

PROJECT INFORMATION DOCUMENT (PID)
APPRAISAL STAGE

Report No.: PIDA3303

Project Name	Ethiopia Geothermal Sector Development Project (P133613)
Region	AFRICA
Country	Ethiopia
Sector(s)	Other Renewable Energy (80%), Transmission and Distribution of Electricity (20%)
Theme(s)	Infrastructure services for private sector development (100%)
Lending Instrument	Specific Investment Loan
Project ID	P133613
Borrower(s)	FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
Implementing Agency	Geological Survey of Ethiopia, Ethiopian Electric Power Corporation
Environmental Category	A-Full Assessment
Date PID Prepared/Updated	27-Mar-2014
Estimated Date of Board Approval	29-May-2014
Decision	
Other Decision	

I. Project Context

Country Context

Ethiopia is a large and diverse country. It is located in the Horn of Africa and is a land-locked country with an area of 1.1 million square kilometer—about the size of France and Spain combined. Its bio-physical environment includes a variety of contrasting ecosystems, with significant differences in climate, soil properties, vegetation types, agricultural potential, biodiversity and water resources. Ethiopia is a country of many nations, nationalities and peoples, with a total population of 91.7 million (2012) . Only 17 percent of the population lives in urban centers, the great majority of them in Addis Ababa. At a current annual growth rate of 2.6 percent, Ethiopia’s population is estimated to reach 130 million by 2025, and is projected by the United Nations (UN) to be among the world’s top ten, by 2050. Ethiopia is vulnerable to terms of trade shocks from international food and fuel prices, and to large domestic weather-related shocks as the 2011/12 East Africa drought demonstrated.

Ethiopia has experienced strong economic growth over the past decade. Economic growth averaged 10.7 percent per year in 2003/04 to 2011/12 compared to the regional average of 5.4 percent. Growth reflected a mix of factors, including agricultural modernization, the development of new export sectors, strong global commodity demand, and government-led development investments. Private consumption and public investment have driven demand side growth, with the latter assuming an increasingly important role in recent years. On the supply side, growth was driven by an expansion of the services and agricultural sectors, while the role of the industrial sector was relatively modest. More recently

annual growth rates have declined slightly, but still remain at high single-digit levels. Growth in the export of goods has also moderated in recent years and a decline was observed in 2012/13 for the first time since 2008/09. There have been bouts of high inflation in recent years and, while inflation is currently much lower, keeping it down remains a major objective for monetary policy.

Ethiopia is one of the world's poorest countries, but has made substantial progress on social and human development over the past decade. The country's per capita income of US\$370 is substantially lower than the regional average of US\$1,257 and among the ten lowest worldwide. Ethiopia is ranked 173 out of 187 countries in the Human Development Index (HDI) of the United Nations Development Program (UNDP). However, high economic growth has helped reduce poverty, in both urban and rural areas. Since 2005, 2.5 million people have been lifted out of poverty, and the share of the population below the poverty line has fallen from 38.7 percent in 2004/05 to 29.6 percent in 2010/11 (using a poverty line of close to US\$1.25/day). However, because of high population growth the absolute number of poor (about 25 million) has remained unchanged over the past fifteen years. Ethiopia is among the countries that have made the fastest progress on the Millennium Development Goals (MDGs) and HDI ranking over the past decade. It is on track to achieve the MDGs related to gender parity in education, child mortality, HIV/AIDS, and malaria. Good progress has been achieved in universal primary education, although the MDG target may not be met. The reduction of maternal mortality remains a key challenge.

The Government of Ethiopia is currently implementing an ambitious Growth and Transformation Plan (GTP) 2010/11-2014/15, which sets a long-term goal of becoming a middle-income country by 2023, with growth rates of at least 11.2 percent per annum during the plan period. To achieve the GTP goals and objectives, the Government of Ethiopia (GoE) has followed a “developmental state” model with a strong role for the government in many aspects of the economy. It has prioritized key sectors such as industry and agriculture, as drivers of sustained economic growth and job creation. The GTP also reaffirms the government's commitment to human development. Development partners have programs that are broadly aligned with GTP priorities.

Sectoral and institutional Context

Energy Sector Achievements in the Last Decade

Since the implementation of the last five year plan, the electricity sector in Ethiopia has been growing at a rapid pace. More than 41 percent of rural towns and villages were connected to the grid and the number of consumers connected grew from 800,000 in 2005, to more than 2.1 million in 2012. With the increase in access, demand for electricity also increased. Average demand growth rate of electricity was above 15 percent per annum during 2005-2010 (about 25 percent and 32 percent, in FY2010 and FY2011, respectively). This growth in demand has outpaced the increase in electricity generation and transmission capacity expansion.

To address the supply shortfall caused by the rapid increase in access and demand, the GoE undertook several short term measures. GoE imposed a moratorium on connecting new consumers from late 2008 to 2010 to manage the rapid increase in electricity demand. Demand side management initiatives including free distribution of about 5 million CFL lamps to replace incandescent lamps were undertaken which reduced the peak demand by 80MW within a short period. Electricity supply to households and industrial consumers was rationed and the sector rented expensive emergency fossil fuel fired thermal plants to bridge the gap between supply and demand.

The Ethiopian Electric Power Corporation (EEPCo), the vertically integrated utility commissioned three large hydro power plants in 2010 to augment supply over the long term. The commissioning of Tekeze (300 MW), Gibe II (420 MW) and Beles (460 MW) power plants increased EEPCo's power generation

capacity from about 850 MW to above 2,000 MW. In FY2011, EEPCo's peak demand was around 1,100 MW which was well within its increased capacity. EEPCo further embarked on an aggressive demand side management by replacing existing incandescent lamps with CFLs, a continuation of the initiative undertaken in 2009.

Institutional Restructuring to Transform the Sector

Number of consumers in EEPCo almost tripled since 2005. The generation capacity doubled over the same period. This steep growth brought in management capacity constraint in EEPCo, a vertically integrated utility. EEPCo's failed to populate its new accounting software incorporating information of the fast growing new consumers and existing consumers. This introduced differences in EEPCo ledger balance with EEPCo billing statements since 2006. The differences only grew over the years and till date couldn't be reconciled. Auditors started to close EEPCo accounts with qualifications as in addition to differing revenue values, they failed to verify physically EEPCo assets recorded in its assets register. As EEPCo accounts lost reliability, it failed to justify tariff revisions. The last tariff revision was in 2006, which set tariff at equivalent to US\$ 0.06/kWh. EEPCo tariff remained same over the years in Birr/kWh, and as Birr devalued over the years significantly, at present average electricity tariff in Ethiopia is below US\$ 0.03/kWh. This tariff level didn't allow EEPCo to operate as a sustainable business entity. GoE however, was reluctant to revise EEPCo tariff without getting reliable information on its performance efficiency level and without improving its management capacity.

GoE restructured EEPCo in December 2013 to transform the sector. The Ethiopian Electric Power Corporation (EEPCo) was unbundled in two public enterprises, namely Ethiopian Electric Power (EEP) and Ethiopian Electric Utility (EEU), with the objective to create modern entities capable of providing efficient, reliable and quality services. According to the Regulations approved by the Council of Ministers, EEP will be responsible for construction and operation of the power generation and transmission part of the sector, while EEU will be responsible for construction and operation of power distribution and sales. Both these enterprises will report to the same Board that used to control EEPCo. Both EEP and EEU have finalized their staffing organogram and have filled their respective management positions following a competitive selection process. At present selection is ongoing to fill up the technical positions, which is expected to complete by June 2014. In the meantime, until, staffs are selected to their respective positions, all EEPCo employees have been requested to continue to work in their respective positions in order to continue the day to day operations. The balance sheets of the enterprises are not yet finalized and GoE plans to split EEPCo accounts to these new organizations after reviewing all of its audit qualifications. It is expected that GoE will either ensure that the qualifications are resolved or written off to allow the newly established entities to start operation with clean balance sheets. To help GoE support in this transition period, which is estimated to last for about thirty months, a management contractor has been appointed.

To introduce modern utility practices in these two new institutions, the GoE has engaged a Management Contractor. In August of 2013, the GoE signed a management contract with the Power Grid Company of India (PGCI) for period of two and a half years. The scope of management contract includes the generation and transmission operation that falls under the responsibility of EEP and all aspects of distribution that falls under the responsibility of EEU. During this transition period while the management contract is in place, EEP management will only be responsible for the generation and transmission projects that are under construction. As GoE provides direct capital subsidy to the Universal Electricity Access Program (UEAP) which falls under the control of the EEP, therefore EEP will retain the responsibility for constructing the rural distribution network. More detail discussion on this institutional reform is covered in Annex 2.

GoE established Ethiopian Energy Authority (EEA) through Energy proclamation 810/2013 published on January 27, 2014 and replaced the former Ethiopian Electric Agency established by the 1997 proclamation. The new EEA covers the electricity as well as energy efficiency activities. The new EEA is authorized issue and renew license to operators on all segments of electricity operation – generation, transmission, distribution, sales, exports and imports. However on national grid tariff, its authority remains as previous Agency where it can only recommend to GoE for tariff approval. The EEA is governed through a Board of Directors and has specific power to approve the regulatory directives as well as proposals related to “off-grid national” tariffs determination guidelines, national energy efficiency strategy and program, model PPA and network agreements.

Energy Sector Development in the Next Five Years

Within the context of the GTP, the energy sector strategy calls for further expansion of sector and large scale investments in energy infrastructure. To achieve a target of 11 percent GDP growth over the next five years, the GoE intends to promote the rapid development of the industrial and service sectors, expand electricity coverage universally and become a regional power hub. Consequently, the domestic demand for electricity is expected to grow by above 25 percent per year. To keep up with the anticipated demand, the GoE wants to harness the abundant renewable energy resources available in Ethiopia (about 45,000 MW hydro potential, 5,000+ MW geothermal potential and 5,000 MW wind power potential). The GoE is investing in additional generation capacity with several new large hydropower projects under various stages of construction (target of 8,000 MW of installed capacity by 2015) and plans to exploit other renewable resources such as geothermal and wind.

To address the challenge of low access rates, the GoE plans to scale up grid connectivity as well as expand off-grid energy programs. According to the GTP, the target is to expand the coverage of electricity services to 75 percent of towns and villages and to increase the number of consumers connected to the grid to 4 million by 2015. The GoE plans to expand the grid through intensification programs. It also plans to increase the adoption of off-grid renewable energy and energy efficiency products for households who are unable to afford the cost of grid connection, or are far from grid connected areas.

The anticipated increase in domestic and export demand as well as the associated investment in supply will mean that the energy sector in Ethiopia will continue to grow at a rapid pace in the coming years. GoE has plans to ramp up electricity exports - the Djibouti interconnector was commissioned in 2011, Sudan started to import electricity from 2012, and Kenya is expected to start importing from 2017.

The Bank will continue to support the GoE in its efforts to develop the energy sector to realize its development goals. The Bank has financed or financing transmission infrastructure to facilitate regional energy trade, specifically, the Ethiopia – Sudan transmission interconnection, which is now operating and the transmission interconnection between Ethiopia and Kenya, which forms the backbone of East Africa Power Pool (EAPP). The latter project is co-financed by African Development Bank (AfDB) and French Development Agency (AFD). The Bank financed projects under implementation support: (i) electricity access for rural people in Ethiopia, through grid based and off grid based solar home systems and modern lighting initiatives; (ii) renovation of the urban distribution networks in the 8 largest cities in Ethiopia to increase efficiency, reliability and capacity of the network capacity, and (iii) capacity building. Development of the existing geothermal resource potential is the next step in the GoE’s energy sector expansion strategy.

Diversification of generation resources is an essential part of the expansion strategy. At present, more than 97 percent of Ethiopia’s electricity generation is derived from hydropower resources, and is

entirely dependent on rainfall. Rainfall in Ethiopia has wide seasonal variation and is further vulnerable to fluctuations due to climate change. So with drought in any one year, its full hydropower capacity is exposed to substantial production risk. In order to ensure reliability of clean electricity for the expansion of access and regional power trade, the GoE plans to scale-up the exploitation of geothermal resources. This would not only improve energy security and economic development for Ethiopia, but will also enhance climate resilience and development of a green economy. Availability of geothermal generation will change the dispatch mix in Ethiopia, where base load could be supported by geothermal energy and peak load by hydropower. This will not only increase Ethiopia's ability to reliably export electricity to neighboring countries with similar or different peak demand period compared to Ethiopia, but will also increase its ability to increase access domestically and ensure reliable supply of electricity.

GoE's Climate Resilient Green Economy (CRGE) Strategy requires Ethiopia to have at least ten percent non-hydro renewable energy to optimize generation mix. This will ensure availability of sufficient energy resources throughout the year for economic growth and access enhancement. To this end, increased exploration and exploitation of geothermal resources and developing power plants based on geothermal resources, which is the second largest renewable energy resource in Ethiopia, is critical.

Developing countries usually find it challenging to raise funds for test drilling and well testing given the high risk profile of the geothermal projects at the initial stage of development. Even when developing a geothermal project through private sector, initial investment cost to confirm the geothermal resource is usually financed through high cost equity. If the electricity tariff structure of the country is subsidized then it poses additional challenges to the developer. A constrained sector cash flow reduces the comfort level of the developer and they tend to add a risk premium in the PPA tariff to ensure appropriate return. Given this risk structure, several models of developing geothermal projects have been exercised in East Africa, mostly in Kenya. Public sector leadership and funding seems to be necessary to bring a geothermal project from pre-feasibility to the post-test drilling phase. A Public Private Partnership may also work well, while a pure private sector initiative would require a Government to agree on a Power Purchase Agreement, before knowing the actual cost of accessing the geothermal resource. After the test and exploration drillings and well testing results are available, the perception of risk is substantially reduced for the drilling of production and injection wells and construction of the power plant and could be developed entirely by the public sector or through a public private partnership or entirely by the private sector.

Perception of risk for any geothermal project remains high until the result of test drillings are found positive. The test drillings and subsequent well testing provides critical information on the reservoir and helps to manage further drilling risks. While any drilling activity has the risk of failure, with more knowledge, drilling of production wells and injection wells poses considerably less risk. Afterwards, a geothermal power plant poses a normal level of risk similar to that of any other power plant. Once the power plant is in operation it is critical to implement a reservoir management program to ensure the fuel/steam risk is minimized.

Geothermal resource development requires public sector support to reach commercial scale success as it is a relatively new technology in the region with relatively higher risk of development. As of now, there has been limited identification of resource potential beyond initial inventory and surface reconnaissance studies. Public funds are required for test and appraisal well drilling and testing for commercial quality (steam) resource identification, including information on geology, geochemistry, geophysics, etc. Moreover, one or more functional geothermal power plants in Ethiopia would demonstrate the resource's potential and encourage private sector participation in the sector in the medium to long term.

Ethiopia's experience in developing large scale energy generation projects is generally limited to the

hydropower sector. However, when it comes to the geothermal sector, GoE needs to build capacity by investing in human resources, training, and related initiatives in order to fully develop the resource base and handle the current and forthcoming growth in the sector. Other countries in the Rift Valley region, such as Kenya, have also adopted similar approach and have invested in domestic capacity building efforts.

GoE has adopted a multipronged approach to develop its geothermal sector. It has requested several development partners to support financing development of a geothermal site from surface exploration to electricity generation and transmission. GoE has also invited private sector to develop another geothermal site from surface exploration to electricity generation. These two approaches will help GoE understand the benefits and constraints of developing geothermal resource in Ethiopia following different financing and investment models. To learn from the above initiatives and develop geothermal resources in future, GoE, with support from its development partners, is developing a framework to support the efficient production of electricity from its geothermal resources, focused on determining the appropriate level of private sector participation in the exploration and production phases and identifying the regulatory, institutional, and capacity requirements needed to attract private investment.

Partnerships Supporting Geothermal Development

The GoE, with support from the WBG raised US\$ 26 million from Scaling-up Renewable Energy Program (SREP) for geothermal development. The SREP is a targeted program of the Strategic Climate Fund (SCF), which is one of two funds within the framework of the Climate Investment Funds (CIF) supporting Low Income Countries. The SREP was established to scale up the deployment of renewable energy solutions and expand renewables markets in the world's poorest countries. It aims to pilot and demonstrate the economic, social, and environmental viability of low carbon development pathways. GoE will use US\$ 23.6 million from its SREP allocation to finance this proposed project.

The International Finance Corporation (IFC) is supporting the GoE in the preparation of a Geothermal Sector Development Strategy to attract private sector investment in energy. The GoE has allocated US\$ 1.5 million from its SREP allocation towards the cost of preparing this strategy paper and the preparation work is underway.

Ethiopia will benefit from the World Bank and Iceland compact formed in 2012. The World Bank and the Government of Iceland formed a partnership to help African Rift Valley countries develop their geothermal sector. This partnership will support Rift Valley countries carry out surveys and investigations effectively and attract investments to develop geothermal fields in Ethiopia. The Icelandic International Development Agency (ICEIDA) will provide support to Ethiopia based on this partnership arrangement. ICEIDA has jointly raised funds with Nordic Development Fund (NDF) to provide the required technical assistance to Ethiopia to develop its geothermal resources. ICEIDA activities will be coordinated along with the Bank's proposed project scope and design.

The Government of Japan (GoJ) will support the proposed project through parallel financing. The Bank with co-financing from the GoJ, has provided financing through the Additional Financing for Energy Access Project, to support drilling of four exploration wells in Aluto Langano. As a continuation of this partnership, the GoJ is considering extending a soft loan to the GoE of up to US\$ 110 million, in two phases, to finance the power plant at Aluto Langano. However, both parties await the findings of the initial exploratory drilling to advance the discussion on the amount and terms of the loan.

The Bank is coordinating with the United States Government (USG) in its Power Africa Initiative (PAI). The PAI, announced in June 2013, aims to leverage U.S. expertise in energy technologies, private sector

transactions, and policy and regulatory reform to support Sub-Saharan African (SSA) nations' energy plans. The USG is coordinating closely with the WBG in preparing a regional geothermal development strategy focusing mainly on East African Rift Valley countries. USG is supporting the development of Corbeti Geothermal Project, sponsored by a U.S. – Icelandic private sector developer, by providing transaction advisory support to EEP. GoE has also requested the Bank to support capacity building activities within EEP to promote private sector participation in geothermal development in Ethiopia. This would include technical assistance on upstream geothermal resource development, effective reservoir management, regulation, monitoring, supervision, pricing, etc. It is expected that this joint support to the EEP will help GoE realize private sector investment in its geothermal sector development effectively.

II. Project Development Objective(s)

The Development Objective of Geothermal Sector Development Project (GSDP) is to develop geothermal resource for electricity generation in Ethiopia.

III. Project Description

Component Name

Aluto Geothermal Site Development

Comments (optional)

This component will finance drilling consumables, associated materials, drilling contractors, supervision engineer, etc. to drill and test 22 wells and set up a steam gathering system connecting the producing wells.

The Aluto geothermal site is located in Oromia Regional State. The project site is about 200 km South-East of Addis Ababa, and is conveniently located in between the Lake Ziway and Lake Langano. A pilot power plant, established in 1998, has been generating approximately 3 MW of electricity at this project site. Financing from IDA and SREP will be used for production drilling and testing activities in order to establish the economic viability of the geothermal resources at the Aluto geothermal site and help finalize the feasibility and design of the planned 70 MW po

Component Name

Alalobad Geothermal Site Development

Comments (optional)

This component will finance drilling consumables, associated materials, drilling contractors, supervision engineer, etc. to drill and test 4 wells. If these wells confirm the expected geothermal resource potential, then well-head generators would be financed under this component.

The Alalobad geothermal site is located in Doubti Woreda, Afar Regional State. The project site is in the North Eastern part of Ethiopia and is about 600 km from Addis Ababa. The Alalobad project area is situated within the Tendaho Graben which is spread over an approximately 100 square kilometer area, containing potentially several distinct geothermal reservoirs.

Component Name

Drilling Rig, Associated Accessories and Spare Parts

Comments (optional)

This component will finance two full size modern diesel electric drilling rigs with all associated

equipment, accessories for directional drilling and both over pressure and under pressure drilling and a complete inventory of spare parts.

Component Name

Legal, institutional and regulatory framework development

Comments (optional)

This component will finance consultancy services for the development of the Geothermal Development Policy and related legislation as well as technical assistance and capacity building support to enhance the geothermal development capacity of stakeholder institutions, including the EEP, the GSE and the MoWIE. This component includes financing for drilling management contracts, supervision consultant contracts and services related to reservoir engineering and management. In addition, this component will help Ethiopia promote private sector participation in geothermal development by building capacity on geothermal technical issues, reservoir management, supervision, monitoring, pricing, licensing and concessions.

IV. Financing (in USD Million)

Total Project Cost:	325.10	Total Bank Financing:	176.00
Financing Gap:	0.00		
Financing Source			Amount
BORROWER/RECIPIENT			12.00
International Development Association (IDA)			26.63
Strategic Climate Fund Grant			23.60
ICELAND Icelandic International Development Authority			3.50
IDA recommitted as a credit			149.37
JAPAN Japan Bank for Internaitonal Cooperation (JBIC)			110.00
Total			325.10

V. Implementation

A. Institutional and Implementation Arrangements

All components under the project will be implemented by EEP. The EEP is a public enterprise created by Resolution 303/2013 on December 9, 2013. Though EEP is newly formed, it benefits from the well-established rules and regulations of its predecessor, EEPCo. Since December 9th, 2013, the structuring of EEP has been progressing, key management positions have been filled through the appointment of qualified personnel and the appointment of technical and administrative positions is well advanced.

A project implementation unit (PIU) has been established that will be responsible for the day-to-day management of the project. The EEP has appointed a Project Coordinator who is well qualified and very familiar with the ongoing exploratory geothermal work that is the forerunner for the GSDP project. The EEP has also appointed key technical and fiduciary staff including Engineers, Financial Management Specialist, Procurement Specialist and a Safeguard Specialist that will comprise the core of the PIU. All these persons have experience working with World Bank Projects within EEPCo prior to its

restructuring and they have been appointed in similar positions in EEP. With this single decision, the GoE avoided considerable delays in implementing the GSDP project. This demonstrates the GoE commitment toward the GSDP project. The central corporate fiduciary and environment management units of EEP will provide support to the PIU to ensure that fiduciary and safeguards related activities are implemented properly.

B. Results Monitoring and Evaluation

Monitoring and reporting of the project implementation progress will be the responsibility of EEP’s project management team. In EEP, the required data will be furnished by the PIU. EEP will have the responsibility to supply current data on the set of agreed performance indicators at least on an annual basis for PDO indicators and on a semi-annual basis for the intermediate outcome indicators at the component level.

C. Sustainability

The GoE (MoFED and MoWIE) and the EEP have demonstrated their full support for this project through their responsive and active support during project preparation and activities being carried out in the Aluto to drill the 4 wells.

Development of geothermal sector

Promotion of long term growth in the geothermal sector requires sustained commitment and effort on part of the GoE. In order to promote and scale up investment in the sector, two major constraints have been identified: (i) access to risk capital, and (ii) technical support for the development of resources. The design of the project includes support for both these issues (as discussed in the lessons learned section) from Bank sponsored projects in Africa and elsewhere.

Financial viability of EEP

EEPCo was not able to provide reliable accounts since 2006 to convincingly justify tariff increase. The inefficiencies in EEPCo were never properly identified and GoE was reluctant to revised tariff without reliable information, risking transfer of EEPCo inefficiencies to the consumers through increased tariff. The current restructuring of the sector is expected to provide more transparency on this issue and offers an opportunity to the newly established enterprises, EEP and EEU, to reconcile their accounts, identify the sector inefficiencies as assess the cost of supply at different levels. In order to introduce modern utility practices, GoE has appointed a management contractor for two and half year to operate the generation, transmission and distribution assets of EEP and EEU. This management contractor, over this period will improve performance of the sector and will assess the cost of supply at different levels of supply. This information will provide the benchmark to GoE to review EEP and EEU existing tariff and revise it accordingly to reflect the market needs. GoE plans to introduce Bulk Supply Tariff (BST), at which EEP will be selling electricity to EEU. EEP will be responsible to export electricity to its neighboring countries, while EEU will be responsible for domestic sales.

VI. Safeguard Policies (including public consultation)

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

Comments (optional)

VII. Contact point

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