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Report No: PAD1325

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON

PROPOSED LOANS
IN THE AMOUNT OF US$250 MILLION

TO

TÜRKIYE SINAI KALKINMA BANKASI A.Ş. (US$150 MILLION)
TÜRKIYE KALKINMA BANKASI A.Ş. (US$100 MILLION)

WITH THE GUARANTEE OF THE REPUBLIC OF TURKEY

AND A

PROPOSED GRANT FROM THE
CLEAN TECHNOLOGY FUND
IN THE AMOUNT OF US$39.8 MILLION

FOR THE

TURKEY GEOTHERMAL DEVELOPMENT PROJECT

OCTOBER 13, 2016

Energy and Extractives Global Practice
Turkey Country Management Unit
Europe and Central Asia Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective November 25, 2015)
Currency Unit = Turkish Lira (TL)
TL 2.9 = US$1

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AFD	*Agence Française de Développement* (French Development Agency)
AUC	African Union Commission
BRSA	Banking Regulation and Supervision Agency
CTF	Clean Technology Fund
DA	Designated Account
DPSP	Dedicated Private Sector Program
EBRD	European Bank for Reconstruction and Development
EFIL	Export Finance Intermediary Loan
EIRR	Economic Internal Rate of Return
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EMRA	Energy Market Regulatory Authority
ESMAP	Energy Sector Management Assistance Program
ESMF	Environmental and Social Management Framework
FCFE	Free Cash Flow to Equity
FI	Financial Intermediary
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GGDP	Global Geothermal Development Plan
GoT	Government of Turkey
GRS	Grievance Redress Service
IFC	International Finance Corporation
IFI	International Financial Institution
IUFR	Interim Unaudited Financial Report
IRR	Internal Rate of Return
KfW	*Kreditanstalt fuer Wiederaufbau* (German Development Bank)
M&E	Monitoring and Evaluation
MAC	Marginal Abatement Cost
MENR	Ministry of Energy and Natural Resources
MTA	General Directorate of Mineral Research and Exploration of Turkey
NPV	Net Present Value
OM	Operations Manual
PDO	Project Development Objective
PIU	Project Implementation Unit

PSREEE	Private Sector Renewable Energy and Energy Efficiency Project
QCBS	Quality and Cost Based Selection
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
RSM	Risk Sharing Mechanism
SA	Special Account
SOE	Statement of Expenditures
TA	Technical Assistance
TKB	*Türkiye Kalkinma Bankasi A.Ş* (Development Bank of Turkey)
TSKB	*Türkiye Sinai Kalkinma Bankasi A.Ş* (Industrial Development Bank of Turkey)
UNFCCC	United Nations Framework Convention on Climate Change

Regional Vice President:	Cyril Muller
Country Director:	Johannes C.M. Zutt
Acting Senior Global Practice Director:	Anna Bjerde
Practice Manager:	Ranjit Lamech
Task Team Leaders:	Shinya Nishimura and Pierre Audinet

REPUBLIC OF TURKEY
Geothermal Development Project

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PAD DATA SHEET

Republic of Turkey

Turkey Geothermal Development Project (P151739)

PROJECT APPRAISAL DOCUMENT

EUROPE AND CENTRAL ASIA REGION

ENERGY AND EXTRACTIVES GLOBAL PRACTICE

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 01-Nov-2016	Project Implementation End Date 31-Dec-2022		
Expected Effectiveness Date 1-Mar-2017	Expected Closing Date 31-Dec-2022		
Joint IFC No			
Practice Manager/Manager Ranjit J. Lamech	Senior Global Practice Director Anna M. Bjerde	Country Director Johannes C.M. Zutt	Regional Vice President Cyril E Muller
Borrowers: Turkiye Sinai Kalkinma Bankasi A.S. (TSKB), Turkiye Kalkinma Bankasi A.S. (TKB)			
Responsible Agency: Turkiye Sinai Kalkinma Bankasi A.S. (TSKB)			
Responsible Agency: Turkiye Kalkinma Bankasi A.S. (TKB)			

Project Financing Data(in USD Million)							
[X]	Loan	[ ]	IDA Grant	[ ]	Guarantee		
[ ]	Credit	[X]	Grant	[ ]	Other		
Total Project Cost:		352.30		Total Bank Financing:		250.00	
Financing Gap:		0.00					

Financing Source	Amount
Borrowers	62.50
International Bank for Reconstruction and Development	250.00
Clean Technology Fund	39.80
Total	352.30

Expected Disbursements (in USD Million)							
Fiscal Year	2017	2018	2019	2020	2021	2022	2023
Annual	0.2	21.0	28.0	50.0	87.6	69.0	34.0
Cumulative	0.2	21.2	49.2	99.2	186.8	255.8	289.8

Institutional Data

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

None

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	39.80
Loan Facility for Resource Development	312.50

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	High
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Moderate
OVERALL	Substantial

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ] No [X]
Does the project require any waivers of Bank policies?	Yes [ ] No [X]
Have these been approved by Bank management?	Yes [ ] No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ] No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X] No [ ]

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**
Loan and Grant Agreements: Schedule 2, Section II Paragraph B.3.	x		Continuous

Description of Covenant

TKB and TSKB shall have their entity financial statements and Project financial statements audited in accordance with the provisions of Section 5.09 (b) of the General Conditions. Each audit of the Financial Statements shall cover the period of one calendar year of the borrowers. The audited financial statements for each such period shall be furnished to the bank not later than six months after the end of such period.

Name	**Recurrent**	**Due Date**	**Frequency**

Loan and Grant Agreements: Schedule 2, Section II Paragraph B.2.	x		Continuous

Description of Covenant

TKB and TSKB shall prepare and furnish to the Bank, not later than forty-five (45) days after the end of each calendar semester, interim unaudited financial reports for the Project covering the semester, in form and substance satisfactory to the Bank.

Name	Recurrent	Due Date	Frequency
Loan and Grant Agreements: Schedule 2, Section II Paragraph B.1.	x		Continuous

Description of Covenant

TKB and TSKB shall maintain financial management systems in accordance with the provisions of Section 5.09 of the General Conditions.

Name	Recurrent	Due Date	Frequency
Loan Agreements: Schedule 2, Section I Paragraph A.1.; Grant Agreement: Schedule 2, Section I, Paragraph A.2.	x		Continuous

Description of Covenant

At all times during project implementation TSKB and TKB shall operate and maintain Project Implementing Units with functions and responsibilities, qualified staff in sufficient numbers, adequate funds, facilities, services and other resources for the project implementation, all satisfactory to the World Bank.

Name	Recurrent	Due Date	Frequency
Loan Agreements: Schedule 2, Section I Paragraph A.2.; Grant Agreement: Schedule 2, Section I, Paragraph A.1.	x		Continuous

Description of Covenant

TKB and TSKB shall carry out the Project in accordance with the relevant provisions of the Project Operations Manuals and shall not assign, amend, abrogate, terminate, waive, or fail to enforce any provisions of the POM without obtaining the prior approval of the Bank.

Conditions

Source Of Fund	Name	Type
CTF	Effectiveness condition	Effectiveness

Description of Condition

The execution and delivery of the Grant Agreement on behalf of the Recipient has been duly authorized or ratified by all necessary corporate action.

Source Of Fund	Name	Type
CTF	Effectiveness condition	Effectiveness

Description of Condition

The Recipient has established a Project Implementation Unit for purposes of implementing Part A of the Project, with staffing, terms of reference, and resources satisfactory to the World Bank.

Source Of Fund	Name	Type
CTF	Effectiveness condition	Effectiveness

Description of Condition

The Recipient has approved the Project Operations Manual, acceptable to the World Bank.

Source Of Fund	Name	Type
CTF	Effectiveness condition	Effectiveness

Description of Condition

The TKB Loan Agreement or the TSKB Loan Agreement has been executed and all conditions precedent to its effectiveness have been fulfilled.

Source Of Fund	Name	Type
IBRD	Effectiveness condition	Effectiveness

Description of Condition

The Borrowers have approved the Project Operations Manuals, acceptable to the Bank.

Team Composition

Bank Staff

Name	Role	Title	
Shinya Nishimura	Team Leader	Sr Financial Analyst	
Pierre Audinet	Team Leader	Senior Energy Economist	
Salih Kemal Kalyoncu	Procurement Specialist (ADM Responsible)	Senior Procurement Specialist	
Ayse Seda Aroymak	Financial Management Specialist	Sr Financial Management Specialist	
Adam Shayne	Counsel	Chief Counsel	
Almudena Mateos Merino	Team Member	Energy Specialist	
Arzu Uraz	Safeguards Specialist	Social Development Specialist	
Ayse Yasemin Orucu	Team Member	Energy Specialist	
Esra Arikan	Safeguards Specialist	Senior Environmental Specialist	
Jasna Mestnik	Team Member	Finance Officer	
Patricia Vargas Santos Correa	Team Member	Consultant	
Rozena Serrano	Team Member	Program Assistant	
Selcuk Ruscuklu	Team Member	Program Assistant	
Thrainn Fridriksson	Team Member	Energy Specialist	
Ben Mescher	Power Engineer (Consultant)		

Locations
Country
Turkey
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 performance since 2000 has been impressive, both before and after the 2008–09 global financial crisis. Macroeconomic and fiscal stability were at the heart of its economic performance, enabling increased employment and labor incomes, making Turkey an upper-middle-income country as well as the world's 17th largest economy. Poverty incidence more than halved during the 2002–12 period, from 44 percent to 21 percent of the population, and this decrease was shared across both urban and rural areas. Extreme poverty fell even faster, from 13 percent to 4.5 percent. During this time, Turkey witnessed dramatic urbanization, opened up to foreign trade and finance, harmonized many of its laws and regulations with European Union standards, and greatly expanded access to public services. It also recovered well from the global crisis of 2008–09, with high economic growth during the 2010–12 period.

2. Developments since 2012 raise concerns about Turkey's capacity to sustain progress toward the twin goals of poverty reduction and shared prosperity. Economic growth has slowed, per capita income has stagnated around US$10,000 per year, and unemployment is inching upward. Moreover, Turkey's macroeconomic achievements have recently been challenged by an uncertain economic and political outlook. Slow growth in Europe and a deteriorating geopolitical environment in parts of Eastern Europe, Central Asia, and the Middle East have negatively affected exports, investment, and growth in Turkey. The influx of almost 3 million Syrian refugees in 2015–16 has also created new social, economic, and political demands, particularly in urban centers where the majority of refugees are living (less than 10 percent of them live in camps).

3. Domestic political developments in 2015 and 2016 presented further challenges. Political events, including national elections in June and November 2015, a change in prime minister, and a cabinet reshuffle in May 2016, an attempted coup in July 2016, as well as changes of public officials following the coup attempt have all affected the Government's reform momentum. Security concerns contributed to a decline of the foreign direct investment inflow, and the Government is considering reforms to improve the investment and business climate in Turkey to counter the effect. Private investments were delayed, leading to slower economic growth. The Government will need to take strong reform measures to address continuing structural vulnerabilities, revitalize private investment, boost growth, and resume Turkey's convergence with Europe. Most notably, new reform momentum is needed to improve the quality of education and to upgrade skills. Only by boosting productivity growth and creating enough high-productivity jobs to accommodate a rapidly growing labor force will Turkey be able to continue to reduce poverty and share prosperity. The Government continues to take action on the reform agenda, including to promote investments and research and development, improve social security and the pension system, establish a national welfare fund as well as housing account schemes, and reform the labor market.

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 core energy policy priority of the Government of Turkey (GoT). 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 percent 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 mechanisms for electricity produced from renewable energy sources. The Government also facilitated access to renewable energy financing provided by international financial institutions (IFIs) such as the World Bank Group and the European Bank for Reconstruction and Development (EBRD), and bilateral institutions (such as the French Development Agency, AFD and the German Development Bank, KfW).

5. In this context, the 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: 4-year exploration licenses are issued to developers—public and private alike—by provincial authorities where the geothermal sites are located, which can then be followed by 30-year exploitation licenses. In addition, for the production of electricity, 30-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 US$0.105 per kWh for geothermal power, for a 10-year period from the commissioning date, with an additional US$0.027 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, the 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. The MTA prioritized 25 sites, out of 190 geothermal sites discovered, which were deemed suitable for electricity production. Those 25 sites were subsequently explored, mostly by the MTA performing additional surface exploration and drilling exploratory wells, and then developed by private sponsors. As of June 2016, geothermal generation capacity in the country had reached a total of 695 MWe. All the MTA-prioritized sites and current geothermal energy producing installations are located in the provinces of Aydin, Denizli (Menderes Graben[1]), and Manisa (Gediz Graben). Most had been explored to different degrees by the MTA, which had mitigated the associated resource risk. Thermal applications (that is, greenhouses, drying and cooling, district heating, and spas), with a total of 2,880 MWt installed as of June 2016, are not concentrated in any particular geographic area.

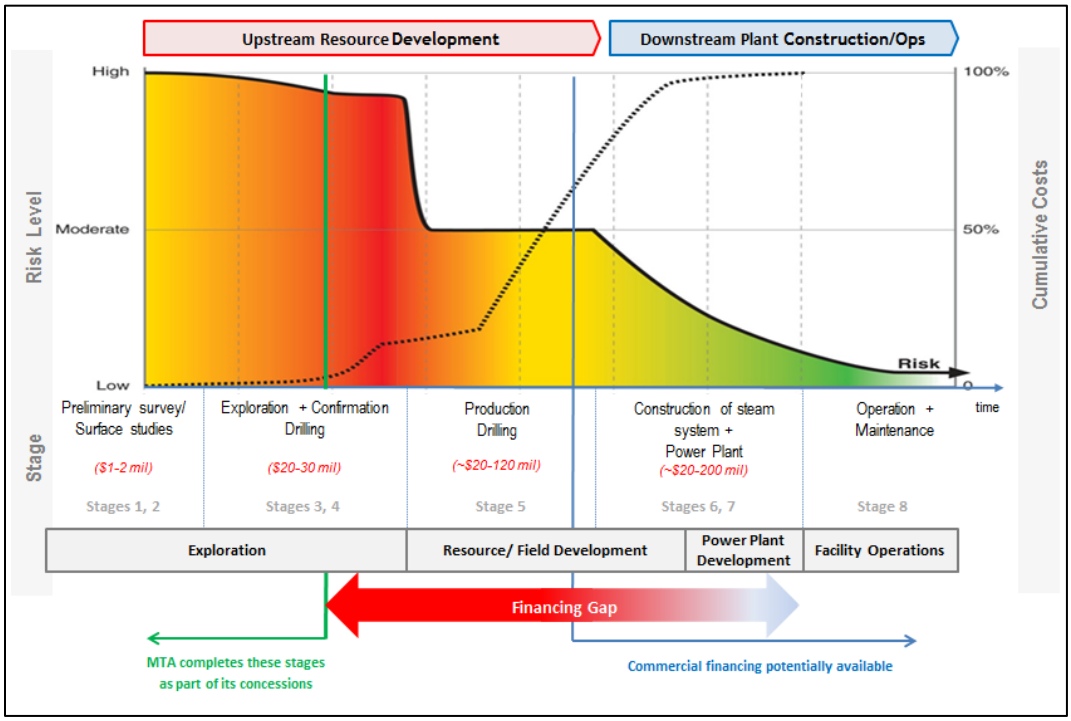
[1] A graben is a geological landscape feature where a block of rock has dropped down relative to its surroundings due to extension of the crust. Grabens are elongated depressions, bounded by two approximately parallel faults on each side. Large grabens appear in nature as kilometers long, flat valleys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

7. Despite the critical role played by the MTA in development of the sector, it no longer has the resources and mandate to undertake extensive geothermal exploration drilling, which leads to a significant slowdown in exploration activities. This is particularly true for exploration in the central or eastern provinces, which remain largely unexplored and where geothermal surface manifestation exists and a significant share of the geothermal market expansion is expected. While 72 percent of the 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**. Because the 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 the 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, and no commercial financing is 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 (that is, a level of productivity measured as megawatt of energy per well sufficient to ensure a positive return on investment).

(b) **Lack of commercial debt financing**. Due to the abovementioned risk profile, no commercial debt or equity is available to finance the exploratory or resource development phases (see Box 1), and, worldwide, developers rely on their own equity. The same is true for the geothermal market in Turkey, where commercial financing is often available only after power plant construction and onward, except in the rare instances when retroactive finance of some of the capacity drilling expenditures has been provided. For instance, it is not uncommon for project developers to finance 40–50 percent of total capital expenditures 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.

Figure 1. Risk and Bankability Profile of a Geothermal Power Project



Source: Modified from the Energy Sector Management Assistance Program (ESMAP), 2012, *Geothermal Handbook*, Technical Report 002/12, Washington.

Box 1. Phases of Geothermal Development

The development of a geothermal power project is commonly broken down into the following four phases:

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 that 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 consists of the final design, procurement, and construction of the power plant that uses the geothermal energy identified in phase II and also includes steam gathering systems, power house, and 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.

8. During preparation of the project, it became clear that some geothermal power plants can have relatively high CO_2 emission factors, specifically in Menderes and Gediz Grabens. Assessments based on nine active geothermal plants in the Aegean region show emissions

ranging from 400 g/kWh to 1,300 g/kWh, with a weighted average of 1,050 g/kWh.[2] These values are about an order of magnitude higher than the global average emission factor for geothermal power plants, 122 g/kWh[3] (see Box 2). This is a result of the unique and unusual geological setting of Turkey's Aegean region geothermal systems, where high temperatures are present in carbonate rock-dominated geology. In all likelihood, based on available data, this problem will not arise to a similar extent outside of those two grabens. Because geothermal is largely considered a non-CO_2-emitting renewable energy source, there are currently no regulations in Turkey that constrain CO_2 emissions from geothermal power plants, and developers are not required to monitor or report their gas emissions either. However, facilities to capture geothermal CO_2 are already installed at three power plants in the Menderes Graben, with the gas being sold to the food and beverage industries.

Box 2. CO_2 Emissions from Geothermal Power Plants

CO_2 is naturally present in all geothermal fluids at various concentrations, and geothermal power production can lead to release of some of the geothermal gases to the atmosphere. The best available global estimate for an average emission factor from geothermal power production is 122 g/kWh or about a quarter of the emissions from gas-fired power plants. As a result of the relatively low CO_2 emission factors from geothermal power production, this issue has so far received limited attention in the scientific community. However, awareness is increasing as efforts are undertaken to curb CO_2 emissions globally. The emission factors for geothermal power plants currently installed in Turkey, all in the Menderes and Gediz Graben area of the Aegean region, are among the highest in the world, and clearly outliers. High values have also been reported from a small number of other geothermal power fields: for example, Monte Amiata (5 of the 33 geothermal power plants active in Italy), Ngawha (1 of the 14 geothermal power plants active in New Zealand), and Coso (California; 1 of the 19 geothermal power plants larger than 50 MW in the United States).

There is also uncertainty with regard to trends in emissions over a plant's lifetime. Volumes, pressure, and composition of gases present in geothermal fluids and remaining un-condensed after energy extraction fluids are monitored as part of normal geothermal plant operations. During the operation of geothermal power plants, a gradual decline in incondensable gas concentration in the reservoir fluid, and thus gradually decreasing gas emissions can happen. This is to a large degree a result of reinjection of gas free of geothermal brine into the peripheries of the reservoir. However, gradual gas decrease has not been systematically documented in many places (in part because power plants do not have to publicly report on such numbers). Information is only available from the Long Valley power plant in California where gas content of the fluid decreased by 39 percent over 4 years, from Ngawha, New Zealand, where the decrease was of the order of 16 percent to 30 percent in 6 years, and the Kizildere plant in Turkey, where the decrease amounted to 15 percent in 16 years. The magnitude of the decrease depends on a number of site-specific and operational factors and is difficult to predict before power production and reinjections begin.

Production from geothermal reservoirs may also affect natural CO_2 emissions through the surface. CO_2 is continuously emitted naturally from geothermal reservoirs, that is, without any drilling or power production taking place. This natural surface CO_2 emission takes place mostly diffusely through soil and to some degree through steam vents. Well-documented examples exist from geothermal fields in Iceland, New Zealand, the United States, Italy, Greece, and the Azores, to name a few. The effects of production on CO_2 emissions through the surface have not been systematically studied. It has been argued, based on observations from geothermal fields in Italy, that power production decreases natural surface CO_2 emissions and that this reduction in natural emissions should thus be subtracted from the gross emissions from the power plant to compute the net emissions resulting from geothermal power production. Unfortunately, data to support these claims have not been published. The Reykjanes field in Iceland is the only place in the world where natural surface CO_2 emissions have been measured before and after the commencement of power production. In this case, natural emissions increased in response to power production,

[2] Aksoy N. 2014. "Power generation from geothermal resources in Turkey", *Renewable Energy*, vol. 68.
[3] Bertani R. and I. Thain. 2002. "Geothermal power generating plants, CO2 emissions survey", *IGA News*, 49.

contrary to what has been argued for the Italian systems. These results are not necessarily incompatible as they may be explained by different characteristics of different geothermal systems. Systematic baseline studies of natural surface CO_2 emissions in a number of geothermal fields before they are taken into production, with annual follow-up measurements, are required to gain a better understanding of these effects.

The national regulatory frameworks for carbon emissions from geothermal power production vary in different countries, reflecting both the limited understanding of the effects of power production on natural surface emissions, the minuscule size of the geothermal sector, and its potential greenhouse gas (GHG) emissions relative to other emitting power producing technologies. In Italy, CO_2 emissions from geothermal power are not considered anthropogenic, in accord with the understanding that emissions from power plants are counterbalanced by reduction in surface emissions as described earlier. As a result, geothermal projects are eligible for green certificates as other renewable power projects. However, CO_2 emissions from Italian power plants are monitored and reported at a regional level. In New Zealand, on the other hand, emissions from geothermal power plants are considered anthropogenic since 2009 and geothermal power producers that emit more than 4,000 tCO_2 per annum are now required by the Climate Change Response Act of 2002 (as updated 2009) to monitor and report their emissions. Producers thus pay a carbon emission tax according to their emission factors. In other countries, such as Iceland, geothermal emissions are considered anthropogenic and reported as such to the United Nations Framework Convention on Climate Change (UNFCCC), but no emission restrictions are currently imposed on the power producers as the emissions are considered negligible.

Specific project activities, discussed in section III (paragraphs 20 and 21), are designed to elucidate uncertainties regarding if and how CO_2 emissions from geothermal power plants will decrease with time and how natural emissions through the surface will change in response to power production. The data gathered through these activities can inform discussions on a regulatory framework for CO_2 emissions from geothermal plants in Turkey and elsewhere.

C. Higher Level Objectives to which the Project Contributes

9. The project is consistent with the Country Partnership Strategy for the FY12–FY16 period, approved by the World Bank's Executive Board on February 21, 2013. The Country Partnership Strategy 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 use of domestic energy sources including renewable energy is one of the pillars of the government policy as well, as reflected in the Ministry of Energy and Natural Resources (MENR) 2015–19 Strategic Plan. The project will also provide developers with access to longer-term credit than is usually available to them, facilitating the development of the geothermal market.

10. Increase in renewable energy capacity in Turkey has also been identified in Turkey's first national communication to the 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.

11. 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 IFIs 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

12. The project development objective (PDO) is to scale up private sector investment in geothermal energy development in Turkey.

13. This will be achieved by reducing the risks taken on by the private sector to validate geothermal resources in the early exploratory phases and by providing access to long-term financing to develop geothermal resources.

B. Project Beneficiaries

14. The project beneficiaries will be private sector investors in geothermal development in Turkey, as well as the citizens 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 (RSM), which will contribute lessons to design similar mechanisms to stimulate geothermal exploration in other markets.

C. PDO Level Results Indicators

15. The achievement of the 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 CO_2 emissions reductions (tCO_2 per year).

III. PROJECT DESCRIPTION

A. Project Components

16. 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 capacity building for the participating financial intermediaries (FI) is expected to incentivize them to take more risk at earlier development stages than they will do under usual market conditions.

17. Reaching the PDO requires providing support in areas where private investment is currently the most active as this market dynamism is a prerequisite for future geothermal investment expansion efforts in other areas of Turkey, notably in Central Anatolia and the eastern provinces. The Menderes and Gediz Grabens, in the Aegean region, are currently the hot spots of geothermal development in Turkey. Support to the exploration and development in these areas is considered indispensable to maintain the growth momentum of the emerging geothermal sector in Turkey.

18. The geothermal fluids in the Menderes and Gediz Grabens, located within the administrative boundaries[4] of Aydin, Denizli, and Manisa in the Aegean region, are characterized by high CO_2 content and consequently high CO_2 emissions from geothermal power plants. CO_2-rich geothermal systems exist elsewhere around the world but constitute a rare occurrence, explained by geological conditions specific to those two grabens. Although there is no global consensus as to whether CO_2 emissions from geothermal power plants are anthropogenic or not, the project will emphasize minimizing CO_2 emissions from geothermal development projects supported by this project. To do so, the project will act at an individual investment level and will bring forward new data on CO_2 emissions from the subprojects supported by this project to engage in the broader dialogue on CO_2 emission regulation with the GoT during supervision.

19. The project will encourage investments outside of the Menderes and Gediz Graben areas by providing higher risk coverage from the RSM in areas outside the administrative boundaries of Aydin, Denizli, and Manisa (60 percent as compared to 40 percent for investments within the administrative boundaries of these three regions). Beneficiaries from the RSM will be able to operate in areas with a likelihood of high CO_2 content of the geothermal fluids, but the RSM beneficiary agreement will also include a clause that will terminate the RSM beneficiary agreement with a beneficiary if the CO_2 content in the fluid from a given well drilled under the RSM is found to be at a level that will result in CO_2 emissions above the grid emission factor (assuming the resource is exploited for electricity generation).

20. Developers receiving financing under Component 2 will have to commit to systematic measurements and reporting of CO_2 emissions from investments supported by the project.[5] The emission data collected and reported by the developers will add to the limited existing international data on the evolution of gas content in geothermal reservoirs under production described in Box 2.

21. Under Component 2, specific subprojects proposed where net emissions are expected to be above the grid emission factor for 2014, that is, 583 g/kWh,[6] will not be viewed favorably for

[4] The administrative city borders are based on border decisions based on Law 5442 on City Management.
[5] Using the Clean Development Mechanism methodology described in ACM002, "Grid Connected Electricity Generation from Renewable Resources," V16.0, see https://cdm.unfccc.int/methodologies/DB/EY2CL7RTEHRC9V6YQHLAR6MJ6VEU83. See also "Greenhouse Gases from Geothermal Power Production," Technical Report 009/16, ESMAP, forthcoming 2016.
[6] See also section VI. B of this document 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 percent = [(0.50 x operating margin) + (0.50 x build margin)], and the UNFCCC is a methodological tool to calculate the emission factor for an electricity system (October 2013).

financing, and a maximum 60 percent of each credit line will be allocated to such subprojects. For subprojects with predicted emissions above the grid emission factor, the Industrial Development Bank of Turkey *(Türkiye Sinai Kalkinma Bankasi A.Ş,* TSKB) and the Development Bank of Turkey (*Türkiye Kalkinma Bankasi A.Ş,* TKB), along with the sub-borrowers, will have to provide explanations regarding their choice of energy conversion technology, that is, flashed binary or condensing technology versus non-emitting, closed circuit, pumped binary technology. Those sub-borrowers will also have to commit to evaluating the economic and technical feasibility of CO_2 capture and treatment by the time of plant commissioning. If found to be economically feasible, investments for CO_2 capture will be eligible for financing under Component 2.

22. The team will seek to enhance a broad dialogue with the GoT on assessing and regulating CO_2 emissions for power generation projects to develop measures to abate CO_2 emissions from geothermal power generation through technical assistance (TA). In this context the ESMAP of the World Bank and EBRD are jointly preparing a baseline study that will allow quantification of the effects of geothermal power production on natural CO_2 emissions from geothermal systems, which occur naturally through the surface in all geothermal fields. Current global scientific understanding of the effects of geothermal power production on natural CO_2 emissions is limited (see Box 2). Field surveys that will be carried out under the joint ESMAP-EBRD project will measure natural CO_2 emissions through soil in up to five geothermal fields in Turkey that are likely to be developed in the foreseeable future. The purpose of these studies is to establish the baseline natural emission levels that will allow assessment of the potential reduction of natural CO_2 emissions from the geothermal reservoirs resulting from geothermal power production once the power plants are operating. The data obtained by these studies will inform the dialogue on whether to consider CO_2 emissions from geothermal power plants as anthropogenic or not.

23. Details of both components are elaborated in the following paragraphs.

Component 1: Risk Sharing Mechanism for Resource Validation (US$38 million CTF Contingent Recovery Grant and US$1.8 million CTF Grant, approved by the CTF Trust Fund Committee on September 8, 2015)

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

24. 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 an RSM, capitalized by a Clean Technology Fund (CTF) contingent recovery grant, and the geothermal developer (that is, 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 predefined percentage of the eligible drilling expenditures incurred by the beneficiary. This will be 40 percent for projects located within the administrative boundaries of Aydin, Denizli, and Manisa in the Aegean region (or whose largest share of the project area is located within those boundaries) and 60 percent in those located elsewhere in the country, which will encourage exploration in new areas, where the resource risk is generally higher given that limited or no previous exploration activities have been carried out by the MTA. Based on current knowledge

of the market and due diligence carried out during project preparation, it is expected that those percentages will attract enough interest from private developers to participate in the RSM. They are, however, subject to revision depending on the market response to the deployment of the RSM and/or on relevant evidence gathered at any other stage during project implementation.

25. The RSM will screen potential beneficiary applications based upon a clear and predefined 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 (that is, exploration and confirmation drilling) they plan to undertake. Selected beneficiaries will apply a pre-established well testing methodology, which will provide the results (that is, enthalpy and flow) against which success and failure will be determined.

26. In case of failure, the RSM will cover the agreed percentage of the beneficiaries' drilling program expenditures (60 percent or 40 percent depending upon the location of the concession as explained earlier). In case of success, the beneficiary will be required to contribute to the RSM a 'success fee' of 10 percent of the planned incurred expenditures, to reduce the rate of depletion of the RSM capital and maximize the number of beneficiary 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 of beneficiaries to pay. 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 percent in the exploration drilling phase in Turkey. The Operations Manual (OM) 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.

27. TKB will be the recipient of the CTF Contingent Recovery Grant and implementing agency of the RSM. TKB will establish a dedicated RSM Project Implementation Unit (RSM Unit), which will be provided with a general authorization to operate the RSM by TKB's Board of Directors. Because TKB is also one of the implementing entities of Component 2, it will ensure that there will be a distinct segregation of implementation responsibilities and information between implementation units of Component 1 and Component 2 (see below) to mitigate any potential conflict of interest. In addition, TKB will ensure that the implementation status and the results of RSM implementation will be periodically reported to the World Bank and MENR, as well as through the dissemination of information to be carried out through a dedicated RSM website.

Subcomponent 1.2: Technical Assistance for TKB (US$1.8 million, CTF Grant)

28. This subcomponent will address capacity-building needs required to successfully implement Component 1. This support will include the following:

(a) Capacity strengthening of the RSM Unit at TKB to effectively operate the RSM. This may include short trainings to cover geosciences, exploration, reservoir engineering, and principles of drilling, as well as TKB hiring geothermal specialized individual consultants' support to the RSM Unit to perform its functions as needed.

(b) Consultancy support to TKB to facilitate implementation of the RSM. TKB will hire a consulting firm (RSM consultant) to provide assistance in the establishment and start-up operation of the RSM and to help ensure that TKB expands its technical capacity to operate the RSM. 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 RSM beneficiary agreements, forms, and websites, and be responsible for its implementation on a day-to-day basis and work with the RSM Unit to build capacity. The RSM consultant will assist in seeking applications to the RSM, which will include evaluating applications, negotiating contracts with successful applicants, monitoring drilling progress, verifying drilling and well testing results, and assessing whether the success criteria were met. The OM for this component will clearly define the responsibilities of the TKB RSM Unit and its consultant.

(c) TKB will also hire an individual procurement consultant to temporarily assist them in the hiring process of the abovementioned RSM consultant during the initial period of project implementation.

Component 2: Loan Facility for Resource Development (US$312.5 million total; US$250 million IBRD loan, US$37.5 million TSKB and US$25 million TKB cofinancings)

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

30. The project will capitalize two credit lines to FIs with two IBRD loans (US$100 million to TKB and US$150 million to TSKB), which will be cofinanced with FIs' own resources. The FIs will on lend at market rates but offer longer maturity than currently available in the market to geothermal developers at the capacity drilling stage and at the construction stage. FIs shall provide cofinancing to the facility from its own resources, while a minimum equity contribution of 15 percent will be required from individual sub-borrowers. The requirements and conditions for the facility, including eligibility of sub-borrowers and projects, will be clearly outlined in a separate OM to be adopted by the FIs for this component. Once the capacity drilling stage is completed, the sub-borrower (that is, the project sponsor) shall be required to publicly disclose basic information about its potential project. The information will be disclosed through the 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 FI and the sub-borrower.

31. The loan facility for resource development will be open to any geothermal development that has reached the capacity drilling stage, regardless of whether it benefited or not from the

RSM 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.

32. The team has identified TSKB and TKB as FIs for Component 2, which have the required technical capacity and experience in renewable energy development. A share of TSKB's and TKB's cofinancing for this component will be dedicated to capacity strengthening on geothermal-specific technical support. Specifically, this may include the support of consultants for technical assessment, due diligence and monitoring of investments, who would be available to the FIs' teams on an as needed basis, at their request.

33. During preparation, two roundtables with potential sub-borrowers were organized in Istanbul and Ankara. An initial market assessment was also undertaken by both TKB and TSKB to assess the volume and realism of potential sub-borrowers. Those efforts demonstrated a promising potential pipeline of investments that could be supported by the credit lines. As TKB requested IBRD support at a later date than TSKB, the two credit lines may disburse at a different pace, with investments by TKB taking potentially longer.

B. Project Financing

34. The project will be financed by a US$38 million contingent recovery grant and a US$1.8 million TA grant from the CTF, IBRD loans of US$150 and US$100 million, TSKB cofinancing of US$37.5 million, and TKB cofinancing of US$25 million. The CTF contingent recovery grant will be provided to TKB as the implementing agency. The IBRD loans will be provided to TSKB and TKB, with the guarantee of the Republic of Turkey. If the RSM resources have not been exhausted by the project closing date, the remaining balance will be returned to the 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 decides to expand its operation to continue as a revolving mechanism.

35. CTF contingent recovery grant resources to support projects under the RSM will be administered through a Designated Account (DA) at TKB and by direct payments from the trust fund account administered by the World Bank. A separate special account will be created by TKB and used to receive the 'success fees' paid by beneficiaries (that is, project sponsors) in case of successful drilling. TKB will keep detailed accounting records to follow the receipt of success fees. Direct payments from the trust fund account as well as payments from the DA will be used in making 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.

C. Project Cost and Financing

Table 1. Breakdown of Project Components and Financing Plan (US$, millions)

Project Components	Project Cost	IBRD	CTF	TSKB / TKB	% IBRD + CTF Financing
1. Risk Sharing Mechanism for Resource Validation	39.8	n.a.	39.8	n.a.	100%
2. Loan Facility for Resource Development	312.5	250.0	0	62.5	80%
Total costs	352.3	250.0	39.8	62.5	n.a.
Total project costs Front-end fees **Total financing required**	— **352.3**	— **250.0**	— **39.8**	— **62.5**	— **82%**

D. Lessons Learned and Reflected in the Project Design

36. The design of the project draws upon knowledge gathered as part of the Global Geothermal Development Plan (GGDP)[7] 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 of 2006; Djibouti Geothermal Power Generation Project of 2013; and the Geothermal Energy Development Program (GeoFund) of 2009. In addition, an analysis of geothermal projects and risk sharing programs in several countries including the United States, France, Germany, Iceland, Philippines, Kenya, Ethiopia, and East Africa (that is, the KfW-African Union Commission Geothermal Risk Mitigation Facility) informed the design of this project. Some of the lessons learned include:

(a) Compared to other measures of support to geothermal exploration (direct public investment, tax and capital incentives, subsidized commercial insurance), cost sharing mechanisms, such as the RSM 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 beneficiary selection is essential to reduce risks of adverse selection.

(d) Beneficiary financial commitment is important to reduce moral hazard.

[7] The GGDP was formally announced by World Bank Group Managing Director Sri Mulyani in Reykjavik (Iceland) on March 6, 2013. The GGDP is an ambitious initiative by the World Bank's ESMAP and other multilateral and bilateral development partners to scale up the use of geothermal power. Knowledge gathered by the GGDP include information on management of CO_2 emissions from geothermal power plants (see ESMAP, 2016, footnote 5).

37. A capable FI 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.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

38. Detailed description of implementation arrangements will be in the three corresponding OMs for the project: the OM for Component 1 for TKB, the OM for Component 2 for TKB, and the OM for Component 2 for TSKB.

39. TKB will assume overall implementation and fiduciary responsibility for the implementation of Component 1. A RSM Unit will be set up within TKB's Technological Monitoring and Research Department, which will be provided with the delegated authority from the TKB board of directors for all implementation and supervision responsibilities of the RSM. TKB does not have experience for the selection of a consultant in accordance with the World Bank's Consultant Guidelines, so support from an experienced procurement expert will be required for the procurement of a consultant firm (RSM consultant) to assist the RSM Unit in the implementation of the RSM component.

40. The RSM consultant will be hired to provide support to TKB in implementing and managing the RSM. The RSM consultant will carry its work under the supervision of the RSM Unit and on behalf of TKB. 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.

41. The RSM Unit, supported by the RSM consultant, will solicit applications on a rolling basis. The applications will be first screened for eligibility of applicants and completeness of their required documentation. The applicants will be notified of the results of this screening process and given two weeks to provide additional documentation if necessary. Vetted applicants into the RSM will be submitted as formal recommendation to the RSM Unit management for review and approval. Once approved, the RSM Unit will enter into negotiations with the applicants to agree on the amounts of risk coverage for each vetted applicant. Based on the negotiations, the RSM beneficiary agreement will be submitted for review by the RSM Unit management. Upon finalization of the RSM beneficiary agreements, they will be submitted to the World Bank for the 'no objection' of the first two agreements. Once the World Bank's 'no objection' is obtained, TKB will proceed to approve the first two RSM beneficiary agreements for signing with the beneficiaries. The subsequent agreements after the initial two will not require a prior 'no objection' and will be subject to post review by the World Bank. Notwithstanding, the World Bank will also approve the RSM beneficiary agreement template to be developed by TKB with the support of the RSM consultant, and that will be included in the RSM OM.

42. In addition, TKB will hire temporary individual geothermal expertise to support TKB's supervision of the RSM consultant, support the overall implementation of the RSM process, if needed, and build in-house capacity. TKB might seek specific technical support in particular with respect to well testing, including to review (a) the standard well testing protocols and specifications developed by the RSM consultant during the preparation phase of the RSM, (b) the qualifications of the service providers contracted by the beneficiaries to carry out the well testing, (c) the well testing reports and associated raw data submitted by the beneficiary and the corresponding evaluation report written by the RSM consultant where the conclusions of the well testing report are either confirmed or contested. If disputes arise regarding the interpretation of the well testing results, TKB will seek a third-party opinion on the well testing results, specifically whether the success criteria for the particular well were met or not.

43. For Component 2, both TSKB and TKB have adequate experience and capacity to implement and take on the risk associated with the capacity drilling activities to be financed through the loan. This assessment was made based on TSKB's and TKB's technical strength, track record in renewable energy development, and significant experience in implementing national and World Bank policies on environmental and social safeguards. The fiduciary capacities in TSKB and TKB are satisfactory and the systems currently used in the implementation of the Private Sector Renewable Energy and Energy Efficiency Project (PSREE) will be utilized for the proposed project. TSKB and TKB will use the existing Project Implementation Unit (PIU) under their respective departments to implement Component 2.

44. Sub-borrowers will be approved by TSKB and TKB based on compliance with their corresponding OM, which covers aspects such as eligibility, safeguards compliance, monitoring requirements, and so on. Sub-loans will be provided to eligible subprojects. The interest rate will be equal to the costs of IBRD funds to TSKB or TKB 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 TSKB's and TKB's administrative costs. Sub-loans from FIs under the project will have a maturity of not less than 8 years. The maturity for loans to finance specific equipment to capture CO_2 emission will be no less than 10 years. Forex risk will be taken on by sub-borrowers.

B. Results Monitoring and Evaluation

45. TKB will be responsible for results monitoring and evaluation (M&E) activities for Component 1, including the submission of semiannual implementation progress reports to the World Bank, as well as to the MENR (General Directorate of European Union and International Affairs and General Directorate of Renewable Energy). 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 and TKB will be responsible for reporting and assessing their respective implementation progress within the confines of the banking law in Turkey.

C. Sustainability

46. The proposed RSM is a pilot that, if successful, could be expanded with additional resources from the GoT or other sources for ongoing support to the riskier phases of geothermal

project development in Turkey. In addition, lessons learned from the institutional and operational setup will inform other countries considering risk sharing schemes for the promotion of geothermal development.

47. 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.

48. 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 experience of the Turkish geothermal market has shown that no other Turkish bank is yet willing to provide financing for capacity drilling, which will receive the majority of funds from the loan facility. Also, 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.

49. Institutional sustainability will also be enhanced by ensuring that TKB and TSKB staff develop strong technical capacity to appropriately identify, evaluate, and monitor the projects. Capacity building already provided during project preparation and TA available during project implementation will help address this issue. In addition, the FI's 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. At the project midterm review, the team will assess the potential interest of other state-owned commercial banks in Turkey in financing geothermal drilling, to monitor the impact of the project on the geothermal financing market.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

50. The overall risk of the project is rated 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, as well as capacity drilling, are high risk by nature, and this risk cannot be commercially hedged (see Technical section below). 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 RSM sooner than expected.

(b) The institutional capacity risk is 'High', mainly due to the innovative nature of Component 1, specifically the RSM. With the RSM, Turkey is becoming one of the global leaders implementing an innovative mechanism to support geothermal energy development, focusing on the high-risk exploration stage. Both TKB and TSKB have experience in renewable energy financing and World Bank projects. However, TKB does not have experience in the implementation and management of a program such as the RSM. Although the RSM consultant will support the work of the RSM Unit, internal approval procedures may face technical, bureaucratic, or time constraints that put at risk the implementation progress of the RSM.

(c) The fiduciary risk is 'Substantial'. The RSM will be the first such facility that will be managed by TKB. The management of the mechanism, especially registering the compensation payments and success fees, is considered risky from a fiduciary perspective. Additionally, TKB does not have experience with the selection of a consultant in accordance with the World Bank's Consultant Guidelines. However, TKB and TSKB are highly experienced in the fiduciary management of credit line operations.

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	High
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Moderate
OVERALL	**Substantial**

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

51. The project's economic impact is assessed based on cost-benefit analysis for a 30 MW power plant. 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 energy security, reduced pollution, 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.

52. The economic benefits quantified in the analysis were as follows:

(a) Revenues from electricity sales

(b) Social value of avoided GHG emissions

53. 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$40.5 million and EIRR of 7.6 percent at a discount rate of 5%. Sensitivity analysis also confirms the economic viability of the project within reasonable margins. Summary of the results for the economic valuation of the project base case is presented in table 2. Details of the assumptions for each scenarios and the methodology of the analysis can be found in annex 5.

Table 2. Summary of Economic Benefit of the Power Plant

NPV (US$, millions)	EIRR (%)
40.5	7.6

54. **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 subproject 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.

55. 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 administrative boundaries of Aydin, Denizli, and Manisa), salvage value, and the probability of success. At the exploratory drilling stage, industrywide the success rate is generally between 30 percent and 80 percent, depending on field-specific conditions and the existing geoscientific evidence. For the present analysis of Component 1, a range of success rates from 80 percent to 30 percent were analyzed. As illustrated in table 3, a probability weighted average of the NPV and internal rate of return (IRR) of the range of possible scenarios shows an IRR of 12 percent 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 3. Summary of Financial Analysis for the RSM

Case Scenarios	Status	Well Program	Region	Market Value of Concession	Probability of Success (%)	IRR (%)	NPV (US$)
Scenario 1	Successful	4 Well	Aydin/Denizli/ Manisa	20,000,000	80	16	2,000,203
Scenario 2	Failure	3 Well	Aydin/Denizli/ Manisa	8,000,000	70	15	1,168,449
Scenario 3	Successful	3 Well	Other provinces	17,000,000	60	18	2,747,252
Scenario 4	Failure	4 Well	Aydin/Denizli/ Manisa	12,000,000	50	14	1,684,748
Scenario 5	Failure	4 Well	Other provinces	6,000,000	40	5	372,865
Scenario 6	Successful	5 Well	Other provinces	19,000,000	30	4	290,560
Probability weighted average						**12**	**1,377,346**

56. 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 percent interest rate, success rate (hit ratio) of 70 percent, and a financial discount rate of 15 percent. Details of the assumptions are provided in annex 6. A summary of the results of the analysis is presented below.

Table 4. Results of the Sample Project Financial Analysis

Free Cash Flow[8] to Equity (FCFE)	
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

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

58. Geothermal energy presently enjoys a feed-in tariff of US$0.105 per kWh. The GoT also provides an additional US$0.027 per kWh when local equipment is used. The analysis takes a conservative tariff of US$0.105 per kWh. A sensitivity analysis was conducted to determine the impact of reducing tariffs from US$0.105 per kWh progressively to US$0.075 per kWh. The financial internal rate of return (FIRR) and NPV remain positive despite a reduction of the feed-in tariff to US$0.085 per kWh.

[8] Calculated as operating cash flow minus capital expenditures.

Table 5. Sensitivity of FIRR and NPV to Tariff Changes

Tariff (US$/kWh)	0.105	0.095	**0.085**	0.075
IRR (%)	17	16	**15**	14
NPV (US$)	17,048,450	9,570,223	**2,091,997**	(5,386,229)

59. Additional sensitivity analysis was conducted to determine the impact of changes in the loan maturity term and grace period. The IRR and NPV remain positive with no significant change.

Table 6. Sensitivity of IRR and NPV to Loan Assumptions

Loan maturity (year)	**15**	**20**	**25**	**11.5**
IRR (%)	17	16	16	15
NPV (US$)	17,048,450	9,904,180	5,617,618	2,759,910
Grace period (year)	**2**	**4**	**6**	**8**
IRR (%)	17	17	17	17
NPV (US$)	13,349,900	13,768,150	14,084,408	14,323,544

B. Technical

60. 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 widespread and have a longer history. The total worldwide installed capacity for geothermal power production is currently about 12.5 GWe, and the corresponding value for direct applications is about 70 GWt.

61. 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 to maximize the likelihood of successful drilling.[9] 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 blowouts, causing damage, destruction of permeability, and so on, can be largely mitigated by following established industry best practices for geothermal drilling.[10]

[9] See Best Practice Guide for Geothermal Exploration, IFC, 2014.
[10] See, for example, Sandia National Laboratories Handbook of Best Practices for Geothermal Drilling (SAND2010-6048) and New Zealand Code of practice for deep geothermal wells (NZS 2403).

62. The project will help establish a high standard for the quality of geothermal surface exploration work in Turkey by requesting high-quality exploration studies as a prerequisite to be supported 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.

63. 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 earlier 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.

64. 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 technologies are very similar with respect to CO_2 emission factors as both emit effectively all the CO_2 contained in the geothermal fluid. These technologies are both well established, 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[11] are also expected to come online in the near future. There are, currently, no pumped binary plants in the country. However, this is also a mature technology 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, for example, 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. The technology to capture and treat CO_2 is relatively well established and commercially available. Locally engineered and built CO_2 capture and treatment plants, producing beverage grade CO2, are currently installed at three geothermal power plants in Turkey.

C. Financial Management

65. Both TSKB and TKB have extensive experience in implementing World Bank-financed projects and have acted both as a wholesale and a retail bank in previous projects. For the currently ongoing PSREEE (where TSKB and TKB are both wholesale banks), the financial management arrangements of the project are fully integrated into TSKB and TKB systems, which allow the loans extended by TSKB and TKB to be followed up from initial application to

[11] Pumped binary plants can be operated without any gas emission.

approval to monitoring through the system. PSREEE financial management arrangements are satisfactory to the World Bank, and the same systems will be used for the proposed project. In addition, as mentioned earlier, TKB will also be responsible for the implementation of the CTF contingent grant-funded RSM, for which a new RSM Unit will be established. Its capacity will be ensured by the overall financial management responsibilities of TKB, assumed by TKB's Financial Institutions Department. The responsibilities and information flow between the departments will be described in detail in the project OM.

D. Procurement

66. 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 and Grants by World Bank Borrowers' 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 and Grants by World Bank Borrowers' dated January 2011 and revised in July 2014 (Consultant Guidelines) and the provisions stipulated in the loan agreements. The 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 (Anticorruption Guidelines) will apply to this project.

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

68. The procurement of consulting services under the TA subcomponent (Subcomponent 1.2) shall be carried out by the TKB RSM Unit established under the Technological Monitoring and Research Department of TKB. The RSM Unit will be responsible for the implementation of the consultancy contract with the RSM consultant.

69. 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, 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 subcomponent will be conducted as agreed in the OM for TSKB and TKB.

70. An assessment of TSKB and TKB has been carried out and concluded that they have adequate capacity to oversee the procurement activities under Component 2. TSKB and TKB are familiar with World Bank procurement procedures through their experiences with implementing several similar credit line projects financed by the World Bank. However, TKB does not have any experience for the selection of a consultant in accordance with the World Bank's Consultant Guidelines, as it will be required under the TA subcomponent (Subcomponent 1.2). The RSM

Unit will conduct the selection of the RSM consultant and also manage the RSM consultant's contract, while also hiring an individual procurement consultant to support selection of the RSM consultant. For this individual hire, TKB may resort to retroactive financing. The procurement risk associated with TKB for the selection of the RSM consultant and management of the contract is substantial as the delay in the selection of the RSM consultant will delay the implementation of the project. Given the size of the financing allocated to the TA subcomponent, the overall procurement risk is assessed as Moderate for the project. A brief summary of the procurement arrangements is provided in annex 3 including risk mitigation measures, which have been discussed and agreed by TSKB and TKB.

E. Social (including Safeguards)

71. The footprints of a geothermal power plant 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 OP 4.12 on Involuntary Resettlement has been triggered.

72. It is expected that there will be subprojects in both Components 1 and 2 that include past land acquisition. In such cases, the FIs will document the details of land acquisition by undertaking an ex post social review. The FIs will ensure that none of the project-affected people were worse off, and the past land acquisition process was in compliance with World Bank OP 4.12. The disclosed Resettlement Policy Frameworks (RPFs) detail the process of ex post social review and proposes additional mitigation measures in case gaps/incompliances are found from the review.

73. Land acquisition occurs gradually, starting with only a few well areas (about 0.5 ha each) for the exploration drilling and ending with the full footprint described earlier for a plant in operation. When developers are having well areas expropriated, the 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 m 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 impact of piecemeal expropriation on the livelihoods of farmers is assessed in the Resettlement Action Plan (RAP). Despite Turkish laws being gender neutral in expropriation payments and in landownership, usually more men than women own the land. The proposed project is also paying attention to gender issues that may arise with land acquisition. During land acquisition, women may be at risk of having less control over compensation or may experience different impacts from those affecting male land users. As such, the RAP will take measures to address this issue. For example, wherever there are both women and men land owners, women will be separately consulted where feasible. Also, the RAPs will explicitly record land users in addition to landowners and propose gender-sensitive mitigation and assistance measures. The formal consultation sessions will be held at times and places allowing people with family responsibilities to participate.

74. In Turkey, the general practice is for the private developers initially to approach landowners 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. In cases of non-agreement with the landowner, if the private developer has the right to expropriate land for the subproject, this will be considered as involuntary resettlement, as defined by OP 4.12.

75. Because the subprojects are not known at this time, two RPFs were prepared by TSKB and TKB in compliance with the policy. The RPFs prepared by TSKB and TKB outline in detail the expropriation procedures for geothermal development in Turkey, the World Bank's OP 4.12 policy on involuntary resettlement, a gap analysis, steps to bridge these gaps, and institutional responsibilities. The final RPF documents were disclosed on clients' websites on September 5, 2016, (TKB) and September 6, 2016, (TSKB) and on the World Bank's InfoShop on September 8, 2016. All site-specific environmental and social documents prepared for each subproject will be consulted with relevant stakeholders according to the process defined in the Environmental and Social Management Framework (ESMF) and RPF.

76. During project implementation, TKB, with support of the RSM consultant for Component 1, and TSKB or TKB for Component 2 will screen subprojects for financing, ensure the preparation of a social audit and/or RAPs as necessary by the private developer, and submit for World Bank review and clearance before financing of infrastructure. TSKB and TKB will also oversee and supervise the implementation of these RAPs. TSKB and TKB fully understand the World Bank's social safeguards requirements and have high capacity to monitor social impacts owing to a long-standing relationship with many international finance institutions. The RSM consultant will also be required to possess capacity to support TKB in the implementation of the RPF for Component 1. If needed, TKB will hire short-term consultants to perform its environmental and social safeguards responsibilities.

77. 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 subproject-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)

78. In accordance with the World Bank's safeguard policy OP/BP/GP 4.01 (Environmental Assessment), the project has been assigned as category FI with potential category A and B subprojects. The subprojects under Component 1 (exploration) and most of subprojects under Component 2 activities are estimated to be category B in nature because potential impacts are expected to be limited and be relatively easy to assess and mitigate through careful siting and good drilling and construction practices. However, some of the energy production facilities under Component 2 may be categorized as 'A' according to environmental and social risks.

79. Because the exact footprints of the subprojects are not determined yet, an ESMF has been prepared by each client (TKB and TSKB) to provide guidance for screening, assessing, conducting consultations, reporting, and monitoring practices. The final ESMF documents were disclosed on clients' websites on August 12, 2016, (TSKB) and on September 1, 2016, (TKB) and on the World Bank's InfoShop on August 15, 2016. In addition, the Executive Summary of the ESMF document was disclosed in-country and in InfoShop and was sent to the World Bank's Board of Executive Directors on April 7, 2016, to inform the Board about environmental and social issues of the project in case any category A project requests financing under the project. All site-specific environmental and social documents prepared for each subproject will be consulted with relevant stakeholders according to the process defined in the ESMF and RPF.

80. TKB will be supported by the RSM consultant during implementation of its ESMF for Component 1. TSKB and TKB will be the responsible parties for the implementation of the ESMF for Component 2. It is planned that the RSM Unit, supported by the consultant, will be responsible for reviewing the exploration applications from the project sponsors in line with national and World Bank safeguards requirements. Both TKB and TSKB have capacity for the implementation of their respective ESMFs as well as good knowledge about World Bank safeguard policies.

81. The ESMFs outline 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 ESMFs for both Components 1 and 2. The ESMFs provide guidance on risk screening of proposed subprojects, mitigation measures to reduce/manage potential adverse impacts. The ESMF also provides clear guidance to subproject sponsors about conducting the public consultation meetings. In summary, the public consultation meeting should be announced in advance to local public and together with a draft environmental and social assessment document (in the form of the Environmental and Social Impact Assessment [ESIA], Environmental and Social Management Plan [ESMP], or partial ESIA). The ESMF also sets out the monitoring requirements for the sub-borrowers, the proper compliance with subproject ESIAs/ESMPs, and reporting arrangements between sub-borrower and the FI and also between the FIs and the World Bank.

82. The exploration and capacity drilling and construction activities (Components 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, and the subprojects in critical habitats will not be eligible for financing. According to OP 4.04, the projects that 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 subproject environmental assessment documents.

83. The project will avoid water extraction from or discharge into international waterways. The international aquifers and eligible list of river basins in Turkey are provided in the respective ESMF documents of the borrower. With regard to OP 7.50, the FI is responsible for ensuring that the projects financed are located on national waterways only. The waterways identified as not being an international waterway (eligible basins) are listed in the ESMF.

G. World Bank Grievance Redress

84. **Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS).** The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB 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. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), 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.

Annex 1: Results Framework and Monitoring

Project Development Objectives

PDO Statement

The PDO is to scale up private sector investment in geothermal energy development in Turkey.

These results are at	Project Level

Project Development Objective Indicators

	Cumulative Target Values						
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Private capital mobilized (US$) (Core)	0	0	65	267	470	594	624
Generation capacity of renewable energy constructed under the project (MW) (Core)	0	0	0	22	46	80	110
Potential CO_2 emissions reductions (tCO_2 per year)	0	0	97,639	260,371	423,102	553,288	650,927

Intermediate Results Indicators

Component 1	**Cumulative Target Values**						
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Exploration drilling projects supported under the RSM (Number)	0	0	3	8	13	17	20
Volume of direct financing catalyzed by CTF financing (US$) – (Core)	0	0	30	81	131	172	202
Geothermal resources confirmed through exploration drilling (electricity and heat) (MW)	n.a.	0	31	83	135	177	208
Component 2							
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target
Geothermal resources developed through capacity drilling (MW)	0	0	0	24	72	120	120
Capacity drilling projects supported by the loan facility (Number)	0.	0	1	3	5	5	5
Volume of indirect financing catalyzed by CTF financing (US$)	0	0	23	70	117	117	117
Portfolio at risk 90 days (Percentage)	n.a.	n/a	4	4	4	4	4
Components 1 and 2							
Grievances registered related to delivery of project benefits addressed within stipulated service standards for response times* (Percentage) (Core)	n.a.	0	80	100	100	100	100

Note: * 15 days for general complaints and 30 days for complex complaints.

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 tracks 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.	Semiannually	Project progress reports from TKB and TSKB	TKB and TSKB
Generation capacity of renewable energy constructed under the project	This measures the capacity of geothermal energy constructed under the project.	Semiannually	Project progress reports from TSKB and TKB	TKB, TSKB
Potential CO_2 emissions reductions	Potential annual CO_2 emissions reduced or avoided over the lifetime (that is, 30 years) of the projects whose resources are confirmed by capacity drilling under Component 1. Commissioning of the majority of these projects (that is, power plants and direct applications) will only be realized after the project has ended and will not involve additional financial resources from the project, so the figures are only indicative.	Annually	Subproject reports, TKB data Potential for annual CO_2 emission reductions will be estimated based on the CO_2 content of the geothermal fluid from the successful exploration drilling projects supported by the RSM.	TKB

Intermediate Results Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Exploration drilling projects supported under the RSM	Number of projects	Semiannually	Project progress reports from TKB	TKB
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 (40% assumed to be attributable to Component 1)	Semiannually	Project progress reports from TKB and TSKB	
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.	Semiannually	Project progress reports from TKB and TSKB	TKB, TSKB
Geothermal resources (for electricity and heat) confirmed through exploration drilling	Geothermal resources confirmed during the exploratory drilling, which will take place under Component 1. This indicator covers resources confirmed for electricity and heat, because some RSM projects are expected to confirm the existence of low temperature resources that are adequate for heat applications (that is, direct uses). The baseline will be zero.	Semiannually	TKB reports	TKB
Geothermal resources developed through capacity drilling	This indicator measures geothermal resources developed during the capacity drilling under Component 2. The baseline will be zero.	Semiannually	TKB and TSKB reports	TKB, TSKB
Portfolio at risk 90 days	Value of the loans outstanding at the end of the reporting period that have one or more installments of principal past due for more than 90 days.	Semiannually	TKB and TSKB reports	TKB, TSKB
Grievances registered related to delivery of project benefits addressed within stipulated	This indicator measures the transparency and accountability mechanisms established by the project so that the target beneficiaries have	Annually	TKB and TSKB reports	TKB and TSKB

service standards for response times (%; gender disaggregated)	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.			

Annex 2: Detailed Project Description

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 widespread seismic and volcanic activity. The countrywide distribution of thermal sites in Turkey reflects how the geothermal activity mainly coincides with the major faults and also to some degree the recent volcanic regions.

2. Geothermal resources in Turkey are used for power production as well as direct applications of geothermal energy, such as space heating and spas. The installed capacity of geothermal power plants in Turkey has grown rapidly in recent years: from some 15 MW in 2006 to 695 MW as of June 2016. 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 widespread in Turkey. While most of the direct application occurs in the western part of the country, significant direct application takes place in the southeastern 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 MWt to 60,000 MWt as the 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 MTA were a critical driver behind geothermal development in Turkey. The 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 190 geothermal sites discovered, the MTA prioritized 25 sites, which were considered suitable for electricity production. Those 25 sites were subsequently explored further, mostly by the 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 the MTA. 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 showing 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 FIs is expected to incentivize them to take more risk at

earlier development stages than they will do under usual market conditions. Details of both components are elaborated in the following paragraphs.

Component 1: Risk Sharing Mechanism for Resource Validation (US$38 million CTF Contingent Recovery Grant and US$1.8 million CTF Grant, approved by the CTF Trust Fund Committee on September 8, 2015)

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 an RSM, that is, the TKB RSM Unit, capitalized by a CTF contingent recovery grant, and the private sector geothermal developer (that is, 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 predefined percentage of the drilling expenditures incurred by the license holder. This will be 40 percent for projects located within the administrative boundaries of Aydin, Denizli, and Manisa 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 the MTA. Based on current knowledge of the market and due diligence carried out during project preparation, it is expected that those percentages will attract enough interest from private developers to participate in the RSM.

7. The RSM will screen applications by potential beneficiaries based upon a clear and predefined 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 (that is, exploration and confirmation drilling) they plan to undertake. Selected beneficiaries will apply a pre-established well testing methodology, which will provide the results (that is, 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 case of success, the license holder will be required to contribute to the RSM a 'success fee' of 10 percent of the incurred expenditures, 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 beneficiary will submit a bank guarantee letter upfront. 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 OM for this component will specify all the application, eligibility requirements, and the well testing protocols. The OM will also provide details on the RSM terms and on the specific list of eligible expenses to be covered by the RSM.

9. Box 2.1 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

- Drilling program can include slim wells, production-size exploratory wells, or a combination.
- Standard agreements will cover three wells, with an option for additional fourth and fifth wells at the discretion of the RSM Unit.
- Coverage for unsuccessful wells:

Well Number	Aydin/Denizli/Manisa	Other Regions
1	40%	60%
2	40%	60%
3	40%	60%
4	**40%**	**40%**
5	**40%**	**40%**

- Beneficiaries will pay a 10 percent 'success fee' on the average estimated well cost only when the well is successful. The success fee will be 25 percent for the fourth and fifth wells.

10. A database on available information of wells drilled and project sites with support from the RSM will be created (RSM database). The database will make use of Geographic Information System 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 need to be tracked and reported regarding the project progress. For individual subprojects, the RSM beneficiary agreements will indicate the information to be made public, which should at least include the name of the developer, the site location, the number of wells drilled and tested, and the number of successful wells.

11. TKB will be the recipient of the CTF contingent grant and implementing agency of the RSM. TKB will establish a dedicated RSM Unit, which will be provided with a general authorization to operate the RSM, according to the OM, by the board of TKB. TKB will ensure that there will be a distinct segregation of implementation responsibilities and information between implementation units of Component 1 and Component 2 (see the following paragraphs) to mitigate any potential conflict of interest. In addition, TKB will ensure that the implementation status and the results of RSM implementation will be periodically reported to the World Bank and MENR, as well as through the dissemination of information to be carried out through a dedicated RSM website.

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

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

(a) **Capacity strengthening of the RSM Unit at TKB to supervise implementation of the RSM**. This will include short trainings to cover geosciences, exploration, reservoir engineering, and principles of drilling, as well as temporary needs for specialized expertise to help with the supervision of the RSM consultant and the overall implementation of Component 1.

(b) **Consultancy support to TKB to facilitate implementation of the RSM**. TKB's RSM Unit will hire a consultant to establish and operate the RSM. The OM for this component will clearly define the responsibilities of TKB and its consultant. Also, because TKB has no experience for the selection of a consultant in accordance with the World Bank's Consultant Guidelines, they will need to hire a consultant to support management activities. Activities under this TA will thus include hiring of a contract management specialist and other required expertise as necessary, to support the RSM.

Component 2: Loan Facility for Resource Development (US$312.5 million total; US$250 million IBRD loan, US$37.5 million TSKB and US$25 million TKB cofinancings)

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 (a) the capacity/production drilling stage and (b) the steam gathering and power plant construction stage.

14. The team has identified TSKB and TKB as FIs with the technical capacity and experience in renewable energy development. A share of TSKB's and TKB's cofinancing for this component will be dedicated to capacity strengthening on geothermal specific technical support. Specifically, this may include support of consultants for technical assessment, due diligence, and monitoring of investments, who will be available to TSKB's and TKB's teams on a needs basis. These consultants are expected to ensure that the FIs are adequately equipped to effectively assess the technical risk of loan applications during project implementation.

15. 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 and TKB will provide cofinancing to the facility from its own resources, while a minimum equity contribution (that is, 15 percent) will be required from project sponsor/concession holders (that is, the sub-borrowers). The requirements and conditions for the facility, including eligibility of sub-borrowers and projects, will be clearly outlined in a separate OM 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 that will be provided in the loan agreement between the FI and the sub-borrowers will include at least the following items:

- Name, address, and legal form of business that will be requesting funds for the power plant construction stage
- 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

- Identification of how the energy will be used under the developer's business plan (power plant, space heating, and so on)

- General status of permits and contracts associated with development

16. 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 RSM under Component 1. Once the capacity drilling is completed, the FI may proceed to provide additional funds to the concession holder for the construction of the geothermal facility. However, to qualify for support under this component, the proposed projects will have to comply with eligibility criteria (these criteria are further developed in the OM for Component 2), including the following:

(a) Sub-borrowers must have the majority of their capital privately owned.

(b) All loans will be based on limited (partial) recourse with the investment (concession) usually indicated as security.

(c) All projects must have adequate technical insurance.

(d) All projects must be offered a minimum of a 1-year grace period.

(e) Financing parameters: US$60 million per project with a maximum of two projects and US$80 million per sub-borrower.

(f) Sub-projects shall have at least 15 percent sponsor equity financing unless otherwise agreed with the World Bank.

(g) Given the risks of geothermal projects, and the expectation that technical assumptions can change in any direction, TSKB and TKB projections of financial yield indicate that projects must show a minimum FIRR of 6 percent and at least 8 percent equity IRR[12] during their projected lifetime.

(h) All projects must have a minimum debt coverage ratio of 1.1 calculated on a three-year moving average after completion of the investment and throughout the life of the loan unless otherwise agreed with the World Bank.

(i) Sub-borrowers must commit to monitoring and reporting CO_2 emissions to the MENR throughout the lifetime of the project.

(j) Sub-borrowers with net emissions predicted to be above the 2014 grid emissions factor will carry out a feasibility of study of CO_2 capture to reduce the net emission of their project to a level below the grid emission factor by the time of plant commissioning.

(k) Sub-borrowers must comply with the environmental and safeguard review procedures set forth in the OM.

[12] IRR based on cash flow to equity.

17. A share of the FI's cofinancing for this component will be dedicated to capacity strengthening. More specifically, it may cover training for FIs' staff, particularly on best available techniques and technologies and geosciences in geothermal development. Such 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 may 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 will be available to FIs' teams on a needs basis, to ensure, may the need arise, an effective assessment of the technical risk of loan applications during project implementation.

Annex 3: Implementation Arrangements

Project Institutional and Implementation Arrangements

Component 1

1. TKB, as implementing agency for the RSM, will be responsible for overall project coordination and oversight, through the RSM implementation unit (RSM Unit) established under its Technological Monitoring and Research Department.

2. Throughout the implementation of the project, TKB will provide adequate budgeting, personnel, and other necessary resources needed to manage the RSM and to monitor the activities of the RSM beneficiaries, according to the terms of the RSM beneficiary agreements with TKB. TKB will ensure that supplemental services will be procured on specific issues (such as drilling, well testing, and so on) from the MTA or other private sector consultants with the requisite expertise.

3. TKB will hire a consultant firm ('RSM consultant') to provide support to the RSM Unit in implementing and managing the RSM. The RSM consultant will carry out work on behalf of TKB and under the supervision of the RSM Unit. The consultant will be required to provide specialized geothermal expertise to the RSM, including 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.

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

5. At every step in the implementation of the RSM, the RSM consultant will provide inputs to the RSM Unit and provide documentation to facilitate the technical review of potential 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 payout (or receipt of success fee).

6. Based on these inputs, the RSM Unit will sign an agreement with the 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 RSM Unit and RSM consultant. Because the 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 and verifying the invoices for the drilling-related expenditures incurred by the developer for the RSM Unit. 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.

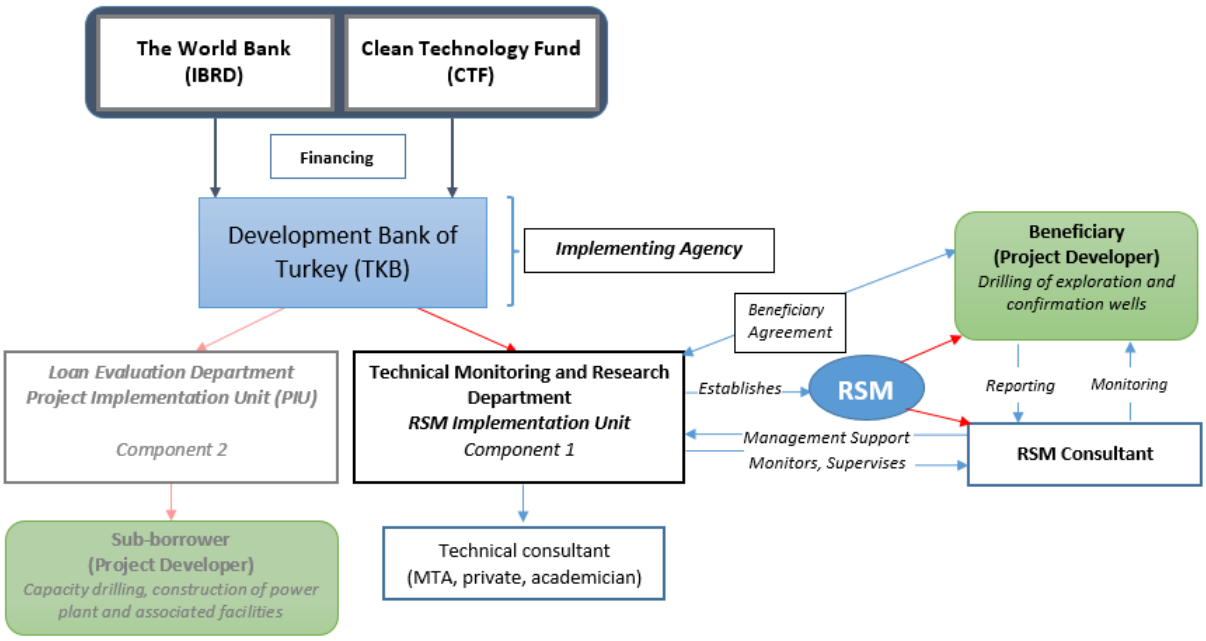
7. The RSM consultant will prepare the results and related documents of the verified expenditures for the TKB RSM Unit, which will report it to the World Bank during the implementation of the agreed upon beneficiary drilling program. The RSM consultant is

expected to verify the claim that will be submitted by the beneficiary at completion of the drilling program to the RSM Unit. TKB will be responsible for making the final decision to make the payout from the DA 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. This will again be based on the verified well test results.

8. The RSM consultant will also be required to ensure availability of all related documents and reports available to external auditors hired by TKB and the World Bank, if applicable, to verify their financial monitoring activities.

9. The OM 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

10. TSKB and TKB will be the FIs that will implement Component 2. TSKB and TKB are development banks 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 TKB's and 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 and TKB will rely, on a needs basis, on consultants for technical assessment, due diligence, and monitoring of investments to ensure effective assessment of the technical risk of loan applications during project implementation.

11. Subprojects will be approved by the FIs based on compliance with their OMs, which cover aspects such as eligibility, safeguards compliance, monitoring requirements, and so on. 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 8 years and not less than10 years for investments in facilities directly intended to reduce CO_2 emissions.

Financial Management, Disbursements, and Procurement

Financial Management

Country Issues

12. The banks in Turkey are subject to strict regulations and supervision by the Banking Regulation and Supervision Agency (BRSA). The BRSA's regulatory and supervisory framework meets modern standards preserving the solidity of the system. Accordingly, the banking sector has proven resilient to the effects of the global crisis. During this period, no bank faced funding problems that required access to the Central Bank of Turkey's emergency liquidity facilities or government support, even at the peak of the global liquidity squeeze. The banks remain highly capitalized and profitable, despite deterioration in asset quality.

13. The banks in Turkey are required to prepare financial statements in compliance with the Turkish Accounting Standards which are based on, and correspond to, interim unaudited financial reports (IUFRs). The BRSA also issues rules governing the external audit of bank financial statements, and only auditors approved by the BRSA may carry out such audits.[13] The external auditor is required to report to the BRSA on the internal control and risk management systems of banks and is obliged to report directly to the BRSA with respect to certain issues that may seriously impact the bank.

Financial Management Risk Assessment and Mitigation Measures

14. The financial management risk for the project is Moderate. The participating banks are experienced in implementing World Bank-financed projects and for their current projects they all have financial management arrangements that are satisfactory to the World Bank. However, TKB has no experience with the selection of a consultant in accordance with the World Bank's Consultant Guidelines and the procurement of the RSM consultant will require adequate knowledge of the World Bank's Consultant Guidelines. Additionally the RSM will be the first-of-its-kind in the World Bank's portfolio in Turkey. In addition to the outflows from the mechanism, there will also be inflows which need to be closely monitored. TKB will hire a procurement consultant to address the capacity issue and will install systems to ensure that the controls on the management of the RSM are exercised.

Implementing Entities

15. Component 1 of the project will be implemented by TKB through an RSM Implementation Unit that will be established under its Technological Monitoring and Research

[13] Some of these responsibilities will be transferred to the newly established Public Oversight, Accounting, and Auditing Standards Board.

Department. The staff assigned to work in Component 1 of the project would be different than the ones working under Component 2. These staff will be assigned and authorized by the decision of TKB's board of directors. TKB would pull staff from its current skills pool to work on the implementation of Component 1. Specific skills could be shared on a cross-support basis with Component 2. However, there would be a distinct segregation of responsibilities and authorities between staff working for Component 1 and Component 2. TKB will use the services of consultants where there is a lack of necessary skills, such as in procurement and geothermal technical analysis. A RSM consultant with the necessary technical qualifications will provide support to TKB in evaluating beneficiary applications, their approvals, and monitoring of projects. The project budgeting, accounting, and reporting will be integrated into TKB's system and the Financial Affairs Department will be responsible to manage the reimbursements from the World Bank and the accounting of the RSM.

16. Component 2 will be implemented by TSKB and TKB (FIs). TSKB was established in 1950 with the support of World Bank and the Central Bank of Turkey and shareholding of private commercial banks and it is Turkey's first privately owned development and investment bank. TSKB provides corporate banking, investment banking, and consultancy services to its customers. TKB is a well-established government-owned development bank. Both banks have extensive experience in implementing credit lines that finance renewable energy projects.

Budgeting and Planning

17. FIs will include project-related expenditures in their annual budgets.

Accounting Staff

18. The FIs have qualified staff and project-related transactions will be executed as part of their regular work. There is a clear segregation of duties between the staff with respect to evaluation of loan applications, their technical and financial assessments, processing and accounting, and reporting. TKB will also ensure that there is clear segregation between the staff assigned to different components of the project. TKB will also hire a consultant firm to establish and operate the RSM. Payments to the RSM beneficiaries will be processed and approved by TKB based on the recommendation of the RSM consultant. The RSM consultant will be responsible for reviewing and certifying the invoices of drilling program expenditures. However, TKB will review such expenditures and has staff with the required qualifications and experience.

Accounting Policies and Procedures and Systems

19. The financial management of the project will be integrated into the participating banks' systems. For the current PSREE, the financial management arrangements of the project are fully integrated into the FIs systems which allow the loans extended by the FIs to be followed up from initial application to approval to monitoring through the system. Project reports are generated automatically from the system. The FIs will use the same system for this project and will complete the required customization by project effectiveness. TKB will have a module for the purposes of Component 1 and will ensure that all transactions related to the RSM would be available for monitoring and reporting in the system.

20. The transactions from the RSM will be executed based on an agreement between TKB and the RSM beneficiaries. The agreements are expected to be signed by the RSM Unit based on an authorization granted by TKB's Board of Directors. The payments from the DAs will be executed by the Financial Affairs Department based on the approval of the corresponding PIUs. TKB's Financial Affairs Department will be responsible for the accounting and reporting for the project. The financial management procedures for the project will be detailed in the OM.

Internal Financial Controls

21. TKB will establish a RSM Unit at its Technological Monitoring and Research Department for the implementation of Component 1. The RSM Unit will be authorized by the TKB's Board of Directors to have the overall responsibility and will benefit from support of the Loans Evaluations Department and other departments. Payments from the RSM will be made against eligible expenditures (defined in the OM). The RSM Unit will review and approve the recommendations of the RSM consultant and will process the payment order.

22. The procedures for the current PSREEE will be adopted for Component 2, with PIUs established in both FIs. In TSKB and TKB, under the PSREE, following the loan approval process, the sub-borrowers withdraw funds from the allocated loan amount upon submission of eligible invoices. The FIs release the funds after the invoices submitted by the sub-borrowers are checked by the relevant technical department and engineers for compliance with the project framework and mathematical correctness.

Reporting and Monitoring

23. The Loan Operations Department in TSKB and the Financial Institutions Department in TKB will be responsible for the preparation of IUFRs which will be prepared semiannually and will be submitted to the World Bank within 45 days after the end of the period. The content and format of the IUFRs will be agreed at negotiations.

External Audit

24. Both TKB and TSKB have their financial statements audited by external auditors in line with the International Standards on Auditing. The auditors of TKB have issued a qualified audit opinion on the bank`s financial statements because of non-consolidation of three of its subsidiaries. TSKB's auditors have issued clean audit opinions. The project financial statements of the PSREEE loan for the year ended December 31, 2014 were also audited and both FIs auditors have issued clean audit opinions on these financial statements. As part of the World 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 World Bank before June 30 of the year following the calendar year in which the first disbursement from the loan has been made.

25. The grant agreement as well as the loan agreements will be signed with the FIs. The continued financial soundness of the banks will be monitored through their annual audited financial statements. Therefore, the entity financial statements of the FIs as well as the project financial statements (that will be prepared separately for Component 1 and Component 2) will be audited by private auditors acceptable to the World Bank in line with the International Standards on Auditing. The FIs have been submitting their entity audit reports as well as the audit reports

for the projects they are currently implementing on time. The audit reports did not include any qualifications or any serious internal control issues.

26. The audited financial statements and audit reports will be publicly disclosed in a manner acceptable to the World Bank. Table 3.1identifies the audit reports and their due dates.

Table 3.1. Due Dates of Audit Reports

Audit Report	Due Date
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 for Component 1	Within six months after the end of each calendar year and also at the closing of the project
Project financial statements for Component 2	Within six months after the end of each calendar year and also at the closing of the project

Disbursements

27. The FIs will open DAs for Component 2 of the project. The FI DAs will only be used for the disbursements from the World Bank loan account and the disbursements to sub-borrowers. The loan will be made available to sub-borrowers 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 used from the DA will be submitted to the World Bank on a semiannual basis and will include a reconciled bank statement as well as other appropriate supporting documents.

28. Payments against sub-loans will be made according to certified statements of expenditures (SOEs). Full documentation in support of SOEs would be retained by the FI for at least two years after the World 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 World 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.

29. TKB will open two accounts (separate from the one that will be opened for Component 2) for Component 1. One will be used for disbursements (CTF DA) and a special account (SA) will be used solely for receipt of success fee payments. All payments for the CTF portion will be made from the CTF DA (except for direct payments). The CTF DA will be ‘replenished’ through Withdrawal Applications submitted by TKB’s Financial Institutions Department. Replenishment requests will be made using the standard forms which will be included as an annex to the Disbursement Letter for the CTF funds. Payments from the DA 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.

30. At the time of signing the RSM beneficiary agreement, RSM beneficiaries will pay the success fee directly to the SA or will submit a bank guarantee letter covering the estimated success fee payments to TKB. The estimated success fee will be 10 percent of the total eligible expenditures defined in the agreement. Amounts accumulated in the SA will be available for financing the program. TKB will use the accumulated funds in the SA if CTF funds are depleted

before the closing date of the project. These funds will be used exclusively for the RSM. TKB will ensure that all documentation relating to outflows from the DA and inflows (outflows if relevant) to the SA are retained for reporting and auditing purposes.

31. **Direct payments.** Payments exceeding the threshold of the DA will be made through direct payments from IBRD upon submission of a Withdrawal Application request, with supporting documentation. The TKB RSM Unit will prepare all supporting documentation and will send the payment request to the World Bank.

32. Standard payment forms and templates to be used by TKB to request payment processing will be provided by the World Bank. These templates may be personalized in line with existing TKB procedures, but should contain the information included in the templates. In line with standard best practices, the RSM Unit will ensure that payments to beneficiaries of the RSM are authorized and requested within two weeks of receipt.

Procurement

33. 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 and 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 and Grants by World Bank Borrowers', dated January 2011 and revised in July 2014 (Consultant Guidelines) and the provisions stipulated in the loan agreements. The 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 (Anticorruption Guidelines) will apply to this project. A General Procurement Notice shall be published for the procurements under the project by TSKB and TKB (FIs).

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

34. Private sector commercial practices will 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 OM for the FIs. Because of the demand-driven nature of the project, it is not possible to estimate either the geothermal concession holders (sub-borrowers) or 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 FIs to develop a Procurement Plan, which provides the basis for the procurement methods. All contracts will be post reviewed by the World Bank as specified in the agreed OM.

B. Risk Sharing Mechanism for Resource Validation (Subcomponent 1.1)

35. Procurement of goods, works, non-consulting, and consulting services for exploration drilling activities by the beneficiaries under Subcomponent 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 paragraphs 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 TA Subcomponent of the Project (Subcomponent 1.2)

36. **Procurement of goods, works, and non-consulting services**. No goods, works, and non-consulting services are foreseen under this subcomponent of the project.

37. **Selection of consultants.** The consultants shall be selected by TKB's RSM Unit for (a) the management of the RSM; (b) the financial audit of the RSM; and (c) the support of the RSM Unit for project management (procurement/contract management, and technical). The employment of RSM Unit 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. If the service is required from a consultancy firm, Quality- and Cost-Based Selection (QCBS) method or Least-Cost Selection method will be applied in accordance with the Section II of the World Bank's Consultant Guidelines. For contracts below US$300,000 equivalent, Selection based on Consultants' Qualification method may be used in accordance with paragraph 3.7 of the Consultant Guidelines. The short list can comprise entirely national consultants, if the contracts with the firms are below US$500,000 equivalent. If additional services are required from the existing consultant or subject to justification of a service needed from a particular consultant, Single-Source Selection method can be used as specified in paragraphs 3.8 through 3.11 of the Consultant Guidelines.

38. **Procurement Plan, methods, and review thresholds.** TKB 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 TKB and the World Bank on June 12, 2016 and will be published on the World Bank's external website after loan negotiations. The agreed Procurement Plan is available in the project files. The Procurement Plan 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 3.1.

Table 3.2. Procurement Packages and Time Schedule for TA Subcomponent

Contract Package	Contract Description	Type	Financing From	Procurement Method	Review Method	Expected Contract Signing Date	Expected Contract Completion Date
Procurements by TKB							
1	Consultancy services for the management of the RSM	CS	CTF	QCBS	Prior	June 2017	December 2022
2	Consultancy services for capacity building and supervision	CS	CTF	INDV	Prior	June 2017	December 2022
3	Procurement specialist (Part-time)	CS	CTF	INDV	Prior	November 2016	May 2018

Note: CS = Consulting Services; INDV = Selection of Individual Consultant.

39. The Procurement Plan includes the procurement methods and review thresholds as well as the project-specific arrangements. The World Bank will review the procurement arrangements performed by TKB's RSM Unit, including contract packaging, applicable procedures, methods, and the scheduling of the procurement processes for its conformity with the World Bank's Consultant Guidelines, the proposed implementation program, and disbursement schedule. The advance contracting of the procurement specialist for the RSM Unit and its retroactive financing would be possible in accordance with paragraph 1.14 of the Consultant Guidelines. Retroactive financing needs for the project will be decided during the loan negotiations. The World Bank's prior review thresholds are provided in the agreed Procurement Plan. The procurements not prior reviewed by the World Bank will be subject to the World Bank's ex post review in accordance with the procedures set forth in Appendix 1 of the Consultant Guidelines on a random basis. One in five contracts of this project's subcomponent will be post reviewed. Post review of the procurement documents will normally be undertaken during the World Bank's implementation support missions or as and when the World Bank may request to review any particular contract.

40. **Procurement capacity and risk assessment.** The procurement capacity assessment concluded that both TSKB and TKB have adequate resources and capacity for implementing the credit line operations of the project through their current credit line PIUs established under the ongoing PSREEE and Innovative Access to Finance Project. However, considering the sector-specific nature of the proposed project, the 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 the FIs/PIUs to evaluate and understand the geothermal project cycle and capacity drilling projects.

41. The above risks will be mitigated, if needed, by (a) training of the FIs' PIU staff by a technical specialist experienced in similar geothermal projects and (b) by close working of the PIUs' staff with the World Bank's experts.

42. The procurement capacity assessment of TKB further concluded that TKB's experience with the World Bank's procurement procedures is limited to overseeing the commercial practices conducted by the beneficiaries under the credit line projects, and it has no experience in carrying out its own procurement through the World Bank's procurement procedures. The TKB RSM Unit will conduct the selection of the RSM consultant and also manage the RSM consultant's contract. TKB staff in the credit line PIU for Component 2 have attended the procurement trainings conducted by the World Bank during the last five years and they are familiar with the World Bank procurement procedures. However, staff in the TKB RSM Unit do not have any experience in the selection of consultants in accordance with the World Bank's Consultant Guidelines. Hence, the procurement risk associated with TKB for the selection of the RSM consultant and management of the resulting contract is substantial.

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

(a) Delay to processing of the RSM and implementation due to lack of proper planning and uncertainties in the responsibilities of different stakeholders

(b) Delay in the implementation of the procurement activities due to lack of experience in TKB's RSM Unit

(c) Contract management problems especially in the RSM consultant's contract due to ambiguities in the roles and responsibilities of the parties

(d) Poor quality of contract deliverables and contractual disputes

44. The above risks will be mitigated as summarized in table 3.2.

Table 3.3. Procurement Risk Mitigation Action Plan

No.	Mitigation Measure	Time Frame
1.	Hiring a procurement expert by TKB experienced in the World Bank's Procurement Guidelines and contract management	Immediately after loan negotiations
2.	Initiate the selection of the RSM consultant at the early stage to ensure that it is in place immediately after the project effectiveness	Immediately after the loan negotiations
3	Close working of the World Bank's procurement specialist with RSM Unit	Throughout the project implementation duration

45. The overall risk rating can be lowered to moderate when the mitigation measures in item 1 and 2 are put in place and further reduced to low when the contract with the RSM consultant is signed and the methodology for the technical review procedure in item 3 is agreed by all stakeholders.

Environmental and Social (including safeguards)

Environment

46. The World Bank will review and provide 'no objection' to all projects assigned as 'category A' in accordance with World Bank procedures before a final decision to fund the subproject can be taken by the FI (mainly TSKB/TKB because some Category A's may be expected under Component 2 only). In the case of Category B subprojects, the first two subprojects will be submitted to the World Bank for review and clearance. Assuming that the ESMF is being implemented by the FI satisfactorily; the next Category B subprojects will be reviewed and cleared by the FI. The World Bank will conduct post review for the Category B subprojects. It should be noted that for all subprojects, the FIs will consult the World Bank for proper environmental risk categorization according to OP 4.01.

47. TSKB and TKB will be the responsible parties for the implementation of their respective ESMFs. Both of them have the capacity for the implementation of their respective ESMFs as well as good knowledge about World Bank safeguard policies. The PIUs in TSKB and TKB will be responsible for implementation of their ESMFs for the capacity drilling and power plant establishment and operation activities. In addition, the RSM Unit in TKB will be supported by the RSM consultant during implementation of the ESMF for Component 1. It is planned that the RSM consultant will also be responsible for reviewing the exploration applications from the project sponsors in line with national and World Bank requirements as defined in this

framework. TKB will be the final responsible party for the World Bank because they will be supervising the RSM consultant.

48. As detailed in the ESMFs, it is expected that Component 1 applications will be reviewed in accordance with the procedures set in the TKB's ESMF by the RSM Unit and their consultant. For Component 2, subprojects will be reviewed by TSKB or TKB for having national environmental clearances and then the necessary environmental assessment documentation in line with ESMF requirements, which will be completed by the sub-borrower.

49. According to the EIA Regulation, the Ministry of Environment and Urbanization monitors and inspects projects that were assessed either 'not to need an EIA' or 'to have a positive EIA' based on provisions specified in the Project Information File or the EIA, respectively. Furthermore, the project proponent is obliged to submit monitoring reports to the Ministry of Environment and Urbanization, which transmits them to the Governorate for disclosure to the public. In addition, the FIs will agree with the subproject sponsors for sharing their ESMP/ESIA monitoring reports (including air emissions, wastewater discharge, and so on and the overall compliance with national regulations and with approved World Bank Environment Assessment documents) with FIs. The FIs will then send these reports to the World Bank on a quarterly basis for InfoShop disclosure.

Social

50. Because the precise locations and the final designs of the subprojects were not completed by appraisal, in accordance with the World Bank's OP 4.12, three RPFs have been prepared by TKB (Component 1 and 2) and TSKB (Component 2). The RPFs, outline in detail the expropriation procedures for land acquisition in Turkey, the World Bank's OP 4.12 policy on involuntary resettlement, a gap analysis, and steps to bridge these gaps and institutional responsibilities. All site-specific social documents prepared for each subproject will be consulted with relevant stakeholders according to the process defined in the ESMF and RPF.

51. During project implementation, TKB (with support from the RSM consultant for Component 1) and TSKB will screen subprojects for financing, ensure the preparation of a post social review and/or RAP as necessary by the private developer and submit for World Bank review and clearance before financing of infrastructure. TKB and TSKB will also oversee and supervise the implementation of these RAPs. TSKB and TKB fully understand the World Bank's social safeguards requirements and have high capacity to monitor social impacts owing to a longstanding relationship with many international finance institutions.

Monitoring and Evaluation

52. For Component 1, the RSM Unit in TKB will be responsible for M&E of project progress, including the relevant intermediate results indicators reflected in annex 1. The RSM Unit will rely on 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.

(a) **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 to ascertain the fulfilment of the conditions and stipulations of the agreements. The RSM consultant will make arrangements for such site visits on behalf of the RSM Unit and will accompany them on monitoring visits.

(b) **Report review.** The RSM consultant shall review the following reports from the beneficiary.

- ESIA Report
- Predrilling 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 TKB. The daily drilling reports will be sent directly to the TKB as well as to the RSM consultant but the consultant shall notify TKB 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.

(c) **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 beneficiary 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 and in individual projects. The status would be reported periodically to the RSM Unit.

53. 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.

54. 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 TKB's RSM Unit. 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; and
- suggestions, if any.

55. For Component 2, the FIs will be responsible for M&E of project progress, including the relevant intermediate results indicators reflected in annex 1.

Role of Partners

56. Implementation of the proposed project will be closely coordinated with EBRD's Geothermal Development Lending Facility, for which a US$25 million from the CTF Dedicated Private Sector Program (DPSP) was approved in January 2015. The Geothermal Development Lending Facility 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 US$100 million of project finance loans for the construction and commissioning of projects successfully developed in Phase I.

57. The design of the proposed project has also taken into account lessons learned from the implementation of the Exploration Risk Insurance for Turkey Project financed by the Global Environment Facility of the International Finance Corporation (IFC) in partnership with Munich Re (this project has now been closed because of delayed progress in the selection of eligible project developers). The World Bank and IFC teams engaged in geothermal development in Turkey will maintain their dialogue to identify any further opportunities for collaboration.

Annex 4: Implementation Support Plan

Strategy and Approach for Implementation Support

1. The strategy for implementation support has been developed based on the nature of the project and its risk profile. It aims to make implementation support 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 World 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 World Bank's team, which will include a geothermal specialist, will provide the required assistance, advice, and guidance to the FIs in implementing the RSM, capacity drilling, and plant construction subprojects. The World Bank's team will conduct site visits alongside the FIs. 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 the FIs to enhance their capacity and contract management efficiency. Implementation support for procurement will follow a risk-based approach and will include (a) support to the FIs in selecting consultants and (b) implementation support to strengthen the procurement mechanisms in both implementing organizations.

5. **Financial management.** As part of its project implementation support missions, the World 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 World Bank will monitor the project's financial management arrangements in the following ways: (a) review the project's semiannual IUFRs 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 World 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 World 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 an annual basis to monitor implementation of safeguards policies.

Table 4.1. Main Focus with Regard to Support to Implementation

Time	Focus	Skills Needed	Resource Estimate (Staff Weeks)
First twelve months	Task management	Sr. energy economist/energy specialists (2)	10
	Technical review of the technical aspects of setting up and implementing the RSM and support of FI in the selection process of subprojects	Geothermal expert	8
	Procurement review of QCBS packages and other procurement activities and review	Procurement specialist	4
	Financial management	Sr. financial management specialist	6
	Environmental supervision	Sr. environmental specialist	3
	Social supervision	Social safeguards specialist	3
12–54 months	Task management	Sr. energy economist/energy specialist	16
	Guidance and implementation support on technical issues	Geothermal expert	10
	Review of procurement documents and procurement guidance	Procurement specialist	10
	Financial management and disbursements	Financial management specialist	6
	Environmental supervision	Environmental specialist	4
	Social supervision	Social development specialist	2

7. The staff skills mix and focus with regard to implementation support is summarized in table 4.2:

Table 4.2. Skills Mix Required

Skills Needed	Number of Staff Weeks	Number of Trips	Comments
Task management	26	Field trips as required	Headquarters and country office 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

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 percent of its electricity generated from gas, 25 percent from coal and lignite, and about 24 percent from hydro.[14] The GoT has set a target of developing 1,000 MW of geothermal electricity generation capacity by 2023. The installed capacity of geothermal in Turkey is presently at 695.337 MW as of June 2016. It is expected that the project will add between 400 and 600 MW 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 in table 5.1.

Table 5.1. Key Assumptions of the Project Economic Analysis

	Unit	Value
Cost Assumptions		
Investment cost	US$	150 million
Operating and maintenance cost (fixed and variable)	US$ per year	5.4 million
Power Generation Assumptions		
Plant capacity factor	%	90
Hours of operation (availability)	hours	7,884
Losses	%	2
MW installed	MW	30
Total MWh generated	MWh per year	217,598
Electricity Assumptions		
EPIA's average market clearing prices - Wholesale	US$ per MWh	60
CO_2 Assumptions		
Weighted average emission for geothermal (direct application and power production)	gCO_2 per kWh	206
(Baseline) Combined margin	gCO_2 per kWh	583
Social value of carbon, base case (2017–2047)	US$ per metric ton	30–65
*Economic discount rate**	%	5
Economic life	Years	30
*Gross domestic product (GDP) (Turkey, 2013)***	US$	10,971

Note: * World Bank Technical Note on Discounting Costs and Benefits in Economic Analysis of World Bank Projects (2015).
** World Bank Group.

Project Development Impact

3. The project's economic impact is assessed based on benefit-cost analysis for a 30 MW power plant. The economic benefits of the project are limited to significant quantifiable benefits and therefore the results regarding the economic NPV and the EIRR should be seen as lower

[14] *Source:* Bloomberg New Energy Finance. Turkey's Changing Power Market – Whitepaper (November, 2014)

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 lifetime 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 it brings to the communities in which it operates 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 (that is, high resource risk) as well as by the long lead time (that is, it can take up to three to four years to confirm the viability of the resource and it takes a minimum of six to seven 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. Because exploration risk cannot be hedged or managed commercially, international experience shows that exploration and resource/field validation phases very often are either partly or entirely financed by concessional or government support. Through the Risk Sharing Mechanism for Resource Validation, 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 FIs for plant construction.

Rationale for World 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 multicountry insurance scheme for East Africa (the African Rift Geothermal Development Program) funded by the Global Environment Facility, 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 World Bank with a unique comparative advantage in structuring an appropriate RSM 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 that will result from the proposed project.

(i) Sales of Electricity by the Geothermal Power Plant

7. Sales of electricity is estimated using the planned installed capacity, the estimated load factor for the projects, and the average projected price of electricity for the life of the plant. It is

assumed the price of electricity is assumed to be US$60 per MWh, which is the wholesale average market clearing price from January 2015 to October 2015.

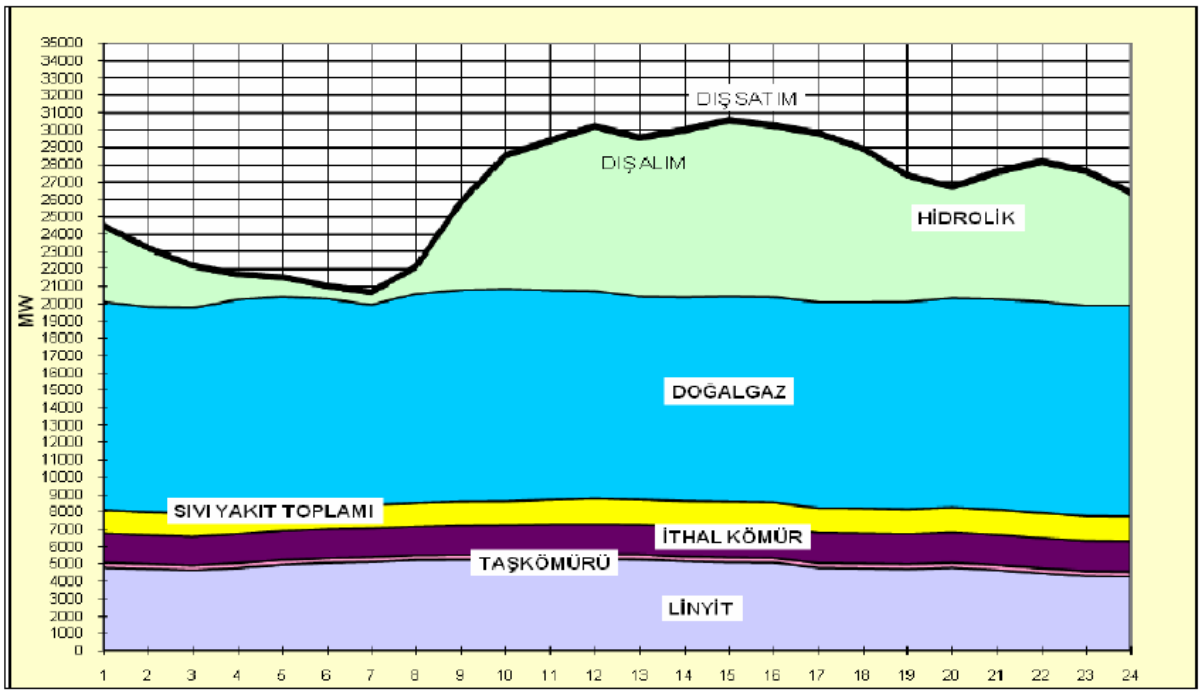
8. The wholesale market clearing price is a conservative value. Because the electricity market in Turkey is competitive, the wholesale market clearing price is a lower bound for electricity prices and represents the willingness to pay for electricity.

(ii) Benefits from Carbon Emissions

9. The project also has the economic benefit of reducing CO_2 emissions when compared to other fossil fuel power plants. The weighted average emission from geothermal energy (from direct use in heating and from power generation) was calculated as 206 gCO_2 per kWh. The combined margin of CO_2 emissions from power generation of 583 kg per MWh was used as a comparator to calculate the net benefit from CO_2 reduction[15] of 394 kg per kWh. This was used to calculate the avoided carbon emissions by replacing power generated from fossil fuel with geothermal energy.

10. 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 energy 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.

[15] *Source:* Turkish Electricity Transmission Company (TEIAS).

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

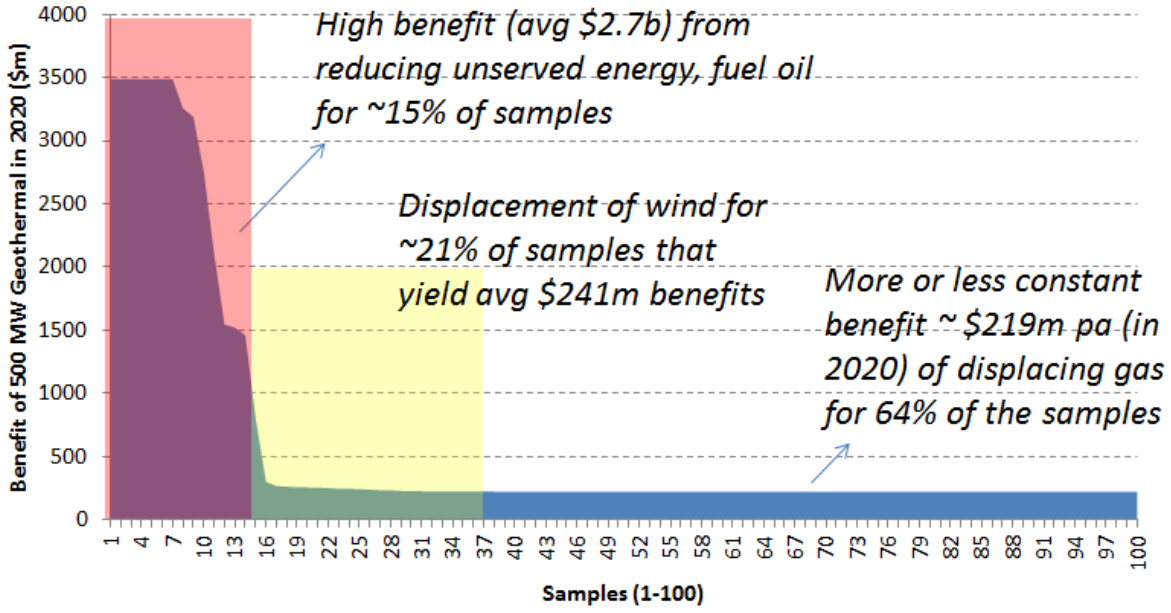
(a) Demand projections vary widely and the high demand is significantly above base/normal scenario projection as shown in figure 1. Given the very low operating cost of geothermal and stable output level, geothermal can play as a good hedge against the high demand growth scenario. If demand is high, geothermal may help to avoid expensive fuel oil or 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 base load geothermal project may have the 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 geothermal energy displacing fuel oil in a significant way as peaking hydro availability may not be ensured.

12. More importantly, any avoided fuel oil and unserved energy is a bonus and one that can, in fact, be substantial for significant uncertainties around demand growth and hydro. The preliminary modelling analysis carried out for 2020 shows there is a 15 percent chance of the geothermal project yielding very high benefits by displacing fuel oil or unserved energy (see figure 2). Annual savings are estimated at US$2.7 billion from such events, even with a 15 percent weight that accounts for US$400 million in additional benefits, that is, over and above the US$200–225 million each year resulting from gas. There is also the potential for the geothermal projects to usefully displace some of the marginal wind projects at an estimated annual benefit of US$241 million each year in 21 percent 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.

13. The benefits of reduced CO_2 emissions were calculated using the social value of carbon estimated at US$15 per tCO_2 for 2015. The social cost of carbon (ranging from US$30 in 2017 to US$65 in 2047) is the base case estimate by the World Bank guidance note.[16] This approach derives the social value of carbon emissions as the present value of expected future damages caused by an additional ton of CO_2-equivalent emitted to the atmosphere in different years. A range of estimates is provided by the Integrated Assessment Models that simulate complex relationships between global climate and economy. These estimates are reviewed in the last Intergovernmental Panel on Climate Change Report of 2014.[17] The approach also incorporates methods to measure the carbon price necessary to achieve a particular climate target. This approach derives the 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 preindustrial temperatures.

Economic Costs

14. 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.[18]

Methodology and Results

15. The project economic analysis was conducted as an analysis of the costs and benefits of investing in geothermal power plants. The economic analysis yielded an NPV equivalent to US$40.5 million and EIRR of 7.6 percent.

Sensitivity Analysis

16. The high CO_2 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 CO_2 reduction. The result of the analysis (table 5.2) showed an unhealthy NPV and EIRR without the additional benefits from CO_2 reduction. The lower range of the social cost of carbon (US$15–40 per metric ton from 2017 to 2047) was also evaluated for sensitivity. A summary of the analysis is presented in table 5.2.

17. It is worth mentioning that the program's NPV is likely to be higher if other positive externalities and indirect benefits generated by the geothermal power plant were taken into account.

[16] *Source:* Turkish Transmission Company (TEIAS).
[16] World Bank guidance note on social value of carbon in project appraisal (September 2014).
[17] Intergovernmental Panel on Climate Change, WGII, Summary for Policy Makers http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf
[18] *Source:* TSKB data.

Table 5.2. Sensitivity of EIRR and NPV to Lower CO_2 Benefits

	Base Case Social Cost of Carbon	Low Case Social Cost of Carbon	Economic Benefits without CO_2 Benefits
NPV (US$)	40.5	20.3	(8)
IRR (%)	27.6	6.39	4.37

18. Calculation of switching values was also conducted. The results presented in table 5.3 show that, in the base case social cost of carbon, a 24 percent reduction of electricity prices would change the investment decision or result in an IRR below cost of capital. Raising unit operating costs (US$ per kWh) by 56 percent and total fixed investment by 37 percent would have the same result. The analysis also shows that a change of approximately 2.65 percentage points in the discount rate is necessary before the NPV becomes zero in the base case social cost of carbon. Table 5.3 summarizes results for the two ranges of social cost of carbon.

Table 5.3. Switching Values

Variable	Base Case Social Cost of Carbon	Low Case Social Cost of Carbon
Electricity price (%)	−24	−12
Discount rate (percentage point)	2.65	1.4
Unit operating cost (%)	56	28
Total fixed investment (%)	37	29

Annex 6: Financial Analysis

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 subproject 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 as follows:

(a) A guarantee in the form of a bank guarantee letter or accessible escrow account for 10 percent of the drilling cost[19] of one well will be provided 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 percent will be paid by the developer for every 'successful' well.

(c) If a subproject is considered a 'failure', the RSM will pay 40 percent of the drilling cost to developers of projects within the administrative boundaries of Aydin, Denizli, and Manisa and 60 percent to developers of projects elsewhere.

(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 subproject and the envisaged use of the geothermal resources.

(e) The cost assumptions for exploratory drilling, as used in the analysis are summarized in table 6.1.

Table 6.1. Cost Assumptions

Item	Description	Amount/Range (US$)
Cost of concession*	Procured from the 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 subsurface data through surface studies, geochemical, and geophysical surveys.	1,200,000
Drilling cost**	Well program scenarios have a combination of slim wells and full-size wells.	1,800,000–4,050,000

Note: * The concession cost will depend on the extent and type of exploratory surveys and studies carried out.
** Drilling costs will differ within the Aegean region and outside. The costs also depend on the well type (slim-hole or full-size wells).

[19] 'Drilling costs' are eligible costs incurred after the developer signs the RSM Agreement.

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 of the drilling program (within and outside the administrative boundaries of Aydin, Denizli, and Manisa), salvage value, and the probability of success. At the exploratory drilling stage, the industry-wide success rate is generally between 30 percent and 80 percent, depending on the existing geophysical evidence. For the present analysis of Component 1, a range of success rates from 80 percent to 30 percent was analyzed. The conservative approach to the probability analysis yielded a weighted average NPV of US$1.38 million and an FIRR of 12 percent. Details of the weighted average of the NPV and IRR of the range of possible scenarios are provided in Table 6.2.

Table 6.2. Summary of Financial Analysis for the RSM (Component 1)

Case Scenarios	Status	Well Program	Region	Market Value of Concession (US$)	Probability of Success	IRR (%)	NPV (US$)
Scenario 1	Successful	4 Well	Aydin/Denizli/ Manisa	20,000,000	80	16	2,000,203
Scenario 2	Failure	3 Well	Aydin/Denizli/ Manisa	8,000,000	70	15	1,168,449
Scenario 3	Successful	3 Well	Other provinces	17,000,000	60	18	2,747,252
Scenario 4	Failure	4 Well	Aydin/Denizli/ Manisa	12,000,000	50	14	1,684,748
Scenario 5	Failure	4 Well	Other provinces	6,000,000	40	5	372,865
Scenario 6	Successful	5 Well	Other provinces	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 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 percent interest rate, success rate (hit ratio) of 70 percent, and a financial discount rate of 15 percent. The assumptions used in the analysis of Component 2 can be found in Table 6.3.

Table 6.3. 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)	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 (US$/MW)	1,500,000
Unit Cost of Well (US$/km)	1,000,000
Investment Period (Years)	3
Weighted Effective VAT (upon above) (%)	15
Economical Life (Years)	30
Concession Fee Assumptions	
Concession Net Total Cost (US$)	16,000,000
Unit Concession Cost (US$/MW)	533,333
Feed-in Tariffs and Operational Cost Assumptions	
First 10 Years Feed-in Tariff (US$/kWh)*	0.105
Sales Price after 10 Years (US$/kWh) = Market Price	0.080
Unit Operating Cost (US$/kWh)	0.025
Financial Assumptions	
Corporate Income Tax Rate (%)	20
Loan Maturity Period (Years)	15
Interest Rate (US$) (%)	5.50
Equity Share (excluding VAT and Interest) (%)	25
Debt/Total Investment (%)	75
Financial Discount Rate (%)	15
Depreciation Period (Years)	30
Cost Assumptions	
Total Investment Cost, Including Cost of Concession (US$)	155,725,000

*Note: *.*

5. A summary of the results of the analysis is presented in table 6.4.

Table 6.4. Summary of Results

FCFE*	
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

Note: * Calculated as operating cash flow minus capital expenditures.

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

7. Geothermal energy presently enjoys a feed-in tariff of US$0.105 per kWh. The GoT also provides an additional US$0.027 per kWh when local equipment is used. The analysis takes a conservative tariff of US$0.105 per kWh. A sensitivity analysis was conducted to determine the

impact of reducing tariffs from US$0.105 per kWh, progressively to US$0.075 per kWh. The FIRR and NPV remain positive despite a reduction of the feed-in tariff to US$0.085 per kWh.

Table 6.5. Sensitivity of FIRR and NPV to Tariff Changes

Tariff (US$/kWh)	0.105	0.095	**0.085**	0.075
IRR (%)	17	16	**15**	14
NPV (US$)	17,048,450	9,570,223	**2,091,997**	(5,386,229)

8. Additional sensitivity analysis was conducted to determine the impact of changes in the loan maturity and grace period. The IRR and NPV remain positive with no significant change.

Table 6.6. Sensitivity of IRR and NPV to Loan Assumptions

Loan Maturity (Years)	**15**	**20**	**25**	**11.5**
IRR (%)	17	16	16	15
NPV (US$)	17,048,450	9,904,180	5,617,618	2,759,910
Grace Period (Years)	**2**	**4**	**6**	**8**
IRR (%)	17	17	17	17
NPV (US$)	13,349,900	13,768,150	14,084,408	14,323,544

Annex 7: Summary Assessment of Financial Intermediaries

TSKB

1. **An assessment of TSKB took place at the appraisal stage based on eligibility criteria in accordance with requirements outlined in OP 10.0.** A detailed confidential appraisal report has been internally filed with summary results presented in table 7.1. These are based on the following sources of information: (a) audited financial statements as of December 31, 2014; (b) written information provided by TSKB; and (c) 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 and 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 TL 369 million, 12 percent higher than 2013, return on equity 17.7 percent, return on asset 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 Management Information Systems	Criterion met

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

Background of TSKB

3. **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. As of 2014, TSKB is the 21st largest bank in Turkey, in asset size. Nearly 78 percent of its total funding is long term (with 91 percent of IFI funding guaranteed by the Turkish Treasury). In addition, its outstanding funding base is composed of 41 percent stemming from IBRD, 30 percent from the European Investment Bank, and the remaining from KfW (9 percent), the Council of Europe Development Ban (7 percent), Inter-American Development Bank (5 percent), IFC (4 percent), AFD (3 percent), and EBRD (1 percent). TSKB had its first Eurobond issuance in the fourth quarter of 2014, of US$350 million, with a five-year term.

4. As of December 31, 2014, its asset size is TL 15.7 billion, placing it as the 21st largest bank in Turkey. It has 334 employees and 2 branches (Izmir and Ankara). About 7 percent of its lending is on lending (apex operations), with the remaining consisting of corporate lending. It is rated 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 of World Bank Projects with TSKB

5. **TSKB is the recipient of three active and four closed lines of credit from the World Bank.** As of November 2015**,** the PSREEE (on lending, IBRD US$550 million, and CTF US$70 million) has disbursed 93 percent and is expected to close in 2016. TSKB completed the Export Finance Intermediary Loan (EFIL) IV additional finance (US$180 million and €87.8 million, on lending, on top of the original US$300 million) in May 2014. In addition, the past World Bank engagements include small and medium enterprise I (US$125 million, originally on lending and 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).

Table 7.2.

TÜRKİYE SINAİ 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
- Trading assets	*8*	*20,543*	*19,561*
- Derivative assets	*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
- Available for sale investment securities		*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**

TKB

6. **An assessment of TKB took place at the appraisal stage based on eligibility criteria in accordance with requirements outlined in OP 10.0.** A detailed confidential appraisal report has been internally filed with summary results presented in Table 7.3. These are based on the following sources of information: (a) audited financial statements as of December 31, 2014; (b) written information provided by TKB; and (c) interviews with senior TKB management.

Table 7.3. Summary of TKB Appraisal

Criterion	Comments
License	Criterion met. TKB was established in 1975.
Owners/Managers 'fit and proper', governance quality	Criterion met. Board members and management team have over 20 and 15-year experience in banking respectively.
Good standing with the BRSA	Criterion met
Capital adequacy	Criterion met. Capital adequacy ratio of 20.4 percent, and 98.17 percent of Tier 1 capital. Leverage ratio of 15.77.
Liquidity	Criterion met
Profitability	Criterion met. The yearly profit for 2014 was TL 46.9 million, 28.1 percent higher than 2013, return on equity 7.3 percent, return on asset 1.2 percent.
Policies and risk management functions	Criterion met
Asset quality and provisions	Criterion met. NPL ratio at 3.41 percent. 20 percent provisioning policy.
Internal audit and controls	Criterion met
Adequate Management Information Systems	Criterion met

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

Background on TKB

8. **TKB is a state-owned, non-deposit taking, development bank.** It was established in 1975 to finance the industrial sector. TKB is the 26th largest bank in Turkey, in asset size. Long-term funding from IFIs constitutes 100 percent of its total funding, with 48.3 percent stemming from the European Investment Bank, 30.6 percent from IBRD, and the remaining from the Council of Europe Development Bank, AFD, Inter-American Development Bank, and Japan Bank for International Cooperation (21.1 percent). In 1985, TKB's first bond issue was as private placement and amounted to JPY7.5 billion. TKB had its first Eurobond issuance in 1989, of US$100 million, with a six-year term. The last bond issue was realized in 1992 and all repayments were made as of June 1999.

9. TKB has 620 employees with a head office in Ankara and one branch in Istanbul.

10. The long-term funding average maturity is 10 years, representing US$2.088 billion with approximately 100 percent guaranteed by the Turkish Treasury. About 61.8 percent of its credit portfolio includes loans to small and medium enterprises, 38 percent corporate loans, and 0.2 percent includes consumer loans and others.

Background on World Bank projects with TKB

11. **TKB is the recipient of one active line of credit from the World Bank.** The PSREEE (on lending, IBRD US$450 million, and CTF US$30 million) has disbursed 54 percent and is expected to close in 2016. In addition, TKB was one of the implementing agencies of the Renewable Energy Project (US$202.03 million lent to the Republic of Turkey, closed 2010).

Table 7. 4. TKB Unconsolidated Balance Sheet

TÜRKİYE KALKINMA BANKASI A.Ş.

Unconsolidated Balance Sheet

(Statement of Financial Position)

(Amounts expressed in Thousands of the Turkish Lira (TRY) unless otherwise stated.)

			THOUSANDS OF TRY					
			AUDITED CURRENT PERIOD (31/12/2014)			AUDITED PRIOR PERIOD (31/12/2013)		
	ASSETS	Disc.	TRY	FC	Total	TRY	FC	Total
I.	CASH AND BALANCES WITH THE CENTRAL BANK	(1)	755	-	755	1.706	-	1.706
II.	FINANCIAL ASSETS AT FAIR VALUE THROUGH PROFIT AND LOSS (Net)	(2)	1	-	1	1.068	-	1.068
2.1	Trading Financial Assets		1	-	1	1.068	-	1.068
2.1.1	Public Sector Debt Securities		1	-	1	1.068	-	1.068
2.1.2	Share Certificates		-	-	-	-	-	-
2.1.3	Financial Assets Held for Trading		-	-	-	-	-	-
2.1.4	Other Marketable Securities		-	-	-	-	-	-
2.2	Financial Assets at Fair Value Through Profit and Loss		-	-	-	-	-	-
2.2.1	Public Sector Debt Securities		-	-	-	-	-	-
2.2.2	Share Certificates		-	-	-	-	-	-
2.2.3	Loans		-	-	-	-	-	-
2.2.4	Other Marketable Securities		-	-	-	-	-	-
III.	BANKS	(3)	34.367	243.299	277.656	163.496	126.246	289.742
IV.	MONEY MARKET PLACEMENTS		283.087	-	283.087	145.569	-	145.569
4.1	Interbank Money Market Placements		-	-	-	-	-	-
4.2	Istanbul Stock Exchange Money Market Placements		-	-	-	-	-	-
4.3	Receivables from Reverse Repurchase Agreements		283.087	-	283.087	145.569	-	145.569
V.	FINANCIAL ASSETS AVAILABLE FOR SALE (Net)	(4)	45.791	26.564	72.355	219.500	2.347	221.847
5.1	Share Certificates		8.037	-	8.037	8.039	-	8.039
5.2	Public Sector Debt Securities		34.282	7.816	42.098	208.242	219	208.461
5.3	Other Marketable Securities		3.472	18.748	22.220	3.219	2.128	5.347
VI.	LOANS	(5)	253.473	2.891.567	3.145.040	282.956	2.475.776	2.758.732
6.1	Loans		192.451	2.891.567	3.084.018	202.443	2.475.776	2.678.219
6.1.1	Loans Extended to Risk Group of the Bank		-	-	-	-	-	-
6.1.2	Public Sector Debt Securities		-	-	-	-	-	-
6.1.3	Other		192.451	2.891.567	3.084.018	202.443	2.475.776	2.678.219
6.2	Loans Under Follow-Up		109.033	-	109.033	124.907	-	124.907
6.3	Specific Provisions (-)		48.011	-	48.011	44.394	-	44.394
VII.	FACTORING RECEIVABLES		-	-	-	-	-	-
VIII.	HELD TO MATURITY INVESTMENTS (Net)	(6)	20.476	-	20.476	29.739	-	29.739
8.1	Public Sector Debt Securities		20.476	-	20.476	29.739	-	29.739
8.2	Other Marketable Securities		-	-	-	-	-	-
IX.	INVESTMENTS IN ASSOCIATES (Net)	(7)	8.415	13.161	21.576	8.111	9.907	18.018
9.1	Accounted with Equity Method		-	-	-	-	-	-
9.2	Unconsolidated Associates		8.415	13.161	21.576	8.111	9.907	18.018
9.2.1	Financial Investments		-	13.161	13.161	-	9.907	9.907
9.2.2	Non-financial Investments		8.415	-	8.415	8.111	-	8.111
X.	INVESTMENTS IN SUBSIDIARIES (Net)	(8)	-	-	-	-	-	-
10.1	Unconsolidated Financial Subsidiaries		-	-	-	-	-	-
10.2	Unconsolidated Non-financial Subsidiaries		-	-	-	-	-	-
XI.	JOINT VENTURES (Net)	(9)	-	-	-	-	-	-
11.1	Accounted with Equity Method		-	-	-	-	-	-
11.2	Unconsolidated Joint Ventures		-	-	-	-	-	-
11.2.1	Financial Joint Ventures		-	-	-	-	-	-
11.2.2	Non-financial Joint Ventures		-	-	-	-	-	-
XII.	FINANCE LEASE RECEIVABLES (Net)	(10)	55	-	55	3	-	3
12.1	Finance Lease Receivables		-	-	-	-	-	-
12.2	Operating Lease Receivables		55	-	55	3	-	3
12.3	Other		-	-	-	-	-	-
12.4	Unearned Income (-)		-	-	-	-	-	-
XIII.	DERIVATIVE FINANCIAL ASSETS FOR HEDGING PURPOSES	(11)	-	-	-	-	-	-
13.1	Fair Value Risk Hedging		-	-	-	-	-	-
13.2	Cash Flow Risk Hedging		-	-	-	-	-	-
13.3	Net Abroad Investment Risk Hedging		-	-	-	-	-	-
XIV.	TANGIBLE ASSETS (Net)	(12)	68.513	-	68.513	64.696	-	64.696
XV.	INTANGIBLE ASSETS (Net)	(13)	1.966	-	1.966	1.627	-	1.627
15.1	Goodwill		-	-	-	-	-	-
15.2	Other		1.966	-	1.966	1.627	-	1.627
XVI.	INVESTMENT PROPERTIES (Net)	(14)	1.067	-	1.067	1.110	-	1.110
XVII.	TAX ASSET	(15)	7.087	-	7.087	6.939	-	6.939
17.1	Current Tax Assets		-	-	-	-	-	-
17.2	Deferred Tax Assets		7.087	-	7.087	6.939	-	6.939
XVIII.	ASSETS FOR ASSET HELD FOR SALE AND HELD FROM DISCONTINUED OPERATIONS	(16)	-	-	-	-	-	-
			-	-	-	-	-	-
18.1	Held for Sale Purpose		-	-	-	-	-	-
18.2	Held from Discontinued Operations		-	-	-	-	-	-
XIX.	OTHER ASSETS	(17)	13.385	1.846	15.231	13.288	1.973	15.261
	TOTAL ASSETS		738.438	3.176.427	3.914.865	939.808	2.616.249	3.556.057

Annex 8: RSM Terms and Conditions

Background

1. The Risk Sharing Mechanism for Resource Validation 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: surface exploration, exploratory drilling, capacity drilling, and project construction (see Box 1 in the main text).

2. Surface exploration includes the geoscientific studies 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 to locate, test, and further define the geothermal reservoir. The exploratory drilling phase represents the highest financial risk to the geothermal program and is therefore the primary focus of the RSM 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 (that is, power generation, spa, greenhouse, and so on).

3. The RSM has been designed to reduce the beneficiary's exploratory drilling risk under a standard three well program by paying up to 60 percent of the average estimated drilling cost of an unsuccessful well located outside the administrative boundaries of Aydin, Denizli, and Manisa, each of which is located within the Aegean region. A coverage ratio of 40 percent will apply for projects located within the administrative boundaries of Aydin, Denizli, and Manisa. Unlike a non-refundable insurance success fee that is paid regardless of the success of a well, the beneficiary will be obligated to pay a 'success fee' calculated as 10 percent of the average estimated drilling cost of the well, only when the well is successful. Payments made under the terms of the RSM beneficiary agreement for both successful and unsuccessful wells will be made after each successive well has been drilled and tested.

4. Although the beneficiary's obligation to pay a success fee is not perfected until certified testing proves a successful well, the beneficiary will be required to provide a success fee payment guarantee. This guarantee will consist of a bank guarantee letter upon which the RSM can draw in the event of nonpayment. The guarantee letter will be in the amount of 10 percent of the estimated value of the qualified drilling expenditures for one well and will be posted before commencement of drilling operations for the three- to five-well program. The beneficiary will be expected to pay the success fee after each successful well is complete and tested, thus allowing the letter of guarantee to remain in place to provide the beneficiary's payment guarantee for each successive drilling.

5. In the event that the beneficiary does not pay the success fee as required under the terms of the RSM beneficiary agreement, the RSM will draw upon the guarantee letter after which the RSM beneficiary agreement will be terminated. The beneficiary shall be obligated to comply with World Bank's Anticorruption Guidelines. These guidelines can be obtained at the following website address:
http://siteresources.worldbank.org/INTLAWJUSTICE/Resources/AnticorruptionGuidelinesOct2006RevisedJan2011.pdf

6. 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 Unit after which the parties will negotiate and agree on the estimated value of the qualified drilling costs to be included for each well under the RSM program.

7. Actual qualified drilling costs based on the beneficiary's proof of expenditure will be tracked by the RSM Unit during the drilling phase. In the event of an unsuccessful well, the RSM will pay the beneficiary 60 percent of the actual qualified drilling costs, up to 60 percent of the estimated value identified in the RSM Agreement (40 percent within Aydin, Denizli, and Manisa). In the event of a successful well, the beneficiary will pay the RSM a success fee equal to 10 percent of the actual qualified drilling costs, up to 10 percent of the estimated value identified in the RSM beneficiary agreement. Simply put, the payout and success fee will be capped as a percentage of the estimate of the qualified drilling costs as identified in the RSM beneficiary agreement.

8. The standard RSM 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 Unit, an optional fourth and fifth well may be drilled based on a 40 percent RSM payout for an unsuccessful fourth or fifth well regardless of its location in the country. In this case, the success fee will be 25 percent.

9. What constitutes a successful well versus an unsuccessful well will be agreed pursuant to specific terms and conditions that will become a part of the RSM beneficiary agreement. All wells shall be drilled to the targeted depth identified in the RSM beneficiary agreement to establish the RSM's obligation to pay for an unsuccessful well. At the sole discretion of the RSM Unit, they may agree with the beneficiary through an official written confirmation that the well is unsuccessful prior to reaching the targeted drilling depth.

10. The RSM reserves the right to implement measures (that is, stimulation) to increase the energy production of an exploratory well before it is 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 successful in the RSM beneficiary agreement, the beneficiary shall be obligated to pay the success fee.

11. The RSM beneficiary agreement will specify unique thresholds for a successful well that 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 in case of two phase wells and a maximum drawdown in case of liquid wells; 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 threshold will be based on measured temperature at a given depth.

12. The RSM consultant will use the template titled 'RSM Well Test Requirements and Threshold Success Values' to guide development of the RSM beneficiary agreement. When completed, this template will establish the threshold requirements for the success of a well in

addition to the means and methods by which certified well testing will be performed. The 'RSM Well Test Requirements and Threshold Success Values' have been included in the OM for Component 1.

13. The RSM beneficiary agreement will include terms under which the agreement will be terminated when well testing proves that two unsuccessful wells have been drilled. To establish the success (or failure) of a well, certified testing must be complete and results analyzed in the context of the threshold success values identified in the agreement. As a result of the time that it takes to perform a certified geothermal well test and analyze the test data, it is anticipated that the beneficiary may choose to commence drilling the next well in the program before the success of the previous well has been established. Therefore, the risk of proceeding with a third well before it is definitively established that at least one of the previously drilled wells is a success shall reside with the beneficiary. At any time during the program, the beneficiary will have the right to terminate the RSM beneficiary agreement after completion of the well currently being drilled and before the start of the next consecutive well identified in the program.

14. TKB's RSM Unit will establish a standardized, quality-based application scoring system before receiving RSM applications. Following the RSM advertisement by TKB, each application will be screened and scored to establish a priority order ranking of completed applications. Incomplete applications will be rejected. To promote geothermal exploration in less developed regions, additional points will be assigned for exploratory drilling programs that fall outside of the Aydin, Denizli, and Manisa administrative boundaries.

15. Applications must be submitted in Turkish with supporting documentation in either Turkish or English. The RSM consultant's recommendations will be in Turkish and English. RSM beneficiary agreements will be drafted in Turkish, which will serve as the official language, after which an English translation will be prepared.

16. At a minimum, the beneficiaries will be required to provide the following information as part of the application:

(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 a 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) A well-documented statement of technical capacity of the legal entity as it pertains to the entity's ability to successfully manage the project

(f) Proof of necessary permits, licenses, and unobstructed rights to the concession

17. The program has been designed to receive applications from potential RSM beneficiaries on a first-come-first-served basis starting in year 2017. The beneficiary's participation in the RSM will be 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 applications. A project that spans past the boundaries of a single concession shall still be limited to three wells with a possible fourth and fifth well to be decided at the RSM's sole discretion.

18. RSM consultant will vet the applications based on a scoring matrix, which includes factors such as the beneficiary's (a) geothermal experience; (b) financial data and pertinent corporate (that is, legal entity that will be party to the RSM Agreement) information; (c) existing geological and surface exploration data for the drilling area; (d) the drilling plan; (e) the cost estimate; and (f) the business plan leading to the threshold success levels which will be compared to the tested output of each exploratory well to establish whether it is a successful or unsuccessful well.

19. Applications will be accepted on a first-come-first-served basis. The worst case RSM payout will be calculated for each additional qualifying applicant that could be allowed into the RSM after which new applications will be constrained based on the likelihood of depleting the RSM grant funding.

20. A preliminary estimate of the RSM consultant's level of the effort to evaluate each RSM application is an average of 12 days. This estimate includes the involvement of a geologist, a geophysicist, a geothermal drilling engineer, a financial analyst, and a geothermal reservoir engineer. If the various disciplines can perform parallel reviews, the 12-day duration may be reduced. Once the technical review is completed, the RSM consultant will draft the RSM beneficiary agreement and provide recommendations for approval of the RSM beneficiary agreements and for payouts associated with unsuccessful wells to the RSM Unit.

21. A technical review process will be undertaken by the RSM Unit with support from geothermal experts hired by TKB, to support the implementation of the RSM. It is anticipated that the review will be completed within 10 calendar days during which any identified issues will be resolved. The technical review will assist in providing 'no objection' as it pertains to the RSM consultant's recommendations for approval of the RSM beneficiary agreements and for payouts associated with unsuccessful wells.

22. TKB's RSM Unit will negotiate with the highest ranked applicants to finalize the RSM beneficiary agreements with the support of the RSM consultant. After the agreement has been drafted to the satisfaction of the parties, the RSM consultant will prepare a formal recommendation for approval of the RSM beneficiary agreement. Upon completion of the review of the recommended RSM beneficiary agreements, the World Bank will be asked for its 'no objection' of the first two recommended agreements. Upon a 'no objection' by the World Bank, the head of the RSM Unit in TKB will be asked for final approval.

23. Information concerning drilling progress will be provided by the beneficiary and monitored by the RSM Unit. Drilling data and test results obtained under this program will be maintained in a confidential RSM database for reference in future projects. TKB will disclose

information on the beneficiaries through its website. The RSM beneficiary agreement will include the type of the information to be disclosed.

24. Before the beneficiary engaging the well testing company, the beneficiary will submit the professional qualifications of the well testing company to the RSM consultant. During the well test, the RSM consultant will conduct site visits to ensure that the well test is performed in accordance with the RSM beneficiary agreement, well test protocol, and specifications. The RSM consultant will also verify through written documentation that (a) the test equipment has been calibrated to the specified standard; (b) test equipment has been set up in accordance with the test protocol; and (c) the testing company is obtaining and recording test data in accordance with the test protocol. Upon completion of each successive well test, the beneficiary will prepare a well test report and submit it to the RSM consultant. Upon receipt of the well test report, the RSM consultant will analyze test results, compare the results to the agreed threshold values for success, and establish whether or not the well is successful or unsuccessful. Based on this analysis, the RSM consultant will prepare a recommendation to the RSM Unit in TKB for RSM payout on an unsuccessful well or for notification of the beneficiary to pay the success fee when the well is successful.

25. Certain regions within Turkey have exhibited high CO_2 emission from geothermal energy applications. Given the environmental impact of CO_2 release to the atmosphere, RSM support in regions where geothermal energy is known to produce high CO_2 shall be at the sole discretion of the RSM Unit. The discretion will be considered in the context of the local geology giving rise to high CO_2 emission, the amount of CO_2 released to the atmosphere under the proposed energy extraction technology, and the financial/technical viability of a CO_2 management plan in the event that high CO_2 is encountered during exploratory drilling.

26. CO_2 emissions predicted to be above 583 g/kWh ('CO_2 Emission Threshold') based on well testing results shall trigger the following RSM beneficiary agreement terms and conditions. For an unsuccessful well that is at or above the CO_2 Emission Threshold, the RSM payout will be made and the program will be terminated. For a successful well that tests above the CO_2 Emission 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 35 business days (or longer upon PIU discretion) to present a viable plan that maintains CO_2 at or below the CO_2 Emission Threshold during project operation. If a viable CO_2 management plan is not produced within the stated time frame, the RSM (at its discretion) may terminate the program and the success fee shall be waived. If a viable CO_2 management plan that does not financially affect the beneficiary's business plan is produced, the success fee shall be paid to the RSM and the program may continue. If a viable CO_2 management plan is produced that financially affects the beneficiary's business plan, the RSM (at its discretion) may waive the success fee or some portion thereof in support of the CO_2 management plan after which the beneficiary at its discretion may continue the program.

27. 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 within and outside of the administrative boundaries of Aydin, Denizli, and Manisa. 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.

Table 8.1. Simulation of RSM usage

Program Cost (Neg # is RSM Payout):		**($37,552,500)**		RSM Facility Cumulative Success Fee / Payout	Cumulative Beneficiary Investment
Total # of Programs Supported:		**20**			
Programs Inside Aydin / Denizli / Manisa	**9**	Programs Outside Aydin / Denizli / Manisa	**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

28. Tables 8.2 and 8.3 identify a possible landscape of RSM exploratory drilling projects performed within and outside of the administrative boundaries of Aydin, Denizli, and Manisa which result in the above referenced number of programs, RSM payouts, and beneficiary investments. 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 ensure 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 provide an indication of how many programs can realistically be supported by the RSM.

Table 8.2. Simulation of RSM usage outside of Aydin, Denizli and Manisa

Programs Outside of Aydin / Denizli / Manisa											
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								
	0	1	0			33.33%	33.33%	($1,980,000)	($1,980,000)	$3,420,000	$3,420,000
2	S	S	S	F	F						
	0	1	1	0	1	60.00%	46.67%	($2,340,000)	($4,320,000)	$11,160,000	$14,580,000
3	S	S	S	F	F						
	0	1	1	0	1	60.00%	51.11%	($2,340,000)	($6,660,000)	$11,160,000	$25,740,000
4	F	F	F								
	0	0				0.00%	38.33%	($4,860,000)	($11,520,000)	$7,290,000	$33,030,000
5	S	S	F								
	1	1	0			66.67%	44.00%	($2,070,000)	($13,590,000)	$5,580,000	$38,610,000
6	F	F	F	F							
	0	1	0	1		50.00%	45.00%	($4,455,000)	($18,045,000)	$11,745,000	$50,355,000
7	S	S	F								
	0	0				0.00%	38.57%	($2,160,000)	($20,205,000)	$5,490,000	$55,845,000
8	F	F	F								
	0	1	1			66.67%	42.08%	($1,620,000)	($21,825,000)	$10,530,000	$66,375,000
9	S	S	F								
	1	0	0			33.33%	41.11%	($3,330,000)	($25,155,000)	$4,320,000	$70,695,000
10	S	S	F	F							
	0	1	1	0		50.00%	42.00%	($2,115,000)	($27,270,000)	$9,585,000	$80,280,000
11	S	S	S								
	0	1	0			33.33%	41.21%	($1,980,000)	($29,250,000)	$3,420,000	$83,700,000

Table 8.3. Simulation of RSM usage inside Aydin, Denizli and Manisa

Programs Inside Aydin / Denizli / Manisa											
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								
	0	1	0			33.33%	33.33%	($1,935,000)	($1,935,000)	$7,965,000	$7,965,000
2	F	F	F	F							
	0	1	1	1		75.00%	54.17%	$202,500	($1,732,500)	$16,402,500	$24,367,500
3	F	F	F								
	0	1	1			66.67%	58.33%	($810,000)	($2,542,500)	$11,340,000	$35,707,500
4	S	F	F	F	F						
	1	0	1	1	1	80.00%	63.75%	$990,000	($1,552,500)	$18,990,000	$54,697,500
5	S	S	F	F							
	1	1	0	1		75.00%	66.00%	($247,500)	($1,800,000)	$11,452,500	$66,150,000
6	F	F	F	F							
	0	1	0	1		50.00%	63.33%	($2,835,000)	($4,635,000)	$13,365,000	$79,515,000
7	S	F	F								
	1	1	1			100.00%	68.57%	$990,000	($3,645,000)	$10,890,000	$90,405,000
8	F	F	F								
	0	0				0.00%	60.00%	($3,240,000)	($6,885,000)	$8,910,000	$99,315,000
9	F	F	F	F	F						
	1	0	1	1	0	60.00%	60.00%	($1,417,500)	($8,302,500)	$18,832,500	$118,147,500

Annex 9: Technical Appraisal

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 worldwide 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 nameplate capacity and load factors are typically well above 90 percent.

- 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 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; an RSM 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 RSM 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. The higher coverage provided for projects outside the Aydin, Denizli, and Manisa is intended to stimulate investments in geothermal exploration in the less explored parts of the country.

4. 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 Unit in TKB will contract international geothermal consultants who 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 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 database developed as a part of this project. All this will 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 and TKB engineering teams and by expert consultants who will be contracted when the need 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 CO_2 content, resulting in CO_2 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 CO_2 emissions from geothermal power plants anthropogenic or not. Italy, for instance, does not include CO_2 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 CO_2 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 CO_2 emissions so as to avoid the average emission factor for the Turkish grid from being surpassed. To this effect, a termination clause in the RSM beneficiary agreements will be triggered if the CO_2 content in the geothermal fluid encountered in wells drilled under the RSM will be so high that it will result in emissions above the grid emission level upon power production. Wells drilled outside the Menderes and Gediz Grabens are expected to encounter fluids with lower CO_2 content and it is expected that higher RSM coverage of wells drilled in those areas will tend to encourage development of these lower CO_2 geothermal resources.

8. Similarly, the loan facility will prioritize projects with estimated net emissions below the grid emission factor for 2014, that is, 583 g/kWh. For projects with predicted emissions above this level, the investors will be required to monitor and report CO_2 emissions from their projects following the Clean Development Mechanism throughout the lifetime of the project. Furthermore, the investors will need to commit to exploring the economic and technical feasibility of using technologies that prevent atmospheric emissions of CO_2, either by using closed-loop pumped binary systems or CO_2 capture for industrial or agricultural uses. For

projects involving energy conversion technologies that result in CO_2 emissions, the investors will need to justify why they choose not to use non-emitting technology, that is, closed-loop pumped binary system. Table 9.1 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 CO_2 emissions, as the gas remains dissolved and is reinjected with the brine after passing through the power plant (see table 9.1). 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 of 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 CO_2 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.

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.

Table 9.1 Technical Options for CO_2 Emissions Mitigation in Geothermal Projects

Resource Characteristics			Technical Options	
Temp. range	Energy extraction technology	CO_2 State	Technical Constraints	CO_2 Capture Options
<150 - 180°C	Pumped binary *At least one plant of this type planned in Turkey*	Remains in liquid phase and reinjected with brine	• 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	• Capture not needed – gas remains dissolved in brine
160 – 220°C	Two phase binary *Most common technology in Turkey*	Exits heat exchanger at 3 to 7 bar pressure – released to atmosphere unless captured	• 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	• Relatively high gas exit pressure favorable for gas capture • Proven technologies exist to capture, compress and clean geothermal CO_2 for use in food, industrial process or agricultural applications • Capital cost for capture and treatment of geothermal CO2 to beverage or food grade for a 50 MW power plant emitting 50 t CO_2/hr is of the order of 32 million USD • Capture of 50 t CO_2/hr and treatment to beverage grade consumes about 5 MW_e • 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 tCO_2/hr) is of the order of 12 million USD • Reinjection of 50 tonne/hr of gas consumes 3 MW_e
>220°C	Condensing/flash *Only one plant in Turkey utilizing this technology*	Exits condenser at 0.03 to 0.07 bar – released to the atmosphere unless captured	• High gas content reduces efficiency making two phase binary more suitable option even at temperature above 220°C	• 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 but more power is needed for compression

Annex 10: Clean Technology Fund

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*
Geothermal energy capacity confirmed (MW equivalent)	208**	208	1,000
Geothermal electricity generation capacity installed [MW electrical]	0	110	
Potential for GHG emissions reduced or avoided*** - Tons per year [tCO_{2eq}/year]	650,927	650,927*****	3,389,87
- Tons over lifetime of the project**** [tCO_{2eq}]	19,527,801	19,527,801	101,696,150
Financing leveraged through CTF funding [US$, millions]	US$318******	US$931.5 million, of which: US$62.5 million TSKB and TKB US$619 million private US$250 million IBRD	US$4,502 million
CTF leverage ratio [1:X]	1:9	1:16	1:113
Cost effectiveness - CTF cost effectiveness [US$ CTF/tCO_2 avoided over lifetime of the project]	5.1	n.a.	n.a.
- Total project cost effectiveness [US$ Total Project/tCO_2 avoided over lifetime of the project]	53.4	n.a.	n.a.
Other co-benefits	• Development of local industry • Employment opportunities • Improved energy security • Environmental co-benefits		

Note: * The GoT has set a target of developing 1,000 MW of geothermal by 2023 (National Renewable Energy Action Plan, 2014).
** Resources expected to be confirmed through exploration drilling with support from the RSM.
*** This potential for emissions reductions will be fulfilled if all the geothermal resources confirmed through the successful exploration drilling projects supported under Component 1 are developed into power plants and direct applications, which would generate the actual emission reductions. The majority of those projects will be commissioned after the GDP has closed.
**** Assumes a lifetime of 30 years for geothermal projects.
***** No additional emission reductions are claimed from the capacity added under Component 2 of the project. This is because the precise nature of the investments which will be financed by sub-borrowers under Component 2 is still unknown and attribution difficult ex ante: (a) they will likely include investments resulting in emissions both below and above the baseline; (b) some will also be a continuation of projects initiated by Component 1.

****** Estimate of financing leveraged is calculated as the direct private cofinancing from Component 1; and 40 percent of total financing for capacity drilling under Component 2. No leveraging attribution has been made for power plant construction under Component 2.

Introduction

Country and Sector Context

1. Turkey's economic performance since 2000 has been impressive, both before and after the 2008–09 global financial crisis. Macroeconomic and fiscal stability were at the heart of its economic performance, enabling increased employment and labor incomes, making Turkey an upper-middle-income country as well as the world's 17th largest economy. However, developments since 2012 raise concerns about Turkey's capacity to sustain progress toward the twin goals of poverty reduction and shared prosperity. Economic growth has slowed, per capita income has stagnated around US$10,000 per year, and unemployment is inching upward. Moreover, Turkey's macroeconomic achievements have recently been challenged by an uncertain economic and political outlook. The Government will need to take strong reform measures to address continuing structural vulnerabilities, revitalize private investment, boost growth, and resume Turkey's convergence with Europe. Only by boosting productivity growth and creating enough high-productivity jobs to accommodate a rapidly growing labor force will Turkey be able to continue to reduce poverty and share prosperity. The Government continues to take action on the reform agenda to include promoting investments and research and development, improving social security and the pension system, establishing a national welfare fund as well as housing account schemes, and reforming the labor market.

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 GoT's core energy policy priority. In this context, the GoT 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 US$0.105 per kWh for geothermal power, for a 10-year period from the commissioning date; with an additional US$0.027 per kWh to reward the use of locally produced equipment.

3. Besides the enhanced regulatory framework, the exploration activities conducted by the MTA have been a critical driver behind geothermal development in the country. Established in 1935, the 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 the MTA in the 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 with early stage geothermal exploration, including exploration drilling. This has resulted in a significant slowdown in new geothermal exploration activities because 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 (that is, 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 GoT 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 ways to ensure significant scaling up of investment in the sector. CTF contingent recovery grant resources would allow the GoT to pilot the proposed RSM, 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 RSM 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 DPSP

5. The GoT has obtained approval from the CTF Trust Fund Committee for US$40 million contingent recovery grant resources from the utility-scale DPSP. 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 (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 an RSM, capitalized by a CTF contingent recovery grant, and the geothermal developer (that is, 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 predefined percentage of the drilling expenditures incurred by the license holder. This percentage will be 40 percent for projects located within the administrative boundaries of Aydin, Denizli, and Manisa 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 the MTA. It is expected that the RSM will be able to support about 20 resource validation projects. The TKB will be the implementing agency for the RSM. This component will also finance TA activities to address relevant capacity-building needs within the RSM implementation unit in TKB.

7. The second component, a Loan Facility for Resource Development (US$312.5 million total; US$250 million IBRD loan, US$62.5 million TSKB and TKB cofinancing), 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 (a) the capacity/production drilling stage and (b) the steam gathering and power plant construction stage. This component will capitalize a credit line to the TSKB and the TKB who will on lend at market rates, but offer longer tenors than what are 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 (that is, the project sponsor) will be required to publicly disclose basic information about the potential project including sponsor, location, expected capacity, and basic investment outline to expand the financing opportunities and 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 RSM under Component 1.

Assessment of Proposed Project with CTF Investment Criteria

Potential for GHG emissions savings

9. The project will result in a net reduction of CO_2 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 and consider that no emission reductions will be generated from the investments financed under the IBRD credit lines in Component 2. The CO_2 emission reduction potential for the project is calculated based solely on the estimated geothermal potential that will be confirmed through the RSM in Component 1. Assessment of potential power generation and direct applications of the project yield an emissions reduction potential of 650,927 tons of CO_2 per year and a total of 19.5 million tons of CO_2 emissions reductions over 30-years lifetime, which is average for geothermal power plants and direct use applications.

10. **Assumptions.** The CO_2 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). This potential for emissions reductions will only be fulfilled if all the geothermal resources confirmed through the successful exploration drilling projects supported under Component 1 are fully developed into power plants and direct applications, which would generate the actual emission reductions. Full development of all these resources is not expected to happen during the project implementation period. In the project scenario, CO_2 emissions were estimated using an average emission factor from geothermal energy facilities in Turkey (power and direct use) estimated at 206 gCO_2/kWh.[20] In the baseline

[20] Mertoglu, Orhan, Sakir Simsek, and Nilgun Basarir. 2015. "Geothermal Country Update Report of Turkey (2010–2015)", *Proceedings World Geothermal Congress 2015*, Melbourne, Australia, 19–25 April 2015.

scenario, CO_2 emissions were estimated based on the combined margin grid emission factor of 583 gCO_2/kWh taken from voluntary C market Gold Standard Projects in the Turkey portfolio.[21] The load factor for electricity generation facilities was assumed as 90 percent and direct applications 45 percent.

Cost-effectiveness

11. CTF cost-effectiveness ratio is 5.1, calculated as the ratio of US$ CTF per tCO_{2eq} avoided over the lifetime of the project. Total project cost effectiveness (total CTF project cost per tCO_{2eq} reduced/avoided) is estimated at US$48.3 total per tCO_2. 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 (MAC) will be well below US$200 per tCO_2.

MAC

12. In October 2013, the CTF Trust Fund Committee suggested providing information on the estimated MAC for projects for which the MAC is likely to exceed US$100 per tCO_2. This decision draws from the CTF criteria which specifies that CTF cofinancing will not be available for investments in which the marginal cost of reducing a ton of CO_2 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 US$200 threshold value per tCO_2. In fact, the MAC for the project should be lower than US$48.3 per tCO_2. This is an overestimation of the MAC, as several economic benefits were not included to estimate 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.

$$MAC = \frac{NPV}{LCO2}$$

where NPV stands for Net Present Value and LCO_2 stands for Lifetime CO_2 emissions savings.

Demonstration Potential at Scale

14. **Scope for avoided annual GHG emissions through replication.** Potential emissions savings that would result if the CTF cofinanced 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 CO_2 per year, that is, 18 percent of 2012 electricity and heat production related CO_2 emissions of the country. The proposed project will additionally contribute to a reduction in other emissions than GHG emissions related to conventional electricity generation, like emissions of sulfur dioxide, nitrogen oxides, and particulates.

[21] 2014 Turkey baseline - Gold Standard Turkey Regional Office (2013–2011, 75 percent of operating margin [639] + 25 percent of build margin [413]).

15. **Transformation potential.** The proposed RSM 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 learned 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 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 to realize the geothermal potential. Higher coverage provided for projects outside the Menderes and Gediz Grabens is intended to stimulate investments in geothermal exploration in the less explored parts of the country and support developers who are willing to take higher risks. Thus, the proposed project can stimulate long-term changes in the geothermal market through facilitating new players in the geothermal market and 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 the improvement of industry practices, including technical, contractual, environmental, and social, required by both 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 environment friendly form of energy with insignificant 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 (for example, surface exploration) or drilling (for example, 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 through 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 estimated that approximately 860 different people with a wide range of skills are employed over the development cycle in a typical 50 MW geothermal project. Approximately two people per MW are involved during the drilling phase.[22]

Implementation Potential

21. **Public sector support for geothermal development.** Maximizing exploitation of domestic primary energy resources and securing sufficient, reliable, and affordable energy for 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 percent 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 mechanisms for electricity produced from renewable energy sources.

22. In this context, the GoT 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 30-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, 30-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 US$0.105 per kWh for geothermal power, for a 10-year period from the commissioning date; with an additional US$0.027 per kWh to reward the use of locally produced equipment.

23. The Government also facilitated access to renewable energy financing provided by IFIs such as the 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 cofinancing.** Private sector leverage was calculated using a conservative approach assuming that not all the projects financed under Component 2, but only 40 percent 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 include cost of concession. Investment costs for direct use were taken from International Energy Agency data. Financing leverage through US$39.8 million CTF funding is estimated at US$377 million, providing a leverage ratio of 5.1 for the case using above assumptions about Component 2.

[22] Geothermal Energy Association. 2010. *Green Jobs Through Geothermal Energy*.

CTF Additionality

25. The CTF 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 prerequisite to mitigate the geothermal risk. Multiple support mechanisms have been experimented with across the world, but, measured by 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 the 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, because the MTA has very limited additional geothermal exploration activities planned, with its strategic focus now concentrated in the exploration of the country's mineral resources, the entire exploration risks in licensed areas that have received little or no previous investments by the 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. The CTF contingent recovery grant resources will allow the GoT to pilot an innovative RSM under which the risk of exploration and confirmation drilling will not be fully taken on by the public or private sector (that is, 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 success fees 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 a key element of the proposed RSM component and 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 CO_2 is encountered during exploratory drilling also will create awareness and additional action in the projects compared to business-as-usual practice.

Implementation Readiness

30. TKB, the responsible implementing agency for the RSM, the CTF-financed component, will establish a RSM Implementation Unit (RSM Unit) staffed with a project coordinator, seven geothermal experts, a procurement specialist, a financial management specialist, and an environmental and social specialist. TKB will hire a consultant ('RSM consultant') to provide support to the RSM Unit in implementing and managing the RSM. The RSM consultant will carry its work on behalf of TKB and under the supervision of the RSM Unit. 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 OM for Component 1, which details functioning of the RSM as well as the responsibilities of TKB, the technical review process, and the RSM consultant, has also been finalized.

31. It is expected that the RSM will be able to receive applications about nine months after project effectiveness. The pre-application and application process is then expected to take about six months, which would be concluded with the signature of RSM legal agreements with beneficiaries. Implementation of the individual subprojects (that is, exploration/confirmation drilling, and well testing), including submission and revision of claims, would be completed in about 18 months.

32. TSKB and TKB will be the FIs that will implement Component 2. Both TSKB and TKB are 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. This is based on their technical strength, track record in renewable energy development, and significant experience in implementing national and World Bank policies in environmental and social safeguards. TSKB and TKB will rely, on a needs basis, on consultants for technical assessment, due diligence, and monitoring of investments 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 17 local drilling companies that together have a total of 30 rigs suitable for geothermal drilling in the country. The success rate of geothermal drilling in Turkey has been above the world average and drilling cost is very low compared to the rest of the world (US$3 to 3.5 million for a full size production well of 2,500 m). There are 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
PROVINCE CAPITALS*
NATIONAL CAPITAL
RIVERS
MAIN ROADS
RAILROADS
PROVINCE BOUNDARIES*
INTERNATIONAL BOUNDARIES
*Province names are the same as their capitals.
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TURKEY
Black Sea
Mediterranean Sea
Sea of Marmara
Gulf of Antalya
BULGARIA
GREECE
GEORGIA
RUSSIAN FEDERATION
ARMENIA
AZER-BAIJAN
AZER.
ISLAMIC REP. OF IRAN
IRAQ
SYRIAN ARAB REPUBLIC
ANKARA
Istanbul
Izmir
Bursa
Adana
Konya
Antalya
Kayseri
Sivas
Erzurum
Trabzon
Samsun
Diyarbakir
Gaziantep
Malatya
Van
Lake Van
Agri Dagi (5166 m)
Kuzey Anadolu Daglari
Toros Daglari
0 50 100 150 200 Kilometers
0 50 100 150 Miles
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