

New possibilities for exploitation of hydro energy on the Drava River

Igor Čuš-DEM

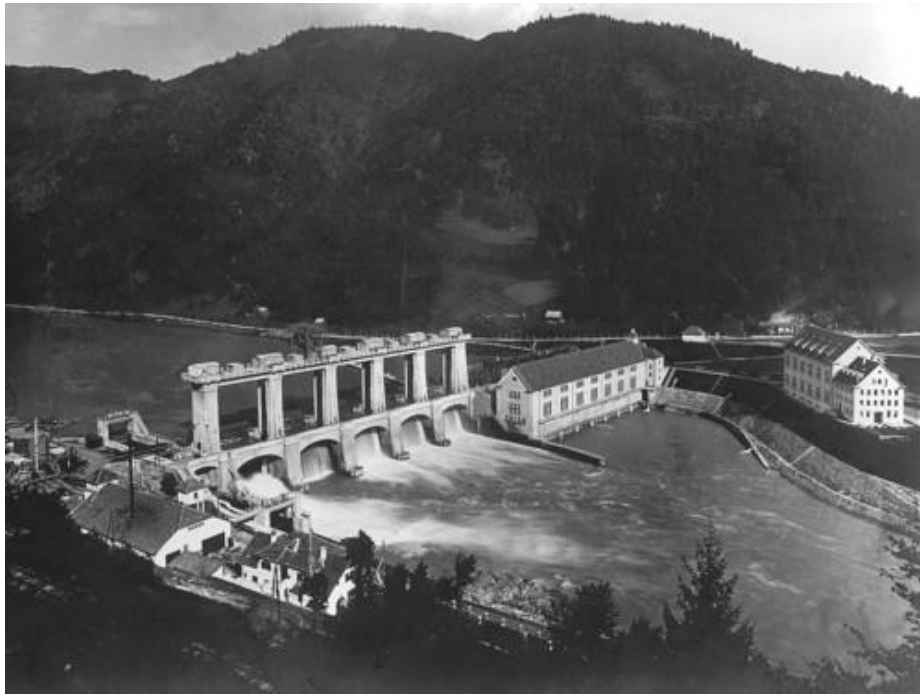
Jože Milič-HSE Invest

The first one was Fala HPP



start of
construction
in 1913

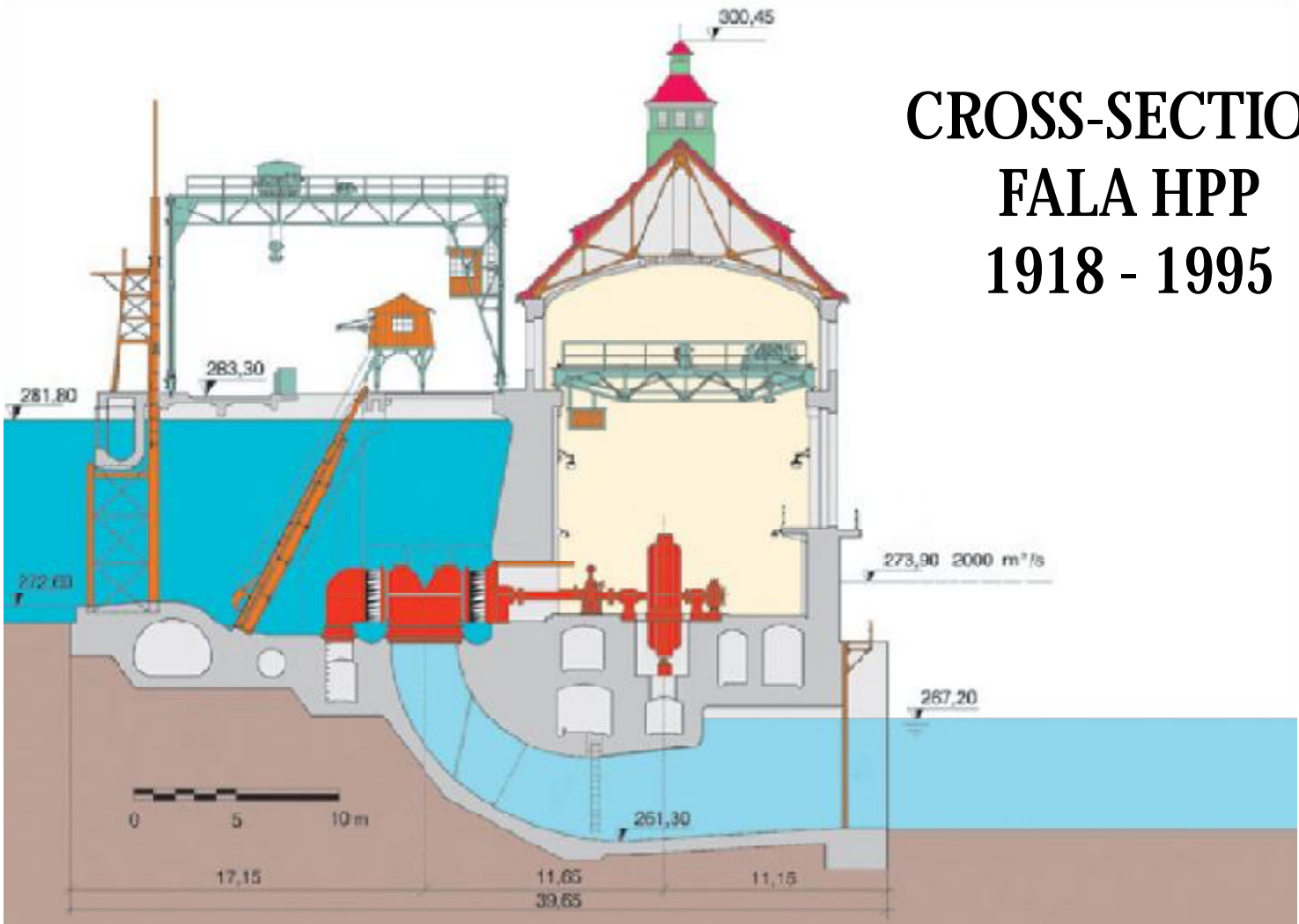
In 1918 with a capacity of 20 MW



today 58 MW



CROSS-SECTION FALA HPP 1918 - 1995



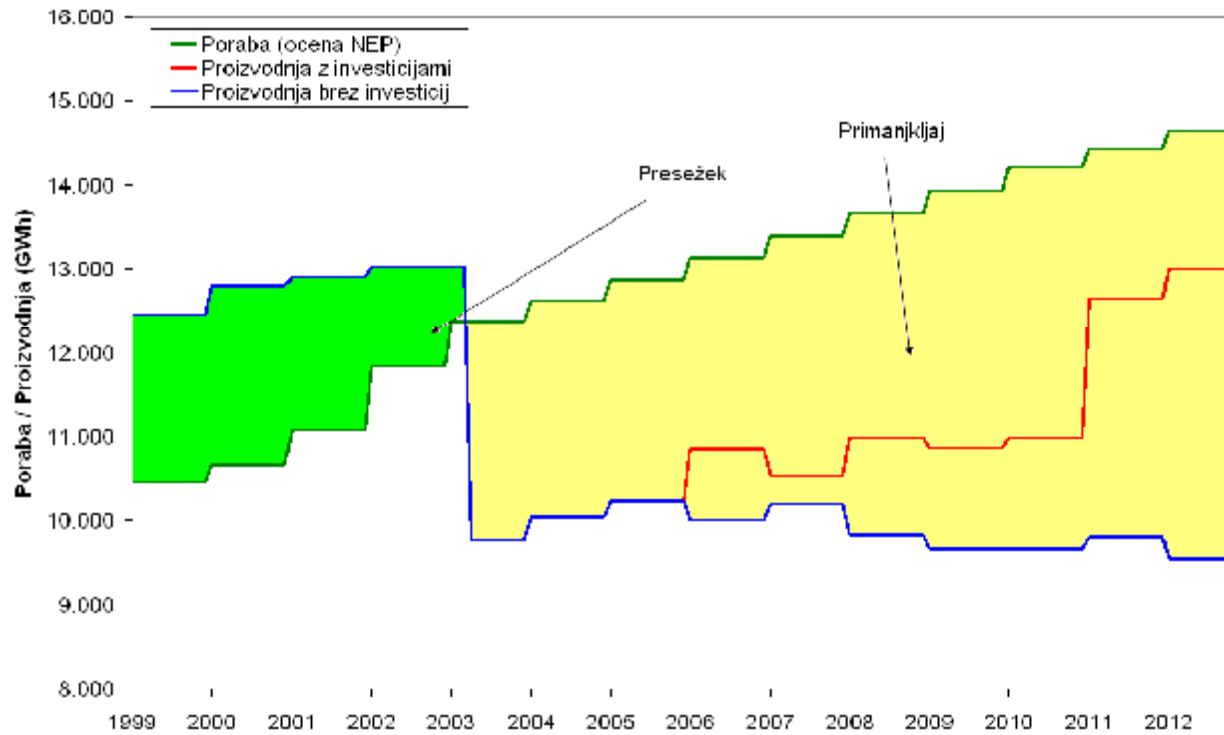
Drava hydroelectric power plants were built in the period from the end of WW II until 1978



The primary aim was to ensure supply of additional electric power.

Slovenian energy consumption

ELEKTROENERGETSKA BILANCA SLOVENIJE



DISCREPANCY BETWEEN CONSUMPTION TRENDS AND NEW CAPACITIES

Why new possibilities for exploitation of Drava hydro power

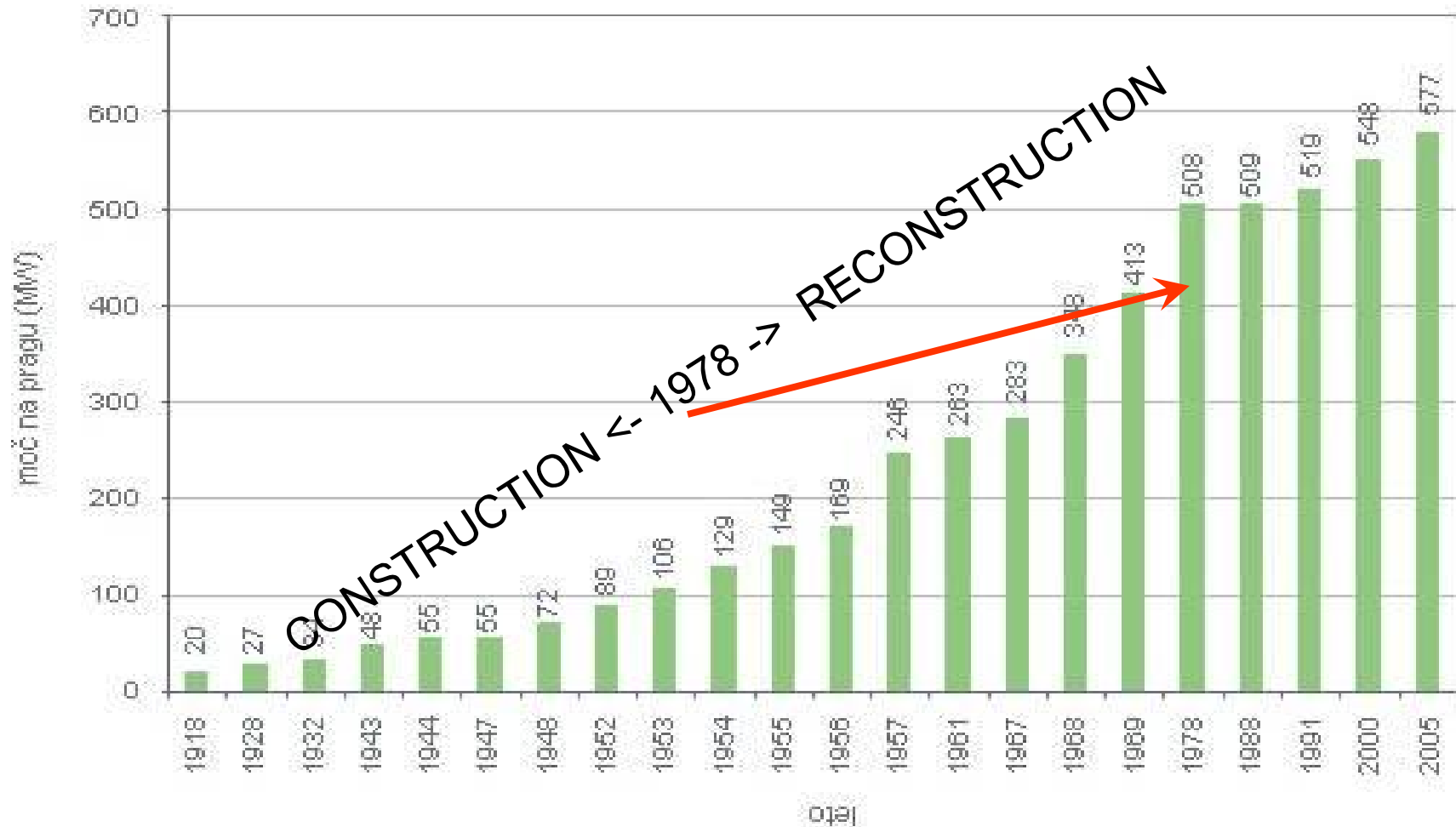
REASONS FOR REFURBISHMENT

Ø Operation of the plants was getting increasingly unreliable since some of the plants had been in operation continuously for 40 years, the Fala HPP almost 70 years

REASONS FOR CONTINUATION OF REFURBISHMENT AND CONSTRUCTION OF PSP

Ø Within 15 years, the original capacity of Drava power plants is going to double, increasing the output by half

**AFTER COMPLETION OF CONSTRUCTION AND REFURBISHMENT OF PLANTS
THE POSSIBILITIES FOR EXPLOITATION OF THE DRAVA HYDRO ENERGY HAVE
BEEN EXHAUSTED**



What possibilities are available for exploitation of hydro energy?

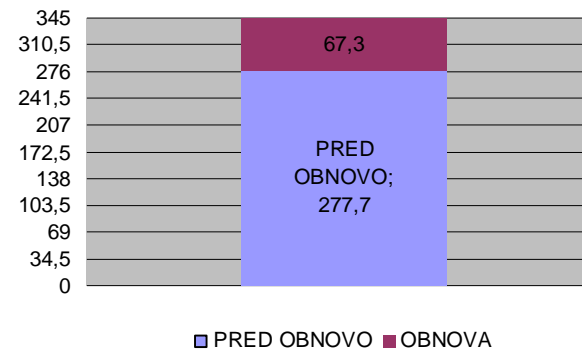
Refurbishment of Drava HPPs

from 508 MW to 577 MW

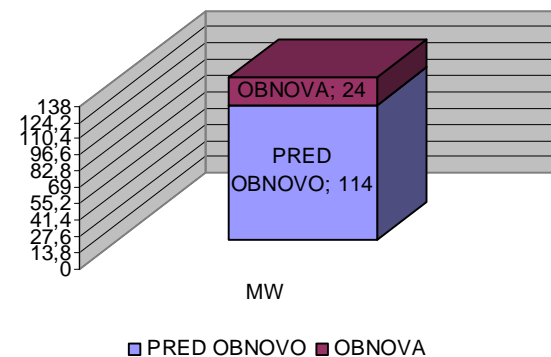
Reconstruction of Zlatoličje HPP

from 577 MW to 601 MW

POVEČANJE MOČI Z OBNOVO (MW)



POVEČANJE MOČI V MW



AIM OF REFURBISHMENT OF ZLATOLIČJE HPP :

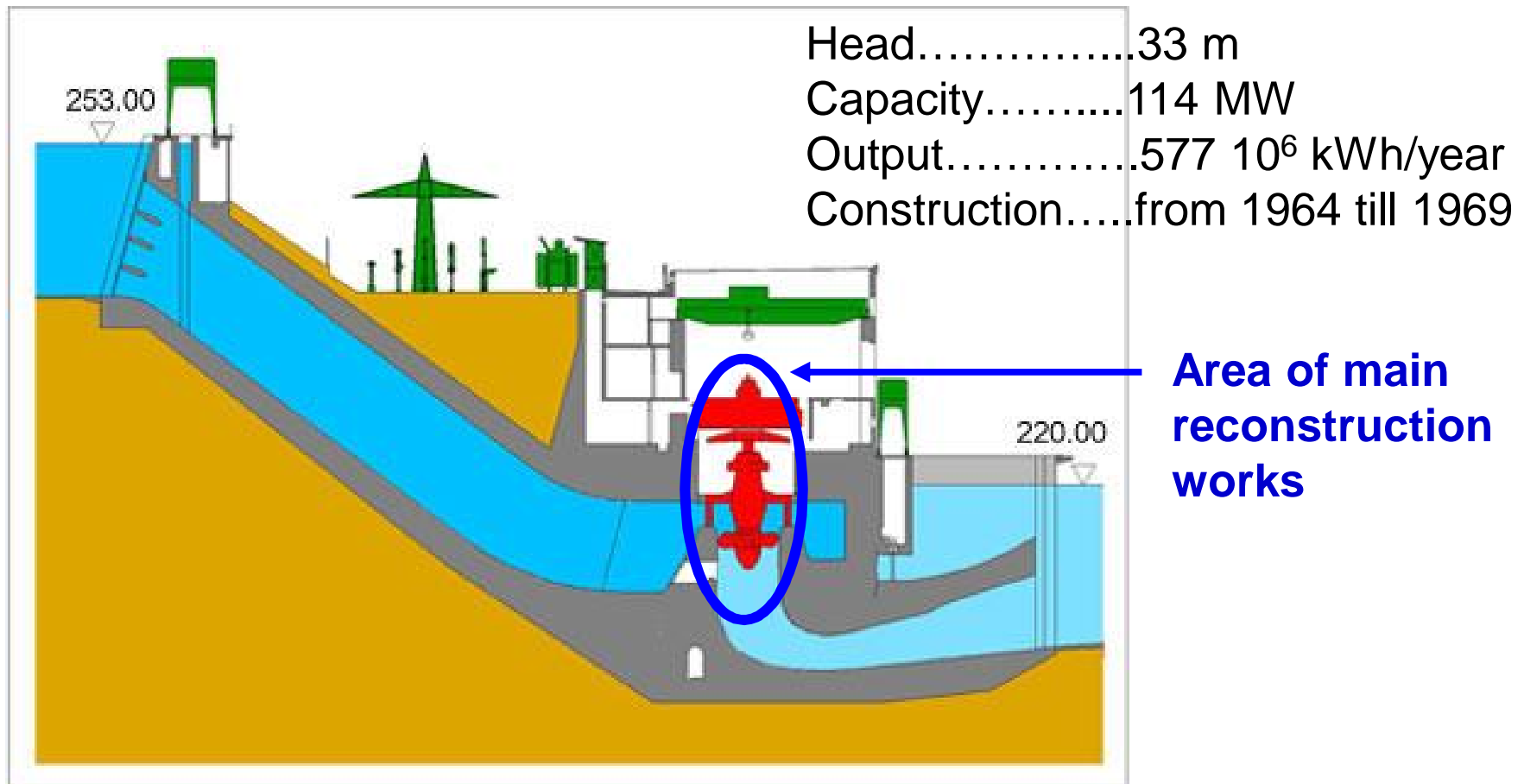


INCREASE OF DISCHARGE
from 450 m³/s to 530 m³/s

**OPTIMISATION OF OPERATION OF
THE WHOLE CHAIN**

INCREASE OF CAPACITY BY 24 MW

Refurbishment of Zlatoličje HPP



SCOPE OF REFURBISHMENT OF ZLATOLIČJE:

- upgrading and replacement of electrical and mechanical equipment on the Melje dam**
- replacement of both Zlatoličje generating units**
- electrical, mechanical and civil works at Zlatoličje and remote control of the plant**
- increased height of supply channel – higher flow**
- structural consolidation of spilling wall - anchors**

Refurbishment data for Zlatoličje :

- Runner diameter increased to 5900 mm
- Replacement of generators 2x85 MW
- electrical, mechanical and civil works
- and remote control of plant



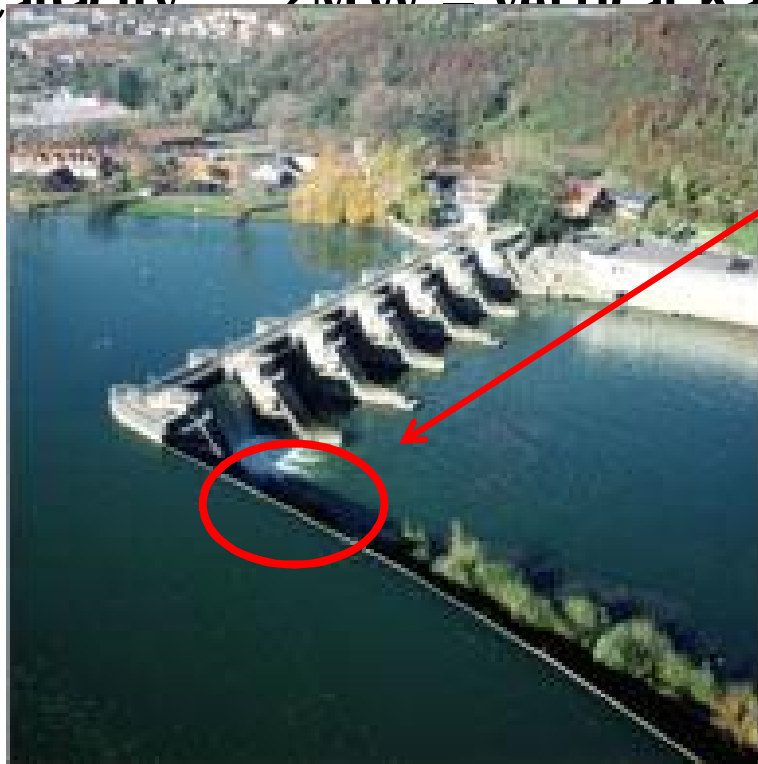
Scope of replacement of electrical equipment:

- unit auxiliary systems (cooling...)
- station services supply 20 kV
- diesel generating set
- electrical protection of units
- control, measuring and telecommunication equipment

Melje small HPP – constructed as part of refurbishment of Melje dam

Discharge: $Q = 20/10 \text{ m}^3/\text{s}$ (Q_{esp} flowing into Drava river bed)

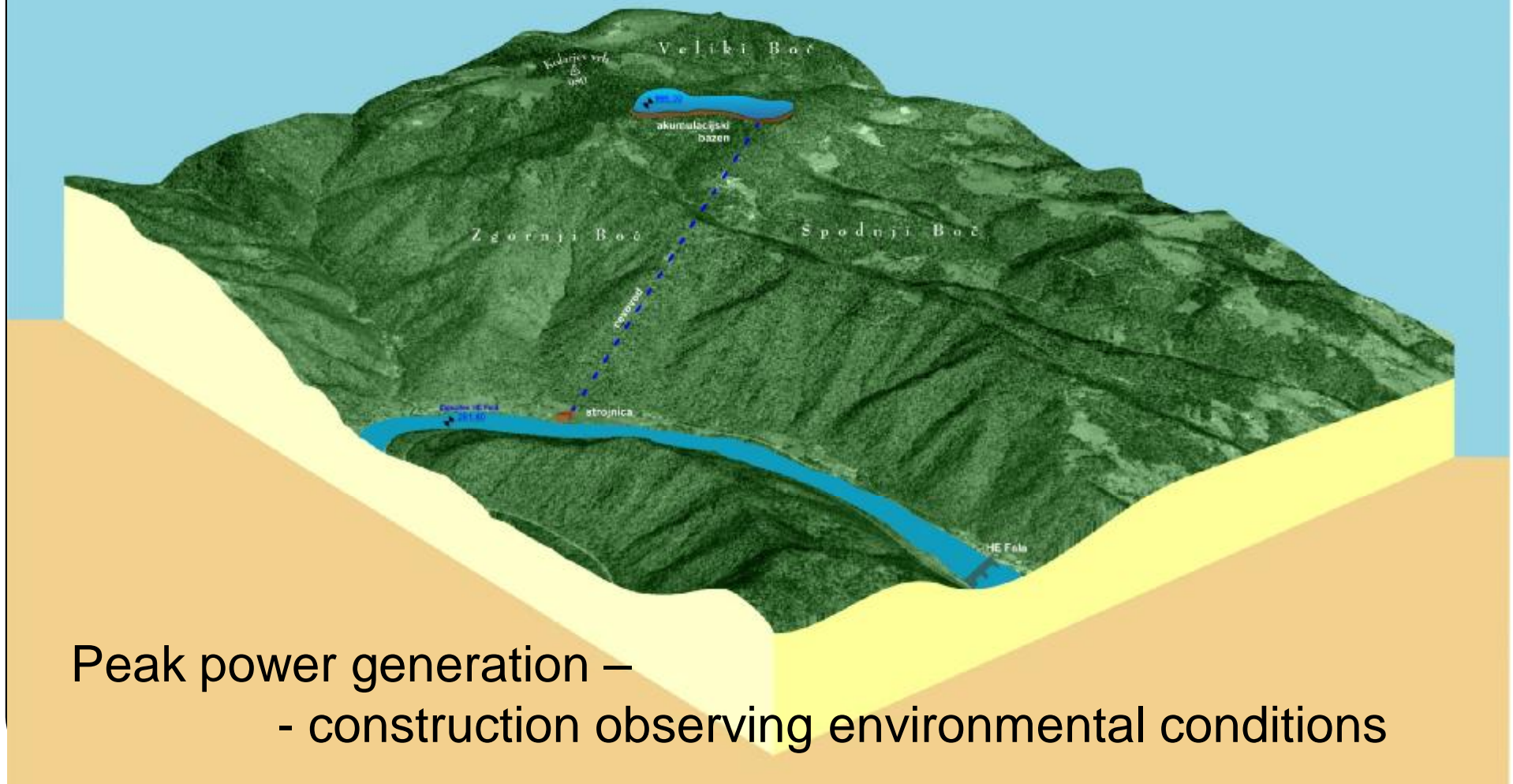
Capacity: 2MW – vertical Kaplan turbine



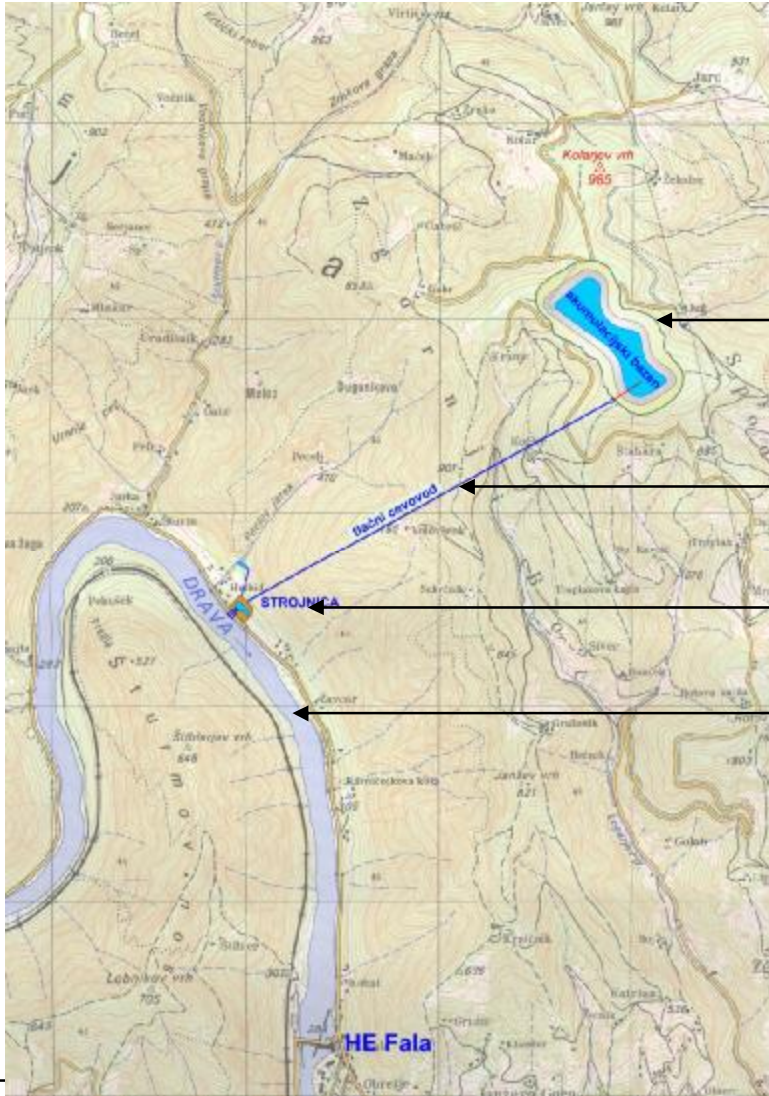
Location of Melje small HPP:

At the supply channel
spilling wall

Pumped storage power plant on the Drava River



Peak power generation –
- construction observing environmental conditions



Kozjak PSP

LOCATION

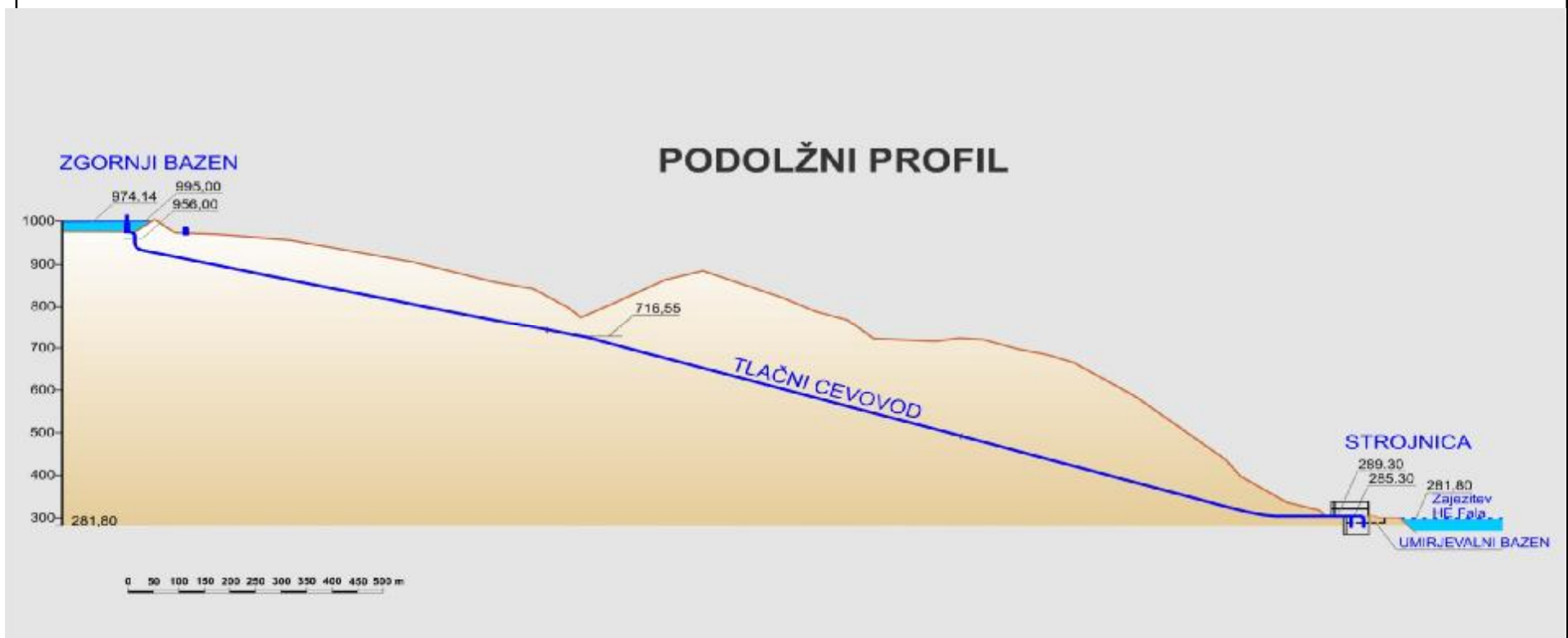
UPPER STORAGE BASIN

PENSTOCK

POWERHOUSE

FALA HPP RESERVOIR

Kozjak PSP



Technical data of Kozjak PSP

Upper storage basin at Kolarjev vrh

- slope of embankments around basin (l:h)	1:2.0/1:1.5
- maximum water level in basin	995.00 m asl
- minimum water level in basin	975.00 m asl
- total volume of upper basin	2,9 10 ⁶ m ³
- crest elevation	996.50 m asl

Lower basin – reservoir of Fala HPP

- maximum water level	282.00 m asl
- minimum water level	280.00 m asl
- active basin volume	0,85 10 ⁶ m ³

Technical data of Kozjak PSP

Penstock: Concrete embedded steel lining

- length	2.234 m
- diameter	4.00/3.80/3.60 m
- longitudinal gradient	33.23 %

Rated flow:	in turbine mode	32,5 m ³ /s
	in pump mode	22,9 m ³ /s

Powerhouse: shaft type with two units

- shaft diameter	30.00 m
- shaft height (bottom 199,00 - top 278,00 m asl)	79.00 m
- entrance in powerhouse building above shaft	284.30 m asl
- elevation of powerhouse floor	210.40 m asl

Powerhouse: 2 vertical reversible units

1 synchronous motor-generator

1 asynchronous motor-generator

Turbine:

- rated speed 600 ± 4% o/min-1
- runaway speed 900 o/min-1

Turbine mode:

- head 690.88 690.88 m
- turbine discharge 32.5 32.5 m³/s
- turbine capacity 197.14 201.55 MW

Pump mode:

- pump head 710.31 710.31 m
- pump discharge 22.9 22.9 m³/s
- pump capacity 176.71 176.71 MW

1 synchronous motor-generator

1 asynchronous motor-generator

Generator:

- capacity 225/183
- efficiency 0.95

228/217 MVA
0.95

Transformer:

- capacity
- voltage

230MVA
412 / 18kV

Switchyard:

400 kV, SF6

Grid connection:

400 kV from PSP to Maribor SS
(length 22 km)

The aim of refurbishment of the Zlatoličje HPP and of construction of the Kozjak PSP is to increase energy exploitation of the Drava River in order to provide competitive advantage and added value to Dravske elektrarne Maribor