

|| SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

A project title and description with clear aims (300 words)

Machine learning optimised models for rainwater purification powered by renewable energy

The environment, water, and energy are indispensable stakeholders in the sustainable development of any society. Removing the contaminants from rainwater using membrane-based technology has the potential to solve the freshwater supply problem in numerous countries in the world including Mexico. Depending upon the locations of harvesting, rainwater may contain different types of microbial and chemical contaminants highly hazardous to human health. These include high level of lead (Pb), aluminium, Cr, Co, Ni, V and different forms of industrial and traffic wastes. Rainwater is also likely to contain faecal matter of squirrels, birds, possums, and rats deposited on the roof surface where the water is collected from. This faecal matter can contain hazardous bacteria, viruses, and protozoan pathogens. As a result, the collected rainwater in storage tanks could be a source of E. coli contamination. Rainwater therefore should not be used for drinking and other domestic purposes without proper treatment. Different types of rainwater treatment methodologies exist in different regions of the world. In many cases, the technology is of quite rudimentary level and is mostly powered by energy extracted from fossil fuels.

Through this studentship, we aim to develop models for a novel membrane-based technology to purify rainwater collected from existing infrastructures such as domestic roof surfaces as well as roof surfaces of public buildings. The models will be useful to fabricate portable rainwater purification technology easy to be implemented widely for mostly domestic and small community use. Machine learning/Artificial Intelligence (AI) based approaches will be used to optimise the developed models.

2. Project Scope

Three research project objectives

The model leading to system implementation will be designed based on annual precipitation level, and maximum renewable energy harnessing potential using PV/WT for appropriate locations in Mexico.

Machine learning/AI based approaches such as deep neural network (DNN) will be used for the purpose of location selection in the target areas in Mexico using metrological inputs such as annual precipitation, solar irradiation and temperature.

Machine learning algorithms will also be used to identify optimum component selection using predicted metrological parameters, energy demand of the system and component costs.

The system will then be modelled mathematically and an interactive virtual model will be developed.

3. Desired Skills from the Student

Key skills needed for the PhD project

Basic knowledge in Chemical/Mechanical Engineering

4. Supervisory Team

Add supervisory team details

Primary: (Name (inc title): Dr M Hasan Shaheed

Secondary: (Name (inc title): Professor Pankaj Vadgama