Cicli di seminari della
SCUOLA DI DOTTORATO
IN INGEGNERIA CIVILE E INDUSTRIALE

UNICUSANO
Università degli Studi Niccolò Cusano - Telematica Roma

Improving the sustainability of geothermal energy: new solutions evaluated through exergy, exergo-economic, LCA and exergo-environmental analysis.

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SSD: ING-IND/08 – MACCHINE A FLUIDO
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12th and 19th July 2022
Time: 9.30-12.30
Event offered online (Webex or Google Meet)

Students shall write an email to giampaolo.manfrida@unifi.it to communicate their participation.

Abstract
Geothermal energy is rapidly developing in many countries; Italy has a long tradition and the solutions developed in the 20th century have effectively contributed to develop the worldwide large-scale use of geothermal energy, and to demonstrate that its use can be sustainable and that this is definitely a renewable resource (RES). A specific feature is that the resource conditions of geothermal energy are widely variable across the world, so that each plant must be accurately adapted to the specific location and the performance level – although different and depending on the resource- must be correctly evaluated by specific indicators, including not only thermodynamic performance but also environmental sustainability. Recently technological advancements are proposed, including complete closed-loop operation (reducing significantly the environmental impact), emissions treatment and the possibility of using difficult resources (such as hot dry rocks, low-temperature resources, or high contents of non-condensable gases). The solution proposed (established or novel) should be evaluated and compared using consolidated and effective tools: specifically, exergy analysis is applied. The exergo-economic approach allows not only to evaluate the cost of products (often electricity and heat for geothermal energy), but also to understand the cost build-up along the process, thus paving the way to economic optimization. LCA is applied, and building a single-score value from a validated de-structured LCA approach allows to proceed with an exergo-enviornmental analysis – identifying the components and processes which are responsible of the major environmental effects during the lifetime (from plant construction/realization to operation and final closure of the wells).

Tentative course programme
The seminar is organized as a two-session event showing the methodology and its application to several cases, including comparison with other renewables and with current production of electricity on the grid.
Duration: 2 seminars of 2-3 hours each.

Short C.V.

Giampaolo MANFRIDA
https://www.unifi.it/p-doc2-2013-200006-M-3f2a3b2a392e2c.html

Professor, University of Firenze (formerly at Un. of Perugia), 1992 to present (teaching: Energy Systems, Fluid Dynamics, Experimental Methods in Turbomachinery, Environmental Issues of Energy Conversion, Thermodynamics and Thermoeconomics)

Education:
- Laurea with honors in Mechanical Engineering (5-year course), Univ. di Firenze, 1977
- Von Karman Institute (VKI) for Fluid Dynamics Diploma with honors, 1981. Theodore Von Karman award as best VKI student of the year.

Research activity:
Renewable energies (solar, wind, geothermal, wave,…). Environmental issues of energy conversion. Power plant optimization (second-law analysis). Energy storage. Design and off-design performance of energy systems and components. Numerical and experimental fluid dynamics of turbomachinery. More than 200 scientific papers in these fields presented at international conferences or published in journals (at 2020).
H-index (Feb 2022): 24 (Scopus).

Cooperation with industrial partner:
Since 1978, always through the University. Co-operations with turbomachinery firms (GE/Nuovo Pignone, Ansaldo, Worthington, Goulds), utilities (ENEL, National Power), and many large/medium/small enterprises (KME, Unitech, Global).

Editorial boards and Conference Organizations:
ASME J. of Energy Resources Technology (Ass. Ed., 1995-1997)
IJOT Journal (member of editorial board, 1997-)
ENERGY (Associate editor 2008-2011; Subject Editor 2012-)
Energy Conversion and Management (Associate Editor 2008-2012)
Sustainability (Energy section) (Associate Editor, 2019-)
Entropie (member of editorial board, 2019-)
FLOWERS International Conference (1994, 1997), Chairman
ECOS International Conference (1995-), Scientific Committee

Reviewer for:
ASME J. of Gas Turbines and Power, ASME J. of Energy Resources Technologies, Int. J. of Energy Conversion and Management, Revue Generale de Thermique, IJCAT, Int. J. of Refrigeration, Geothermics, Energies, Sustainability, Applied Energy, Applied Thermal Engineering, Energy, Renewable Energy, ...

Memberships:
ASME (Member 1987-2002; Fellow 2002-), IAHE, ICAT, VKI ALumini

Link to selected published scientific papers:
https://drive.google.com/drive/u/1/folders/1L7CwnDK4QNxwcDAQBeVP0u-Kpnmaa6e9