

# Geothermal in Croatia

August 2023



# Croatian Geothermal Sector

## Current Status

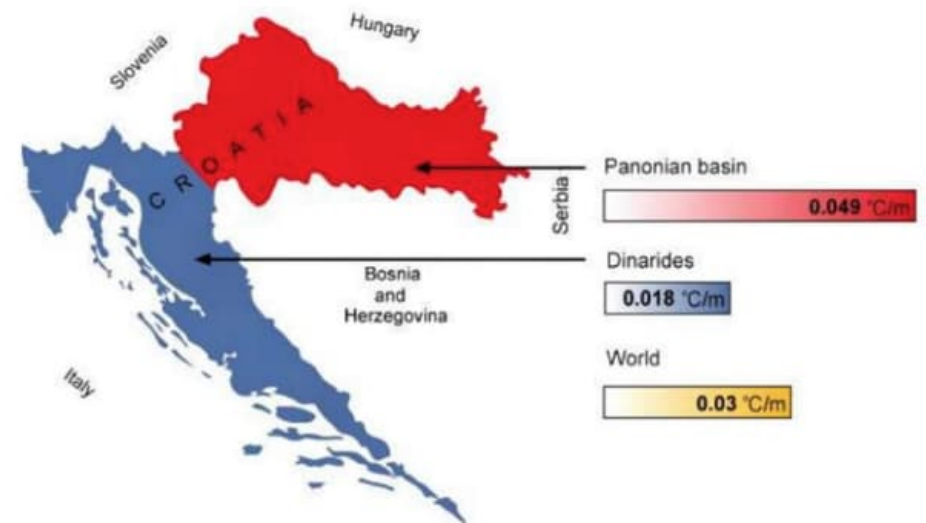
- Nascent but fast growing, heavily promoted (by the government) sector
- Single operating plant Velika Ciglena (17.5MWe)

## Geology

- Proven to have a geothermal gradient 60% higher than the European average
- Significant existing data set from oil and gas exploration:
  - Over 3,500 wells and 2D and 3D seismic covering an area of 20,000km<sup>2</sup>
  - Well test data demonstrating temperature and permeability

## Regulation & Country Risk

- Licencing through the Croatian Hydrocarbon Agency.
  - Initial 5 year exploration licence, followed by the production permit (subject to fulfilling licence obligations during the exploration phase)
- Croatia has been an EU member country since July 2013 and adopted the Euro in Jan 2023
  - Regulatory risk, country risk and, following adoption of Euro, foreign exchange risk is assessed (by management) as low



Geothermal gradients in Croatia



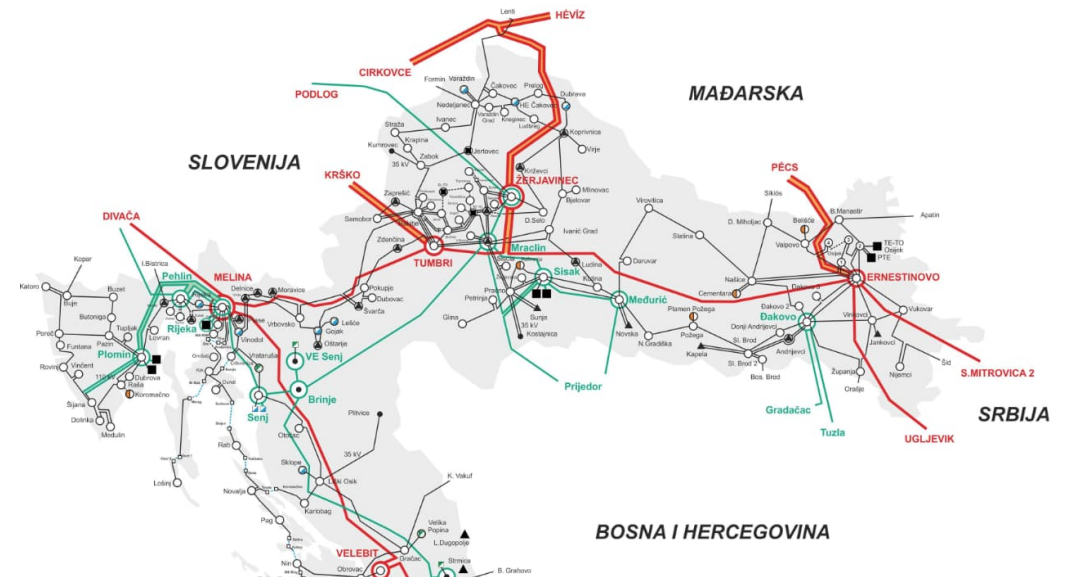
# Croatia Power Sector

## Grid Connections

- The Croatian Transmission System Operator (HOPS) owns and operates the entire Croatian transmission network (400kV, 220kV, 110kV)
- HOPS is independent and is non-discriminatory towards all transmission system users

## Offtake (electricity sales)

- Sale of electricity is through two methods (developer choice):
  - Croatian electricity and gas regulator Hrvatski Operator Trzista Energije (HROTE) runs tenders to promote renewable energy production using a market premium system (contract for difference). The market premium lasts for a 12 year generation period, with plants needing to be online within 4 years of the grant of the market premium; or
  - Electricity can be sold bilaterally throughout Europe



# Ernestinovo Licence

## The Licence

- A 76.66km<sup>2</sup> exploration licence in Eastern Croatia with 3 deep exploration wells drilled (extensive data suite) and 250km of 2D seismic data reprocessed and interpreted.

## Fulfilled work program

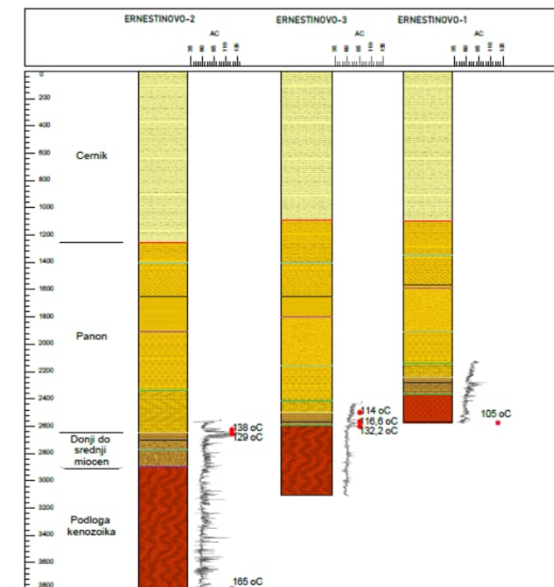
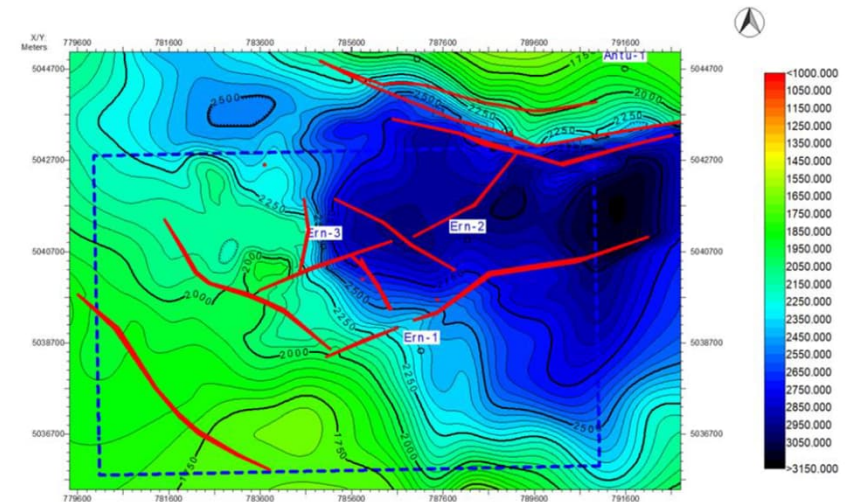
- Subsurface data has been reviewed, sorted and graded, the database has been created. Seismic data has been reprocessed to gain more resolution within the deep granite-gneiss structures where the main geothermal target has been defined. The G&G study of the area which encompasses all the data, analyses and interpretation of the geothermal potential has been made.
- Conceptual project for Ernestinovo-3 well workover has been submitted.

## Remaining Licence commitments

- Re-enter an abandoned oil and gas well (Ern-3) to test the geothermal potential of the fractured metamorphic pre-Cenozoic formation
- Complete and submit to the Croatian Ministry of Economics and Sustainable Development a conceptual development plan and reserve report

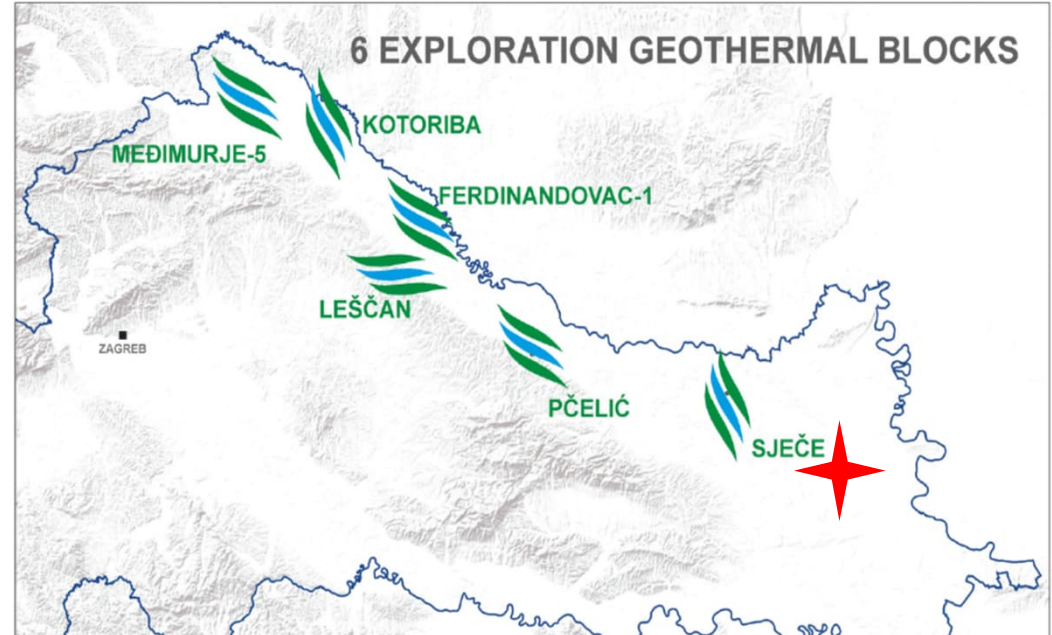
## Development Concept


- Based on preliminary heat reserves and well productivity estimates, a 10MW electricity generation plant (ORC) is planned:
  - 4 producing and 2 injecting wells (4 new wells and 2 well re-entries of abandoned wells)
  - Connect into Ernestinovo HOPS substation - a major substation with 400kV transmission lines to Zagreb, Hungary, Serbia and Bosnia, with step down to 110 kV and 85kV.



# The Licence tenders

- Formal licence tender process run by the Croatian Hydrocarbon Agency
- 6 exploration areas in four Croatian counties (Međimurje, Koprivnica-Križevci, Podravina, Osijek-Baranja)
- Geological region is the Drava depression (identical to Ernestinovo area)
- Following review by the IGeoPen, Peninsula and GT Energy teams, 3 licences have been bid for
- Bids include a licence specific work programme (to be executed in the exploration phase) and a royalty % (min 5%).
- Licence awards expected by December 2023
- The Croatian Hydrocarbon Agency has communicated it has received 16 offers from 11 companies



 Ernestinovo licence