THE HONG KONG INSTITUTION OF ENGINEERS
SCHEME "A" GRADUATE TRAINING
CONSOLIDATED MODEL TRAINING GUIDE
ENERGY ENGINEERING

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	1. Introduction			**1**
	1.1 Information about the Company			
Location 1	***Description 1***			
	1.1.1 Own Organisation			
	a) Discuss the size, history and internal culture of the trainee's own organisation.	*CCO 1.10*	11	
	b) Discuss an overview of the relationship between the trainee's own organisation, government departments and other organisations.	*CCO 1.10*	11	
	c) Discuss the structure and functions of different units within the trainee's own organisation.	*CCO 1.10*	11	
	d) Demonstrate the awareness to follow operational procedures and practices as required by the trainee's own organisation.	*CCO 1.10*	11	
	e) Discuss the objectives, requirements and processes that support the quality assurance system within the trainee's own organisation.	*CCO 1.10*	11	
	f) Apply the quality assurance system according to the policy of the trainee's own organisation.	*CCO 1.10*	11	
	1.1.2 Training Programme, Prospects and Career Development			
	a) Discuss an overview of the internal communication systems, training system and career development pathway within the trainee's own organisation.	*CCO 1.10*	11	

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	b) Demonstrate a commitment to extend and develop up-to-date technical knowledge through reading relevant engineering publications, participating in seminars or conferences, and information searching.	*CCO 1.2*	11	
	c) Demonstrate a commitment to extend and develop up-to-date knowledge of local, regional and international current affairs through reading relevant engineering publications, participating in seminars or conferences, and information searching.	*CCO 1.3*	11	
	d) Demonstrate a commitment to participate in the local organisations or community services for general personal development.	*CCO 1.3*	11	
	1.2 Information about the HKIE			
Location 2	***Description 2***			
	a) Discuss an overview of the HKIE organisation as well as its history and role in society.	*CCO 1.1*	11	
	b) Demonstrate a commitment to participate in relevant activities organised by the HKIE.	*CCO 1.1*	11	
	2. Engineer as a Profession			**Conti-nuous**
	2.1 Professionalism			
Location 3	***Description 3***			
	a) Discuss the social and ethical responsibilities of engineers in society.	*CCO 1.2*	8	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Explain the rules and standard requirements of conducting engineering activities to the HKIE, employers, clients, general public and colleagues in accordance with the HKIE Rules of Conduct.	*CCO 1.2*	8	
	c) Explain the ethical standards and responsibilities of professional engineers as required by the HKIE.	*CCO 1.2*	8	
	d) Demonstrate the awareness to follow the codes of practice of professional engineers.	*CCO1.2*	8	
	e) Demonstrate the awareness to uphold the dignity, standing and reputation of the engineering profession.	*CCO 1.2*	8	
	f) Demonstrate the awareness to protect the interests of the community including the environment, welfare, health and safety in conducting engineering activities.	*CCO1.2*	8	
	2.2 Occupational Safety and Health			
Location 4	***Description 4***			
	a) Demonstrate an understanding of the statutory health and safety requirements.	*CCO 1.5*	9	
	b) Demonstrate an understanding of the responsibilities of professional engineers for the health and safety of the employers, employees and general public when engaging in engineering activities.	*CCO1.5*	9	
	c) Apply the safety management system in accordance with the industry standards and regulatory requirements.	*CCO 1.5*	7	
	2.3 Environment			
Location 5	***Description 5***			
	a) Demonstrate an understanding of the relevant statutory environmental requirements related to the trainee's discipline.	*CCO 1.6*	9	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Evaluate the inter-relationship of technology with the environment in the work place.	*CCO 1.6*	9	
	c) Demonstrate the awareness of the impact of technology on the environment in society.	*CCO 1.6*	9	
	3. Engineering Practices, Design, Projects and Energy issues			**52**
	3.1 Workshop Training			4
Location 6	***Description 6***			
	a) Demonstrate the ability to use hand, power and machine tools, system energy performance analytical tools / software.	*New CO*	1	
	b) Recognise the system energy performance and deficiencies.	*New CO*	1	
	c) Evaluate building automation control and management system.	*New CO*	1	
	d) Verify building and system energy performance.	*New CO*	1	
	e) Evaluate heating, ventilation and air conditioning system, solar battery system.	*New CO*	1	
	f) Conduct solar assessment, measurement and calculation of power generation of solar system.	*New CO*	1	
	g) Perform O&M tasks and techniques in retro-commissioning.	*New CO*	1	
	3.2 Energy Engineering Fundamental			13
Location 7	***Description 7***			
	a) Demonstrate the awareness of social, sustainability and environmental effects on energy issue from engineering activities.	*CO 1.1*	9	
	b) Appraise general energy science.	*CO 1.2*	1	
	c) Differentiate fuel/energy properties and applications.	*CO 1.3*	1	
	d) Comprehend fuel production and supplies.	*CO 1.4*	1	
	e) Comprehend energy generation and distribution methods.	*CO 1.5*	1	

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	3.3 Engineering Design			13
Location 8	***Description 8***			
	3.3.1 Design Practice			
	a) Design solutions that comply with relevant codes of practice or meet statutory requirements of Hong Kong.	*CO 2.1*	2	
	b) Assess the requirements of different stages of design.	*CO 2.1*	4	
	c) Produce clear design specifications that may be understood and interpreted.	*CO 2.1*	4	
	d) Plan the information retrieval process.	*CO 2.1*	3	
	e) Justify the design alternatives with different perspectives.	*CO 2.1*	12	
	3.3.2 Computer Aided Design (CAD) / Building Information Modeling (BIM)			
	a) Differential the application areas of Computer Aided Design (CAD) and/or Building Information Modeling (BIM).	*CO 2.2*	12	
	3.3.3 Design Aspects			
	a) Select the appropriate types of energy systems and required equipment.	*CO 2.3*	5	
	b) Evaluate the areas of applications and limitations of various energy systems.	*CO 2.3*	3	
	c) Evaluate different types of energy efficiency and energy conversation measurement methods.	*CO 2.3*	3	
	d) Evaluate the client requirements, utilities planning, spatial planning, cost estimates and alternative solutions of energy systems.	*CO 2.3*	3	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	e) Evaluate other important design aspects such as buildability, operability and maintainability etc.	*CO 2.3*	3	
	f) Justify the most efficient and effective design by applying the concept of total design considerations.	*CO 2.3*	12	
	3.3.4 Safety Considerations in Design			
	a) Classify hazardous area classification and equipment selection.	*CO 2.4*	5	
	b) Apply methods of protection from fire and explosion, and excessive variation of operation parameters.	*CO 2.4*	1	
	c) Apply various safety concept, such as safety interlock, fail safe design, emergency stop, emergency and protective shut off etc., in engineering design.	*CO 2.4*	1	
	d) Comply the design with dangerous goods license applications and requirements.	*CO 2.4*	1	
	e) Carry out risk management and control and/or qualitative and quantitative risk assessment.	*CO 2.4*	7	
	f) Apply computer modeling such as chemical dispersion computer modeling etc.	*CO 2.4*	1	
	3.3.5 Environmental Considerations in Design			
	a) Assess the data from environmental analysis.	*CO 2.5*	5	
	b) Assess the environmental impacts from pollutant emissions and disposal of used fuels.	*CO 2.5*	7	
	c) Apply the recommendations of environmental impact assessment in the design.	*CO 2.5*	6	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	d) Comply the design with environmental licenses applications and requirements.	*CO 2.5*	1	
	3.4 Work Processes and Procedures / Operational Reliability			11
Location 9	***Description 9***			
	3.4.1 Automation			
	a) Analyse information retrieved from energy management control system and software.	*CO 3.1*	3	
	b) Apply energy system integration to achieve operational reliability.	*CO 3.1*	4	
	3.4.2 Installation, Testing and Commissioning			
	a) Develop the procedures of installation, testing and commissioning of an engineering project.	*CO 3.2*	5	
	b) Plan the preparation works of installation, testing and commissioning of an engineering project.	*CO 3.2*	5	
	c) Appraise the testing process on the operational reliability.	*CO 3.2*	5	
	d) Formulate the procedures of handling equipment guarantees and defects.	*CO 3.2*	5	
	3.4.3 Instrumentation			
	a) Select appropriate instruments with considerations such as range and accuracy.	*CO 3.3*	5	
	b) Plan the use of instruments for fuel/energy measurement and metering system and performance monitoring.	*CO 3.3*	1	
	c) Compile the calibration procedures of instruments.	*CO 3.3*	1	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	3.4.4 Quality Management			
	a) Plan the quality assurance procedures by employing the concept and methodology of quality management system.	*CO 3.4*	6	
	b) Implement the quality control / quality assurance procedures.	*CO 3.4*	6	
	3.4.5 Energy Systems Safety and Risk Management			
	a) Appraise the energy systems safety and risk management.	*CO 3.5*	1	
	b) Carry out energy systems safety and risk management to comply with international and local safety standard and specifications.	*CO 3.5*	6	
	3.4.6 Energy Production, Transmission and Distribution			
	a) Analyse energy production, transmission and distribution processes.	*CO 3.6*	3	
	3.4.7 Maintenance			
	a) Evaluate the applications and limitations of different types of maintenance practices such as corrective and preventive maintenance.	*CO 3.7*	3	
	b) Carry out implementation of programmes for reliability and maintainability for energy systems.	*CO 3.7*	5	
	c) Apply appropriate diagnostic techniques to analyse maintenance problems.	*CO 3.7*	1	
	3.5 Energy Efficiency and Conservation			11
Location 10	***Description 10***			
	3.5.1 Energy Efficiency for Buildings			
	a) Comply the energy efficiency of buildings with local regulations and /or international standards.	*CO 4.1*	2	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	b) Evaluate alternative solutions to achieve energy efficiency for buildings.	*CO 4.1*	3	
	c) Develop solution to achieve energy efficiency for buildings.	*CO 4.1*	4	
	d) Carry out energy efficiency plan for buildings.	*CO 4.1*	5	
	3.5.2 Operations and Energy Management			
	a) Assess results from various analytical methods such as indoor environmental assessment, demand analysis, load research and analysis.	*CO 4.2*	3	
	b) Develop procedures for energy management and operations.	*CO 4.2*	4	
	3.5.3 Auditing and Energy Conservation			
	a) Comply the energy audit and conservation processes with local regulations and/or international standards.	*CO 4.3*	2	
	b) Justify the selection of energy saving alternatives and conservation measures.	*CO 4.3*	12	
	c) Assess results from economic assessment and analysis.	*CO 4.3*	3	
	4. Engineering Administration and Management Aspects			**26**
	4.1 Interpretation or preparation of project / plant / equipment specifications and drawings.			
Location 11	***Description 11***			
	a) Analyse the client requirements.	*CO 5.1*	6	
	b) Compile specifications according to the client requirements.	*CO 5.1*	6	
	c) Develop engineering drawings.	*CO 5.1*	6	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	4.2 Familiarisation of tendering procedures and undertaking tender evaluation and contract administration.			
Location 12	***Description 12***			
	a) Support the procurement process such as tender and/or contract appraisal and administration.	*CO 5.2*	6	
	4.3 Performing budgeting and estimation of labour, materials, manufacturing, installation, transport and life cycle costs.			
Location 13	***Description 13***			
	a) Formulate the project budget. b) Derive the cost estimates of the engineering project including labour resources, materials, installation processes and transport costs.	*CO 5.3* *CO 5.4*	6 6	
	4.4 Conducting project scheduling and resources management.			
Location 14	***Description 14***			
	a) Develop the project plan including any critical path. b) Formulate project work scheduling and management plan by adopting appropriate management information system.	*CO 5.3* *CO 5.5*	6 6	
	4.5 Preparation of reports, procedures and manuals of construction, installation, testing, commissioning, operation and maintenance.			
Location 15	***Description 15***			
	a) Produce grammatically correct, clear and concise documents (including memos, letters, instructions, reports, resumes and technical papers) which meet the business objectives. b) Evaluate the needs of the intended readers to design appropriate technical contents for communication.	*CCO 1.7* *CCO 1.7*	10 10	

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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	4.6 Conducting technical presentation, sales and contract negotiation.			
Location 16	***Description 16***			
	a) Demonstrate negotiating skills required for various engineering activities.	*CCO 1.4*	10	
	4.7 Knowledge of general administration including financial management, human resources, social awareness, marketing technique etc.			
Location 17	***Description 17***			
	4.7.1 Human Resources Management			
	a) Demonstrate the awareness of the duties and employment criteria for different job positions in an engineering project.	*CCO 1.8*	6	
	b) Demonstrate an understanding of the relevant legal requirements and regulatory issues of labour employment and management.	*CCO 1.8*	6	
	c) Discuss the appropriate staff training and development programmes in the organization.	*CCO 1.8*	6	
	4.7.2 Business Operations			
	a) Recognise the importance of intellectual property to business operations.	*CCO 1.11*	11	
	b) Describe the legal requirements in Hong Kong relevant to intellectual property rights.	*CCO 1.11*	11	
	c) Identify appropriate tools and method to measure and improve the productivity of business operations.	*CCO 1.11*	11	
	d) Identify appropriate information technology applications to manage business information and to facilitate business operations.	*CCO 1.11*	11	
	e) Recognise the importance of research and development towards business operations.	*CCO 1.11*	11	

Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	f) Demonstrate the awareness of financial considerations in operation business.	*CCO 1.11*	11	
	g) Recognise the importance of business development in business operations.	*CCO 1.11*	11	
	4.8 Development of communication skills in verbal and written Chinese and English.			
Location 18	***Description 18***			
	a) Communicate ideas orally in an accurate and clear manner under various situations (including presentations and meetings).	*CCO 1.7*	10	
	b) Formulate an oral presentation of complicated data and information in an effective and persuasive manner.	*CCO 1.7*	10	
	5. Direct Objective Training			**25**
	This section covers any activities related to Energy Engineering. It should aim to develop skills and knowledge relating to personal qualities, communication, human resources management and business operational sense in addition to the technical, commercial and engineering knowledge acquired by the trainees during earlier parts of their training. Latest developments in the discipline should be included. All Training Outcomes, if not yet achieved in earlier parts of training, should be completed here. *Specific project(s) should be assigned to the trainee according to the work nature of the trainee in this period. The emphasis of the project(s) should be on the applications of the essential knowledge and skills acquired in the previous phases of the training programme. The trainee is expected to report the progress at scheduled intervals.* *Regular reviews between the supervisor(s) and the trainee should be arranged so as to ensure the progress to be in line with the project objective(s).*			

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Location where Training will be done	Training Outcomes	Previous Reference	HKIE Compe-tence Ref.	Length of Time (weeks)
	6. Other Common Core Outcomes for Continuous Development			**Conti-nuous**
	6.1 Leadership Qualities			
Location 19	***Description 19***			
	a) Discuss the various leadership qualities required of a leader including accountability, conflict management and resources management etc.	*CCO 1.9*	6	
	b) Explain the importance of accountability and responsibility required by a leader for making decisions on engineering activities.	*CCO 1.9*	6	
	c) Apply various management skills in engineering projects.	*CCO 1.9*	6	
	d) Distinguish the relationship between good leadership and good management skills.	*CCO 1.9*	6	
	e) Demonstrate an understanding of the importance of teamwork and partnering skills in engineering projects.	*CCO 1.9*	6	
	6.2 Development of Personal Qualities			
Location 20	***Description 20***			
	a) Identify appropriate innovative approach and/or tools for professional development.	*CCO 1.4*	11	
	b) Demonstrate interpersonal skills for professional development.	*CCO 1.4*	10	
	c) Demonstrate sound time management skill for professional development.	*CCO 1.4*	11	
	d) Demonstrate a commitment to continuous development and enhancement.	*CCO 1.4*	11	

N.B.

1. The training period must not be less than 104 weeks (24 months).
2. The programme set out is for guidance only but substantial departure should not be made. Employers should endeavour to provide training to their trainees in as many areas as possible as is appropriate to the sector of employment.
3. This guide should be read in conjunction with Section 3 of the M3 Routes to Membership.
4. During the training, each trainee is required to maintain a Graduate Training Log Book, Record of Continuing Professional Development and Record of Training Outcomes.

5. The Appendix to this guide gives examples of the topics against some of the Training Outcomes for reference by the training companies.

APPENDIX TO
CONSOLIDATED MODEL TRAINING GUIDE
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EXAMPLES FOR TRAINING OUTCOMES

This Appendix to the Energy Engineering Consolidated Model Training Guide (CMTG) gives some examples of the topics for the Training Outcomes in the CMTG for reference by the training company.

Training Outcome (reference to the corresponding Section in the CMTG)	**Examples for Reference**
3.2 (a) Demonstrate the awareness of social, sustainability and environmental effects on engineering issues from engineering activities	Climate changes, fuel mix, energy availabilities, energy policy, global energy supplies, demand, reliability and security, environmental impacts in global and societal context, principles of energy efficiency and conversation, carbon footprint and life cycle emission, indoor air quality, innovative technologies and creative business/work practice for sustainable development of fuel / energy supplies and applications, etc.
3.2 (b) Appraise general energy science	Basics of energy science, mechanical energy, thermal energy, chemical energy, renewable energy, nuclear energy, electrical energy, etc.
3.2 (c) Differentiate fuel energy properties and applications	Types, properties, combustion characteristics, hazards, efficiency, availability and resources, basic knowledge of fuel and energy applications, alternative energy fundamentals and technologies, fuel analysis techniques, quality testing and control, etc.
3.2 (d) Comprehend fuel production and supplies	Exploration and refinery systems and processes, production systems and processes, transmission and distribution systems and processes, transportations and operations, retail systems and operations, etc.
3.2 (e) Comprehend energy generation and distribution methods	Electric power and distribution engineering, elements of nuclear engineering, fusion engineering, solar, wind and ocean energy generation system, fuel cells, hydrogen and hybrid system, biofuels and biomass energy engineering, thermal fluid system, heat absorption, heat pump and heat reclaim systems, district energy and distribution engineering, alternative and renewable energy engineering, energy storage, etc.

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3.4.5 Energy Systems Safety and Risk Management	Codes, standards, specifications, statutory requirements, safety management and environmental management system for production and operation facilities, dangerous goods facilities maintenance and license renewal, resource scheduling, monitoring and control, supervision and management, safety practices and procedures, risk assessment and control, chemical release and spillage prevention and protection, explosion and fire prevention and protection, leakage detection and survey, management of changes, contingency plan, emergency responses and crises management, etc.
3.4.6 Energy Production, Transmission and Distribution	Fuel / energy production processes, power supplies system for the plant, plant operations, control and protection, operations, control and protection of storage, transmission and distribution systems, operations, control and protection of transportation facilities, operations, control and protection of transportation facilities, operations, control and protection of retail, utilization facilities and appliances, modifications and decommissioning of facilities, etc.
3.5.1 Energy Efficiency for Buildings	Building envelope, HVAC systems, electrical systems, lighting installation, water supply and drainage systems, lifts and escalators installation, performance base approach, waste heat recovery, etc.