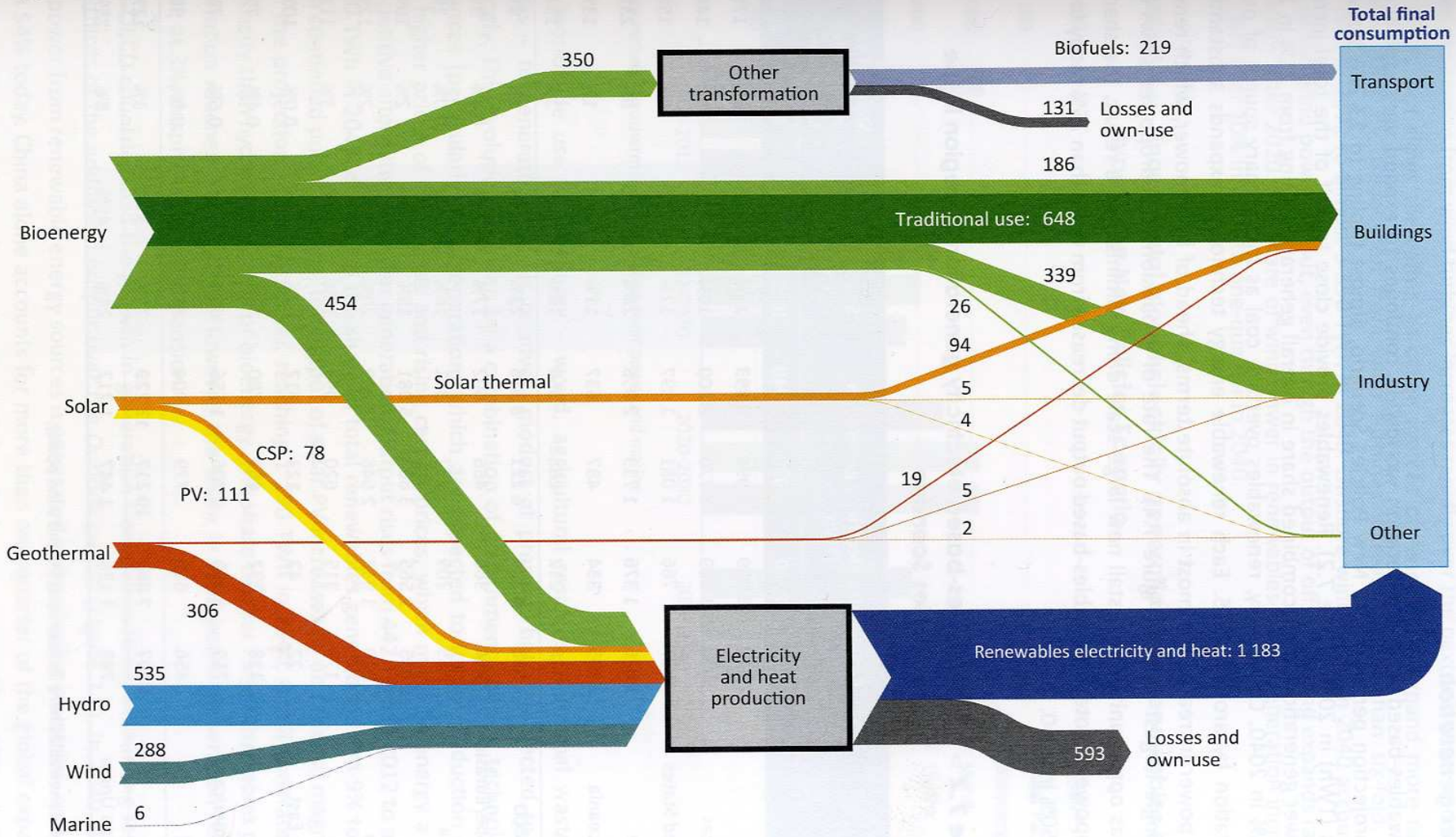
Utilizing Geothermal Energy in Hungary Today

International Workshop

(Conference on Renewable Energy potentials is approaching (26-27 of March, 2015))

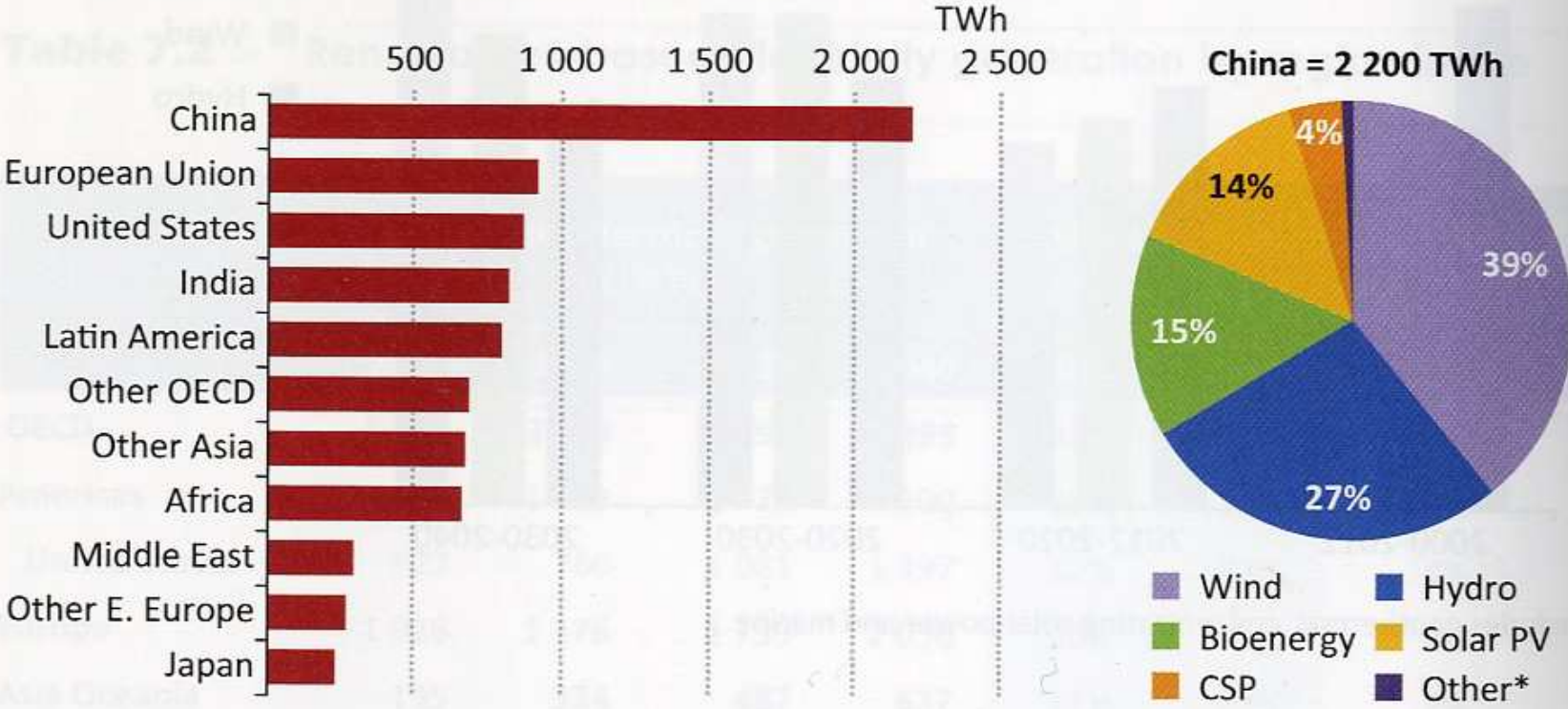
Dr. Habil Lajos Göőz
Professor emeritus
E-mail: **goozl@upcmail.hu**

Figure 7.3 ▷ World renewable energy balances in the New Policies Scenario, 2040 (Mtoe)



Notes: Other transformation includes bio-refining (processing of bioenergy to make biofuels). CSP = concentrating solar power; PV = photovoltaics.

Figure 7.5 ▷ **Incremental electricity generation from renewables by region in the New Policies Scenario, 2012-2040**



* Other includes geothermal and marine and represents only 1% of incremental generation in China between 2012 and 2040.

Figure 7.16 ▷ Illustrative electricity load curve for high-demand summer day

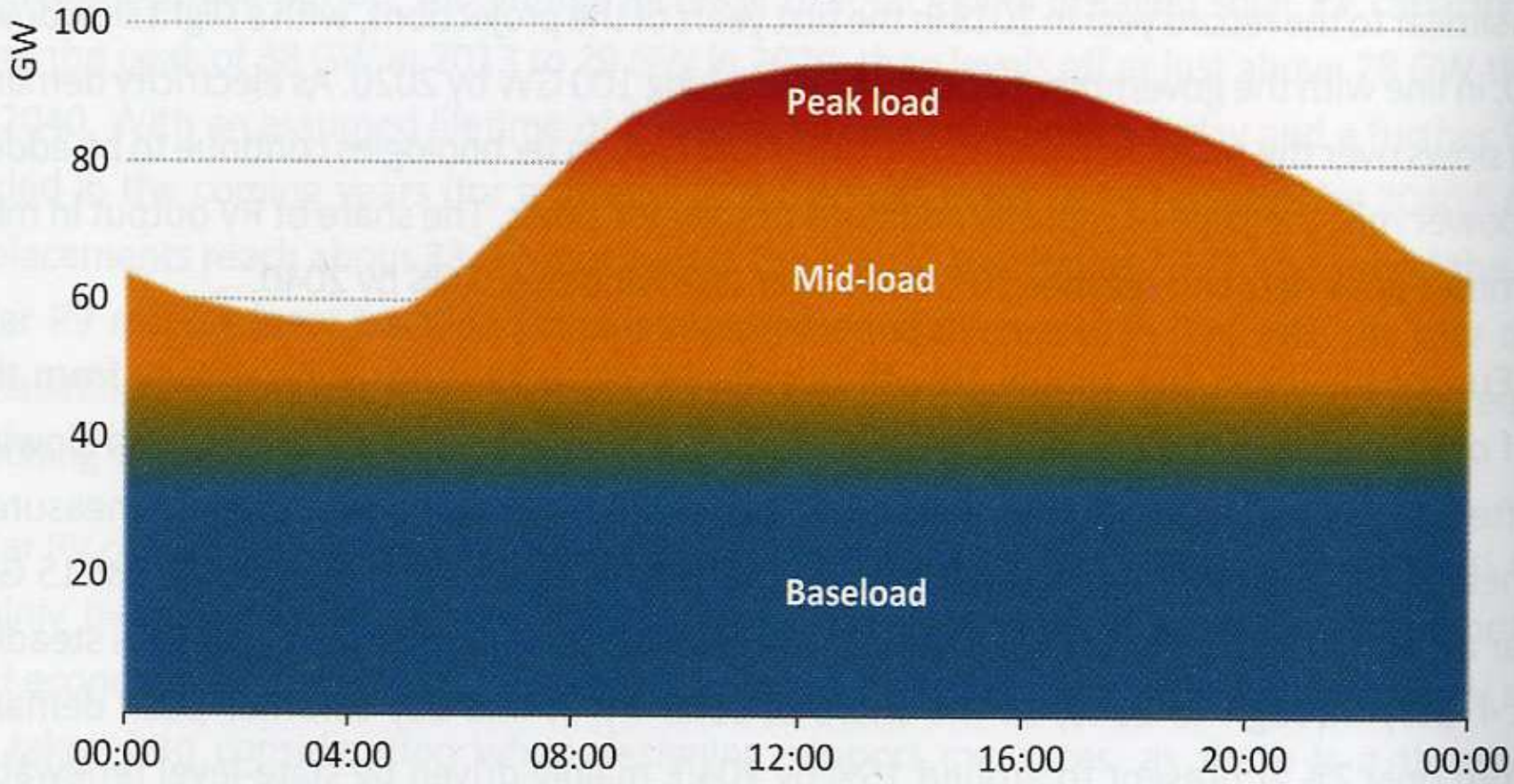
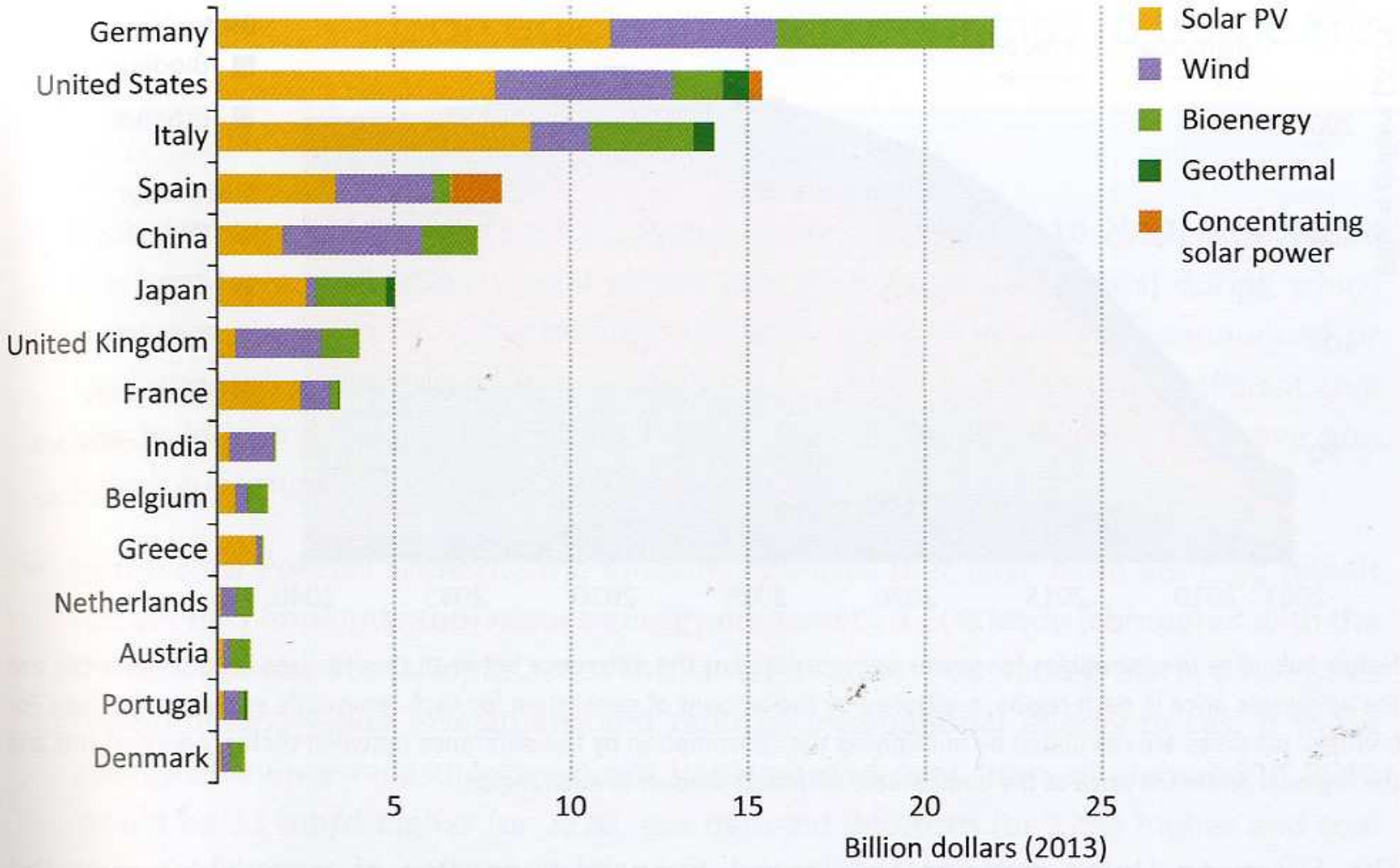


Figure 7.20 ▷ **Renewables power subsidies by source in the top-15 countries, 2013**



- **Current market prices for fossil and nuclear energy represent only a fraction of the true costs to society. If the external costs for environmental damage and political conflict were also considered, renewable energy would be competitive or even less expensive than conventional energy.**

- **Out of renewable energy sources, thermal energy is not very important in Hungary for the time being. A comparison with the situation in other countries offers interesting conclusions.**

- **The solar energy plants created in Southern Germany–primarily Bavaria–with government subsidy are able to generate electric power equal to the output of 13 nuclear power plants the size of Paks.**
- **There is, however, one problem with that: this incredible output is only achieved in sunshine. In an overcast weather or at night the performance drops to 10% or zero.**

- **Another problem with the renewable energy sources in Germany is that the electric power generated by the wind power plants in the northern parts of the country can be fed into the national grid with considerable difficulties and at a large cost. Three new power lines, 2,700 km long each, are to be constructed.**

The Use of Geothermic Energy in Hungary

- **It is widely known that the well for Széchenyi Spa, made in 1878, was a world record at its time with its depth of 970,48. The temperature of the water found at that dept is 74℃.**
- **Budapest called Új-Lipótváros,**
- **in 1953**
- **the ”three-tap solution”.**

- **In the National Renewable Action Plan geothermic energy contains the following in relation to both heating and cooling: 700 new wells are planned, the amount of energy to be used for heating, cooling and hot water supply is 14,95 PJ. For electric power generation (which is going to be an interesting new feature in the Hungarian energy industry) 1,42 PJ is included in the plan. The total renewable energy usage in Hungary in 2010 amounted to a total of 4,23 PJ.**

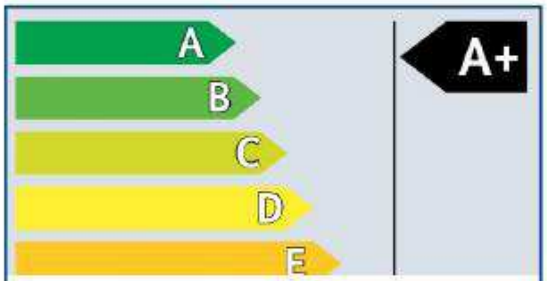
- **What investment does the Action Plan require for renewable energy sources? A total amount of HuF 160 billion is needed, which includes boring the 700 new wells.**

The Exploitation of Thermal Water

- **In 2007, 58,3 million m3 of thermal water was exploited in Hungary. Out of that, 12,3 million m3 was use for energetic purposes. At that time, the remaining 46,0 million m3 was used for other goals. It suggests that geothermic district heating systems have undergone a significant development in the past few years. Some of the early systems were mentioned previously, but even before 1990 the towns and cities of Hódmezővásárhely, Szentes, Budapest, Veresegyház, Szeged, Dunaújváros, Makó, Miskolc, Szolnok and Debrecen. In the Transdanubian areas Mosonmagyaróvár and Pécs have extensive systems. The new system of Miskolc is going to be one of the largest in the nation.**

- **There are plans for further development, and insvetmnetrs are underway, for instance in Veresegyház new and new users are added to the system every year. It is therefore not easy to provide up-to-date figures about the users of thermal energy. Not only public and community institutions, e. g. schools, hospitals, swimming pools, but business enterprises, such as the American company, the General Electric in Veresegyház. Other companies, factories, pharmacies etc. use thermal energy**.

Renewable energy



Energy efficiency

Grid expansion

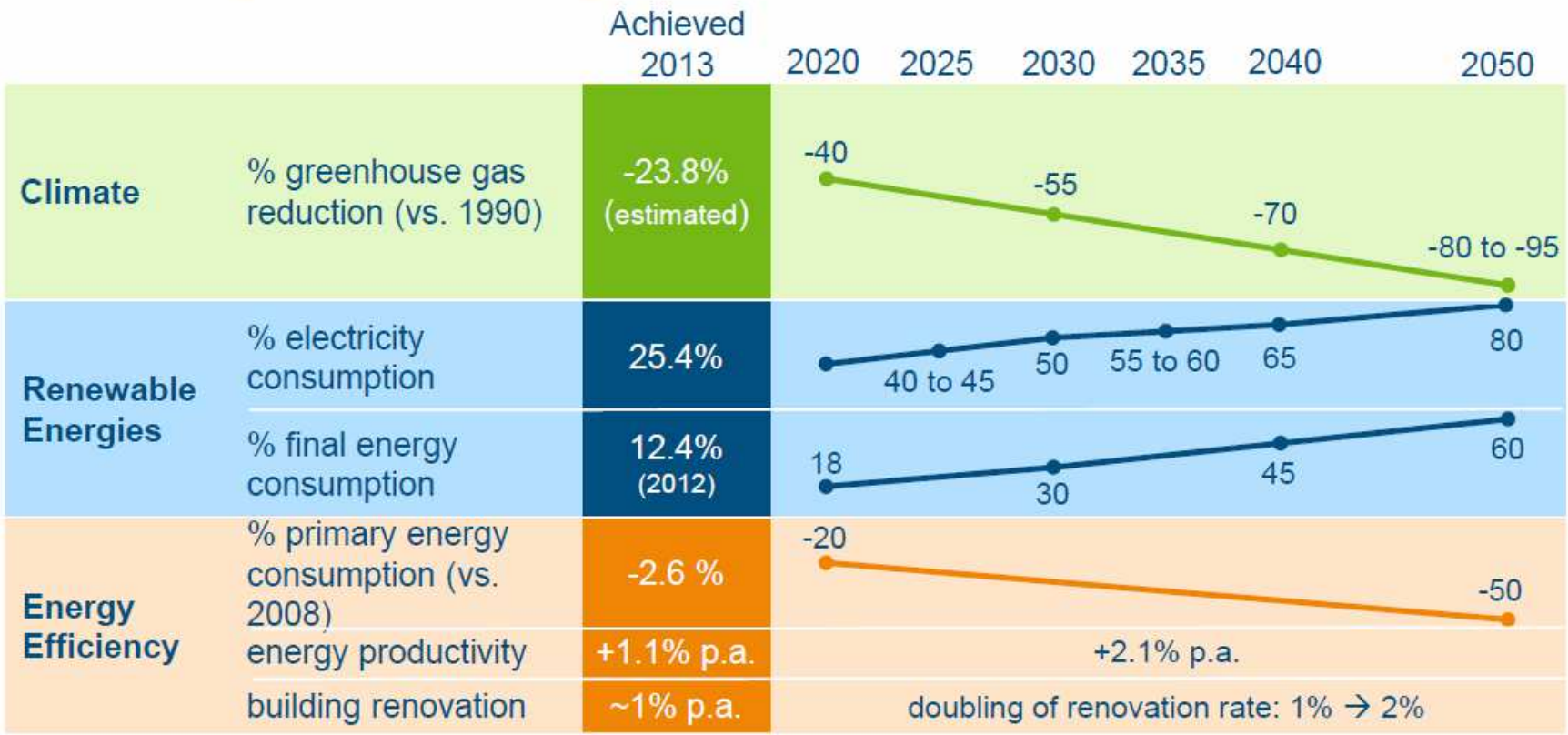
Renewable Energy Sources Act	National Climate Initiative Market Incentive Programme	Energy Saving Ordinance	Grid Expansion Acceleration Act Federal Requirement Plan

- Steady growth
- Cost-efficient
- Environmentally friendly

- Reduce energy consumption
- Improve efficiency

- Increase flexibility
- Enlarge capacities
- Integrate renewables

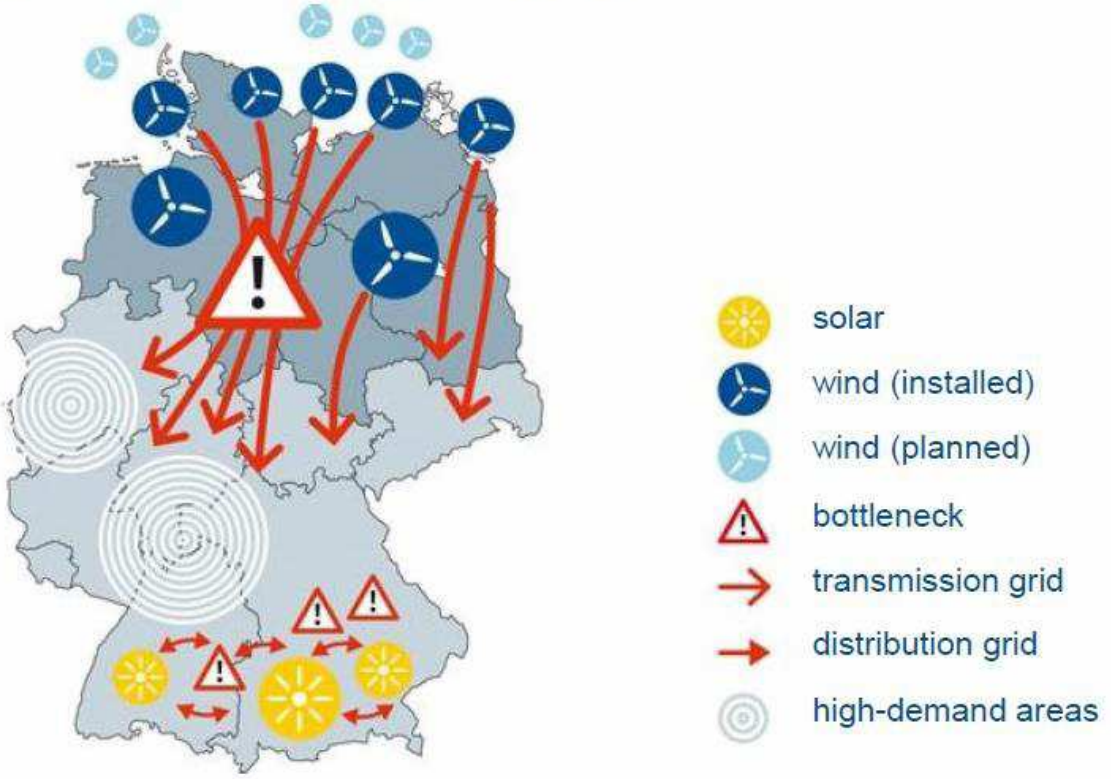
Switch to renewables, halve energy consumption and upgrade grids.



Source: Federal Government 2010, BMU/BMWi 2014, AGEE-Stat 2014

Germany has set ambitious targets in all sectors and is on track.

The challenge: connecting supply and demand



Source: DUH 2011

New power lines need to transport excess supply in northern Germany to southern Germany in order to prevent shortages.

Priority projects in the First Federal Requirement Plan

36 combined projects (51 single)
5,000 km of priority lines by 2023

- 2,700 km new construction
- 2,300 km optimisation

HVDC lines: new technology for large distance electricity transmission with reduced losses

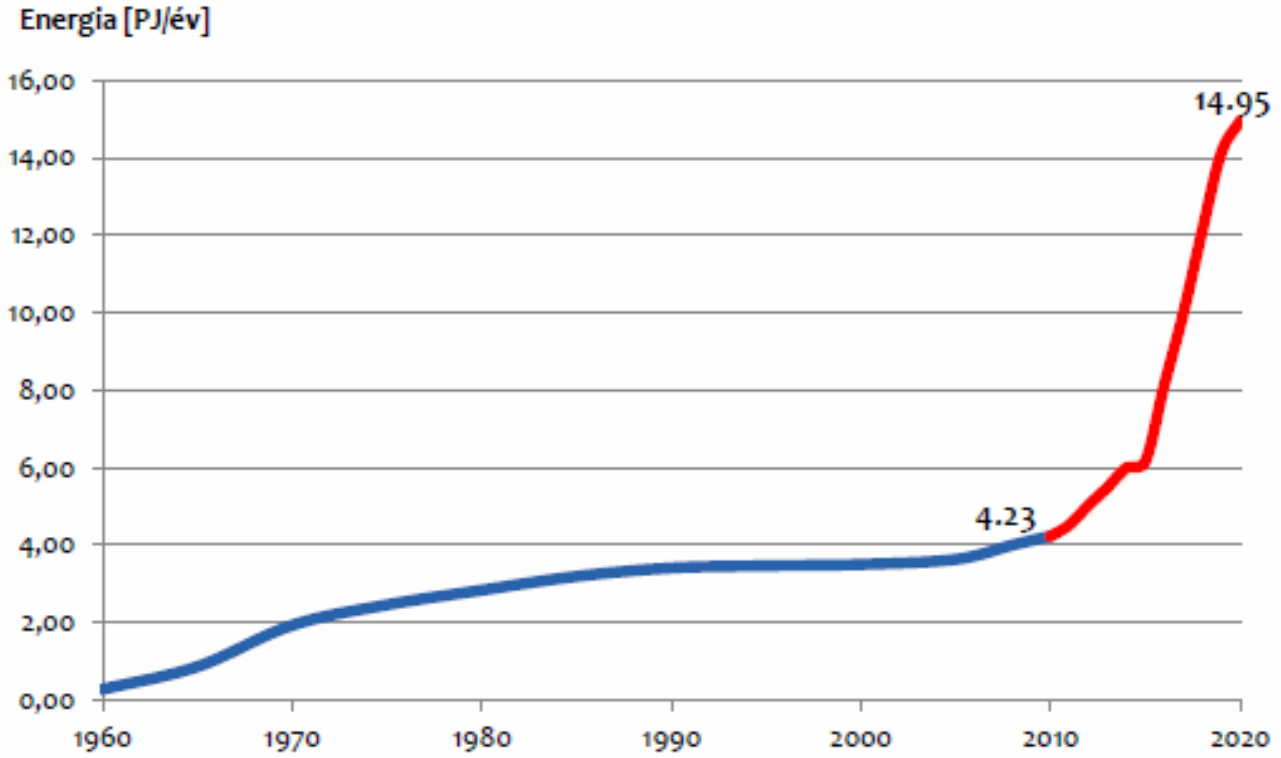
Source: Federal Network Agency 2013

36 expansion projects were identified as vital for security of supply.

Nemzeti Megújuló Energia Cselekvési Terv

Vállalt célok:

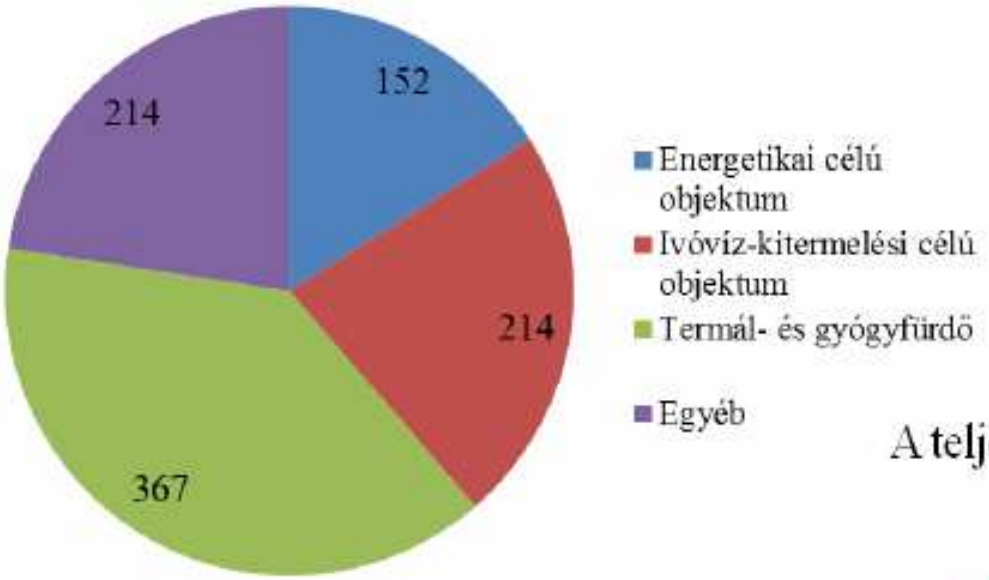
- geotermikus fűtésre (hűtésre): 14,95 PJ/év
- geotermikus áramtermelésre: 1,42 PJ/év



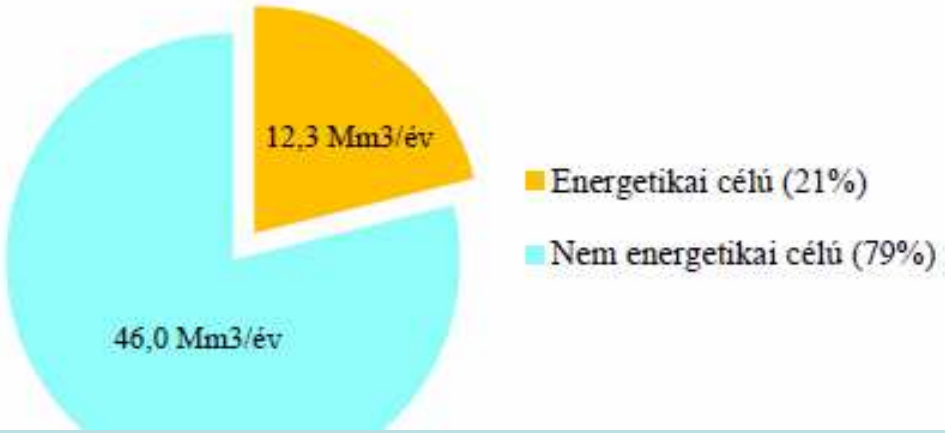
- Megfúrandó kutak száma: kb. 700 db
- Beruházási támogatási igény: 160 mrd Ft

A termálvíz kitermelés célterületei

Termálvíztermelés 2007-ben



A teljes kitermelt mennyiség 2007-ben: 58,3 Mm3



Forrás: Dr. Kling István, KvVM államtitkár
VI. Geotermikus Konferencia 2010. márc. 4. Budapest

Az energetikai termálvíz-hasznosítás fő területei - 1

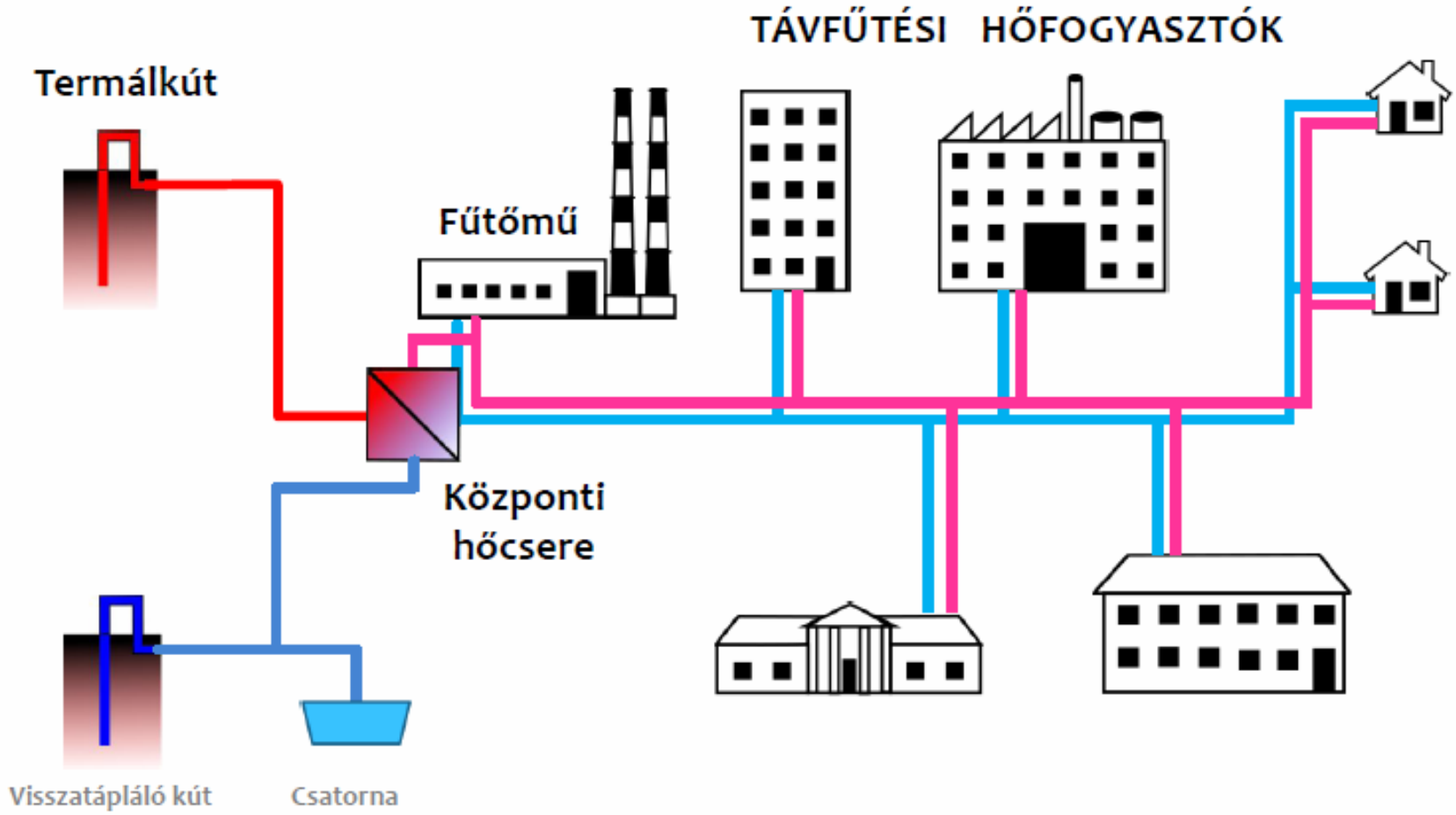
Növényházak, fóliasátrak fűtése

Az energetikai termálvíz-hasznosítás fő területei - 2

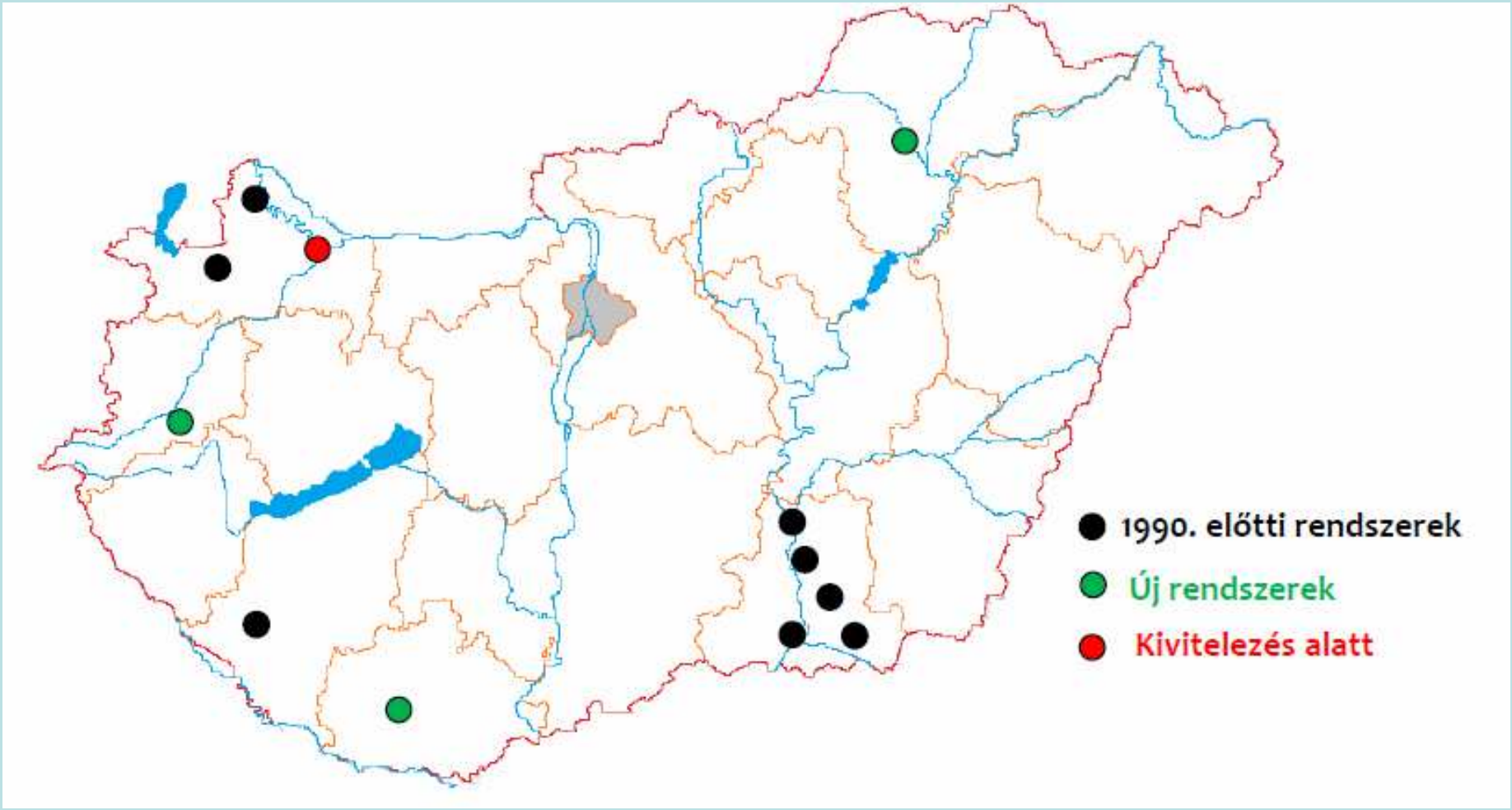
Gabonaszárítás

Állattartó telepek fűtése

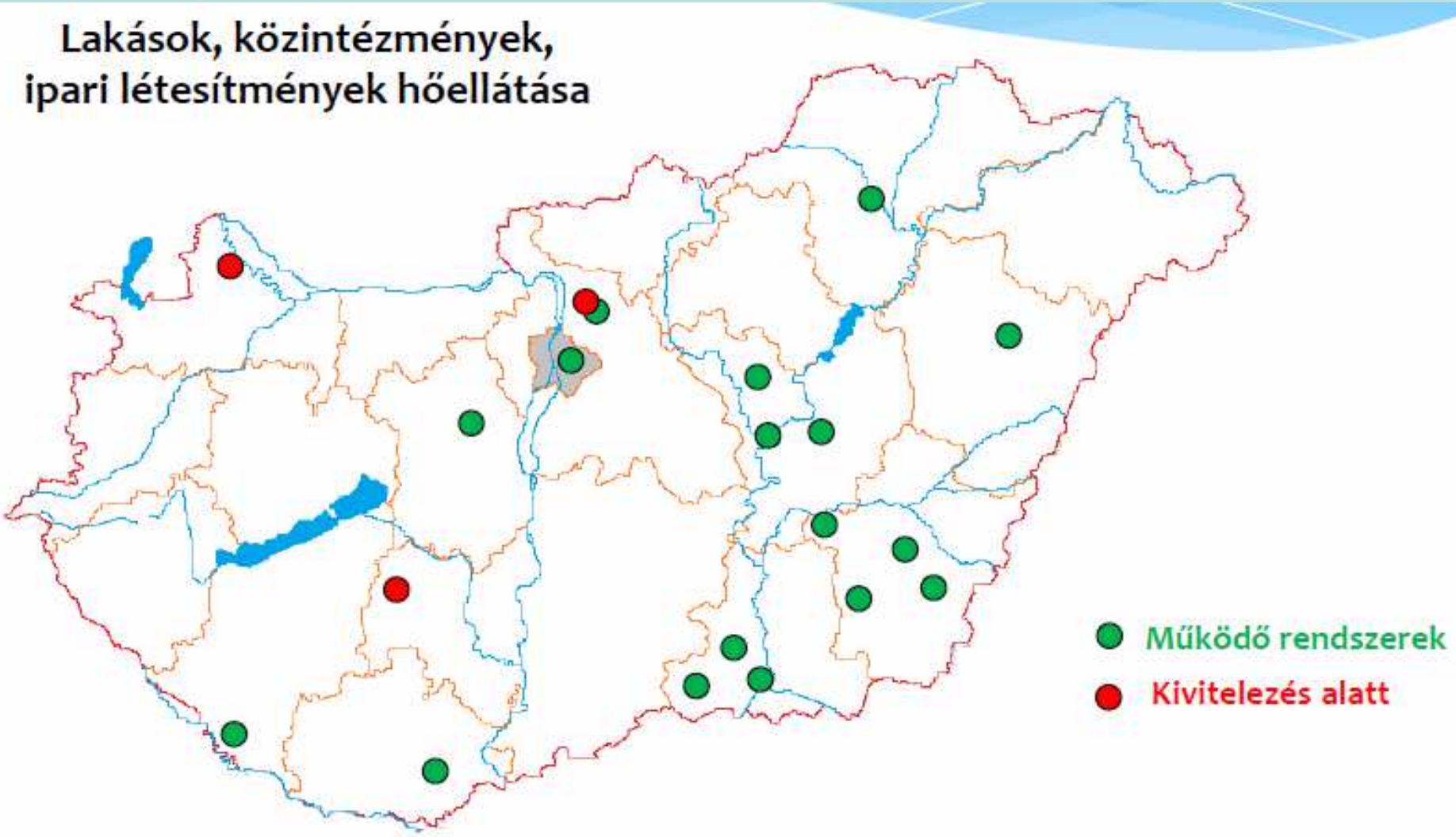
Termálvizes épületfűtés távhőellátáson keresztül



Geotermikus távfűtési rendszerek



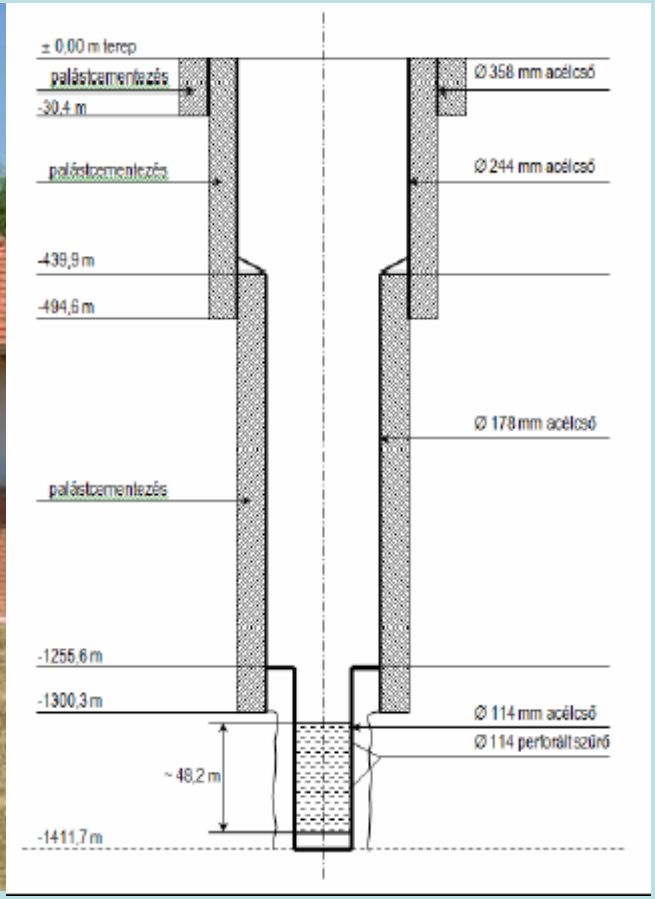
Termálvizes településfűtések



Hőhasznosítás – 3 (2001- 2003)

Mézesvölgyi Általános Iskola, tornaterem és uszoda

Hőhasznosítás - 4: KIOP program (2006- 2007)

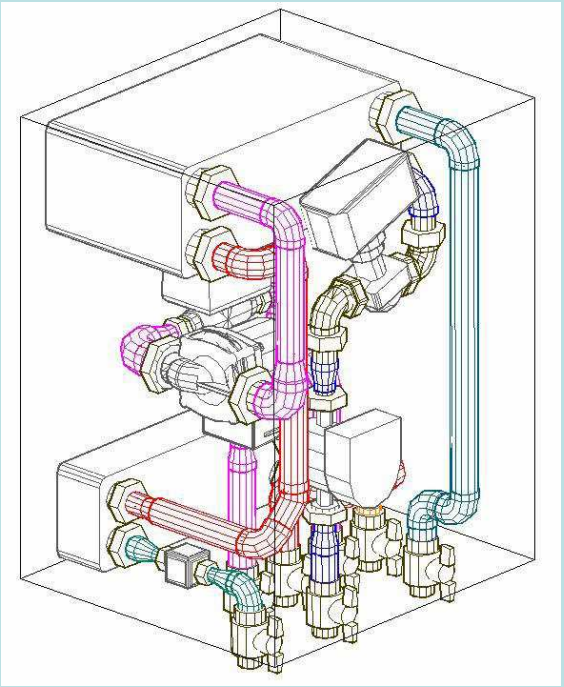


K-23 visszasajtoló kút lemélyítése
Mélység: 1600 m
Szűrőzés: 1310-1403 (3 szakasz)

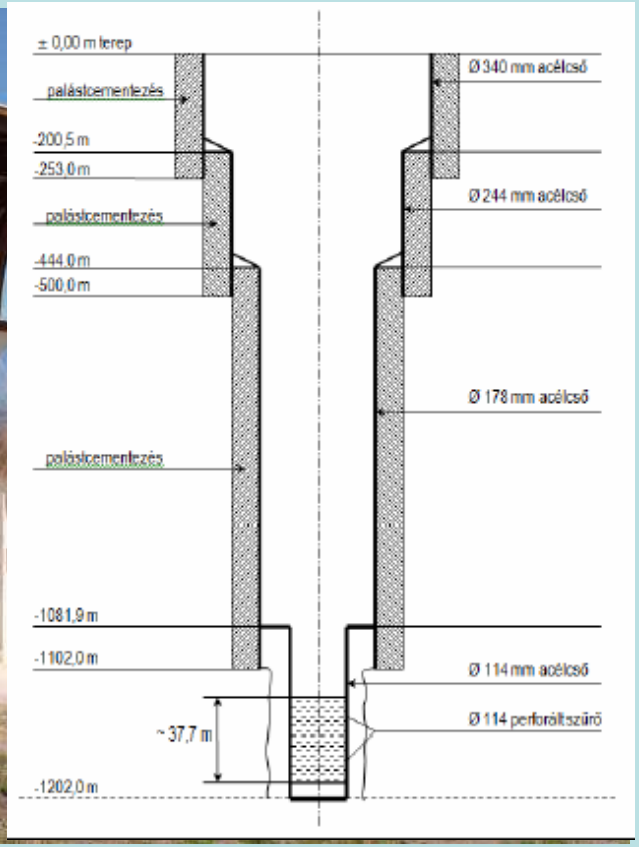
Hőhasznosítás – 4: KIOP program (2006- 2007)

- Szivattyúház
- Mozi
- Posta
- Városháza
- Fő téri üzletház
- Innovációs Központ
- Katolikus templom
- Idősek Otthona
- Gyermekliget Óvoda
- Katolikus plébánia
- Szent Pió Idősek Klubja
- Misszió Egészség Központ

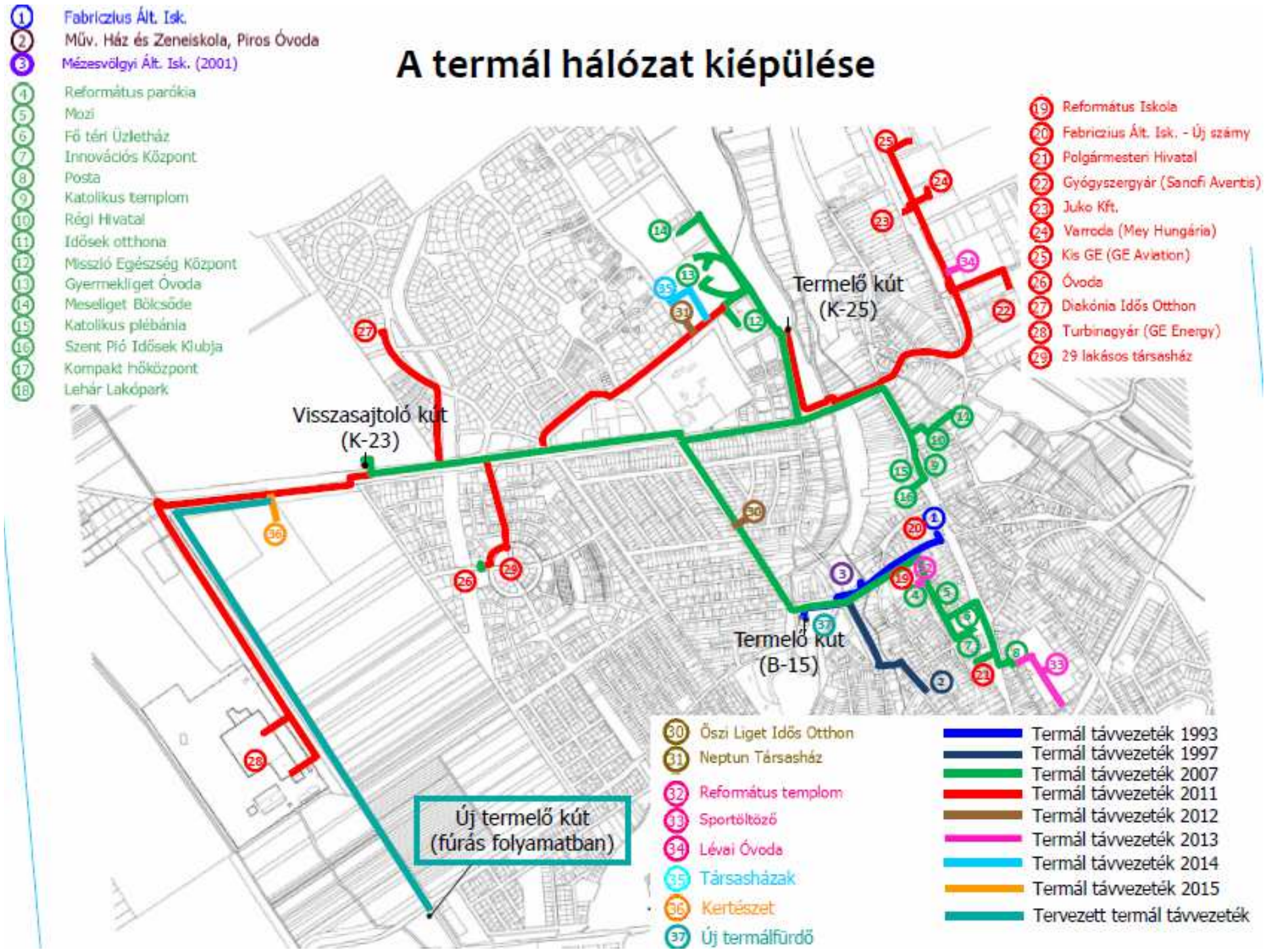
Hőhasznosítás – 6 (2009)



Hőhasznosítás – 7: KMOP program (2011)

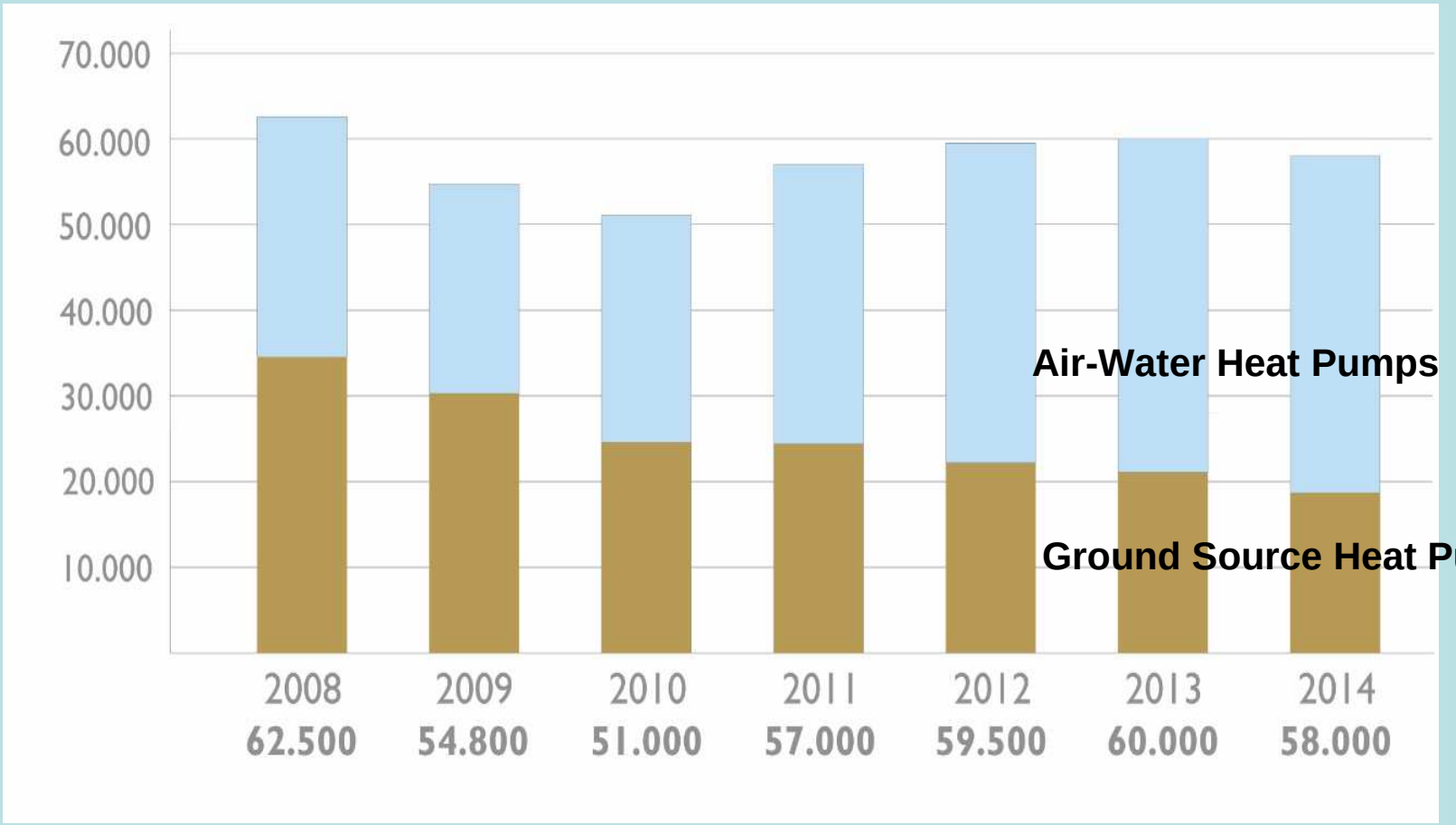


A termál hálózat kiépülése



Egy terv 2015-2016-ra: új fürdő

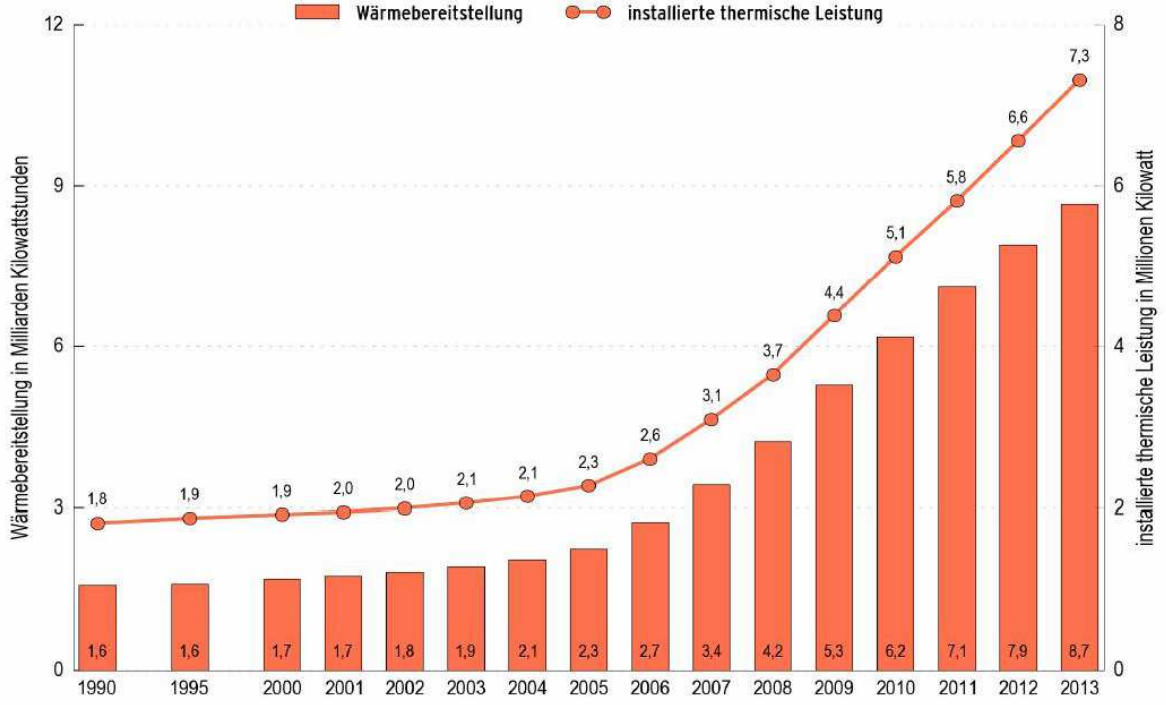
Heat Pump Sales (Space Heating) 2007-2014



Bundesministerium
für Wirtschaft
und Energie

Arbeitsgruppe Erneuerbare Energien - Statistik

Entwicklung der Wärmebereitstellung und installierten thermischen Leistung von Wärmepumpen (oberflächennahe Geothermie und Umweltwärme) in Deutschland



ZSW nach Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat); Stand: Februar 2014; Angaben vorläufig

Heat Pumps: 8700 GWh Heat 7,3 GW Installed capacity

Zero-emission Football Arena, Augsburg

- **Heating requirement: 1,7 Mio kWh/a**
- **Cooling requirement: 440 kWh/a**
- **Heating system: 2 heat pumps (1,200 kW) + 1 biogas boiler (900 kW)**
- **Passive Cooling**

Ikea Berlin

- **3 Heat Pumps with 1.500 kW capacity for heating and 1.200 kW for cooling + 2 gas boilers (1.000 kW) for peak load demand**

- **Sewage:**
  - **70 % of annual heating demand**
  - **100 % of annual cooling demand**

- **Reduction of CO2-emissions: 770t/a**

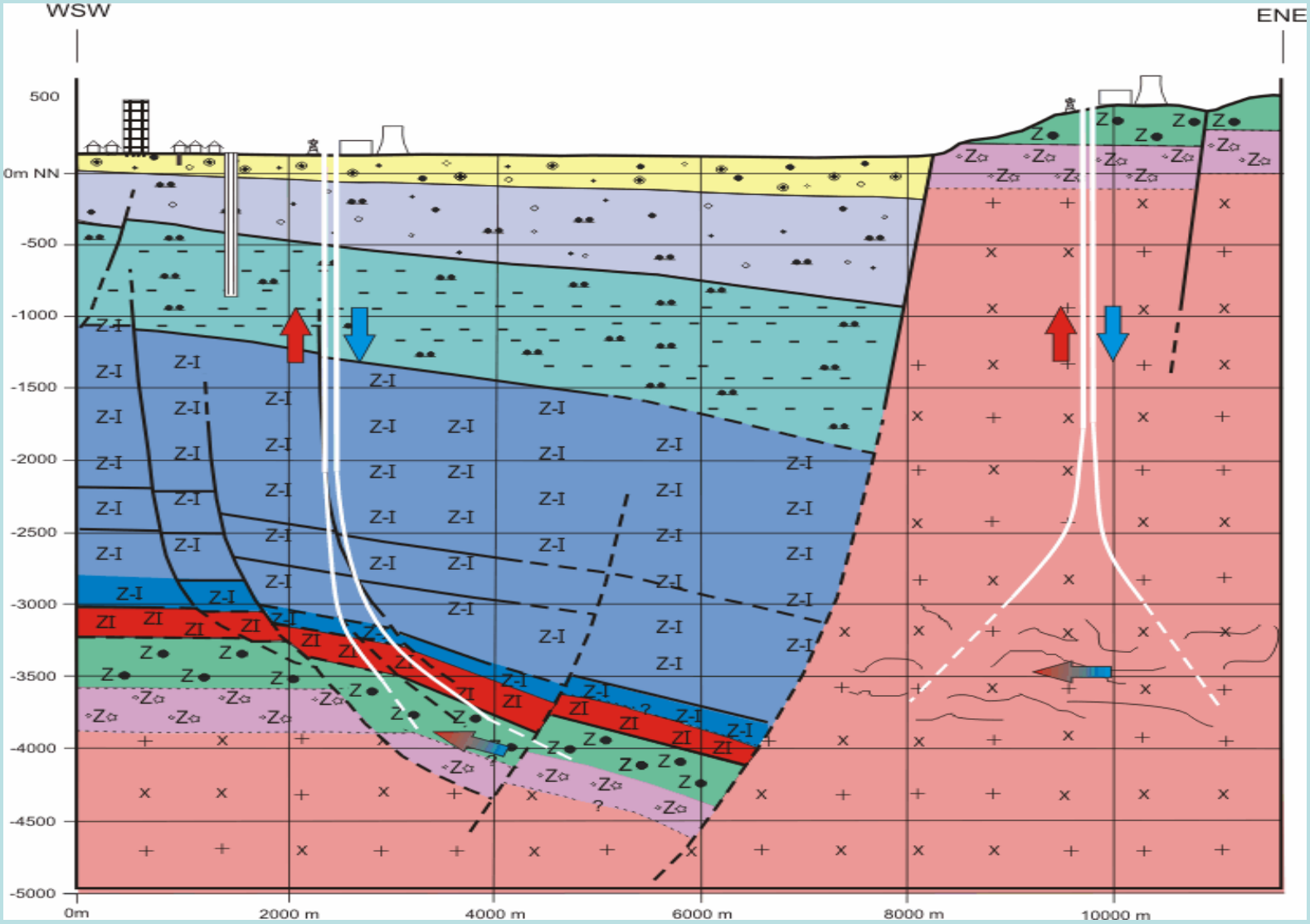
2000 yearsprocessexperience

•Treatinghotandhalinewaters
•Sustainabletemperatureandproductivity
•Heating
•Medical andspaexperience, healthandwellness

Communication andmonitoring

•Geological andseismicsupervision
•Continiouswaterqualitymonitoring
•Liabilityandinsurance
•Someyearsofdesigning, permissionandconstruction
•Involvement ofthepublicandthelocalpolicy
•Mining lawandotherlegal regulatio

Széchenyi, Budapest: PicfromMarc Ryckaert


WSW
ENE
500
0m NN
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
-4500
-5000
0m
2000 m
4000 m
6000 m
8000 m
10000 m

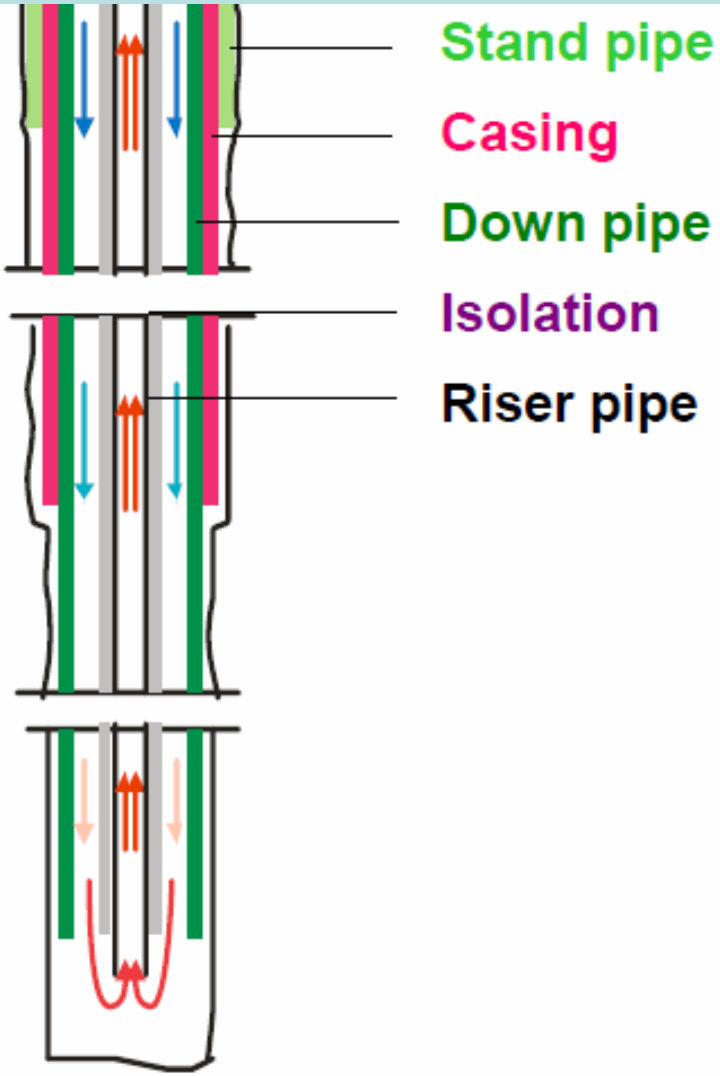
Deep Borehole heat exchanger

Depth > 1000 m

Arnsberg 2.835 m,

Kaiserslautern 1.500 m

...



Geothermal Power Worldwide

Geothermal Power Generation—Leading Countries

	INSTALLED IN 2010 (MWe)	COUNTRY TOTAL POWER GENERATION (GWh)	GEOTHERMAL GENERATION (GWh)	SHARE OF GEOTHERMAL (%)	POPULATION (2008), IN MILLIONS	MWe INSTALLED PER MILLION INHABITANTS
USA	3,093	4,369,099	17,014	0.4	307	10
Philippines	1,904	60,821	10,723	17.6	90.3	21
Indonesia	1,197	149,437	8,297	5.6	227.3	5
Mexico	958	258,913	7,056	2.7	106.4	9
Italy	843	319,130	5,520	1.7	59.8	14
New Zealand	628	43,775	4,200	9.6	4.3	146
Iceland	575	16,468	4,038	24.5	0.3	1,917
Japan	536	1,082,014	2,752	0.3	127.7	4
El Salvador	204	5,960	1,519	25.5	6.1	33
Kenya	167	7,055	1,180	16.7	38.9	4
Costa Rica	166	9,475	1,131	11.9	4.5	37
Sources |	*Bertani 2010*	*IEA 2009b*	*IEA 2008*	*Authors' calculations*	*World Bank data*	*Authors' calculations*

Note | MWe stands for megawatts electric, only power generation is considered.


Construction Situation June 2012


Construction Situation October 2012

Thank you very much for your attention !