Geothermal Energy Development in S.E. Europe in the Context of the GEOFAR Project

Administrative Schemes and Regional Development

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Nicholas Sofianos, Mphil Development (Glasgow University)
European Projects Coordinator
Institute of Energy for South East Europe (IENE)

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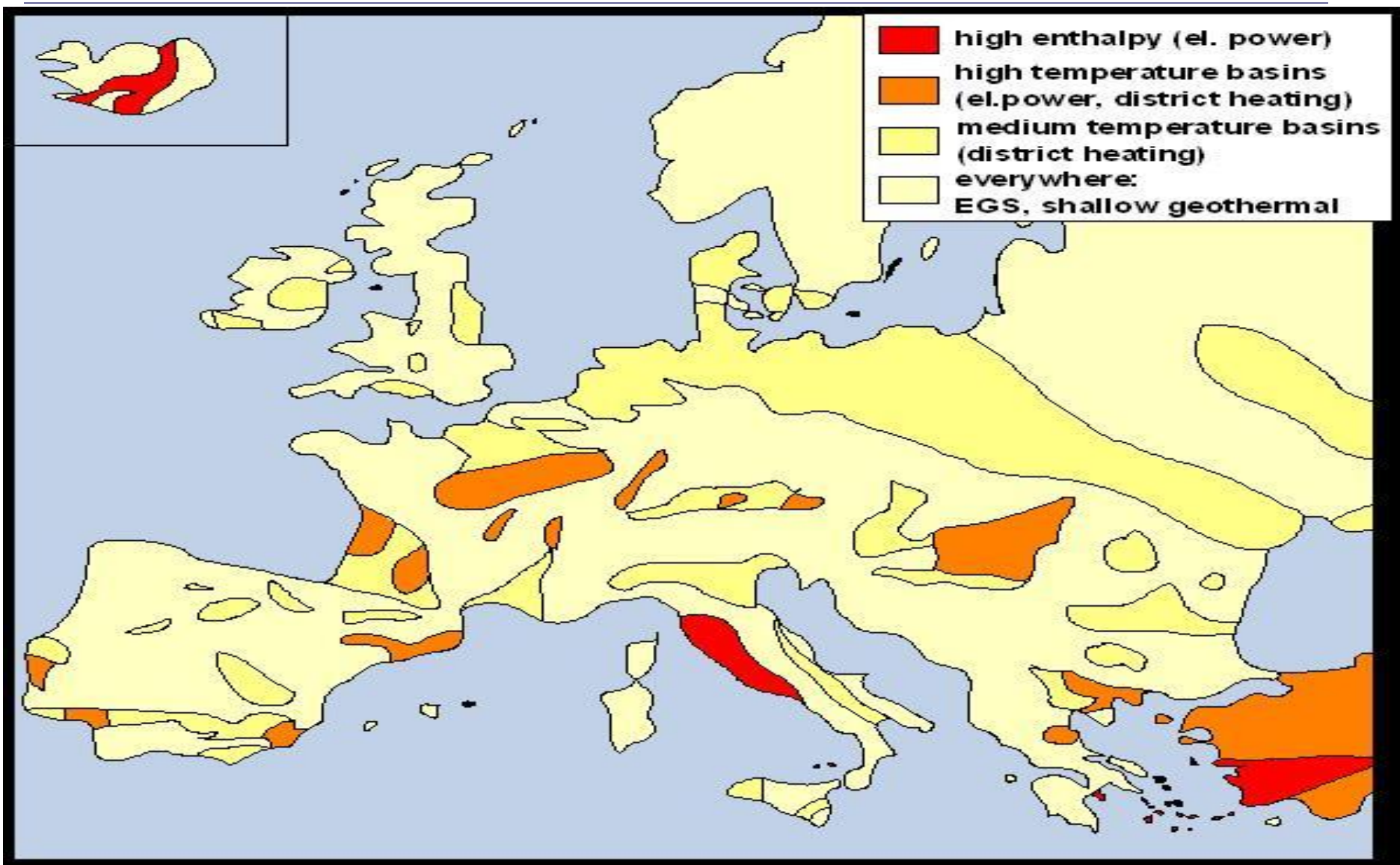
Outline

- Brief Introduction (Geothermal Energy in Europe and GEOFAR project)
- S.E. Europe Geothermal Energy Outlook
- Selected Case Studies
- The Role of Geothermal Energy in Regional Development
- Administrative Schemes for Geothermal Energy Development
- Conclusions

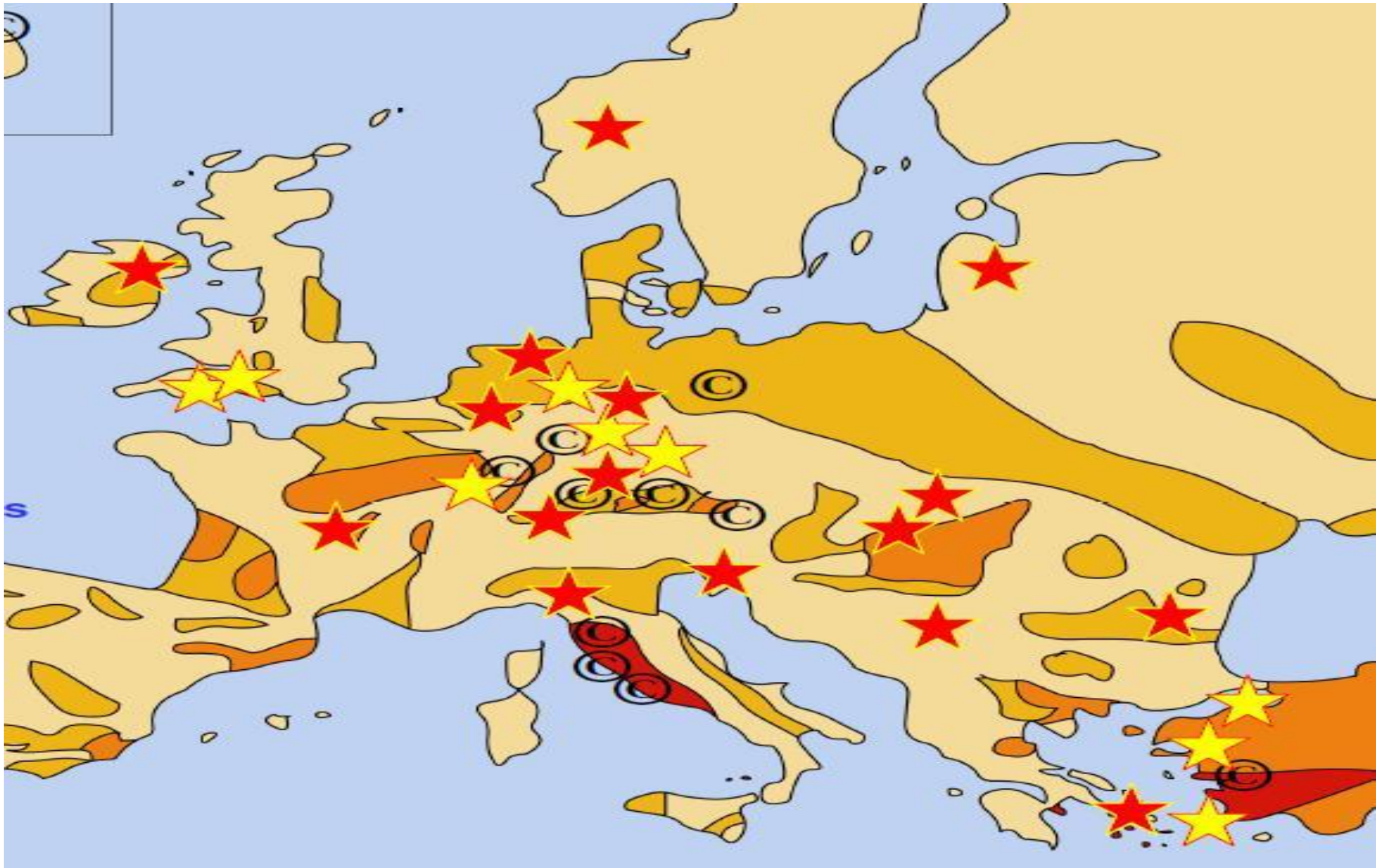
Geothermal Potential in Europe



S.E. Europe Geothermal Energy Outlook

- Adequate Low Geothermal Potential
- Sufficient geothermal data in most of the SE European countries
- Familiarity with geothermal energy use through traditional applications (balneology)
- Insufficient development in large scale investments
- Insufficient development in innovative geothermal applications

Existing – Projected – Planned Geothermal Electri Plants in Europe



Geothermal District Heating Systems in Europe

Geothermal Outlook - Greece

GREECE	
Geothermal Enthalpy	Low – Medium – High
Geothermal Applications	Space Heating, Industrial, Agricultural, Aquaculture, Balneology, Heat pumps
Installed Capacity	117 MWth
Geothermal Power Plant	No / Planned / Ideas
Thermal Potential	+ 1000 MWth

Geothermal Outlook - Bulgaria

BULGARIA	
Geothermal Enthalpy	Low – Medium < 100ºC
Geothermal Applications	Space Heating, Cooling, Industrial, Agricultural, Balneology
Installed Capacity	110 MWth
Geothermal Power Plant	No
Thermal Potential	+ 800 MWth

Geothermal Outlook – F.Y.R.O.M.

F.Y.R.O.M.	
Geothermal Enthalpy	Low < 80ºC
Geothermal Applications	District Heating, Agricultural, Space Heating, Balneology
Installed Capacity	63 MWth
Geothermal Power Plant	No
Thermal Potential	+ 500 MWth

Geothermal Outlook - Albania

ALBANIA	
Geothermal Enthalpy	Low < 70ºC
Geothermal Applications	Balneology
Installed Capacity	10 MWth
Geothermal Power Plant	No
Thermal Potential	+ 600 MWth

Geothermal Outlook - Serbia

SERBIA	
Geothermal Enthalpy	Low < 97ºC
Geothermal Applications	Space Heating, Balneology, Agricultural, Industrial, Cooling,
Installed Capacity	89 MWth
Geothermal Power Plant	No
Thermal Potential	+ 800 MWth

Geothermal Outlook – Bosnia & Herzegovina

BOSNIA – HERZEGOVINA	
Geothermal Enthalpy	Low < 85º
Geothermal Applications	Balneology
Installed Capacity	-
Geothermal Power Plant	No / Planned (prior to the civil war)
Thermal Potential	50 MWth (Based on existing wells)

Geothermal Outlook - Croatia

CROATIA	
Geothermal Enthalpy	Low – Medium < 180ºC
Geothermal Applications	Space Heating, Balneology
Installed Capacity	114 MWth
Geothermal Power Plant	Projected (2012 - 4,71 MWe)
Thermal Potential	+ 900 MWth

Geothermal Outlook - Romania

ROMANIA	
Geothermal Enthalpy	Low – Medium < 150ºC
Geothermal Applications	Space Heating, Agricultural, Industrial, Balneology
Installed Capacity	145 MWth
Geothermal Power Plant	No / Ideas / The University of Oradea developed a pilot Binary Cycle Power Plant
District Heating	University Campus of Oradea

Case Studies – Greece (Operating Project)

Location	Neo Erasmio (Xanthi)
Production	Heat production
Geology	Eastern edge of the Delta Nestos Basin
Number of drilled wells/number of planned wells	22 exploration boreholes and 6 production wells of about 500 m
About the resource	Between 40 °C to 65 °C
Heat production	140 kW_{th}
Uses of heat	Dehydration process to dry tomatoes (industrial application)
Year of production	2001
Environmental impact	About 70 toe saved per season
Juridical set up	Geothermica Hellas SRL as investor and operator
Difficulties met	Technical difficulties due to the launch of pilot process
Global amount of investment	0.15 M€

Case Studies - Greece (Operating Project)

Location	Loutraki (Corinth)
Production	Heat production
Geology	South Aegan volcanic arc (the most important high enthalpy fields of Greece)
Number of drilled wells/number of planned wells	2 wells (between 50 and 60m, existing but not used yet)
About the resource	Up to 300 m3/h and 35°C available, average daily production 175 m3/h
Uses of heat	Balneology uses: Rehabilitation and construction of new buildings
Year of production for operating plants or objective of production	1932
Juridical set up	D.A.E.T (Muncipal Societe Anonyme, shareholders: municipality 100%) aims to develop the tourism in the area of Loutraki
Difficulties met	Expensive operating costs
Global amount of investment	15 M€
Way of financing the project	Equity (35%), Subsidy (20 %) and Loan (45%)

Case Studies – Greece (Failed Project)

Location	Nea Kessani (Xanthi)
Production	Heat production
Geology	Xanthi – Komotini basin
Number of drilled wells/number of planned wells	25 exploration wells and 7 production wells between 200 to 300 m were drilled within an area of about 15 km2
About the resource	Between 70 and 75°C and total estimated flow rate superior to 300 m"/h
Uses of heat	Mainly greenhouses
Juridical set up	Initially developed (exploration phase) through the VALOREN project, the rights for the investigation and the construction of infrastructure works were transferred to the Hellenic Industrial Development Bank (ETVA) in 1988.
Difficulties met	The project failed at the use stage since the local farmers were not interested in installing any greenhouses in the ready heating distribution network. The main reason was that the ETVA did not create a suitable management scheme of the geothermal plant. Another reason is that the local farmers prefer to have their own geothermal well (s) in their own property.
Global amount of investment	About 3,5 M€ given by the VALOREN Project but doesn't cover all the invest-ment
Way of financing the project	Project integrated in the VALOREN Programme and it was funded at 65% by this program.
Perspective of development	To find an investor

Case Studies – Bulgaria (Failed Project)

Location	Sapareva Banya (South West of Bulgaria)
Production	Heat production
State of development	Feasibility studies achieved
Geology	Geothermal spring in granite-gneiss
Number of drilled wells/number of planned wells	1 well (already drilled) and no reinjection well
About the resource	16 l/s and 96 °C
Heat production (estimated)	3110 kW/8425 MW_h
Uses of heat	Spa and district heating system to build
Environmental impact (estimated)	Annual CO2 savings emission estimated of by 441 tonnes
Juridical set up	Municipality as owner of the permit
Global amount of investment	About 370,000 € (geothermal heating station and district heating network)
Way of financing the project	Studies financed through the World Bank and a loan from the Word bank would be possible to develop the operation
Perspective of development	Looking for investors

Case Studies – Bulgaria (Failed Project)

Location	Zlatograd - Erma River (South Bulgaria)
Production	Heat production
State of development	Feasibility studies achieved
Geology	Geothermal spring (gneiss and marble)
Number of drilled wells	7 wells up to 300 meters
About the resource	About 10 l/s (authorised) and 89 °C
Heat production (estimated)	About 3 MW_t
Uses of heat	District heating
Environmental impact (estimated)	Annual CO_2 savings emission estimated of by 1.425 tonnes
Juridical set up	Municipality as owner of the permit
Global amount of investment	Estimated to 2,117 M€ (for geothermal heating station and construction of the network)
Way of financing the project	Studies financed through the World Bank and a loan from the Word bank would be possible to develop the operation
Perspective of development	Looking for investors

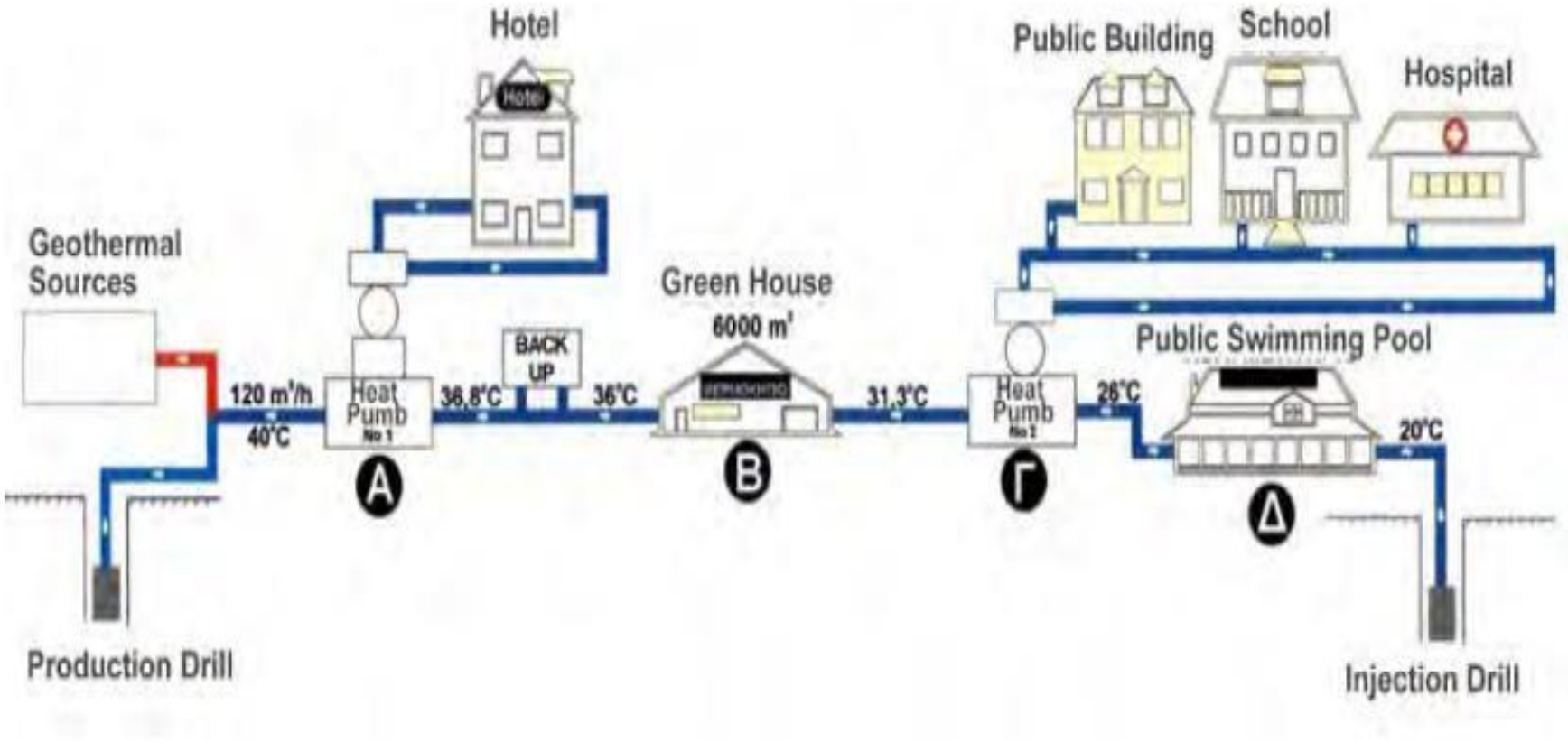
Case Studies – F.Y.R.O.M. (Operating Project)

place of investment	F.Y.R.O.M. - Kocani
installed capacity (kw/mw)	300 l/sec.
project cost (gross, in euro)	EUR 2 500 000
project type	Public
number of users of generated energy	2000 local citizens
type of energy resource replaced	Oil, coal, wood, electricity from the grid
start of operation	1985
financial sources	Local and private funds
investor	Republic of Macedonia and Communal Public Company – Water Supply ”Vodovod” - Kocani

The Role of Geothermal Energy in Regional Development

- Regional development and sustainable development
- The Role of a Regional Development Plant
- The role of Low Enthalpy
- The Competitive Advantage of Geothermal Energy

Regional Development Plan – Some examples (a)

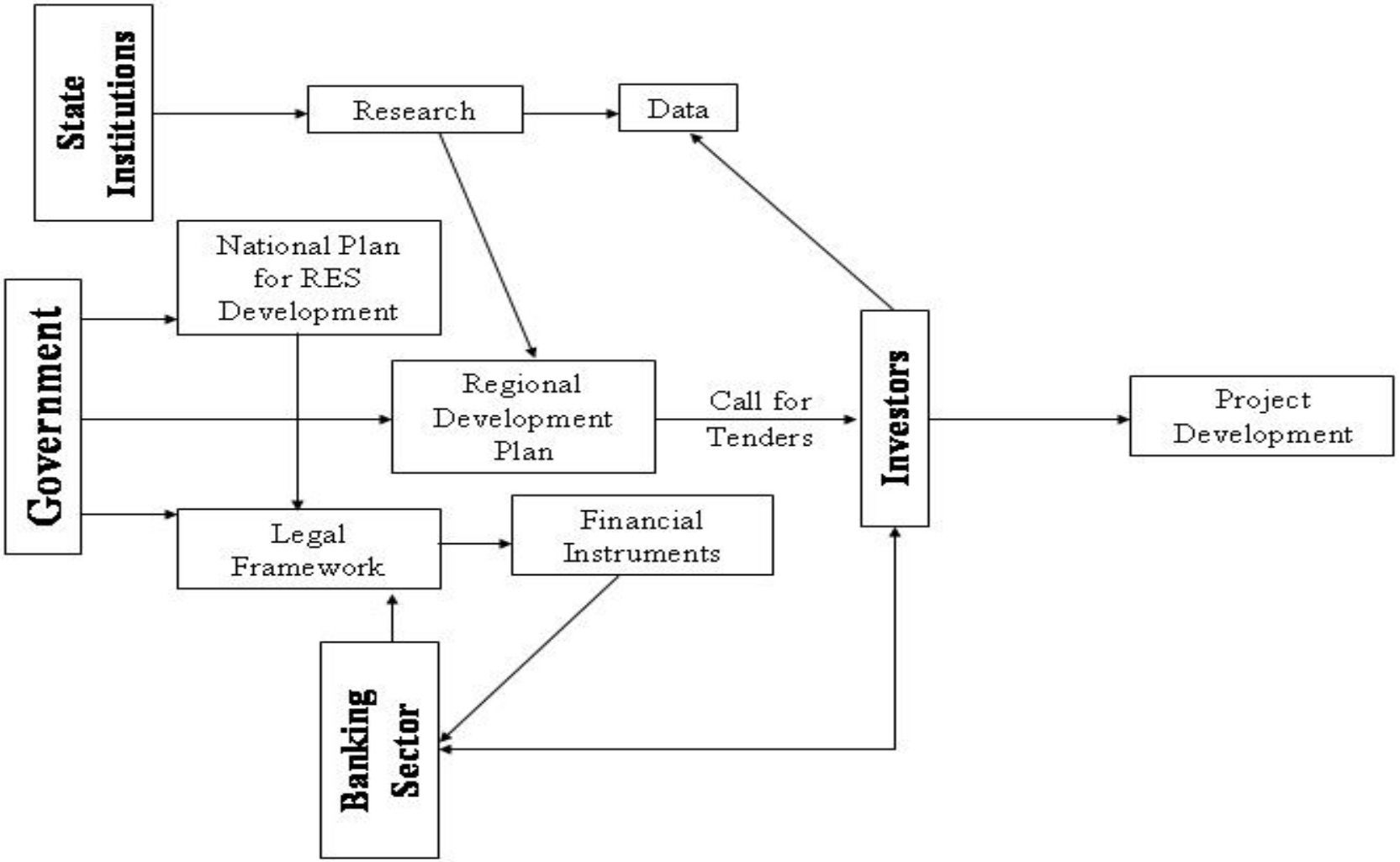


Regional Development Plan – Some examples (b)

Administrative Schemes for Geothermal Energy Development - Conclusion

- Key role of Government
- Harmonization of legislation and financial instruments
- Good cooperation with the State Geological Institution
- Special consideration to geothermal projects

Administrative Scheme for the Development of Geothermal Investments



Thank you very much