Unit ID 1668

Domain SOLAR INSTALLATION
Title: Design Photo Voltaic Pumping
Level: 3 Credits: 3

Purpose

This unit standard specifies the competencies required to design a Photo Voltaic Pumping system. It includes the following elements: perform site assessments, determine water demand and pump flow, determine the potential of the borehole, determine the power load and pump size, calculate module size, determine protection devices, determine data acquisition systems and determine storage capacity. This unit is intended for those who work as solar technicians.

Special Notes

1. Entry information:

   Prerequisites
   - *1642: Demonstrate basic knowledge of electricity*
   - *1647: Draw and interpret basic technical drawings*
   - *1649: Perform basic estimations, measurements and calculations*
   - *1655: Develop and interpret intermediate technical drawings*
   - *1643: Demonstrate basic knowledge of environmental issues relating to solar energy installations*
   - *1645: Demonstrate knowledge of plumping principles*

2. To demonstrate competency, at a minimum, evidence is required of calculating correct sizes of modules, storage, cables and control units as well as drawing and interpreting schematic drawings of complete systems using common and standard symbols including labelling all components and connections correctly.

3. Tools, equipment, accessories and materials may include but are not limited to removing/fixing tools, calculators, pencil/pen, manufacturers' manuals and guides.

4. Assessment evidence may be collected from drawings, real workplace or an appropriate simulated realistic environment in which system designs are carried out.

5. Performance of all elements in this unit standard must comply with all relevant workplace requirements and manufacturers' specifications.

6. Glossary of terms:
   - '*PVP'* refer to Photovoltaic Pump.
   - *'AC'* refers to Alternating Current.
   - *'DC'* refers to Direct Current.

7. Regulations and legislation relevant to this unit standard include the following:
    - Labour Act No. 11 of 2007.
    - Petroleum Products and Energy Amendment Act No. 2 of 2005.
    - National Energy Fund Act of 2000.
    - Gas Act (Draft 2b).
    - Occupational Health and Safety Regulations No. 18, 1997 and all subsequent amendments.
    - ISO 14001 (Environmental Management Standard) and all subsequent amendments to any of the above.

Quality Assurance Requirements

This unit standard and others within this subfield may be awarded by institutions which meet the accreditation requirements set by the Namibia Qualifications Authority and the Namibia Training Authority and which comply with the national assessment and moderation requirements. Details of specific accreditation requirements and the national assessment arrangements are available from the Namibia Qualifications Authority on www.namqa.org and the Namibia Training Authority on www.nta.com.na

Elements and Performance Criteria

Element 1: Perform Site Assessment (Borehole data, including water quality)

Range

Site assessment may include but is not be limited to workplace inspection, equipment defect identification, assessment of conditions and hazards, borehole information, water quality and determination of work requirements.

Performance criteria

1.1. Angle of the array is determined.

1.2. Factors affecting solar power generation are determined.

1.3. Power supply for construction available on site is explained.

1.4. Daily insolation is explained.

Element 2: Determine water demand and pump flow

Performance criteria

2.1 Quantity of water required is calculated (litres per day).

2.2 Peak flow rate is calculated.

2.3 Pipe diameter is determined.

2.4 Peak velocity is calculated.

Element 3: Determine the potential of the borehole

Performance criteria

3.1. The deepness of the bore hole is determined.

3.2. Water head is determined.

3.3. Depth at which the PV Pump will be installed is determined.

Element 4: Determine the power load and pump size

Performance criteria

4.1. Motor voltage at the design operating point is identified.

4.2. Electric power required to drive the pump motor is calculated.

4.3. Daily energy required to meet the water demand is calculated.

4.4. Pump size is determined.

Element 5: Calculate the size of the modules

Performance criteria

5.1. Peak sun hours is determined.

5.2. Total energy demand is calculated.

5.3. Total energy output by each module per day calculated.

5.4. Module energy output at operating temperature is calculated.

5.5. Number of modules required to meet daily energy is calculated.

Element 6: Determine the protection devices

Performance criteria

6.1. Protection devices are be defined.

6.2. Advantages and disadvantages of protection devices is explained.

6.3. Protection devices sizes are determined.

6.4. Use of floating switch is explained.

6.5. Earthing requirements are explained.

Element 7: Determine data acquisition systems

Performance criteria

7.1. Data acquisition is explained.

7.2. Advantages and disadvantages of different data is explained.

7.3. The systems hardware and software architectures are described.

Element 8: Determine storage capacity

Range

Storage capacity includes but not limited to batteries, and tanks.

Performance criteria

8.1. Days of storage desired explained.

8.2. Allowable depth of discharge is determined.

8.3. Required battery and tank capacity is calculated.

8.4. Number of batteries in series and parallel is calculated.

8.5. Number of tanks in series is determined.

Registration Data

Subfield:	Electrical Engineering
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