INTERNATIONAL SUMMER SCHOOL
on Direct Application of Geothermal Energy
POLISH GEOTHERMAL ASSOCIATION
International Geothermal Days
POLAND 2004
EUROPEAN BRANCH
Under the auspice of Division of Earth Sciences

4.1.
RISK SHARING AND RENEWABLE ENERGY THE CASE OF GEOTHERMAL ENERGY PROJECTS

Helmut Schreiber
World Bank, Washington

Introduction

There exist numerous barriers to the increased utilization of geothermal energy resources in the ECA[1] countries, the most prominent ones are those associated with the management of geological risk. While investors and financiers are prepared for and willing to take economic/financial risks and conventional technology risks, the special knowledge that pertains to the assessment and handling of geological risks is often beyond the experience and capacity of both potential energy investors and lenders which reduces their willingness to undertake geothermal projects of large investment requirement.

Although insurance schemes for conventional investments are readily available on the market, a mechanism that guarantees against losses from geothermal energy exploration is not yet common, given the high level of uncertainty about the success of the investment not only for the construction time but also for a prolonged period during operation.

The World Bank/GEF[2] Geothermal Development Fund (GeoFund) addresses the issue of geological risk management through its insurance scheme and plays a vital role in sharing risk with the private sector. With legislative support from concerned public -wable energies to recognize full economic costs of energy use) the geothermal resources of the ECA region can be exploited in an economic and sustainable way.

Barriers to Geothermal Energy Development

Barriers to Renewable Energies in ECA Countries

The major barriers that retard the increased utilization of renewable energy resources (RER) in ECA countries include:

The lack of expertise and know-how about RER among energy sector decision makers at government-, industry- and local consulting services' levels;

Issues of ECA countries' energy markets, including poor energy policies (e.g. high subsidies for fossil-fuels, energy tariffs not covering costs), inadequate and non-transparent legal, regulatory and institutional frameworks, leading to uncertainties in the industry and to a bias in favor of fossil fuels, and

High transaction costs due to typically small size of RER projects compared to the large fossil-fuel-based projects.

Technology-inherent Barriers to Geothermal Energies

In addition to the barriers to the development of RER in general, there are also technology-inherent barriers particular to geothermal energy (GE):

High up-front costs relative to conventional technologies (due to the need of identifying the geothermal deposits and drilling the hight cost extraction/re-injection wells), and

The associated geological risks both during construction and operation.

[1] ECA: Europe and Central Asia

[2] GEF: Global Environment Facility

Overview of geological risks	
Exploration risks	Dry well or insufficiently large reservoir Lower than expected (or decreasing during operation) yield of the aquifer Lower than predicted temperature of geothermal fluid Lower than expected geo-physical/geo-chemical parameters of geothermal fluid (i.e. high TDS, too much captive CO_2)
Re-injection risks	Insufficient ability of the reservoir rocks to absorb the returned geothermal fluid Thermal draw down

World Bank – GEF: Geothermal Energy

Development Fund

The Geothermal Energy Development Fund (GeoFund) is the central funding mechanism of the Geothermal Energy Development Project, that follows a strategic approach in providing assistance in barrier removal, financial support, and technical assistance in project preparation and implementation to project developers in World Bank/GEF client countries to ultimately facilitate the implementation of individual geothermal projects. The Geothermal Energy Development Project is an umbrella for many geothermal sub-projects in participating ECA countries.

Activities

The Project, which would support the development of GE for electricity generation, district heat, and other heating applications, will involve:

- Provision of technical assistance and capacity building to transfer know-how and to establish a geothermal data base and capacities to develop and implement GE projects;
- Support of capital investments in GE projects;
- Development of reforms of energy market related policies, legal, regulatory and institutional framework, and
- Monitoring of trends of use of GE and RERs during the period of 2001-2007 in participating ECA countries.

Innovative Financing of Projects

The financing mechanism of the Project, the GeoFund is designed as a market intervention responsive to medium-/ long-term market conditions existing in the participating countries. The paramount objective of the GeoFund is to build sustained market capacity to develop and finance geothermal projects on commercial terms using local private capital. The GeoFund's three principal instruments are as follows:

- The *Technical Assistance (TA) Window* will address in the first place barriers that retard the use of RERs and GE. It will work with participating governments to identify the barriers, determine their resolution queue and devise means to implement improved policies, legal, regulatory and institutional frameworks. The TA Window will also help set up geothermal databases and atlases, and will identify and prepare/implement geothermal projects. The amount of the TA Window will be US$ 5 million, with expected co-financing from International Financial Institutions (IFIs), multilateral and bilateral donors.
- The *Partial Risk Guarantee (PRG) Facility* will partially insure project promoters/investors against the short-term, up-front geological risk of exploration/re-injection, and/or the long-term geological risk of unfavorable/deteriorating reservoir parameters.

The main purpose of the PRG Facility is to provide help to project promoters to obtain adequate commercial lending for their project. The PRG Facility, that will have a well-defined risk coverage, is proposed to be endowed with US$12 million.

- The *Investment Funding Window* would provide contingent grants, low cost loans or, in limited cases, grant financing, thereby covering a part of the project cost through monetization of external benefits. The total amount for this window will be US$8 million.

A Partnership

Potential Partners in the ECA Geothermal Umbrella Project will be:

(a) Participating client count-ries in the ECA Region;
(b) The World Bank and GEF;
(c) Other IFIs, such as the International Finance Corporation and the European Bank for Reconstruction and Developemnt;
(d) the United Nations Development Programme and the United Nations Environment Programme;
(e) Multilateral and bilateral donors, and (f) Other Institutions (Utilities, Investors, Commercial Banks, Carbon Finance Institutions, etc.).

Project Types

The GeoFund would fund investments in GE use for three purposes:

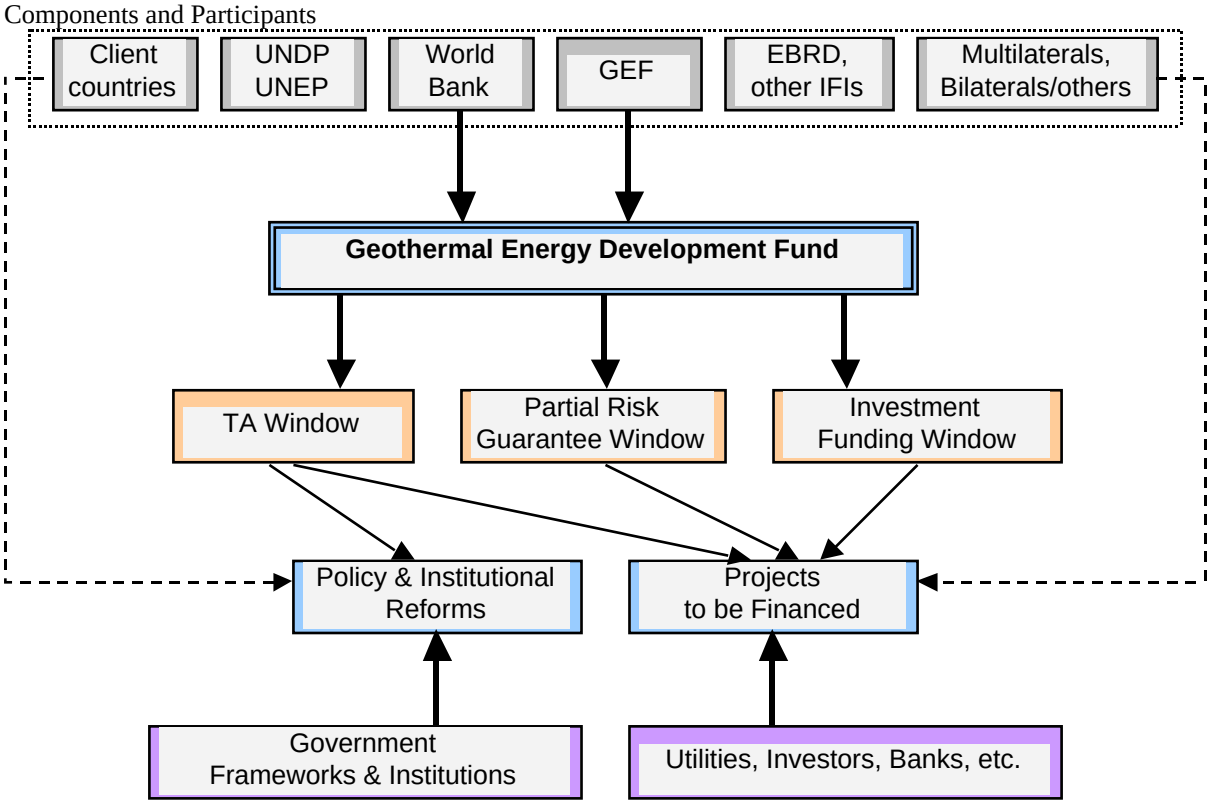
- Electricity generating projects in places where the geothermal reservoir promises sufficiently high temperatures. (up to 20% of total portfolio)
- Fuel substitution projects in existing district heating facilities will be the most likely projects; in

these cases geothermal energy would be to a large extent substituted for an existing fossil fuel source; these have a good potential throughout most of the ECA countries, (well over 60% of total portfolio)

- Geothermal energy projects for the purpose of heating of individual housing blocks, of greenhouses, of wood drying chambers, as well as spas and other balneological facilities. (up to 20% of total portfolio)

Of course, any combination of the three above project types is conceivable. In many cases, a cascading approach might be used where geothermal resources would be cooled down in successive stages (industrial heating, heating of housing, heating of greenhouses, heating of balneological facilities, etc.), before being re-injected.

Components and Participants



Country and Project Eligibility

Country Eligibility: In principle, the ECA Geothermal Umbrella Project and its GeoFund would be open to any country in the ECA Region that have ratified the United Nations Climate Change Convention. To qualify for the participation in the Umbrella Project and for the potential support from the GeoFund, a country would have to:

- Subscribe to the objectives and mode of operation of the ECA Geothermal Umbrella Project and its GeoFund;
- Be ready to review its barriers to RER and GE utilization and commit to improving legal, regulatory and institutional frameworks in the interest of reducing those barriers;
- Provide support in the establishment of geothermal data bases and atlases and be ready to provide concessions for accessing geothermal resources and permits for operating geothermal plants estimated to be feasible, and
- Encourage development of public and private geothermal investments and assist in the publicity and dissemination of project results.

Project Eligibility: Project proposals from investors/utilities in participating ECA Client Countries will need to fulfill a number of basic eligibility criteria for financing under the ECA Geothermal Umbrella Project and its GeoFund. Eligible project proposals:

- Are in line with country energy sector priorities (GEF Focal Point endorsement)
- Meet relevant GEF Operational Program criteria
- Are based on thorough geological investigation helping minimize up-front geological risk
- Demonstrate technical, economic and financial feasibility
- Have established a sound business plan, incl. compliance with the Bank's safeguard policies
- Have applied for additional financing to assure a complete financing plan
- Have signed a PPA or heat off-take agreement of sufficiently long term nature
- Provide CO_2 reductions of at least 5,000 tons of CO_2 annually

Financing

The GeoFund would expect additional funding from cofinancing partners by leveraging GEF funds at an aggregated overall program ratio of 1 to 8 (GEF: US$25 million, other sources: US$ 175 million; in total, for about ten projects estimated to cost about US$200 million). It is expected that low-cost funding could become available on a ratio of 1 to 2 (GEF and other sources, including bilateral sources and domestic sources).

The other parts of funding (60 to 70%) would come in the form of equity contributions from project sponsors and other investors and, in the form of loans from multilateral and bilateral donors, as well as commercial banks, whose entry would be facilitated through the Partial Risk Guarantee Mechanism under GEF funding. The minimum debt/equity ratio required for individual projects is 1:5.

Risk Sharing between the GeoFund and the Private Sector

The GeoFund: Geological Risk

The most important investment barrier associated with the geological risk of GE projects is the unwillingness of investors to take this risk and the difficult access to reasonable financing. The main objective of the GeoFund is to eliminate this hurdle through providing guarantee (Partial Risk Guarantee – PRG) against the geological risk of geothermal projects. It is expected that the availability of such guarantee mechanism will attract private and public investors to develop projects and facilitate access to affordable commercial loans. This shall promote private investment flows to geothermal energy development.

The PRG compensates investors or their commercial banks in case of specified risks materializing. Its beneficiaries will be investors and/or financial institutions with interest in GE projects. The risk guarantee facility is partial with well-defined risk coverage. In order to control the risk to be underwritten by the PRG, workable selection criteria will be formulated for every project based on the study of existing geological data available in the drilling area. Technologies deployed for exploration and extraction will also be taken into consideration when assessing these up-front project risks.

Two types of risks will be covered under the PRG Facility:

(a) drilling of the production well (exploration risk), and

(b) insufficient thermal energy re-coverable over the life of the well (geological/ope-rational risks of re-injectivity, or inadequate resource parameters).

A cover of the first risk will compensate for a part of the cost of drilling in the event of a "dry" well. A cover of the second risk will compensate for a part of revenue losses caused by insufficient heat energy recovered from the well. The reserves of the facility will earn interest while no covenanted event occurs, thus compensating in part against outlays occurring when a covenanted risk materializes.

The Private Sector: Technological and Economic/financial Risk

While the assessment and handling of geological risks is often beyond the experience and capacity of both potential energy investors and lenders, it is the private sector that is the best prepared – and willing – to handle conventional technology and economic risks of investments. Non-geological technology risks may include:

- High cost contingencies of connections to customers with varied actual heating systems
- High cost contingencies of related DH rehabilitation
- Unexpected environmental impacts – costs of mitigation

The most important economic risks are:

- Market risk related to fluctuations of fuel prices that may make the geothermal plant uneconomic
- Market penetration risks – heat sales
- Demand risk – less than estimated heat demand
- Risks of cost over-runs, of late completion
- Lifetime risks (reliable operation and performance risks, risk of new regulations)
- Ownership risk (unspecified owners, change of owners, mergers, bankruptcies)

Public Institutions: Additional Support

The increasing price of conventional energy resources, the growing recognition of their full economic costs in view of their environmental impacts and the need to increase energy security and economic competitiveness have been emphasizing the importance of RERs for some time. Legislative support to the development of RERs been growing and reached different levels in different countries, with the European Union (EU) on the lead EU where this support is the most progressive. The EU has announced ambitious targets in the form of directives and has encouraged its member states to implement national policies for support schemes for RERs. The development of the respective legislative framework in the newly accessed states of the EU has been following the recommendations of the EU to various degrees. (See table below)

Prospective client countries for the GeoFund that have recently accessed to the EU include the Czech Republic, Hungary, Poland and the Slovak Republic. These countries all have introduced some form of preferential price support for electricity or heat sales from renewable generation.

There are a number of indirect incentives in the *Czech Republic* to promote the use of RERs, including lower import duties on equipment, tax

holidays, and lower VAT taxes. The new State Energy Policy proposes the introduction of a system of tradable green certificates of electricity produced from renewable energy sources, the guaranteeing of the minimum amount of revenue for a unit of produced electricity to investors in renewable energy sources, the obligation to produce a part of the supplied energy from renewable energy sources for the development and refurbishment of heat generation sources and the obligation to cover a part the heat consumption of new and refurbished buildings from renewable energy sources.

Current legislative support of renewable energy in *Hungary* is limited to the preferential buy-back of renewable electricity. A separate renewable energy law is currently being prepared. This law envisages decentralized support and promotion of local use, as well as state guarantee for loans to set up renewable energy enterprises. The "Szechenyi Plan", a general purpose investment promotion fund, includes a limited size window for providing grant funding for renewable energy projects.

Energy companies are obliged in *Poland* to purchase electricity and heat from non-conventional energy sources or from renewables. Funding of geothermal/renewable energy projects is facilitated by such general environmental protection purpose funds as the National Fund for Environmental Protection and Water Management (loan funding, subsidy funding, equity funding) and the EcoFund (to channel part of the foreign debt of Poland into a fund intended to support environmental protection projects).

In the *Slovak Republic* the legislation obliges distribution companies to purchase electricity produced from renewable sources and heat suppliers to purchase heat from renewable or waste heat sources or from combined heat and power plants. There is also income tax holiday for operators of renewable energy sources and combined heat and power production facilities in the first five year of operation.

Most of the potential client countries of the GeoFund that have not yet accessed to the EU, and more so the CIS[3] countries do not have an adequate policy framework in place that transparently supports renewable/geothermal energies.

The envisaged role of participating countries' decision making entities in the collaborative effort to increase the use of geothermal energy is to implement a legislative framework that is transparently supportive of renewable/geothermal energy. Among the various measures that compensate the natural distortion toward favoring conventional resources and help remove the barriers the most important are:

- Preferential price for electricity generated from RER/GE ("green-pricing")
- Price support to renewable-based heat by local governments
- State support to promote renewable energy investment (preferential customs treatment of equipment imported, accelerated depreciation, special tax holidays for investors, preferential rates of taxation, etc.)
- Support of geothermal projects through participation in Joint Implementation or Clean Development Mechanism under the Kyoto Protocol

Portfolio Development for the GeoFund

There are a number of countries in which the concept, objectives and modalities of the ECA Geothermal Umbrella Project and its GeoFund have been discussed and partially or fully endorsed. These countries are Bulgaria, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic and Russia. Prospective project portfolio in these countries prevails as follows:

In *Bulgaria*, two projects are under consideration, which would be designed to substitute geothermal heat for coal/fuel oil firing in existing district heat systems in the cities of Velingrad (medium sized) and Separeva Bania (small).

In the *Czech Republic*, there is a project under advanced implementation in Decin where the support of the GeoFund might be coming late. However, other geothermal projects are under preparation.

In *Hungary*, a number of very promising geothermal resources with temperatures in excess of 130 degrees C, and therefore suitable for electricity generation are under consideration. The Hungarian Goernment has requested World Bank-GEF support for project preparation. The private oil and gas company MOL, which owns all oil and gas wells in Hungary, has indicated readiness to cooperate with the Umbrella Project and its GeoFund.

In *Poland*, there are two projects under preparation or early implementation (Stargard in the northwest of Poland, and Kolo in Central Poland) which will substitute geothermal energy for coal firing in municipal district heat systems. Poland has developed a detailed geothermal resource atlas and has started to systematically overlay the map, indicating cities with DH systems with the geothermal resource map, thereby identifying potential projects.

In the *Slovak Republic*, a very promising geothermal deposit has been identified near the city of Kosice and has been confirmed by initial exploratory drillings funded by the EU. This project would provide fuel substitution (geothermal for coal) in the city's existing DH system and possibly could generate electricity as well at attractive tariffs, provided certain externalities are monetized. There is also a very small Project in Trvdosin (south side of the Tatry mountains), which would require a partial risk guarantee to obtain commercial loan financing.

[3] CIS: Commonwealth of Independent States

Romania also has abundant exploitable geothermal resource potential. Two projects have been proposed by TRANSGEX S.A., the Oradea based exploration company in collaboration with the Municipality of Oradea. The Nufarul district geothermal project aims to provide space heating and hot tap water in the Nufarul district of Oradea City. The Beius project contains the drilling of a re-injection well in the town of Beius in order to maintain reservoir parameters following increased withdraw.

In *Russia*, there are a number of promising geothermal deposits, some of which allowing the production of electricity. A recent geothermal power generation project in Kamchatka is funded by EBRD, which, with the Russian sponsor, was proposing the geothermal initiative support for a second project in the same area, also to be supported by EBRD. Other possibilities are in the pre-Caucasus region of southern Russia, at the Lake Baikal and in various other parts of the country.

There are a number of *other countries*, where geothermal resources are particularly promising, but where investment has been limited because of the technology inherent barriers. These countries would very likely join the ECA Geothermal Umbrella Project as soon as it gets underway. Recently, the National Strategy Study for greenhouse gas reductions in the *Ukraine* identified a number of promising geothermal projects. There are several opportunities in the Trans-Carpatian Mountains. Recently, Georgia has indicated interest in geothermal development.

Track ID of this document: c:\data\wb\geofund\risksharing.doc