



# Energy Systems: A New Approach to Engineering Thermodynamics

By Renaud Gicquel

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Considered as particularly difficult by generations of students and engineers, thermodynamics applied to energy systems can now be taught with an original instruction method. **Energy Systems** applies a completely different approach to the calculation, application and theory of multiple energy conversion technologies. It aims to create the reader's foundation for understanding and applying the design principles to all kinds of energy cycles, including renewable energy. Proven to be simpler and more reflective than existing methods, it deals with energy system modeling, instead of the thermodynamic foundations, as the primary objective. Although its style is drastically different from other textbooks, no concession is done to coverage: with encouraging pace, the complete range from basic thermodynamics to the most advanced energy systems is addressed.

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This volume is intended as for courses in applied thermodynamics, energy systems, energy conversion, thermal engineering to senior undergraduate and graduate-level students in mechanical, energy, chemical and petroleum engineering. Students should already have taken a first year course in thermodynamics. The refreshing approach and exceptionally rich coverage make it a great reference tool for researchers and professionals also. Contains International Units (SI).

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#### Review

"This is a comprehensive book on energy systems with an almost encyclopedic coverage of the details of the equipment and systems involved in power production, refrigeration, and air-conditioning. The integration of technical content with advanced software allows a range of users from students who are beginning their study to those involved in research on promising cycles. From a teaching perspective, the initial focus on the system level combined with the simulation tool Thermoptim serves to quickly bring students up to speed on applications, and provides motivation for further study. This book promises to be one that engineers will keep on their desks for ready reference and study."

?John W. Mitchell, Kaiser Chair Professor of Mechanical Engineering, Emeritus, University of Wisconsin-Madison, Madison, Wisconsin, USA

"By its content and its character, this book is an encouraging and stylish manifesto of a new teaching practice of engineering thermodynamics. In contrast to existing methods, it spares the reader mathematical contingencies, the aggregation of knowledge, and the immutable laws of thermodynamics in the first steps...ideal for the technicians and engineers we train, who often have a much lower accurate mathematical level at their disposal than when they were still students. Technologies are presented simply at first, and subsequently with increasing detail. In combination with the [www.thermoptim.org](http://www.thermoptim.org) portal and the possibilities this offers Energy Systems is an appealing textbook and developing tool, a very powerful reference that allows easier implementation into practice than any existing books on the subject. Usage has changed my approach to thermodynamics, both in my engineering work and in preparing course content. The development of a much more accessible and user-friendly approach than encountered earlier made using it a pleasure, both personally and in training. Last but not least, it widely opens the doors to creativity, which is a major requirement for our energy future."

?Alain Lambotte, Content Manager, Competence and Training Center, Electricity Utility, Belgium

#### About the Author

Renaud Gicquel is Professor at the École des Mines de Paris (Mines ParisTech), France. He has a special interest and passion for the combination of thermodynamics and energy-powered system education with modern information technology tools and developed various software packages to facilitate the teaching of applied thermodynamics and the simulation of energy systems.

*Professional background:* Renaud Gicquel was trained as a mining engineer and obtained his PhD in the same discipline at the Paris VI University in Paris. In the early eighties, he started his professional life as a Special Assistant to the Secretary General at the United Nations Conference in New York on new and renewable sources of energy. After positions at the French General Electric Company and the Ministry of Research and Technology, he was the advisor for International Issues at the Centre National de la Recherche Scientifique (CNRS). In 1986, together with Michel Grenon, he founded the Mediterranean Energy Observatory (OME) in Sophia Antipolis in the South of France. In the early nineties, he was the Deputy Director of the Ecole des Mines de Nantes (EMN) and Head of the Energy Systems and Environment Department. He also acted as the coordinator of ARTEMIS, a thermal energy research group, which he created in partnership with the University of Nantes and Polytech Nantes. Since the mid eighties, Dr Gicquel

continued his academic career at the Centre for Energy Studies of the Ecole de Mines de Paris. Acting as the head and as a full professor, he teaches applied thermodynamics, global energy issues and energy system modeling. His research activities are focused on the optimization of complex thermodynamic plants and on the use of information and communication technologies for scientific instructions. He developed several software packages and published two textbooks. To facilitate the student's learning of applied thermodynamics and the simulation of energy systems better, he developed the Thermoptim software system, which has been supported since 2006 by the portal [www.thermoptim.org](http://www.thermoptim.org).

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