



## Subject card

|                                             |                                                                                                                                                                                                                            |                                                          |                                                                                                                                                                                                                                                     |                                     |         |                                                                                                                                        |     |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------|-----|
| Subject name and code                       | PHYSICAL AND CHEMICAL METHODS OF ENERGY GENERATION, PG_00064334                                                                                                                                                            |                                                          |                                                                                                                                                                                                                                                     |                                     |         |                                                                                                                                        |     |
| Field of study                              | FIZYCZNE I CHEMICZNE METODY GENEROWANIA ENERGII                                                                                                                                                                            |                                                          |                                                                                                                                                                                                                                                     |                                     |         |                                                                                                                                        |     |
| Date of commencement of studies             | February 2026                                                                                                                                                                                                              |                                                          | Academic year of realisation of subject                                                                                                                                                                                                             |                                     |         | 2025/2026                                                                                                                              |     |
| Education level                             | second-cycle studies                                                                                                                                                                                                       |                                                          | Subject group                                                                                                                                                                                                                                       |                                     |         | Optional subject group<br>Specialty subject group<br>Subject group related to scientific research in the field of study                |     |
| Mode of study                               | Full-time studies                                                                                                                                                                                                          |                                                          | Mode of delivery                                                                                                                                                                                                                                    |                                     |         | at the university                                                                                                                      |     |
| Year of study                               | 1                                                                                                                                                                                                                          |                                                          | Language of instruction                                                                                                                                                                                                                             |                                     |         | Polish                                                                                                                                 |     |
| Semester of study                           | 1                                                                                                                                                                                                                          |                                                          | ECTS credits                                                                                                                                                                                                                                        |                                     |         | 3.0                                                                                                                                    |     |
| Learning profile                            | general academic profile                                                                                                                                                                                                   |                                                          | Assessment form                                                                                                                                                                                                                                     |                                     |         | assessment                                                                                                                             |     |
| Conducting unit                             | Department of Energy Conversion and Storage -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology                                                                                                        |                                                          |                                                                                                                                                                                                                                                     |                                     |         |                                                                                                                                        |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                         |                                                          | dr hab. inż. Katarzyna Januszewicz                                                                                                                                                                                                                  |                                     |         |                                                                                                                                        |     |
|                                             | Teachers                                                                                                                                                                                                                   |                                                          |                                                                                                                                                                                                                                                     |                                     |         |                                                                                                                                        |     |
| Lesson types                                | Lesson type                                                                                                                                                                                                                | Lecture                                                  | Tutorial                                                                                                                                                                                                                                            | Laboratory                          | Project | Seminar                                                                                                                                | SUM |
|                                             | Number of study hours                                                                                                                                                                                                      | 15.0                                                     | 0.0                                                                                                                                                                                                                                                 | 30.0                                | 0.0     | 0.0                                                                                                                                    | 45  |
|                                             | E-learning hours included: 0.0                                                                                                                                                                                             |                                                          |                                                                                                                                                                                                                                                     |                                     |         |                                                                                                                                        |     |
| Learning activity and number of study hours | Learning activity                                                                                                                                                                                                          | Participation in didactic classes included in study plan |                                                                                                                                                                                                                                                     | Participation in consultation hours |         | Self-study                                                                                                                             | SUM |
|                                             | Number of study hours                                                                                                                                                                                                      | 45                                                       |                                                                                                                                                                                                                                                     | 3.0                                 |         | 27.0                                                                                                                                   | 75  |
| Subject objectives                          | The aim of the classes is to familiarize students with aspects of physical and chemical methods of generating energy, as well as to discuss their advantages, disadvantages and challenges associated with them.           |                                                          |                                                                                                                                                                                                                                                     |                                     |         |                                                                                                                                        |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                                                             |                                                          | Subject outcome                                                                                                                                                                                                                                     |                                     |         | Method of verification                                                                                                                 |     |
|                                             | [K7_U04] predicts the properties of the materials obtained and the course of processes involving them, based on knowledge of technology and related fields and computer methods of data analysis, modelling and simulation |                                                          | The student is able to explain the physical and chemical processes related to the production, conversion and storage of energy. Understands the processes involved in the production and movement of pollutants associated with the energy industry |                                     |         | [SU1] Ocena realizacji zadania<br>[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu                          |     |
|                                             | [K7_U05] uses instrumental methods applied in technology and related fields                                                                                                                                                |                                                          | The student is able to calculate the costs of producing energy from various sources and the environmental costs related to the generation, conversion and transmission of energy.                                                                   |                                     |         | [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu<br>[SU4] Ocena umiejętności korzystania z metod i narzędzi |     |
|                                             | [K7_W03] selects methods of data analysis, including statistical and modelling, useful for solving scientific and technological problems                                                                                   |                                                          | The student is able to explain the physical and chemical processes related to the production, conversion and storage of energy. Understands the processes involved in the production and movement of pollutants associated with the energy industry |                                     |         | [SW2] Ocena wiedzy zawartej w prezentacji                                                                                              |     |

|                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |
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| Subject contents                                               | Course content – lecture<br><br>LECTURE:1. Global and Polish energy market.2. Sustainability.3. Conventional energy sources: coal, natural gas, crude oil: resources, amount of energy generated, construction of power plants. Nuclear energy: resources, construction and principles of operation of power plants.4. Chemical and physical methods of energy conversion.5. Obtaining energy from renewable sources.6. Waste as a new potential energy source. 7. Processes of extraction, processing and use of raw materials.LABORATORIES: Work in groups using research stations. Familiarization with the principles of operation, laws and calculations in the field of physical and chemical methods of energy conversion.1. Low-temperature solar energy systems.2. Wind energy.3. Biomass recycling (biodiesel, combustion, pyrolysis)4. Fuel cells.5. Heat pump. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |
| Prerequisites and co-requisites                                | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |
| Assessment methods and criteria                                | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Passing threshold                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Percentage of the final grade |
|                                                                | Exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 60.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 50.0%                         |
|                                                                | Laboratory tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 60.0%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 50.0%                         |
| Recommended reading                                            | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1. Klugmann-Radziemska E., Lewandowski W., Wilamowska-Zawłocka M., Dettlaff A., Januszewicz K., Ryms M., Kuczyńska-Łażewska A., Energetyka i ochrona środowiska. Generowanie i magazynowanie energii. Odpady energetyczne. Analiza cyklu życia, PWN, 2023<br>2. W. M. Lewandowski, E. Klugmann-Radziemska Proekologiczne odnawialne źródła energii. Kompendium, Wydawnictwo Naukowe PWN, 2017<br>3. W. M. Lewandowski, M. Ryms Biopaliwa. Proekologiczne odnawialne źródła energii, WNT, 2013 |                               |
|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1. E. Klugmann-Radziemska. Fundamentals of Energy Generation. Wyd. P.G. Gdańsk 2009<br>2. B. Viswanathan Energy Sources. Fundamentals of Chemical Conversion Process and Applications, Elsevier, 2017                                                                                                                                                                                                                                                                                         |                               |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |
| Example issues/<br>example questions/<br>tasks being completed | Discuss the principle of operation of a nuclear power plant,<br><br>What determines the efficiency of a solar collector or wind farm?<br><br>What methods can be used to obtain energy from waste?<br><br>Describe the process of obtaining biofuel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |
| Practical activites within the subject                         | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |

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