



# **THE COAL FLY ASH OF UKRAINIAN THERMAL POWER STATIONS AS SECONDARY SOURCE TO RECOVER THE REEs**



***Prof.Dr.Mykola Kharytonov &  
Dr.Oleksandr Berezniak***

**Dnipro State Agrarian and Economic University  
Dnipro University of Technology**

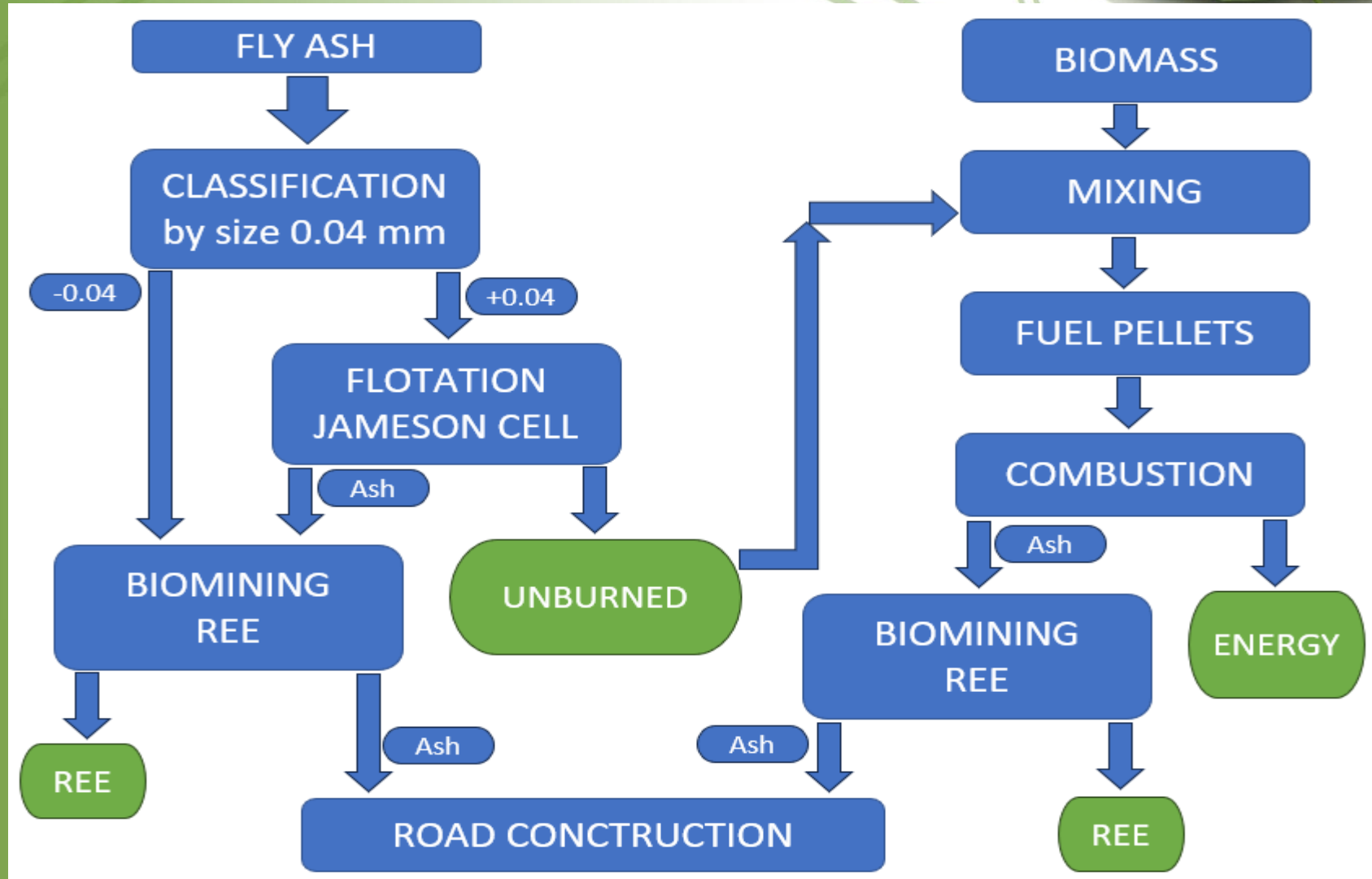
**Dusseldorf, 6-7 March 2025**

# FUTURE HORIZONS EUROPE PROJECTS



- **Stable production biomass in the marginal lands for pellets and briquettes production**
- **Investigation on fuel granules forming under low pressure (less than 1 MPa) and high pressure ( $> 10$  MPa) using various binders**
  - **The production of the composite pellets consisting of carbon enriched materials (CFA, non conditional coal), energy crops and trees biomass and residues (tree bark, lignin, etc) for different utilisation options in the energy system**
    - **Using Pyrometallurgical and Hydrometallurgical Methods for REE recovery**

# A conceptual scheme for recovering REEs from coal fly ash



# Short description of the type and role of partners (Part A)



- **In order to analyze fly ash, the following analytical methods could be applied:**
- **Examination using a reflected light petrographic microscope, immersion oil, and an OPTON-ZEISS optical microscope;**
- **XRD analyse with X-ray Diffractometer;**
- **The determination of chemical composition (the presence of minor, trace, and rare elements) with using inductively coupled plasma mass spectrometry (ICP-MS) and X-ray powder spectroscopy;**
- **Thermogravimetric analysis and bomb calorimetry;**
- **Multi-Step Physical Separation**

# Partnership for REE Recovering (Part B)



- **Enrichment of REEs in Coal Using Physical Methods  
Gravity, Magnetic, Electrostatic, and Flotation Techniques**
- **Pyrometallurgical Methods:**
  - a) after burning of carbon enriched CFA pellet;
  - b) removal of hydrocarbons from waste water
  - using carbon enriched CFA to burn in mini boiler
- **Hydrometallurgical Methods:**
  - a) Chemical or (and) Microbiological Leaching
  - b) Recovery from Leachates: Extraction or Adsorption
  - c) The selective precipitation method application

# Brief overview of previous scientific and technological expertise



- **EU projects:** Biomining & Ecomining DAAD Projects (2016-2022); Jean Monnet Project Tutor (Module) “EU Standards for Environmental Rehabilitation of Mining Lands” EU Erasmus+ program (EUSERML – ERASMUS-JMO-2022-HEI-TCH-RSCH 2022-2025); Erasmus + K107 grant mobility project (2016-2025)
- **References:** Kharytonov, M., Berezniak, O., Klimkina, I., Rula, I., Eckart, S., Guhl, S., & Wiche, O., 2025. Prerequisites for using trace and rare-earth elements from the fly ash of Ukrainian thermal power stations. *International Journal of Environmental Studies*, 1–11.  
<https://doi.org/10.1080/00207233.2024.2444196>
- Zolotovska O., Kharytonov M., Rula I., Martynova N., Roubík H. 2022. The role of volatile components in the process of thermal destruction and ignition of the sunflower husk biomass. *INMATEH – Agricultural Engineering*. 66 (1), 331-339.
- Zolotovs’ka O.V., Kharytonov M., Onyshchenko O. 2016. Agricultural residues gasification, dependency of main operational parameters of the process on feedstock characteristics. *INMATEH, Agricultural Engineering*, 50,(3), 119-126
- **Email:** [kharytonov.m.m@dsau.dp.ua](mailto:kharytonov.m.m@dsau.dp.ua) and [envteam@ukr.net](mailto:envteam@ukr.net)