

## UTILITY-SCALE BATTERY ENERGY STORAGE SYSTEMS (BESS)

12 & 13 FEBRUARY 2025  
DORSETT GRAND SUBANG

*\* Inclusive of printed material,  
Signature IK Laptop Bag, IK T-  
shirt, IK Pen and IK notepad*

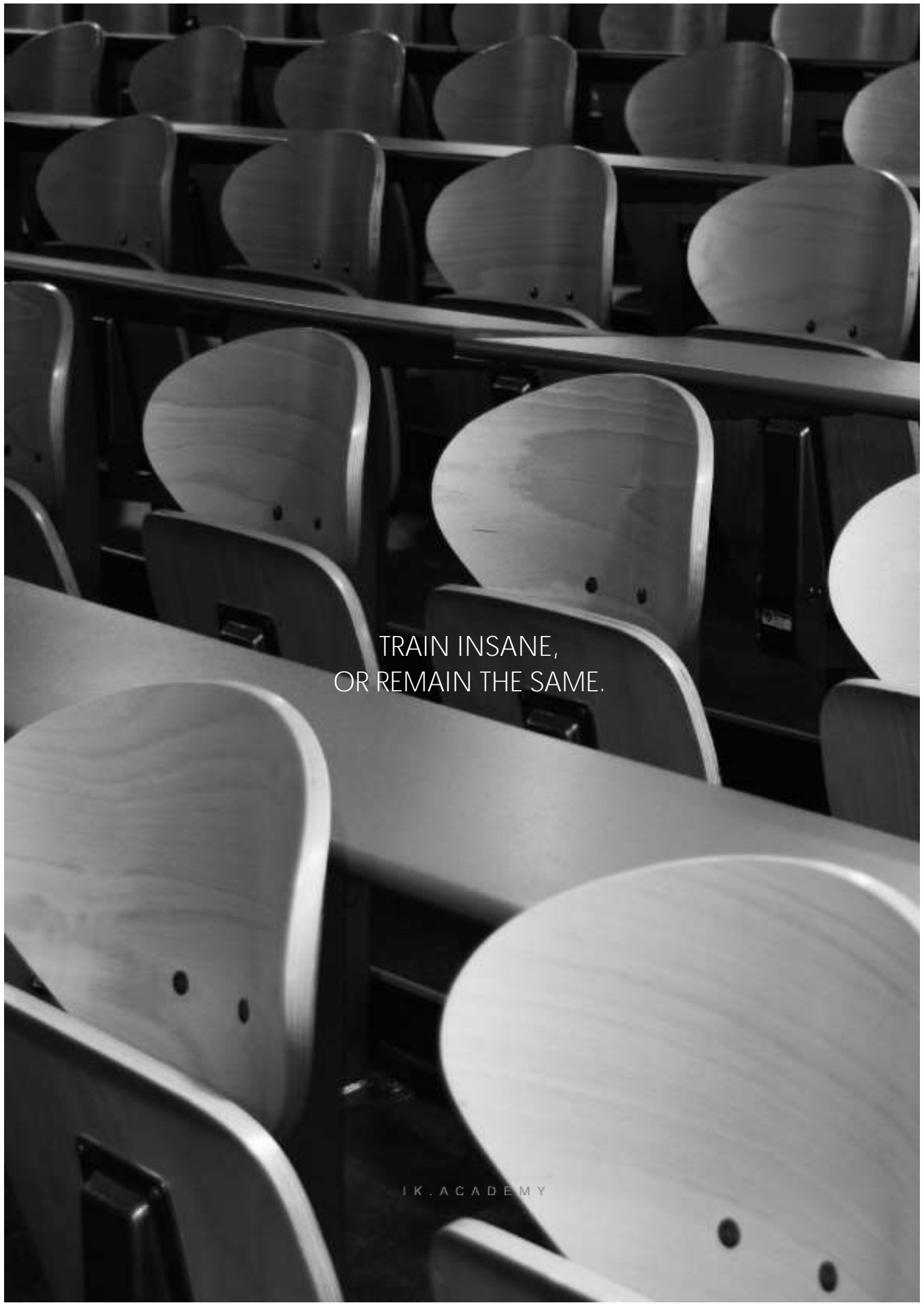


**Our Consultant: Ir. Ts. Norul Rafiq bin Namas Khan**

### **COURSE OUTCOME**

Upon completion of this course the participant will be able to:

- Understand the problems brought about by the energy transition on the grid.
- Understand the reasons and needs for an energy storage system.
- Understand the various technologies and components in an energy storage system, and the limitations associated with them.
- Understand the safety issues related to energy storage systems.



TRAIN INSANE,  
OR REMAIN THE SAME.

IK.ACADEMY



## COURSE DESCRIPTION

A two-day energy storage training course which presents an overview of the energy storage landscape and its associated issues in implementing grid connected energy storage systems.

## COURSE OBJECTIVES

At the end of this course, the participants will gain valuable knowledge about the main principles of energy storage, various available energy storage technologies and the issues related to implementing energy storage systems. This will enable them to understand the overview and needs for a safe, effective and efficient energy storage system.

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- Understand the safety issues related to energy storage systems.

Collectively contribute to projects involving implementation of energy systems

## WHO SHOULD ATTEND

- Asset managers, operations & maintenance engineers, electrical engineers, aspiring energy storage technology enthusiasts.
- **Organizations:** Utility companies (generation, transmission, and distribution network owners, water utility companies, oil and gas industry companies), manufacturers, government bodies (i.e. Suruhanjaya Tenaga, DOSH, Bomba).

## PRE-REQUISITES

- Degree in Engineering

## METHODOLOGY

- This training is delivered in-person in a classroom environment. The two-day session involves a mix of lectures (70%), case studies sharing (20%) and interactive activities (10%).
- Role playing
- Quiz
- Examination

## TOOLS, EQUIPMENT, MATERIALS

- Various online apps – cluedo, menti, slido.
- Sologic Causelink ®RCA sandbox software (\*possible use)

## COURSE CONTENT

Day	Main topic / Case Study /Activity	Subtopics / Activities
Day 1	Energy storage overview	Energy transition
		Need for flexibility
		Classification of energy storage technologies
		Energy storage applications
	Grid Network and Electricity Market Requirements	Generation and demand
		System reliability
		System security
		System capacity and operating reserves
	Grid Connected Applications	Frequency regulation
		Voltage regulation
		Peak shaving and load levelling
		RE integration
	Case Study I	Co-location project – Solar PV and Battery Energy Storage System (BESS)
	Energy storage technologies	Classification
		Matching applications with technology
		Lithium-ion batteries - overview
		Solid state vs. regular Lithium-ion
		Sodium ion
		Flow batteries
		Flywheel
		Supercapacitor
		Compressed air energy storage (CAES)
		Pumped hydro storage
		Thermal
	Hydrogen	
	Case Study II	Lithium-ion projects:
		a. Vistra Energy, California 300 MW BESS
		b. Tesla 182.5 MW Megapack Battery
	Case Study III	Vanadium redox flow project
		a. 40 kW system in Texel, The Netherlands
	Case Study IV	Flywheel project:
		a. 20 MW Beacon Power flywheel USA
	Quiz	
Q&A Session		
BESS trends and development	Cumulative energy storage deployment	
	Battery peaker plants vs gas fired peaker plants	
	Grid-scale energy storage is maturing, perception is changing	

		Developments in battery energy storage system design
		Global battery race
		BESS cost
Day 2	BESS Planning and Construction	Planning of BESS up to financial close
	Quiz	
	Q&A Session	
	What is in the box?	Components on Energy Storage Systems
		DC components
		Power Conversion System (PCS)
		Battery Management System (BMS)
	Technical performance indicators	Definitions
		Relationship between power, energy and SoC
	Case Exercise (Interactive session)	Sizing a battery storage system
	Quiz	
	Q&A Session	
	Energy storage technology risks	Catastrophic failures of energy storage systems
		Battery safety
		Thermal runaway
		Causes of internal failures
		Possible solutions to safety issues
	Case Study V	Drogenbos fire, Belgium
	Case Study VI	20 MW BESS fire, Liverpool
	Case Study VII	When ambition seems to collide with safety, South Korea
	Risk assessment and mitigation measures	How to ensure safety
		Technical risks – Hazard Risk Analysis
		Failure Mode, Effect and Criticality Analysis (FMECA)
		Risks associated with water-based suppression
		Open modules vs. closed modules
		Toxicity
		Heat risk vs. explosion risk
Quiz		
Q&A session		
Energy storage project risks	Project risks in different life phases	
BESS decommissioning	Non-failure decommissioning	
	Lithium-ion recycling	
Warranties and responsibilities	Warranty and performance guarantee	
	Supply chain and supply chain challenges	

	Case Exercise (Interactive session)	Capacity degradation
	Regulations and standards	
	Levelized cost of storage	
	Case Exercise (Interactive session)	
	Q&A session	

## TENTATIVE SCHEDULE

*\*Training schedule is tentative and may be subject to change.*

### DAY 1

Time	Schedule Outline
9.00 am – 10.30 am	<ul style="list-style-type: none"> <li>• Energy storage overview</li> <li>• Grid Network and Electricity Market Requirements</li> </ul>
10.30 am – 10.45 am	Tea Break
10.45 m – 1.00 pm	<ul style="list-style-type: none"> <li>• Grid Connected Applications</li> <li>• Case Study I</li> <li>• Energy storage technologies</li> </ul>
1.00 pm – 2.00 pm	Lunch
2.00 pm – 3.30 pm	<ul style="list-style-type: none"> <li>• Case Study II</li> <li>• Case Study III</li> <li>• Case Study IV</li> </ul>
3.30 pm – 3.45 pm	Tea Break
3.45pm – 5.00 pm	<ul style="list-style-type: none"> <li>• Quiz</li> <li>• Q&amp;A Session</li> <li>• BESS trends and development</li> </ul>

## DAY 2

Time	Schedule Outline
9.00 am – 10.30 am	<ul style="list-style-type: none"> <li>• BESS Planning and Construction</li> <li>• Quiz</li> <li>• Q&amp;A Session</li> </ul>
10.30 am – 10.45 am	<b>Tea Break</b>
10.45 am – 1.00 pm	<ul style="list-style-type: none"> <li>• What is in the box?</li> <li>• Technical performance indicators</li> <li>• Case Exercise (Interactive session)</li> <li>• Quiz</li> <li>• Q&amp;A Session</li> </ul>
1.00 pm – 2.00 pm	<b>Lunch</b>
2.00 pm – 3.30 pm	<ul style="list-style-type: none"> <li>• Energy storage technology risks</li> <li>• Case Study V</li> <li>• Case Study VI</li> <li>• Case Study VII</li> <li>• Risk assessment and mitigation measures</li> <li>• Quiz</li> <li>• Q&amp;A session</li> </ul>
3.30 pm – 3.45 pm	<b>Tea Break</b>
3.45 pm – 5.00 pm	<ul style="list-style-type: none"> <li>• Energy storage project risks</li> <li>• BESS decommissioning</li> <li>• Warranties and responsibilities</li> <li>• Case Exercise (Interactive session)</li> <li>• Regulations and standards</li> <li>• Levelized cost of storage</li> <li>• Case Exercise (Interactive session)</li> <li>• Q&amp;A session</li> </ul>



## OUR CONSULTANT

### **Ir. Ts. Norul Rafiq Bin Namas Khan**

*HRDF Certified Trainer (TTT/20576)*

*P.ENG. (MIEM), C.ENG. (MIET UK), P.TECH. (MBOT).*

Norul Rafiq bin Namas Khan is a Professional Engineer who offers experience and knowledge in failure investigation to contribute to high quality electrical engineering solutions and improvement programs. He has 15 years' experience conducting over 200 root cause investigations for a broad array of medium and high voltage equipment failures, some of which have resulted in loss of life and damage to property from fire incidents. Such investigations are mainly carried out for the purpose of continuous engineering practice improvements, claims (insurance and warranty) and litigation pursuit.

Since 2020, as a Senior Consultant at DNV Energy Netherlands he has performed investigations for international clients across Europe, Middle East, Africa, and Asia. He also provided annual trainings on power cables and failure investigations.

Aside from the above core area of focus, he has worked with renewable energy related projects including commissioning of grid connected large scale solar plants (between 2017 and 2020) and technology survey for a future grid connected offshore wind park (in 2022).

He is a passionate lifelong learner who is always looking for new solutions to existing and future challenges. There is a special place for new business development in his heart.

In 2023, he began venturing into an Independent Consulting role and registered Volta Engineering and Inspection Sdn. Bhd., a Malaysian-based forensic engineering company. Through this company he offers his expertise in electrical failure investigations to various stakeholders in the energy sector.

### **Affiliations and Certifications**

- Chartered Engineer, Institute of Engineering and Technology (MIET), United Kingdom.
- Member, International Council on Large Electric Systems (CIGRE), The Netherlands.
- Global Wind Organization (GWO) complete certification for offshore wind personnel, STC KNRM The Netherlands.
- Professional Engineer, Institute of Engineers (MIEM), Malaysia.
- Professional Technologist, Board of Technologist (MBOT), Malaysia.
- Member, National Association of Fire Investigators (NAFI), United States of America.
- Prospective Member, Expert Witness Institute, United Kingdom.
- Mentor, Startup Bootcamp Amsterdam.
- EASA Certified Drone Pilot – category A1 and A3, Europe.
- HRDF Certified Trainer, Malaysia.
- CAAM Endorsed Drone Pilot (sUAS), Malaysia.
- Category 1 Thermographer (ISO 18436), Infrared Training Center, Sweden.
- Certified Lead Auditor ISO 9001: 2015.
- Currently in progress for evaluation – ASEAN Chartered Professional Engineer (ACPE), ASEA Mutual Recognition Arrangement (MRA) on Engineering Services.
- Currently in progress for examination - Certified Fire and Explosion Investigation accreditation from National Association of Fire Investigators (NAFI), United States of America.
- Currently in progress for registering as EUR ING, European Federation of National Engineering Associations (FEANI).





### Work Experience:

- **TNB Research Sdn. Bhd. | Nov. 2023 - Current**  
*Technical Advisor*
- **KEMA Labs Netherlands B.V. (owned by CESI S.p.A) | Oct. 2023 - Current**  
*Associate Inspector (Global Inspection Group)*
- **Volta Engineering and Inspection Sdn. Bhd. | Oct. 2023 – Current**  
*Independent Consultant (Electrical Failure Investigations)*
- **DNV ENERGY SYSTEMS, Arnhem, The Netherlands | May 2020 - Sept. 2023**  
*Senior Consultant (Power Failure Investigation)*
- **TNB LABS SDN. BHD., Bangi, Malaysia | April 2018 – May 2020**  
*Technical Expert (Failure Analysis)*
- **TNBR QATS SDN. BHD., Bangi, Malaysia | Jan. 2016 – March 2018**  
*Section Head, Forensic Engineering Group*
- **TNB RESEARCH SDN. BHD., Bangi, Malaysia | Aug. 2008 – Dec. 2015**  
*Investigation Engineer (Electrical)*
- **UNIVERSITI TENAGA NASIONAL, Bangi, Malaysia | July 2007 - July 2008**  
*Research Assistant*

### Education:

- **UNIVERSITI TENAGA NASIONAL, Bangi, Malaysia | Sept. 2000 – Sept. 2006**  
*Bachelor of Electrical Power Engineering (Hons.): Electrical Engineering*



REGISTRATION FORM

03-76511000

Please register the following personnel to attend the training as above  
Please photocopy for multiple bookings.

Name: \_\_\_\_\_

NRIC: \_\_\_\_\_

Designation & Dept. : \_\_\_\_\_

Email: \_\_\_\_\_

Office (Direct Line) \_\_\_\_\_

Mobile Phone: \_\_\_\_\_

Name: \_\_\_\_\_

NRIC: \_\_\_\_\_

Designation & Dept. : \_\_\_\_\_

Email: \_\_\_\_\_

Office (Direct Line) \_\_\_\_\_

Mobile Phone: \_\_\_\_\_

Name: \_\_\_\_\_

NRIC: \_\_\_\_\_

Designation & Dept. : \_\_\_\_\_

Email: \_\_\_\_\_

Office (Direct Line) \_\_\_\_\_

Mobile Phone: \_\_\_\_\_

Company Name: \_\_\_\_\_

Contact Person: \_\_\_\_\_

Designation: \_\_\_\_\_

Address: \_\_\_\_\_

Office (General Line): \_\_\_\_\_

Office (Direct Line): \_\_\_\_\_

Fax No: \_\_\_\_\_

Email: \_\_\_\_\_

Person In Charge: \_\_\_\_\_

(Finance)

Email (Finance): \_\_\_\_\_

Contact Number: \_\_\_\_\_

(Finance)

I hereby agree to Asia iKnowledge Sdn. Bhd.'s Company Registration Policy by signing and affixing the company stamp below:

Two empty rectangular boxes for signature and stamp.

Authorized Signature

Company Stamp

4 EASY WAYS TO REGISTER

Call : +603-76511000

Fax : +603-76511001/2

Email : register@ik.academy

Mail : Suite 3A21, Kelana Centre Point, Block A,  
Jalan SS7/19, Kelana Jaya, 47301 Petaling  
Jaya Selangor, Malaysia

TRAINING INVESTMENT

Early Bird Registration (Before 12<sup>th</sup> January 2025)

Early Bird Pricing : RM 3800 per pax  
(RM 4104/pax incl 8% SST)

Normal Registration

Individual Pricing : RM 4200 per pax  
(RM 4536/pax incl 8% SST)

Group Pricing : RM 4100 per pax  
(RM 4428/pax incl 8% SST) (for 3 pax & above)

8% SST based on Malaysia Budget Table on Oct. 2023

\*HRD Corp Claimable (\*If the course fee exceeds HRDC approved claim limits, client is liable for the difference.)

HRD CORP CLAIMABLE COURSES REGISTRATION POLICY

For HRD-CORP CLAIMABLE COURSES clients, the grant approval letter must be obtained from HRD CORP at least 48 hours prior to the training date. In the event that the grant approval letter is not obtained, IK Academy reserves the right to deny your entry into the training session. You may opt to issue a letter of undertaking to IK Academy as a guarantee of payment. Note that the letter of undertaking is subject to review by the management of IK Academy. IK Academy reserves the right to issue invoices directly to clients should there be any failure to provide the grant approval letter issued by HRD CORP after the training is concluded.

COMPANY REGISTRATION POLICY

It is important to read and understand our Company Registration Policy before signing or stamping the registration form. You may get a copy of our policy from our personnel or from the link below:  
<http://ik.academy/assets/ikpolicy.pdf>

CANCELLATION & PAYMENT POLICY

You may substitute the participants any time. No cancellation is allowed upon issuance of confirmation letter.

PROGRAM POLICY

Our consultant & topics are confirmed at the time of publishing. However, circumstances beyond the control of the organizers may occur. Asia iKnowledge S/B reserves the right to alter or modify the advertised speakers/ dates/topics if necessary.

PAYMENT DETAILS

Payment is required within 7 days upon receipt of the invoice. All payment must be received 7 working days prior to the training date.

1. Direct Deposit

Company Name: ASIA IKNOWLEDGE SDN BHD

Account number: 144-300-562-0

Bank: United Overseas Bank (Malaysia) Berhad, UOBM Damansara Uptown, Ground Floor, No. 1, Jalan SS21/58, Damansara Uptown, 47400 Petaling Jaya, Selangor

\* Please instruct your bank to pay all transfer charges from your account and send in a copy of remittance advice by email/fax.

2. Bank Cheque or Bank Draft

Payable to "ASIA IKNOWLEDGE SDN BHD"