

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

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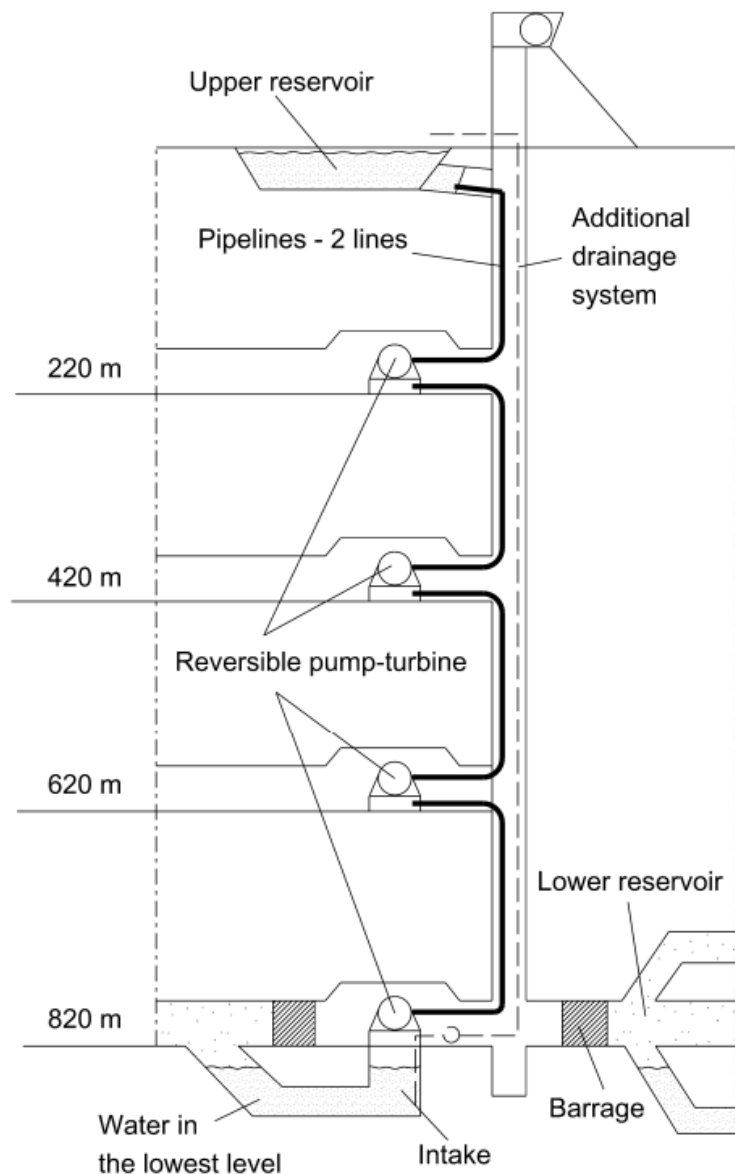
# MAIN ASSUMPTIONS

- ❖ 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 KRUPIŃSKI 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

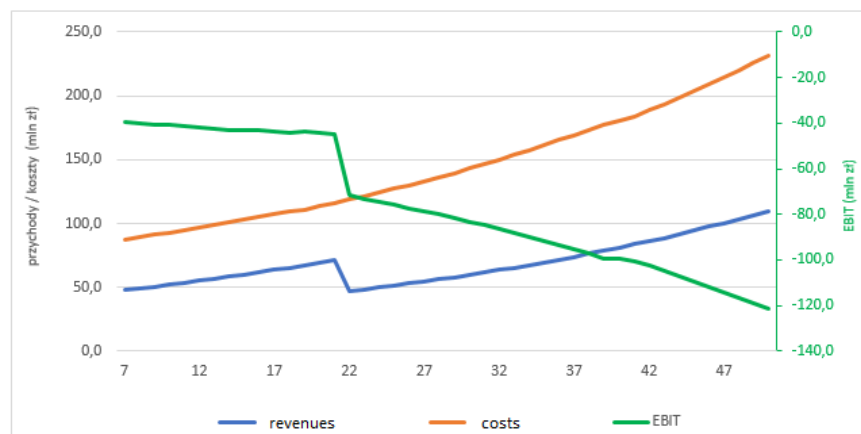
### OPTION 2 (hypothetical) :

- ❑ 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

<b>INSTALLED POWER</b> 93 MW	
<b>PP OPERATION TIME</b> 4,5 h	<b>PUMP TIME</b> 7 h
<b>PRICE OF ENERGY SALE</b>	<b>PRICE OF ENERGY PURCHASE</b>
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)
<b>capacity market CERTIFICATES</b> on	<b>Transmission cost</b> on
<b>CAPEX</b> 756,2 mln zł	<b>EXTERNAL FINANCING LEVEL</b> 85%

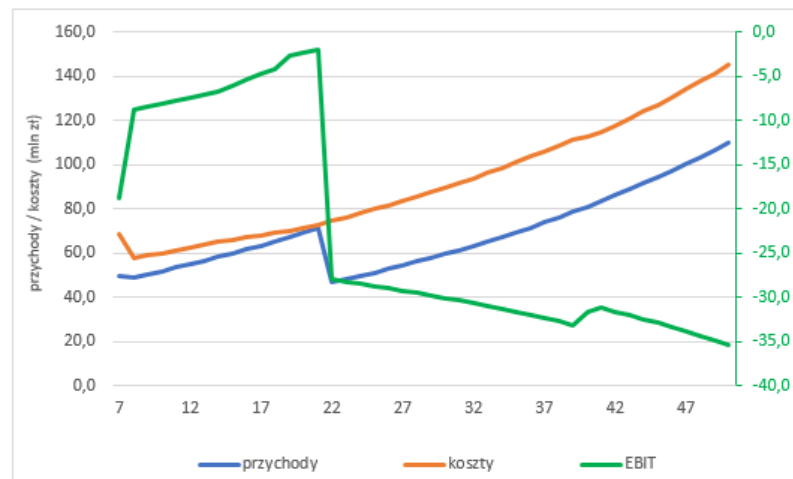


**NPV** -449,1 mln zł

**EUR -103,5 M**

## OPTION 2

<b>INSTALLED POWER</b> 93 MW	
<b>PP OPERATION TIME</b> 4,5 h	<b>PUMP TIME</b> 7 h
<b>PRICE OF ENERGY SALE</b>	<b>PRICE OF ENERGY PURCHASE</b>
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)
<b>capacity market CERTIFICATES</b> on	<b>Transmission cost</b> on
<b>CAPEX</b> 756,2 mln zł	<b>EXTERNAL FINANCING LEVEL</b> 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 COMMISSION (II-IIIQ 2019);
- ❖ CREATING A STRONG INTERNATIONAL GROUP INTERESTED IN IMPLEMENTATION OF TECHNOLOGIES FOR MINING SHAFTS, AS ENERGY STORAGE (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

# WEAKNESSES AND STRENGTHS

## STRENGTHS:

- ❖ INCREASING THE SECURITY OF ENERGY SYSTEM,
- ❖ MAXIMIZING THE POSSIBILITIES OF USE OF THE RENEWABLE ENERGY IN POLAND AND EU,
- ❖ OPTIMIZING THE COSTS OF RENEWABLE ENERGY PRODUCTION,
- ❖ THE RATIONAL USE OF POST-MINING AREAS,
- ❖ MEETS THE BIGGEST CHALLENGE OF THE ENERGY PRODUCTION SECTOR OF THE WHOLE WORLD - THE PROBLEM OF ENERGY STORAGE,
- ❖ THE PRESENCE OF THE NECESSARY INFRASTRUCTURE,
- ❖ HIGH MINING AND ENGINEERING COMPETENCES OF JSW AND ITS COOPERANTS,
- ❖ PROJECT SUPPORT OPPORTUNITY FUNDING WITH THE COAL REGIONS IN TRANSITION PROGRAM,
- ❖ IMPROVING THE QUALITY OF THE NATURAL ENVIRONMENT,
- ❖ CREATING NEW JOBS,
- ❖ IMPLEMENTATION OF INNOVATIVE PROJECTS SUPPORTING RENEWABLE ENERGY SECTOR.

## WEAKNESSES :

- ❖ LACK OF NECESSARY REGULATIONS REGARDING ENERGY STORAGE,
- ❖ LACK OF APPROPRIATE MOTIVATION TO INVEST IN ENERGY STORAGE FROM THE EUROPEAN COMMISSION SIDE,
- ❖ TECHNOLOGICAL ISSUES,
- ❖ GEOLOGICAL RISKS.



*Thank you for your attention*

