School of
Engineering

Short Course in

Renewable Energy Fundamentals for Industry Professionals

Short Course Overview

This three-day course is specifically designed for engineers, scientists, project managers, decision makers and business owners who have an interest in renewable energy. This course consists of an overview of renewable energy in the context of recent national and global strategies including a technological overview, renewable energy system design principles, and economic analysis of renewable energy projects.

Some focus areas of the course are:

- Design of different renewable energy technologies in compliance with Australian standards
- Simulation techniques of renewable energy systems using HOMER (Hybrid Optimization of Multiple Energy Resources) software
- Economic analysis of renewable energy projects including a step-by-step process of determining key macro-economic parameters, including Net Present Value (NPP) and Internal Rate of Return (IRR)

Learning Outcomes

On completion of this course, participants will be able to:

- Explain the important role of renewable energy technologies in transitioning to a sustainable energy future
- Apply design procedures to renewable energy systems and projects in compliance with Australian standards
- Assess the economic feasibility of renewable energy projects

Duration

The course will be delivered over three days. It runs for 7.5 hours per day, with tea and lunch breaks.

Delivery Methods

The School provides a high level of support with tuition by discipline experts and exposure to industry professionals. The delivery mode of this short course consists of face-to-face lectures integrated with workshops in our state-of-the-art renewable energy laboratory facilities.

About the Presenter

David Harries has worked in the field of energy for 35 years, including as the director of two state government energy policy agencies, two academic energy research institutes, and as a director on the boards of four Perth-based solar companies. He is currently the director of an energy consulting business, an adjunct with the School of Electrical, Electronic and Computer engineering at UWA and served on President of the Conservation Council of Western Australia for 6 years. , David has a B.Sc.(double major in physics), Master of Environmental Studies and a PhD. (Energy policy and planning) from the University of Tasmania.

Course Details

Date: 5-7 September 2022

Venue: Building 27, School of Engineering, ECU Joondalup Campus

Cost: $2900 plus GST
*This cost includes lunch and tea.

**ECU students and alumni are eligible to receive a discount. Contact seadmin@ecu.edu.au for more information.

Bookings and Enquiries

Any general enquiries regarding the course, please contact seadmin@ecu.edu.au.

Appendix 1 – Short Course Program

Day 1
Part A: Setting the scene **Presentation:**
A1. Overview of renewable energy and renewable energy technologies This section discusses the drivers behind the current transition to renewable energy: energy diversification to increase energy security, the need to address global climate change, energy economics, socio-economics, Sustainable Development Goal 7. It looks at the challenges and opportunities and compares the costs and benefits of renewable energy technologies with other conventional power generation technologies. **A2. The current commercial status of renewable energy technologies** This section briefly looks at the commercial status of the various renewable energy conversion technologies and then looks in more detail at the three most mature technologies : hydroelectric systems, wind turbines and solar PV.
Part B: Trends in investment in RE: Global, Australia & WA :
B1. Trends in investment in renewable energy for electricity generation This section looks at recent trends in the investment in renewable energy technologies at the global level. Some technologies are progressing more than others – both in terms of technological advancement and costs. This section presents an overview of some winning technologies. **B2. Trends in investment in renewable energy – Australia and Western Australia** This section presents an overview of the increase in the uptake of renewable energy in Australia and in Western Australia. The overview summarises the installed capacities, national and state government policies, renewable energy targets, the regulatory frameworks and non-government voluntary drivers.
Part C: Solar Photovoltaic (PV) Technology **Presentation:**
C1. Different types of solar PV systems and projects This section first briefly explains solar PV technology – PV cells, modules, and arrays. It then describes the different types of solar PV systems, starting with the simplest systems and moving toward the larger and more complex systems and their components (batteries, inverters. It also discusses challenges related to the increased use of solar PV technologies and how these are being addressed.
Day 2
Part C: Solar Photovoltaic (PV) Technology - continued **Presentation:**
Case studies of solar PV systems This section looks at emerging and new applications of solar PV technology, and presents case studies of some of the recent, planned and proposed largest solar PV projects in Australia and in the world.
Part D: Power conversion by solar PV systems **Practical (laboratory) component:**

D1. Solar PV laboratory investigation

Hands-on experience of power conversion by solar PV systems using state-of-the-art lab facility at ECU

Part E: Solar PV System Design:

E1. Design techniques for renewable energy systems

This section outlines the basic concepts and the steps involved in designing solar PV power supply systems. It then describes each of the steps in detail, including load estimation, battery sizing, solar resources estimation and PV array sizing, and the selection of charge controllers and inverters. for designing grid-connected and hybrid stand-alone systems

E2. Grid-connected and Stand-Alone Solar PV Systems

In this section, the different approaches used in the design of grid-connected and stand-alone solar PV power supply systems are covered, including the relevant Australian standards governing the design and installation of grid-connected solar PV systems and the procedures and requirements for connection to the distribution network.

E3. Different design and simulation tools

This section introduces some of the engineering solar simulation modelling tools that are used in the design of solar PV systems.

E4. A case study of a PV System design using the HOMER Pro simulation tool

This section briefly describes the HOMER simulation tool and then demonstrates the step-by-step process of designing a solar PV power supply using the HOMER Pro simulation software for a particular site.

Day 3

Part F: Financial analysis of renewable energy technologies/projects Presentation:

F1. Undertaking financial analysis of renewable energy projects

This section explains the various financial analyses commonly used to assess the financial or economic performance of a proposed renewable energy project. It outlines the methods for calculating the important financial metrics of a project, such as the Simple Payback Period (SPbP), Net Present Value (NPV), Internal Rate of Return (IRR) and Levelised Cost of Electricity (LCoE). It then undertakes these calculations for a case study using a wind project.

F2. Financing mechanisms of renewable energy projects

This section presents an overview of both the conventional and new or innovative mechanisms that are used to finance renewable energy projects, including cases study examples.

Part G: Energy storage systems for renewable energy projects Presentation:

G1. Overview of energy storage systems

This section discusses different types of energy storage systems in use or being developed, including some of the emerging technologies that are yet to be commercialised. The benefits of using energy storage are explained and common energy storage technologies are described in detail.

Part H: Renewable Energy and Hydrogen
This section looks at the current high level of interest in adding hydrogen as a fuel in the energy mix. The drivers behind the rapid investment in hydrogen energy production are discussed and the various hydrogen production methods and the costs of producing ‘grey’ and ‘green’ hydrogen are discussed. Current key large-scale hydrogen projects are briefly reviewed.
Part I: Renewable Energy and Transportation
The drivers behind the efforts to increase reliance on renewable energy for transportation are discussed. The two pathway options, biofuels and electrification, are briefly discussed along with their challenges. Electric vehicle (EV) technologies are described and compared with a particular focus on comparing plug-in electric vehicles, fuel cell electric vehicles and all-electric battery vehicles. The impacts of charging EVs on electricity supply networks and charging infrastructure requirements are briefly discussed.