



Recent development of deep geothermal energy in The Netherlands

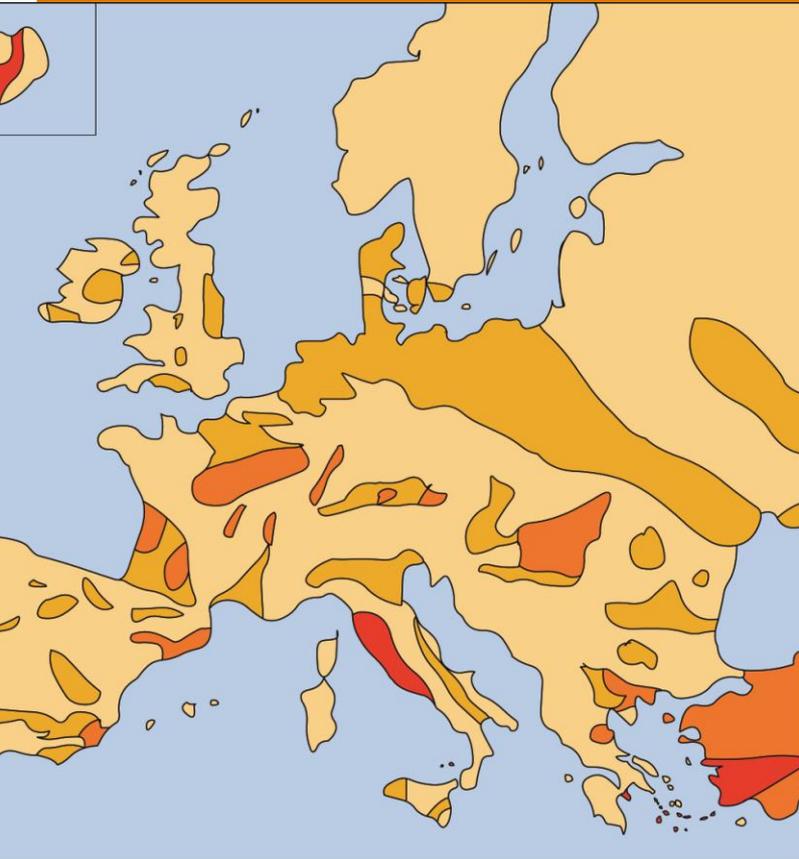
Guus Willemsen

IF Technology

Hannover, October 16, 2014



Basic geology factors & setting



Sandstone aquifers with primary permeability 1 to 3 km deep

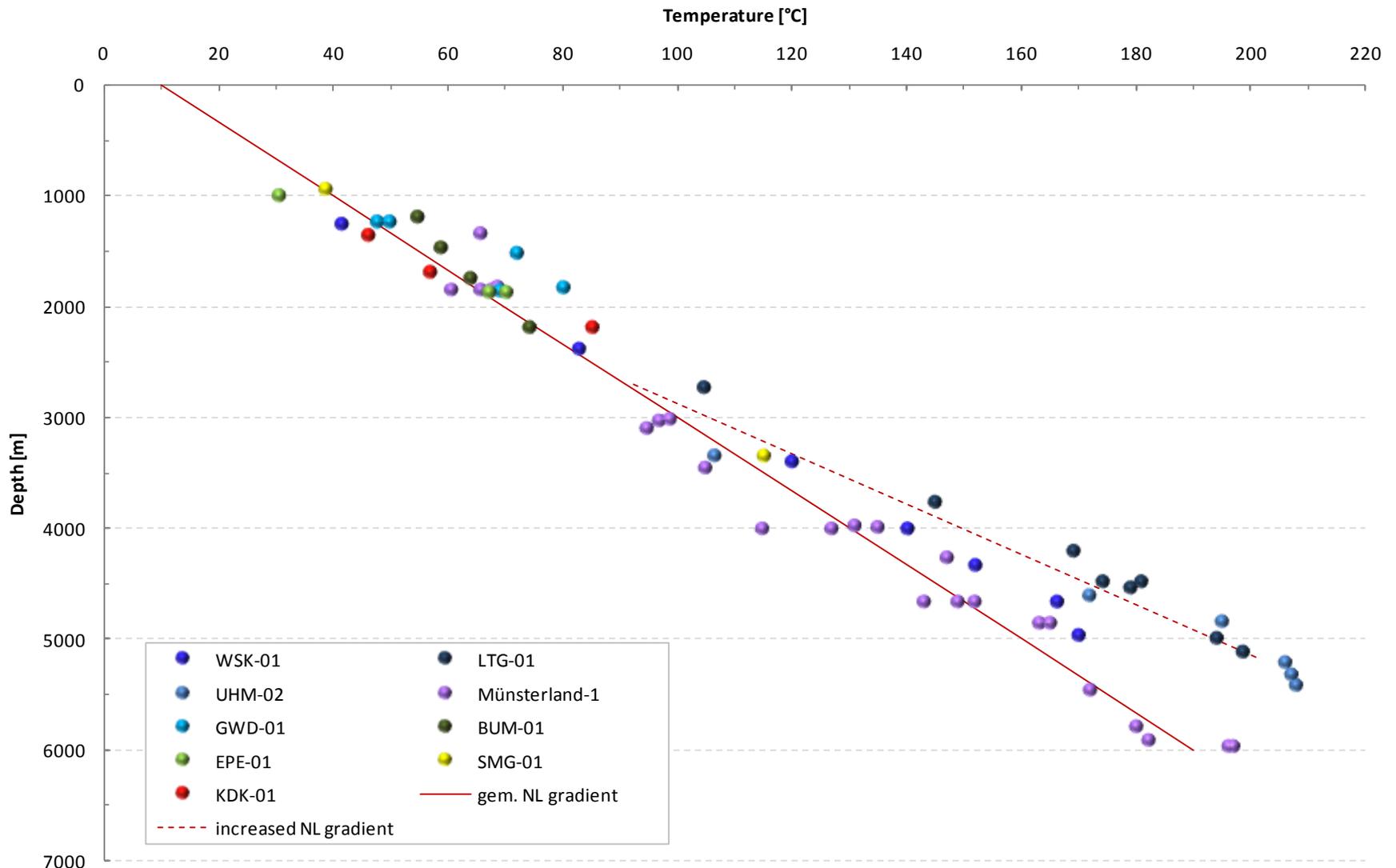
Production volumes of 100 to 400 m³/h (30 to 100 l/s)

Temperature gradient : 30 °C / km

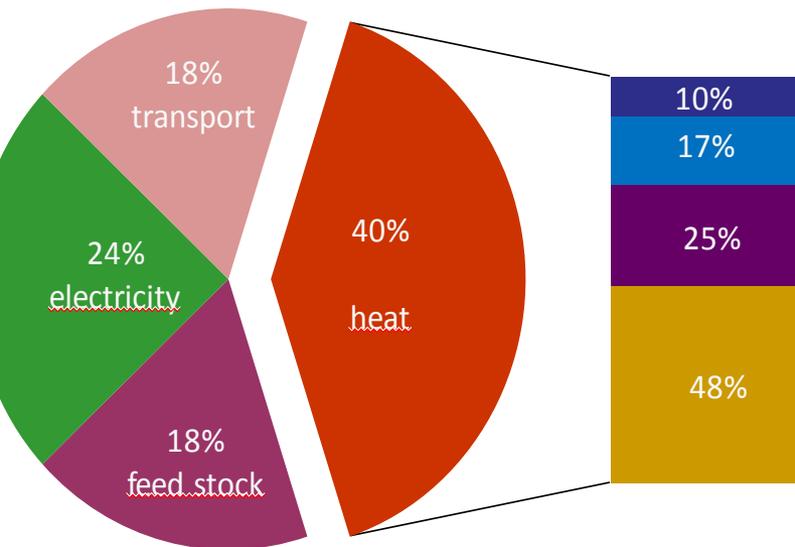
Dutch settings roughly comparable to France, Northern Germany, Denmark

Conditions allow 'Direct Use' application of geothermal energy

Temperature gradient in The Netherlands



Primary energy consumption 3.200 PJ/year

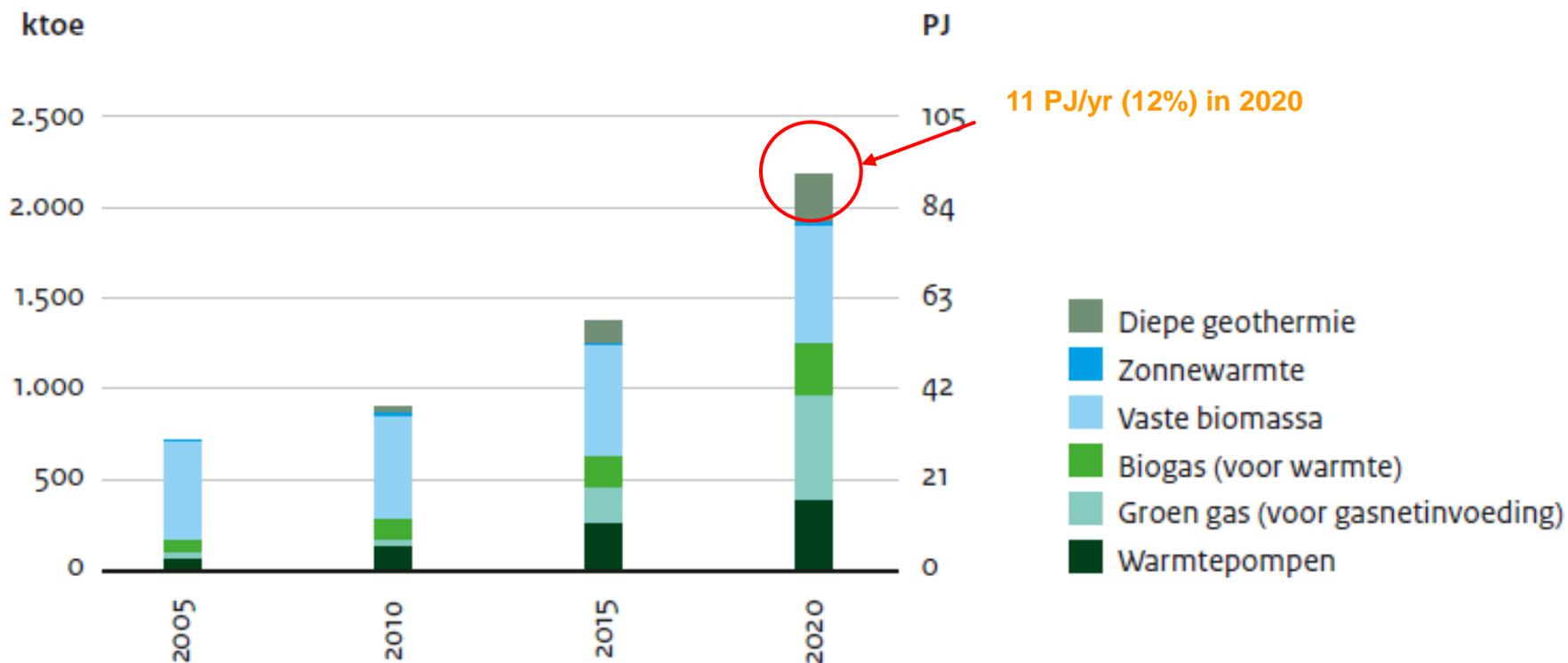


Greenhouses (129 PJ)
Offices etc (215 PJ)
Houses (327 PJ)
Industry (619 PJ)

Dutch government foresees significant contribution of geothermal energy to renewable heat

Hernieuwbare warmte

Direct heat

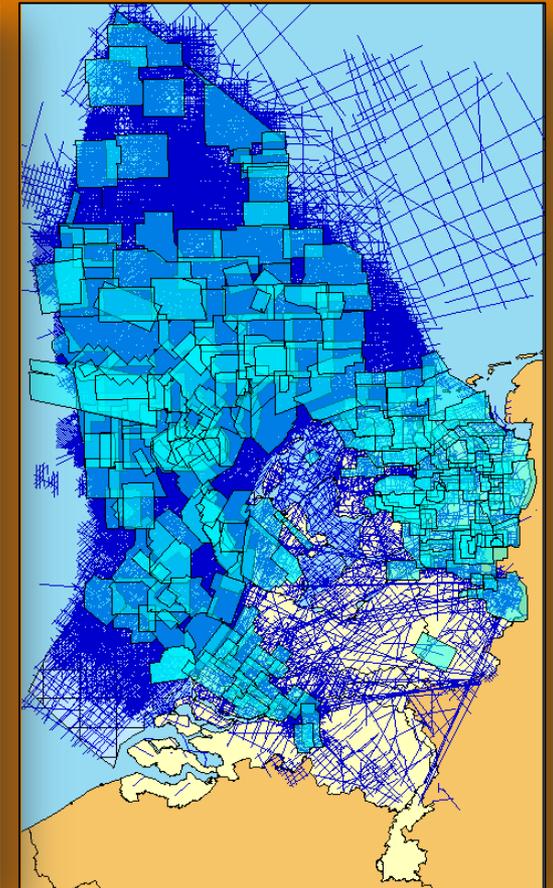
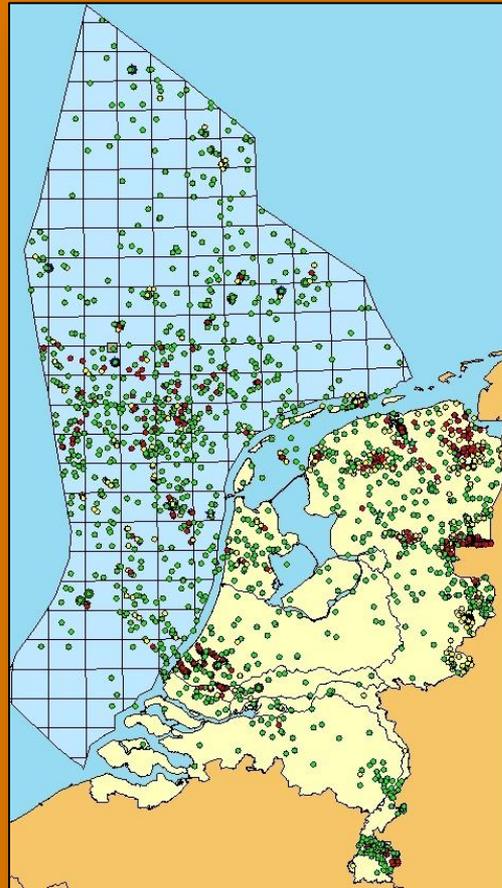


Source: Nationaal actieplan voor energie uit hernieuwbare bronnen (agentschap NL, 2010)

Data on the Dutch subsurface

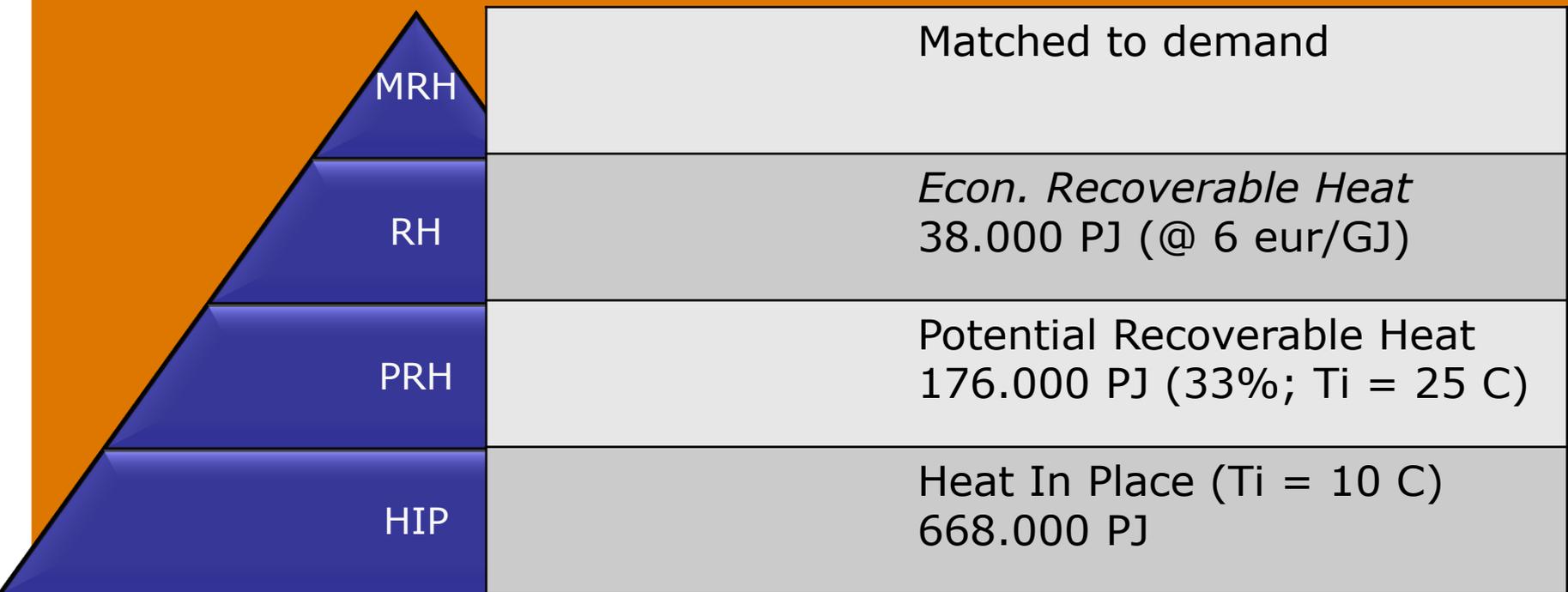
Available from
NLOG.NL

Public after 5 years



Potential for geothermal energy in The Netherlands

From: Thermogis, Expectation P50, TNO

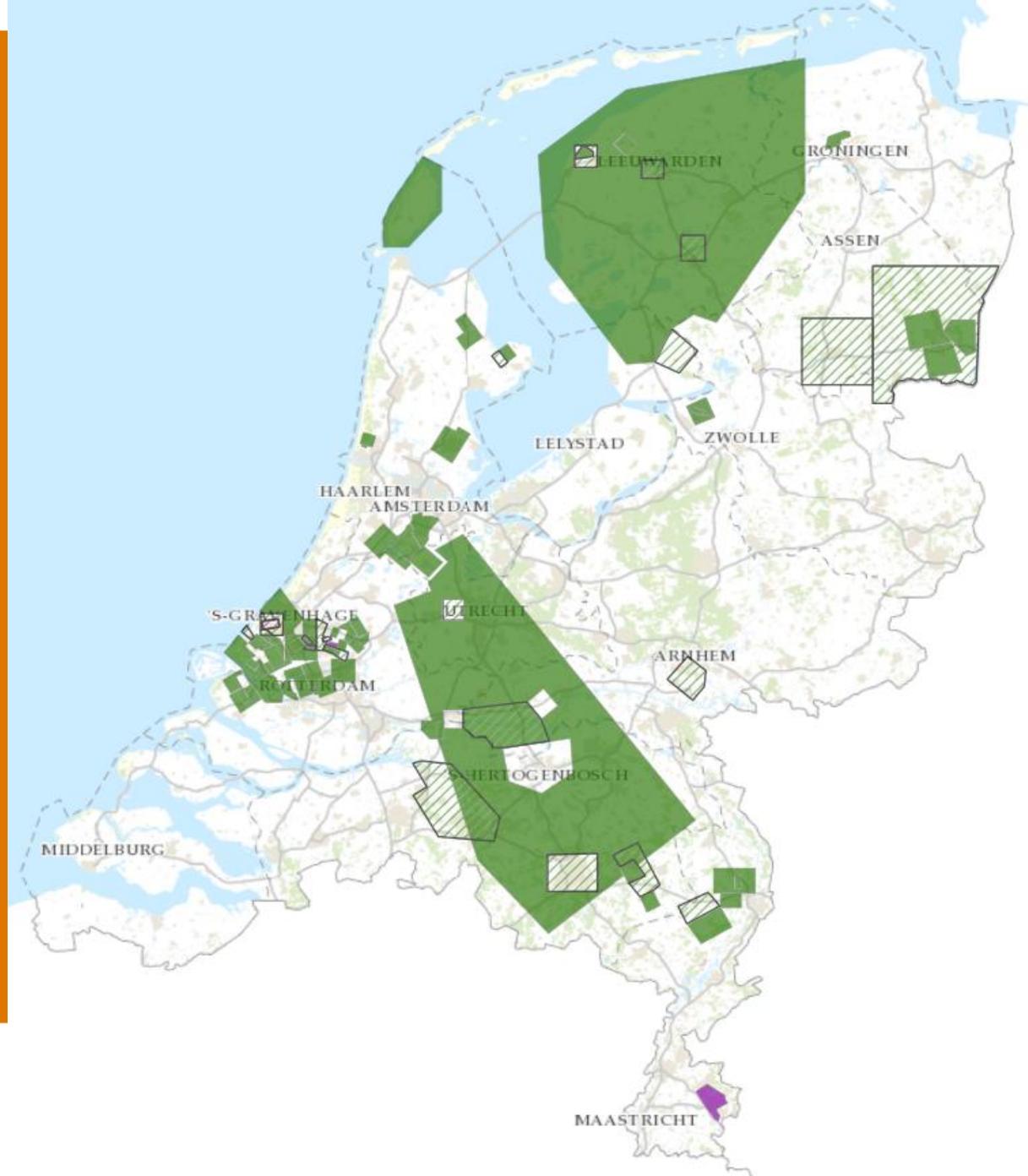




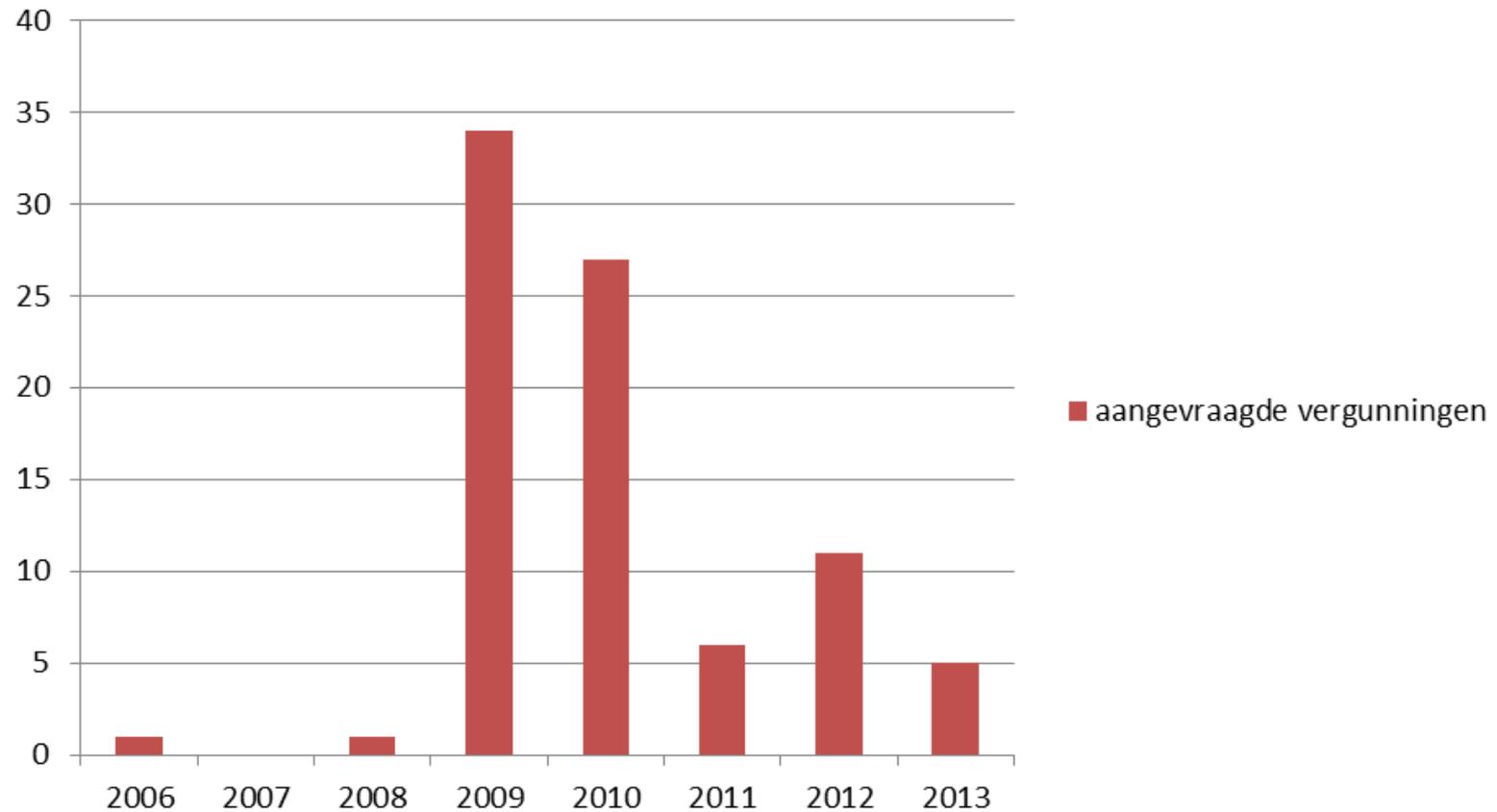
- 1980 – 2000 Various unsuccessful attempts
- 2005 First new feasibility studies
- 2007 Bleiswijk 1.600 meter
- 2009 Guarantee scheme
- 2011 Geothermal Action Plan (11 PJ in 2020)
- 2012 SDE+ (Feed-In Tariff scheme)
- 2013 Capacity restrictions in FIT scheme

De Lier drilling (KCA Deutag)

Permit applications in NL in 2014

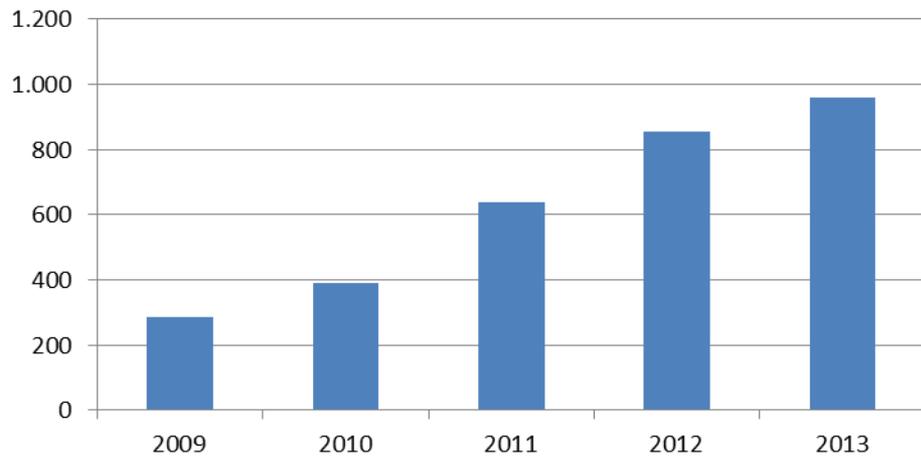


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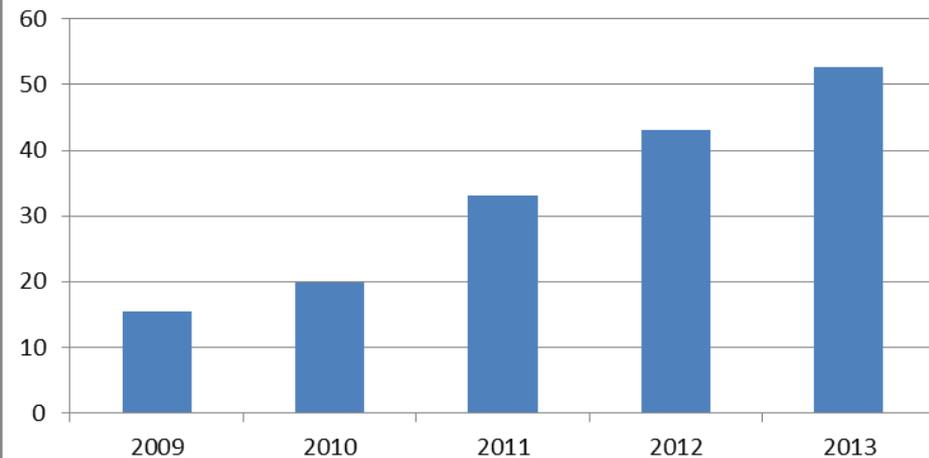


Geothermal energy production

Production in TJ/yr



Capacity in MWth



11 projects realized

10 of them in greenhouses

2007: first project realized (!)

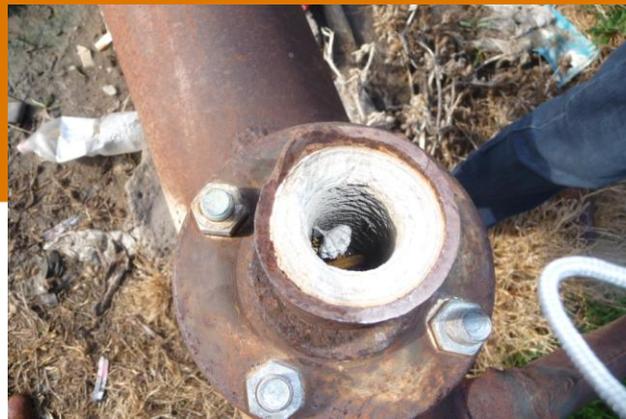
Success factors

- Public database (www.nlog.nl)
- FIT for geothermal heat (SDE+)
- National Risk Mitigation Fund for mitigating geological risk
- High heat demand density (in GJ/ha) with low T @ greenhouses (return < 35 C)



Yes, there are problems, but problems can be solved

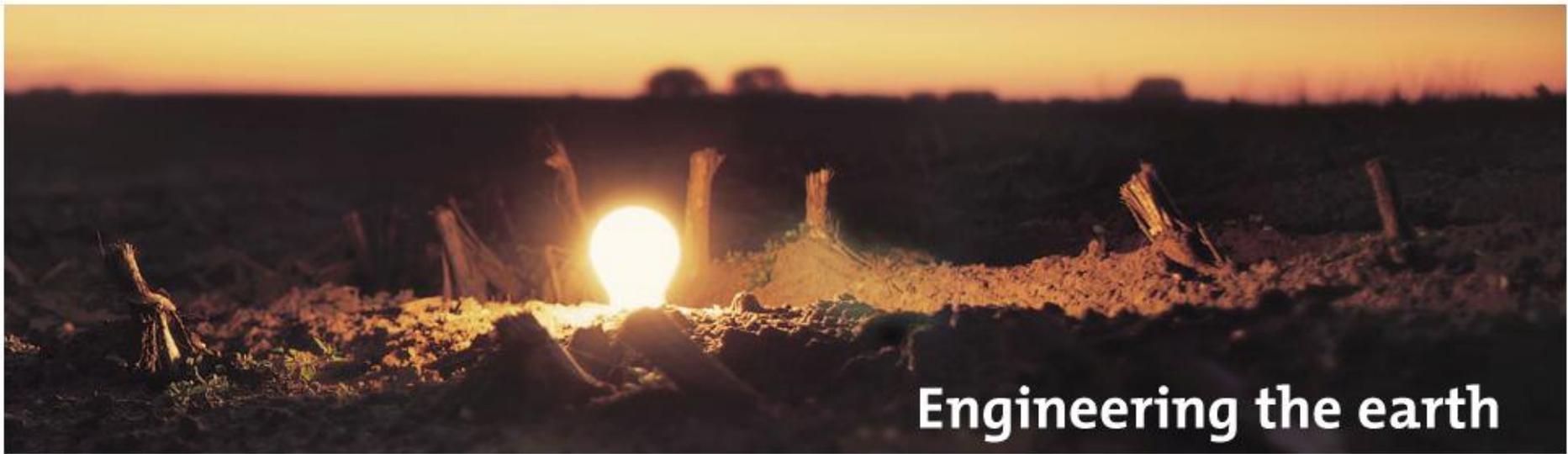
- Drilling problems – well and drilling design, contingency plans, risk budget
- Low flow – contingency plans & Dutch Risk Mitigation Fund
- Injectivity & skin– mud selection, underbalanced drilling, clean out, hydraulic stimulation
- Scaling & corrosion – assess probability before drilling, water treatment as option in design
- Seismicity – design for low risk & monitor



Future outlook

- Greenhouse geothermal market development slows down – lack of money – role for geothermal operators
- Professionalization: industry standards are being developed
- New heat demand markets:
 - District heating (existing & new)
 - Industry (food, paper, chemical)
- New technology developments
 - Heat pumps to $T > 100\text{ C}$
 - Fault zones & karst in deep seated aquifers
 - EGS
 - Electricity from low temperature heat (Climeon)





Engineering the earth

Thank you