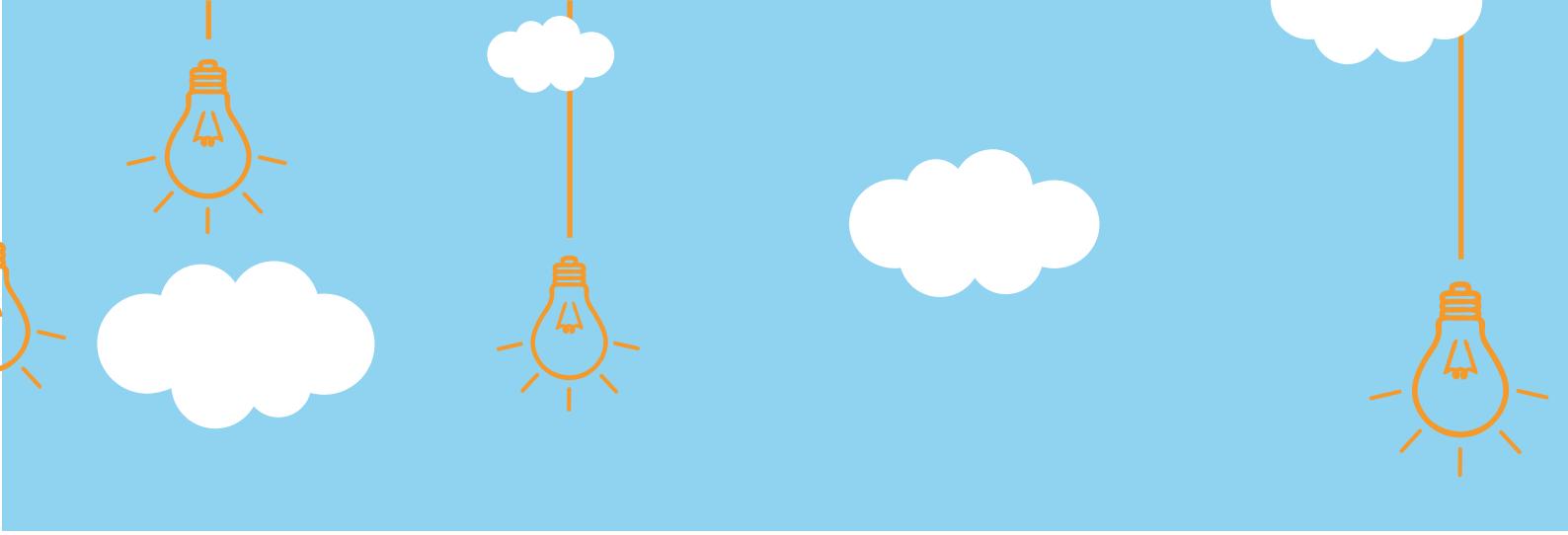

METU's Science, Technology, Engineering & Mathematics (STEM) and Social Sciences & Humanities (SSH) communities come together for research collaboration

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SSH-STEM Seminar/Workshop

Critical problems that are the focus of recent scientific endeavor are complex and multifaceted. Science, Technology, Engineering, and Mathematics (STEM) fields help the development of science and technology; providing innovation, problem solving skills, logical thinking and a good understanding of world's functioning. Social Sciences and Humanities (SSH)—such as Anthropology, Economics, Business Administration, Sociology and Psychology—are concerned with society and the relationships among individuals within a society. SSH provides an understanding of others, ethics, justice, empathy, critical thinking, analysis skills, among others.

The current state of science has reached a point where scientific research is not able to advance within the boundaries of a single discipline. The complex and multifaceted problems, which usually take place in the cross-sections of different fields of science, can be apprehended by multiple disciplines, thus requiring inter-, multi-, and even transdisciplinary approaches. For instance, STEM disciplines excel on energy generation from sustainable and clean resources as well as unsustainable resources. The understanding of public attitudes towards utilisation of alternative resources and how it is shaped by underlying perceptions, knowledges and experiences is an area that falls under the SSH umbrella. The grand challenges the world faces recently include immigration, preservation of natural and historical heritage, equality in access water, food, sanitation, education, energy transition, health services, and climate change. SSH plays a critical role in disseminating the technological advances offered by STEM research to the society, and uncovering their potential for changing the behavior of current generations to have a sustainable future for next generations.

METU, since its foundation in 1956, has been a university which brings together a wide array of disciplines—in Engineering, Basic Sciences, Design, Humanities, and Social Sciences—in a belief that their co-existence benefits each other in terms of creativity, free thinking, vision and originality. Although METU is a technical university, it also holds a very strong SSH tradition. Recently, the university initiated policies to reinforce interactions among various disciplines, to open up new avenues for multidisciplinary and interdisciplinary research and education.

The purpose of the workshop and seminar, prepared by METU Business Administration (BA) Energy Group, is to explore and increase collaboration opportunities between the working in energy-related SSH and STEM at METU. The event aimed to trigger communication between scholars from a diverse set of disciplines and is eventually expected to lead to the evolution of a common language and a more complete understanding of grand challenges we face today. A large proportion of people invited to the event were graduate students or junior faculty members, since they will be benefiting from the transdisciplinary collaborations for a longer time.

The workshop was divided into three sections: (1) the seminar presentations by METU researchers Prof. Ramazan Sari (Dean of Faculty of Economics and Administrative Sciences), Prof. Rasit Turan (Director of Center for Solar Energy Research and Applications) and Prof. Oguz Uzol (Director of Center for Wind Energy Research) (see Box 1), (2) the graduate workshop under three groups including doctoral students and early stage academics, with senior faculty as facilitators, and (3) the final session where the outcomes of three separate workshops were shared and discussed.

Box 1 - The seminar presentations

Presentations (Moderator: Deniz Demircioglu)

Need for Inter-disciplinary and Trans-disciplinary Research: Nature Based Solution and Energy Justice Cases

Prof. Dr. Ramazan Sarı (Middle East Technical University/SHAPE ENERGY/NATURE4CITIES)

Impact of Solar Energy Technologies on Socio-Economic Developments

Prof Dr. Raşit Turan (Middle East Technical University/GUNAM)

Socio-Economic Impact on Wind Turbine Blade Design

Prof. Dr. Oğuz Uzol (Middle East Technical University/RÜZGEM)

The workshop and its findings

In this workshop, three groups were asked to discuss 'How can STEM and SSH collaborate on energy issues?' Groups were designed to achieve a balance among researchers from STEM, SSH and interdisciplinary programs and contain 10 individuals each. Each group was moderated by one of the presenters in the seminar session.

The highlights from workshops are as follows:

- There needs to be increased communication and interaction between STEM and SSH researchers. Steady and sustainable communication mechanisms (like half-day long joint seminar and workshop sessions, discussion platforms, etc.) are needed to facilitate circulation of knowledge, ideas, techniques and concepts among researchers from different backgrounds. While STEM researchers may not master the methods for quantifying social acceptance, for instance, SSH researchers may not know what it takes to install a wind turbine (e.g. technical considerations). Accommodation of communication mechanisms may contribute to this lack of knowledge for both parties.
- There are different mindsets and tools employed by STEM and SSH researchers. Communication entitles both parties to the mindset of the other, fostering creativity, flexibility and versatility.
- Half-day long joint lectures can be established to educate both parties.
- There is a need for informal or formal mechanisms to improve 'scientific' and 'sustainability' literacy among citizens, which may be used as a common background for both SSH and STEM researchers. Ordinary citizens should be able to understand and evaluate scientific knowledge and form opinions on that basis. This is one way for an ordinary citizen to influence policymaking. Sociologists, for instance, may be asked to investigate the low level of scientific literacy.
- Interdisciplinary studies should start from undergraduate level, as students' mindsets are shaped in this period. Embedding interdisciplinary approaches in such early levels of education may facilitate communication among different professions.
- Secondary level educators may serve as agents to translate the aims, processes and outcomes of engineering projects as they hold a pivotal role in the intersection of science and education. The institutions of higher education can mediate between the educators and the projects which will be undertaken by private firms.
- Engineering firms, especially those operating in energy-related sectors should employ social scientists along with engineers.
- Just as Environmental Impact Assessment Reports (EIA Reports) are prepared to investigate the environmental impact, governments should also regulate a system that would evaluate the social impact of the projects. Grassroots social movements embodying locals have the potential to slow down, or even eliminate large scale projects. People have more power than anticipated by the corporations. Through recognising the importance of social impact and acceptance (as well as resistance), for example, new sectors may emerge concerning social impact evaluation.
- Technically, the energy projects can have a lesser than expected impact on the environment due to its overt focus on advancement of technology. SSH may, for instance, assume the role of communicating these advancements to the locals. In order to do this, the first step is to recognise local people, along with the opinion of leaders among them. They should be convinced with the provision of scientific facts, using scientific methods employed by social scientists.
- Technological developments are often driven by the technical aspects, giving less attention to what people really want and how people perceive such developments. Technologies that endured are not the best solutions to the problems at hand, rather they are the ones perceived to be superior by the consumers.
- 'Social acceptance' includes not only public acceptance but also policy makers' acceptance. In other words, policy makers and decision makers should be convinced in order to move on

to the issues of public acceptance and awareness. Academic research should be conducted to investigate public acceptance of high-tech projects.

- There is a need to quantify the dimension of 'public awareness.' Although there are some psychological and demographical frameworks towards this end, a new framework that can introduce an indexed measurement is necessary.
- Market forces and policy issues are the basic determinants of how we produce sustainable energy. The natural and social environment should be taken into account, responding to the concerns raised by all stakeholders, developing environment friendly and sustainable solutions, in order to achieve public acceptance.
- Like technical specifications, tenders should include specifications related to achieving social acceptance or overcoming resistance from the local citizens. Also the fact that social acceptance has a cost for companies should be recognised.
- 'Social cost measurement' lacks proper attention in the literature.
- There is a need for 'stakeholder analysis' to be integrated into tender documentation, which will support both 'social impact analysis' as well as 'social cost measurement.' This will increase public acceptance of new technologies and policies as well.
- To achieve sustainability in energy consumption - via e.g. reducing energy consumption, or shifting the sources of energy supply - forming teams with public organisations and municipal authorities to develop 'nudging' projects to help reduce consumption and adoption of more efficient energy production systems. One such example of a nudging project would be an initiative that informs people about their electricity use, and how it compares to that of their neighbours, which has been shown to alter e.g. household consumption.

Future directions

In light of this event, two interrelated themes seem to emerge summarising separate and joint discussion sessions (which are not confined to energy-related studies alone):

- There is an increasing need for inter-, multi- and even transdisciplinary approaches to provide answers to big questions. Disciplinary approaches fall short on understanding today's complex and multifaceted problems. There has been a lack of cooperation and communication between not only STEM and SSH disciplines, but between disciplines within each field itself. There is a need for mechanisms and platforms to overcome this disciplinary divide, facilitating free exchange of ideas among researchers from different fields. Taking a step back, exposing students to the viewpoints of other disciplines may help them to form a distinct mindset allowing for a holistic perspective when approaching research problems. Graduate students and junior faculty may benefit immensely from this new mindset in their future research.
- In addition to doing research, applying scientific knowledge requires the cooperation of different disciplines. The technological breakthrough driven by STEM fields should be supported by SSH disciplines in uncovering human behavior, individually and culturally backed by different value sets, which may hamper the application of new technologies. SSH could be instrumental in understanding different stakeholders groups' concerns, needs, motives, and perceptions regarding technology, as well as overcoming social resistance and achieving social acceptance. The social impact is a dimension too significant to be neglected, even forming huge barriers hampering diffusion of the most humane and environment-friendly solutions.

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