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Dutch German Geothermal Energy Meeting

Business Development in the Geothermal Energy Sector

International Networks – The Entry to New Business Opportunities

Dr. Rolf Schiffer
Schiffer Consult - GEO · Services
Marl, Germany

www.schiffer-consult.de

Status as of June 13nd 2016

Schiffer Consult

Overview

Content

- Brief introduction
- Geothermal potential of The Netherlands and Germany and geothermal applications as source for joint activities
- Geothermal potential and topics as insights for bilateral international activities - case study Turkey
- Thermal applications in Turkey – status and possibilities for development
- Examples and possibilities for networking and bilateral collaboration in Turkey from German view
- International networking and bilateral collaboration
- Conclusion

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Brief company introduction

Schiffer Consult

SBS Beratung + Service

SGS GEO · Services

Schiffer Consult is acting in specialist counselling, business consultancy as well as in project and business development and gives services to it‘s customers international.

Schiffer Consult - GEO · Services

International geoscientific and technical consulting
in geology, renewables, infrastructure, resources, hydrogeology, environment, conversion management, health and safety

Geothermal sector (extract)

Project and management consultancy

Studies, assessments / due diligence

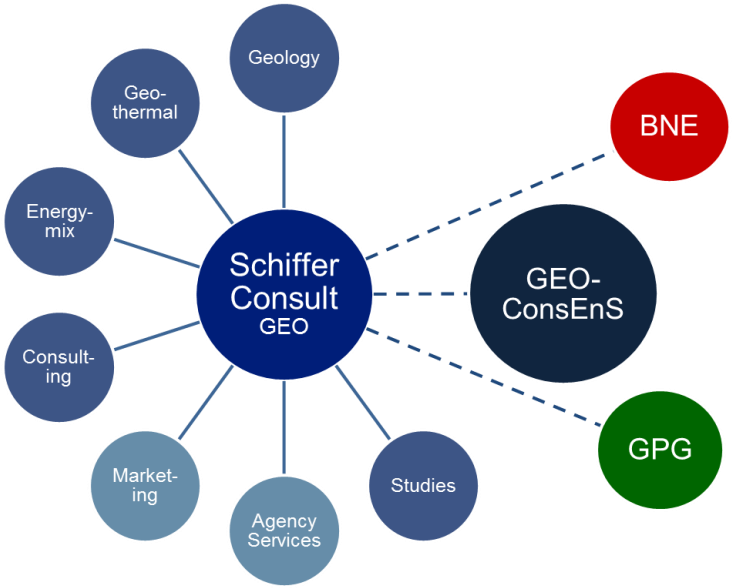
Project and business development

Marketing

Agency services

Customer relationship management

Services



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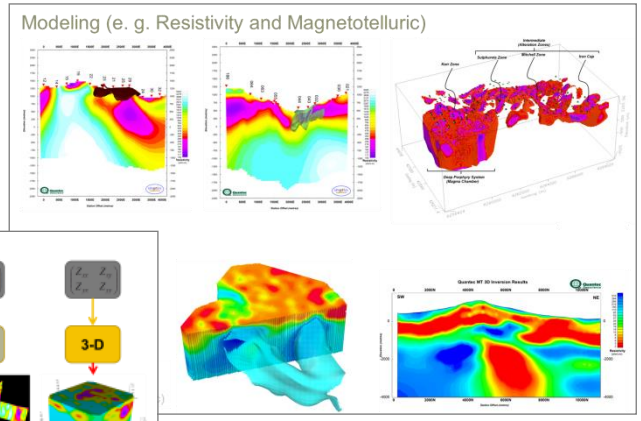
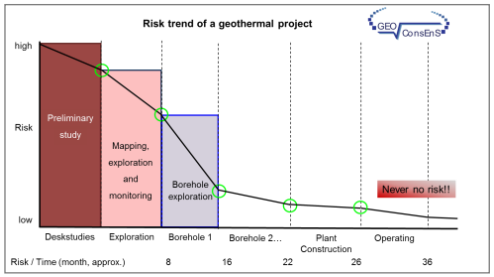
Offers and benefits for geothermal market (extract)

- ✓ Consultancy and expertise often covering
- ✓ Specialist consultancy
- ✓ System solutions and risk management
- ✓ Project evaluation and assessment
- ✓ Second (2nd) opinion reporting
- ✓ Due diligence (technical, economical)
- ✓ Project and business development
- ✓ Management consultancy
- ✓ Marketing services
- ✓ in special case: venture financing & funding





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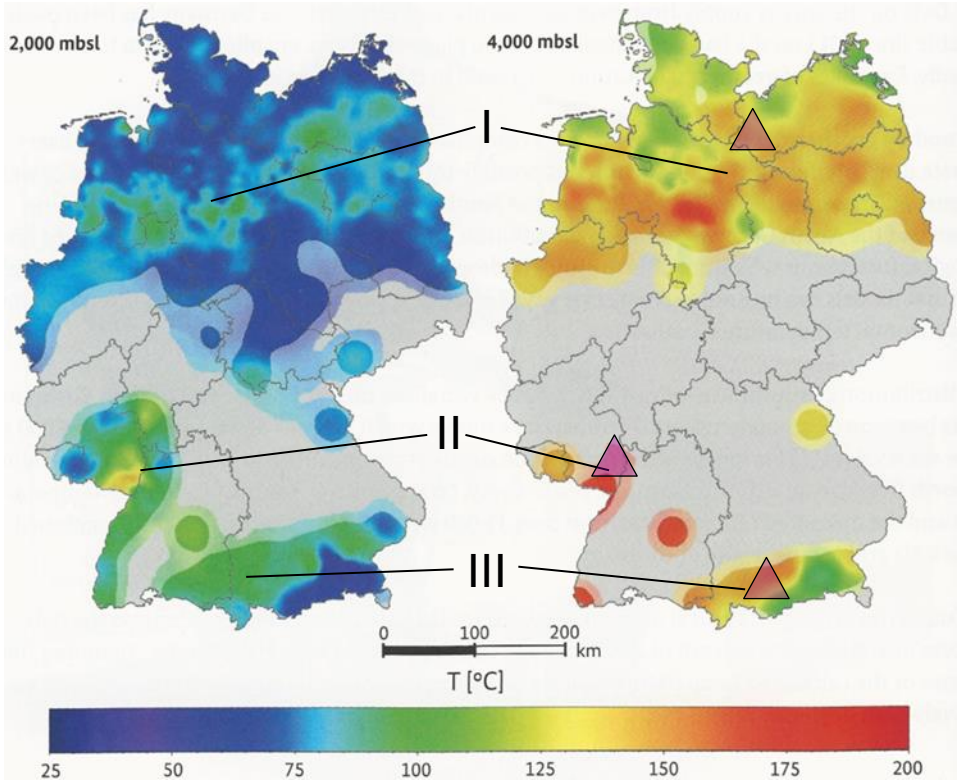
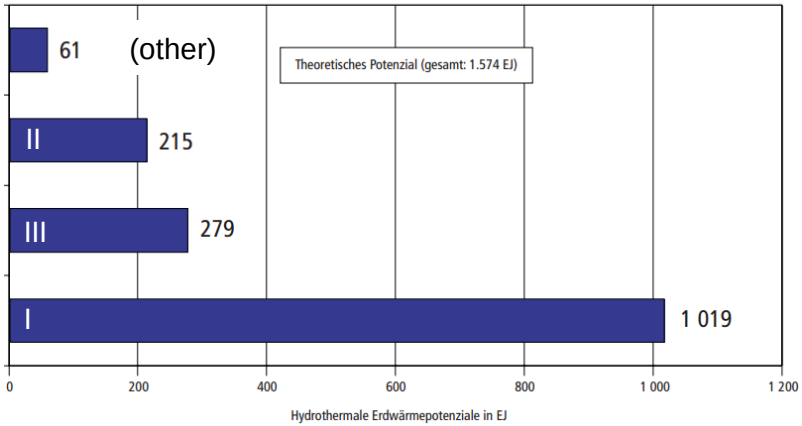
Geothermal temperature and potential in Germany





Source: Tiefe Geothermie in Deutschland – Federal Ministry for Environment, Nature Conservation and Nuclear Safty (2007)

I: North German Basin II: Upper Rhine Graben III: South German Molasse Basin

Region with geothermal power production (generation of electricity)

Source: Deep Geothermal Energy – Federal Ministry for Economic Affairs and Energy (2014)

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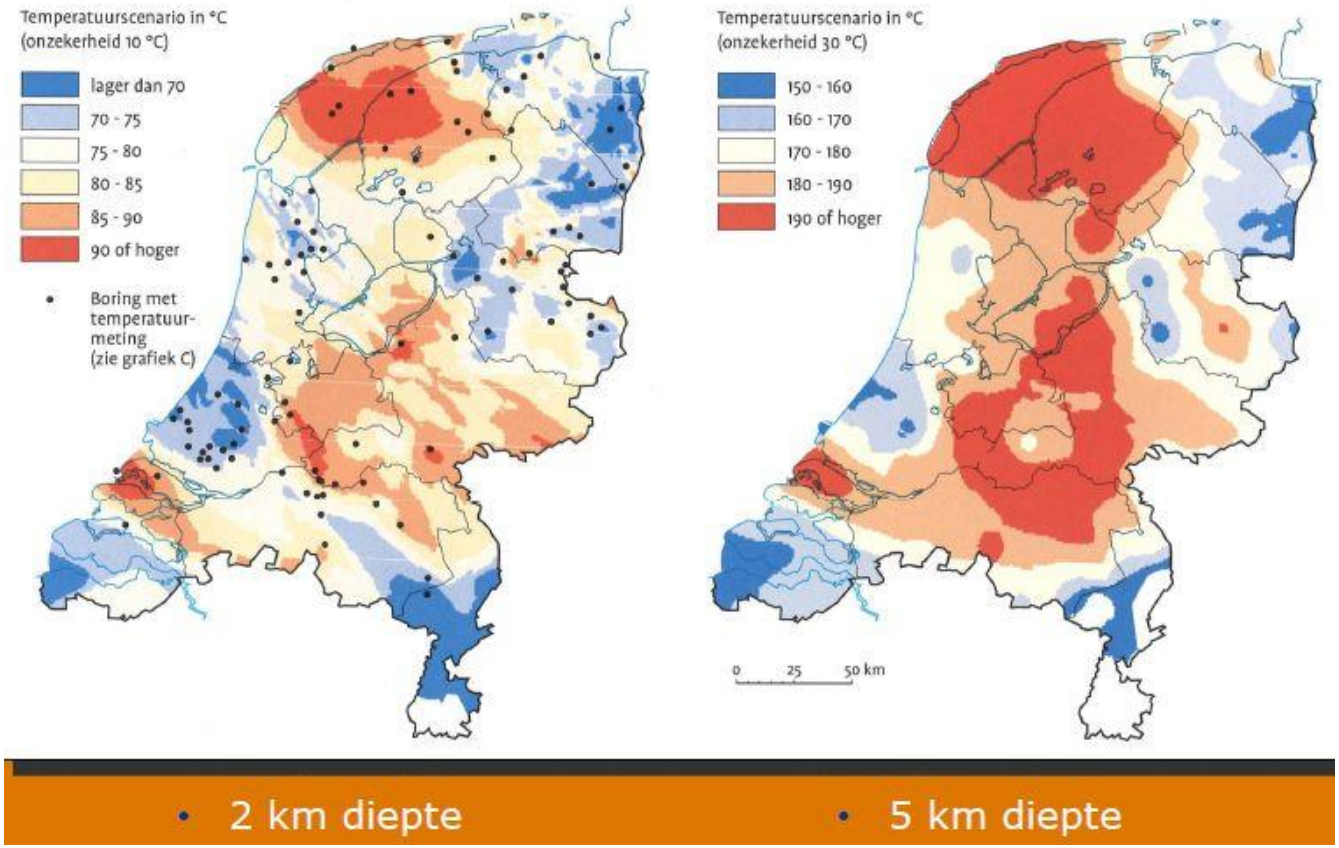
Geothermal temperatures of the Netherlands



Temperatures at 2000 m and 5000 m depth below surface

Source: www.dgem.nl - De Groene Energie Maatschappij (2013)

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Geothermal direct heat uses

	Netherlands		Germany	
Use	**Installed Capacity** [MW_t]	**Annual Energy Use** [TJ/yr]	**Installed Capacity** [MW_t]	**Annual Energy Use** [TJ/yr]
Individual Space Heating	-*	-*	3.4	20.8
District Heating	-*	-*	208.1	1909.4
Air Conditioning (Cooling)	-*	-*	-*	-*
Greenhouse Heating	100	1426	-*	-*
Fish Farming	-*	-*	-*	-*
Animal Farming	-*	-*	-*	-*
Agricultural Drying	-*	-*	-*	-*
Industrial Process Heat	-*	-*	-*	-*
Snow Melting	-*	-*	-*	-*
Bathing and Swimming	-*	-*	47.1	1401.1
Other Uses (specify)	-*	-*	-*	-*
Geothermal Heat Pumps	690	5000	2590	16200
TOTOAL	**790.0**	**6426.00**	**2848.6**	**19531.3**
* - no data available				

Source: IGA - Country Update Reports (2010-2015)

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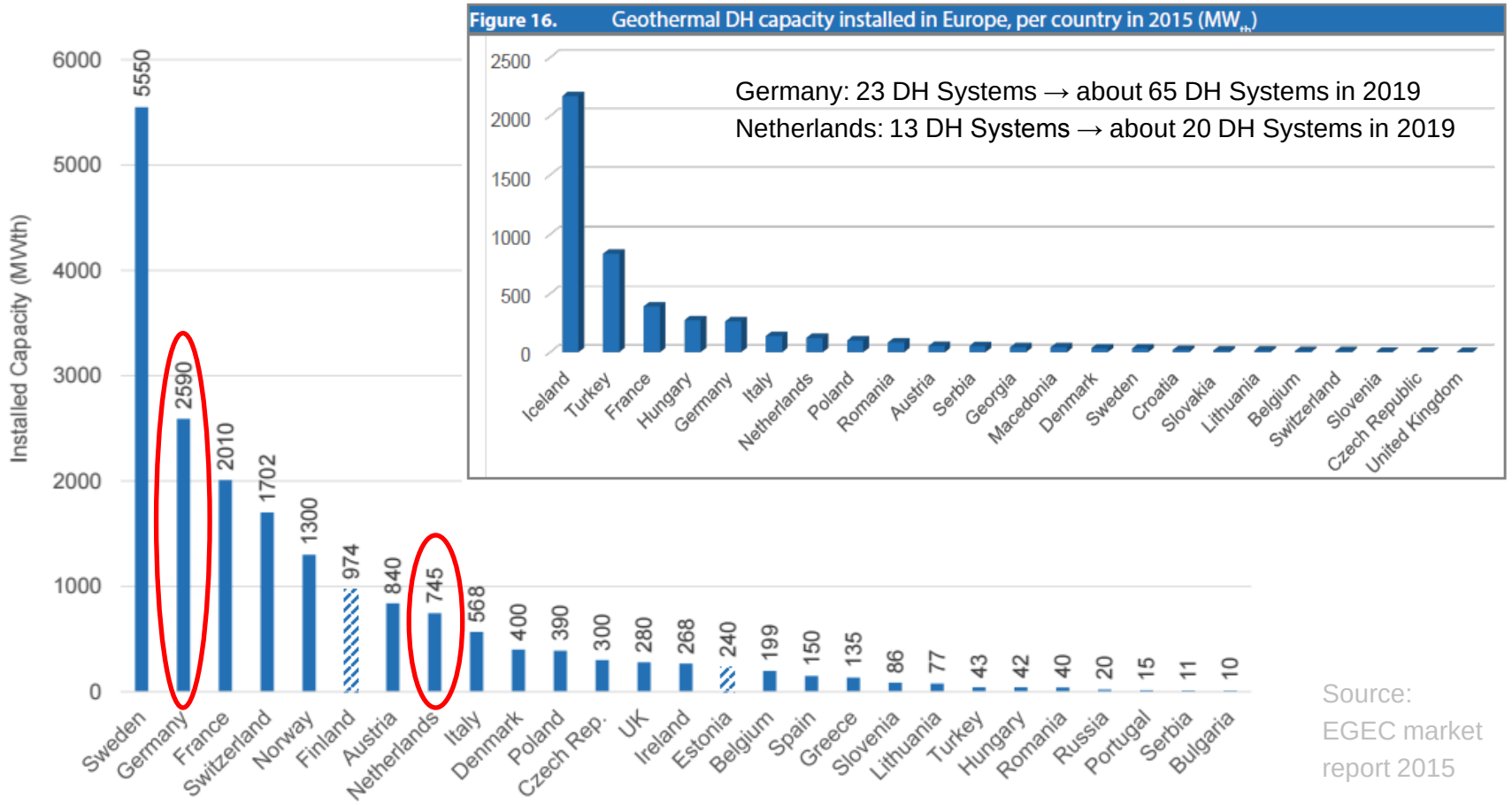
Installed capacity for shallow geothermal and DH



Source: EGEC market report 2015

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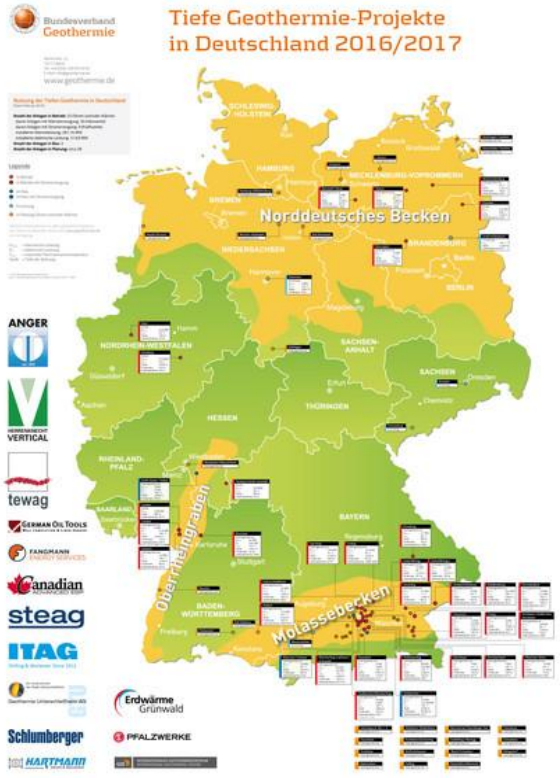
Deep Geothermal Projects in Germany



Tiefe Geothermieprojekte in Deutschland

Projekte in Betrieb

Status	Name	Bundesland	Art der Nutzung	MW_{therm}	MW_{el}	max. Temperatur in °C	Teufe in m	Förderrate (l/s)	Jahr d. Inbetrieb-nahme
33 Projekte in Betrieb	Bruchsal	Baden-Württemberg	Hydrogeothermie	5,5	0,44	120	2.542	24	2009
	Aschheim, Feldkirchen, Kirchheim	Bayern	Hydrogeothermie	9,8	0	85	2.630	75	2009
	Dürrnhaar	Bayern	Hydrogeothermie	0	7	141	3.926	130	2013
	Erding	Bayern	Hydrogeothermie	10,2	0	65	2.200	55	1998/2008
	Garching	Bayern	Hydrogeothermie	7,95	0	74	2.100	100	2010
	Ismaning	Bayern	Hydrogeothermie	7,2	0	77	1.906	85	2013
	Kirchstockach	Bayern	Hydrogeothermie	0	7	139	3.882	130	2013
	Kirchweidach*	Bayern	Hydrogeothermie	12	0,7*	128	3.500	130	2013
	München-Riem	Bayern	Hydrogeothermie	13	0	93	2.746	75	2004
	Oberhaching-Laufzorn / Grünwald	Bayern	Hydrogeothermie	38	4,3	127	4.083	140	2011/2014
	Poing	Bayern	Hydrogeothermie	9	0	76	3.000	100	2011
	Pullach	Bayern	Hydrogeothermie	11,5	0	107	3.445	105	2005/2012
	Sauerlach	Bayern	Hydrogeothermie	4	5	140	5.567	110	2014
	Simbach/Braunau	Bayern	Hydrogeothermie	9	0	90	1.942	90	2001
	Straubing	Bayern	Hydrogeothermie	2,1	0	36	800	45	1999
	Taufkirchen/Oberhaching*	Bayern	Hydrogeothermie	35	4*	133	3.800	120	2014
	Traunreut	Bayern	Hydrogeothermie	12	5,5	118	ca. 4.500	130	2014
	Unterföhring	Bayern	Hydrogeothermie	10	0	87	2.124	87	2009
	Unterföhring (2. Dublette)	Bayern	Hydrogeothermie	10	0	93	2.341	90	2014
	Unterhaching	Bayern	Hydrogeothermie	38	3,36	122	3.350	150	2007
	Unterschleißheim	Bayern	Hydrogeothermie	7,5	0	79	1.960	100	2003
	Waldkraiburg	Bayern	Hydrogeothermie	16,4	0	108	2.650	65	2012
	Neuruppin	Brandenburg	Hydrogeothermie	1,5	0	64	1.700	13,9	2007
	Prenzlau	Brandenburg	Sonde	0,15	0	108	2.790	k.A.	1994
	Heubach/Groß-Umstadt	Hessen	Sonde	0,09	0	38	800	0	2012
	Neubrandenburg	Mecklenburg Vorpommern	Hydrogeothermie	k.a.	0	53	1.267	28	1987
	Neustadt Glewe	Mecklenburg Vorpommern	Hydrogeothermie	4	0	99	2.320	35	1994
	Waren	Mecklenburg Vorpommern	Hydrogeothermie	1,3	0	63	1.566	17	1984
	Arnsberg	Nordrhein-Westfalen	Sonde	0,35	0	55	2.835	5,6	2012
	Marl	Nordrhein-Westfalen	Sonde	0,06	0	20	700	k.A.	2010
	Insheim	Rheinland-Pfalz	Hydrogeothermie	0	4,3	165	3.300	85	2012
	Landau	Rheinland-Pfalz	Sonde	0,08	0	k.A.	800	k.A.	2014
	Landau	Rheinland-Pfalz	Hydrogeothermie	5	0,79	160	3.340	70	2007
	SUMME			**280,68**	**37,69**				

*Kraftwerk in Bau

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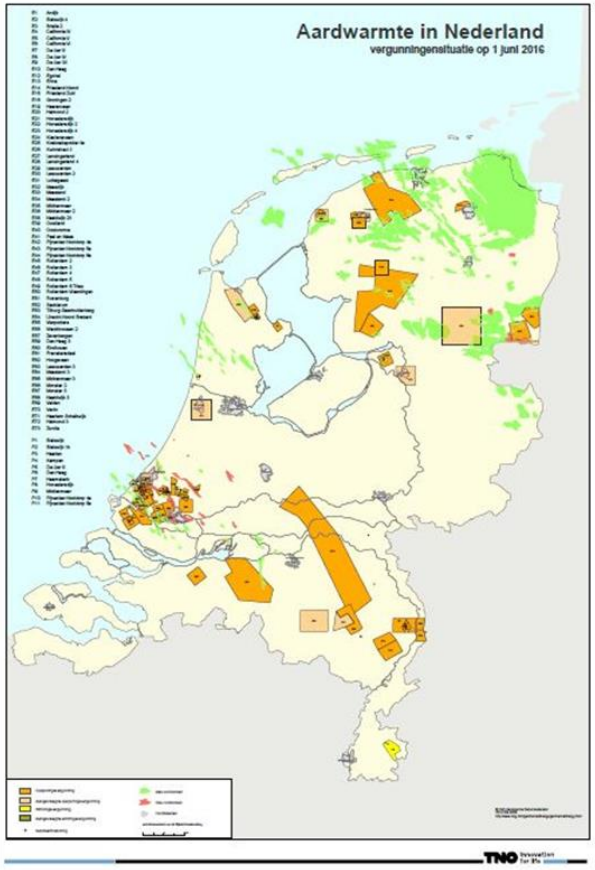
Geothermal Projects and Licenses in the Netherlands

There is NO electrical power production from geothermal in the Netherlands up to now.



Source: TNO - Netherlands Organisation for Applied Scientific Research (2016)

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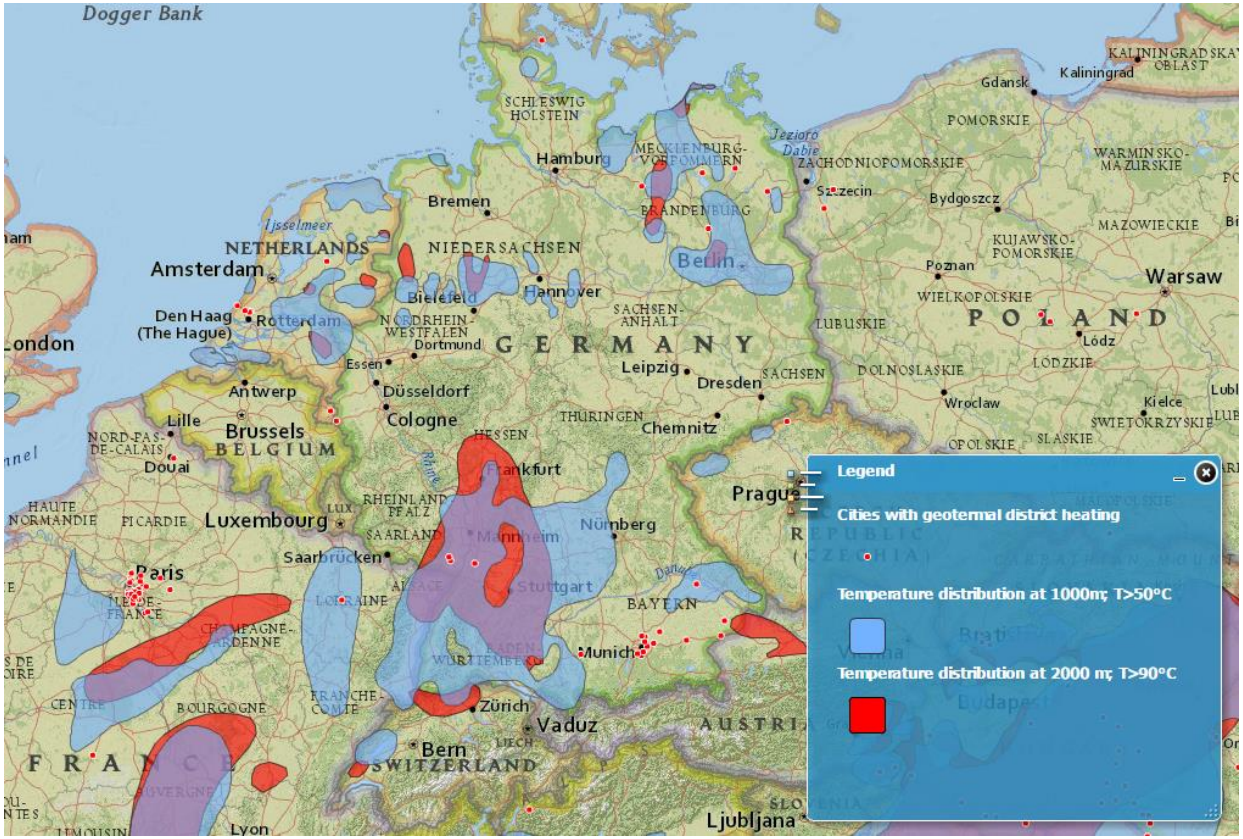
Opportunities for bilateral and joint collaboration in geothermal sector



Geothermal district heating and areas with high potential (GeoDH)

- Low enthalpy power production
- Middle deep heat exchanger
- Agriculture projects (geothermal, hybrid)
- Geothermal drilling technology
- Shallow geothermal application
- Storage
- Power plant technology

➡ International JV

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Geothermal potential and topics as insights for bilateral international activities - case study Turkey

Picture: SC · SGS, SCHIFFER, R.

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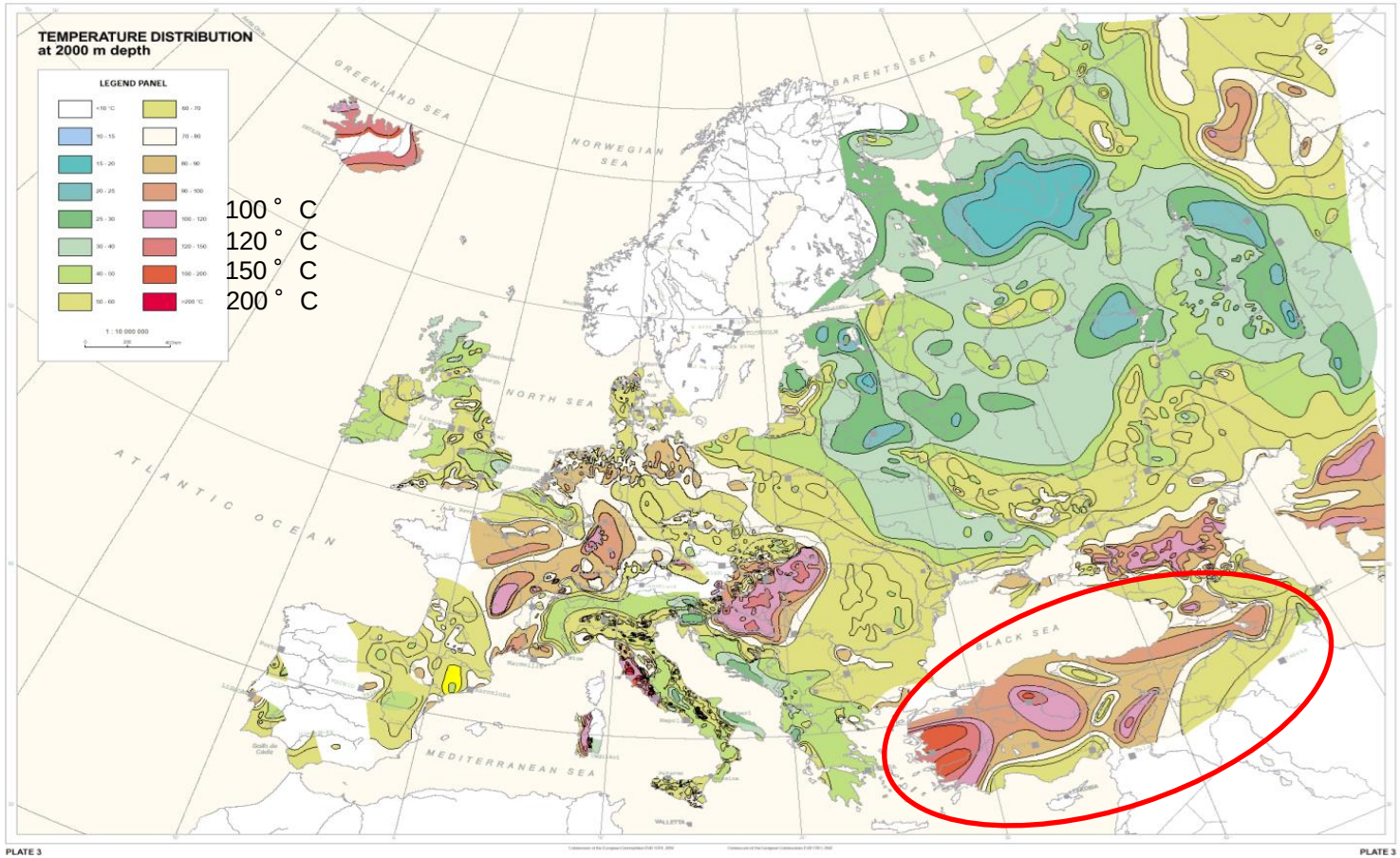
Geothermal resource of Europe



Source:
Geothermal map of Europe

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Geothermal potential of Turkey

About 300 geothermal fields in use and development

2,000 hot and mineral water resources (Temperature range 20 °C to 287 °C)

Drilled: ~ 1,200 geothermal exploratory, production and reinjection wells

Geothermal heat capacity potential estimated 2015: 60,000 MW_{th} (2010: 31,500 MW_{th})

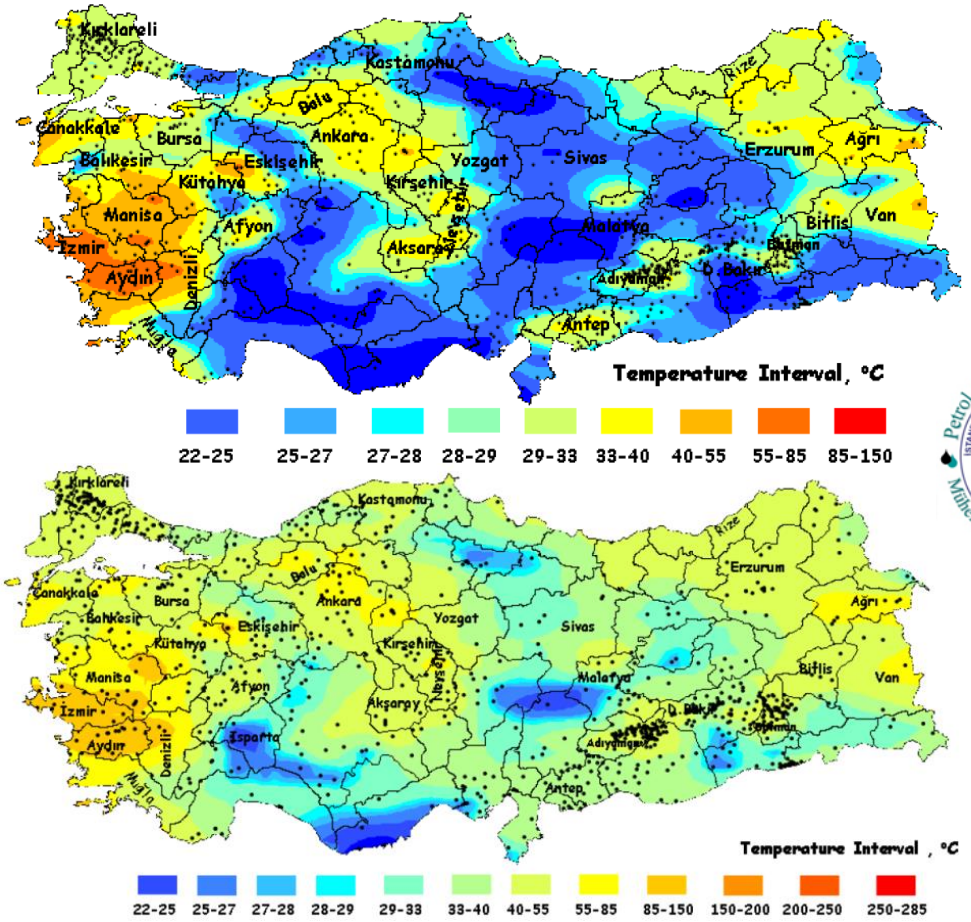
Installed geothermal heat capacity ~ 2,880 MW_{th} in direct use incl. heat pumps

Installed geothermal power production ~ 700 MW_{el} (06/2016)

Total geothermal technical and economical electricity potential: 2,000 MW_{el}
(hydrothermal 0–3 km, next 15 – 20 years, incentive 0.105 US-$)
theoretical: 4,500 MW_{el}

Estimated technical EGS electricity production potential 250,000 MW_{el}
(petro-thermal , 3-5 km)
Total EGS electricity production technical and economical potential 25,000 MW_{el}
(estimated next 20 years)

Temperature model of Turkey (500 m and 1000 m)



Turkey has a lot of well known geothermal resources which can be used.

Know-how and expertise as well as technology transfer are needed, e.g. in shallow geothermal, HP applications, agriculture business or innovative and specific technologies.

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Thermal applications in Turkey – status and possibilities for development

Pictures: top: SC· SGS, SCHIFFER R ; bottom: topnews.in; formanfarms.ca; attensaat.de; www.geziyerleri.org

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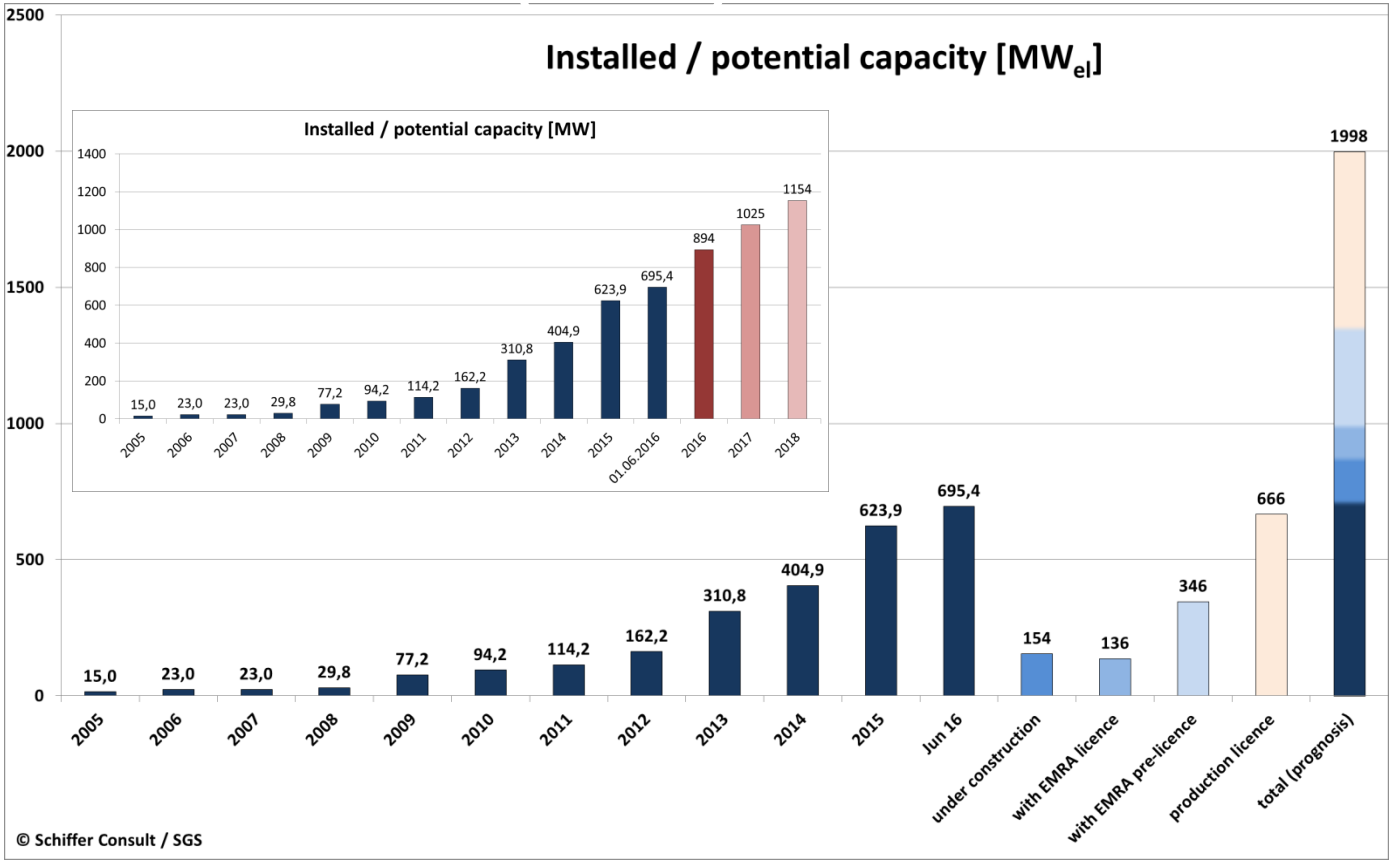
Geothermal direct heat uses

	Netherlands		Germany		Turkey	
Use	**Installed Capacity** [MW_t]	**Annual Energy Use** [TJ/yr]	**Installed Capacity** [MW_t]	**Annual Energy Use** [TJ/yr]	**Installed Capacity** [MW_t]	**Annual Energy Use** [TJ/yr]
Individual Space Heating	-*	-*	3.4	20.8	420	4635
District Heating	-*	-*	208.1	1909.4	805	8885
Air Conditioning (Cooling)	-*	-*	-*	-*	-*	-*
Greenhouse Heating	100	1426	-*	-*	612	11580
Fish Farming	-*	-*	-*	-*	-*	-*
Animal Farming	-*	-*	-*	-*	-*	-*
Agricultural Drying	-*	-*	-*	-*	1,5	50
Industrial Process Heat	-*	-*	-*	-*	-*	-*
Snow Melting	-*	-*	-*	-*	-*	-*
Bathing and Swimming	-*	-*	47.1	1401.1	1005	19016
Other Uses (specify)	-*	-*	-*	-*	-*	-*
Geothermal Heat Pumps	690	5000	2590	16200	42.8	960
TOTOAL	**790.0**	**6426.00**	**2848.6**	**19531.3**	**2886.3**	**45126**
* - no data available						

Source: IGA - Country Update Reports (2010-2015)

Turkish capacity for geothermal power generation



Data based on Turkish Ministry of Energy and Natural Resources, 06/2016
added by License information from EMRA and company information

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Geothermal projections for 2014 – 2018 of Turkey

Acc. to the 10th development plan (2014 – 2018) of the Turkish Ministry of Development

Geothermal Utilizations	**Government Targets for 2018**	**Additional Investment USD (until 2018)**
Electricity Generation	750 MW_{el} (6 Billion kWh)	2.0 Billion USD
Heating (Residences, Hotels, Thermal Facilities and others)	4,000 MW_{th} (500,000 Residences Equivalence)	1.4 Billion USD
Greenhouse Heating	2,040 MW_{th} (6 Billion m^2)	300 Million USD (including Wells)
Drying	500 MW_{th} (500.000 tons/year)	180 Million USD
Thermal Tourism	1,100 MW_{th} (400 Thermal Facility Equivalence)	1.2 Billion USD
Air conditioning	300 MW_{th} (50,000 Residences Equivalence)	300 Million USD
Aquaculture + others	400 MW_{th}	150 Million USD
Total Direct Use	**8,340 MW_{th}**	**5.53 Billion USD**
Natural Gas Equivalence of all the above mentioned geothermal direct use Utilizations	*6,1 Billion USD/year*	
The economical value added to the Turkey's Economy by means of above mentioned Utilizations until the End of 2018	*32 Billion USD/year*	
The created Employment (Direct and Indirect)	*300,000 Person*	

Source: Turkish Geothermal Association; GEOPOWER Turkey, 10-2013

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Examples and possibilities for networking and bilateral collaboration in Turkey from German view

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Picture source (overworked): http://www.b4bschwaben.de/cms_media/module_img/401/200699_1_lightbox_Deutsch_tuerkische_Zusammenarbeit_Foto_Ruskpp_iStock_thinkstock.jpg

Networking examples

SGS‘ shares & partners

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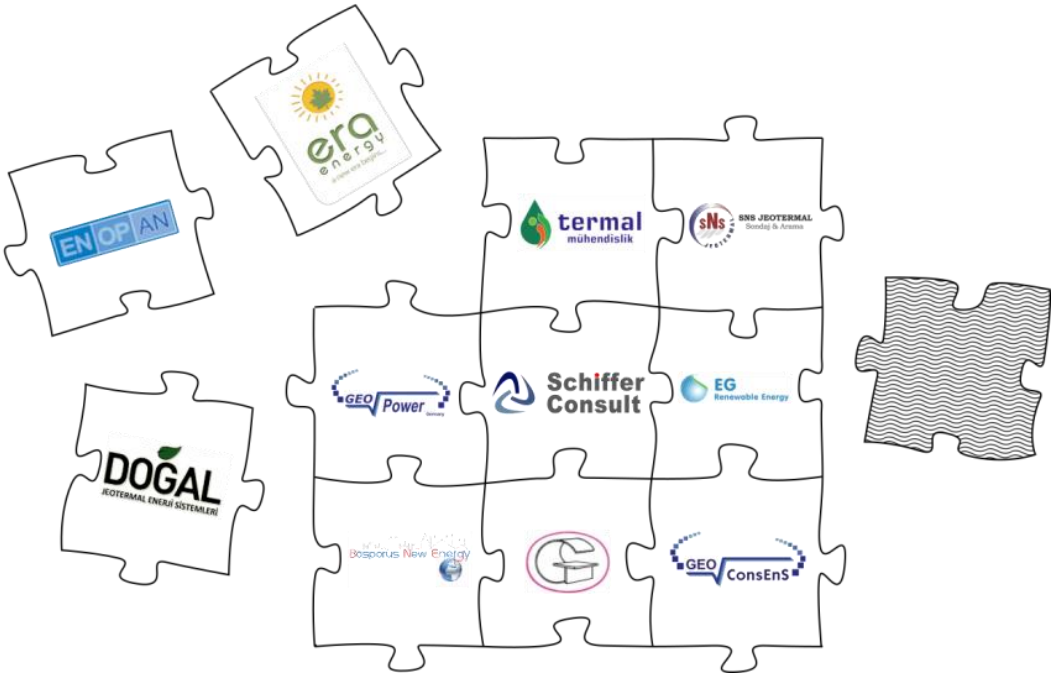
Pictuie source: http://www.cw-connectingworld.com

Networking examples

SGS' clients and partnerships relating to Turkish renewable energy / geothermal market



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Pictuie source: http://www.cw-connectingworld.com

Networking examples

Gefördert durch:

Bundesministerium für Wirtschaft und Energie

ZIM Zentrales Innovationsprogramm Mittelstand

ZIM network co-operation
(for geothermal market Turkey)


(Source: http://www.help.fr/wp-content/uploads/2014/06/pedagogie-1024x274.jpg)

Managing & sales company

+

GG GEOTHERMAL GROUP

founded 11/2015

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Pictuie source: http://www.cw-connectingworld.com

Application examples

Special technologies, valves

Special materials, stimulation fluids, borehole heat exchangers

Exploration, re-processing, data combining

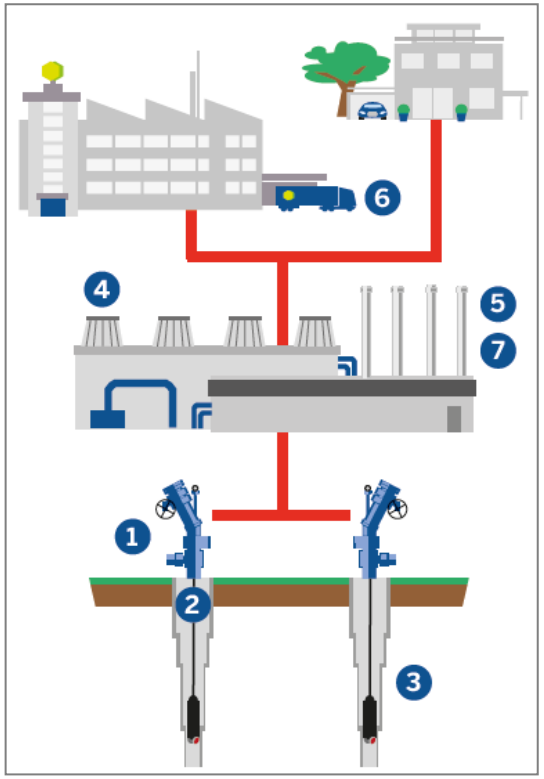
Power plant technologies, modules

Project and material management

Innovative and optimized products and technologies

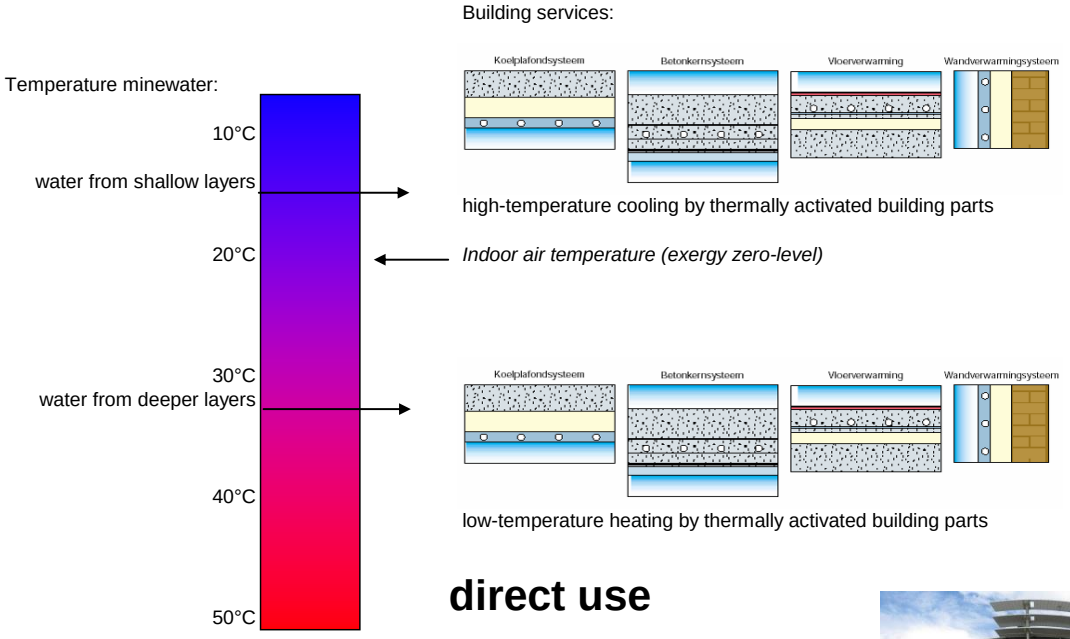
Consultancy and project realization - projections: increase of efficiency, parallel / cascade use, storage, intelligent systems and system management

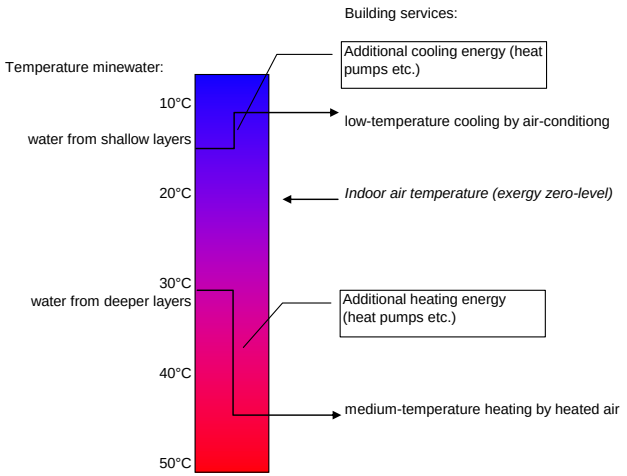
➡ Special-purpose solutions



(Source: Geothermal Group

Low enthalpy heating and cooling





direct use

indirect use (ad.)

(Source: Minewater 2.0 project)

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Geothermal based regional developement and ressource management

Geothermal Energy in Alasehir

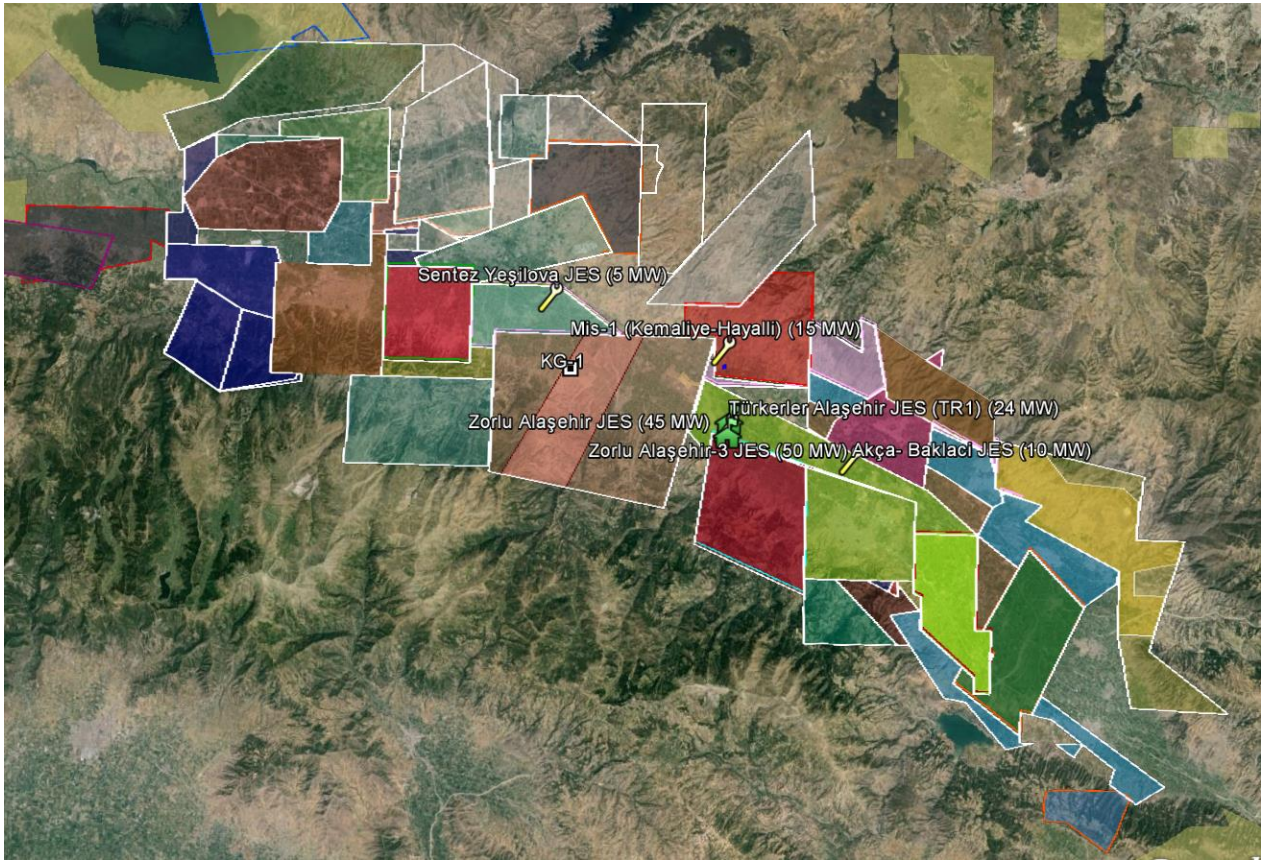
> 50 fields

> 2000 km²

~ 20 companies

2 municipalities

1st phase in 2016



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International networking and bilateral collaboration

Picture source : dnhk.org

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Geothermal information exchange by Dutch and German associations and organizations

IGA International Geothermal Association	www.geothermal-energy.org	EGEC GEOTHERMAL	www.egec.org
GT	geothermie.nl	dena Deutsche Energie-Agentur	www.dena.de
Bundesverband Geothermie	www.geothermie.de	bodem energie nl	bodemenergienl.nl
TNO	www.tno.nl	WKO Nederland Grondboring - Bodemenergie - Grondwatertechniek	www.wkonederland.nl
GEODH	geodh.eu	GeotIS	www.geotis.de
bwp Bundesverband Wärmepumpe e.V.	www.waermepumpe.de	DNHK	www.dnhk.org
AHK	www.ahk.de	GERMANY TRADE & INVEST	www.gtai.de

as well as others, like universities, scientific institutions … and specialists.

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Please consider: “The essence of business relationships is people doing business with people.”

Some recommendations for bilateral understanding and interaction

Try to arrange yourself with

- The finding of acceptance for traditional or typical attributes, practices and behaviours,
- the general preferred kind of business contacts,
- the widespread compliance of cultural and individual rules.
- values and morals - rooted in education and culture,
- different communication styles - more objective or emotional and relational communication and acting - aiming and basing on trust.

It needs "quite a bit of time" to build up the necessary confidence or even friendship for a successful co-operation. – Hang in there!

Preferences

German prefer	**Dutch** prefer	**Turkish** prefer
long term benefit and economy	attractive benefit	practical result in a short run
high quality	quality	applicability
steady	pragmatically and flexible	flexible
parity	egalitarianism and understatement *“doe maar gewoon, dan doe je al gek genoeg”*	hierarchy
objective, factual trust *“Zahlen, Daten, Fakten”*	quality of information and facts	individual trust
scheduled	scheduled	open *“hayırlısı”*
result orientated	process orientated	relation orientated
precise and direct wording	direct wording	global and indirect wording
recheck of information flow	flexible and pragmatically for detailed information	assume of information flow
Consequence		
flurry due to “less information”	we’ll see, the end justifies the means	irritated due to “waste information”

Conclusion

Picture: SC · SGS, SCHIFFER. R.

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Conclusion

- A good base for a joint business development in the geothermal energy sector by interaction and co-operating
- Related geothermal energy potential and conditions
- Support of the renewables and activities by government
- Growing geothermal markets
- Requests and needs for heating (and cooling)
- Investments in geothermal energy sector
- Experts and attractive partners on both sides
- Possibilities for joint activities (also in international markets)

Contact

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Picture source: http://image.stern.de (d)