Legal and Regulatory Aspects of Geothermal Energy in Turkey

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ENERMET Energy

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Outline

• The Recent Situation of Geothermal Energy in Turkey

• Geothermal Law

• Electricity Market Law

• Renewable Energy Law/Incentives

• Conclusions
Turkey is located on the Mediterranean volcanic belt which is one of the most promising geothermal fields in the world.

Almost 200 geothermal fields have been discovered so far by MTA General Directorate.

On the other hand, after the Geothermal Law come into effect in 2007, many geothermal fields have been discovered by the private companies.
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Geothermal Fields of Turkey

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• The proven geothermal potential is 4,000 MWt and Turkey is ranked as 7th in the world.

• More than 90% of those fields are low and moderate enthalpy fields and not suitable for electricity production with conventional technologies but still can be used for district heating and for industrial purposes.

• Then; low-temperature geothermal electricity generating technologies with a reasonable cost will have an advantage in Turkish geothermal market.
• Turkey is ranked as 5th in the world in the direct use of geothermal sources with a capacity of 1.385 MWt.

• For today; 24 projects with a capacity of 482 MW have license for electricity generation and 7 of them with a capacity of 114,2 are in operation.

• 300 MW project are under construction.

• 19 license application with a capacity of 500 MW is under review and evaluation stage in EMRA.
These figures show that Turkey can reach an 1,000 MW geothermal power plant capacity until 2023 where the target of the government is 600 MW.
**Legal and Regulatory Aspects of Geothermal Energy in Turkey**

### Installed Capacity of Geothermal Power Plants of Turkey by Years

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Project Place</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarayköy JES</td>
<td>Denizli-Sarayköy</td>
<td>15</td>
</tr>
<tr>
<td>Kızıldere JES</td>
<td>Denizli-Sarayköy</td>
<td>6.85</td>
</tr>
<tr>
<td>Germencik JES</td>
<td>Aydın-Germencik</td>
<td>47.4</td>
</tr>
<tr>
<td>Dora 1 JES</td>
<td>Aydın-Salavatlı</td>
<td>7.95</td>
</tr>
<tr>
<td>Dora 2 JES</td>
<td>Aydın-Salavatlı</td>
<td>9.5</td>
</tr>
<tr>
<td>Tuzla JES</td>
<td>Çanakkale-Tuzla</td>
<td>7.5</td>
</tr>
<tr>
<td>Maren JES</td>
<td>Aydın-Germencik</td>
<td>20</td>
</tr>
</tbody>
</table>

**114,2 MW in operation**

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ESTIMATED CAPACITY OF GEOTHERMAL POWER PLANTS OF TURKEY

YEARS

INSTALLED CAPACITY (MW)

500 MW in 2017

1,000 MW in 2023

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<table>
<thead>
<tr>
<th>Number of Projects</th>
<th>Capacity of Projects (MW)</th>
<th>Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>167.5</td>
<td>Review and Evaluation</td>
</tr>
<tr>
<td>17</td>
<td>331</td>
<td>Eligible for Licence</td>
</tr>
<tr>
<td>24</td>
<td>482</td>
<td>Licenced</td>
</tr>
<tr>
<td>43</td>
<td>980.5</td>
<td></td>
</tr>
<tr>
<td>Number of Projects</td>
<td>Capacity of Projects (MW)</td>
<td>Situation</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>7</td>
<td>114.2</td>
<td>In Operation</td>
</tr>
<tr>
<td>14</td>
<td>331</td>
<td>Under Construction</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>Others</td>
</tr>
<tr>
<td>24</td>
<td>482</td>
<td></td>
</tr>
</tbody>
</table>
Legal and Regulatory Aspects of Geothermal Energy in Turkey
Legal and Regulatory Aspects of Geothermal Energy in Turkey
## Legal and Regulatory Aspects of Geothermal Energy in Turkey

### Licence Projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Project Place</th>
<th>Company</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umurlu JES</td>
<td>Aydın-Umurlu</td>
<td>Karkey Enr. A.Ş.</td>
<td>5</td>
</tr>
<tr>
<td>Sanko JES</td>
<td>Manisa- Salihli</td>
<td>Santral Jeo. A.Ş.</td>
<td>15</td>
</tr>
<tr>
<td>Dora 3 JES</td>
<td>Aydın-Salavatlı</td>
<td>Menderes Jeo.A.Ş.</td>
<td>34</td>
</tr>
<tr>
<td>Alres JES</td>
<td>Aydın-Atça</td>
<td>Alres Enerji A.Ş.</td>
<td>9,5</td>
</tr>
<tr>
<td>Gümüşköy JES</td>
<td>Aydın-Gümüşköy</td>
<td>Gümüşköy Jeo. A.Ş.</td>
<td>15</td>
</tr>
<tr>
<td>Pamukören JES</td>
<td>Aydın-Pamukören</td>
<td>Çelikler Jeo. A.Ş.</td>
<td>61,72</td>
</tr>
<tr>
<td>Sultanhisar JES</td>
<td>Aydın-Sultanhisar</td>
<td>Çelikler Jeo. A.Ş.</td>
<td>9,9</td>
</tr>
<tr>
<td>Alaşehir JES</td>
<td>Manisa-Alaşehir</td>
<td>Zorlu Jeotermal A.Ş.</td>
<td>30</td>
</tr>
<tr>
<td>Kiper JES</td>
<td>Aydın-Nazilli</td>
<td>Kiper Elektrik Ürt A.Ş.</td>
<td>20</td>
</tr>
<tr>
<td>Jeoden JES</td>
<td>Denizli-Sarayköy</td>
<td>Jeoden Elektrik Ürt A.Ş.</td>
<td>2,52</td>
</tr>
<tr>
<td>Alaşehir JES</td>
<td>Manisa-Alaşehir</td>
<td>Türkerler Jeotermal A.Ş.</td>
<td>24</td>
</tr>
<tr>
<td>Dora 4 JES</td>
<td>Aydın-Salavatlı</td>
<td>Menderes Jeo.A.Ş.</td>
<td>17</td>
</tr>
<tr>
<td>Tekkeköy JES</td>
<td>Sarayköy-Denizli</td>
<td>İnaltı Termal Turizm A.Ş.</td>
<td>3</td>
</tr>
<tr>
<td>Babadere JES</td>
<td>Çanakkale-Ayvacık</td>
<td>MTN Enerji A.Ş.</td>
<td>3</td>
</tr>
<tr>
<td>Maren 2 JES</td>
<td>Aydın-Germencik</td>
<td>Maren Jeotermal A.Ş.</td>
<td>24</td>
</tr>
<tr>
<td>Sarkız JES</td>
<td>Manisa-Alaşehir</td>
<td>Türkerler Jeotermal A.Ş.</td>
<td>10</td>
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<tr>
<td>Ken Kipaş JES</td>
<td>Aydın-Yılmazköy</td>
<td>Ken Kipaş A.Ş.</td>
<td>24</td>
</tr>
<tr>
<td><strong>TOPLAM</strong></td>
<td></td>
<td></td>
<td><strong>307,64</strong></td>
</tr>
</tbody>
</table>
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Geothermal activities are regulated by:

13/06/2007 / 5686
“Law on the Geothermal Resources and Natural Mineral Waters”

11/12/2007
“By-Law regarding the Geothermal Resources and Natural Mineral Waters”

14/10/2008
“By-Law regarding the Use of the Geothermal Sources for Electricity Generation”
The aim of the “Law on the Geothermal Resources and Natural Mineral Waters”

The aim of the Law is to set forth the principles and procedures regarding the effective exploration, research, development, production and protection of geothermal and natural mineral water resources; holding rights on these resources and devolution of the rights, economic utilization of the resources in a compatible way to the environment, and abandonment of these resources.
The main principles of the Law and By-Law (1)

- Geothermal resources and natural mineral waters are under the authority and possession of the State and are not subject to the property of land where they are found.
- Geothermal activities cannot be run without a license.
- The exploration license applications are made to the Administration which does not exceed 5,000 hectares with the exploration project.
- Priority right forms the basis in the applications.
- The exploration license period covers a period of 3 years and can be extended for additional 1 year.
The main principles of the Law and By-Law (2)

- The exploration license holders can apply for the operation license by appending the operation project. The “operation license” is issued and MİGEM is informed with determined blocked areas if blocked areas exist.
- Unless the permission of the Administration is obtained, any project modifications and revisions cannot be realized.
- The activities within both exploration and operation periods are executed under the responsibility of an engineer from the relevant engineering branches.
- Annual exploration and operation reports are submitted by the owner of the establishment to the Administration until the end of March of the following year.
The main principles of the Law and By-Law (3)

- The operation license holders are responsible for obtaining the required permissions from the related institutions. The operation license holders are required to apply for the permissions within 3 months and shall be obtained in 2 years. Otherwise, the license is cancelled.

- The activities are audited by the Administration. If the Administration requires, MTA can also audit, if needed.

- The exploration and operation licenses can be transferred.
The main principles of the Law and By-Law (4)

- Licenses which have been cancelled, abdicated or curtailed by any reason are made available for exploration and operation by the Administration through tendering procedure.
- If the holder of exploration license can not come to an agreement with the owner of immovable of private ownership in the area of search actions, he/she can claim his/her rights to usufruct.
- During the period of operation license, if a settlement can not be arranged with the owner of immovable as for the places such as drilling site, transmission line and catchment, the license holder can claim the right to nationalization and usufruct by applying to the Administration.
The main principles of the Law and By-Law (5)

• In actions subject to this law; protection of geothermal system, no waste of the resource and protection of environment are basic principles and before the actions for operation, protection area study of the resource by the license holder is obligatory. Otherwise, actions shall be stopped.

• Reports of protection area study, after taking the opinion of MTA, requires the approval of the Administration.

• Reinjection of the waste water is essential. If it is not possible for technical reasons, the waste water can be discharged within the limits of environmental rules.
**The main principles of the Law and By-Law (6)**

- MTA carries out its research of geothermal and natural mineral water resources upon a license obtained pursuant to the provisions of the Law with exemption from the license fee and compensation.

- MTA can carry out any kind of scientific and technical survey anywhere, including the viable license areas, without requirement of the license.
Electricity generation by using geothermal resources is regulated by:

- 03/03/2001 / 4628 “Electricity Market Law”
- “By-Law on Electricity Market License”
- “By-Law regarding the Electricity Generation by Using Geothermal Resources”
Legal and Regulatory Aspects of Geothermal Energy in Turkey

- A license should be granted by EMRA (Energy Market Regulatory Authority) in order to operate in the electricity market.
- All legal entities subject to private law and applying for a license in order to operate in the market, are required to have been established as joint stock or limited liability companies in accordance with the provisions of the Turkish Commercial Code no. 6762.
- The companies which generate and sell electricity from geothermal resources are required to obtain a "Generation License".
- The companies which generate electricity from geothermal resources and use it for their own consumption must receive a "Autoproducer License".
• The real persons or legal entities generating electricity for their own needs and having a capacity of less than 500 kW are exempted from obtaining a license and establishing a company.

• In order to be granted a license to operate in the market, the legal entities shall apply to EMRA by submitting the documents indicated in “List of Information and Documents to be submitted during License Application”.

• These documents are mainly related with the company and the project.

• The most important document for geothermal projects is an “operation license” granted by the Administration.
• A letter of bank guarantee, equal to TL 10,000 per MW of planned capacity shall be submitted during the application.

• EMRA shall request the opinion of TEIAS and/or the distribution licensee in the distribution region wherein the generation facility is located, regarding the connection to the transmission and/or distribution system and system use by the generation facility to be constructed.

• The review and evaluation conducted by the Authority is submitted to the Board and the license application is concluded with a Board decision.
• The legal entity that is deemed eligible for obtaining a license is notified in writing that in order to be granted the related license, it must submit the followings within ninety days following the Board decision;
  • Amend main charter of the company as required,
  • Raise the minimum capitals to equal to twenty percent of the total investment amount envisaged for the generation facility, (Investment cost is calculated as 2.100.000 TL/MW)
  • The remaining part of the letter of bank guarantee equal to 6% of the total investment amount for the first 10 MW, 4% for 10-100 MW and 2% over 100 MW.
  • The legal entity fulfilling the requirements is granted the related license by a Board decision.
• 22 months is given to the company to receive the necessary permits for construction. 38 months is given to the projects with a capacity of less than 50 MW and 46 months for the projects with the capacity of more than 50 MW as construction period.

• Legal entities having a license for engaging in generation business are obliged to submit progress reports concerning their activities till to the facility completion date in every January and July.

• Excluding the general force majeure and the specific force majeure defined in the related licenses; if the facility cannot be completed until the completion date written on the license, the license may be cancelled by a Board decision.
“By-Law regarding the Electricity Generation by Using Geothermal Resources”

- The objective of this regulation is to regulate the procedure and the principles regarding the application to EMRA for generation license for those have received an operation license from the Administration.

- According to this By-Law, the operation license holders must apply to EMRA within 3 months. If the generation license is cancelled or terminated, the operation license is also cancelled or vice versa.
Incentives Applied for Electricity Generation Using Geothermal Resources
10/05/2005 Ref. 5346
“Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy”
Following the effectiveness of this Law, no development plan affecting the utilization and efficiency of renewable energy resource areas shall be prepared in the public or Treasury territory.
Prices in the Schedule I attached hereto shall be applicable for a period of ten years for production licenses subject to the RES Support Mechanism that are or will be commissioned as from 18/5/2005 when this Law was enacted until 31/12/2015.
## Schedule I

<table>
<thead>
<tr>
<th>Type of Production Facility Based on Renewable Energy Resources</th>
<th>Prices Applicable (US Dollar cent/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroelectric production facility</td>
<td>7.3</td>
</tr>
<tr>
<td>Wind power based production facility</td>
<td>7.3</td>
</tr>
<tr>
<td><strong>Geothermal power based production facility</strong></td>
<td><strong>10.5</strong></td>
</tr>
<tr>
<td>Biomass based production facility (including landfill gas)</td>
<td>13.3</td>
</tr>
<tr>
<td>Solar power based production facility</td>
<td>13.3</td>
</tr>
</tbody>
</table>
In the event that the mechanical and/or electro-mechanical equipment used in the production facilities of license holder entities based on the Renewable Energy Resources within the scope hereof and commissioned before 31/12/2015 are manufactured domestically; prices in Schedule I will be added to the prices given in Schedule II, attached hereto, for a term of five years as from the commissioning of the production facility for electrical energy produced and given in such facilities and given to the distribution system.
<table>
<thead>
<tr>
<th>Type of Facility</th>
<th>Domestic Production</th>
<th>Domestic Contribution (US Dollar cent/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geothermal power based production facility</td>
<td>1- Steam or gas turbine</td>
<td>1,3</td>
</tr>
<tr>
<td></td>
<td>2- Generator and power electronics</td>
<td>0,7</td>
</tr>
<tr>
<td></td>
<td>3- Steam injector or vacuum compressor</td>
<td>0,7</td>
</tr>
</tbody>
</table>

06.12.2012
Prices in the Schedule I shall be applicable for a period of ten years for production licenses subject to the RES Support Mechanism that are or will be commissioned as from 18/5/2005 when this Law was enacted until 31/12/2015. However, in line with other developments with the foremost being the supply security, the amount, price and times and resources applicable to this Law, shall be determined by the Council of Ministers, provided that they don‘t exceed the prices given in the Schedule for RES certified production facilities that will be commissioned after 31/12/2015. Those wishing to be subjected to the RES Support Mechanism in the next calendar year are obliged to obtain RES Certificates and apply to the EMRA (Energy Market Regulatory Authority) until the 31st October.
As principal, housing units within the borders of administrative districts and municipalities located in regions where geothermal resources are sufficient to meet heating needs shall primarily be heated through geo- and solar-thermal sources.
Incentives for Electricity Generation Using Geothermal Resources

Permission, lease, easement and usufruct permission fees shall be eighty-five percent discounted during the initial ten years of investment and operation of power transmission lines including those under operation as of the date of publication hereof, for production facilities based on Renewable Energy Resources within the scope hereof that will be commissioned until 31/12/2015, transportation roads and including those to be transferred to the TEIAŞ and distribution companies until the point of connection to the system specified in their licenses. Further the collection of Forest Villagers Development Revenue and Erosion Control Revenue shall not be made.
Conclusion
The geothermal activities are regulated properly with the Law No. 5686 since 2007.

With the Law the geothermal activities in Turkey boomed up.

The installed capacity has reached to 114 MW, where it was just 15 MW before the Law.

The installed capacity is expected 500 MW in 2017 and 1,000 MW in 2023.
• Although most of the problems related with legal aspects have been solved with this Law, there are still some problems related with the application of the Law.
• The main problem encountered is the interference between the neighboring exploration and operation license.
• Although electricity generation has been promoted by the Law, there is not enough promotion for direct use of the geothermal sources.
• Geothermal exploration activities must be promoted to increase exploration of deep geothermal reservoirs.
Thanks for your attention

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06.12.2012
Geothermal energy in Germany – drilling technology, discovery, safety and sustainability

Volker Wittig, International Geothermal Center, Bochum, DE
R & D Manager for Advanced Drilling Technologies
Bochum University of Applied Sciences

Turkish-German Conference & Trade Mission on Geothermal Energy, Izmir, TK, 27th of November 2012
www.renewables-made-in-germany.com
www.exportinitiative.bmwi.de
International Geothermal Center

combined public / private research institution
<table>
<thead>
<tr>
<th>Bochum School of Geothermal Technology</th>
<th>GZB</th>
<th>Geothermal Economy Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bochum University AS</td>
<td>Public Bodies, Universities, Administr., Governmental Org., Chambers</td>
<td></td>
</tr>
<tr>
<td>Central R&amp;D Department of Bochum University</td>
<td>Non-profit Association of Public Institutions</td>
<td></td>
</tr>
<tr>
<td>Administration of IGL</td>
<td>Scientific Management of the IGL, Networking, Communication</td>
<td></td>
</tr>
<tr>
<td>Academic Education, Ba / Ma Sc. Programs</td>
<td>Profit-oriented; Construction Drilling, Utilities, Consultants Financing of the Branch Office; Marketing; Sponsoring</td>
<td></td>
</tr>
</tbody>
</table>

Companies

- Public Bodies, Universities, Administr., Governmental Org., Chambers
- Non-profit Association of Public Institutions
- Scientific Management of the IGL, Networking, Communication
- Profit-oriented; Construction Drilling, Utilities, Consultants Financing of the Branch Office; Marketing; Sponsoring

Institutions and Organisations

- Profit-oriented; Construction Drilling, Utilities, Consultants Financing of the Branch Office; Marketing; Sponsoring
- Non-profit Association of Public Institutions Scientific Management of the IGL, Networking, Communication
- Central R&D Department of Bochum University Administration of IGL Academic Education Ba / Ma Sc. Programs
- Bauconsult & Sachverständigen Büro Dr.- Ing. Ulrich Güttler
- DBT DEUTSCHE BOHRTENKONIC
- ECOS ENERGIE
- HOCHTIEF CONSTRUCTION AG
- DMT
- EnBW
- Dresden University of Applied Sciences
- Evonik Industries
- Hütte
- Philipp Langer
- Philipps
- RAG
- REHAU
- Stadtwerke Bochum GmbH
- UNIPZZ
- Vogelsang Gutachter Dr. Bergisch Glas
Bochum School of Geothermal Technology

Bochum University Appl.Sc.
Host of the International Geothermal Center

Central R&D Department of Bochum University
Administra- tion of IGL
Academic Education Ba / Ma Sc. Programs

Public Bodies, Universities, Administr., Gov- ernmental Org., Chambers
Non-profit Association of Public Institutions
Scientific Management of the IGL, Networking, Com- munication

RWTH Aachen

Universidad de Chile
Pontificia Universidad Católica
University of Antártida Chilena

Universidad de Concepción

Bochum University Appl.Sc.

Technische Universität Darmstadt
Vertikalbohranlage (40 t pull) Doppelkopf alle gängigen Bohrverfahren möglich

Shallow rig BO-REX 40 ton pull < 1.000 m
shallow rig
BoRex
40 ton pull
< 1.200 m

CT rig – up to 90 ton pull
> 5,000 m
shallow / near surface geothermal energy
(earth coupled) ground source heat pumps
Geothermal energy use: shallow, direct + electric power

Depth

- 200°C/392°F
- 150°C/302°F
- 120°C/248°F
- 100°C/212°F
- 80°C/176°F
- 60°C/140°F
- 40°C/104°F
- 20°C/68°F
- 0°C/32°F

- Conventional power plants
- Binary geothermal power plants
- Fruit & vegetable drying
- Mushroom culture
- Soft drink carbonation
- Geothermal/ground-source heat pumps

- Cement & aggregate drying
- Onion & garlic drying
- Fulp & paper process
- Concrete block curing
- Snow farming & aquaculture

- Lumber drying
- Pacon dyeing
- Greenhouses & soil sterilization
- Bathing

- Refrigeration & icemaking
- Building heating & cooling & water heating
- Blanching, cooking & pasteurization

- Ethanol, biofuel prod.
- Beet sugar evaporat. & pulp drying
- Biogas process

- 0 m
- 400 m
- 2,000 m
- 3,500 m

- Electricity
- Foods & related
- Heating and related
- Other
shallow useage of earth’s heat – various possibilities

- **well systems (open “loop”), Brunnenanlagen**
  (offen, erfordert 2 Brunnen + gutes Wasser, höchste Effizienz)

- **horizontal collectors, Erdwärme- kollektoren**
  (geschlossen, geringste Effizienz, hoher Platzbedarf, evt. Großer eigener Arbeitsanteil möglich)

- **borehole heat exchangers (closed loop system), Vertikale Erdwärmesonden**
  (gute Effizienz, keine Wartung, geschlossenes System, sehr guter + effizienter + wirtschaftlicher Standard)
Bohrtechnik, Baustelle, Erdwärmesonde, Wärmepumpe

- Bohrtechnik
- Baustellen + Logistik
- Sondeneinbau
- Verpressung
- Dichtigkeitsprüfung
- Verteiler + Hausanschluß
- Dichtigkeit Gesamtsystem
- Wärmepumpe
- Dokumentation
German standards for (private) use of shallow geothermal energy

DIN / VDI standard 4640

7.4 Umweltschutz bei Bohrarbeiten
Bohrunternehmen für Arbeiten im Rahmen der flächennahen Geothermie (bis ca. 400 m Tiefen) sollten als Fachfirma nach DVGW W 120 (Verfahren für die Erteilung der DVGW-Bescheinigung für Bohr- und Brunnenbauunternehmen) zugelassen sein. Bei Bohrungen und Bau von Grundwasserbrunnen muss

- environmentally sound
- no pollution
- ground water protection
- sustainable

Generally
- German standard VDI 4640 „Thermal mining of the subsurface parts 1–4“
- Swiss technical guideline SIA 384/6 „ground heat exchangers“
Local water authorities will grant a permit including certain specific requirements. Need to have a permit issued through the local water authorities:

- Report start + end of drilling
- No drilling additives
- Mining authorities (Bundesbergg.) > 100 m depth

Certified drilling company.
 educated, experienced personal required to run drilling equipment and execute the job ticket

- DIN 4640 regulates the execution of the (drilling) work

Thermische Nutzung des Untergrundes
Erdgekoppelte Wärmepumpenanlagen

- Zertifizierungen für Bohr- / Fachpersonal
- education and testing of drillers (DIN 4021 )
- certified drilling company according to DVGW - W 120
- Abstände: Sonden untereinander, Grundstücksgrenzen, auch unterirdisch
- (Erd-) Leitungen beachten
- Hinweise auf Bohrverfahren und Bohr Ø beachten
very important: design / dimensioning of the complete ground loop heat exchanger system including heat pump

- Wärmpumpe “knapp” / heat pump “lean”
- Bohrung “satt” / borehole “mean” (→ deep)
- Die Abstimmung / Auslegung der Bohrung auf die Wärmpumpe und örtliche Geologie ist Vorraussetzung für eine effizient laufende WP Anlage mit high JAZ (overall COP) → Fachfirmen, geschultes Personal
- running hours / year very important (2,400 hrs / yr including warm water)
- Die schwächste Sonde bestimmt die Leistung in der Summe (Prinzip “Kette”)

U-Rohr-Sonde

4 Rohre
Biegeradius 40 cm
Sandbett 20 cm
Zement-Opalit-suspension
Bohrdurchmesser 110 – 133 mm
Potential maps for the utilisation of shallow geothermal energy

- **For most central European countries**
- Partly available as GIS online-applications
- German state specific diagrams with different approaches
  - Geothermal yields for borehole heat exchangers up to 100 m according to VDI 4640 page 2
  - Heat conductivity of the geological and hydrogeological conditions
  - Data (geology, thermal physics) of existing exploratory drilling
  - Synthetic drilling profile with geological layer construction
  - Usability of the geological and hydrogeological conditions for shallow geothermal use
statewide description of the near to surface geothermal potential up to a depth of 100 m via geographic information system (geological state office NRW)

- Editing as CD-ROM basic and a professional version
- Basic concept of the map: digital topographic map in scale of 1:50,000
- Basis of calculation: tabular values according to VDI-Richtlinie 4640, page 2
- Use on individual units < 30 KW thermal output limited with borehole heat exchangers
- Calculation of the site-specific geothermal yield based on the existing information on the subsurface buildup
Geothermal potential in NRW:

- High – very high (partly >150 Kwh/(ma)):
  terrace sediments in the Rhine Valley with sands and gravel which show high conductivity and strong ground water flow.

- High (> 120 Kwh/(ma)):
  Bedrock with carbonic and devonian sand and claystone in the average mountains and in the Ruhr area.

- Medium (> 90 Kwh/(ma)):
  Compact marl in the Münsterland Cretaceous Basin

- Very low (< 60 kWh/ma)):
  Dry sands in the Rheinische brown coal-mining district (Aachen-Köln)
Geothermal potential survey North Rhine Westfalia

Example
Bochum,
Germany
Geothermal potential survey
North Rhine Westfalia

Example Bochum

- Depth range 0 – max. 30 m: medium geothermal yield in the low permeable unconsolidated sediment and chalk marls
- Depth range from approx. 20 – 30 m depth: higher geothermal yield in the carboniferous sand and claystone
- Opening depths for the borehole heat exchangers should be chosen preferably large for small units
Example Bochum

- Calculation of the depth of the borehole heat exchanger
  - Heat pump thermal output: 11 kW
  - Cop-Coefficient of Performance : 4.3
  - Evaporator (cooling) capacity : 8.5 kW
  - annual operating hours: 2,400 h/a (heating including hot water)
  - Annual heat requirement : 20,400 Kwh/a

- Case 1: Med. geothermal yield for 40 m : 103 KWh/(ma)
  - Total length of the bore hole heat exchanger : 20,400 Kwh/a /103 KWh/(ma) = 200 m
  - Apportional in 5 bore hole heat exchangers a 40 m

- Case 2: Med. geothermal yield for 80 m: 119 KWh/(ma)
  - Total length of the bore hole heat exchanger : > 20,400 Kwh/a /119 KWh/(ma) = 170 m
  - Apportionable in 2 bore hole heat exchangers a 85 m
shallow / near surface geothermal drilling technologies
“shallow” (< 400 m) geothermal standard drilling technology in Europe

mud rotary drilling (Spülbohren)
incl. PDC bits and drill mud

DTH Hammer Luft / air
Spülungsmedium
air (+ water)

DTH hammer Wasser / water
Spülungsmedium clear water
DTH percussion (air) hammer

- Decades of proven technology
- „rescue 33“ Chile 2010: very fast pneumatic DTH air hammer system drills to 800 m (Center Rock Inc.)
- (Schramm T 130 Rig + CRI DTH hammer magazine → from 5,5“ – 26“ hole size)
- Air hammer well known as standard in shallow hard rock drilling (< 200 m ground water table)

→ high ROP in hard rock
- BUT: depth limitation + very inefficient
physical comparison DTH
air + water

- Air (gas) is compressible
  - > 3 – 4 x more power required
- Very high speed of return air / “flow”
- Depth limitation due to low specific density of air

Air
15-30 l/s @ 12-20 bar
300-400 l/s @ 1 bar(a)

Water
4-6 l/s @ 120-180 bar
~1 m/s

20-30 m/s
borehole safety and quality

Unabhängig von Tiefe und Grundwasser

Wasser mit

Tiefe + Geologie entsprechen dem hydrostatischen Druck

→ "balanced drilling"

Hydrostatischer Druck der Wassersäule stabilisiert das Bohrloch automatisch.

Unabhängig von Tiefe und Grundwasser.
borehole safety and quality

expanding air (gas)
→ large caverns, voids, erosion
“explosions” possible

→ e.g. city of Stockholm banned DTH air hammer drilling

ground water will be pumped ("geyser")

rising velocities

water at depth + geology match the hydrostatic pressure

"balanced drilling"
- air hammer:  \( \text{ROP } \phi \text{ for } 11 \text{ Bohrungen} = 0.7 \text{ m/min} \)
- water hammer:  \( \text{ROP } \phi \text{ for } 15 \text{ Bohrungen} = 0.5 \text{ m/min} \)

**But:** air compressor’s power 3 x higher!!
energy / diesel consumption while drilling down to 220 m

ROP appr. 0.7 m/min in > 200 MPa rock

Diesel consumption while drilling with conventional air hammer (left) and high pressure water (right, blue) down to 220 m depth

DTH air hammer (compressor) requires 4 x more energy than DTH water hammer
Deviation from vertical drilling axis

borehole deviation while drilling to 210 m with DTH air hammer (red) and DTH water hammer (blue)

DTH water hammer < 5 - 10 deviation ➔ ca. 5 x straighter than DTH air

Abstand 14 m Spü lungsaustritt

Bohrtiefe 130 m
Deviation from vertical drilling axis
light colors: DTH air - dark colors: DTH water
radial geothermal system GeoStar

radial directional drilling with straight hydraulic DTH hammer technology
typical drill site for shallow (< 300 m) geothermal drilling with DTH water hammer < 200 bar

- iron rough neck clamp + break out
- sediment container
- Triplex plunger pump
- double head drill rig
GeoStar drill site for geothermal field at new GZB

- 20 drill holes à 200 m
- 10° deviation / slope angle
- starting “point“ is ellipsoid with 7 + 10 m Ø
- 6“ DTH water hammer with 7 ¼“ drill Ø
- 6“ drill rod Ø = 152,4 mm
DTH water hammer geothermal drilling in Bochum shallow drilling < 200 m depth x 30 holes 180 bar

ROP 1-2 m/min (130 mm hole Ø)
DTH water hammer < 180 bar
@ 12 – 20 m³ / hr

full material recycling
sample taking

Water Management filter
and sedimentation
stages for mud return
sample taking
Shallow geothermal, direct use BHE: max. thermal conductivity + min. Hydr. pressure losses

- double loop (U) is standard
- 25 mm to appr. 60 m
- 32 mm to appr. 130 m
- 40 mm to appr. 250 m (500 m)
- coaxial BHE more versatile
- pressure loss of the brine pump
- manufacturer’s QA / QC
Verpressen / Hinterfüllung / grouting

- **bentonite**: schlechte thermische Leitfähigkeit, gut abdichtend (d.h. hydraulische Sperre), nicht frostbeständig; hydraulic barrier
- **cement**: gut frostbeständig, bessere thermische Leitfähigkeit, weniger gute hydraulische Dichtwirkung, strong bond
- **quarzite / Quartzmehl**: hohe Wärme- (+ hydraulische) Leitfähigkeit,
- Heute üblich: sog. “Dämmer” mit ca. (> 2 W / m K

rohr von unten nach oben im Contractorverfahren bis zum Austritt an der Geländeoberkante zu verpressen. Die Abdichtung darf den Durchlässigkeitsbeiwert von kₚ = 1 · 10⁻³ m/s nicht überschreiten. Durch die Bohrung darf kein dauerhafter künstlicher hydraulischer Kontakt zwischen Grundwasserstockwerken geschaffen werden. Die Bohrfirma hat den Nachweis zu erbringen, dass die Trennung der Grundwasserstockwerke erhalten bleibt, für das eingebaute Material ist ein Eignungsnachweis
installation / grouting / contractor process
Druckprüfung / leakage + pressure testing

- **Nicht mehr mit Luft**
  
  (ca. 8 – 10 bar für einige Stunden)

- **now with water according to DIN 4640 / EN 805**
  : hydraulisch, angelehnt an Normen für Rohrleitungsbau

- (Wasser ist nicht kompressibel)
Neue Dichtigkeits- / Druckprüfung / pressure test
DIN 4640 / EN 805: with water, not air
geothermal system: manhole connector
Soleverteiler / Verteilerschacht

- Verteiler (-schacht)
- Vor- / Rücklauf
- mit / ohne Boden / (Grund-) wasser
- Absperrhähne
- Befüllung
- Kondensation (Schwitzwasser)
- Durchflußregler (Taco Setter)
- Nicht ständig zugänglich
- Tichelmann
- Doppel - U hat ca. 18 % mehr Effizienz als einfach U
- pressure losses in the system are critical
- manufacturer’s integrated brine pumps commonly under powered
- COP: Coefficient of Performance (listed by manufacturer e.g. B 0 / W 35)
- **JAZ (annual overall COP)**: Jahresarbeitszahl (real, overall performance / efficiency over one year)
final reports

- Schichtenverzeichnisse
- Bohrprotokolle
- Bautagesberichte
- Druckprüfungen
- Sondenprüfzeugnisse
- Verpressprotokoll / -log

Information sending to:

- Untere Wasserbehörde (local water authorities
- Geologischer Dienst Krefeld (geological survey
- Bez.-Reg. Arnsberg (mining authorities) when depth > 100 m
medium deep drilling applications and technology just in the process of getting started target depth often around 1.000 m
Geothermal energy use: shallow, direct + electric power

- 200°C/392°F: Conventional power plants
- 150°C/302°F: Binary geothermal power plants
- 120°C/248°F: Cement & aggregate drying, Onion & garlic drying
- 100°C/212°F: Fertilizer process, Paper process, Plywood drying, Pulp & paper process
- 80°C/176°F: Fruit & vegetable drying
- 60°C/140°F: Mushroom culture
- 40°C/104°F: Geo-thermal/ground-source heat pumps, Snow melting & de-icing
- 20°C/68°F: Bathing, Soil warning
- 0°C/32°F: Geothermal/ground-source heat pumps

- 3.500 m: Ethanol, biofuel prod.
- > 3.500 m: Beet sugar evaporat. & pulp drying
- 2.000 m: Building heating, cooling & water heating
- 2.000 m: Blanching, cooking & pasteurization
- 400 m: Biogas process
- 0 m: Other
2007: medium deep geothermal ground loop at 706 m, Switzerland

- Tiefste dokumentierte PE-Erdwärmesonde (drilled)
- Nov. 2007 wurde in Oftringen, Schweiz, die mit 706m derzeit tiefste dokumentierte 40mm Doppel-U PE-Erdwärmesonde der Welt erfolgreich eingebaut.

new (co-axial) heat exchanger materials
at GZB in Bochum: new 40 ton BoRex mobile drill rig and drilling methods down to 1.200 m

shallow rig BoRex
40 ton pull
< 1.200 m
new development: 250 ton mobile drill rig down to 2,500 m
new development: 250 ton mobile drill rig down to 2,500 m
Deep Drilling / laws / restrictions / environment / technology
deep geothermal drilling + equipment > 3.000 m

depth drilling rig „Herrenknecht“ Terra Invader
§ 2 BBergG Sachlicher und räumlicher Geltungsbereich

Das Bundesberggesetz gilt für:

- Aufsuchen, Gewinnen und Aufbereiten von bergfreien und grundeigenen Bodenschätzen
- Wiedernutzbarmachen der Oberfläche
- Betriebsanlagen und Betriebseinrichtungen die der Aufsuchung, Gewinnung, Aufbereitung und Wiedernutzbarmachung dienen oder zu dienen bestimmt sind
Bergrechtliches Verfahren für Geothermie Bohrungen

**drilling / borehole**

- no
  - Kein bergrechtliches Verfahren
- yes
  - bohrehole > 100 m?
    - no
      - Bestätigung des Eingangs der Anzeige
    - yes
      - Anzeige nach § 127 BBergG

**exploration / mining**

- Aufsuchungs-Erlaubnis
- Betriebsplan zur Aufsuchung § 51 BBergG
- Gewinnungs-bewilligung
- Betriebsplan Zur Gewinnung § 51 BBergG
application + permit process + (major) operation plan for a (medium) deep geothermal borehole in Germany

- Erlaubnis zur Aufsuchung von Erdwärme (§ 7 BBergG)
- Gestattungsvertrag mit dem Grundstückseigentümer
- Betriebsplan für eine Bohrung (§ 127 BBergG i.V.m. § 51 BBergG)
- Hauptbetriebsplan für die Gewinnung von Erdwärme aus einer geothermischen Bohrung (§ 51 BBergG)
- Abschlussbetriebsplan für die Betriebseinstellung (§ 53 BBergG)
Hauptbetriebsplan für die Gewinnung von Erdwärme
§ 55 BBergG Zulassungsvoraussetzungen

major operating plan for mining of geothermal heat

Anforderungen an den Hauptbetriebsplan

• Berechtigungsnachweis für die Gewinnung (permit)
• fachkundige, verantwortliche Personen (educated personal)
• Vorsorge gegen Gefahren für Leben, Gesundheit und Schutz von Sachgütern, Beschäftigten und Dritten im Betrieb; safety
• Schutz der Oberfläche
• ordnungsgemäße Abfallbeseitigung (waste management)
• Vorsorge zur Wiedernutzbarmachung (re-urbanization)
• keine gemeinschädlichen Einwirkungen (no general intrusion)
• Abschlussbetriebsplan (final report)
Use of deep (> 1,000 m) geothermal energy for electric power production

- (exploration) drilling technologies
- Reservoir characterization
- Open systems
- Petrothermal - Hot dry rock (HDR)
- Stimulation, EGS
- Ratio of thermal to electric power appr. 3 : 1, depending on T, geology, reservoir

Geothermal drilling rig on site in the United States (source: TheraSource)
horizontal (stage) stimulation / opening of pathways via CT for heat mining of petrothermal reservoirs

(source: Worldoil)
Deep geothermal projects: timeline exploration + development

CT exploration drilling cuts down timeline + project costs

- Start-up
  - Legal Work
  - Concession
  - Permits
  - Geophysical surveys
  - Geochemical and geological data collection & analysis
  - Temperature gradient drilling
  - Focused exploration on most favorable resource area
  - Sufficient Exploration data collected & analyzed

- Exploration
- Pre-Feasibility
- Feasibility
- Design & Construction
- Year 1
- Year 2
- Year 3
- Year 4
- Year 5
- Commercial Operation
- Drilling of first successful, full-sized production well
- Confirmation Wells, Reserve Estimates & Preliminary Design
- Drilling & testing of remaining production and injection wells
- Civil works required
- Final design & testing
Deep geothermal projects
timeline exploration + development

Geothermal power development

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
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<tbody>
<tr>
<td>Start-up</td>
<td>Legal work, concessions, permitting</td>
</tr>
<tr>
<td>Exploration</td>
<td>Geophysical surveys, geochemical and geological data collection and analysis, temperature gradient drilling</td>
</tr>
<tr>
<td>Pre-feasibility</td>
<td>Focused exploration of most favorable resource area, sufficient exploration data collected &amp; analyzed</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Drilling of first successful, full-sized production well, confirmation wells, reserve estimates &amp; preliminary design, securing PPA and final permits</td>
</tr>
<tr>
<td>Design &amp; Construction</td>
<td>Drilling &amp; testing of remaining production and injection wells, civil works, final design &amp; testing</td>
</tr>
</tbody>
</table>

![Geothermal power capacity in development](image-url)

In MW by different development stages, 2007–2010
Basic components of a CT rig

- Fluid Management System and Tanks
- Coiled Tubing
- Gooseneck
- Injector Head
- Mast / Crane
- BoP
- Tubing Reel
- Control Cabin
- Power Pack
- Motor
- Drill Bit
- Directional Sensors

Hydraulic DTH hammer possible
CT Drilling System at GZB, Bochum
versatile CT rig with
DTH fluid hammer on (flexible) coil
Thank you very much for your attention!

Contact information:

Volker Wittig, International Geothermal Center, Bochum, DE
R & D Manager for Advanced Drilling Technologies
Bochum University of Applied Sciences
volker.wittig@hs-bochum.de
www.geothermie-zentrum.de
AHK-Geschäftsreiseprogramm
German Trade Mission to Turkey

Financing Support for Geothermal Energy Investments

Kai Berndt, GFA
Izmir, November 2012
The Financing Advisory Instrument of BMWi’s EnEff & RE Export Initiatives

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<th>Modul 1: National and International Financing Support</th>
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<td>Modul 2: Financing Support by German Institutions</td>
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<td>Modul 3: Carbon Finance</td>
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<tr>
<td>Modul 4: Matching and Innovative Financing Concepts</td>
</tr>
</tbody>
</table>

**Tools and Methods:**
- Report on Financing Mechanisms
- Presentation
- Individual Counselling

**Target Group:**
German Trade Delegation Members and potential Business Partners in the Host Country
Modul 1:
Selected National and International Financing Support
Favorable National Investment Framework

- No special permission required for foreign investments
- Foreign investors may set up 100% foreign owned companies
- Elimination of minimum capital requirement for setting-up a company owned by foreigners
- Exemption from customs duties and VAT on imported technological equipment
Framework Condition on Renewable Energies

- **Legal Framework:**
  - Law No 5686 on Geothermicsince June 2007
  - Durchführungsvorschrift No 26727

- **Feed-in tariffs:**
  - Geothermic 10,5 US Dollar cent/ kWh
  - increased tariffs using local components
  - May 2005 till December 2015

- **Further Support:**
  - reduced fees on diverse permissions
  - priority regarding connection to the grid

- **Subsidies on Investments:**
  - 4 Programmes on Investments
  - incentives e.g. tax reductions up to 65 %
  - depending on the Region and Special Industrial Zones
National Support Mechanisms

**Renewable Energy Support Programme**
- Project Duration: Maximum 1.5 years
- Support Amount: up to 1,000,000 US-$ (max. 50% of project costs)
- 1 year grace period, in total 4 years interest-free
- Service Charge: 6% of TTGV support amount

Contact: info@ttgv.org.tr

**Renewable Energy and Environmental Loans**
- Cooperation with different IFIs (e.g. World Bank, KFW, EIB)
- Thus diverse on-lending programmes with various conditions
- Funding / loan approval takes 3 to 5 weeks
- Hands on Experience with Geothermic Projects
- Loan application to TSKB ‘s Corporate Marketing Department

Contact: info@tskb.com.tr
International Support Mechanisms

- Low-interest credit lines for Sustainable Energy Financing from EBRD (TurSEFF, MidSEFF) : EUR 900 million
- Green Growth Fund for SEE and Turkey
EBRD’s Sustainable Energy Financing Facility Concept

EBRD’s Sustainable Energy Financing Facilities (SEFFs)
Credit Lines for EE, RE targeting emission reduction combined with Technical Assistance:

- Introduced in 2004
- Framework of EUR 1.8 billion
- Now in 15 countries
- >EUR 400 million provided as loans to 50 partner banks

2 SEFFs in Turkey:

- Turkey Sustainable Energy Financing Facility (TurSEFF)
- Turkey Mid-size Sustainable Energy Financing Facility (MidSEFF)
Loan Products, Project Types, Target Groups

1. Commercial EE investments
   1a. small-scale up to USD 300,000
   1b. medium-sized > USD 300,000 to USD 5 million

2. Stand Alone RE investments
   up to USD 5 million

3. Building sector EE/RE investments
   up to USD 5 million

4. EE/RE investments residential Sector
   up to USD 75,000

5. Supplier loans
   up to USD 1 million
Technical Assistance

Implementation Team
- MWH
- GFA
- Frankfurt School of Finance & Management
- Bankakademie HfB
- D'Appolonia

Standardised Process

Comprehensive Assessment

Loan Facility
- US$ 200 m

Verification Consultant

Residential / Small-Scale Energy Efficiency

Commercial / Industrial EE/RE Projects
Turkey Mid-size Sustainable Financing Facility (MidSEFF)

- Launched in December 2010
- Support investments in RE and EE to increase energy savings and reduce carbon emissions
- Credit lines for banks in Turkey with the amount of EUR 400 million and technical assistance
- Funds are provided by the EBRD to banks in Turkey for on-lending to:
  - mid-size (5 – 50 MW; up to 40 MW for hydropower plants – HPP) renewable energy Sub-projects;
  - energy efficiency improvements in the industrial sector;
  - private sector investments in municipal and/or industrial waste-to-energy projects.
Turkey Mid-size Sustainable Financing Facility (MidSEFF)
GGF - Green Growth Fund Southeast Europe and Turkey

Eligibility criteria for investments through Financial Institutions

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>Non-standard</th>
<th>SME/Industrial/Municipalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipient</td>
<td>Households, SME</td>
<td>HOA, SME</td>
<td>Businesses, Municipalities, Public</td>
</tr>
<tr>
<td>Min sub-loan</td>
<td>N/A</td>
<td>N/A</td>
<td>€500k</td>
</tr>
<tr>
<td>Max sub-loan</td>
<td>€500k</td>
<td>€500k</td>
<td>€10 million</td>
</tr>
<tr>
<td>Eligible Measures</td>
<td>Building envelope, heat source &amp; distribution, lighting, renewable utilization, combined heat/power, (white goods* – standard only)</td>
<td></td>
<td>EE and RE projects</td>
</tr>
</tbody>
</table>
# GGF - Green Growth Fund Southeast Europe and Turkey

## Investments through/to Non-Financial Institutions

<table>
<thead>
<tr>
<th></th>
<th>To/through ESCOs</th>
<th>Energy service/supply</th>
<th>Municipalities &amp; Corporates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recipient</strong></td>
<td>Public sector, industrial</td>
<td>EE/RE service or equipment companies</td>
<td>Public and private sector entities</td>
</tr>
<tr>
<td><strong>Min loan</strong></td>
<td>€100k</td>
<td>N/A</td>
<td>€1 million</td>
</tr>
<tr>
<td><strong>Max loan</strong></td>
<td>€10 million</td>
<td>€10 million</td>
<td>€10 million</td>
</tr>
<tr>
<td><strong>Eligible Measures</strong></td>
<td>Energy efficiency, renewable energy, energy performance contracts, energy supply contracts</td>
<td>EE/RE producers or vendors, service companies</td>
<td>Energy efficiency, renewable energy projects</td>
</tr>
</tbody>
</table>

www.ggf.lu
Modul 2: Selection of Financing Support by German Institutions
Overview – German Support Instruments

Various financial and technical support instruments available to foster EE investments

Renewable Energy Projects / Investments with German participation:
- technology export
- or direct involvement

Project Support Instruments:
- PPP projects
- Feasibility Studies
- Climate Partnerships with private sector

Export & Trade Finance
- kfw
- DEG
- Euler Hermes
Export Finance – Buyer Loan

Main lending instrument in export business is the so-called buyer loan

1. Export Contract
2. Loan Agreement
3. Export Goods or Services
4. Export Contract Payment
5. Loan Repayment

Usually covered by an export guarantee provided by official export credit insurance
**KFW IPEX – Export Financing**

KfW IPEX-Bank provides project finance and offers trade and export finance.

| Target Group & Eligibility | • German Exporters and Foreign Buyers of German Exports – Goods and Services  
• Financed are exports insured via HERMES Credit Cover (not conditional)  
• Substantial proportion of German technology and service |
|----------------------------|---------------------------------------------------------------------------------------------------------------|
| Terms and Conditions       | • Loan volume up to 25 Mio. EUR / max. up to 85% contract value  
• Individual, case-by-case decision on interest rates  
• Maturity: minimum 4 years |
| Application                | • Application for Supplier Credit at every German Bank Institute  
• Application Buyer Credit turn to KfW IPEX-Bank GmbH  
  E-Mail: info@kfw-ipex-bank.de  
  Internet: [http://www.kfw-ipex-bank.de](http://www.kfw-ipex-bank.de) |
| Small Ticket Europe        | • Export Finance for Small and Medium Companies  
• Small Export Loans 0.5 to 5 Mio. EUR with maturities ranging from 2 to 5 years  
• Information: kmu_export@kfw.de |
Euler Hermes Export Credit Cover protects German Exports against payment defaults and cash losses, due to: Political Risk and Economic Risks

**Eligibility**
- Export of goods and services and structure financing / project financing
- None-marketable, but justifiable risks abroad
- Special focus on small and medium enterprises
- No minimum export value

**Terms and Conditions**
- Variable maturity – for energy efficiency, renewable energies up to 18 years
- Flexible redemption payment possible – e.g. annuity
- Administrative fee + premium
- Premium depends on country rating, credit period, creditworthiness of buyer
Export Credit Cover Instruments:

- Manufacturing Risk Cover
- Supplier Credit Cover
- Buyer Credit Cover
- Constructional Works Cover
- Cover of Project Financing and Investments
- Guarantees

Contact: Phone +49 (0)40/8834 9000 • Email: info@exportkreditgarantien.de
DEG – Deutsche Investitions- und Entwicklungsgesellschaft mbH

A partner for German private-sector companies investing in developing and emerging-market economies.

**DEG Instruments**

- **Variable equity participation** in the company in the investment country – minority stake with clearly defined exit strategies
- **Project-specific mezzanine finance**
- **Long-term loans** between 4-10 years maturity, max. 25 Mio. EUR
- **Guarantees** – e.g. risk sharing with local bank

**Contact:** Phone: +49(0)221 4986-0 – Email: info@deginvest.de
**DEG – Financing of Feasibility Studies**

DEG uses funds from the Federal Ministry for Economic Cooperation and Development (BMZ) to co-finance feasibility studies.

<table>
<thead>
<tr>
<th><strong>Target Group</strong></th>
<th><strong>SMEs located and operating within the EU</strong> with a turnover of up to 500 Mio EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial Support</strong></td>
<td><strong>DEG provides a up to 50% of the feasibility study cost’s</strong> – upper limit 200.000 EUR</td>
</tr>
<tr>
<td><strong>Requirements</strong></td>
<td><strong>Preparation of realistic private sector investment</strong> – plausible in terms of successful implementation and profitability</td>
</tr>
</tbody>
</table>
| **Application** | **Further information and application form**  
[www.deginvest.de](http://www.deginvest.de) -  
Phone: +49 (0)221 4986 1128 – Email: machbarkeitsstudien@deginvest.de |
Modul 3: Carbon Financing
Carbon Financing – How it works?

- Project in Host Country
  - CO2-Emissions
    - Baseline Scenario
  - CO2-Emissionen
    - Climate Project Scenario

- Annex 1 country receives certificates
- Annex 1 Country e.g. Germany
- Emission Reduction Certificates

- Host country (e.g. Turkey) profits from technology transfer and future emission reductions
- Project in host country profits from additional revenues (Co-Financing)
Carbon Finance in Turkey:

- Turkey officially ratified the Kyoto Protocol on August 26th, 2009, but has not adopted any target for limitation or stabilization of GHG emissions in the first commitment period (2008-2012).
- Due to the lack of the individual emission reduction targets Turkey is not able to use the flexible mechanisms (JI, CDM, emission trade).
- However, voluntary emission reduction is possible
- Voluntary Emission Reductions (VERs) are used by purchasers for climate neutrality purposes or for marketing
- Most commonly used standards: Gold Standard and Verified Carbon Standard
Voluntary market in Turkey

- Market size: 5 MT CO₂ traded in 2012
- Most common project types: wind and hydropower projects
- Number of VER projects in Turkey:
  - Number of GS projects in Turkey (October 2012):

<table>
<thead>
<tr>
<th>Listed</th>
<th>Validated</th>
<th>Registered</th>
<th>Issued</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>92</td>
<td>39</td>
<td>26</td>
<td>27</td>
<td>184</td>
</tr>
</tbody>
</table>

- Number of GS and VCS registered projects in Turkey:

<table>
<thead>
<tr>
<th>Type of standard</th>
<th>Number of projects registered</th>
<th>Number of wind power projects registered</th>
<th>Number of hydropower projects registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>GS</td>
<td>26</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>VCS</td>
<td>49</td>
<td>2</td>
<td>44</td>
</tr>
</tbody>
</table>
**Voluntary market in Turkey**

- Governed by typical market laws, the VERs are obviously priced at a lower price than the CERs (Certified Emission Reductions resulting from the official mechanisms) since these refer to voluntary markets.
- Prices depend on project type, standard applied, project size, market conditions, sustainable development indicators and project risk.
- GS requires highest environmental and social criteria of projects.
- Due to the general decline of price in the carbon market VER prices have dropped to 1 to 4.5 US$. VER GS may come up till 10 US$. 

CONCLUSION

• Several national support and financing mechanisms available

• Various international programs providing financing and support for the development of EnEff projects (KfW, SEFFs, GGF, etc.)

• German support mechanisms to finance energy efficiency investment abroad and to mitigate export risks

• Carbon finance available only as voluntary emission reduction activities
Thank you for your attention!

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