TEMOL (Training in Energy Management Through Open Learning)

A Broad-Scale, Independent Study Program Prepares Energy Managers with a 16-Step "Hands-On" Tutorial

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Editor's Note: There are extensive requirements for today's energy manager, beyond the technical. (For an actual listing, refer to the brief note following Mr. Tripp's report.)

To help prepare energy managers for this new dimension, British energy management practitioners have worked with other groups to develop the project-oriented TEMOL Study Program. Several unique features—for instance, each student is assigned a "tutor"—make TEMOL a valuable way to expand one's knowledge. Efforts are underway to make the program available in the U.S. For further information, see the closing footnote.

There is a school of thought, one that I subscribe to, that the effectiveness and sustainability of an energy management strategy depends in large measure on the attention given to the related knowledge and skills of people in the organization. Part of this view is that energy efficiency needs to be incorporated into the organization's value structure—the corporate culture—if the same care and accountability afforded to other corporate priorities is to be given to the use of energy. Another part of it is that there is a critical role to be played

by energy managers, or line managers who carry responsibility for energy use, in industrial, commercial and institutional organizations, a role that is both technical and management in its scope.

Of course, the development of the necessary values and attitudes, skills and knowledge, is predicated to some extent on the availability of relevant, effective, and accessible training.

The various components of the organization—the CEO, the office occupant, the line worker, the custodian, and so on—all have an impact on energy use, and all have particular needs for "attitude adjustment," knowledge and skills. Creating an energy-valuing culture is not an easy nor short-term task.

WHAT DOES AN ENERGY MANAGER DO?

However, many organizations that have successfully managed energy have found that a key role can be played by an "energy manager." The name on the organization chart may vary, but there are some interesting answers to the question, "What does an energy manager do?" One such view is found in the UK. The "Standard for Managing Energy," part of the British National Vocational Qualification (NVQ) system, defines energy management as an area of professional activity that includes the following key roles:

- Identify the scope for improvement in the way the organization manages energy
- Provide advice on the development and implementation of energy policies
- Promote energy efficiency
- Monitor and evaluate energy efficiency
- Identify improvements to energy efficiency
- Provide advice and support for the development of energy efficient practices
- Provide advice and support for the development and implementation of systems to measure energy usage

When these roles are broken down to a finer level of detail, and when the skills and knowledge that are required for each are examined, it becomes apparent that a great deal of knowledge is required about:

- the technology of energy efficiency, that is, the equipment that contributes to or detracts from the achievement of energy efficiency goals
- efficient practice in terms of operations and maintenance
- management information systems for the monitoring of energy performance, and the analysis of management information for decision-making
- the development of an energy efficiency culture in the organization
- management issues such as policy development, internal communications, human resources development in support of energy efficiency, financial analysis of proposed efficiency measures
- how to provide organizational leadership towards energy efficiency improvement.

It is also apparent that the energy manager is truly a "manager," required to act strategically, to communicate, to influence others, and to find and critically assess relevant information. The context in which he or she works involves a number of key organizational aspects that bear on the capacity for energy efficiency improvement:

- Energy policy
- Organizational structure in terms of energy management functions
- Skills and knowledge throughout the organization to sustain energy management
- Information systems for decision-making on energy reduction targets and for performance monitoring

- Communications within the organization to motivate and sustain commitment
- Investment practices for energy efficiency measures.

The point that should be apparent is that, while motors and furnaces consume energy, there are many critical issues for which the focus is people, not machines.

TEMOL—TRAINING IN ENERGY MANAGEMENT THROUGH OPEN LEARNING

Where, then, can an aspiring energy manager obtain the knowledge and skills required for this sometimes daunting role? One answer, again, comes to North America from the UK via Canada. The TEMOL (Training in Energy Management through Open Learning) Program, as the name implies, is an independent study program providing a comprehensive treatment of the energy manager's role, mapped specifically on the Standard described above.

TEMOL was developed in the UK by a consortium involving energy management practitioners, The Institute of Energy, the University of the West of England, the Department of Environment and the two energy efficiency studies units, ETSU and BRECSU. The Canadian Institute for Energy Training (CIET) has contextualized and expanded the program to reflect North American circumstances and needs, and has recently launched delivery in Canada.

While very conventional in its structure—16 paper-based modules—TEMOL has a number of interesting features that contribute to its appeal and effectiveness. The first is that tutor support is provided to each candidate. The approach employed in the UK and adopted in North America is to assign an energy management professional as personal tutor to the learner for assistance on an as-needed basis, probably electronically via telephone, fax or email. Since participants are likely to come from one of the industrial, commercial or institutional sectors, the learner-tutor relationship is most beneficial when the tutor has knowledge of the environment in which the student works; this is the main criterion for matching tutors with learners.

The second feature is that the curriculum is project-oriented. Guided learning activities are incorporated into the text and these

typically involve the learner in tasks in his or her own workplace. For example, if an inventory of energy-consuming loads is to be created and documented, the learner's facility is the "laboratory" for the assignment. One of the goals is to use the study program to generate useful, and hopefully, rewarding information that often results in the tuition costs being saved through the learner's impact on energy efficiency in the organization.

The third feature is the integration of a multi-faceted evaluation structure into the program. This is training designed for adult learners, and it relies heavily on self-assessment, questions and problems that the learner uses to assess his or her own understanding of key principles. There is a need for thorough evaluation of learning as well, and this is achieved with seven written examinations that are graded by the tutor. Finally, a terminal consolidation project that provides an opportunity for the learner to integrate the scope of knowledge and skills developed and to apply them to real needs in the workplace is evaluated on a pass/fail basis. In the UK, TEMOL is one of the means of developing the knowledge and skills required for a Certificate of Qualification under the NVQ system, and, therefore, evaluation of learning is doubly important. In Canada, successful completion of TEMOL results in the award of 36 continuing education units (CEUs) through the Engineering Institute of Canada; arrangements have yet to be made for this in the United States, but the program is clearly regarded as a substantial undertaking.

The fourth feature is the use of a comprehensive library of resource literature, much of it from the UK Best Practices (BP) Program. The references provided and cited in the modules include case studies, good practice guides, technical bulletins, innovation profiles, and management guides. The hallmarks of these ETSU and BRECSU publications are the very high quality of the technical writing, their practicality, and the physical presentation of the material. The fifty or so titles included in the TEMOL program provide an introduction to a collection of 700 or more BP publications. Other references are from Canadian and American sources.

Where TEMOL especially shines is in its reflection of the definition of energy management discussed earlier. In the modules listed below, one finds a comprehensive treatment of the technological aspects, albeit in a generic sense, the environmental impact issue, and the management functions.

Module	Description
Part A: Technical	Part A consists of seven modules that provide a basic technical understanding of energy utilization, including electrical and fuel-based systems.
1 An *Introduction to Energy Technology*	This is an introduction to fuel types, combustion, heat transfer and fluid flow. It includes instruction on fuels in general, fossil fuels, principles of heat transfer and fluid flow, key elements of combustion; secondary energy systems including electricity generation and distribution, heat pumps, compressed air and renewable energy.
2 *Principles of Fuel Combustion*	The concepts of stoichiometric and real combustion conditions, flame temperature, and efficiency in combustion systems are addressed in this module.
3 *Combustion Equipment and Practice*	The technology of combustion, starting with a simple gas burner, to actual combustion systems used for oil, gas and coal, is the subject of this module.
4 *Electrical Energy Basics*	This module develops a comprehensive understanding of electrical energy from point of purchase to end use. The operating parameters of generic electrical systems, including metering, lighting, motors and fans are considered along with basic definition of important electrical terms such as demand, energy, power factor and efficiency. It provides the key elements of an assessment and opportunities identification process, along with CALC and LOAD software tools to assist with the assessment of IC&I facilities.
5 *Heat Transfer Fundamentals*	Following from the introduction in module 1, this module is a rigorous treatment of thermal energy, heat transfer, heat quality, and related thermodynamic principles. Temperature scales, internal energy, enthalpy, phase change are among the topics for which a working knowledge is developed.
6 *Mechanisms of Heat Flow*	Conduction, convection and radiation as mechanisms of heat flow are introduced and examined in the context of energy management applications. The properties of materials encountered in facilities, such as thermal conductivity and resistivity, and the characteristics of thermal systems, such as convective resistance, laminar and turbulent flow, evaporation and condensation, are examined.
7 *Instrumentation*	If you can't measure it, you can't manage it. This module examines energy instrumentation from simple hand-held devices to building energy management systems.

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Module	Description
Part B: The Environmental impact of Energy	**Part B focuses on the relationship between energy production and consumption, and the environment.**
8 Energy and the Environment	Pollution control related to energy systems, in the context of economic factors and legislation is addressed in this module. The dynamics of air pollution resulting from emissions from fuel combustion, such as acid rain and particulates, and global climate issues arising from greenhouse gas emissions are examined.
9 Water Efficiency	This module makes the connection between water conservation measures and energy efficiency. It provides a template for the assessment of facility water use, and the identification and evaluation of water efficiency measures. AQUAUDIT software is included as a tool for the development of water use inventories for large facilities.
Part C. Energy Management	**In Part C, the emphasis is on the "management" side of the issue. The skills and knowledge required by an energy manager, and the tasks that need to be carried out, in order to achieve energy efficiency improvements, are developed.**
10 An Overview of General Energy Utilization	The purpose of this module is to link the technical aspects to the management functions. A description of the technical role of the energy manager is developed, including checklists for executing that role in regard to the management of people, equipment and services. Specific attention is given to boilers, heat exchangers, furnaces, space heating, insulation, refrigeration, air conditioning and lighting, along with the interdependencies of these systems.
11 Management Techniques for the Energy Manager	This module recognizes the fact that it is people in organizations that save, or waste, energy, and that any successful energy management strategy includes efforts to create awareness, "buy-in," and accountability. The importance of information systems and internal communications is emphasized.
12 Developing the Financial Case	The collection of data, preparation of cash flow statements, and the analysis of these are the fundamental financial management functions addressed in this module. Simple payback, discounting, internal rate of return, and other methods of analysis are introduced. As well, emphasis is given to the analysis of risk and sensitivity.
13 Energy Auditing	The process of energy auditing is defined, and a rationale for conducting an audit is developed. The key elements of an auditing process are examined and various checklists provided.

Module	Description
PART C Continued	
14 Energy Costs, Rate Structures and Scheduling	This module examines typical rate structures for electricity and gas. The important features of such structures are examined in order to enable the energy manager to interpret the tariffs that actually apply to his or her facility. Demand, consumption, and power factor are among the terms revisited in this study. Load profiles and scheduling measures that impact energy costs are examined.
15 Energy Monitoring and Targeting	Monitoring and targeting is a proven approach to energy management planning and implementation. The methods of information gathering, the type and level of information required, and the analysis and reporting of information are examined. Degree-days, regression analysis, and other statistical approaches are examined. A quantitative method of target setting for energy reduction is developed.
Part D: Energy Efficiency	**Part D provides a context of "efficiency" within which to consider the foregoing modules. This single element is designed to be studied at any point in the program.**
16 Energy Efficiency	This module develops an historical perspective on energy efficiency, provides definition, and describes key related issues such as cost-effectiveness, and appropriate energy sources. An overview of the responsibilities of key individuals and functions within organizations, to set and achieve energy efficiency goals, is developed.

TEMOL is career education. Being open learning, access to it is not a numbers nor a geographical problem, as is the case in group programs. It involves a commitment of, typically, about a year of part-time study. Certainly the intention in the UK, and CIET's intention in North America, is to offer the program as a highly relevant, practical preparation for energy managers. It is obviously not the whole story; codes and standards, current technology, utility practices in a deregulated environment, are among the issues that are deeper and broader than the program can address. However, the foundation is laid for the energy manager to know how to deal with these and similar matters.

The program is also at a level that presumes at least some post-secondary education such as technician or technologist programs, engineering, or qualified trades that relate to facility operation, or equivalent work experience. Participants need not be engineers to manage

well in the program, but engineers do not find their intelligence insulted. Indeed, individuals from non-technical disciplines whose experience involves facility management also find the program to be helpful and appropriate to their needs.

Whether energy management is the sole function, or part of the accountability of a line manager, TEMOL provides the tools needed to carry out this function effectively. There are other key elements to an human resources focus in energy management, but TEMOL goes a long way towards creating the prime mover in the organization, the energy manager.

ABOUT THE AUTHOR

Doug Tripp is the executive director of CIET. He is a professional engineer holding masters degrees in engineering and education, and has devoted 30 years to technological education and training. CIET provides a variety of training programs, including TEMOL, to the IC&I sectors. More information can be obtained from CIET via its website: www.cietcanada.com, by telephone at 1-800-461-7618 or 416-410-2597.

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Job Description for An Advanced Energy Manager

Doug Tripp's article describes "TEMOL," a sophisticated training program for energy managers. What responsibilities will face them? A recent job opportunity, posted on the Internet, describes how extensive these responsibilities can be today. In this case, the energy manager's work required the ability to manage a $ 15 million annual energy budget covering 100 buildings, numerous divisions, and a competitive environment. Here is the posted job description: