

# **Phase Shifting Transformer Design and Fabrication**

## **Motivation**

Utility power is taken for granted from the consumer's point of view. Flip the switch and the power in your house or office is turned on, but where does that power come from? From the utilities point of view it comes from coal fire plants, nuclear power plants, hydroelectric dams or geothermal sites. Now as of recently utilities have had to integrate solar and wind generation, two variable and weather dependant resources. With so many different sources of generation coupled with transmission lines and substations, there are a lot of challenges involved in providing your house with electricity.

One of these challenges the utility faces is to coordinate and direct all of the various sources of power so that the customer receives uninterrupted and efficient delivery of electricity. There are many different ways to control power flow; one of these solutions is a phase shifting transformer. This type of transformer induces a phase shift in its connected transmission line, which helps to control the amount of power sent through a transmission line. This control allows for even power distribution on the various transmission paths the electricity takes as it travels from the various sources to you home making the electricity you use more efficient and more economical.

## **Objective**

There are many different designs for a phase shifting transformer, but all comprise of a series injection winding and an exciter winding. The series winding injects the needed voltage to produce the phase shift while the exciter winding is variable and determines the amount of phase shift produced.

This project will focus on the design and fabrication of a phase shifting transformer, both the series and exciter components. The design will involve choosing the most common phase shifting design and specifying and ordering or building the appropriate winding configuration. Additionally, the tap changer, an integral component used to control the amount of phase shift, will require an appropriate design and will be fabricated at the UI ME machine shop.

Ultimately, this transformer will be used for testing and experimentation here at the ECE department's power laboratory.

## **Deliverables**

- Simulation model to test initial design
- Two tank transformer design with access to appropriate measurements points
- Successful and precise tap changing device
- Sufficient phase shift and phase reversal capability
- Lab testing verify proper operation

## **Proposed team makeup**

1 EE

2 ME