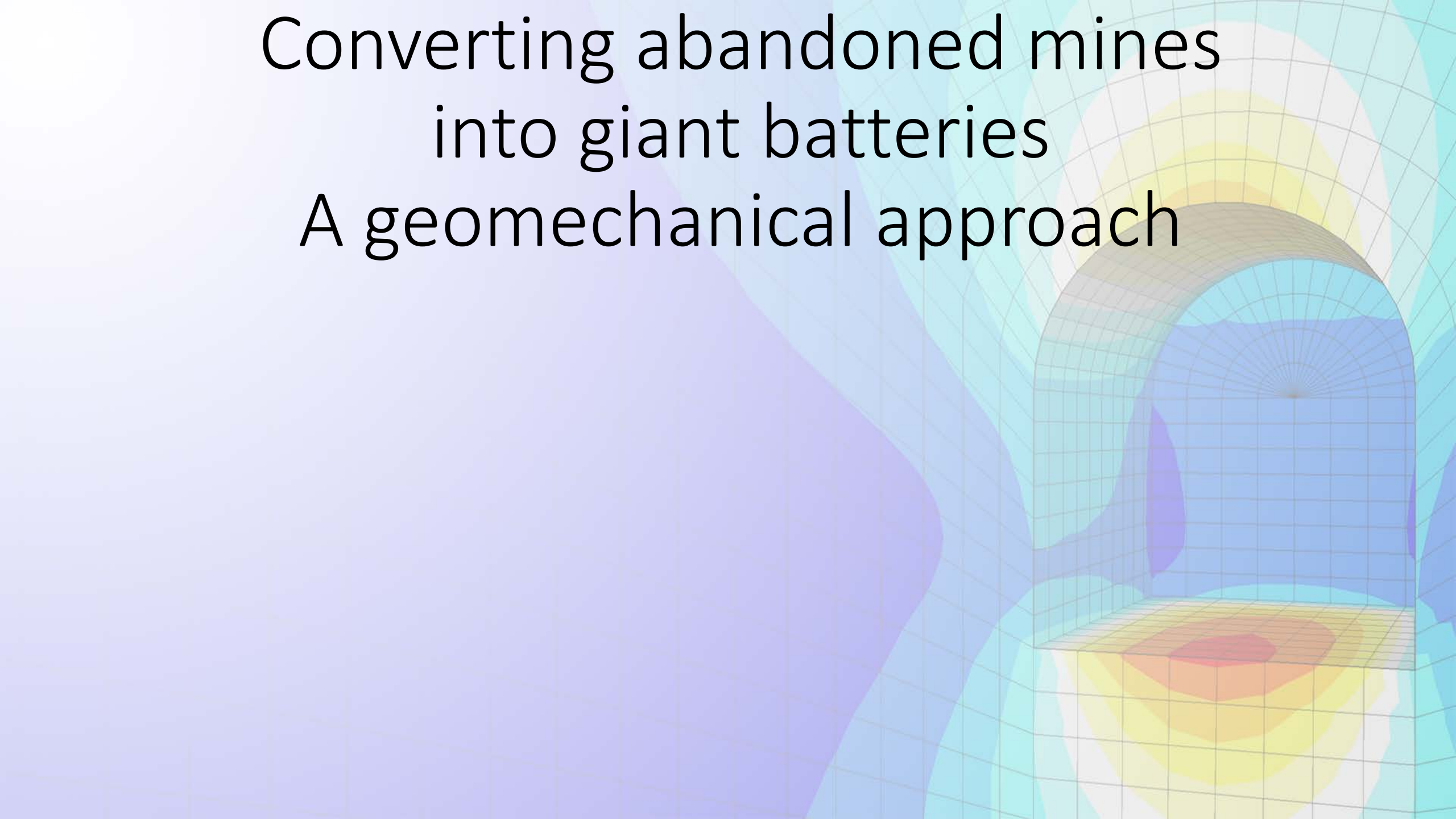
Converting abandoned mines into giant batteries
A geomechanical approach



Personal Info and Motivation

- CV Falko Schmidt
  - Dipl. Ing. Geotechnical Engineering and Mining (Germany)
  - Homologized to Engineering Geology (Spain)
  - Recognized as Mining Engineer (Spain)
  - 14 years active as Consultant (Construction and Design)

- PhD related research:
  - Collaboration with a client related to Asturian Coal Mining led to research topic
  - How to use these structures for energy storage

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Evaluation Scheme

BASIC SKILLS	2. Science &Technique (bibliographic study)	3. Technology (tools and instruments)	4. Educational Activities (courses and seminars)	5. Results (publications)	6. Scientific Criticism (SWOT Analysis)	7. Work Plan	8. Mobility	9. Funding	10. Ethics
CB11 – Systematic understanding of a field of study and command of the skills and research methods related to the field.	X	X	X						
CB12 – Skill to conceive, design or create, implement and adopt a substantial process of research or creation.				X		X			
CB13 – Skill to contribute to the enlargement of the knowledge limits through an original research.				X					
CB14 -Skill to carry out a critical analysis and assessment and synthesis of new and complex ideas.									
CB15 – Skill to communicate with the academic and scientific community and with society in general about the scope of knowledge in the ways and languages of common use in the international scientific community.				X					
CB16 – Skill to encourage, in academic and professional contexts, the scientific, technological, social, artistic or cultural progress in a society based on knowledge.				X					X

CAPACITIES AND PERSONAL ABILITIES	2. Science &Technique (bibliographic study)	3. Technology (tools and instruments)	4. Educational Activities (courses and seminars)	5. Results (publications)	6. Scientific Criticism (SWOT Analysis)	7. Work Plan	8. Mobility	9. Funding	10. Ethics
CA01 – Cope in contexts in which there is little specific information.	X	X							
CA02 – Find the key questions to be answered to solve a complex problem.				X					
CA03 – Design, create, develop and undertake new and innovative projects in the knowledge scope.						X			
CA04 – Work both in teams and individually in an international or multidisciplinary context.			X	X					
CA05 – Integrate knowledges, face complexity and formulate judgements with limited information.	X	X							
CA06 – Intellectual criticism and defence of solutions.									

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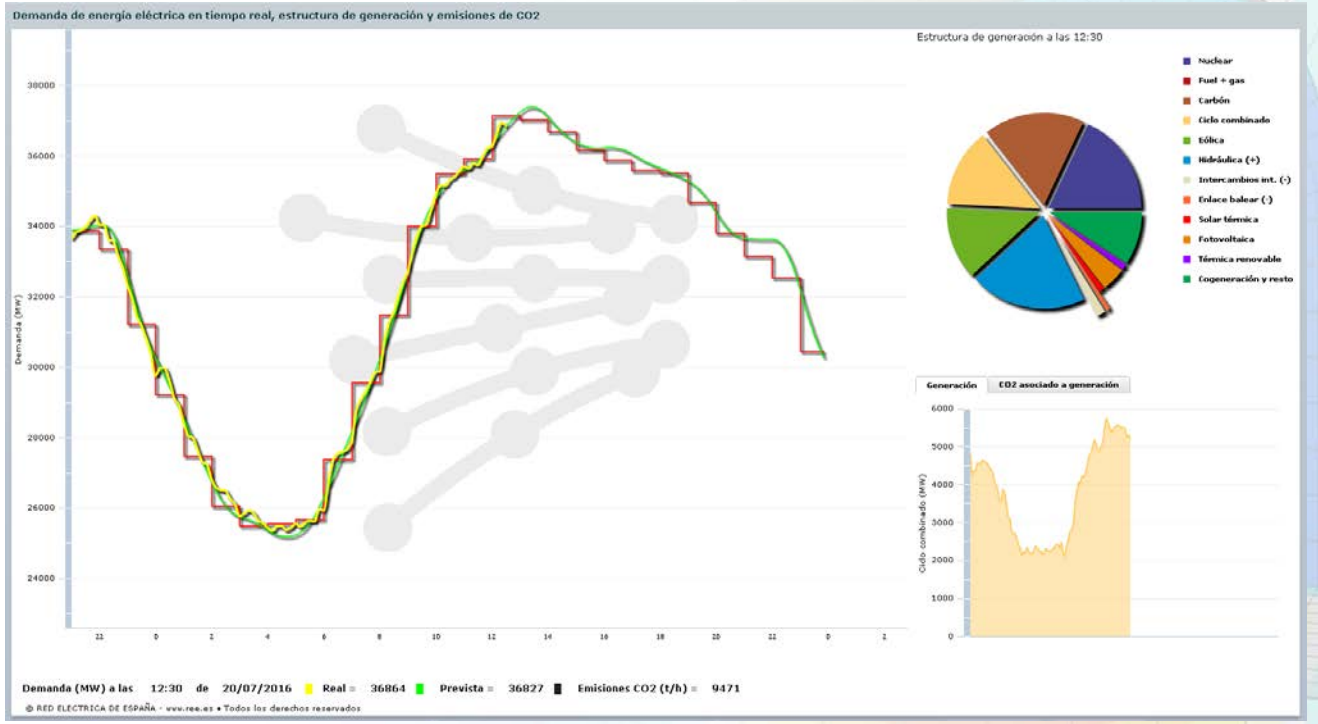
Introduction

- Why store Energy?



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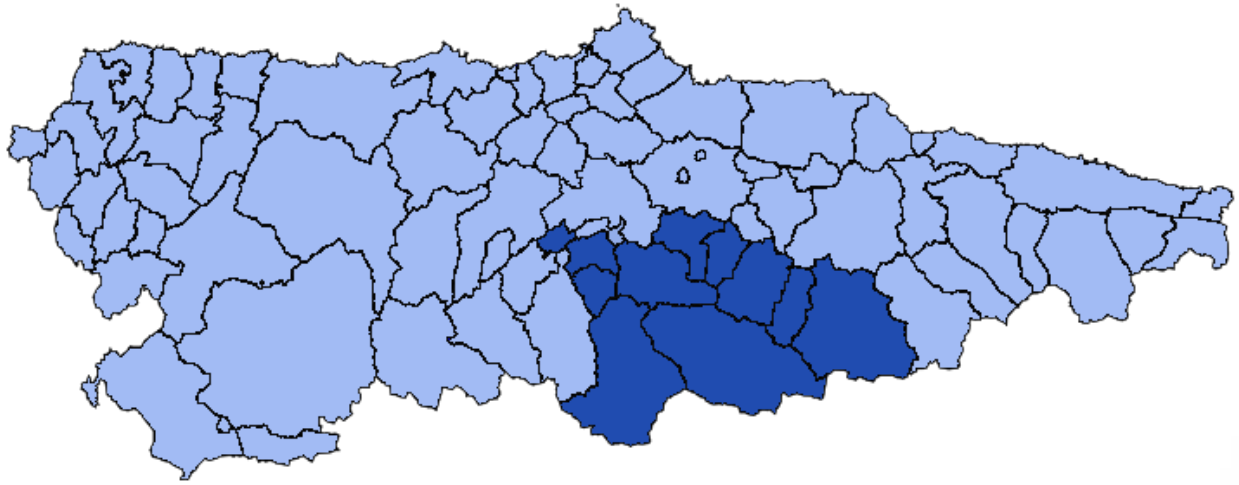
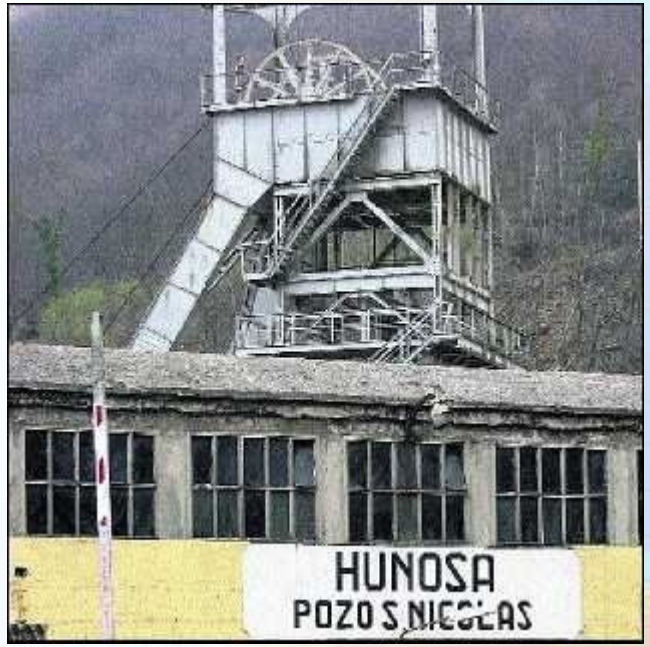
planned Approach

- Where to store Energy?





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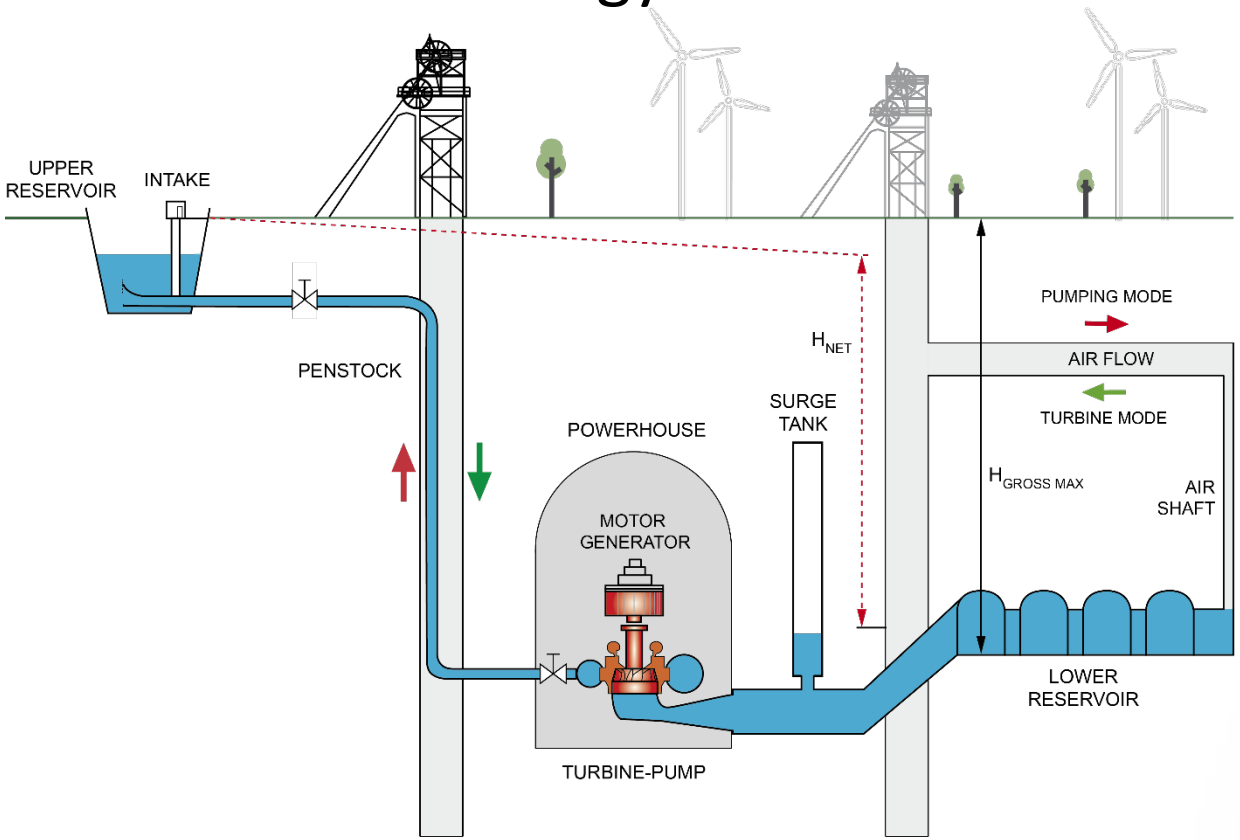
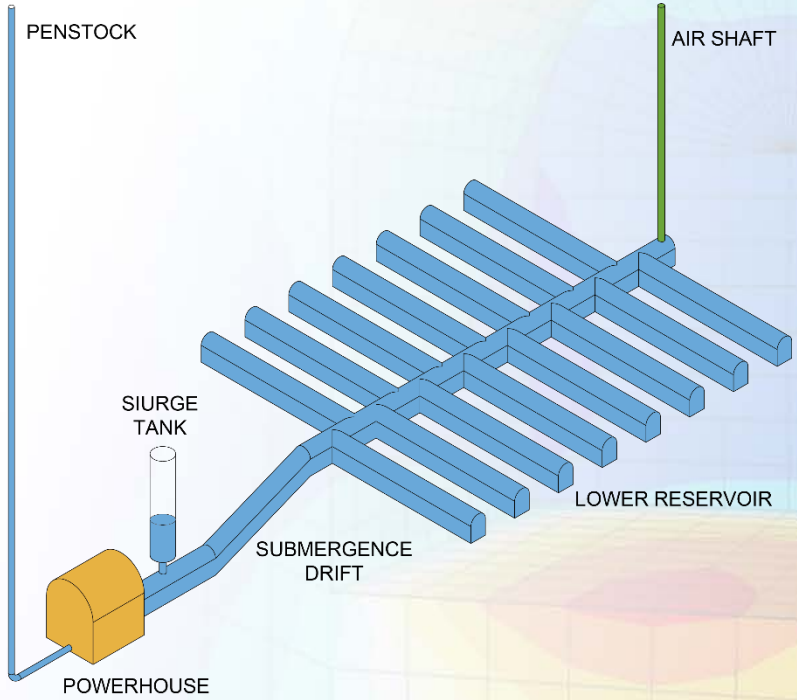
planned Approach

- How to store Energy?





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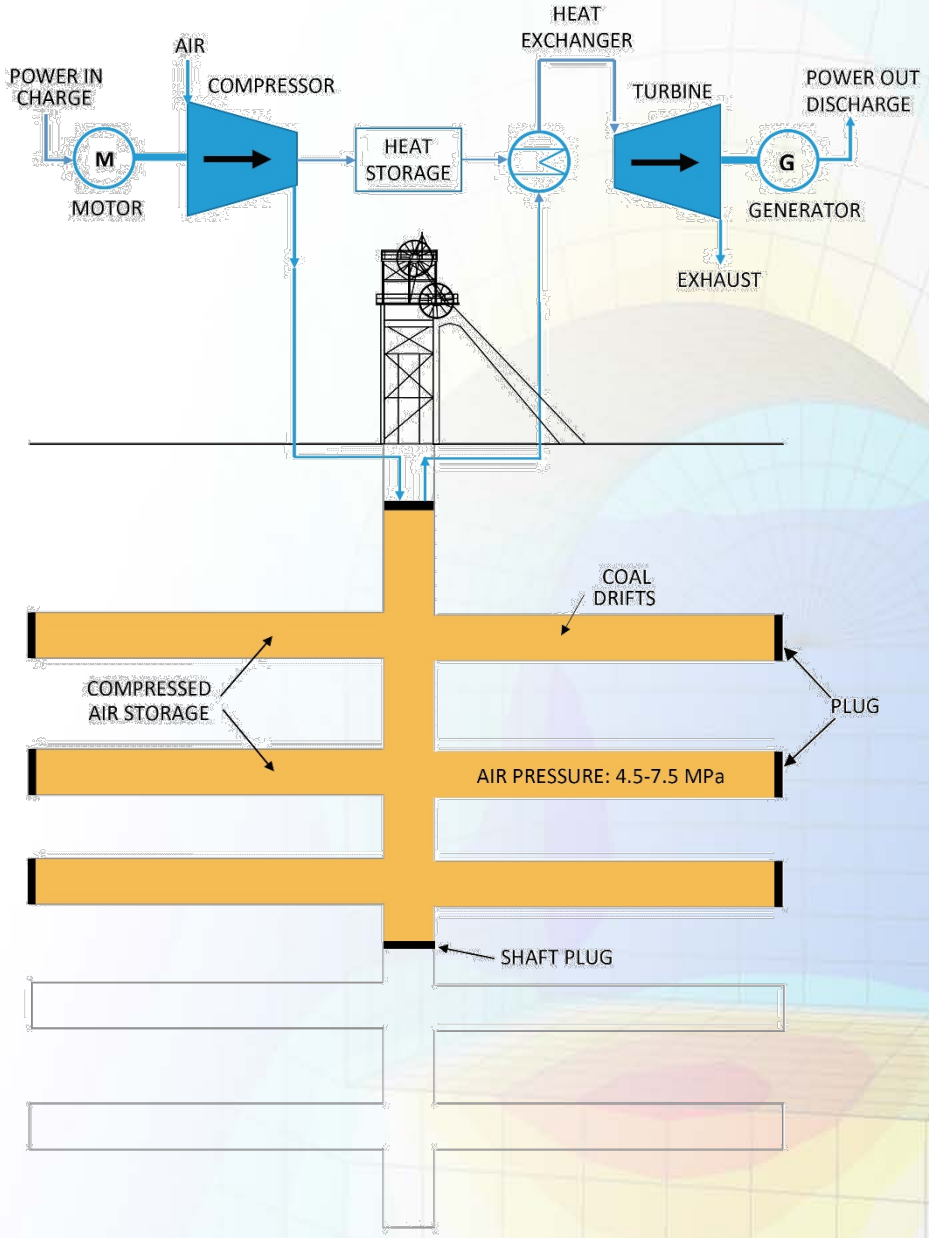
planned Approach

- How to store Energy?



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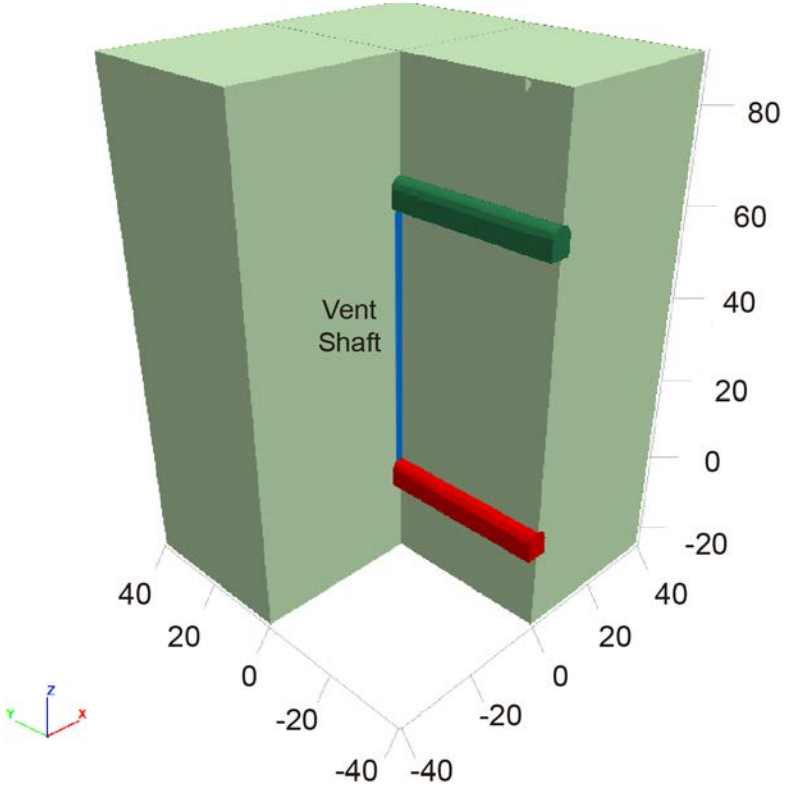
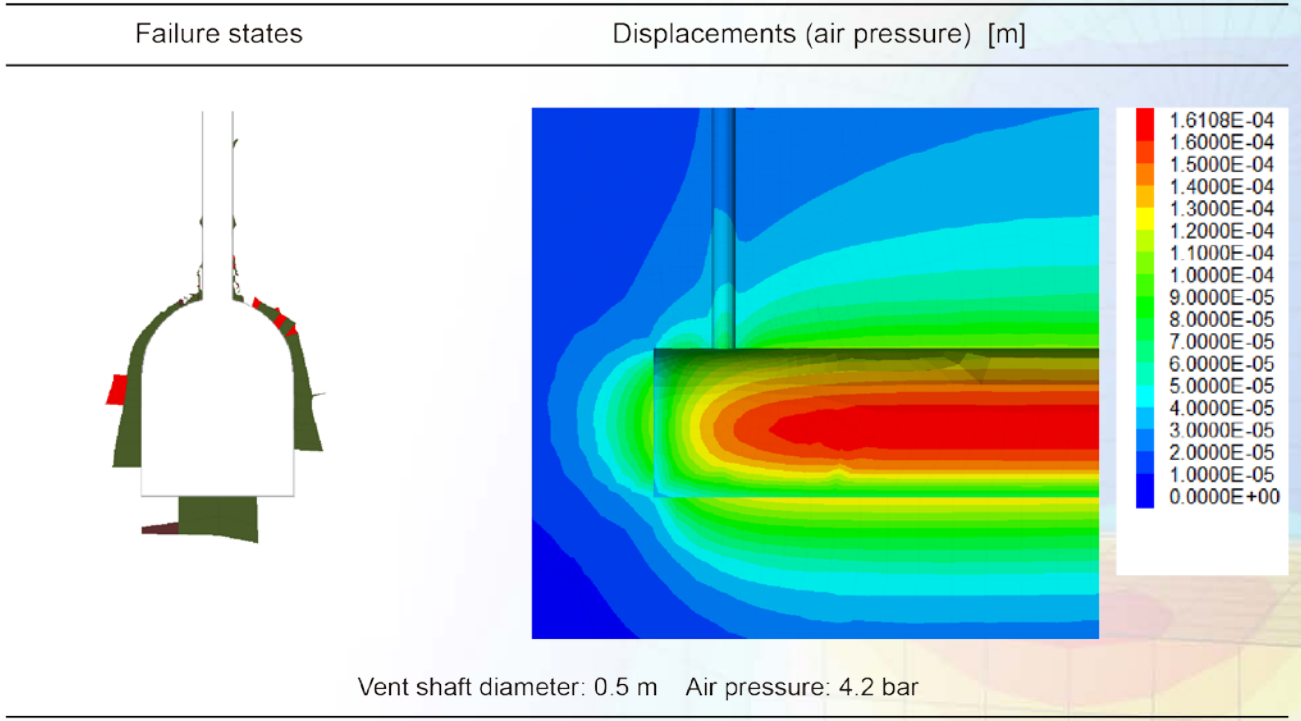
planned Approach

- Focus on geomechanical problems:





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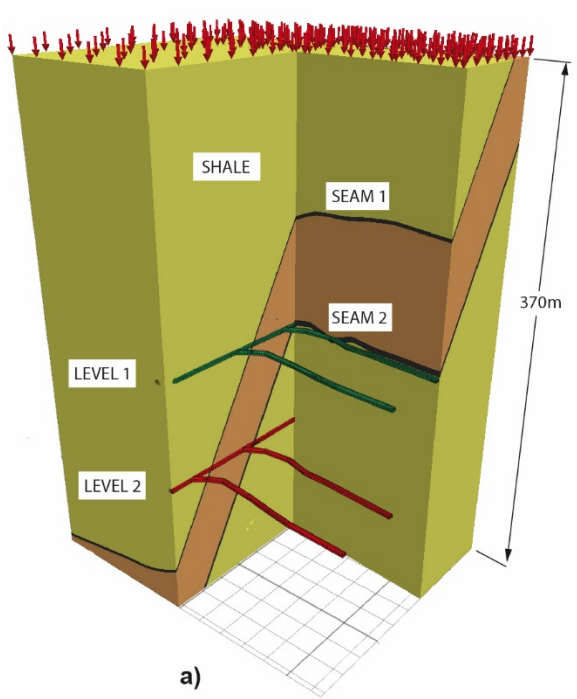

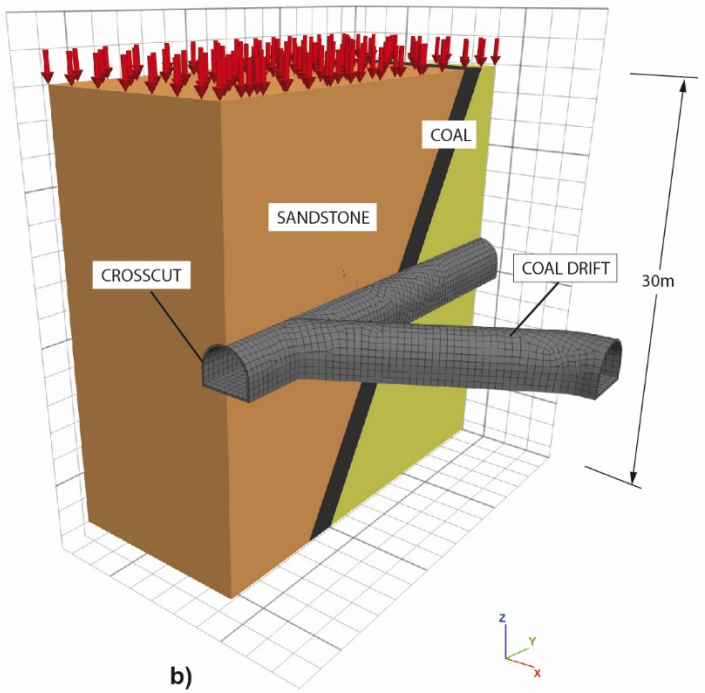

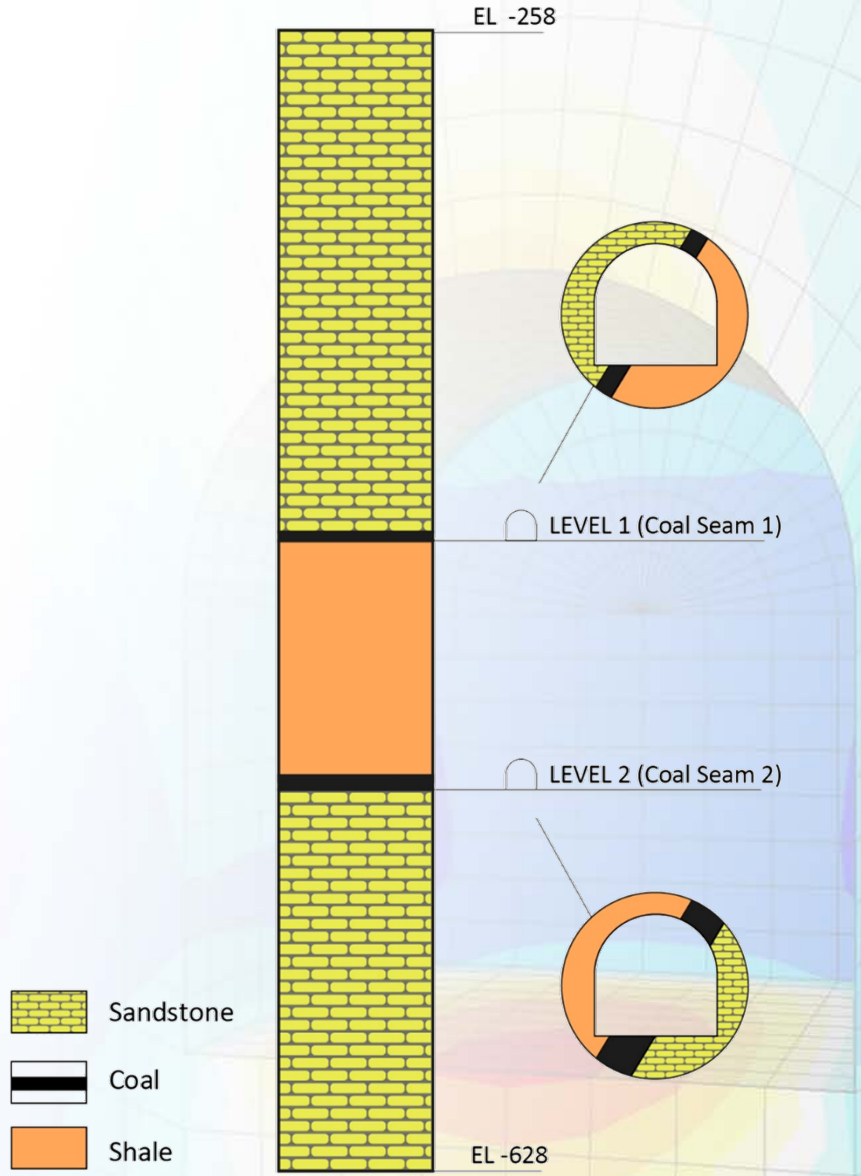

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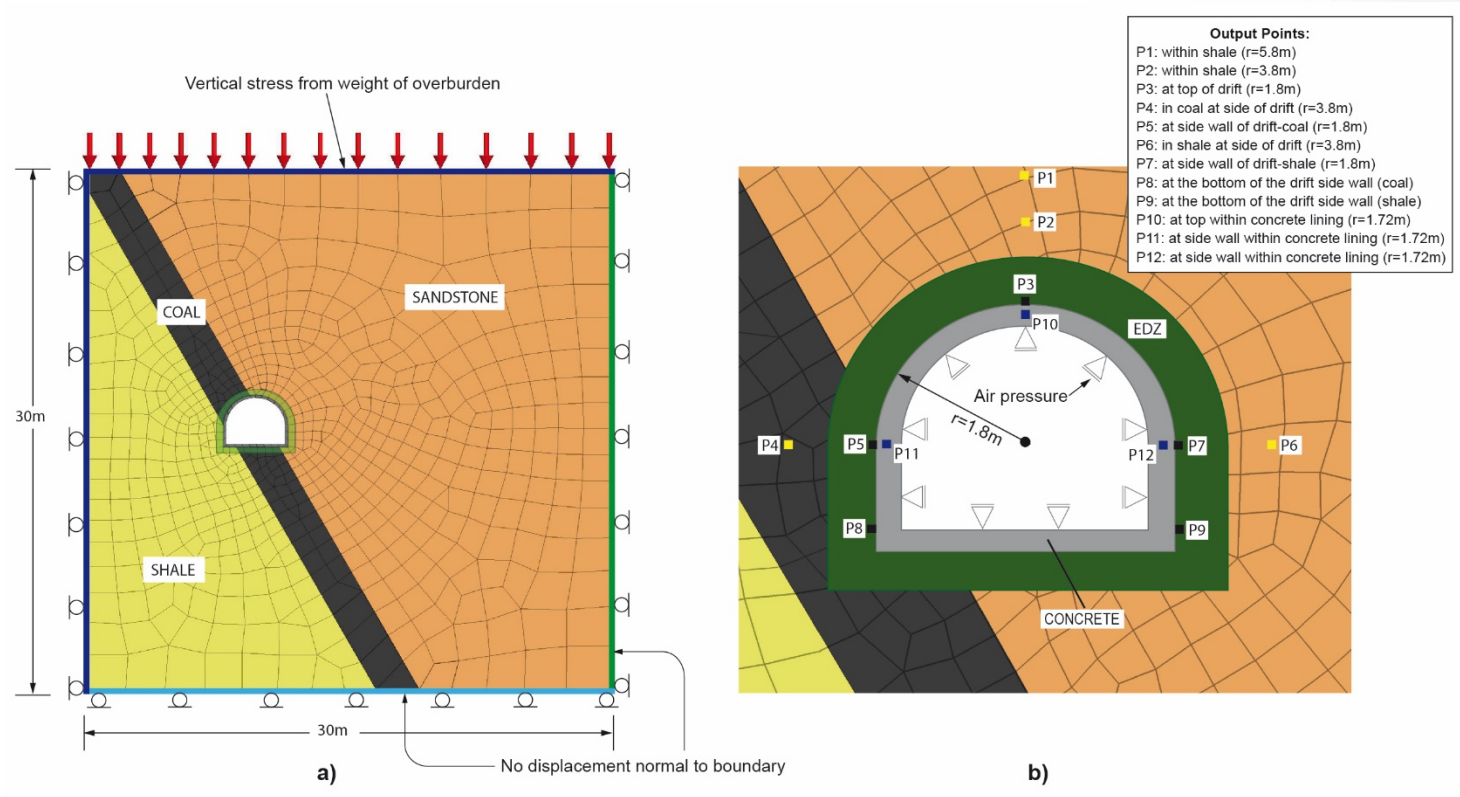

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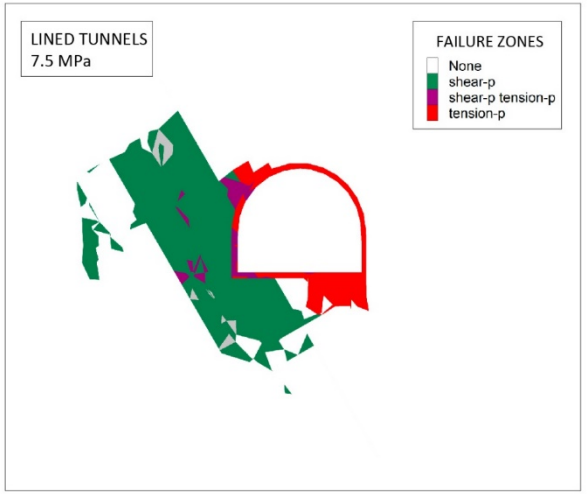
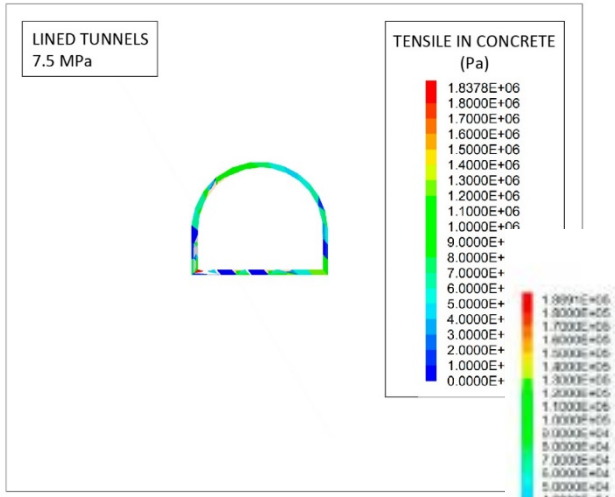
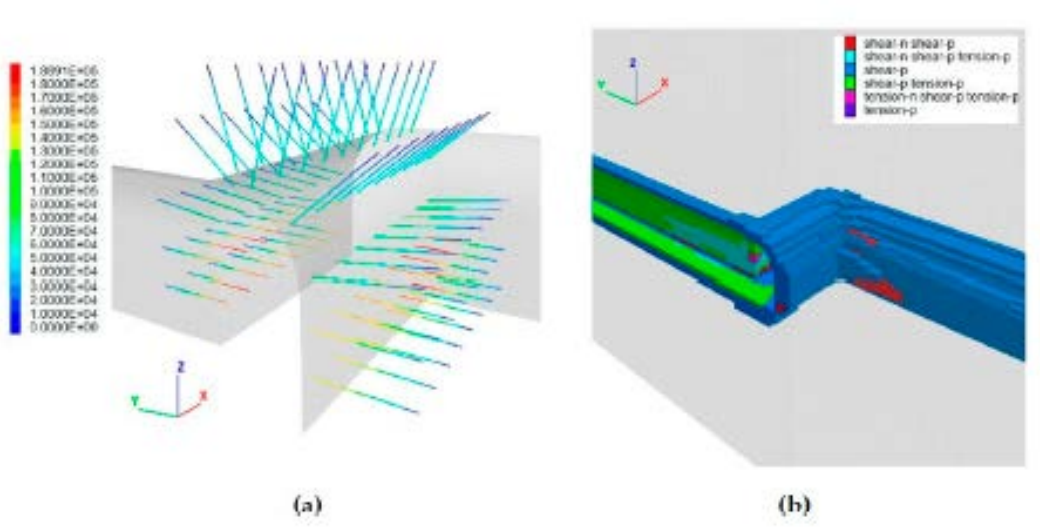


a)



b)



(a) (b)

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Outputs

- Papers:
  - Stability analysis of the underground infrastructure for pumped storage hydropower plants in closed coal mines, 2019
  - Empirical Analysis and Geomechanical Modelling of an Underground Water Reservoir for Hydroelectric Power Plants, 2020
  - Converting closed mines into giant batteries: Effects of cyclic loading on the geomechanical performance of underground compressed air energy storage systems, 2020
- Posters & Presentations:
  - NUMERICAL MODELING OF MINING STRUCTURES FOR THE CONSTRUCTION OF UNDERGROUND HYDROELECTRIC POWER PLANTS, IEEE, 2019
  - Comparing subsurface energy storage systems: Underground pumped storage hydropower, compressed air energy storage and suspended weight gravity energy, SCIEI, 2020
  - Comparing Subsurface Energy Storage Systems: Underground Pumped Storage Hydropower, Compressed Air Energy Storage and Suspended Weight Gravity Energy Storage, ICPEME 2020
  - Problems related to Geomechanics in hard coal mining in the Asturian Central Coal Basin, Freiberg, 2020

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