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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Alternativni viri električne energije in energetski trgi | | | | | | | | | | | | | | |
| **Course title:** | | | Alternative sources of electrical energy and energy markets | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| **Elektrotehnika, 2.stopnja, UN** | | | | | **Vse smeri** | | | | | | | | **1.** | | **2.** | | |
| **Electrotechnics, 2 level, UN** | | | | | **All fields** | | | | | | | | **1.** | | **2.** | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Izbirni strokovni/optional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64266 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **45** |  | | | **30** | | |  | | | |  | | |  | |  | **6** |
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| **Nosilec predmeta / Lecturer:** | | | | | Marko Čepin, Miloš Pantoš | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | **slovenski, v primeru večjega števila tujih študentov tudi angleški** | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **slovenski, v primeru večjega števila tujih študentov tudi angleški** | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v letnik predmet | | | | | | | | |  | Enrolment in the year of the course | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Tehnologija pretvorbe različnih oblik energije v električno energijo (energija vetra, geotermalna energija, energija iz odpadkov, energija iz biomase, vodikova tehnologija, gorivne celice, sončna energija), načini shranjevanja energije, primerjava s tehnologijami pretvorbe energije nekonvencionalnih virov v električno energijo, izkoristki pretvorbe energije v električno energijo, vpliv tehnologij na varovanje okolja.  Deregulacija elektrogospodarstva in prestrukturiranje podjetij, pravni okvir trga z energijo, organizacija in tipi trga, udeleženci trga, regulatorni okvir, borza, borzni instrumenti, vrsta trgov: sprotni, urni, srednje- in dolgoročni trg, trg odstopanj, trg sistemskih storitev, terminski posli, terminske pogodbe, opcije in finančni inštrumenti, način poravnave finančnih inštrumentov, tveganja na trgu, njihovo merjenje in obvladovanje, mehanizmi varovanja tveganj, tržna moč, strategije proizvajalcev, ponudbe proizvajalcev, načrtovanje in optimizacija obratovanja proizvodnih enot ponudnika, napoved cene električne energije, vozni redi in obračun odstopanj, strategije dobavitelja, optimizacija njegovega portfelja, pogoji za dobavo in odjem energije, sistem meritev in obračun energije, zamenjava dobavitelja, struktura cene. | | | | | | | |  | | Technology of transformation of various energy sources into electrical energy (wind energy, geothermal energy, energy from waste, energy from biomass, hydrogen technology, fuel cells, thermal solar energy, and solar energy from photovoltaics).  Means of conservation of energy.  Comparison of technology of alternative sources with technology of conventional sources.  Efficiency of transformations of energy. The effect of energy technologies considering the environment.  Deregulation and unbundling of power sector, regulation, organization and market models, pool, spot market, derivatives market, market participants, power exchange, market derivatives, financial derivatives, forward, futures, options, ancillary services, balancing market, clearing, risk assessment and management, market power, trading strategies, offers, unit commitment, economic dispatch, planning, optimization, price forecasting, load forecasting, power supply, system security, metering, energy pricing, transmission service pricing, price structure. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. E. F. Fuchs, l. M. A.S. Masoum, Power Conversion of Renewable Energy Systems, Springer, 2011 2. Sorensen, B., Renewable Energy, Third Edition, Academic Press 2004 3. Farret, F.A., Integration of Alternative Sources of Energy, Wiley-IEEE Press 2006 4. Ilič, M., Galiana, F., Fink, L., Power System Restructuring Engineering and Economics, Kluwer Academic Publishers, 1998. 5. Kirschen D., Strbac G.: Power System Economics: Introduction; Wiley, 2000. 6. Stoft, S.: Power System Economics: Designing Markets for Electricity: Wiley, 2002. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Študenti se bodo seznanili s tehnologijami pridobivanja električne energije iz alternativnih virov in primerjavo s konvencionalnimi načini. Poudarek je na tehnologijah, načinu pretvorbe energij v električno energijo. Študentje bodo spoznali tehnične, ekonomske in okoljevarstvene vplive tehnologij pridobivanja električne energije iz alternativnih virov.  Študenti se pri predmetu spoznajo z modeli trga, ki povezujejo električno in ostale vrste energije. Spozna mehanizme trga, vloge udeležencev na trgu ter strategije prodaje in nakupa energije. Posebej se seznani z obvladovanjem tveganj s pomočjo finančnih inštrumentov. | |  | | Students will become familiar with the technologies of power generation from alternative sources. They will be able to compare the alternative with conventional sources.  Students will learn the technical, economic and environmental impacts of technologies of electric energy generation from alternative sources.  Students will gain basic knowledge in the field of market modelling, trading mechanisms, the role of market participants, trading strategies, risk assessment and management, the role of financial derivatives. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Znanje in razumevanje:  Študent bo razumel delovanje in razvoj tehnologij pridobivanja električne energije iz obnovljivih virov in primerjavo z konvencionalnim načinom. Pridobljeno znanje bo študent sposoben povezati s trgom z električno energijo.  Uporaba:  Širši pregled na področju elektroenergetike, splošni pregled uporabe alternativnih virov električne energije, širši vpogled v tehnologije pridobivanja električne energije, splošna znanja na področju trgovanja z električno energijo.  Prenosljive spretnosti:  Sposobnost sodelovanja pri oblikovanju razvojnih programov na področju energetike in izrabe alternativnih virov z upoštevanjem različnih vidikov: tehnični, ekonomski in okoljevarstveni ter sposobnost sodelovanja pri širših razpravah na tem področju in na področju trgovanja z električno energijo. | | |  | Knowledge and understanding:  Students will understand operation and development of technologies for production of electrical energy from alternative sources and comparison with technologies for production of electrical energy from conventional sources.  The obtained knowledge will be connected with electric energy market.  Application:  Review of electrical energy production and review of current practices. General knowledge of electric energy market.  Transferable skills:  Ability to participate in the development programs in the field of energy and the use of alternative sources of energy, taking into account different aspects: technical, economic and environmental well as the ability to participate in wider discussions in the field of electrical energy market. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja in vaje za utrjevanje pridobljenega znanja. | | |  | Lectures and exercises | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje, pisni izpit, ustni izpit.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Pozitivna ocena vaj je pogoj za pristop k izpitu.  Prispevki k oceni:  laboratorijske vaje  pisni izpit  ustni izpit | 50%  25%  25% | | | | Type: laboratory exercises, written exam, oral exam.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Positive evaluation of laboratory exercises is a prerequisite for the exam.  Contributions to final grade:  laboratory exercises  written exam  oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. ČEPIN, Marko. Assessment of power system reliability. London: Springer, 2011. 2. ČEPIN, Marko. Advantages and difficulties with the application of methods of probabilistic safety assessment to the power systems reliability. Nucl. Eng. Des., 2012, vol. 246, str. 134-140 3. BRICMAN REJC, Živa, ČEPIN, Marko. Izboljšana metoda za oceno zanesljivosti proizvodnje v elektroenergetskem sistemu. Elektrotehniški vestnik., 2013, letn. 80, št. 1/2, str. 57-63. 4. PANTOŠ, Miloš. Market-based congestion management in electric power systems with increased share of natural gas dependent power plants. Energy, 2011, vol. 36, no. 7, str. 4244-4255. 5. PANTOŠ, Miloš. Exploitation of electric-drive vehicles in electricity markets. IEEE trans. power syst., 2012, vol. 27, no. 2, str. 682-694. | | | | | |