Alternative Energy Science

Spring 2023

Dr. Tali Zohar
3 weekly hours, 3 credits, undergraduate

Abstract
Modern society relies on stable, readily available energy supplies. Renewable energy is an increasingly important component of the new energy mix. The course covers the history, utilization, and storage of renewable technologies such as wind, solar, biomass, fuel cells, and hybrid systems. The course also touches upon the social, cultural, and environmental consequences of energy production and consumption, both renewable and fossil, the impact on climate change, and the transition towards a sustainable society .

Course Objectives and Goals
I. Understand the utilization and storage for renewable technologies such as wind, solar, biomass, fuel cells and hybrid systems and for more conventional fossil fuel-based technologies.
II. Understand the social, cultural, and environmental consequences of energy production and consumption, the impact on climate change, and the road towards sustainability .
III. Understand and evaluate the regional environmental problems and the role of renewable energy in solving and minimizing these problems.

Course structure
This course will focus on new developments in renewable energy technologies. There will be 11-course sessions of 3 hours each. The program is based on lectures, readings, site visits, project-based learning, and fruitful discussions.

Grading
The final grade will be based on:
Attendance & Punctuality (15%)
Active participation (20%)
Project presentation (25%)
Final project (40%)

	Lecture	Explanation	Readings	Date
1	**World Energy and world-related green gas emissions**	We will cover the forms of pollution and the share of energy sources and uses of this pollution in the world and the region. Also, the environmental impacts of conventional and renewable sources will be discussed.	International energy Agency, World Energy Outlook 2022 (To read the executive summary and roadmap to net zero) https://www.iea.org/reports/world-energy-outlook-2022	11/2
2+3	**Solar Thermal energy and Photovoltaics**	We will review the technologies and applications of solar thermal energy, power production, and heating applications.	Kabir, E., Kumar, P., Kumar, S., Adelodun, A. A., & Kim, K. H. (2018). Solar energy: Potential and future prospects. Renewable and Sustainable Energy Reviews, 82, 894-900. Shinnar, R., Francesco Citro f. 2007. Solar thermal energy: The forgotten energy source. Technology in Society, 29 (3). pp. 261-270.	18/2
		We will discuss the need for solar energy in the world and the region and study the basics of converting sunlight into electricity, the behavior of solar cells, cell properties, and system components.	Sampaio, P. G. V., & González, M. O. A. (2017). Photovoltaic solar energy: Conceptual framework. Renewable and Sustainable Energy Reviews, 74, 590-601. Nadarajah Kannan, Divagar Vakeesan. Solar energy for future world- A review. Renewable and Sustainable Energy	25/2

			Reviews, Volume 62, September 2016, Pages 1092-1105	
4	**Agricultural Biomass and Bioenergy**	We will review the use of crops, animals, and agricultural wastes in producing alternative fuels.	Field, C. B., Campbell, J. E., & Lobell, D. B. (2008). Biomass energy: the scale of the potential resource. Trends in ecology & evolution, 23(2), 65-72. Capareda, S. (2013). Introduction to biomass energy conversions. https://books.google.co.il/books?hl=iw&lr=&id=3ZsAAAAAQBAJ&oi=fnd&pg=PP1&dq=biomass+energy+review&ots=UI1XiaZ6Fe&sig=NKgZ0CNuXbyhRVJ_Ax0_4UvFIkA&redir_esc=y#v=onepage&q=biomass%20energy%20review&f=false	10/3
5	**Field trip Southern Arava**	Solar energy installations and energy storage sites	AM (times TBA)	17/3
6	**Wind + Hydro**	This lecture will outline the principles of wind turbines and review electricity generation. We will review the hydroelectric power process.	Wagner, H. J. (2020). Introduction to wind energy systems. In EPJ Web of Conferences (Vol. 246, p. 00004). EDP Sciences Kaldellis, John K., and Dimitris Zafirakis. "The wind energy (r) evolution: A short review of a long history." *Renewable energy* 36, no. 7 (2011): 1887-1901.01	24/3
7	**Energy storage and grid, fuel cells, hydrogen Guest Lecture: Dr. Tareq Abu-**	This lecture will cover energy storage technologies, the production and storage methods of hydrogen, and the principles and applications of fuel cells.	Abe, J. O., Popoola, A. P. I., Ajenifuja, E., & Popoola, O. M. (2019). Hydrogen energy, economy and storage: Review and recommendation. International journal of hydrogen energy, 44(29), 15072-15086	31/3

	Hamed		Aneke, M., & Wang, M. (2016). Energy storage technologies and real-life applications–A state of the art review. *Applied Energy*, *179*, 350-377.	
8	**Energy Transition Guest Lecture: Jozsef Kader**	What is the status of the energy transition? What does the energy transition mean in different continents/countries? Israeli energy transition will be discussed.	Sovacool, B. K. (2016). The history and politics of energy transitions: Comparing contested views and finding common ground (No. 2016/81). WIDER working paper Campos, I., & Marín-González, E. (2020). People in transitions: Energy citizenship, prosumerism and social movements in Europe. Energy Research & Social Science, 69, 101718. The role of society in energy transitions. Nature Climate Change 6, 539 (2016) UPDATE OF ISRAEL'S NATIONALLY DETERMINED CONTRIBUTION UNDER THE PARIS AGREEMENT: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Israel%20First/NDC%20update%20as%20submitted%20to%20the%20UNFCCC.docx UPDATED SUBMISSION OF JORDAN'S 1st NATIONALLY DETERMINED CONTRIBUTION (NDC): https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Jordan%20First/UPDATED%20SUBMISSION%20OF%20JORDANS.pdf	7/4

			The State of Palestine's First Nationally Determined Contributions (NDCs) "Updated Submission": https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/State%20of%20Palestine%20First/Updated%20NDC_%20State%20of%20Palestine_2021_FINAL.pdf	
9	**Renewable energy and off Grid Technologies**	Hands-on session in the research park		5/5
10	**Review session & Students Project Presentation**			12/5
11	**Review session & Students Project Presentation + Summary**			19/5
	Submit final Project			24/5