



**JSW**  
INNOWACJE



**„PESP”  
Underground Pumped  
-Storage Hydro Power  
Plants in Abandoned  
Coal Mine „Krupiński”**



# MAIN ASSUMPTIONS

- to study possibilities of location underground pumped-storage hydro power plants in abandoned coal mine „Krupiński” (**done** and **to be done**)
- to determine the main project assumptions and needs necessary for its activation and implementation (**done** and **to be done**)
- to determine optimal energy storage technologies for application in quantities of Krupiuński mine (**done** and **to be done**)
- to get necessary financing („preparation of the project stage”) and support by the government and the european commission (**to be done**)
- to do the feasibility study („preparation of the project stage”) (**to be done**)
- to get necessary financing („implementation of the project stage”) (**to be done**)
- to get necessary decisions (**to be done**)
- implementation of the project (**to be done**)

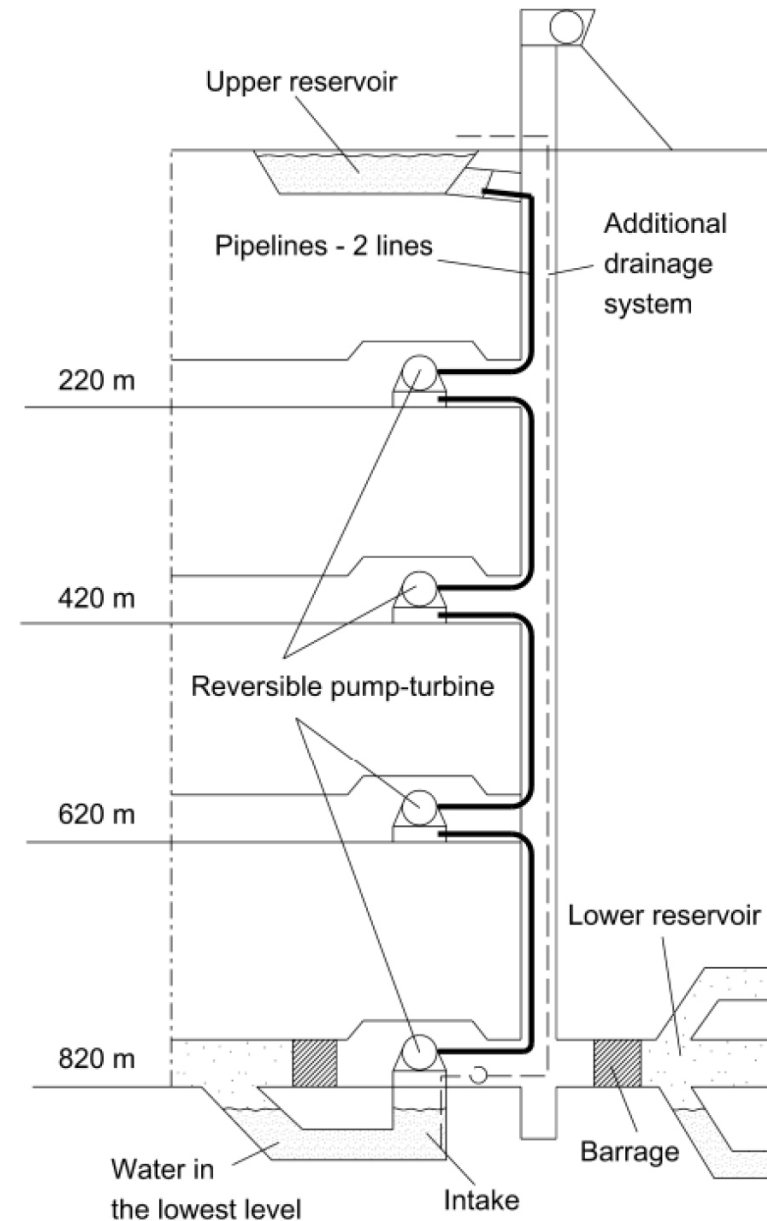
## WORK DONE

- the post- mining area revitalization program of „KRUPIŃSKI” coalmine;
- the preliminary concept of the underground pumped storage power plant in KWK KRUPIŃSKI (pesp krupiński); emag research institute;
- the analytical study of the possibilities of financing the project concerning the underground pumped storage power plant on the infrastructure of the hard coal mine „secondary use of KWK KRUPIŃSKI”; sage power a.s;
- analysis of real options in the preliminary concept of the underground pumped storage power plant in KWK KRUPIŃSKI; UNIVERSITY OF ECONOMICS IN KATOWICE;
- analysis of discounted cash flows of the preliminary concept of the underground pumped storage power plant in KWK KRUPIŃSKI; UNIVERSITY OF ECONOMICS IN KATOWICE;
- talks were held with the european commission to determine the possibility of obtaining financing for the pesp project;
- a working group of polish entities involved in the project (TAURON PE S.A., SRK S.A.).

# TECHNOLOGICAL ISSUES

- Turbine cycle operating time: 4,5 h
- Power turbine cycle: 93 MW
- Pump cycle operating time: 7 h
- Storage energy : 418 MWh
- Technological arrangement: doubled 4 steps cascade
  
- Pump-turbine power output: 13 MW
- Pipeline diameter: 2 x 1600 mm
- Head: 820 m
- Reservoir capacity: 220.000 m<sup>3</sup>

Lower reservoir is built from an old tunnels (70.000 m<sup>3</sup>)  
+ new tunnels dedicated as lower reservoir (150.000 m<sup>3</sup>).



# ECONOMICAL ISSUES

## ASSUMPTIONS:

- installed power: **93 mw**
- power plant operation time: one cycle of **4.5 hours/ day**
- efficiency: **90%**.
- capex: **pln 756.2 m (eur 174 m)**
- external financing level: **85%**
- forecast period: **50 years**

## OPTION 1:

- transmission costs: **eur 2,88 m/year** (increasing annually by 2.5%),
- costs of purchase of energy certificates: **eur 0,96 m annually**, (increased annually by 2.0%),
- costs of shaft maintenance: **eur 3,9 m** in the first year to **eur 2,74 m** in next 6 years (time of investment implementation). from 8 year, **eur 2,81 m** (increased by 2.5% each year),
- not included incomes from the sale of methane, geothermal and pv energy production and

## OPTION 2:

- transmission costs have been eliminated
- the costs of purchase of energy certificates have been eliminated (result of regulations for energy storage and possibility that pesp will be considered as a renewable energy
- the costs of shaft maintenance were included only during the investment implementation stage (first 7 years)
- it was assumed that during the first 7-year of investment stage, incomes from the sale of methane: **eur 2 m / year**

# ECONOMICAL ISSUES

## OPTION 1

INSTALLED POWER 93 MW

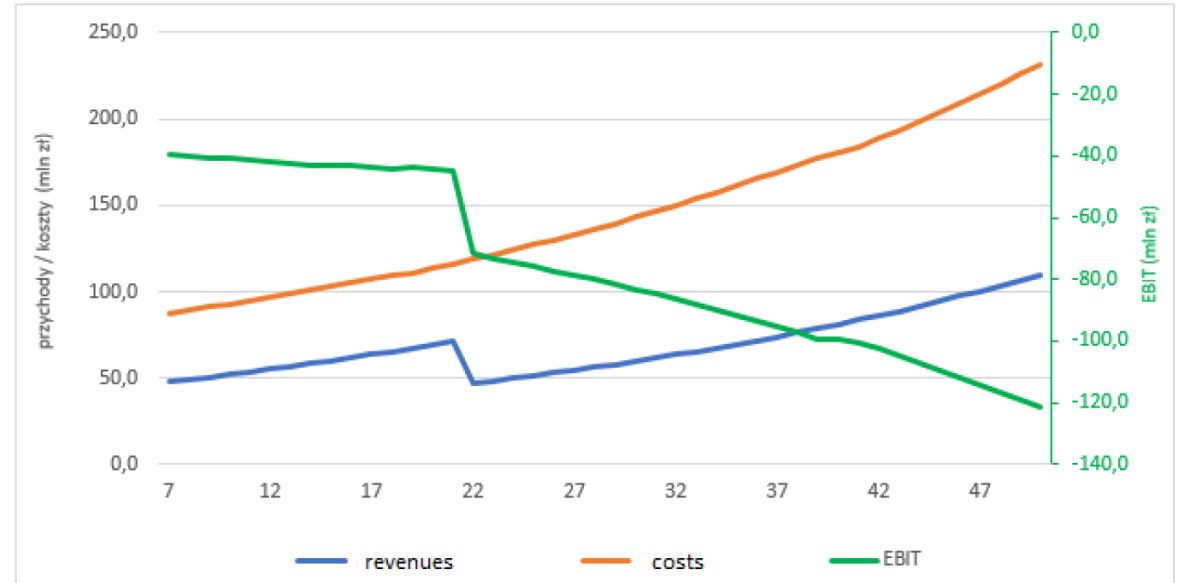
PP OPERATION TIME	4,5 h	PUMP TIME	7 h
PRICE OF ENERGY SALE		PRICE OF ENERGY PURCHASE	
MON-FRI	212,82 zł/MWh	MON-FRI	129,75 zł/MWh
SUT-SUN	171,80 zł/MWh	SUT-SUN	123,29 zł/MWh
forecasted increase	3,14% (CAGR)	forecasted increase	3,19% (CAGR)

capacity market  
CERTIFICATES on  
on

Transmission cost on

CAPEX 756,2 mln zł

EXTERNAL FINANCING LEVEL 85%



NPV

-449,1 mln zł

EUR -103,5 M

# ECONOMICAL ISSUES

## OPTION 2

INSTALLED POWER 93 MW

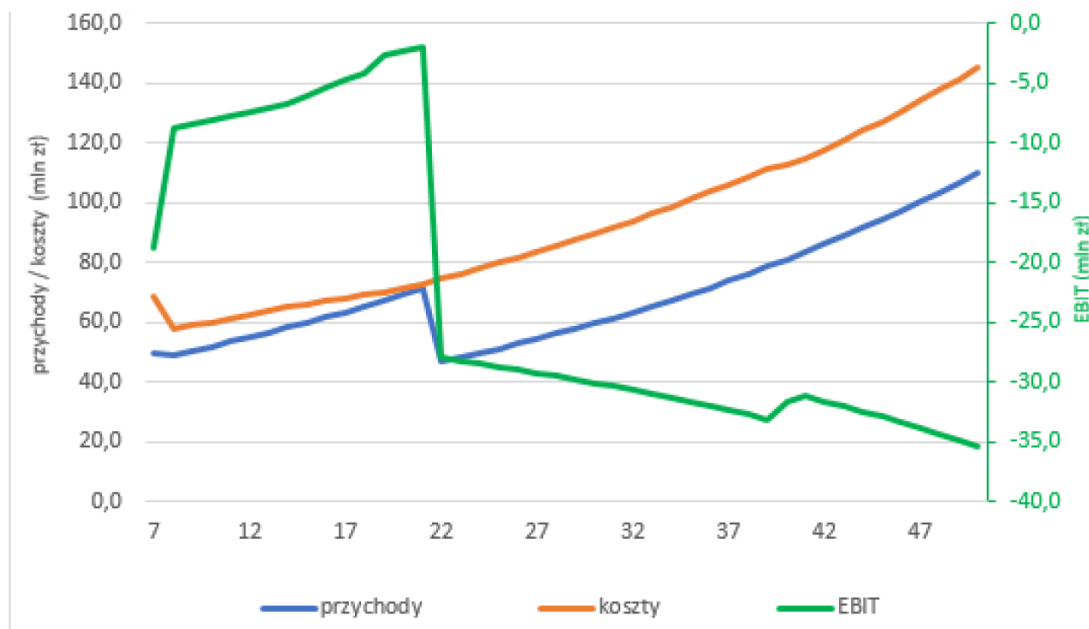
PP OPERATION TIME	4,5 h	PUMP TIME	7 h
PRICE OF ENERGY SALE		PRICE OF ENERGY PURCHASE	
MON-FRI	212,82 zł/MWh	MON-FRI	129,75 zł/MWh
SUT-SUN	171,80 zł/MWh	SUT-SUN	123,29 zł/MWh
forecasted increase	3,14% (CAGR)	forecasted increase	3,19% (CAGR)

capacity market  
CERTIFICATES on

Transmission cost on

CAPEX 756,2 mln zł

EXTERNAL FINANCING LEVEL 85%



NPV -208,5 mln zł

EUR -45 M

# WORK TO BE DONE

## STAGE I: „PREPARATION OF THE PROJECT”

- providing the necessary support of government bodies and european cimmission (II-IIIQ 2019);
- creating a strong international group interested in implementation of tehchnologies for mining shafts, as energy storages (iiq 2019);
- providing the necessary external financing, approved by european commission (II-IIIQ 2019);
- creating the spv dedicated to the project (II-IIIQ 2019);
- feasibility study (IIQ 2019 – IVQ 2020);
- necessary decisions and assets (from IIQ 2019);
- estimated costs of the stage I: **2-3 mln euro**

## STAGE I (ALTERNATIVE):

- analysis of possibilities of other energy storage technology (e.g. kinetic mechanism)
- preparation of the project



**Thank you  
for your  
attention**



**JSW**  
**INNOWACJE**

[www.jswinnowacje.pl](http://www.jswinnowacje.pl)

