## GEOELEC Prospective for Geothermal Electricity in Europe

## **Regional Workshop Spain-Portugal**

**Burkhard SANNER** 

European Geothermal Energy Council

Valencia, 10/11/2011



# Regional compilation of prospective areas and resource assessment

**Geoelec Geothermal resource assessment protocol** 

Data compilation

Critical review of bibliographic compilation from:

- Geological surveys
- Oil & Gas company public reports
- Direct contacts with underground 'explorators'
- 7 regional workshops to complete data compilation





## **Early geothermal data compilations**

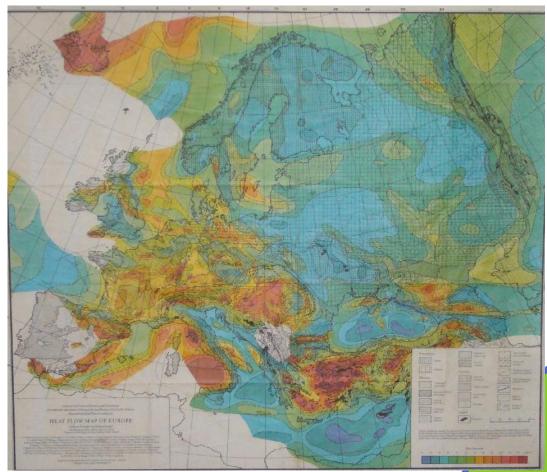
#### CERMAK, V. & RYBACH, L. (eds.) (1979): Terrestrial Heat Flow in Europe

Book with different papers from a Workshop

A map of heat flow density was included in that book

Similar book: CERMAK, V. & HÄNEL, R. (eds.) (1980): Geothermics and Geothermal Energy, Symposium EGS/ESC Budapest

**GE E E** 



(Map by Cermak & Hurtig, 1979)

### **Early geothermal data compilations**

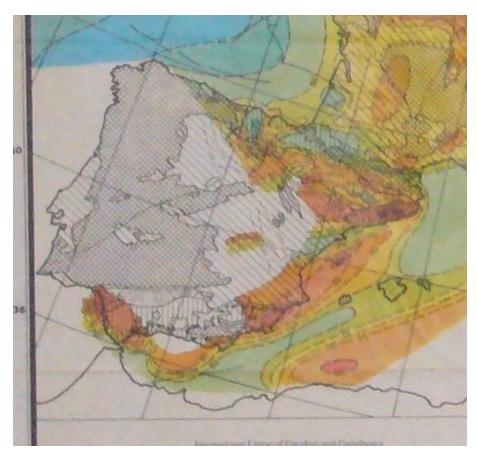
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**GE E E** 

**Enlargement Iberia** 



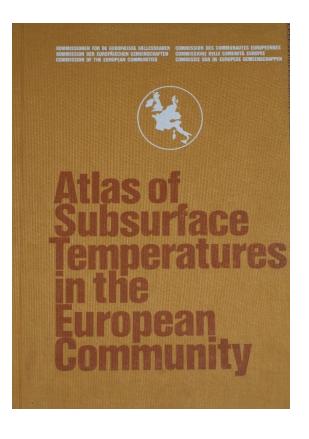
(Map by Cermak & Hurtig, 1979)

### **Early geothermal data compilations**

#### EC 'Atlas of Subsurface Temperatures in the EC' (1980)

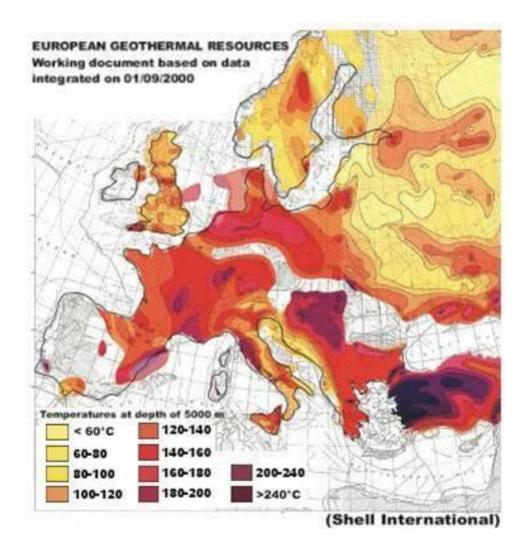
Coordinated by BGR, Hannover (Ralph Hänel)

Only heat flow and temperatures at depths between 500 and 5000, for countries and regions (e.g. Soultz-Landau)





### **SHELL Map (2000)**

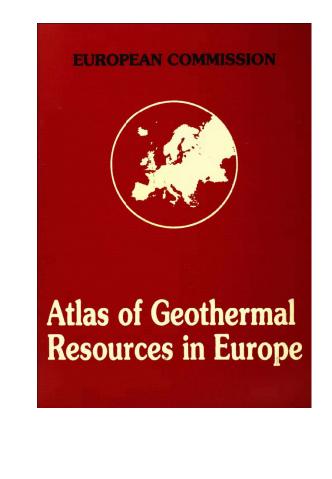


# Regional compilation of prospective areas and resource assessment

#### EC 'Atlas of geothermal resources in Europe' (2002)

Coordinated by BGR, Hannover (Suzanne Hurter)

Overview: Heat Flow Temperature at 1 Km and 2 Km depth European Geothermal resources

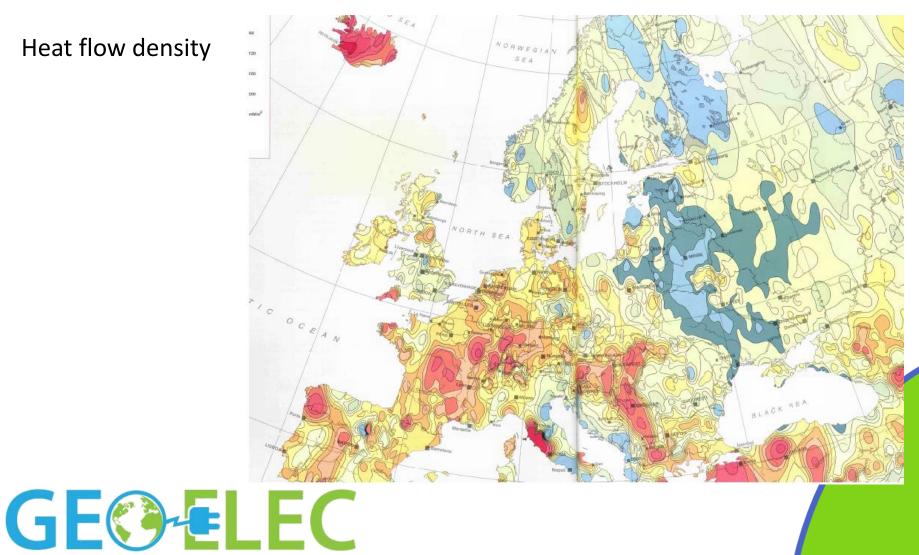




## **Regional compilation of prospective areas and** resource assessment

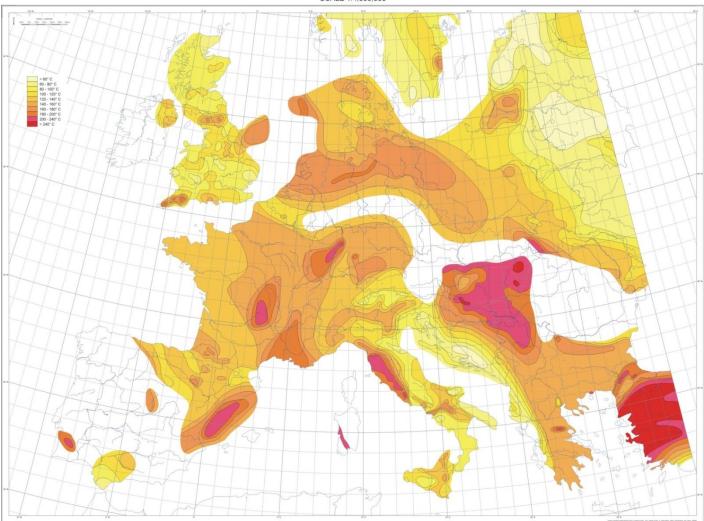
#### EC 'Atlas of geothermal resources in Europe' (2002)

Heat flow density



## **ENGINE Project (FP6)**

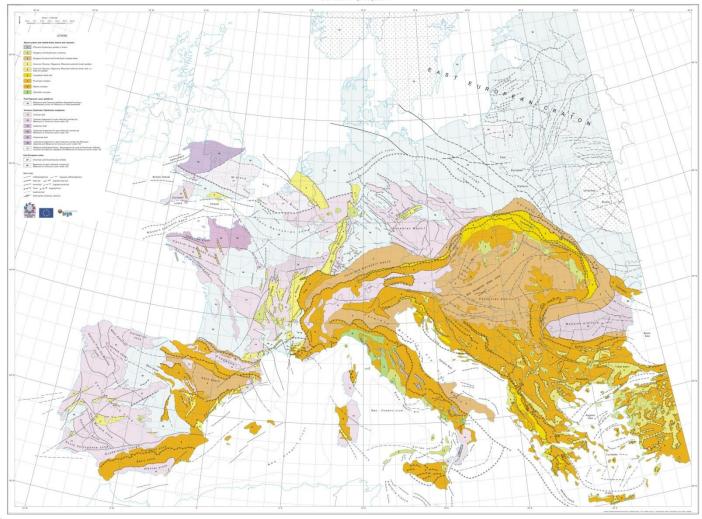
MAP OF THE TEMPERATURES EXTRAPOLATED AT 5 KM DEPTH SCALE 1:4,000,000



Temperatures at 5 km depth

## **ENGINE Project (FP6)**

DEEP GEOTHERMAL ANOMALIES IN THEIR EUROPEAN GEODYNAMIC SETTING SCALE 1:4,000,000



Tectonic patterns

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### **Other Public Sources:**

- WGC 1995, 2000, 2005, 2010: Country Updates
- National geological databases
- Methodology from other continents:
  - Canada
  - USA
  - Australia





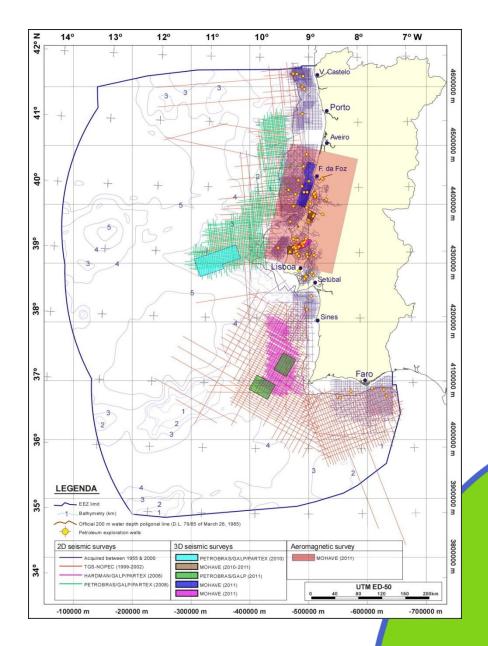
#### **Other National Sources:**

## Exploration work by hydrocarbon industry

for Portugal: mainly offshore

from http://www.dgge.pt/





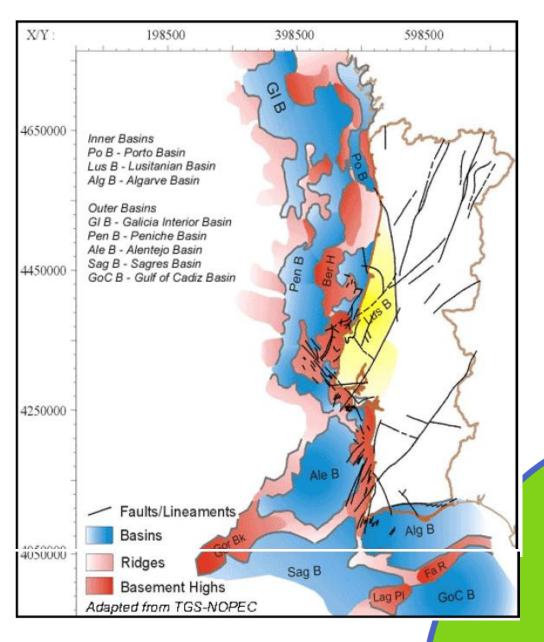
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GE Co-ELEC



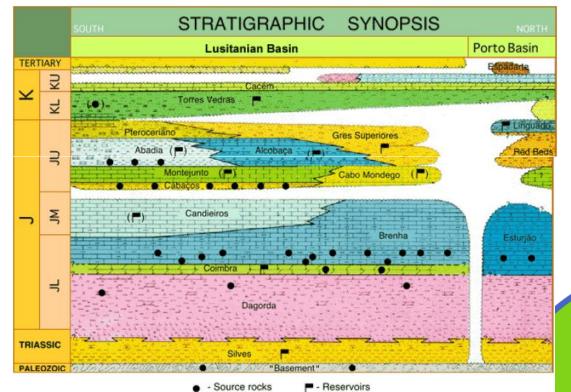
#### **Other National Sources:**

## Exploration work by hydrocarbon industry

for Portugal: mainly offshore

from http://www.dgge.pt/

**GE E E E** 



#### Canada

#### Geothermal energy resource potential of Canada (GS of Canada, 2011)

#### Contains maps on EGS potential !

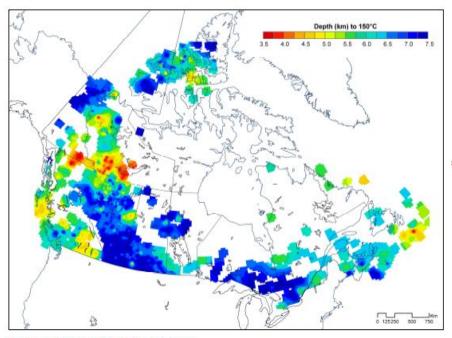
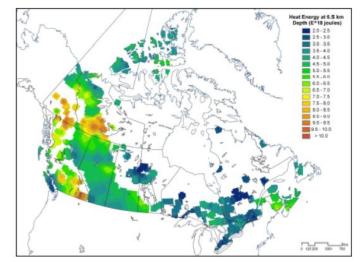


Figure 8.4. Depth (km) to 150 °C temperature.





igure 8.2. Heat Energy at 6-7 km depth.

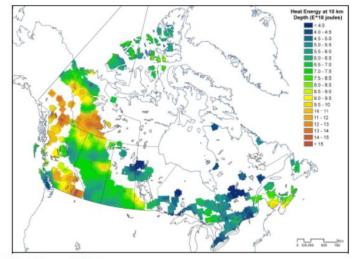


Figure 8.3. Heat Energy at 9-10 km.



#### Canadian Geothermal code for public reporting, Cangea, 2010



"Accelerate Canadian exploration and development of geothermal resources in order to provide secure, clean and sustainable energy"

5,000 MW BY 2015!

#### THE CANADIAN GEOTHERMAL CODE FOR PUBLIC REPORTING

REPORTING OF EXPLORATION RESULTS, GEOTHERMAL RESOURCES AND GEOTHERMAL RESERVES

2010 EDITION

Prepared by The Canadian Geothermal Code Committee (CGCC):

- Mr. Lee Deibert, Meridian Environmental Consulting Ltd. (CanGEA Director and Committee Co-Chair)

- Mir. Jan McDanak, Nexen Incritisering Mir. Jan McDonak, Nexen Incritise, Inc. (CanGEA Trassurer) Ms. Alison Thompson, Magma Energy Corp. (CanGEA Founder and Chair) Mr. Brian Tochey, Nexen Inc. (CanGEA Director and Committee Co-Chair) Dr. Daniel Yang, Borealis Geopower Inc.



#### USA

• The Future of Geothermal Energy, MIT, 2006

- GOOGLE.ORG:
  - U.S. Geothermal Resource (3-10 km depth) on Google Earth

#### The Future of Geothermal Energy

Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21<sup>st</sup> Century







#### The Geothermal reporting code, 2008, AGEA-AGEG



Australian Code for Reporting of Exploration Results, Geothermal Resources and Geothermal Reserves

The Geothermal Reporting Code 2008 Edition

Effective August 2008

Prepared by: The Australian Geothermal Code Committee (AGCC)

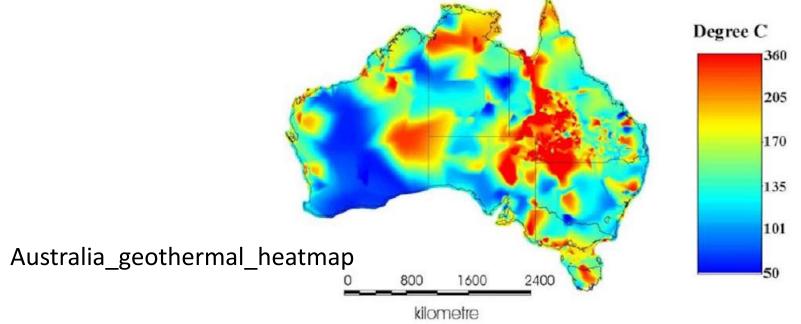
A committee of the Australian Geothermal Energy Group (AGEG) and the Australian Geothermal Energy Association (AGEA)





#### **Australia**

November 07, 2011: Exciting project looks at new way of characterizing resources in Australia



The Australian geothermal energy industry goes new ways with enlisting machine learning experts to identify and characterise resources by combining industry data and data of Geoscience Australia



# Regional compilation of prospective areas and resource assessment

**Geoelec Geothermal resource assessment protocol** 

**Expected results:** 

- Compilation of geological and geophysical data inside Geological surveys, accessible to interested developers as open and easily as possible
- European Geothermal Reporting Code (discussion already started within TP Geoelec)



## Thank You!

## Visit www.geoelec.eu



