

THE FUTURE OF GEOHERMAL DEVELOPMENT

EUROPEAN GEOHERMAL ENERGY COUNCIL (EGEC)
PROJECTIONS



www.egec.org

THE FUTURE OF GEOTHERMAL DEVELOPMENT

EREC'S RENEWABLE ENERGY ROADMAP

Table 5: Renewable Electricity Installed Capacity Projections

TYPE OF ENERGY	2000 EUROSTAT	2004 EUROSTAT	Annual growth rate 2000-2004	PROJECTION 2010	Annual growth rate 2004-2010	PROJECTION	Annual growth rate 2010-2020
1. Wind	13.2 GW	33.6 GW	26.3	80 GW	15.6	180 GW	8.5
2. Hydro	93 GW	107.5 GW	3.7	113 GW	0.8	120 GW	0.6
3. PV	0.18 GW _p	0.86 GW _p	47.8	8 GW _p ³	45.0	52 GW _p ³	20.6
4. Biomass	9.5 GW _e	13.1 GW _e	8.6	25 GW _e	11.2	50 GW _e	7.2
5. Geothermal	0.6 GW	0.66 GW	2.4	1 GW	7.2	2 GW	7.2

Table 7: Renewable Heat Generation Projections

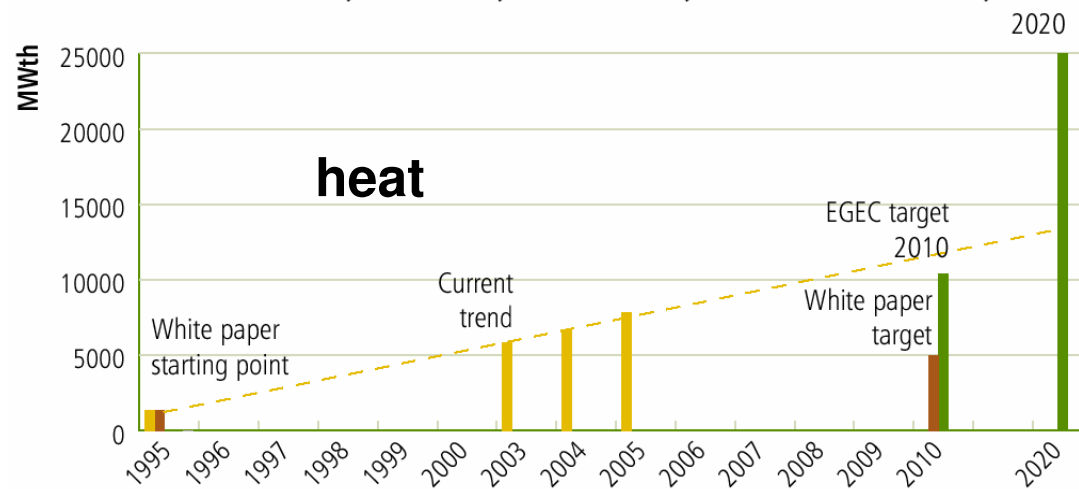
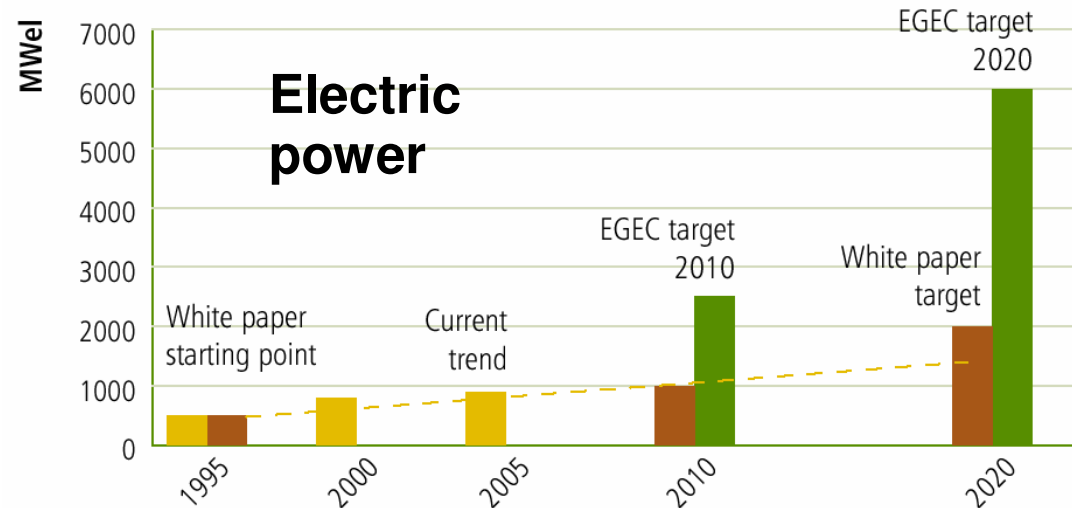
TYPE OF ENERGY	2000 Eurostat	2004 Eurostat	AGR 2000-2004	Projection 2010	AGR 2004-2010	projection 2020	AGR 2010-2020
Biomass for heat	44.7 Mtoe	48.4 Mtoe	2.0%	65 Mtoe	5.0%	105 Mtoe	4.9%
Solar thermal	0.38 Mtoe	0.68 Mtoe	15.6%	2 Mtoe	19.7%	12 Mtoe	19.6%
Geothermal	0.66 Mtoe	1.5 Mtoe	22.8%	4 Mtoe	17.7%	8 Mtoe	7.2%

Source: Antics & Sanner (EGEC/EREC 2007)



FUTURE DEVELOPMENT TRENDS

EGEC FORECASTED TARGETS



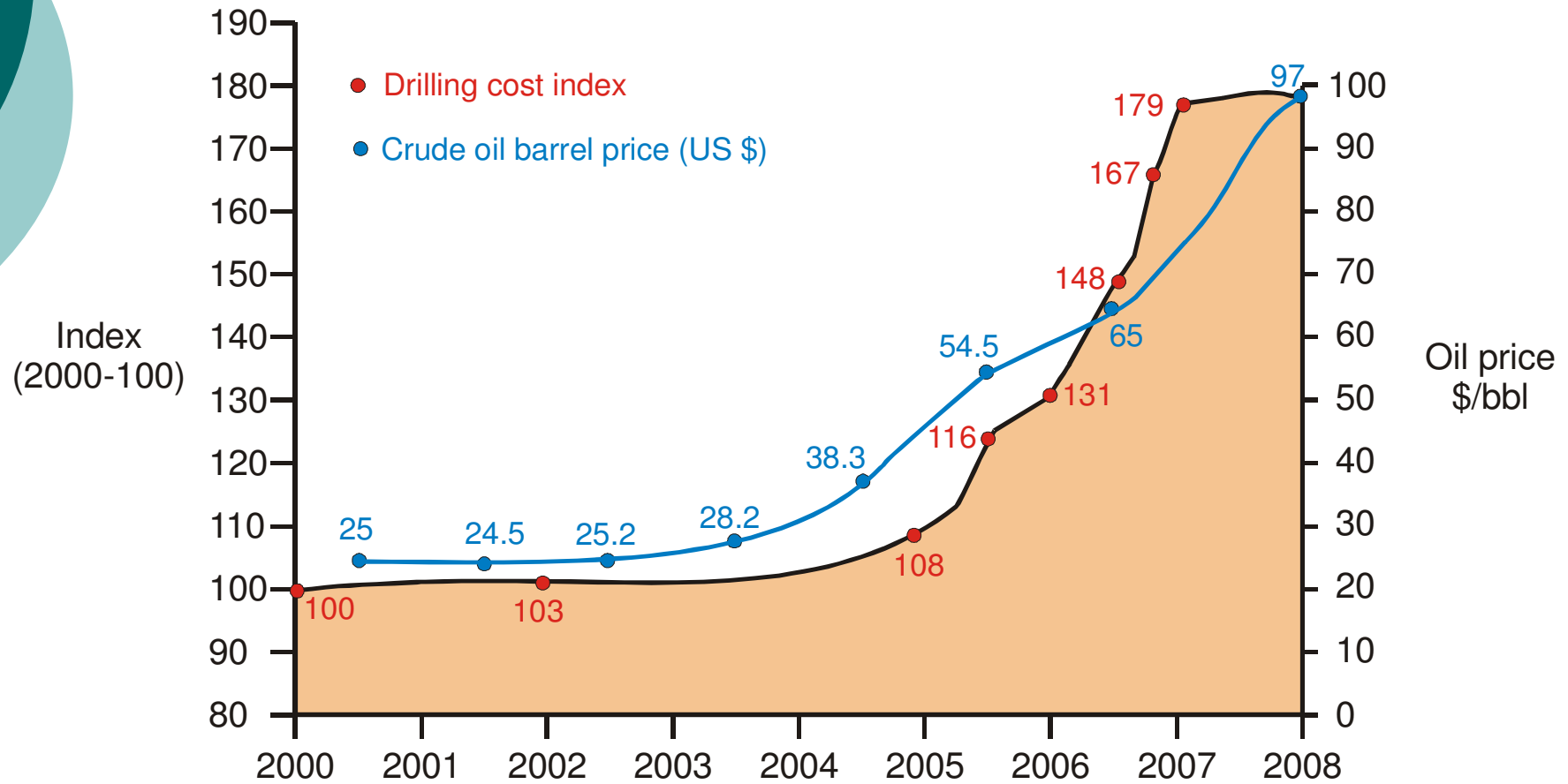
Source: Antics & Sanner (EGEC/EREC 2007)



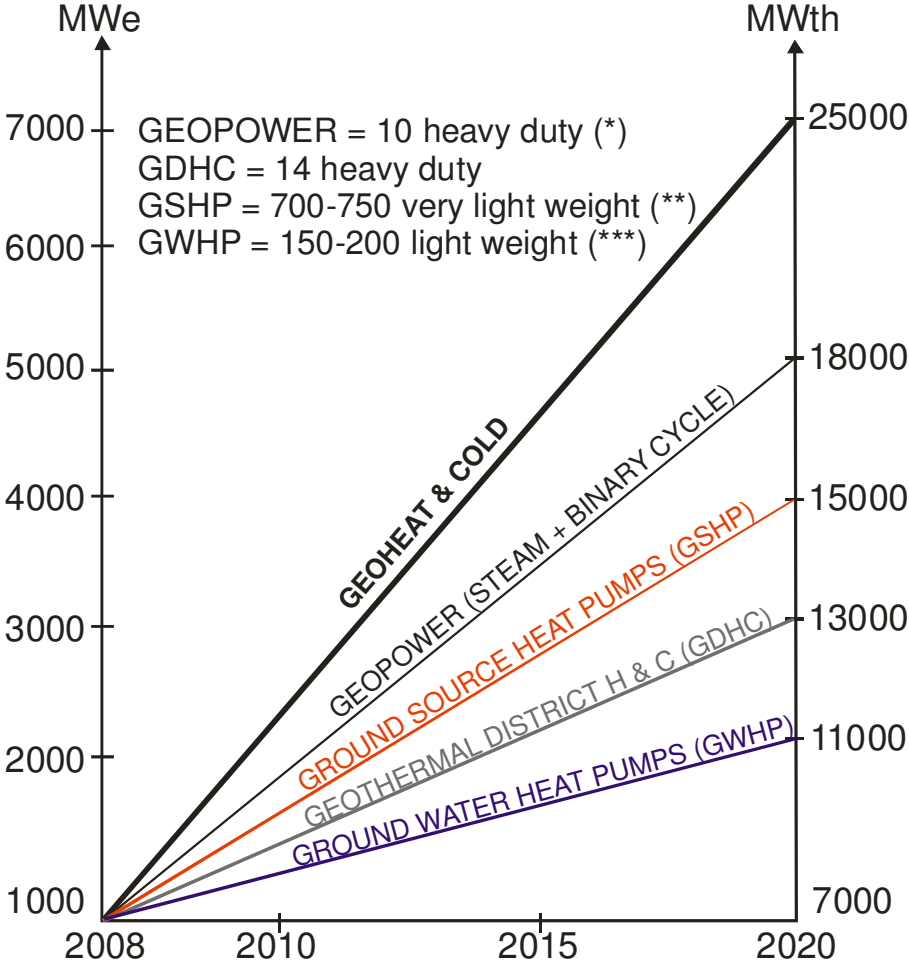
GEOHERMAL (NEW) POWER PLANT TIME TABLE

PHASE \ YEAR	1	2	3	4	5	6	7	8	9
EXPLORATION	■	■							
PRE-FEASIBILITY			■						
FEASIBILITY				■	■				
PLANT COMMISSIONING					■				
PLANT DESIGN						■			
PLANT CONSTRUCTION							■	■	
START UP/OPERATION									→

DRILLING COSTS VS CRUDE OIL PRICES



DRILLING RIG FORCE REQUIREMENTS



(*) 200-350 t hook load diesel electric
 (**) percussion air/foam drilling
 (***) rotary mud drilling





INVESTMENT NEEDS (€/kW and bn €)

UNIT INVESTMENT COSTS (€/kW)

○ Geopower	
● Steam cycle	2000
● Binary cycle (*)	2500
○ Geoheat and cold	
● District heating	2000
● GSHP	2000
● GWHP	750

TOTAL GROSS ESTIMATES (2008-2020) **bn €**

Geopower	6.4
Geoheat and cold	31
Grand total	37.4


(*) associated with heat (CHP)




EGEC Brussels declaration

11 February 2009

- **> A major advantage of geothermal energy is the availability of the resource all day and night, throughout the year: a load to the grid, operating up to 100% of time (the best ratio of all energy technology !).**

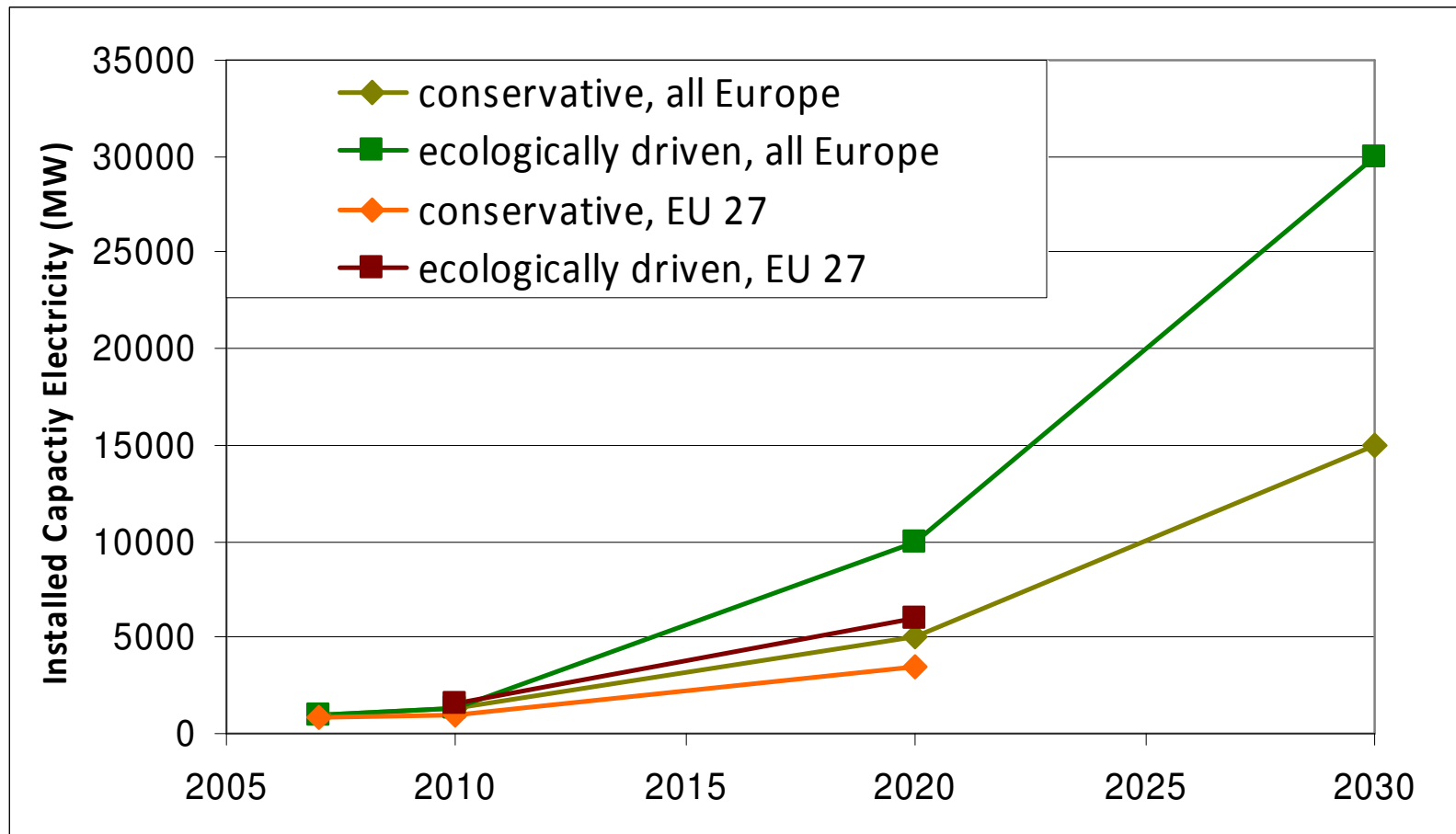
- 
-
- **> Geothermal energy is a safe and controlled renewable energy technology: present anywhere and available everytime, independent of the season, climatic conditions and day time, use from antique time for heating & cooling!**

- 
-
- *> Until now we just used a marginal part of the underground heat reservoir potential. The most promising areas are the construction of new district heating networks (Geothermal district heating & cooling, with 50 €/MWh, is one of the most competitive energy technologies), optimisation of existing networks, and increased new and innovative applications of geothermal energy in transport, industry and agriculture.*

Geothermal power

Geothermal Power - EU-27	2000	2005	2010	2020
Conventional	0,812	0,829	0,910	1,2
Low enthalpy	0,013	0,014	0,069	0,300
EGS	-	-	0,010	4,5
Total : GWe TWh	0,815	0,843	0,989	6
		5,5	7	55

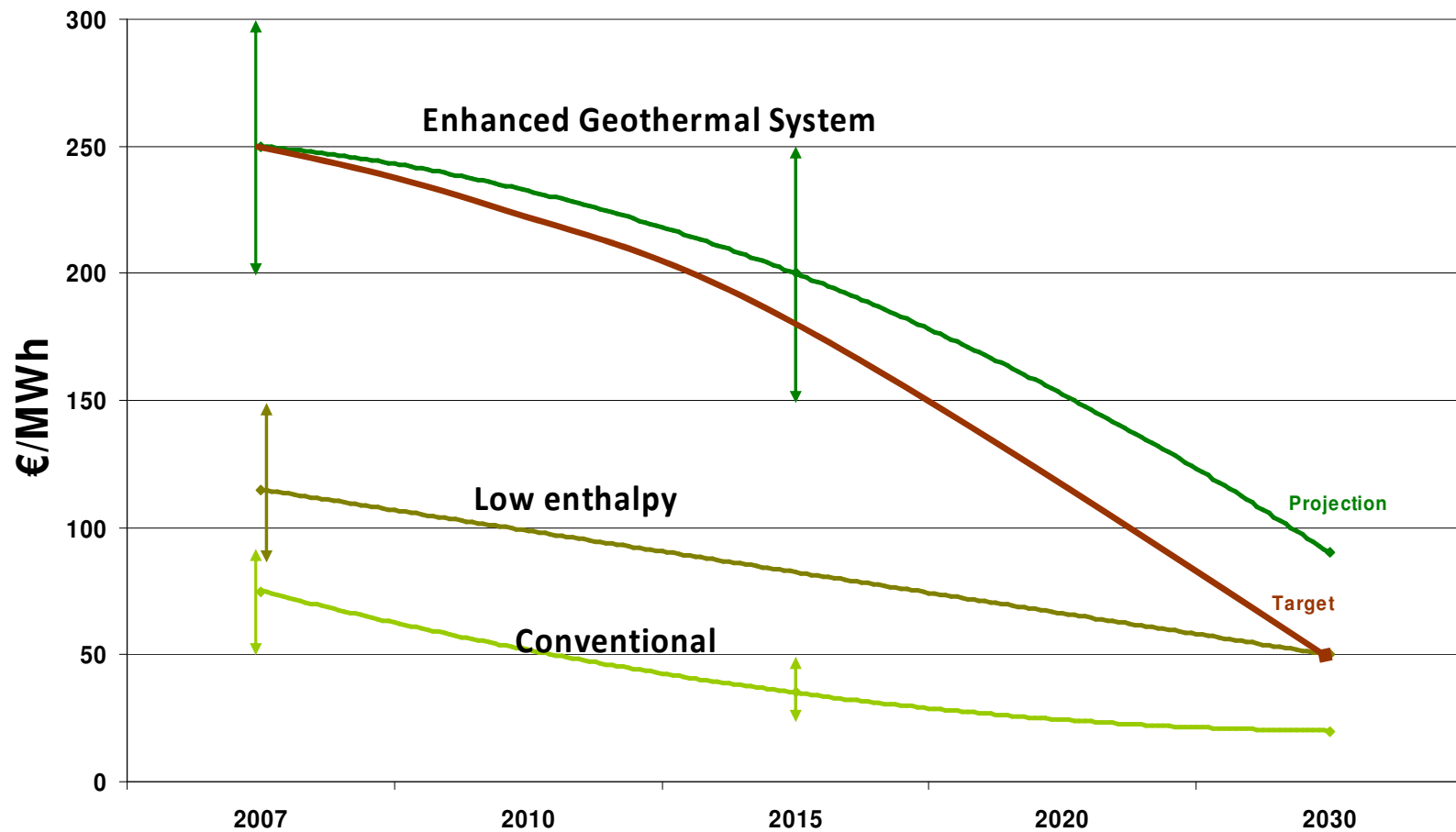
Geothermal power



Summary of targeted costs

ELECTRICITY	Costs 2007		Costs 2030
	Range(€/MWh) (€/MWh)	Average	Average (€/MWh)
Conventional Power	50 to 90	70	20
Geothermal Low Enthalpy Production	80 to 150	115	Target: 50
EGS	200 to 300	250	Target: 50 Projection: 90

Geothermal power unit cost

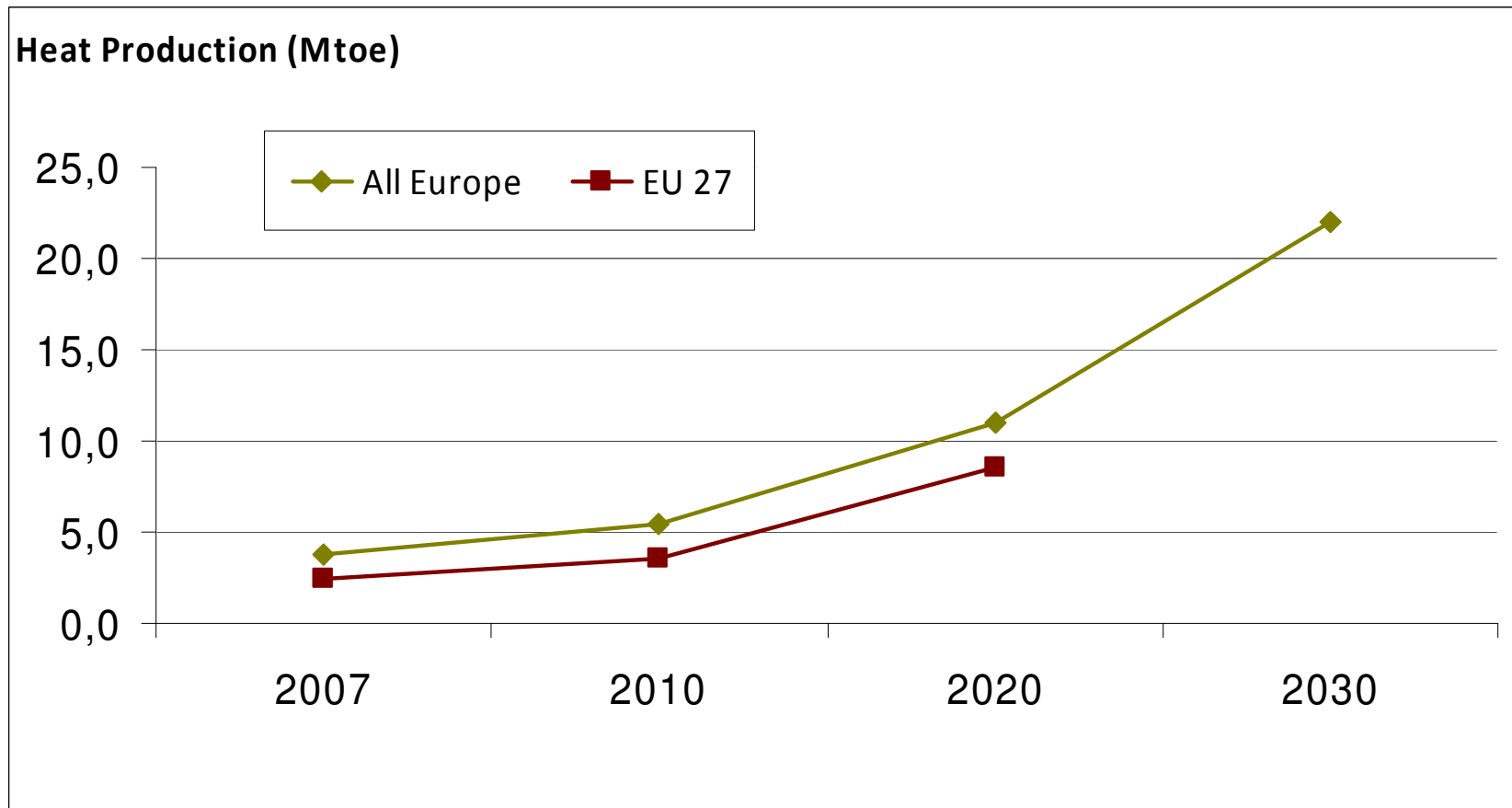




Geothermal heating and cooling

Geothermal h&c - EU-27	2007	2010	2020
Geothermal HP	1,4	2,5	6,2
Direct uses	1	1,2	2,3
Total : Mtoe	2,4	3,6	8,6
MWth	9 820	16 000	39 000

Geothermal heat production

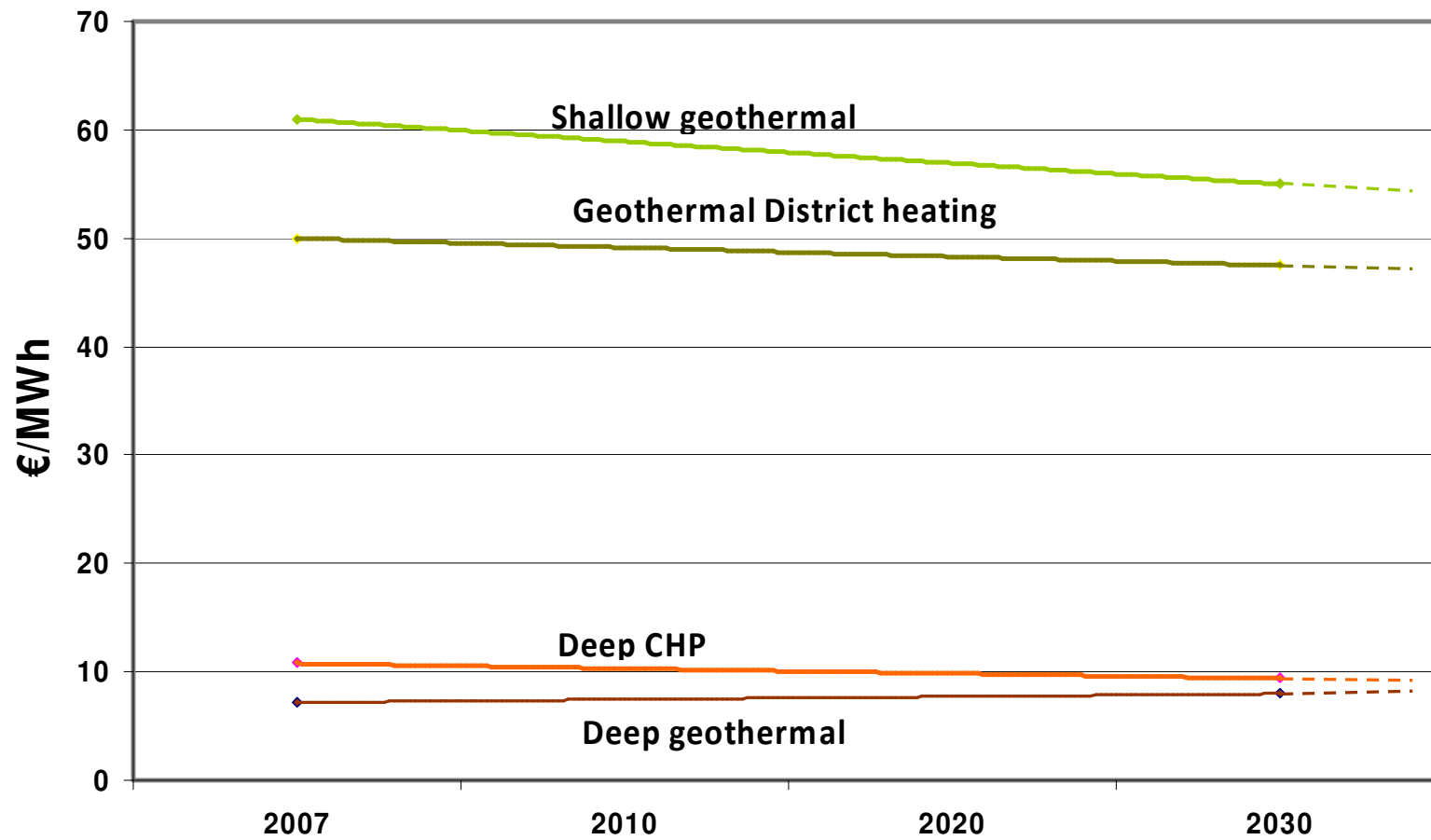


Summary of targeted costs

HEATING & COOLING		Costs 2005 Range (€/MWh)	Average (€/MWh)	Costs reduction by 2030 (% 2005 costs)
Deep geothermal		2 to 40	7,2	+11
District Heating ^[1]		40 to 80	50	-5
Shallow	Heat only	10,8 to 320	19	-9
	H&C: heating	7,2 to 270	61	-8
	H&C: cooling	7,2 to 350	16	-8

^[1] The figures for deep and shallow geothermal are from the IEA report 2007: *Renewables for heating & cooling*. The data on District Heating are EGEC projections for geothermal DH in Europe.

Geothermal heating





EGEC research agenda objectives

- In January 2009, EGEC published a geothermal research agenda fixing the research priorities for all geothermal technologies until 2030, in order to decrease costs:
 - by 5% for geothermal District heating: reach 40 €/MWh
 - by 10% for geothermal heat pumps: reach 15 €/MWh
 - by 30% for conventional geothermal power (flash and dry steam): reach 20 €/MWh
 - by 50% for low enthalpy production: reach 50 €/MWh
 - by more than 50% for EGS: reach 50 €/MWh