ANAMISE

ANALYSE - OPTIMISE - ADVISE

Commercial Photovoltaic System Sizing & Design

Course Outline

Summer 2017

Introduction

Commercial solar system designers may implement data driven solutions to ensure their customers minimise their overall electrical operating expenditure. The availability of 30-minute load data from commercial sites and solar data from the Australian Bureau of Meteorology means commercial designers have information readily available to size systems properly. Common tools such Microsoft Excel and Visual Basic for Applications allow designers to optimize design parameters such as system size, tilt and orientation to minimize a company's overall energy costs. The training given will emphasize the benefits of data-driven commercial solar design solutions and how to implement these design processes.

Real world examples will be used to show how load profiles from different sites such as manufacturing plants, small businesses, schools and recreation centres will change the expected return on a solar investment due to the amount of solar used on site compared to the amount of solar exported to the grid. An investigation will be presented into the ability of solar to reduce the 30-minute maximum demand tariff associated with commercial sites. Examples will be given explaining how to present the derived data to a customer.

An in-depth explanation will be given into how to model expected solar generation and historical load profiles. Visual Basic for Applications will be used to show how to rearrange load data and find the optimal system size to minimize electrical operating expenditure. Microsoft Excel will be used to dynamically model the generation data throughout the day and year depending upon the system location and design parameters. Furthermore, it will be shown how to present this information in a professional business report to the customers who are looking to benefit from these services.

Ultimately, all commercial solar design and installation companies will benefit from this training by learning more accurate engineering design methods and financial forecasting strategies. Commercial solar companies will gain extra credibility and prestige as they learn to expertly determine solar system design parameters. Business owners will be reassured knowing that commercial designers are implementing logical forecasting strategies to maximise the business's overall cash flow. Overall, this training will improve design processes throughout the solar industry.

Table of Contents

1. Staff

Alexander Robinson BEng. UNSW (Photovoltaic and Solar Energy)

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	Alexander Robinson	Alexander.Robinson @Anamise.com.au	Office Hours by Appointment Only	0423 070 843

Alexander's specialization is in providing Australian solar investors with site-specific business cases and engineering designs that add value to a customer's investment. Since founding Anamise in 2015, the consulting work delivered by the Anamise team has been well received by high profile Australian organizations.

Testimonials:
"Alex has worked with SFS and Brilliant Energy for the past year. He has been instrumental in developing analytical tools for the development of our energy contracting business. He has a good business sense which enables him to make commercial decisions that back up his analytical intellect." – Kevin Heydt, Solar Financial Solutions

"Hats off to the Anamise team for their comprehensive analysis of energy data, application of innovative research and unique mathematical models to produce easy to understand visual data models and representations of the most financially and energy beneficial implementation of solar to buildings." – Karin Wunsch, Townsville City Council

Experience:
Alexander has extensive experience in the solar industry having worked as a quality assurance team member at the 100MW First Solar Pilot Project. He has been educated at the prestigious University of New South Wales School of Photovoltaic and Renewable Energy. Furthermore, he has worked as a project manager for MPower Group on the SP Ausnet residential battery energy storage project.

2. Course information

Units of credit: *45 Clean Energy Council CPD Points*

Pre-requisite(s): Basic understanding of energy, maths and computing.

Teaching times and locations: Times and locations may be accessed on the Anamise website. www.anamise.com.au

Note: Courses may be scheduled by calling Alexander on 0423 070 843.

2.1 Course summary

Course participants will improve their ability to develop an optimised commercial solar system design. The main outcome of the course will include applying data based methodology to optimise the financial forecasting of a solar system investment. This methodology involves comparing the site load profile to the solar generation profile as recommended in section 9.1 of the Clean Energy Council's 30 – 100 KW DESIGN GUIDELINES. The course will involve both practical and theoretical lessons and assessments.

2.2 Course aims

The course empowers more solar businesses to sell and design commercial solar systems. Furthermore, investors in commercial solar systems will be provided with knowledge to make optimised investment decisions. An understanding of:

- Sun path and power density calculations
- Solar design parameters
- Financial forecasting
- How a computer can be used as a tool to add value to solar designs

2.3 Course learning outcomes (CLO)

At the completion of this course participants will be able to:

- Calculate the angle between the sun's position and a fixed solar array at a certain location time of the day.
- Use a computer to optimise solar system design parameters such as system size, tilt and orientation.
- Have an introductory understanding of the programming language Visual Basic for Applications.
- Read Discounted Cash Flow models in Excel.
- Publish and interpret data graphed and presented in reports.

2.4 Relationship between course learning outcomes and assessments

Course Learning Outcome	LO Statement	Related Tasks and Assessments
1	Participants will complete activities based around pveducation.org to gain an understanding of the sun's position and power density	Demonstration of sun position and power density through an open book worksheet assessment.
2	Participants will use different tools such as the Excel Add-In Solver to determine the maximum value of a function with different variables	Participate in a guided tutorial teaching designers and investors how to use a data driven design methodology
3	Participants will learn about named ranges, constants, and variables. They will be able to copy and paste Excel ranges automatically using VBA.	A walk-through sheet will provide systematic instructions allowing participants to include new site generation data in the software suite.
4	Emphasis will be placed on the time value of money and the types of finance available for solar system investment.	Participants will model and compare different types of solar investments.
5	Emphasis will be placed on data storytelling, and creating a business case for solar investment.	Practical presentation given by participants pitching solar investments.

2.5 Feedback on Assessments

Feedback will be given to course participants both during the assessment activities and after presentations are given. Participants will be assessed as either competent or as requiring further training. The course is designed so that all engaged participants with some form of electrical background such as electrician; engineer or sustainability officer should be marked as competent. In the case of an engaged participant requiring further 1 on 1 training, tuition will be provided at the day's end.

3. Strategies and approaches to learning

3.1 Learning and teaching activities

Learning and teaching activities will include a combination of tutorials, computer lab work and group presentations. Participants will each be provided with a computer to participate in the tutorial and lab work. Participants will develop problem-solving skills through discussion and research activities. An open-book learning approach will be implemented to develop participants' research skills. Topic discussions will be encouraged to monitor and guide the development of participants throughout the course. Communication skills will be practiced and developed to ensure solar designers can convey the value of solar investments to key stakeholders.

3.2 Expectations of students

To pass the course participants will be required to:

- Complete all activities and assessment tasks.
- Engage in discussion by providing comments, questions, insights, ideas and help to other participants.
- Shown evidence of completing prior reading material.
- Behave in a responsible, courteous and respectful manner

4. Course schedule and structure

This course consists of 8 hours of class contact hours. You are expected to take an additional 1 hours of non-class contact hours to complete readings prior to course commencing.

Time	Topic	Activity	Related CLO
9am	Introduction	Discussion/Admin	All
9:30am	Sun Position and Power Density	Activity 1	1.
10:30am	Morning Tea		
10:45am	Solar Optimisation	Activity 2	2.
11:45am	Engineering Design	Activity 3	3.
12:45pm	Lunch		
1:15pm	Financial Forecasting	Activity 4a	4.
2:15pm	Business Case Presentation	Activity 5	5.
3:15pm	Conclusion	Discussion/Admin	All
4:00pm	Day End		

4.1 Course Materials

Anamise will supply all course materials including:

- Activity Worksheets
- Computers
- Software
- Calculators
- Stationary
- Sample Electricity Meter Data
- Sample Electricity Bills

Participants may bring their own calculator and stationary, but personal computers will NOT be permitted.

5. Readings and Resources

Participants will be required to read one of the following resources in full before commencing the course:

- PVEducation.Org (C. Honsberg, S. Bowden) – *Chapter 2.4 "Terrestrial Solar Radiation"* Beginning at page: *pveducation.org/pvcdrom/2-properties-sunlight/solar-radiation-earths-surface*
- Applied Photovoltaics (S. Wenham, M. Green, M. Watt, R. Corkish) – Chapter 1 "The Characteristics of Sunlight" Available from the University of New South Wales Bookshop:
  www.bookshop.unsw.edu.au

6. Administrative Matters

Please feel free to contact Alex with any questions or to arrange a course near you.

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