothermal power plants in Turkey has grown rapidly in recent years; from some 15 MW in 2006 to 410 MW produced by 17 power plants as of January 2015, with power plants of total capacity of 165 MW are currently under construction. This growth has been restricted to Western Turkey; the vast majority of the capacity development has taken place in the Menderes and the Gediz grabens. The total technical and economical electricity production potential has been estimated at 2,000 MW.

3. Direct application of geothermal energy is more wide spread in Turkey. While most of the direct application occurs in the Western part of the country, significant direct application takes place in the South Eastern part and to some degree in the central part of the country. The total direct use of geothermal energy currently amounts to 2,880 MWt, while reported estimates range from 31,500 to 60,000 MWt as total geothermal potential of the country. Direct application of geothermal energy in Turkey has not grown significantly in the last five years in contrast to the rapid growth of geothermal power production.

4. Exploration activities conducted by the General Directorate of Mineral Research and Exploration (MTA) were a critical driver behind geothermal development in Turkey. MTA, established in 1935, was responsible for the exploration and mapping of geothermal resources in the country until 2007, and was traditionally the main institution advancing the development of geothermal utilization. Out of a total of 190 geothermal sites discovered, MTA prioritized 25 sites, which were considered suitable for electricity production. Those 25 sites were subsequently explored further, mostly by MTA performing additional surface exploration and exploration drilling. Most of the geothermal development in recent years has taken place in areas that had initially been explored by MTA. In order to maintain the growth of the geothermal power sector and revive growth of direct uses of geothermal it is necessary to boost geothermal exploration efforts in Turkey.

Geothermal Development Project

5. The proposed project envisages two components: (a) Component 1 will establish a Risk Sharing Mechanism for resource validation, to support the exploration and confirmation drilling conducted by the private sector. The component follows the international experience shows that publically supported mechanisms that reduce/share the resource risk at these stages are the most cost effective way to ensure significant scaling up of exploration and investment, (b) Component 2 will set up a Loan Facility for resource development to provide financing to the resource development stage and to the power plant construction phase. Financing with a long maturity period for the participating Financial Intermediary (FI) is expected to incentivize them to take more risk at earlier development stages than they would do under usual market conditions. Details of both components are elaborated below.

Component 1: Risk Sharing Mechanism for Resource Validation (US\$ 38 million CTF contingent recovery grant, US\$ 1.8 million CTF grant)

Subcomponent 1.1: Risk Sharing Mechanism for Resource Validation (US\$ 38 million, CTF contingent recovery grant)

6. This component aims to promote private sector participation in the early stage geothermal exploratory and confirmation drilling stages by sharing the risk of failing to validate a geothermal resource among two parties: the administrator of a Risk Sharing Mechanism (RSM), capitalized by a CTF contingent recovery grant, and the private sector geothermal developer (i.e. the beneficiary). In case a well fails to yield outputs at a pre-agreed level between the RSM and the beneficiary, the RSM will cover a pre-defined percentage of the drilling expenditures incurred by the license holder. This percentage will be 50 percent for projects located in the Aegean region and 60 percent in those located elsewhere in the country, where the resource risk is generally higher given that limited or no previous exploration activities have been carried out by MTA.

7. The RSM will screen applications by potential beneficiaries based upon a clear and pre-defined set of technical, financial and corporate eligibility criteria to ensure that potential beneficiaries have carried out the appropriate surface exploration studies and have the necessary technical and financial capacity to complete the resource validation process (i.e. exploration and confirmation drilling) they plan to undertake. Selected Beneficiaries will apply a pre-established

well testing methodology, which will provide the results (i.e. temperature and flow) against which success and failure will be determined. In case of failure, the RSM will cover the agreed percentage of the license holder’s drilling program expenditures. In the case of success, the license holder will be required to contribute to the RSM a “success fee” of 10 percent of the incurred expenditures, as a way to reduce the rate of depletion of the RSM capital and maximize the number of projects to be supported.

8. To avoid the risk of delays in recovering the success fee after drilling is completed, the success fee will be paid upfront by the beneficiary. The percentage has been established based on the willingness of license holders to contribute to the Mechanism and the expected success rates to be achieved. The Operational Manual for this component will specify all the application, eligibility requirements, and the well testing protocols. The Manual will also provide details on the RSM terms, and on the specific list of eligible expenses to be covered by the RSM.

9. The box below summarizes some of the main terms and conditions of the RSM (see Annex 8 for a full description).

Box 2.1. Summary of RSM Terms and Conditions

<ul style="list-style-type: none"> • Drilling program can include slim wells, production-size exploratory wells, or a combination • Standard agreements will cover three wells, with an option for an additional 4th and 5th well at the discretion of the RSM. • Coverage for unsuccessful wells:

Well number	Aegean region	Other regions
1	40%	60%
2	40%	60%
3	40%	60%
4	40%	40%
5	40%	40%

<ul style="list-style-type: none"> • Beneficiary will pay a 10% “Success Fee” on the average estimated well cost only when the well is successful
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10. A data base on all available information of wells drilled and project sites with support from the RSM will be created (RSM Database). The database will make use of GIS techniques and use layers for different information and allow for reporting and analysis. The database will also include project information data, as well as progress and any issues that needs to be tracked and reported regarding the project progress.

11. The General Directorate of Renewable Energy (GDRE) and the General Directorate of External Relations and EU Affairs (DGEU) of the Ministry of Energy and Natural Resources (MENR) will be the implementing agency for the Risk Sharing Mechanism.

Subcomponent 1.2: Technical Assistance for GDRE (US\$ 1.8 million, CTF grant)

12. This sub-component will be included to address capacity building needs required to successfully implement the component. This support will include:

- a) **Capacity strengthening of the geothermal team at the GDRE to supervise implementation of the RSM.** This will include short trainings to cover geosciences, exploration, reservoir engineering, and principles of drilling. Other areas of training will include planning and budgeting, accounting, financial reporting, external auditing, funds flow, internal controls, procurement, and environmental and social safeguards.
- b) **Consultancy support to GDRE to facilitate implementation of the RSM.** GDRE will hire a consultant to establish and operate the RSM. The Operational Manual for this component will clearly define the responsibilities of MENR and its consultant. Also, as GDRE has not previously implemented a Bank project, they will need to hire consultants to support financial management and procurement activities. Activities under this TA will thus include hiring of short term procurement and financial management specialists, and other required expertise as necessary, to support the RSM.

Component 2: Loan Facility for Resource Development (US\$ 187.5 million total; US\$ 150 million IBRD loan, US\$ XX million TKB/TSKB co-financing)

13. This component aims to address the financing gap that license holders face today in the resource development stages of geothermal project development by providing debt financing to encourage and support both license holders and financiers investing in (i) the capacity/production drilling stage and (ii) the steam gathering and power plant construction stage.

14. The team has identified the Industrial Development Bank of Turkey (TSKB), as the financial intermediary with the technical capacity and experience in renewable energy development. A share of TSKB's co-financing for this component will be dedicated to capacity strengthening on geothermal specific technical support. Specifically, this will include support of consultants for technical assessment, due diligence and monitoring of investments, who would be available to TSKB's team on a needs basis. These consultants are expected to ensure that TSKB is adequately equipped to effectively assess the technical risk of loan applications during project implementation.

15. The team is also exploring the possibility of the Development Bank of Turkey (TKB) joining the project as a second financial intermediary, as strong interest was expressed by TKB. This would serve to further expand the capital market for geothermal investments. The project appraisal document will be revised as necessary once the proper due diligence and approvals are completed.

16. In addition, the team is exploring the possibility of allocating from CTF Investment Plan (endorsed January 30, 2009; revised and updated November 12, 2012) for the FIs to finance the additional costs of sub-borrowers' investments in CO2 capture/processing technologies as stated earlier. A revision to Turkey's CTF Investment Plan will be presented to CTF once this allocation

is confirmed. The allocation between beneficiary Financial Institutions or FIs (TKB and TSKB) will be determined by the needs of individual sub-borrowers.

17. The FIs will on-lend at market rates, but offer longer tenors than currently available in the market, to geothermal developers at the capacity drilling stage, and to a secondary extent, at the construction stage. TSKB will provide co-financing to the Facility from its own resources, while a minimum equity contribution (i.e. 25 percent) will be required from project sponsor/concession holders (i.e. the sub-borrowers). The requirements and conditions for the Facility, including eligibility of sub-borrowers and projects, will be clearly outlined in a separate Operational Manual to be adopted by the FIs for this component. Once the capacity drilling stage is completed, the FIs shall be required to publicly disclose basic information about the potential project. This disclosure is intended to expand the financing opportunities of the project sponsor and to avoid market distortion through limits on access to information. The details of the disclosure will be included into the loan agreement between the FI and the sub-borrowers will include, at least, the following items:

- Name, address, location and legal form of business that would be requesting funds for the power plant construction stage (if corporation, outstanding shares if privately owned number of private investors)
- Link to the exploratory drilling results shown on the RSM website (only for projects that also benefited from the RSM)
- Number of capacity wells drilled and a summary of the well test results (i.e. temperature, flow, basic chemistry, enthalpy calculation)
- Identification of how the energy will be used under the developer's business plan (power plant, space heating, etc.)
- Expected geothermal energy requirement under the business plan and how much has been proven with the capacity drilling to date
- If power generation, expected MW output
- Type of technology to be utilized to exploit the geothermal resource
- General status of permits and contracts associated with development

18. The Loan Facility will be open to any geothermal development that has reached the capacity drilling stage, regardless of whether it benefited or not from the Risk Sharing Mechanism under Component 1. Once the capacity drilling is completed, the financial intermediary may proceed to provide additional funds to the concession holder for the construction of the geothermal facility. However, in order to qualify for support under this component, the proposed projects will have to comply with eligibility criteria, including:

- i. Borrowing company must have the majority of their capital privately owned.
- ii. Eligible companies should maintain a debt coverage ratio of at least 1.1.
- iii. All loans will be based on limited (partial) recourse with the investment (concession) usually indicated as security.
- iv. All projects must have additional technical insurance to cover technical risks during drilling.
- v. Financing parameters: US\$60 million per project with a maximum of two projects and US\$80 million per sponsor.

- vi. Given the risks of geothermal projects, and the expectation that technical assumptions can change in any direction, TSKB projection of financial yield indicate that projects must show a minimum IRR of 8% based on capital cash flow, and at least 10% as return on equity;
- vii. The estimated net emissions of the proposed project must not be above the grid emission factor for 2014, i.e. 583 gCO₂/kWh;
- viii. Projects must comply with the environmental and safeguard review procedures set forth in the Operational Manual

19. A share of FI's co-financing for this component will be dedicated to capacity strengthening. More specifically, it will cover training for FI staff, particularly on best available techniques and technologies and geosciences in geothermal development. Specifically, the training will increase capacity to evaluate and understand the geothermal project cycle, as well as to develop necessary technical expertise needed for evaluating capacity drilling projects. Other training areas will include: geothermal energy utilization, exploration, policy framework, sustainability and environmental impacts and international best practices in project implementation. It will also cover the support of consultants for technical assessment, due diligence and monitoring of investments, who would be available to FI's team on a needs basis. These consultants are expected to ensure that FI is adequately equipped to effectively assess the technical risk of loan applications during project implementation.

Annex 3: Implementation Arrangements
TURKEY: Geothermal Development Project

Project Institutional and Implementation Arrangements

Component 1

1. On behalf of the Republic of Turkey, the Ministry, as implementing agency for the RSM, will be responsible for overall project coordination and oversight, through the General Directorate of Renewable Energy (GDRE) and the General Directorate of External Relations and EU Affairs (GDEU). The Ministry will ensure effective coordination between GDRE and GDEU. The Ministry will also have overall fiduciary responsibility for project implementation with specific roles carried out by the GDEU and GDRE, through dedicated teams in both Directorates for this purpose.
2. As the agency charged with promoting geothermal energy development in the Ministry, GDRE will act as the Project Implementing Unit (PIU), which will be responsible for the technical and implementation responsibility of the RSM. Throughout the implementation of the project, GDRE will provide adequate budgeting, personnel and other necessary resources needed to manage the RSM and to monitor the activities of each RSM Sub-Project, per the terms of the beneficiary agreement with MENR. GDRE will be supported by a RSM Technical Committee in the capacity of a Technical Working Group will be set up to provide technical, review, and advisory role to facilitate the implementation of the RSM. The Technical Committee will be chaired by GDRE and will consist of representatives from MENR, GDEU, MTA (Directorate General for Mineral Research and Exploration), MIGEM (MENR Directorate General for Mining Affairs), and other relevant agencies with the technical capacity to review and support the GDRE to review and assess RSM applications and provide its Decision for GDRE's final approval.
3. As part of its mandate to coordinate external relations, the General Directorate of External Relations and EU Affairs (GDEU) will serve as the coordination unit responsible for the project's financial management reporting to the Bank and will provide procurement support to GDRE.
4. GDRE will hire a consultant ("RSM consultant") to provide support to the PIU in implementing and managing the RSM. The RSM consultant will carry its work on behalf of MENR and under the supervision of the PIU. The consultant will be required to provide specialized financial and geothermal expertise to the RSM, specifically regarding the assessment of the corporate, financial and technical eligibility of applicants, as well as the interpretation of surface exploration data and conceptual models presented, proposed drilling and testing plans and protocols, assessments of development and business plans, and monitoring and reporting of all activities undertaken by the selected beneficiaries.
5. GDRE will establish a "Technical Committee" to provide the technical advice needed to manage the RSM. The Technical Committee will be chaired by GDRE and will include representatives from MENR General Directorate of Mining Affairs/MENR (MIGEM), MTA, and

other relevant agencies with the technical capacity to provide review, and recommendation on implementation of the RSM for GDRE's final approval.

6. The RSM consultant will be required to complete the logistical arrangement of the RSM for the PIU, including preparation of the required documents, forms and websites, and its implementation on a day to day basis.

7. At every step in the implementation of the RSM, the RSM consultant will provide inputs to the PIU and provide documentation to the RSM Technical Committee to facilitate the selection of beneficiaries, review of the applications, drafting of agreements to be signed between the RSM and the beneficiaries, assessment/acceptance of well test results and payment of pay out (or receipt of success fee).

8. Based on these inputs, the PIU will provide recommendations for decision making by the GDRE of MENR. The MENR, taking these recommendations under consideration, will sign an agreement with Beneficiaries for their participation in the RSM. This agreement will specify the terms and responsibilities of each party as well as the role of the PIU and RSM consultant. Since actual cost of drilling will be a parameter in determining the final payout and success fee payments, careful monitoring of the actual cost of drilling is critical. The RSM consultant will be responsible for preparing a report, verifying the invoices for the drilling related expenditures incurred by the developer for the PIU. The verification process will ensure that the expenditure incurred is eligible (an agreed list of eligible expenditures will be prepared), related to the specific drilling project and that it is actually paid by the developer.

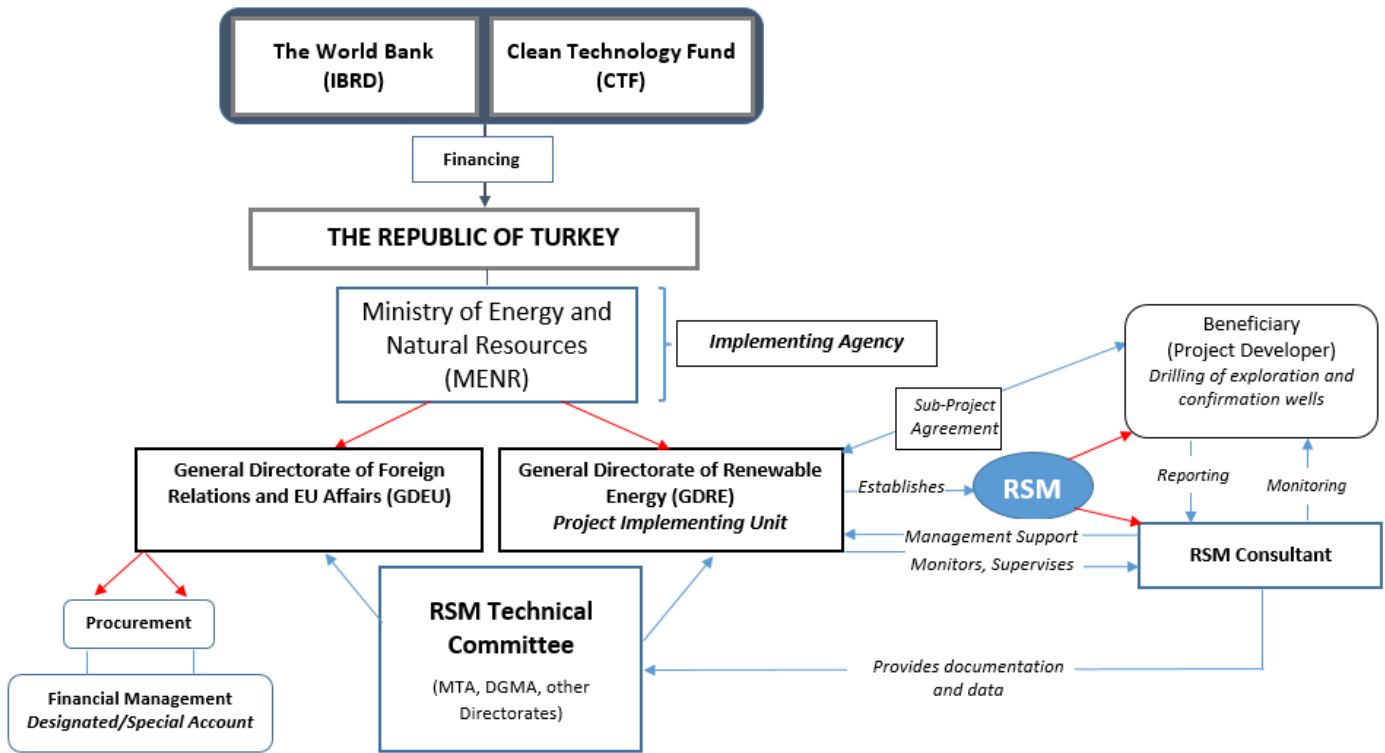
9. The RSM consultant will prepare the results and related documents of the verified expenditures with PIU for reporting to MENR and World Bank during the implementation of the beneficiary drilling program agreed upon. The RSM consultant is expected to verify the claim that will be submitted by the beneficiary at completion of the drilling program for PIU to make its recommendation. MENR will be responsible for making the final decision to make the payout from the special account based on the verified claim of the beneficiary. In cases of success in validating an expected level of geothermal resource, a success fee will be paid by the beneficiary to the special account again based on the verified well test results.

10. The RSM consultant will also be required to ensure availability of all related documents and reports available to external auditors hired by the PIU, appropriate Government agencies, and World Bank to verify their financial monitoring activities.

11. The Operations Manual for this component includes a detailed account of the accountability and decision-making roles for each of the RSM parties.

Figure 3.1. Overview of RSM parties

Component 2



12. TSKB will be the Financial Intermediary that will implement of Component 2. TSKB is a development bank in Turkey with adequate experience and capacity to implement and take on the risk associated with the capacity drilling activities to be supported by the project. This is based on TSKB’s technical strength, track record in renewable energy development and significant experience in implementing national and World Bank policies in environmental and social safeguards. TSKB will rely, on a needs basis, on consultants for technical assessment, due diligence and monitoring of investments in order to ensure effective assessment of the technical risk of loan applications during project implementation.

13. Subprojects will be approved by the FI based on compliance with its Operational Manual, which covers aspects such as eligibility, safeguards compliance, monitoring requirements, etc. Sub-loans will be provided in parallel to eligible subprojects. The interest rate will be equal to the costs of IBRD funds to the FI plus a risk-adjusted spread based on the risk classification of the sub-borrower and the subproject passed onto the sub-borrower along with an appropriate spread to cover the FI’s administrative costs. Sub-loans from IBRD will have a maturity of not less than 4 years.

Financial Management, Disbursements and Procurement

Financial Management

Country Issues

14. The Strategic Framework for Public Expenditure Management Reform introduced a comprehensive approach to public expenditure management in 2001. The enactment of a new Public Financial Management and Control law (2003) formed the cornerstone of the legal framework for the modern public financial management system in Turkey. The law, which addressed a number of weaknesses in the existing system, (i) brought forward the concept of “general government,” incorporating a comprehensive definition of public revenues and expenditures, ii) introduced a medium-term approach to budget preparation in line with strategic planning, iii) provided a description of the accountability of ministers and heads of public administrations, iv) provided the Ministry of Finance with clear legal authority to determine budget classifications and accounting and reporting standards for all government agencies, v) delegated financial control responsibilities to spending units, and vi) strengthened government accountability by extending the scope and mandate of the external audit.

15. Although there has been a major transformation in public sector management as a result of the reform initiatives, implementation challenges still remain. These are mainly the lack of linkages between plans, policies, and budgets; the credibility of the medium-term fiscal framework; the need for improvements in the quality of strategic planning in the line agencies; problems in the implementation of the new internal and external audit frameworks; incomplete reform of the public procurement system; and the need for improved parliamentary scrutiny of budget preparation and implementation

Financial Management Risk Assessment and Mitigation Measures

16. The financial management risk for the project is substantial. The MENR GDRE has no experience or relevant financial management capacity for project implementation purposes and GDEU has limited financial management capacity. Additionally MENR will be responsible for the implementation of the Clean Technology Fund (CTF) funded Risk Sharing Mechanism (Component 1) part of the project and this will be the first such facility that will be managed by MENR. A financial management consultant will provide support to the GDRE and GDEU in installing and maintaining satisfactory financial management arrangements for the project. The roles and responsibilities that will be assumed by GDRE and GDEU in the implementation of the RSM are still under discussion between the GDs and such arrangements will be defined in detail in the project financial management manual that will be prepared before negotiations. Until such arrangements are clarified the financial management risk for the project is substantial.

Implementing Entities

17. Component 1 of the project will be implemented by MENR through its general directorates GDRE and GDEU. GDEU will provide support to GDRE in executing project transactions and also managing the RSM. Additionally GDEU will be responsible for project accounting and reporting.

18. Component 2 will be implemented by TSKB, with potential participation of TKB. Both TSKB and TKB have implemented several credit line operations funded by the World Bank loans and has satisfactory financial management arrangements for the current Renewable Energy Project.

Budgeting and Planning

19. Since component 1 will be funded by a CTF funded contingent recovery grant an allocation in the annual investment budget of the MENR is not a requirement. Both MENR and the FI will prepare annual budgets for the use of project funds.

Accounting Staff

20. The project staff that will be assigned by MENR will be supported by a financial management consultant. The management of RSM would require close monitoring and strong implementation capacity. The financial management consultant will provide the necessary support to GDRE in the management of the RSM. MENR will also hire a consultant firm to establish and operate the RSM. Payments to the license holders from the RSM will be processed and approved by the GDRE upon recommendation of the Consultant. The Consultant firm will be responsible for reviewing and certifying the invoices of drilling program expenditures.

21. The FI will designate a responsible staff for the financial management of the Geothermal Project. Current staff are highly qualified a need to support the capacity at FI with a consultant is not envisaged.

Accounting Policies and Procedures and Systems

22. MENR is currently working on the roles and responsibilities of GDRE and GDEU in the implementation of component 1 of the Project. For regular project expenditures it is expected that GDRE will prepare the terms of reference and GDEU will execute the transaction in line with the World Bank procurement procedures. The transactions from the RSM will be executed based on an agreement between MENR and beneficiary enterprises. The agreements are expected to be signed by GDRE on behalf of MENR. The payments from the designated account will be executed by GDEU based on the approval of the GDRE. GDEU will be responsible for the accounting and reporting for the project. The financial management procedures for the project will be detailed in the project financial management manual that will be prepared by MENR before negotiations.

23. The project transactions that will be made by MENR will be processed through the Public Expenditure and Accounting Information System (KBS). GDRE or GDEU will send payment orders together with the supporting documents to the Ministry of Finance Accounting Office (MOF-AO) in MENR and the accounting at the MOF-AO will enter the transactions into the KBS and will approve the payment order for processing from the designated account. The transactions will be entered into the KBS in Turkish lira equivalent and will also be recorded under the account code dedicated to the project.

24. The GDEU will maintain detailed accounts of the project in EUR in an accounting software that will be utilized for project accounting in foreign currency. The accounting entries will be based on the information on payment confirmations from the designated account. MENR will purchase and customize an accounting software that will have adequate security levels, facilitate reporting in foreign currency, and that could produce the Interim Unaudited Financial Reports (IFRs) as well as the end of the year financial reports by before the project becomes effective.

25. For the current Private Sector Renewable Energy and Energy Efficiency Project (where TSKB and TKB are the wholesale bank) the financial management arrangements of the project are fully integrated into the FI systems which allow the loans extended by the FI to be followed-up from initial application to approval to monitoring through the system. Project reports are generated automatically from the system. The FI will utilize the same system for the Geothermal Development Project and will complete the required customization by project effectiveness.

Internal Financial Controls

26. MENR is currently working on defining the roles and responsibilities of GDRE and GDEU in project implementation. The project operations manual will define the roles and responsibilities of each department as well as payment procedures relating to the RSM. Payments from the RSM will be made against eligible expenditures (that will be defined in the operations manual) upon approval of the RSM consultant. MENR will control the approvals submitted by the RSM consultant and will prepare the payment order. All payments under the RSM will be made from the designated account and all premiums will again be made to the designated account by the beneficiary. DGEU will be responsible for installing systems to separately account for the RSM payments and receipts with supporting documentation. The internal controls for component 1 of the project together with the budgeting, accounting, reporting and auditing procedures will be defined in the project financial management manual.

27. In TSKB and TKB under the current REL project following the loan approval process, the beneficiary enterprises withdraw funds from the allocated loan amount upon submission of eligible invoices. The Loan Operations Department is responsible for release of funds from the beneficiaries' loan accounts. They release the funds after the invoices submitted by the beneficiary enterprises are checked by the relevant technical department and engineers for compliance with the project framework and mathematical correctness. The same procedures will be adopted for the Geothermal Development project and will be defined in the project operations manual.

Reporting and Monitoring

28. GDEU in MENR and The Loan Operations Department in the FI will be responsible for the preparation of Interim Un-audited Financial Reports (IFRs) which will be prepared quarterly and will be submitted to the World Bank within 45 days after the end of the period. The content and format of the IFRs will be agreed at negotiations.

External Audit

29. As part of the Bank’s auditing requirements, the project’s financial statements will be subject to external auditing. The first set of audit reports will be submitted to the Bank before June 30th of the year following the calendar year in which the first disbursement from the loan has been made.

30. The project financial statements for component 1 will be audited by the Treasury controllers in accordance with International Standards on Auditing. The Treasury controllers are the external auditors for all projects implemented by the ministries in Turkey. The ToR for the audit will be included in the project financial management manual.

31. The entity financial statements of the FI as well as the project financial statements for component 2 will be audited by private auditors acceptable to the Bank in line with the International Standards on Auditing. The FI has been submitting its entity audit report as well as for the projects it is implementing on time. The audit reports were received on time and did not include any qualifications or any serious internal control issues.

32. The audited financial statements and audit reports would be publicly disclosed in a manner acceptable to the Bank. The following chart identifies the audit reports and their due dates:

<i>Audit Report</i>	<i>Due Date</i>
Entity financial statements (FI)	Within six months after the end of each calendar year and also at the closing of the project.
Project financial statements (PFS) for MENR, including SOEs and the designated account.	Within six months after the end of each calendar year and also at the closing of the project.
Project financial statements (PFS) for MENR, including SOEs and the designated account.	

Disbursements

33. Designated Account: For Component 1, Disbursements will be made through a Designated Account (DA). GDEU of the MENR will be signatory to the DA. The DA will be “replenished” through Withdrawal Applications submitted by GDEU. Replenishment requests will be made using the standard payment forms which will be included as an annex to the Disbursement Letter for the CTF Funds. Payments from the Designated Account will be made in line with the IBRD Disbursement Guidelines. A threshold will be determined for the DA and withdrawal application requests will not exceed this threshold.

34. Routine expenses, including payment to the RSM Consultant will be made from the DA. However, MENR, as the Implementing Agency for the CTF Funds, may decide to make payments

to the Beneficiaries from the Designated Account (in the case of an unsuccessful drilling program.) To ensure that adequate funds are available in the DA to meet the financial obligation of all signed contracts (payout will be 50% of eligible drilling cost; or a maximum of US\$ 3 million per project), MENR may request the World Bank to increase the threshold of the DA.

35. GDRE will obtain all requisite approvals from the Ministry and from the IBRD, through a “No-Objection.” and send the payment request to the bank holding the DA through MENR Accounts Department. A copy of the supporting documents as well as the payment order will be kept by the GDEU for project accounting purposes. The supporting documents will include:

- a) GDRE authorization of the invoices and outputs that would be the basis of payments from the DA.
- b) Executed Beneficiary Agreements and a Certification verifying that all invoices related to payments to RSM Beneficiary Developers have been reviewed and are in line with eligible expenditures as indicated in the Agreements in the case of a Sub-Project failure;
- c) Supporting documents for payments to the RSM Consultant, per the terms of the Contract Agreement.

36. The Central Bank (or Commercial Bank) will send payment execution receipts to GDEU (GDEU will share a copy with) GDRE upon completion of payment transfer. These receipts along with records of all transaction in foreign currencies will be retained by GDEU for reporting and audit purposes.

37. At the time of signing the beneficiary agreement, RSM beneficiaries will pay the premium directly to the Designated Account. The premium will be lower than 25% of the total eligible expenditures defined in the agreement (this value will be finalized at the time of appraisal). GDEU will ensure that all documentation of all such “Reflows” to the DA are separately retained for reporting and audit purposes.

38. Direct payments: Payments exceeding the threshold of the Designated Account will be made through Direct Payments from the IBRD upon submission of a Withdrawal Application request, with supporting documentation. GDEU will prepare all supporting documentation and will send the payment request to the World Bank upon receiving the approval of the GDRE.

39. Standard Payment Forms and Templates to be used by GDEU to request payment processing will be provided by the World Bank. These templates may be personalized in line with existing MENR procedures, but should contain the information included in the templates. In line with standard best practice, the PIU will ensure payments to beneficiaries of the RSM are authorized and requested within 2 weeks of receipt.

40. For Component 2, the FI will open a Designated Account for the Project, one in US\$ and one in EUR. Funds from the loan will be made available to beneficiary sponsors following submission of and verification of invoices and payment documents. The withdrawal applications from the FI will have two signatures indicated in its list of authorized signatories. Applications documenting funds utilized from the Designated Account will be submitted to the Bank on a quarterly basis, and will include a reconciled bank statement as well as other appropriate supporting documents.

41. Payments against sub-loans will be made according to certified Statement of Expenditure (SOEs). Full documentation in support of SOEs would be retained by the FI for at least two years after the Bank has received the audit report of the fiscal year in which the last withdrawal from the Loan Account was made. This information will be available for review during supervision by Bank staff and for annual audits which will be required to specifically comment on the propriety of SOE disbursements and the quality of the associated record-keeping.

Procurement

42. Procurement of goods, works and non-consulting services for the proposed Project will be carried out in accordance with the World Bank's "Guidelines: Procurement of Goods, Works and Non-Consulting Services under IBRD Loans and IDA Credits & Grants" dated January 2011 and revised in July 2014 (Procurement Guidelines); and procurement of consultant services will be carried out in accordance with the World Bank's "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011 and revised in July 2014 (Consultant Guidelines) and the provisions stipulated in the Loan Agreements (LAs). World Bank's "Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants", dated October 15, 2006 and revised in January 2011 (Anti-Corruption Guidelines) will apply to this Project. A General Procurement Notice shall be published for the procurements under the Project by MENR GDRE and the FI.

A. Procurements under Resource Development Component of the Project (Component 2)

43. Private Sector Commercial Practices may be followed for Goods, Works and Non-Consulting Services in accordance with paragraph 3.13 of the Procurement Guidelines; and for Consulting Services contracts in accordance with paragraph 3.13 of the Consultant Guidelines, and the provisions stipulated in the Operational Manual for the FI (OM). Because of the demand-driven nature of the project, it is not possible to estimate neither the geothermal concession holders (sub-borrowers) nor their procurement requirements under credit line financing of the sub-loans at the appraisal stage of the Project. Therefore, for this component, it is not possible for the FI to develop a Procurement Plan which provides the basis for the procurement methods. All goods, works and non-consulting services contracts equal or above US\$50 million equivalent and all consulting services contracts equal or above US\$3 million equivalent are subject to the Bank's prior review. All other contracts will be post reviewed by the Bank as specified in the agreed OM.

B. Risk Sharing Mechanism for Resource Validation (Sub-Component 1.1)

44. Procurement of goods, works, non-consulting and consulting services for exploration drilling activities by the Beneficiaries under Component 1.1 of the Project shall be done with due attention to economy and efficiency and in accordance with procedures which meet the requirements of paragraph 1.5 and 1.8 of the Procurement and Consultant Guidelines respectively. Such procurements will be reviewed and confirmed by the RSM consultant.

C. Procurement of Goods, Non-consulting Services and Consulting Services under Technical Assistance Sub-component of the Project (Sub-Component 1.2)

45. Procurement of Goods, Works and Non-consulting services: No goods, works and non-consulting services are foreseen in this component of the project.

46. Selection of Consultants: The consultants shall be selected by MENR GDEU for (i) the management of the risk sharing mechanism; (ii) the financial audit of the risk sharing mechanism; and (iii) the support of GDEU and GDRE PIU for project management (financial management, procurement and technical). Similarly, the FI will select a specialized consultant firm to assist in technical assessment, due diligence and monitoring of investments (under Component 2). The employment of PIU experts for project management will be conducted through the selection of individual consultants in accordance with the provisions of the Section V of the Consultant Guidelines. In case the service is required from a consultancy firm, Quality and Cost Based Selection (QCBS) method or Least Cost Selection (LCS) method will be applied in accordance with the Section II of the World Bank’s Consultants’ Guidelines. For the contracts below US\$300,000 equivalent Selection Based on Consultants’ Qualification (CQS) method may be used in accordance with paragraph 3.7 of the Consultants’ Guidelines. The short list can comprise entirely national consultants, if the contracts with the firms are below US\$500,000 equivalent. In case additional services are required from the existing consultant or subject to justification of a service needed from a particular consultant, Single Source Selection (SSS) method can be used as specified in paragraphs 3.8 through 3.11 of the Consultant Guidelines.

47. Procurement plan and methods and review thresholds: MENR and the FI developed a Procurement Plan for the entire duration of the project which also provides the basis for the selection methods and thresholds. This plan has been agreed between MENR, the FI and the Bank individually on XXX and will be published on the Bank’s external web-site after grant and loan negotiations. The agreed procurement plans are available in the project files. The Procurement Plan(s) will be updated at least annually or as required to reflect the actual project implementation needs. A summary of the agreed procurement packages and their schedule are given in Table 1.

Table 3.1. Procurement Packages and Time Schedule for TA Sub-component

Contract Package	Contract Description	Type	Financing from	Procurement Method	Review Method	Expected RFP Issue Date	Expected Contract Completion Date
<i>Procurements by GDRE</i>							
1	Consultancy Services for the management of risk sharing mechanism	CS	CTF	QCBS	Prior		
2	Consultancy Services for auditing of risk sharing mechanism	CS	CTF	CQS	Prior		
3	Procurement Consultant	CS	CTF	INDV	Prior		

4	Financial Management Consultant	CS	CTF	INDV	Prior		
Procurements by FI							
1	Specialized Consultancy Services for technical support to FI PIU	CS	FI	CQS	Prior		
WB: World Bank; CTF: Carbon Trust Fund; CS: Consulting Services; QCBS: Quality and Cost Based Selection; LCS: Least Cost Selection; CQS: Selection Based on Consultants Qualifications; SSS: Single Source Selection; INDV: Selection of Individual Consultant							

48. The procurement plans include the procurement methods and review thresholds as well as the project specific arrangements. The Bank will review the procurement arrangements performed by GDEU and the FI as including contract packaging, applicable procedures, methods and the scheduling of the procurement processes for its conformity with Bank's Consultant Guidelines, the proposed implementation program and disbursement schedule. The Bank's prior review thresholds are provided in the agreed procurement plans. The procurements not prior reviewed by the Bank will be subject to the Bank's ex-post review in accordance with the procedures set forth in Appendix 1 to the Consultant Guidelines respectively on a random basis. One in five contracts of the Project will be post reviewed. Post review of the procurement documents will normally be undertaken during the Bank's implementation support missions or as the Bank may request to review any particular contract at any time.

49. Procurement Capacity and Risk Assessment: The procurement capacity assessment of GDEU concluded that GDEU has limited capacity for implementing the procurement activities with moderate risks that need to be mitigated. As of April 2015, GDEU has successfully completed the selection of one consultancy contract in accordance with QCBS procedures under the EU IPA Energy Sector TA Project (P131921). In addition, the General Directorate hired various individual consultants under SME Energy Efficiency Project (P122178). As the unit responsible for the procurement activities in MENR projects, GDEU has been developing capacity in the procurement of Bank financed projects with the support of Bank procurement team. GDEU has one individual procurement consultant who is working for SME Energy Efficiency Project and there is one staff assigned for the procurement tasks. The selection of the consultants under the Project will be conducted by the GDEU. The RSM consultant contract, which will be the largest single contract under the Project, will be signed by MENR GDEU as the client, but GDRE will be assigned as the authorized representative of MENR for implementation of this contract. GDRE PIU will provide technical support to GDEU in the selection of RSM consultant. This support will include but is not limited to drafting of the terms of reference, selection evaluation, contract negotiation and signing.

50. GDRE will establish a PIU under the Department of Renewable Energy Resources, which will be responsible for the implementation and supervision of the RSM activities including the RSM consultant contract. The assessment of the Bank has revealed that GDRE does not have adequate experience in the implementation of such a similar Bank financed contract. Energy Efficiency Department of GDRE provides support to the GDEU in the technical matters of the procurement activities under the ongoing EU IPA and SME Energy Efficiency Projects and therefore some staff in GDRE are familiar with Bank standard form of consultancy contracts. A bilingual English Turkish speaking engineer will be/ has been assigned to the PIU to undertake the contract management responsibility.

51. The following risks have been identified in the procurement activities:

- a) Delay to processing of risk sharing mechanism and implementation due to lack of proper planning, and uncertainties in the responsibilities of GDEU and PIU.
- b) Improper implementation of the procurement activities due to inadequate number of experienced procurement staff in GDEU.
- c) Contract management problems especially in the RSM consultant contract due to ambiguities in the roles and responsibilities of the parties.
- d) Poor quality of contract deliverables and contractual disputes.
- e) Payment delays to the RSM consultant due to delays in decision making by the RSM Technical Committee on technical matters.

52. The above risks will be mitigated as summarized in Table 2.

Table 3.2. Procurement Risk Mitigation Action Plan

No.	Mitigation Measure	Time Frame
1.	Hiring a procurement expert to GDEU	Immediately after the effectiveness of the Project
2.	Establishing the project teams both in GDRE and GDEU, and determining the roles and responsibilities; Assigning an engineer in PIU for contract management activities	Before the effectiveness of the Project
3.	Establishing the technical committee with representatives from GDRE, MTA and GD and their mandates	Before the effectiveness of the Project
4.	Close working of the Bank's procurement specialist with PIU	Throughout the Project implementation duration

53. The risk rating can be lowered to moderate after establishing the teams in item 2 and 3 and it can be further lowered to low when the mitigation measure in item 1 is put in place and GDEU signs at least 2 other QCBS contracts under the other Bank financed projects.

54. With regard to the FI, the procurement capacity assessment concluded that it has adequate resources and capacity for implementing the credit line operations of the Project through their current PIU established under the ongoing Private Sector Renewable Energy and Energy Efficiency Project and Innovative Access to Finance Projects. However, considering sector specific nature of the proposed Project following risks were identified in the credit line operations:

- Implementation delays, poor quality of contract deliverables and inflated prices on the procured goods, works and services due to limited capacity of FI/PIU to evaluate and understand the geothermal project cycle and capacity drilling projects.

55. The above risks will be mitigated (i) by the employment of a specialized consultant firm before the loan effectiveness through advance contracting; and (ii) by close working of the Bank's procurement specialist with the FI PIU during the selection process of this specialized consultant.

Environmental and Social (including safeguards)

Environment

56. In accordance with World Bank safeguard policy OP/BP/GP 4.01 (Environmental Assessment), the project has been assigned as Category FI (Financial Intermediary) with potential Category B sub-projects. The sub-projects are estimated to be Category B in nature since potential impacts of both Component 1 drilling activities and Component 2 activities are expected to be limited and be relatively easy to assess and mitigate through careful siting and good drilling and construction practices.

57. Since the exact footprints of the sub-projects are not determined yet, an environmental and social management framework (ESMF) has been prepared by the clients (GDRE and FI) to provide guidance for screening, assessing, conducting consultations, reporting and monitoring practices. The ESMF has been consulted with key stakeholders on XXXXX and the final framework document has been disclosed on clients' websites on XXX and on Bank's Infoshop on XXX.

58. In addition to client, GDRE and the FI will be the responsible parties for the implementation of ESMF. Same as social policies, GDRE is not experienced about environmental safeguard policies of World Bank. In that respect, GDRE will be supported by RSM consultant during implementation of ESMF. It is planned that the RSM consultant will be also responsible for reviewing the exploration applications from the project sponsors in line with national and World Bank requirements as defined in this FW. DGRE will be the final responsible party for the World Bank since they will be supervising the RSM consultant. On the other hand, TSKB has capacity for the implementation of ESMF as well as its good knowledge about World Bank safeguard policies. The PIU in the TSKB will be responsible for implementation of this ESMF for the capacity drilling and power plant establishment and operation activities.

59. The ESMF outlines the best practices in drilling, well management, and construction of power plants and associated infrastructure to be followed by the sub-borrower and the monitoring protocols to be followed for adequate supervision. The gaps between national environmental screening and assessment procedures and World Bank safeguard policies are also detailed in the ESMF for both Component 1 and 2. The ESMF provides guidance on risk screening of proposed sub-projects (including assessment of potential cumulative impacts), mitigation measures to reduce/manage potential adverse impacts.

60. The exploration and capacity drilling and construction activities (Component 1 and 2) may take place in rural areas which are potential natural habitats. Therefore, the policy is considered to be triggered to be on the safe side. But the sub-projects in critical habitats will not be eligible for financing. According to OP 4.04, the projects which do not create any significant adverse impacts on natural habitats and that are not placed in critical natural habitats will be eligible for financing. Issues related to natural habitats will be detailed in the sub-project environmental assessment documents.

61. The locations and the scope of sub-projects will be identified during the project implementation and relevant environmental assessment documents will be prepared according to

sub-project categorization. As it is detailed in the ESMF, it is expected that component 1 applications will be reviewed in accordance with the procedures set in the ESMF by the RSM consultant of GDRE. For component 2 sub-projects will be reviewed by TSKB for having national environmental clearances and then necessary environmental assessment documentation in line with OP 4.01 requirements, which will be completed by the sub-borrower. Sub-project partial EAs/EMPs will be submitted to the World Bank for prior review. After getting no-objections, these will be disclosed in the client's/sub-borrower's websites and will be included in the corresponding bidding documents and/or contracts of the investment projects.

Social

62. The footprints of a geothermal power plants requires land acquisition for the power plant itself, multiple wells, the network of interconnecting pipework, a transformer station, electricity transmission lines to connect to the grid, access roads and administrative offices. Accordingly, the World Bank Operational Policy 4.12 on Involuntary Land Acquisition has been triggered.

63. Land acquisition occurs gradually, starting with only a few well areas (about 0.5 hectares each) for the exploration drilling and ending with the full footprint described above for a plant in operation. When developers are having well areas expropriated, remaining land of the owner may be left with "holes" and not viable for livelihoods or farming. Similarly, the lattice of interconnecting pipes (about 2 meters wide, installed above ground) can have a more significant impact compared to just the base area for land acquisition due to dividing farmers' plots and cutting off access for people, animals and machinery. Potential impacts of piecemeal expropriation on the livelihoods of farmers is assessed in the Resettlement Action Plan (RAP). In these cases, expropriation of all of the owner's land or other mitigation measures may be necessary.

64. In Turkey, the general practice is for the private developers initially to approach land owners through a willing buyer-willing seller process. This land acquisition is considered voluntary as the company has some flexibility for the siting of wells, and uses this power to avoid involuntary land acquisition where it can and to avoid impacts on residential plots. Barring voluntary sale, the private developer needs to apply to the Provincial Administration for expropriation procedures during the exploration and productions stages, or to EMRA and the Ministry of Finance during the generation stage. In short, expropriation will be conducted by multiple parties and at different times. Likely, when the developer is accessing World Bank financing, some of the land acquisition will have been completed, for which the developer will conduct a social audit and a mitigation plan if necessary, and some of the land acquisition will take place during project financing, for which the developer will prepare a RAP outlining how the involuntary land acquisition will take place.

65. Since the sub-projects are not known at this time, two Resettlement Policy Frameworks (RPFs) were prepared by GDRE and TSKB in compliance with the policy. The Resettlement Policy Frameworks prepared by GDRE and TSKB outline in detail the expropriation procedures for geothermal development in Turkey, World Bank's OP 4.12 policy on involuntary resettlement, a gap analysis, steps to bridge these gaps and institutional responsibilities. The RPF has been consulted with key stakeholders on XXX and the final document has been disclosed on clients' websites on XXX and on Bank's Infoshop on XXX.

66. During project implementation, GDRE, with support of the RSM consultant, and TSKB will screen sub-projects for financing, ensure the preparation of a social audit and/or RAP as necessary by the private developer, and submit for World Bank review and clearance prior to financing of infrastructure. GDRE and TSKB will also oversee and supervise the implementation of these RAPs. TSKB fully understands the World Bank's social safeguards requirements and has high capacity to monitor social impacts thanks to a longstanding relationship with many international finance institutions. GDRE is currently not familiar with such safeguard policies. Accordingly, the RSM consultant will be required to possess capacity to oversee and implement the RPF and to build capacity in GDRE as necessary.

67. Additionally, in some of the Southwestern and Western areas of Turkey, especially if local communities were not adequately consulted, there have been cases of resentment, dissatisfaction and protest regarding power plants. Broad community support will be sought through timely consultations and sub-project level grievance redress mechanisms will be set up to resolve concerns as they arise. Both consultations and grievance mechanisms will take into account the different needs and concerns of men and women. Encouraging developers to implement community projects and / or use excess hot water for heating or tourism or greenhouse warming can also present opportunities for positive social impacts to surrounding communities.

Monitoring & Evaluation

68. For Component 1, the Project Implementation Unit, GDRE, will be responsible for monitoring and evaluation of project progress, including the relevant intermediate results indicators reflected in Annex 1. GDRE will rely on the periodic reporting provided by the RSM consultant who will closely monitor the activities of the beneficiaries covered by the RSM. This will include three main components; site visits, data and report review and receipt and storing of well data and financial information.

- i. *Site visits*: Carried out intermittently during drilling and during all or most well tests. The objective of the site visits is to monitor the progress during drilling, verify that costs incurred correspond to activities on site and observe the well testing in order to ascertain the fulfilment of the conditions and stipulations of the Agreements. The RSM consultant will invite GDRE to these site visits.
- ii. *Report review*: The RSM Consultant shall review the following reports from the beneficiary:
 - Environmental and Social Impact Assessment Report
 - Pre-drilling geological prognosis report, drilling program
 - Daily drilling reports,
 - Well completion reports,
 - Well testing report in which the performance of the well is measured against the success criteria.

The RSM consultant will submit written comments on the above reports to the GDRE. The daily drilling reports will be sent directly to the GDRE as well as the RSM Consultant but the consultant shall notify GDRE in case the drilling activity deviates from the drilling plan.

The RSM Consultant shall evaluate the validity of any claims to the RSM from the beneficiary presented in the well testing report. If disputes arise over drilling results it may be necessary to contract independent geothermal experts to verify the results. This may call for a repeat of well logging and/or discharge tests under the supervision of the independent experts.

- iii. *Data and invoice receipt:* Throughout the drilling and testing period the RSM Consultant will receive financial and technical data from the beneficiary as specified in the RSM agreement.

The beneficiary is to submit invoices and proof of payment to the RSM as expenses are incurred in the exploration drilling projects. The RSM consultant shall receive and verify this information. This information shall be stored in an appropriate Financial Management system allowing ‘real-time’ overview of the expenditures incurred on individual wells in individual projects.

69. Technical data related to exploration wells drilled with coverage of the RSM will be submitted to the RSM by the beneficiary as the drilling proceeds. The data will be submitted in a standardized format as defined by the RSM Consultant. The Consultant will be responsible for entering the data into the RSM database.

70. The RSM Consultant will prepare quarterly and annual reports on the RSM and on the exploration drilling projects supported by the RSM. The Consultant will submit these reports to the GDRE. These reports shall include:

- Details of Agreements under negotiation and signed;
- Total value of coverage committed / under negotiation;
- Costs to date /expected cost of Consultant, Auditor and Legal Advisor;
- Commentary on effectiveness of Prequalification, Application, Evaluation, Grant Agreement and Grant Provision processes;
- Activities of the RSM by region;
- Impacts achieved.
- Any problems or issues raised on individual projects and implementation.
- Suggestions if any.

71. For Component 2, the FI will be responsible for monitoring and evaluation of project progress, including the relevant intermediate results indicators reflected in Annex 1.

Role of Partners

72. Implementation of the proposed project will be closely coordinated with EBRD's Geothermal Development Lending Facility (GeoDELf), for which a US\$ 25 million from the CTF DPSP was approved in January 2025. GeoDELf is a US\$ 125 million framework lending facility for Turkey to provide both early and final stage financing for geothermal power projects. Phase I funding will provide CTF loans to geothermal projects to part-finance early project development, exploration drilling in particular. For Phase II, EBRD will provide in aggregate up to 100 million of project finance loans for the construction and commissioning of projects successfully developed in phase I.

73. Design of the proposed project has also taken into account lessons learnt from the ongoing implementation of IFC's GEF-financed Exploration Risk Insurance for Turkey project in partnership with Munich Re. Coordination with IFC's team will be maintained during project implementation in order to ensure that any potential synergies between both project, particularly on the technical assistance and capacity building components, are considered. In addition, the World Bank and IFC teams engaged in geothermal development in Turkey will maintain their dialogue in order to identify any further opportunities for collaboration.

Annex 4: Implementation Support Plan
TURKEY: Geothermal Development Project

Strategy and Approach for Implementation Support

1. The strategy for implementation support (IS) has been developed based on the nature of the project and its risk profile. It aims to make IS to the client more flexible, efficient and focused on preventing risks and efficiently addressing implementation challenges. The strategy will combine technical advice with supervision of implementation progress, and evaluation of results on the ground.

Implementation Support Plan

2. The Bank team members will be based at headquarters and in the Turkey country office to ensure timely, efficient and effective implementation support to the client. Formal implementation support missions and field visits will be carried out at least twice a year.

3. Technical. The Bank's team, which will include a geothermal specialist, will provide the required assistance, advice and guidance to the MENR and the FI in implementing the RSM, capacity drilling, and plant construction sub-projects. The Bank's team will conduct site visits alongside MENR and the FI. These site visits will take place during exploratory drilling, well testing, capacity drilling, and plant construction activities.

4. Procurement. The procurement team will provide timely support to the Implementing Units in MENR and the FI in order to enhance their capacity and contract management efficiency. Implementation support for procurement will follow a risk-based approach and will include: (i) support to the MENR and the FI in selecting consultants; and (ii) implementation support to strengthen the procurement mechanisms in both implementing organizations.

5. Financial Management. As part of its Project implementation support missions, the Bank will conduct risk-based financial management implementation support and monitoring within a year from the Project effectiveness, and then at appropriate intervals. During the Project implementation, the Bank will monitor the Project's financial management arrangements in the following ways: (a) review the Project's semi-annual IFRs as well as the entity's and the Project's annual audited financial statements and auditor's management letters and remedial actions recommended in the auditor's management letters; and (b) during the Bank's on-site missions, review the following key areas, (i) Project accounting and internal control systems; (ii) budgeting and financial planning arrangements; (iii) disbursement arrangements and financial flows, including counterpart funds, as applicable; and (iv) any incidences of corrupt practices involving Project resources. As required, a Bank-accredited financial management specialist will participate in the implementation support process.

6. Environmental and social safeguards: The environmental and social development specialists will closely supervise implementation of the ESMF, RPF and RAP (if required) of the project. The environmental and social specialist will conduct field visits on annual basis to monitor implementation of safeguards policies.

Time	Focus	Skills Needed	Resource Estimate (staff weeks (SW))
First twelve months	Task management	Sr. Energy Economist / Energy specialists (2)	10 SWs
	Technical review of the technical aspects of setting up and implementing the RSM; Support FI in the selection process of sub-projects	Geothermal expert	8 SWs
	Procurement review of QCBS Packages and other procurement activities and review	Procurement specialist	4 SWs
	Financial management	Sr. Financial management specialist	6 SWs
	Environmental supervision	Sr. Environmental specialist	3 SWs
	Social supervision	Social safeguards specialist	3 SW
12-54 months	Task management	Sr. Energy Economist / Energy specialist	16 SWs
	Guidance and implementation support on technical issues	Geothermal expert	10 SWs
	Review of procurement documents, and procurement guidance	Procurement specialist	10 SWs
	Financial management and disbursements	Financial management specialist	6 SWs
	Environmental supervision	Environmental specialist	4 SWs
	Social supervision	Social development specialist	2 SWs

7. The staff skills mix and focus in terms of implementation support is summarized in the tables below.

Skills Mix Required

Skills Needed	Number of Staff Weeks	Number of Trips	Comments
Task management	26	Field trips as required	Headquarters and Country based
Geothermal expert	18	3-4	Headquarters based
Procurement specialist	14	Field trips as required	Country office based
Sr. Financial management specialist	12	Field trips as required	County office based
Environmental specialist	7	4	Country office based
Social specialist	5	3	Country office based

Annex 5: Economic Analysis
TURKEY: Geothermal Development Project

Overview

1. The objective of the project is to scale up private sector investment in geothermal energy development in Turkey by reducing the risks taken on by the private sector in the exploratory phases, and by providing access to long-term financing for resource development phases. To meet its growing energy demand, Turkey is currently heavily reliant on imported gas, with about 44% of its electricity generated from gas, 25% from coal and lignite, and about 24% from hydro.⁷ The government of Turkey has set a target of developing 1000 MW of geothermal electricity generation capacity by 2023. The installed capacity of geothermal in Turkey is presently at 340MW⁸. It is expected that the project will add between 400 - 600MW to the existing geothermal potential in Turkey, and will increase private sector investment in the development of geothermal energy.

2. The assumptions underpinning the analysis are elaborated below:

Table 5.1: Key Assumptions of the Project Economic Analysis

Cost Assumptions	Unit	Value
Investment cost	US\$	US\$ 290 million
Operating and Maintenance cost (fixed and variable)	US\$/year	US\$ 5.4 million
Power Generation Assumptions		
Plant Capacity factor	%	90%
Hours of operation (Availability)	hours	7,884
Losses	%	2%
Generation from exploratory drilling	MWe	208
Generation from capacity drilling	MWe	70
Generation capacity constructed under the project	MWe	66
Total MWe installed	MWe	344
Total MWh generated	MWh	2,712,096
Gas Assumptions		
World Bank Forecasted commodity prices for gas (2015 – 2045)	US\$/mmbtu	8.5 - 10
CO₂ Assumptions		
Weighted average emission for geothermal (direct application, power production)	gCO ₂ /kWh	206
(Baseline) Combined Margin	gCO ₂ /kWh	583
Social value of Carbon, Base case(2015 – 2045)	US\$/metric tonne	30 - 65
<i>Economic discount rate</i>		10%
<i>Economic life</i>		30 years
<i>GDP (Turkey, 2013)⁹</i>	US\$	10,971

Project Development Impact

⁷ Source: Bloomberg New Energy Finance. Turkey’s Changing Power Market – Whitepaper (November, 2014)

⁸ Ibid.

⁹ Source: World Bank Group

3. The project's economic impact is assessed based on benefit-cost analysis for both components of the project. The economic benefits of the project are limited to significant quantifiable benefits and therefore the results regarding the economic net present value (NPV) and the economic internal rate of return (EIRR) should be seen as lower bounds relative to the actual economic benefits. Compared to other renewable energy and fossil fuel power sources, geothermal power systems have a much higher plant capacity factor which leads to higher levels of reliability as a power source, and lower level of life-time revenues to meet capital recovery and operating costs. This economic benefit is recognized but not analyzed as part of the economic analysis of the project. In addition, irrespective of scale, geothermal exploration has several indirect benefits including the induced investment they bring to the communities in which they operate, and new temporary and permanent jobs.

Rationale for Public Sector Investment

4. The unique risk profile of geothermal projects is characterized by the high levels of uncertainty associated with the initial exploration and resource / field development phases (i.e. high resource risk) as well as by the long lead time (i.e. it can take up to 3-4 years to confirm the viability of the resource and it takes a minimum of 6-7 years to complete all the stages of development and start generating electricity) and the need to put a large amount of financial resources (sometimes over 30-50 percent of total project costs) at risk to complete the necessary drillings at depth. For this reason, few investors are willing and able to invest their own equity in the exploration and field development phases. To undertake a full geothermal development project, a private sector investor requires long-term funds to be used for expensive, lengthy and risky drilling activities. Since exploration risk cannot be hedged or managed commercially, international experience shows that exploration and resource/field validation phases are very often either partly or entirely financed by concessional or government support. Through the Risk Sharing Mechanism for Resource Validation (RSM), the Project aims to provide this kind of support for exploration and confirmation drilling. The Loan Facility for Resource Development will provide commercial financing for capacity drilling and will leverage financing from FI for plant construction.

Rationale for Bank Involvement

5. Multiple support mechanisms for geothermal have been used across the world and the World Bank has been leading many of them, with over US\$2.2 billion in financing. Examples include a multi-country insurance scheme for East Africa (ARGeo) funded by the Global Environment Facility (GEF), a risk guarantee instrument under the Geofund project for geothermal development in Eastern Europe, and various financing provided in Africa and Asia regions. This experience provides the Bank with unique comparative advantage in structuring an appropriate risk sharing and financing mechanism for geothermal market development in Turkey and to leverage private sector investment in geothermal energy.

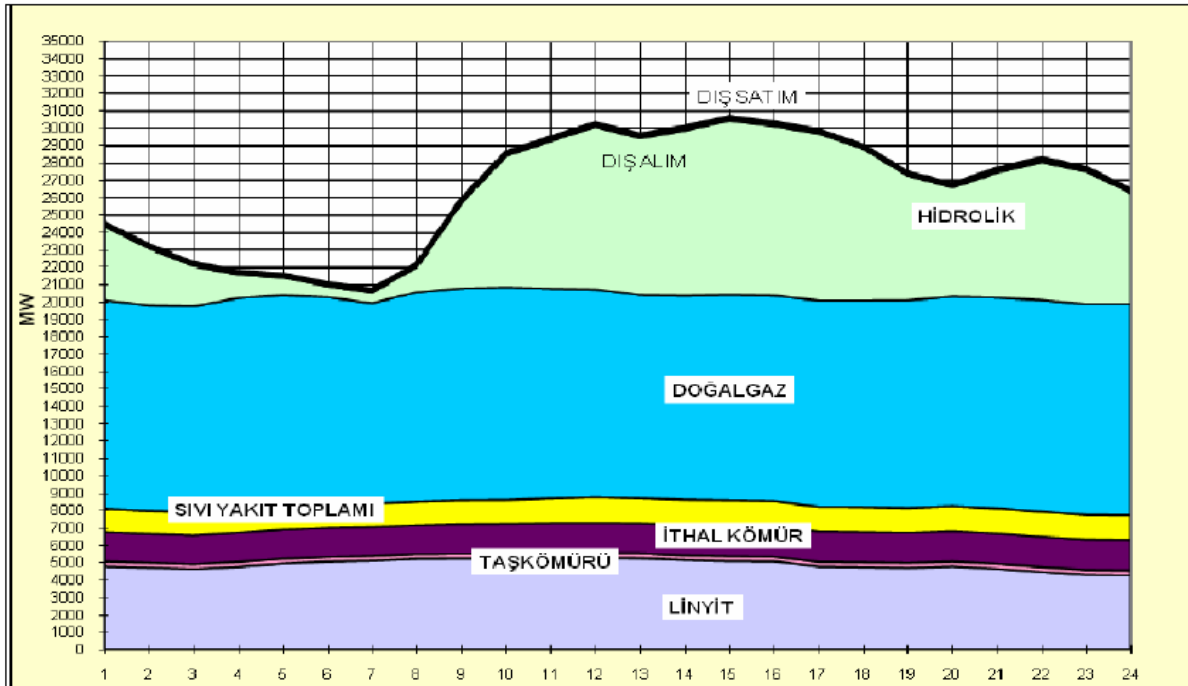
Economic Benefits

6. The economic analysis considers two major benefits which will result from the proposed project:

(i) **Geothermal energy as a replacement for gas**

7. An economic benefit of the project is avoided cost of reduced gas imported for power generation. An analysis of the recent projects added to the electricity grid in 2014 shows that 6,303 MW of generation capacity was added in Turkey in 2014 (3,899MW of coal and gas; 1366MW of Hydro; 882MW from Wind; and 156MW from other renewable energy sources including geothermal.)¹⁰ A further analysis was conducted to ascertain what geothermal energy will displace in the short term, and in the long term. The analysis took a short-term view with sufficient capacity already in place and available, and a normal hydro year. In this case, geothermal is most likely to displace gas which is the marginal fuel because gas accounts for a substantial part of the generation mix throughout the day (see Figure 5.1).

Figure 5.1. Typical daily dispatch in Turkey (Dogalgaz is domestic gas)



Source: World Bank staff estimates

8. The long term analysis took the following factors into consideration:

- Demand projections vary widely and the high demand is significantly above base/normal scenario projection as shown in Figure 1. Given the very low operating cost of geothermal and stable output level – geothermal can play as a good hedge against the high demand growth scenario. If demand is high, geothermal may help to avoid expensive fuel oil or

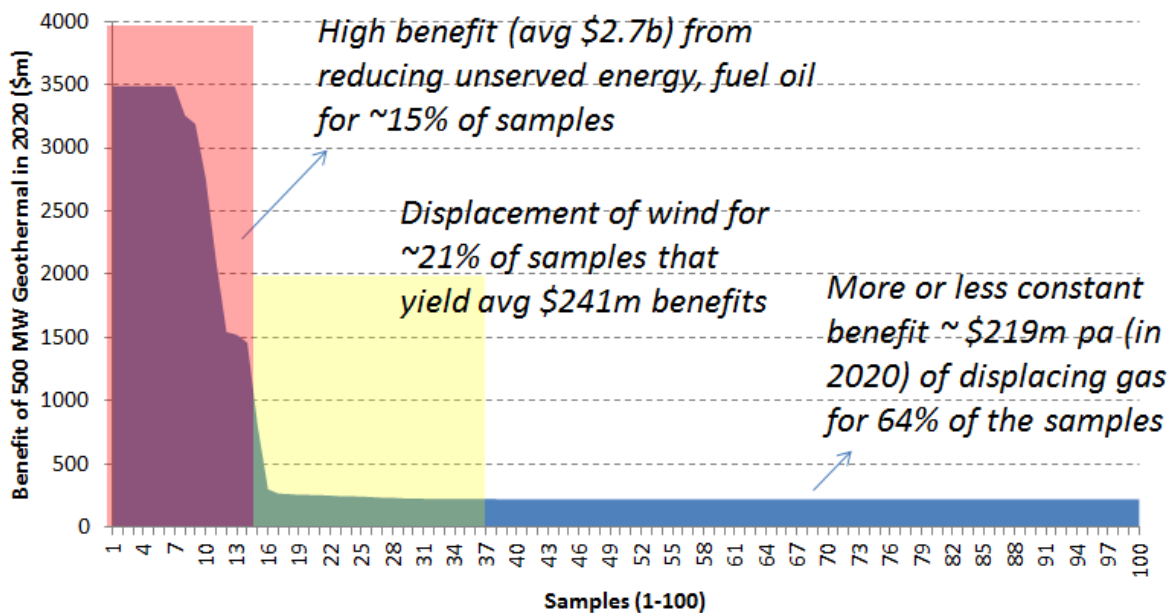
¹⁰ Source: Ministry of Energy and Natural Resources statistics.

even power outages in extreme cases. If demand is normal or low – it is possible that it would largely avoid gas imports.

- b) Uncertainty around capacity addition to keep pace with demand is also an issue and again a baseload geothermal project may have opportunity to displace more expensive fuel or avoid power cuts.
- c) Variability of hydro is an issue too – one or more years of drought may see the geothermal displacing fuel oil in a significant way as peaking hydro availability may not be ensured.

9. More importantly, any avoided fuel oil and unserved energy is a bonus and one that can, in fact, be substantial when we look at significant uncertainties around demand growth and hydro. The preliminary modelling analysis we have carried out for 2020 shows there is a 15% chance of the geothermal project to yield very high benefits by displacing fuel oil or unserved energy (see Figure 2). At US\$2.7b annual savings from such events and even with a 15% weight that accounts for US\$400 million in additional benefits, i.e., over and above the US\$200-225 million pa resulting from gas. There is also the potential for geothermal to usefully displace some of the marginal wind projects at an estimated annual benefit of US\$241 million pa in 21% of the samples.

Figure 5.2. Probability analysis of benefits of a 500 MW geothermal project – benefits across 100 samples



Source: World Bank staff estimates

(ii) Benefits from carbon emissions

10. The project also has the economic benefit of reducing CO₂ emissions when compared to other fossil fueled power plants. The weighted average emission from geothermal (from direct use in heating and from power generation) was calculated as 206 gCO₂ per kWh. The combined margin of CO₂ emissions from power generation of 583 kg per MWh was used as a comparator to calculate

the net benefit from CO₂ reduction¹¹. This was used to calculate the avoided carbon emissions from replacing power generated from gas with geothermal energy.

11. The benefits of reduced CO₂ emissions were calculated using the social value of carbon estimated as US\$15 per ton of CO₂ for 2015. The social cost of carbon (ranging from US\$30 in 2015 to US\$65 in 2045) is the base case estimate by the World Bank guidance note¹². This approach derives the social value of carbon emissions as the present value of expected future damages caused by an additional ton of CO₂-equivalent emitted to the atmosphere in different years. A range of estimates are provided by the Integrated Assessment Models (IAMs) that simulate complex relationships between global climate and economy. These estimates are reviewed in the last IPCC Report of 2014.¹³ The approach also incorporates measure the carbon price necessary to achieve a particular climate target. This approach derives shadow price of carbon from large energy-environment-economy models. The shadow price of carbon is conceived as the uniform global carbon price or tax that would cover the marginal cost of achieving a particular climate policy target – such as the internationally accepted goal of limiting mean global warming to 2°C above pre-industrial temperatures.

Economic Costs

12. The economic costs of the project consist of tax exclusive investment costs, and the operating and maintenance cost associated with the project. The annual operating and maintenance costs include both fixed and variable costs, and were estimated to be US\$ 5.4 million¹⁴.

Methodology and Results

13. The project economic analysis was conducted as an analysis of the costs and benefits of investing in geothermal development compared to gas. The economic analysis yielded an NPV equivalent to US\$452 million and EIRR of 29 percent. A summary of the results for the economic valuation of the project base case is presented below.

Table 5.2. Summary of economic benefit of reduced fossil fuel imports

NPV (US\$ million)	EIRR (%)	Average Annual savings (US\$/kwh)
452	29	34

Sensitivity analysis

14. The high CO₂ content in some parts of Turkey significantly elevates the risk of geothermal exploration. A sensitivity analysis was conducted to determine the economic valuation of the project without any economic benefit from CO₂ reduction. The result of the analysis (Table 3) showed a healthy NPV and EIRR without the additional benefits from CO₂ reduction. The lower

¹¹ Source: TEIAS.

¹² World Bank Guidance note on social value of carbon in project appraisal (September 2014).

¹³ IPCC, WGII, Summary for Policy Makers http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf

¹⁴ Source: TSKB data.

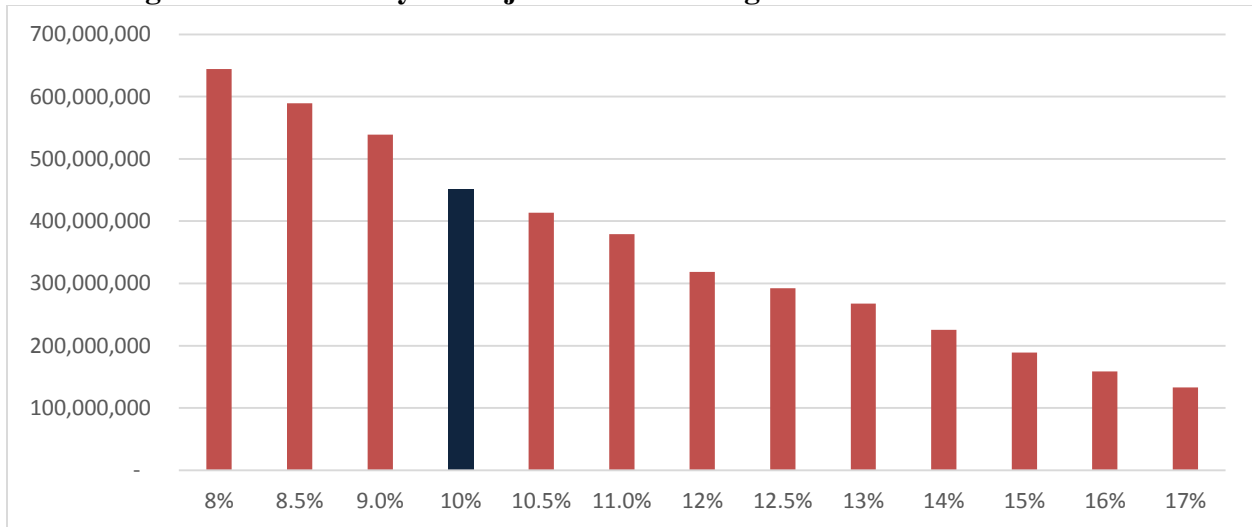
range of the social cost of carbon (15 – 40 US\$/metric tonne from 2015 - 2045) was also evaluated for sensitivity. A summary of the analysis is presented in Table 5.3.

Table 5.3: Sensitivity of EIRR and NPV to lower CO₂ benefits

	Base Case Social Cost of Carbon	Low Case Social Cost of Carbon	Economic Benefits without CO ₂ benefits
NPV	\$452	\$366	\$244
IRR	29%	27%	22%

15. A sensitivity analysis was also conducted on the use of a higher discount, up to the hurdle rate of the energy sector in Turkey. The results presented below, show that at 17% discount rate, the project will still have an NPV of US\$133 million.

Figure 5.3. Sensitivity of Project NPV to a range of economic discount rates



Annex 6: Financial Analysis

TURKEY: Geothermal Development Project

1. From a financial analysis perspective, the purpose of the project will be two pronged. The project will finance the riskiest part of geothermal exploration with grants to developers to reimburse a percentage of their investment when the sub-project is considered a failure. The project will also provide loans to private sector developers to finance capacity drilling and construction of power plants. Due to the unique nature of the two components, the financial analysis of the project was conducted separately for component 1 and component 2.

Financial Analysis – Component 1

2. The assumptions made in the financial analysis of component 1 are summarized below:

- a) A premium of 10% of the drilling cost¹⁵ will be paid by the developer upon acceptance into the RSM. This payment will be due after signing of the RSM Agreement;
- b) A success fee of 10% will be paid by the developer for every “successful” sub-project. This fee is deducted from the premium payment, with the difference, if any, to be paid upon financial closure;
- c) If a sub-project is considered a “failure”, the RSM will pay 40% of the drilling cost to developers in the Aegean Region and 60% to developers outside the Aegean Region;
- d) Upon completion of a drilling program, the concession will have a financial value. This value will depend on the level of success of the sub-project and the envisaged use of the geothermal resources;
- e) The cost assumptions for exploratory drilling, as used in the analysis are summarized below:

<i>Item</i>	<i>Description</i>	<i>Amount/Range (US\$)</i>
Cost of concession ¹⁶	Procured from MTA or from a third party	5,000 – 500,000
Preliminary surveys	To assess the available evidence for geothermal potential	300,000
Exploratory surveys	To gather available surface and sub-surface data through surface studies, geochemical, and geophysical surveys.	1,200,000
Drilling cost ¹⁷	Well program scenarios have a combination of slim wells and full size wells.	1,800,000 – 4,050,000

3. In the analysis of the financial viability of component 1, six different scenarios were analyzed to cover the scope of possible drilling programs (3, 4, and 5 well programs) in the RSM. In the six scenarios, different assumptions were made about the cost of investment, characteristics

¹⁵ “Drilling costs” are eligible costs incurred *after* the developer signs the RSM agreement.

¹⁶ The concession cost will depend on the extent and type of exploratory surveys and studies carried out.

¹⁷ Drilling costs will differ within the Aegean Region and outside. The costs also depend on the well type (slim-hole or full size wells).

of the drilling program (within and outside the Aegean Region), salvage value, and the probability of success. At the exploratory drilling stage, the industry-wide the success rate is generally between 30 to 80 percent, depending on the existing geophysical evidence. For the present analysis of Component 1, a range of success rates from 80 to 30 percent were analyzed. The conservative approach to the probability analysis yielded weighted average NPV of US\$ 1.38 million and a FIRR of 12%. Details of the weighted average of the NPV and IRR of the range of possible scenarios are provided below.

Table 6.1. Summary of financial analysis for the Risk Sharing Mechanism (Component 1)

Case Scenarios	Status	Well Program	Region	Market value of Concession	Probability of success	IRR	NPV
Scenario 1	Successful	4 Well	Aegean	20,000,000	80	16%	\$2,000,203
Scenario 2	Failure	3 Well	Aegean	8,000,000	70	15%	\$1,168,449
Scenario 3	Successful	3 Well	Not Aegean	17,000,000	60	18%	\$2,747,252
Scenario 4	Failure	4 Well	Aegean	12,000,000	50	14%	\$1,684,748
Scenario 5	Failure	4 Well	Not Aegean	6,000,000	40	5%	\$372,865
Scenario 6	Successful	5 Well	Not Aegean	19,000,000	30	4%	\$290,560
Probability Weighted Average						12%	\$1,377,346

Financial Analysis – Component 2

4. To establish the financial viability of projects in financed in component 2, a sample 30 MW project was analyzed. The total capital expenditure was US\$155,725,000, including the cost of the concession, capacity drilling, and plant construction. The base case assumes a debt-equity ratio of 75:25, 15 year loan term, 5.50% interest rate, success rate (hit ratio) of 70%, and a financial discount rate of 15%. The assumptions used in the analysis of Component 2 can be found in Table 2 below.

Table 6.2. Assumptions for Financial Analysis of Component 2

Installed Power and Well Assumptions	
Target Installed Gross Capacity (MW)	30
Internal Consumption	8%
Installed Power per well (MW/Well)	4
Average Well Depth (km)	3
Well Undershoot (Hit Ratio)	70%
Production Assumptions	
Plant Capacity factor	90%
Hours of operation (Availability)	7,884
Transmission Losses %	2%
Yearly Production (MWh)	217,598
Yearly Electricity Sales Volume (MWh)	213,246
Investment Assumptions (Excluding Concession Fee)	
Unit Cost of Surface Plant (\$/MW)	1,500,000

Unit Cost of Well (\$/km)	1,000,000
Investment Period (years)	3
Weighted Effective VAT (upon above)	15%
Economical Life (year)	30
Concession Fee Assumptions	
Concession Net Total Cost (US\$)	16,000,000
Unit Concession Cost (\$/MW)	533,333
Feed-in Tariffs and Operational Cost Assumptions	
First 10 years Feed-in Tariff (\$-cent/kWh)*	10.50
Sales Price after 10 years (\$-cent/kWh)=Market Price	8.00
Unit Operating Cost (\$-cent/kWh)	2.50
Financial Assumptions	
Corporate Income tax rate	20%
Loan maturity period, years	15
Interest rate	5.50%
Equity share (excl. Vat &int.)	25%
Inflation rate, Turkey	8.9
Debt/Total Investment	75%
Financial Discount Rate	15%
Depreciation period, years	30
Cost Assumptions	
Total investment cost, including cost of concession	155,725,000

5. A summary of the results of the analysis is presented below.

<i>Free cash flow¹⁸ to Equity</i>	
Return on equity (based on FCFE)	31%
Equity NPV (based on FCFE)	US\$ 51,975,579
<i>Free cash flow to the Project (net income)</i>	
IRR	17%
NPV	US\$17,048,450
<i>Project IRR and NPV</i>	
Project IRR	7%
Project NPV	US\$11,163,744

6. The free cash flow methodology analyzes the financial benefits from the perspective of equity investors while the Project IRR and NPV uses the project cash flows to determine financial viability.

7. Geothermal energy presently enjoys a feed-in tariff of 10.50 cents/kWh. The government of Turkey also provides an additional 2.7 cents/kWh when local equipment is used. The analysis takes a conservative tariff of 10.50 cents/kWh. A sensitivity analysis was conducted to determine the impact of reducing tariffs from 10.50 cents/kWh, progressively to 7.5 cents per kWh. The FIRR and NPV remain positive despite a reduction of the feed in tariff to 8.5 cents per kWh.

¹⁸ Calculated as operating cash flow minus capital expenditures.

Table 6.3. Sensitivity of FIRR and NPV to Tariff changes

Tariff (c/kWh)	10.5	9.5	8.5	7.5
IRR	17%	16%	15%	14%
NPV	17,048,450	9,570,223	2,091,997	(5,386,229)

Annex 7: Summary Assessment of TSKB
TURKEY: Geothermal Development Project

1. **An assessment of TSKB took place at the appraisal stage based on eligibility criteria in accordance to requirements outlined in OP10.0.** A detailed confidential appraisal report has been internally filed with summary results presented in the Table 1 below. These are based on the following sources of information: (i) audited financial statements as of December 31, 2014; (ii) written information provided by TSKB; (iii) interviews with senior TSKB management.

Table 7.1. Summary of TSKB appraisal

Criterion	Comments
License	Criterion met. TSKB was established in 1950
Owners/Managers “fit & proper”, governance quality	Criterion met. Board members cleared by BRSA as “fit and proper.” TSKB received the highest rating on Corporate Governance based on the principles of the Capital Markets Board (9.44/10).
Good standing with the BRSA	Criterion met.
Capital Adequacy	Criterion met. Capital adequacy ratio of 18.33 percent, and 94 percent of Tier 1 capital. Leverage ratio of 6.9
Liquidity	Criterion met.
Profitability	Criterion met. The yearly profit for 2014 was TL369 million, 12 percent higher than 2013. ROE 17.7 percent, ROA 2.6 percent.
Policies and Risk Management Functions	Criterion met.
Asset Quality and Provisions	Criterion met. NPL ratio at 0.17 percent. 100 percent provisioning policy.
Internal Audit and Controls	Criterion met.
Adequate MIS	Criterion met.

As result of the assessment, the eligibility of TSKB as participating financial institution has been confirmed by the appointed reviewer based on OP 10.00.

Background on TSKB

2. **Türkiye Sınai Kalkınma Bankası A.Ş. (TSKB) is a private, non-deposit taking, development and investment bank.** It was established in 1950 with the support of the World Bank, the Central Bank of the Republic of Turkey, and shareholding of private commercial banks. Ownership is 50 percent Is Bank, 8.4 percent Vakifbank and the remaining mainly free float. TSKB is the 21st largest bank in Turkey, in terms of asset size. Long term funding from IFIs constitutes 94 percent of its total funding, with 41 percent stemming from IBRD, 30 percent from EIB, and the remaining from KfW (9 percent), CEB (7 percent), IDB (5 percent), IFC (4 percent), AFD (3 percent), and EBRD (1 percent). TSKB had its first Eurobond issuance in the 4th quarter of 2014, of US\$350 million, with a 5-year term.

3. Its asset size is TL12.9 billion, placing it as the 21st largest bank in Turkey. It has 314 employees and 2 branches (Izmir and Ankara). Its funding is 94 percent long term (with 91 percent of it guaranteed by the Turkish Treasury), of which 45 percent is IBRD, followed by EIB at 29 percent, while others include CEB, KfW, AFD, IFC, EBRD and IDB. About 9 percent of its lending is on-lending (apex operations), 52 percent project finance, and 39 percent corporate loans. It is rated as BBB- by Fitch LTFC and Baa3 by Moody's LTIR. It has received the highest corporate governance rating of 9.44/10 according to the principles of Borsa Istanbul.

Background on World Bank projects with TSKB

4. **TSKB is the recipient of three active and four closed lines of credit from the World Bank.** The Private Sector Renewable Energy and Energy Efficiency project (on-lending, IBRD US\$550 million, and CTF US\$70 million) has disbursed 82 percent and is expected to close in 2016. TSKB completed the EFIL IV additional finance (US\$180 million and €87.8 million, on-lending, on top of original US\$300 million) in May, 2014. In addition, the Past World Bank engagements include SME I (US\$125 million, originally on-lending later restructured for direct lending, closed in 2012); EFIL II (US\$303 million, on-lending, closed 2009); EFIL III (US\$305 million on-lending, closed in 2010).

TÜRKİYE SİNAİ KALKINMA BANKASI AŞ AND ITS SUBSIDIARIES

CONSOLIDATED STATEMENT OF FINANCIAL POSITION

AS AT 31 DECEMBER 2014

(Amounts expressed in thousands of Turkish Lira (TL) unless otherwise stated)

ASSETS	Notes	31 December 2014	31 December 2013
Cash and cash equivalents	5	14	107
Balances with central bank	6	34,612	78,155
Reserve deposits at central bank	6	473,168	266,778
Loans and advances to banks	7	503,981	421,304
Interbank money market placements	5	104,913	50
Funds lent under repurchase agreements	5	293	-
Financial assets at fair value through profit or loss		95,417	60,248
- <i>Trading assets</i>	8	20,543	19,561
- <i>Derivative assets</i>	32	74,874	40,687
Loans and advances to customers	9	10,852,263	9,060,422
Investment securities	10	3,520,426	2,976,196
- <i>Available for sale investment securities</i>		3,520,426	2,976,196
Investments in equity-accounted investees	11	261,745	234,988
Goodwill	12	383	383
Property and equipment	13	26,619	24,567
Investment property	14	224,090	222,295
Intangible assets	15	1,169	1,245
Deferred tax assets	21	8,940	14,977
Other assets	16	93,259	80,746
Total assets		16,201,292	13,442,461

Annex 8: RSM terms and conditions
TURKEY: Geothermal Development Project

Background

1. The Risk Sharing Mechanism for Resource Validation (RSM) has been prepared to promote private investment in the surface exploration and exploratory drilling phases of renewable geothermal energy projects in Turkey. For the purposes of the RSM, geothermal development has been categorized into four primary development phases which include surface exploration, exploratory drilling, capacity drilling, and project construction (see Section I. B. Box 1, in the main text).

2. Surface exploration includes the geophysical, geochemical and various testing techniques that are used to identify a potential geothermal reservoir and the exploratory drilling targets most likely to produce geothermal fluids. Exploration wells are then drilled towards the drilling targets in order to locate, test and further define the geothermal reservoir. The exploratory drilling phase represents the highest financial risk to the geothermal program beneficiary and is therefore the primary focus of the Risk Sharing Mechanism tool. After successful exploratory drilling has located and adequately defined the reservoir, capacity drilling is commenced to obtain the geothermal energy capacity necessary to meet the requirement of the beneficiary's business plan (i.e. power generation, spa, green house, etc.).

3. The RSM has been designed to reduce the beneficiary's exploratory drilling risk by paying up to 60% of the average estimated drilling cost of an unsuccessful well outside of the Aegean Region (40% inside of the Aegean Region) under a standard three well program. Unlike a non-refundable insurance premium that is paid regardless of the success of a well, the beneficiary will pay a 10% "Success Fee" on the average estimated drilling cost only when the well is successful. To help assure accurate estimating of drilling costs and effective management of drilling operations, the RSM Payout and Success Fees will be paid as a percentage of the estimated cost; however, when the estimated cost is found to be higher than the actual cost realized during the program, these payments will be capped based on a percentage of the actual drilling cost (see table below). The RSM standard program is based on drilling three exploratory wells to confirm the location and power production potential of the geothermal reservoir. At the discretion of the RSM, an optional fourth and fifth well may be drilled based on a 40% RSM payout for an unsuccessful 4th or 5th well both in the Aegean region and elsewhere in the country.

4. What constitutes a successful versus an unsuccessful well will be agreed pursuant to specific terms and conditions that will become a part of the RSM Agreement signed by the beneficiary. As part of this agreement, unique success / failure criteria will be established based on the energy requirements of the beneficiary's business plan. The energy requirements that set the threshold for a successful well will be established as a combination of enthalpy and flow rate of the geothermal well at a minimum well head pressure; all of which will be compared to well test results established through certified well testing. In the case of slim wells which are drilled for the purpose of exploring reservoir temperature, the success / failure criteria will be based on measured temperature at a given depth.

5. In addition to a business plan, the beneficiary will be required to provide a professionally prepared cost estimate as part of the RSM application. The estimate will be vetted by the RSM after which the parties will agree on the average estimated cost per well that will be used to set the identified percentage “Payout” and “Success Fee” for each of the wells in the program.

6. The program has been designed with three rounds of RSM applications starting in year 2016. The number of participants in each round will be limited based on the statistical probability of depleting the RSM grant funding during such round.

7. To reasonably establish the number of programs that the RSM can support before depleting the US\$38 million CTF contingent recovery grant, the terms and conditions of the program have been applied to a likely sequence of programs in and out of the Aegean Region. The result indicates that approximately 20 programs can be supported with a cumulative RSM Payout of US\$37.5 million. It also indicates that through the catalyst of RSM support, the cumulative beneficiary investment in geothermal energy could exceed US\$ 200 million.

Program Cost (Neg # is RSM Payout):		(\$37,552,500)		RSM Facility Cumulative Success Fee / Payout	Cumulative Beneficiary Investment
Total # of Programs Supported:		20			
Programs in Aegean Region	9	Programs out of Aegean Region	11		
RSM Cost per Program		RSM Cost per Program			
1	(\$1,935,000)	1	(\$1,980,000)	(\$3,915,000)	\$11,385,000
2	\$202,500	2	(\$2,340,000)	(\$6,052,500)	\$38,947,500
3	(\$810,000)	3	(\$2,340,000)	(\$9,202,500)	\$61,447,500
4	\$990,000	4	(\$4,860,000)	(\$13,072,500)	\$87,727,500
5	(\$247,500)	5	(\$2,070,000)	(\$15,390,000)	\$104,760,000
6	(\$2,835,000)	6	(\$4,455,000)	(\$22,680,000)	\$129,870,000
7	\$990,000	7	(\$2,160,000)	(\$23,850,000)	\$146,250,000
8	(\$3,240,000)	8	(\$1,620,000)	(\$28,710,000)	\$165,690,000
9	(\$1,417,500)	9	(\$3,330,000)	(\$33,457,500)	\$188,842,500
10		10	(\$2,115,000)	(\$35,572,500)	\$198,427,500
11		11	(\$1,980,000)	(\$37,552,500)	\$201,847,500

8. The following tables identify a possible landscape of RSM exploratory drilling projects performed in and out of the Aegean Region which result in the above referenced number of programs, RSM Payout and beneficiary investment. These tables identify the type of well drilled as either Full Sized (F) or Slim Hole (S) for each of the RSM programs performed. Each well is then identified as Successful by assigning a value of “1” or as Unsuccessful by assigning a value of “0”. To assure a realistic modeling process, individual program success rates have been assigned to reflect the actual success rates experienced in Turkey. It must be noted that this progression of program types and success rates have been established to give an indication of how many programs can realistically be supported by the RSM. The actual programs and success rates will be set based on beneficiary participation and need.

Outside Aegean Region

Average Cost Per Full (F) Size Well:		\$4,050,000									
Average Cost Per Slim (S) Well:		\$1,800,000									
Success Fee as Percent of Cost Wells 1, 2 & 3 :		10%		Success Fee as Percent of Cost Wells 4 & 5 :		25%					
RSM Payout in Event of Failure Wells 1, 2 & 3 :		60%		RSM Payout in Event of Failure Wells 4 & 5 :		40%					
Drilling Program								RSM Facility		Beneficiary	
Program #	Well #1	Well #2	Well #3	Well #4 Option	Well #5 Option	Program % Success Rate	Cumulative Success Rate	Individual Program Success Fee / Payout	Cumulative Success Fee / Payout	Beneficiary Program Investment	Cumulative Beneficiary Investment
1	S	S	S			33.33%	33.33%	(\$1,980,000)	(\$1,980,000)	\$3,420,000	\$3,420,000
	0	1	0								
2	S	S	S	F	F	60.00%	46.67%	(\$2,340,000)	(\$4,320,000)	\$11,160,000	\$14,580,000
	0	1	1	0	1						
3	S	S	S	F	F	60.00%	51.11%	(\$2,340,000)	(\$6,660,000)	\$11,160,000	\$25,740,000
	0	1	1	0	1						
4	F	F	F			0.00%	38.33%	(\$4,860,000)	(\$11,520,000)	\$7,290,000	\$33,030,000
	0	0									
5	S	S	F			66.67%	44.00%	(\$2,070,000)	(\$13,590,000)	\$5,580,000	\$38,610,000
	1	1	0								
6	F	F	F	F		50.00%	45.00%	(\$4,455,000)	(\$18,045,000)	\$11,745,000	\$50,355,000
	0	1	0	1							
7	S	S	F			0.00%	38.57%	(\$2,160,000)	(\$20,205,000)	\$5,490,000	\$55,845,000
	0	0									
8	F	F	F			66.67%	42.08%	(\$1,620,000)	(\$21,825,000)	\$10,530,000	\$66,375,000
	0	1	1								
9	S	S	F			33.33%	41.11%	(\$3,330,000)	(\$25,155,000)	\$4,320,000	\$70,695,000
	1	0	0								
10	S	S	F	F		50.00%	42.00%	(\$2,115,000)	(\$27,270,000)	\$9,585,000	\$80,280,000
	0	1	1	0							
11	S	S	S			33.33%	41.21%	(\$1,980,000)	(\$29,250,000)	\$3,420,000	\$83,700,000
	0	1	0								

Aegean Region											
Average Cost Per Full (F) Size Well:		\$4,050,000									
Average Cost Per Slim (S) Well:		\$1,800,000									
Success Fee as Percent of Cost Wells 1, 2 & 3 :		10%		Success Fee as Percent of Cost Wells 4 & 5 :		25%					
RSM Payout in Event of Failure Wells 1, 2 & 3 :		40%		RSM Payout in Event of Failure Wells 4 & 5 :		40%					
Drilling Program						RSM Facility			Beneficiary		
Program #	Well #1	Well #2	Well #3	Well #4 Option	Well #5 Option	Program % Success Rate	Cumulative Success Rate	Individual Program Success Fee / Payout	Cumulative Success Fee / Payout	Beneficiary Program Investment	Cumulative Beneficiary Investment
1	S	F	F			33.33%	33.33%	(\$1,935,000)	(\$1,935,000)	\$7,965,000	\$7,965,000
	0	1	0								
2	F	F	F	F		75.00%	54.17%	\$202,500	(\$1,732,500)	\$16,402,500	\$24,367,500
	0	1	1	1							
3	F	F	F			66.67%	58.33%	(\$810,000)	(\$2,542,500)	\$11,340,000	\$35,707,500
	0	1	1								
4	S	F	F	F	F	80.00%	63.75%	\$990,000	(\$1,552,500)	\$18,990,000	\$54,697,500
	1	0	1	1	1						
5	S	S	F	F		75.00%	66.00%	(\$247,500)	(\$1,800,000)	\$11,452,500	\$66,150,000
	1	1	0	1							
6	F	F	F	F		50.00%	63.33%	(\$2,835,000)	(\$4,635,000)	\$13,365,000	\$79,515,000
	0	1	0	1							
7	S	F	F			100.00%	68.57%	\$990,000	(\$3,645,000)	\$10,890,000	\$90,405,000
	1	1	1								
8	F	F	F			0.00%	60.00%	(\$3,240,000)	(\$6,885,000)	\$8,910,000	\$99,315,000
	0	0									
9	F	F	F	F	F	60.00%	60.00%	(\$1,417,500)	(\$8,302,500)	\$18,832,500	\$118,147,500
	1	0	1	1	0						

RSM terms and conditions

9. The RSM will be governed by the following basic terms and conditions which have been considered in the program modeling. These terms and conditions are subject to refinement during the project implementation stage.

- i. As part of the RSM application process, the RSM will screen license holders based on the following information to be provided by the beneficiary:
 - a) Surface exploration information which meets base RSM requirements for participation in the program
 - b) A professionally prepared business plan showing how the geothermal energy will be utilized inclusive of the geothermal resource energy requirements necessary to meet such plan
 - c) A professionally prepared drilling program and corresponding cost estimate
 - d) The financials and governing documents of the legal entity that will be the beneficiary of RSM funds as well as clarification of any liabilities facing the legal entity
 - e) Proof of necessary permits, licenses and unobstructed rights to the concession

- f) A well-documented statement of technical capacity of the legal entity as it pertains to the entity's ability to successful management of the project
- ii. Certain regions within Turkey have exhibited high CO₂ production from geothermal energy applications. Given the environmental impact of CO₂ release to the atmosphere, RSM support in regions where geothermal energy is known to produce high CO₂ shall be at the sole discretion of the RSM. RSM discretion will be considered in the context of the local geology giving rise to high CO₂ production, the amount of CO₂ released to the atmosphere under the proposed energy extraction technology and the financial / technical viability of a CO₂ management plan in the event that high CO₂ is encountered during exploratory drilling. When an RSM exploratory drilling program identifies CO₂ production during well testing above ____ grams / kWh ("CO₂ Production Threshold") , the following terms and conditions will apply:
- a. Unsuccessful Well: For an unsuccessful exploratory well (i.e. doesn't meet stated energy success criteria) that is at or above the CO₂ Production Threshold, the RSM Payout will be made and the program will be terminated.
- b. Successful Well: For a successful exploratory well that meets the stated energy criteria and tests above the CO₂ Production Threshold, the drilling program will be stopped and the Success Fee to be paid by the beneficiary will be put on hold. The beneficiary shall then have a period of ____ business days (or longer upon RSM discretion) to present a viable plan that maintains CO₂ at or below the CO₂ Production Threshold during project operation. If a viable CO₂ management plan is not produced within the stated timeframe, the RSM (at its discretion) may terminate the program and the Success Fee shall be waived. If a viable CO₂ management plan is produced that *does not* financially impact the beneficiary's business plan, the Success Fee shall be paid to the RSM and the program may continue. If a viable CO₂ management plan is produced that *does* financially impact the beneficiary's business plan, the RSM (at its discretion) may waive the Success Fee in support of the CO₂ management plan after which the beneficiary may continue the program.
- iii. Upon RSM approval of the beneficiary's drilling program estimate, the total estimated cost will be divided by the number of like wells to be drilled (i.e. full size versus slim hole) to establish the average estimated cost per well. Programs that include a combination of slim hole and full size wells will be assigned estimated cost based on industry standard estimating procedures. The average estimated cost per well will be used to set the Payout and Success Fee for each well subject to the identified percentage threshold of actual costs that shall not be exceeded.
- iv. The beneficiary will prepare and provide accounting of drilling program actual cost with supporting documentation consisting of certified payments of invoices. This information will be provided to the RSM financial manager within predetermined time frames as specified in the agreement between the RSM and beneficiary. Payment certification requirements (i.e. proof of payment) will be established in the agreement between the RSM and beneficiary.

- v. Forty percent (40%) of the average estimated cost of an unsuccessful well will be paid by the RSM for exploratory drilling occurring in the Aegean Region. Sixty percent (60%) will be paid outside of the Aegean Region where geothermal development represents a higher risk for investment. The RSM reserves the right to implement measures (i.e. stimulation) to increase the energy production of an exploratory well prior to it being deemed “unsuccessful”. Measures ordered by the RSM that are not otherwise included in the detailed drilling estimate will be at the expense of the RSM. If such measures increase energy production above the energy threshold identified as “success” in the RSM agreement, the beneficiary shall be obligated to pay the Success Fee.
- vi. A standard RSM drilling program will include three geothermal wells with an option for a fourth and fifth well at the discretion of the RSM.
- vii. RSM involvement will be terminated when two unsuccessful wells are consecutively drilled.
- viii. The beneficiary can discontinue RSM involvement after completion of the well currently being drilled and before the start of the next consecutive well identified in the program. Actual costs will then be compiled through demobilization of the drilling equipment (when applicable) to establish an average actual drilling cost per well.
- ix. Payouts and Success Fees will be calculated at the completion of the drilling program after which a single financial transaction will be performed when a Payout or Success Fee is due and owing.
- x. Beneficiary’s participation in the RSM is on a project basis as opposed to a concession basis. Generally, the second and third projects on the same concession will be included in subsequent application rounds unless the current application round is under subscribed.
- xi. The beneficiary shall be obligated to comply with World Bank Anti-Corruption Guidelines. These guidelines can be obtained at the following website address:

<http://siteresources.worldbank.org/INTLAWJUSTICE/Resources/AnticorruptionGuidelinesOct2006RevisedJan2011.pdf>
- xii. Information concerning drilling progress will be provided to and monitored by the RSM as specified in the agreement between the beneficiary and the RSM. Drilling data and test results obtained under this program will be maintained in a non-confidential RSM database for reference in future projects.

Annex 9: Technical Appraisal

TURKEY: Geothermal Development Project

1. Both geothermal power generation and use of geothermal heat for direct applications are established technologies that have a track record of over 60 years of large scale implementation in several countries. The total world-wide installed capacity for geothermal power production is currently about 12.5 GW_e and the corresponding value for direct applications is about 70 GW_t. Where available, geothermal energy is an attractive source of power and heat due to various reasons:

- Geothermal power is a stable base load source, not affected by diurnal or seasonal fluctuations. Most geothermal power plants are operated at name plate capacity and load factors are typically well above 90%.
- Geothermal power plants, wells and surface installations can be expected to last for 30 years with proper maintenance.
- Modern geothermal wells are drilled and operated safely without significant risks of blowout or contamination of ground water reservoirs and reinjection of geothermal fluids to reservoir levels prevents contamination of surface waters.
- The surface footprint of geothermal projects is smaller than for most other power sources. In addition, most environmental impacts are reversible.

2. The proposed Turkey Geothermal Development Project aims to enhance the utilization of geothermal energy in the country for both power generation and direct use. This will decrease the country's reliance on imported energy, increase access to affordable heating and power and stimulate private sector investments in applications such as greenhouses, spa facilities and power production. A two pronged approach will be taken to achieve the goals of the project; a Risk Sharing Mechanism will be established to mitigate the resource risk in the exploration drilling stage and a Loan Facility will be established to finance project development.

3. The Risk Sharing Mechanism will cover 40 to 60 percent of the cost of exploration wells in case of resource related failure. This will greatly reduce the risk for project sponsors and help them raise funds for costly exploration drilling projects. Higher coverage provided for projects outside the Aegean region is intended to stimulate investments in geothermal exploration in the less explored parts of the country.

4. In order for projects to be eligible for coverage under the RSM, the appropriate exploration studies need to be carried out. Applications for coverage by the RSM will need to be supported by results of high quality geological, geochemical and geophysical surface exploration studies. A conceptual model of the geothermal system, consistent with the results of the exploration studies will have to be developed and drilling targets for the exploration wells will need to be based on the conceptual model. Furthermore, well design and well drilling and testing will have to be consistent with industry best practices. The RSM will contract international geothermal consultants that will evaluate applications to the RSM based on the quality of the surface exploration studies and geothermal conceptual modes as well as the quality of the well design and drilling programs. The consultants will also closely follow the drilling activities and well testing in order to ensure that good practices are followed throughout the process. Finally, all technical

data collected from wells drilled with the support of the RSM will be made publicly available in an open data base developed as a part of this project. All this will both reduce the technical risks of individual projects and reinforce high quality scientific and engineering work in the Turkish geothermal sector, contributing to its sustainability.

5. The Loan Facility for geothermal development will provide financing for capacity drilling and power plant construction. The goal of this facility is to bridge the financing gap between the exploration stage and the power plant construction stage. Despite lower resource risk after the exploration stage has been completed, financing of capacity drilling is still difficult for project developers in Turkey and elsewhere. Projects financed by the loan facility will also be required to apply industry best practices, as described above for projects covered by the RSM. This will be ensured by the TSKB engineering team and by expert consultants that will be contracted when needs arise.

6. The geothermal fluids in the Menderes and Gediz grabens in the Aegean region, where most of the geothermal power plants are concentrated, are characterized by high CO₂ content, resulting in CO₂ emissions of up to 1000 g/kWh in some cases. There is not a consensus in the international scientific community as to whether to consider CO₂ emissions from geothermal power plants anthropogenic or not. Italy, for instance, does not include CO₂ emissions from geothermal power generation in the national inventory of GHG emissions, whereas geothermal power plant emissions are considered anthropogenic in New Zealand and Iceland. The core question is whether geothermal power production will substantially reduce the magnitude of natural emissions. This can only be answered by long term emission monitoring from a number of geothermal fields before and during power production. To date very limited data of this nature exist. This is due to the relatively small size of the sector and also because this issue is not pressing in most countries where GHG emission from geothermal power plants are low compared to emissions from power generation using fossil fuels (the global weighted average CO₂ emission factor from geothermal energy is 122 g/kWh).

7. Taking into account the uncertainty regarding the nature of GHG emissions from geothermal power plants, the Project will take a conservative approach to potential CO₂ emissions in order to ensure that the average emission factor for the Turkish grid would not be surpassed. To this effect, a termination clause in the RSM agreements will be triggered if the CO₂ content in the geothermal fluid encountered in wells drilled under the RSM will be so high as to result in emissions above the grid emission level upon power production. Wells drilled outside the Aegean region are expected to encounter fluids with lower CO₂ content and it is expected that higher RSM coverage of wells drilled in those areas will tend to encourage development of these lower CO₂ geothermal resources.

8. Similarly, the Loan Facility will not finance projects with estimated net emissions above the grid emission factor for 2014, i.e. 583 g/kWh. The Facility will thus focus on projects that either produce energy from low CO₂ fluids or utilize technologies that prevent GHG emissions above the limit. This can include power plants using closed circuit pumped binary technology and technologies to capture the geothermal gas. The table below summarizes the resource temperature ranges of the available energy conversion technologies and the corresponding technical options and constraints for gas capture.

9. Closed circuit, pumped binary power plants are most favorable with respect to CO₂ emissions as the gas remains dissolved and gets reinjected with the brine after passing through the power plant (see Table below). The feasibility of pumped binary power plants is, however, constrained by the resource temperature to a maximum of 180°C under optimal conditions and even to 150°C if the fluid needs to be pumped from more than 250 m depth. Pumped binary plants are currently uncommon in Turkey but will be a favorable option for power production using lower enthalpy resources outside the Menderes and Gediz grabens.

10. Two phase binary plants, the most common geothermal energy conversion technology used in Turkey, is favorable for gas capture as the geothermal gas exits the power plant under 3 to 7 bar pressure (see Table). Captured geothermal gas can be treated and used for a number industrial and agricultural applications. Geothermal gas is currently captured at two geothermal power plants in Turkey, Kizildere and Dora, and used to produce dry ice and food-grade CO₂ for carbonated drinks. Some of the captured geothermal gas could also be reinjected to the geothermal reservoir together with the brine but this has not been done yet on a large scale. The Task Team is currently exploring the possibility of allocating US\$ 48 million of CTF Loan for financing of installations needed to capture, process and/or reinject the geothermal gas.

11. In summary, the Turkey Geothermal Development Project is expected to positively impact the geothermal sector in the country in several ways. It will facilitate exploration in Central and Eastern Turkey where the geothermal resources are currently underdeveloped. It will also encourage the adoption of best practices in surface exploration, drilling and well testing. Finally, the Project will result in reduced CO₂ emissions from geothermal utilization in Turkey, first by facilitating development of geothermal resources outside of the Menderes and Gediz grabens and second by providing financing for the development of low CO₂ geothermal resources and for CO₂ capture for use or reinjection.

Resource Characteristics			Technological Options	
Temp. range	Energy conversion technology	CO ₂ State	Technological Constraints	CO ₂ Capture Options
<150 - 180°C	Pumped binary <i>At least one plant of this type planned in Turkey</i>	Remains in liquid phase and reinjected with brine	<ul style="list-style-type: none"> • Upper limit generally constrained by temperature tolerance of submersible pumps (140 to 150°C) • Line shaft pumps can endure higher temperature (200°C) but reach only 250 m depth - can extend the temperature range to 180°C in rare cases • Pumping high T fluid with a line shaft pump can induce boiling below the pump • High gas content complicates pumping – pushes down the maximum temperature for pumped binary 	<ul style="list-style-type: none"> • Capture not needed – gas remains dissolved in brine
160– 220°C	Two phase binary <i>Most common technology in Turkey</i>	Exits heat exchanger at 3 to 7 bar pressure – released to atmosphere unless captured	<ul style="list-style-type: none"> • High gas content facilitates flashing – makes flashed binary feasible at lower temperature • High gas content does not decrease the efficiency of two phase binary as much as is the case for condensing/flash plants 	<ul style="list-style-type: none"> • Relatively high gas exit pressure favorable for gas capture • Proven technologies exist to capture, compress and clean geothermal CO₂ for use in food, industrial process or agricultural applications • Geothermal gas can be reinjected with brine to the reservoir – has not yet been done on a large scale • Capital cost for gas reinjection for a 50 MW power plant (50 ton/hr) is of the order of 5 million USD • Reinjection of 50 ton/hr of gas consumes 4 MW.
>220°C	Condensing/flash <i>Only one plant in Turkey utilizing this technology</i>	Exits condenser at 0.03 to 0.07 bar – released to the atmosphere unless captured	<ul style="list-style-type: none"> • High gas content reduces efficiency making two phase binary more suitable option even at temperature above 220°C 	<ul style="list-style-type: none"> • Relatively low gas exit pressure unfavorable for gas capture • Additional equipment needed to condense steam from ejectors and compress gas • Same possibilities for application and reinjection as for two phase binary

Annex 10: Clean Technology Fund
TURKEY: Geothermal Development Project

Table 10.1. Results Framework

Indicator	Results attributable CTF contingent recovery grant	Total Results expected from Geothermal Development Project	Transformational Scaled-up Phase: Turkey's Target of 1,000 MW geothermal capacity by 2023 ¹⁹
Geothermal capacity confirmed/developed [MWe]	208	424	1,000
Potential for GHG emissions reduced or avoided -Tons per year [tCO _{2eq} /yr]	260,371 ²⁰	650,927	3,389,87
-Tons over lifetime of the project [tCO _{2eq}]	7,811,120	19,527,801	101,696,150
Financing leveraged through CTF funding [\$ million]	\$377 million ²¹ , of which: \$302 million Private \$15 million TSKB \$60 million IBRD	\$844.5 million, of which: \$150 million IBRD \$37.5 million TSKB \$455 million Private	\$4,502 million
CTF leverage ratio [1:X]	1:9	1:21	1:113
Cost effectiveness			
- CTF cost effectiveness [$\$_{CTF}/tCO_2$ avoided over lifetime of the project]	5.1	n/a	n/a
- Total project cost effectiveness [$\$_{Total\ Project}/tCO_2$ avoided over lifetime of the project]	48.3	n/a	n/a
Other co-benefits	<ul style="list-style-type: none"> • Development of local industry • Employment opportunities • Improved energy security • Environmental co-benefits 		

¹⁹ The Government of Turkey has set a target of developing 1,000 MW of geothermal by 2023 (National Renewable Energy Action Plan, 2014).

²⁰ 40% of the projects in Component 2 attributed to CTF-funded Component 1.

²¹ Conservative estimate of financing leveraged which is calculated as \$202 million direct private co-financing from Component 1, and 40% of \$150 million IBRD, \$37.5 million TSKB co-financing, and \$250 million private sector capital from Component 2.

A. Introduction

Country and Sector Context

1. Turkey's economic development over the past decade has resulted in impressive economic achievements. Per-capita income almost tripled in less than a decade, and Turkey is now an upper middle-income country with the world's 17th largest economy. As other emerging markets, Turkey has seen growth moderate since 2012. Given its high structural current account deficit (CAD) and dependence on foreign financing, Turkey is vulnerable to changes in investor sentiment, and hence growth has been volatile. Turkey's macroeconomic prospects have been buoyed in recent months by the fall in oil prices, changing the balance of risks. Oil prices have fallen some 55 percent since the summer, and are expected to remain at that level during 2015. This is likely to lead to substantial improvements in external and internal balances in 2015. It is estimated that GDP growth reached 3.1 percent in 2014 and it is expected to rise marginally to 3.5 percent in 2015. Despite of this more beneficial outlook, risks related to a reversal of investor sentiment remain and capital buffers in the corporate and financial sector have been declining. Moreover, investment has now been subdued for over two years, raising questions over future productivity growth. Over the medium-term, Turkey's growth prospects depend on the recovery of private investment. An increase in investment and innovation as well as in education and skills is needed to boost productivity growth and create enough high-productivity jobs to accommodate Turkey's rapidly rising labor force.

2. Maximizing exploitation of domestic primary energy resources and securing sufficient, reliable and affordable energy to a growing economy in an environmentally sustainable manner has been, and remains, the Turkish government's core energy policy priority. In this context, the government of Turkey has set a target of developing 1,000 MW of geothermal electricity generation capacity by 2023 (National Renewable Energy Action Plan, 2023) and has put in place a supportive legal framework to facilitate geothermal development. A critical milestone was the Geothermal Law of 2007, which set out the rules and principles for effective exploration, development, production and protection of geothermal and natural mineral water resources. The Law also clarified the right of economic use of subterranean resources, the applicable environmental regulation in project development, and the licensing procedures. Finally, the 2010 amendment to the Renewable Energy Law established a feed-in tariff of 10.5 US\$ cents per kWh for geothermal power, for a 10 year period from the commissioning date; with an additional 2.7 US\$ cents per kWh to reward the use of locally produced equipment.

3. Besides the enhanced regulatory framework, the exploration activities conducted by the General Directorate of Mineral Research and Exploration of Turkey (MTA) have been a critical driver behind geothermal development in the country. Established in 1935, MTA has been responsible for the exploration and mapping of geothermal resources in Turkey and has traditionally been the main institution advancing the development of geothermal utilization. However, despite the critical role played by MTA in development of the sector, it no longer has the resource and mandate to undertake extensive geothermal exploration drilling and thus assume the significant resource risk associated to early stage geothermal exploration, including exploration drilling. This has resulted in a significant slowdown in new geothermal exploration activities since most private investors who have acquired exploration licenses have limited technical/geological expertise and financial capacity for taking on such risks and confirm the presence of a source of

geothermal energy and validate its commerciality (i.e. a level of productivity measured as MW of energy per well sufficient to ensure a positive return on investment). The lack of commercial debt and equity financing not only for the exploration, but also for the resource development phase, makes many license holders unable to develop their geothermal prospects.

4. The Government of Turkey is committed to support the private sector to further scale up geothermal development and aims to do so by creating a mechanism to share the resource risk associated to the validation of geothermal resources. This strategy is consistent with international experience, which shows that mechanisms that reduce the resource risk by using public support to help share the risk at these stages are the most cost effective way to ensure significant scaling up of investment in the sector. CTF contingent recovery grant resources would allow the Government of Turkey to pilot the proposed risk sharing mechanism, which it could later decide to recapitalize with its own resources if proven successful. The CTF contribution thus has the potential to be transformational by proving the capability of the Risk Sharing Mechanism not only to boost private investment in the early stages of geothermal development but also to catalyze investment and local industry growth in the overall value chain (prospective ground studies, test and production drilling, power generation, multiple use of geothermal resources, institutional development, and geothermal development knowledge expansion).

CTF Dedicated Private Sector Program

5. The Government of Turkey is requesting US\$ 40 million contingent recovery grant resources from the Utility-Scale Dedicated Private Sector Program (DPSP) approved by the CTF Sub-Committee in October 2013. Turkey was then identified as one of the priority countries for the first tranche of DPSP financing. The proposed project is consistent with the objectives outlined in the DPSP as it aims to support geothermal development with private sector participation by addressing resource risk during well drillings in the early stages of geothermal development.

Project description

6. The proposed project envisages two components. Component 1, Risk Sharing Mechanism for Resource Validation (RSM) (US\$ 39.8 million, CTF), aims to promote private sector development of geothermal energy projects in the early stage exploratory and confirmation drilling stages by sharing the risk of failing to validate a geothermal resource among two parties: the administrator of a Risk Sharing Mechanism (RSM), capitalized by a CTF contingent recovery grant, and the geothermal developer (i.e. the beneficiary). In case a well fails to yield outputs at a pre-agreed level between the RSM and the beneficiary, the RSM will cover a pre-defined percentage of the drilling expenditures incurred by the license holder. This percentage will be 40 percent for projects located in the Aegean region and 60 percent in those located elsewhere in the country, where the resource risk is higher given that limited or no previous exploration activities have been carried out by MTA. It is expected that the RSM will be able to support about 20 resource validation projects. The General Directorate of Renewable Energy (GDRE) and the General Directorate of External Relations and EU Affairs (GDEU) of the Ministry of Energy and Natural Resources (MENR) will be the implementing agencies for the RSM. This component will

also finance technical assistance activities in order to address relevant capacity building needs within the Ministry.

7. The second component, a Loan Facility for Resource Development (US\$ 187.5 million total; US\$ 150 million IBRD loan, US\$ 37.5 million TSKB co-financing), aims to address the financing gap that license holders face today in the resource development stages of geothermal project development by providing debt financing to encourage and support both license holders and financiers investing in (i) the capacity/production drilling stage and (ii) the steam gathering and power plant construction stage. This component will capitalize a credit line to the Industrial Development Bank of Turkey (TSKB), who will on-lend at market rates, but offer longer tenors than currently available in the market, to geothermal developers at the capacity drilling stage (an estimated 40 percent of available resources in the Facility), and to a secondary extent, at the construction stage (an estimated 60 percent of resources). Once the capacity drilling stage is completed, the borrower (i.e. the project sponsor) will be required to publicly disclose basic information about the potential project including sponsor, location, expected capacity and basic investment outline in order to expand the financing opportunities and to avoid market distortion through limits on access to information.

8. The Loan Facility will be open to any geothermal development that has reached the capacity drilling stage, regardless of whether it benefited or not from the Risk Sharing Mechanism under Component 1.

B. Assessment of Proposed Project with CTF Investment Criteria

Potential for GHG emissions savings

9. The project will result in a net reduction of CO₂ emissions through substitution of power generation supplied by the existing generation sources connected to the grid and likely future additions to the grid. Taking into account the uncertainty regarding the nature of GHG emissions from geothermal power plants, the proposed Project will take a conservative approach in estimating CO₂ emissions reductions to be achieved within the project implementation period of 5 years. Assessment of potential power generation and direct applications of the Project, including Components 1 and 2, yield an emissions savings of 650,927 tons of CO₂ per year and a total of 19.5 million tons of CO₂ emissions reductions over 30 years lifetime. Based on the conservative assumption that 40% of all projects financed under Component 2 (Loan Facility) will utilize geothermal resources confirmed under the CTF-funded Component 1 (RSM), the CO₂ emission savings attributed to the CTF are 260,371 tons of CO₂ per year and 7,8 million tons of CO₂ over 30 years lifetime.

10. **Assumptions.** The CO₂ emissions reduction potential was calculated by subtracting projected lifetime emissions from the Project (project scenario) from the projected lifetime emissions in the business-as-usual scenario (baseline). In the Project scenario, CO₂ emissions were estimated using an average emission factor from geothermal energy facilities in Turkey (power

and direct use) estimated as 206 gCO₂/kWh²². In the Baseline scenario, CO₂ emissions were estimated based on the combined margin grid emission factor of 583 gCO₂/kWh taken from voluntary C market Gold Standard Projects Turkey portfolio.²³ The output power MWe was assumed as 30% of the thermal output in geothermal applications, while the load factor for electricity generation facilities was assumed as 90% and direct applications 45%.

Cost-effectiveness

11. CTF cost-effectiveness ratio is 5.1, calculated as the ratio of US\$_{CTF}/tCO_{2eq} avoided over lifetime of the project. Total project cost effectiveness (total CTF project cost per ton CO_{2eq} reduced/avoided) is estimated as 48.3 US\$ total/tCO₂. This estimation remains a conservative estimate as it assumes that not all the projects financed under component 2 have been previously supported by the RSM in component 1. Thus the marginal abatement cost will be well below 200 US\$/tCO₂.

12. **Marginal abatement cost.** In October 2013, the CTF Trust Fund Committee suggested providing information on the estimated marginal abatement cost (MAC) for projects for which the marginal abatement cost is likely to exceed US\$100 per ton of CO₂. This decision draws from the CTF criteria which specifies that CTF co-financing will not be available for investments in which the marginal cost of reducing a ton of CO₂ exceeds US\$200, which reflects the lower-end estimate of the incentive needed to achieve the objectives of the BLUE Map Scenario as indicated in the *International Energy Agency's Energy Technology Perspectives 2008 Report*.

13. Preliminary calculations confirm that the MAC for the project will not exceed the aforementioned US\$200 threshold value per ton of CO₂. In fact, the MAC for the project should be lower than 48.3 US\$ per ton of CO₂. This is an overestimation of the MAC, as several economic benefits were not included to estimate Net Present Value (NPV). These include indirect benefits from induced investment in spas, greenhouses, and other secondary uses of geothermal heat, and new temporary and permanent jobs created in the communities where geothermal resources are developed.

$$MAC = \frac{NPV}{LCO_2}, \text{ where NPV stands for Net Present Value and LCO}_2 \text{ stands for Lifetime CO}_2 \text{ emissions savings.}$$

Demonstration Potential at Scale

14. Scope for avoided annual GHG emissions through replication: Potential emissions savings that would result if the CTF co-financed project were to be replicated in Turkey in a wider scope (under 2000 MWe + 5000 MWt scenario based on the available potential) is estimated at the scale of 21 million tons of CO₂ per year, i.e. 18% of 2012 electricity and heat production related CO₂ emissions of the country. The proposed project will additionally contribute to a reduction in other

²² Mertoglu & al. 2015, "Geothermal Country Update Report of Turkey (2010-2015)", *Proceedings World Geothermal Congress 2015*, Melbourne, Australia, 19-25 April 2015.

²³ 2014 Turkey baseline - Gold Standard Turkey Regional Office (2013-2011, 75% of OM (639) + 25% of BM (413))

emissions than GHG emissions related to conventional electricity generation, like emissions of sulphur dioxide, nitrogen oxides and particulates.

15. **Transformation potential:** The proposed Risk Sharing Mechanism is a pilot that, if successful, could be expanded with additional resources from the Government or other sources for ongoing support to the riskier phases of geothermal project development in Turkey, which would enable a further scale-up of the sector by continued risk sharing in the early phases of geothermal development. In addition, lessons learnt from the institutional and operational set up would inform any necessary design and implementation changes in Turkey as well as the design of similar risk sharing schemes in other countries. The proposed RSM will cover 40 to 60% of the cost of exploration wells in case of resource related failure. This will greatly reduce the risk for project sponsors and help them raise funds for costly exploration drilling projects to realize the geothermal potential. Higher coverage provided for projects outside the Aegean region is intended to stimulate investments in geothermal exploration in the less explored parts of the country and supporting the developers who are willing to take higher risks. Thus proposed project can stimulate long term changes in the geothermal market through facilitating new players in geothermal market through targeting project developers with less capital resources available.

16. In addition, the proposed project has the potential to contribute to the reduction of costs through expansion of the geothermal industry operating in Turkey, including local service providers at all the stages of project development. It will also contribute to capacity building and to the improvement of industry practices, including technical, contractual, environmental and social, required both by the RSM and the Loan Facility. These enhanced practices can become the industry standard in Turkey if a significant project pipeline is realized through the proposed operation.

Development Impact

17. **Improved energy security.** Geothermal sector development in Turkey will reduce dependence on energy imports by contributing to local energy production in line with the GoT's policies and targets. Geothermal energy provides both base-load and flexible power with high capacity factor and will help Turkey achieve its renewable energy targets.

18. **Environmental co-benefits.** Geothermal energy is widely accepted as one of the cleanest and most environmentally form of energy with small land footprint and low air emissions. The absence of a fuel cycle as compared to other sources of energy production in Turkey will also result in reduced impact on the environment.

19. **Development of local industry.** The project will catalyze the growth of local providers in the entire value chain of geothermal projects, which also has the potential to trigger cost reductions for specific services (e.g., surface exploration) or drilling (e.g., if additional rigs are assigned to geothermal drilling).

20. **Employment opportunities.** The project will increase drilling activity, contributing to the direct creation of jobs as part of the drilling crews and associated services. In addition, jobs in construction and maintenance of power plants and other geothermal facilities will be created, both

directly investments under the Loan Facility and indirectly through the full development of projects for which resources are confirmed with support from the RSM or developed through capacity drilling financed by the Loan Facility. For reference, the Geothermal Energy Association (GEA) estimated that approximately 860 different people with a wide range of skills are employed over the development cycle in a typical 50MW geothermal project. Approximately 2 people per MW are involved during the drilling phase.²⁴

Implementation Potential

21. **Public sector support to geothermal development.** Maximizing exploitation of domestic primary energy resources and securing sufficient, reliable and affordable energy to a growing economy in an environmentally sustainable manner has been, and remains, the Turkish government's core energy policy priority. The Electricity Sector Security of Supply Strategy (2009) identified a target of increasing the share of electricity generated by renewable energy to 30% of the total 100 GW installed power generation expected by 2023 (including wind, hydro, solar and geothermal). A major milestone was the 2005 Renewable Energy Law, which established purchase guarantee and Feed-in-Tariff mechanism for electricity produced from renewable energy sources.

22. In this context, the government of Turkey has set a target of developing 700 MW of geothermal electricity generation capacity by 2019 and has put in place a supportive legal framework, which the proposed project will benefit from, to facilitate geothermal development. A critical milestone was the Geothermal Law of 2007, which set out the rules and principles for effective exploration, development, production and protection of geothermal and natural mineral water resources. The Law also clarified the right of economic use of subterranean resources, which rests with the provincial authorities, and the applicable environmental regulation in project development, including proper reclamation after use. The licensing procedures were also clarified under the law: four-year exploration licenses can then be followed by thirty year exploitation licenses which are issued to developers – public and private alike – by provincial authorities where the geothermal sites are located. In addition, for the production of electricity, thirty year energy generation licenses (power) are issued by the Energy Market Regulatory Authority (EMRA). Finally, the 2010 amendment to the Renewable Energy Law established a feed-in tariff of 10.5 US\$ cents per kWh for geothermal power, for a 10 year period from the commissioning date; with an additional 2.7 US\$ cents per kWh to reward the use of locally produced equipment.

23. The government also facilitated access to renewable energy financing provided by International Financial Institutions (IFIs) such as World Bank Group and EBRD, as well as Bilateral Institutions (such as AFD and KfW). In addition, some geothermal projects in Turkey benefit from voluntary carbon markets which provide additional financing during operation.

24. **Leveraging of co-financing.** Private sector leverage was calculated using a conservative approach assuming that not all the projects financed under component 2, but 40% of them would have been previously supported by the RSM in component 1. Average investment costs for power investments were taken from the financial model and includes cost of concession. Investment costs

²⁴ Geothermal Energy Association (GEA), "Green Jobs Through Geothermal Energy", October 2010.

for direct use was taken from International Energy Agency data. Financing leverage through US\$40 million CTF funding is estimated at US\$377 million, providing a leverage ratio of 9:1 for the case using above assumptions about Component 2.

C. CTF Additionality

25. Additionality is to correct a market failure specific to the geothermal sector which, left to itself, would result in a considerable slowdown of the geothermal sector market. Additionality will arise from mobilizing sufficient concessional and climate finance to pave the way for a market expansion, allowing for future complementary commercial and multilateral lending, as well as sponsor equity.

26. Geothermal-based electricity production development has a very unique risk profile. Exploration and development of the geothermal resource itself is high risk and requires a long phase of technically complex and capital intensive investment before constructing the power plant. This is a major barrier to scaling-up geothermal-based electricity generation, not only in Turkey but worldwide, which is exacerbated by the fact that no commercial equity financing or other long-term financing is available for geothermal exploration and resource development phases. Public investments have proven an absolute pre-requisite to mitigate the geothermal risk. Multiple support mechanisms have been experimented with across the world, but, measured in terms of installed geothermal power generation capacity, there is no doubt that cost-sharing mechanisms have proved to be more cost-effective than other forms of support. In all countries where geothermal energy has seen an expansion, periods of rapid growth in installed capacity have systematically been preceded and accompanied by government support, either through cost-sharing drilling schemes or through the government acting as a developer.

27. Turkey is no exception to this, with MTA having played a crucial role in the development of the sector through its prior mandate to undertake extensive surface exploration and exploration drilling. However, Since MTA has very limited additional geothermal exploration activities planned, with its strategic focus now concentrated in the exploration of the country's mineral resources, of the entire exploration risks in licensed areas that have received little or no previous investments by MTA are now to be taken on fully by the private investors who acquire exploration licenses. However, except for a few of them, many of the exploration license holders have limited technical/geological expertise and financial capacity for taking on such risks. License holders are expected to take on significant capital expenditures and exploration risks that cannot be commercially mitigated.

28. CTF contingent recovery grant resources will allow the Government of Turkey to pilot an innovative Risk Sharing Mechanism under which the risk of exploration and confirmation drilling will not be fully taken on by the public or private sector (i.e. the developers/license holders), but instead shared between both parties, thus reducing the pressure on the developers' equity. Unlike insurance products, no high up-front premiums will be required; RSM Beneficiaries will only pay a "success fee" when drilling of a specific well is successful, while the RSM will cover a pre-defined percentage of drilling costs when drilling is unsuccessful. Piloting of such a Mechanism depends on the availability of grant resources that can be put at risk.

29. Triggering environmental and social safeguards will be key element of the proposed RSM component, thus will create additional awareness as well as good practice in the country. The fact that RSM beneficiaries will need to provide a Carbon Management Plan in the event that high CO₂ is encountered during exploratory drilling also will create awareness and additional action in the projects compared to business as usual practice.

D. Implementation Readiness

30. The General Directorate of Renewable Energy (GDRE) in MENR, the responsible implementing agency for the RSM, the CTF-financed component, will establish a Project Implementation Unit (PIU) staffed with a project coordinator, seven geothermal experts, a procurement specialist, a financial management specialist, and an environmental and social specialist. The General Directorate of External Relations and EU Affairs (GDEU) in MENR will assume the fiduciary responsibilities for the RSM component. In the first months of project implementation, GDRE hire a consultant (“RSM consultant”) to provide support to the PIU in implementing and managing the RSM. The RSM consultant will carry its work on behalf of MENR and under the supervision of the PIU. The consultant will be required to provide specialized financial and geothermal expertise to the RSM, specifically regarding the assessment of the corporate, financial and technical eligibility of applicants, as well as the interpretation of surface exploration data and conceptual models presented, proposed drilling and testing plans and protocols, assessments of development and business plans, and monitoring and reporting of all activities undertaken by the selected beneficiaries. The draft Operation Manual for Component 1, which details functioning of the RSM as well as the responsibilities of GDRE, GDEU, an RSM Technical Committee, and the RSM consultant, has also been finalized.

31. It is expected that the first round of applications to the RSM will be launched about 9 months after project effectiveness. The pre-application and application process is then expected to take about 6 months, which would be concluded with the signature of RSM legal agreements with Beneficiaries. Implementation of the individual sub-projects (i.e. exploration/confirmation drilling and well testing), including submission and revision of claims, would be completed in about 18 months.

32. TSKB will be the Financial Intermediary that will implement of Component 2, with potential participation by TKB. TSKB is a financial intermediary with adequate experience and capacity to implement and take on the risk associated with the capacity drilling activities to be supported by the project. This is based on TSKB’s technical strength, track record in renewable energy development and significant experience in implementing national and World Bank policies in environmental and social safeguards. TSKB will rely, on a needs basis, on consultants for technical assessment, due diligence and monitoring of investments in order to ensure effective assessment of the technical risk of loan applications during project implementation.

33. The Turkish geothermal sector has expanded and matured rapidly over the last five years and the conditions are favorable for further acceleration of geothermal development. There are eight local geothermal developers that are currently operating power plants in the country. Many of the developers of the existing plants and five new developers are at an advanced stage of development of new projects (capacity drilling or power plant construction). There are seventeen

local drilling companies that together have a total of 30 rigs suitable for geothermal drilling in the country. Success rate of geothermal drilling in Turkey has been above world average and drilling cost is very low compared to the rest of the world (3 to 3.5 MUS\$ for a full size production well of 2500 m). There is a number of local geoscientific consultants working in the sector and many of the larger developers also use experienced international consultants. The Turkish geothermal sector is, thus, ready to expand geothermal exploration work with support from the RSM (Component 1) and capacity drilling and power plant construction with financing provided through Component 2.

TURKEY: Geothermal Development Project



TURKEY: Geothermal Development Project, Geological Fault Lines



Source: General Directorate of Mining Research and Exploration