

Introduction

- Wind turbine blades ice in cold climates
- Decreased efficiency (36%)
 - Increase mechanical loads

GE wants technical evaluation of microwave deicing option

Engineering Requirements

1) Microwave Generator Design

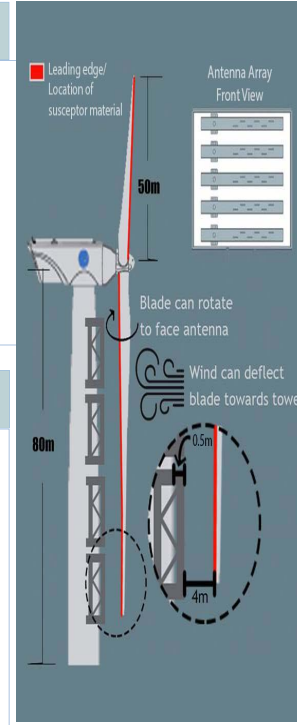
- Air Cooling
- ### 2) Susceptor Materials
- At least 50% microwave absorption
 - Add less than 1% to blade weight
- ### 3) Antenna Design
- 1-2kW/m² over 1m span at 4 m away
 - Radiation at ground level < 5mW/cm²
- ### 4) Package Design
- Package < 0.5m radial extent from tower
 - NEMA 4

Background

- Blade and Ice do not absorb microwaves.
- Susceptor materials needed to absorb microwaves.
 - 50% + efficiency identified
 - Application method unidentified
- Heating of > 500 W/m² to deice in < 1 hour
- Magnetron preferred microwave source: cost, size
- Blade bends toward tower, limits module size
- Antenna needed to direct microwaves
 - Slotted Waveguide chosen to fit in module

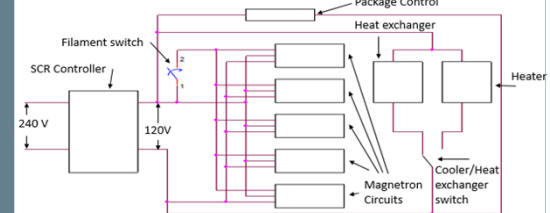
Semester Objectives

- Design test system to deice 1 meter blade section
- Microwave Generation – select microwave source and thermal management
 - Antenna – design to deliver 1-2 kW/m² microwave power 4m away
 - Package – design module for antenna array suitable for tower mounting
 - Susceptor Materials – identify materials and application methods
- Provide insight to full scale feasibility

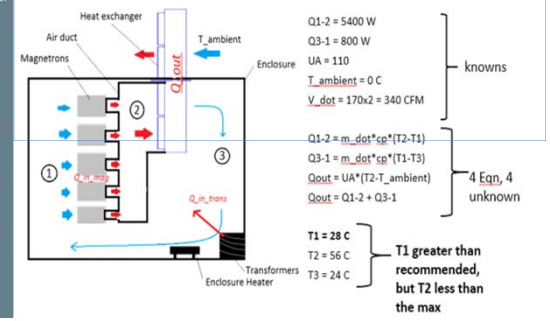


1. Microwave Generator and Cooling

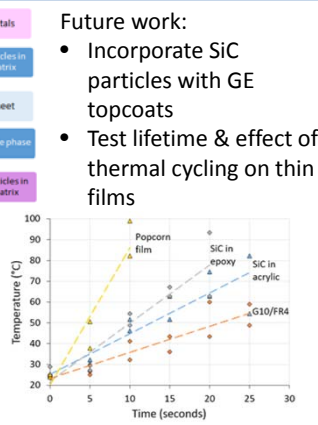
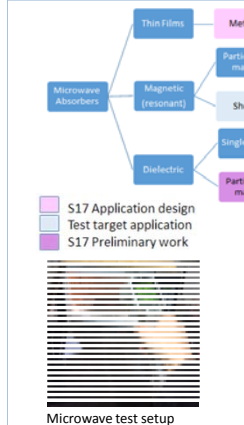
Circuit Diagram



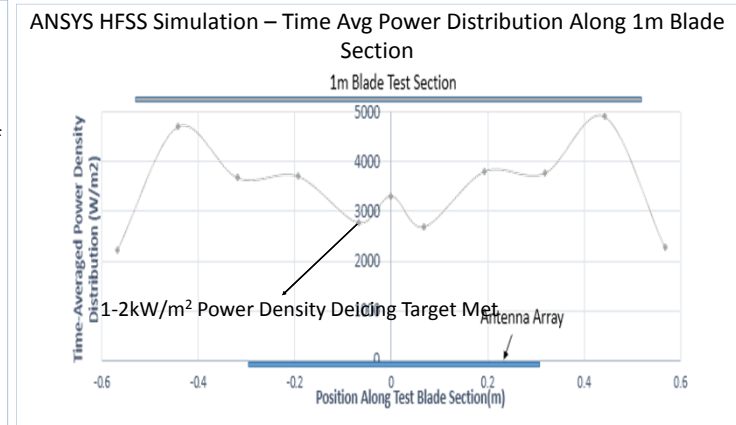
Air Flow Diagram



2. Susceptor Materials



3. Antenna Design



4. Antenna Array Package Design

