



2015: A Year in Review

1. Overview: One of my primary goals in establishing and maintaining our CERES group is to strengthen our research and graduate education by promoting a shared vision and fostering a cohesive and collaborative environment. To support these goals, I want to share a few of our 2015 accomplishments and set a common objective of being even better in 2016.

1.1 Mission: Many of today's global challenges are intimately tied to energy such as socio-economic development, climate change, national security, resource depletion, and pollution. These challenges represent an opportunity for engineers to create innovative solutions and make a meaningful contribution to society. Through Research, Education, and Service, CERES members are working to develop solutions to these global challenges that are economically viable, and socially, environmentally, and globally responsible.

1.2 Goals: Our goals are excellence in research, education, and service in the area of clean thermal energy conversion systems. The simplest measure for success in reaching these goals is opportunities.

1.3 Research Areas: As detailed below, due to new opportunities our research is increasingly focused on Concentrating Solar Thermal (CST) technologies, with a specific emphasis on technologies to support Solar Thermal Electricity (STE) (also called Concentrating Solar Power/CSP). Currently our research also extends into nearly zero energy buildings and districts, and renewable energy supported micro-grids.

1.4 Research Objective: Our Research Objective is for all members to demonstrate the ability to do research of publishable quality and to disseminate this work through publications.

2. Broad Initiatives

2.1 SEG: Sustainable Energy Group. Over the winter and spring of 2015 I collaborated with several faculty members to create The Sustainable Energy Group (SEG) at Middle East Technical University. The mission for SEG is to advance the state-of-the-art in thermal energy conversion technologies through excellence in research, technology and human resource development, and innovation based on synergistic collaborations with other research institutions, industry, professional associations and funding agencies at national and international levels. From my perspective SEG and CERES are complementary in their current forms. Both SEG and CERES share a common mission to improve research and graduate education. SEG and CERES differ in that currently SEG is targeted at faculty members while CERES is targeted at students. For me the most tangible outcome from the creation of SEG is that it provides a framework and platform to initiate and facilitate discussions about research collaboration among the participating faculty members, and the ideas embedded in the creation of SEG facilitated the subsequent creation of the new research laboratory ODAK described below. Further details on SEG can be found at the SEG website: seg.me.metu.edu.tr

2.2. ODAK: The Concentrating Solar Thermal Research Laboratory. In August 2015 the ODTÜ Center for Solar Energy Research and Applications (GÜNAM) was awarded an expansion project by the Turkish Ministry of Development that includes creating the CST laboratory ODAK, from *odaklanmış ısı güneş enerjisi*. The scope of the project is to create the underlying research infrastructure (i.e., experimental facilities) to enable Research, Technology Development and Innovation (RTDI) in solar energy conversion technologies. ODAK's research facilities will reflect

the vision for ODAK to be a smaller indoor CST RI to promote excellence in lower [Technology Readiness Level](#) (TRL) activities in carefully selected niche areas. ODAK is specifically being structured to be integrated into [EU-SOLARIS](#), which is a pan-European distributed RI on CST technologies currently being created. The integration of ODAK into EU-SOLARIS will allow ODAK to add-value across the entire CST value-chain and all TRLs. We recently submitted an application for ODAK to become a member of the European Energy Research Alliance Joint Programme on Concentrating Solar Power ([EERA JP-CSP](#)), and if approved this membership will further integrate ODAK into the European CST RTDI community. The GÜNAM Director Prof. Dr. Raşit Turan is directing the implementation of the GÜNAM expansion project, and Drs. Tuba OKUTUCU, İker TARI, Almıla YAZICIOĞLU and I are collaborating to create the ODAK lab.

2.3 IESC: Initiative for Excellence in Scientific Communication for Funding, Disseminating and Exploiting Research: IESC is a formal name I gave last spring to my continuing efforts to improve scientific communication skills among my students. I increasingly view the ability to communicate one's research as a fundamental research skill, and that as a skill it can be strengthened in a structured manner. In parallel, I think the manner in which a person communicates one's research is a reflection of how one thinks about one's research, a well-structured scientific communication reflects a sophisticated manner of thinking about one's research, and teaching a student how to structure a scientific communication also teaches the student how to think about her (his) research. Finally, I think developing and practicing scientific communications improves research through several positive feedback mechanisms and creates research opportunities. The outcomes from this initiative are presented in the Publications section below.

3. Our Successes

3.1 2015 Graduates

Mine KAYA



Degree: METU ME MSc, 2015

Thesis Title: Numerical comparison and sizing of sensible and latent thermal energy storage for compressed air energy storage

Supervisor: Assoc. Prof. Dr. İker TARI

Co-Supervisor: Assoc. Prof. Dr. Derek BAKER

Note: After graduating Mine entered the PhD program at The University of New Orleans.

Onur ÖZKAN



Degree: METU ME MSc, 2015

Thesis Title: Design and modeling of a novel rectifier with ceramic hollow fiber membrane contactor for miniaturized absorption cooling devices

Supervisor: Assoc. Prof. Dr. Almıla Güvenç YAZICIOĞLU

Co-Supervisor: Assoc. Prof. Dr. Derek BAKER

Note: After graduating Onur entered the PhD program at The University of Texas-Austin.

3.2 Publications: Publications is one of the most universal metrics to assess research and researchers. Through the IESC described above, I have been systemically working to strengthen publication skills among my students. To highlight the outcomes of IESC, in this list of publications

I have underlined the names of co-authors who were students. The list includes publications accepted in 2015 that will be published in 2016.

SCI-Core Journal Publications

3. Okoye, C. O., O. Taylan, D. Baker (2016). *Solar energy potentials in strategically located cities in Nigeria: Review, resource assessment and PV system design*. Renewable & Sustainable Energy Reviews. 55C. 550-566. doi: [10.1016/j.rser.2015.10.154](https://doi.org/10.1016/j.rser.2015.10.154)
2. Sadati, S. M. S., F. U. Qureshi, D. Baker, (2015). *Energetic and Economic Performance Analyses of Photovoltaic, Parabolic Trough Collector and Wind Energy Systems for Multan, Pakistan*. Renewable & Sustainable Energy Reviews. 47. 844-855. doi: [10.1016/j.rser.2015.03.084](https://doi.org/10.1016/j.rser.2015.03.084)
1. Ali, S. M. H., M. J. S. Zuberi, M. A. Tariq, D. Baker, A. Mohiuddin (2015). *A Study to Incorporate Renewable Energy Technologies into the Power Portfolio of Karachi, Pakistan*. Renewable and Sustainable Energy Reviews. 47. 14-22. doi: [10.1016/j.rser.2015.03.009](https://doi.org/10.1016/j.rser.2015.03.009)

METU A-type Book Chapters

4. Baker, D., Özalevli, C. C., Sömek, S. K. (2015). "Technical Study of a Hybrid Solar-Geothermal Power Plant and its Application to a Thermal Design Course," *Progress in Clean Energy - Volume 2 Novel Systems and Applications*. Dincer, I., Colpan, C.O., Kizilkan, O., Ezan, M.A. (Eds.). Springer. doi: [10.1007/978-3-319-17031-2_58](https://doi.org/10.1007/978-3-319-17031-2_58)
3. Karshenass, A., Baker, D., Yamali, C., Singh, R. (2015). "Technical Analysis of Hybrid Desiccant Cooling in a Mediterranean Climate," *Progress in Clean Energy - Volume 2 Novel Systems and Applications*. Dincer, I., Colpan, C.O., Kizilkan, O., Ezan, M.A. (Eds.). Springer. doi: [10.1007/978-3-319-17031-2_59](https://doi.org/10.1007/978-3-319-17031-2_59)
2. Bilyaz, S., Singh, R., Karshenass, A., D. Baker (2015). "Modeling and Transient Simulations of 30 MW Solar Thermal Electric Power Plants in the Northeast Mediterranean Region," *Progress in Clean Energy - Volume 2 Novel Systems and Applications*. Dincer, I., Colpan, C.O., Kizilkan, O., Ezan, M.A. (Eds.). Springer. doi: [10.1007/978-3-319-17031-2_74](https://doi.org/10.1007/978-3-319-17031-2_74)
1. Sankir, M., Semiz, L., Serin, R. B., Sankir, N. D., Baker, D. (2015) "Hydrogen Generation from Chemical Hydrides, Advanced Catalytic Materials" *Advanced Materials Book Series*. Eds: A. Tiwari and S. Titinchi. Wiley-Scrivener Publishing, USA. doi: [10.1002/9781118998939.ch5](https://doi.org/10.1002/9781118998939.ch5)

International Conference Papers

4. Bonyadi, N., S. K. Sömek, C. C. Özalevli, D. Baker, I. Tarı (2015). "Experimental analysis of energy storage device using phase change material integrated with a milk storage system." Proceedings of 1st Thermal and Fluid Engineering Summer Conference, TFESC, August 9-12, 2015, New York City, USA.
3. Çepni, K., D. K. Baker, M. Çalışkan (2015). "A methodology for designing tonpiz-type transducers." Proceedings of 1st International Conference and Exhibition on Underwater Acoustics (UA2013), June 21-26, Crete, Greece.
2. Bonyadi, N., S. K. Sömek, C. C. Özalevli, D. Baker, I. Tarı (2015). "Numerical analysis of phase change material characteristics used in a thermal energy storage device." Proceedings of ASME-ATI-UIT 2015 Conference on Thermal Energy Systems: Production, Storage, Utilization and the Environment, 17-20 May 2015, Napoli, Italy. ISBN: 978-88-98273-17-1.
1. Özkan, O., A. Yazicioğlu, D. Baker (2015). "Modeling of the Rectifier of a Mini Absorption Cooling Device Using Ceramic Hollow Fiber Membranes." Proceedings of ASME-ATI-UIT 2015 Conference on Thermal Energy Systems: Production, Storage, Utilization and the Environment, 17-20 May 2015, Napoli, Italy. ISBN: 978-88-98273-17-1.

Under Review: METU A-Type Journal

Bonyadi, N., S. K. Sömek, C. C. Özalevli, D. Baker, I. Tari. *Numerical analysis of phase change material characteristics used in a thermal energy storage device.* Submitted to *Heat Transfer Engineering* as part of the Special Issue on ASME-ATI-UIT 2015 Conference.

Under Review: International Conference Paper

Kaya, M., I. Tari, D. Baker, “Numerical comparison and sizing of sensible and latent thermal energy storage for compressed air energy storage systems.” Submitted to ASME 2016 Power and Energy Conference (PowerEnergy2016), June 26-30, 2016, Charlotte, North Carolina, USA.

3.3 Innovation Award

2nd Place Renewable Energy Category, Global Cleantech Innovation Program. CERES members Cihan Özalevli is the Co-founder and General Manager and Süleyman Kazım Sömek is an Industrial Design and Analysis Engineer at the start-up energy technology company [TYT](#) which won this award for their [HydroSolar](#) project



Best wishes for a happy, safe and successful 2016 full of Research, Technology Development, Innovation, Education, and Service!

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