# HV Insulation

## NIST/DOE Workshop on Enabling Technologies for Next Generation Electric Machines

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GE Global Research
8 September, 2015

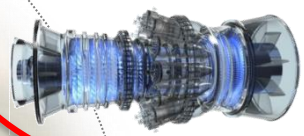
**Imagination at work.**

# GE businesses

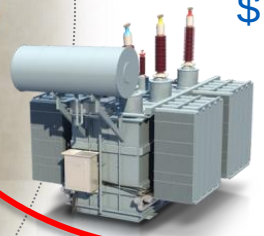
**Aviation**
$20B

**Healthcare**
$18B

**Power & Water**
$28B



**Energy Management**
$7B



**Transportation**
$6B

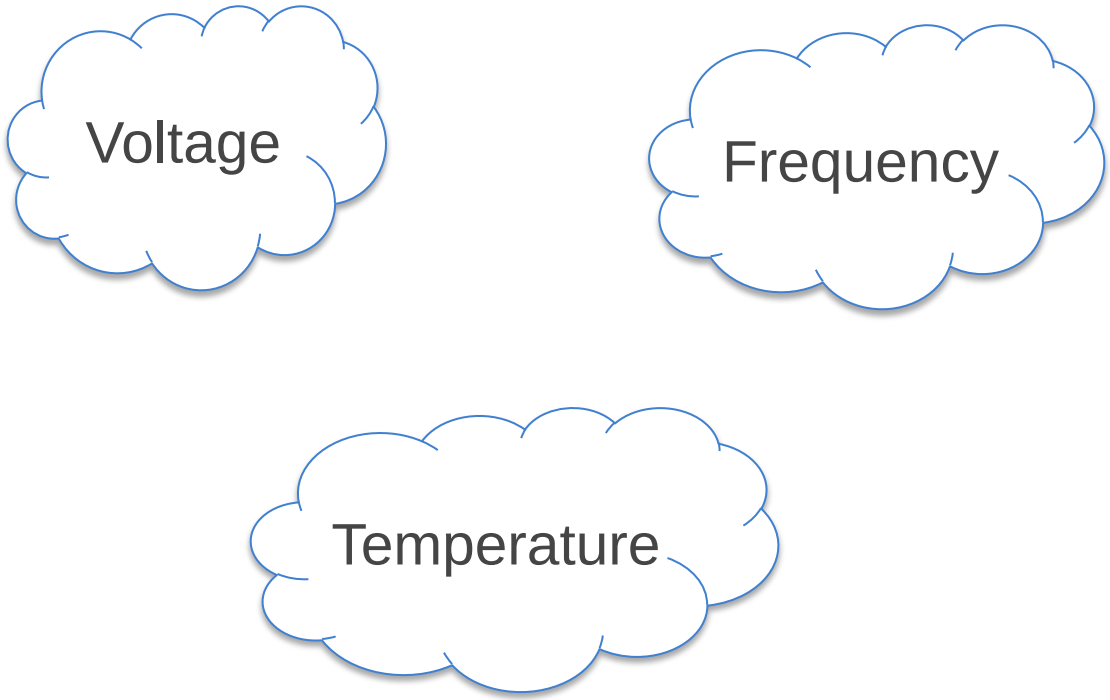

**Oil & Gas**
$15B

**Appliances & Lighting**
$8B

## R&D Spending = $5+B/year

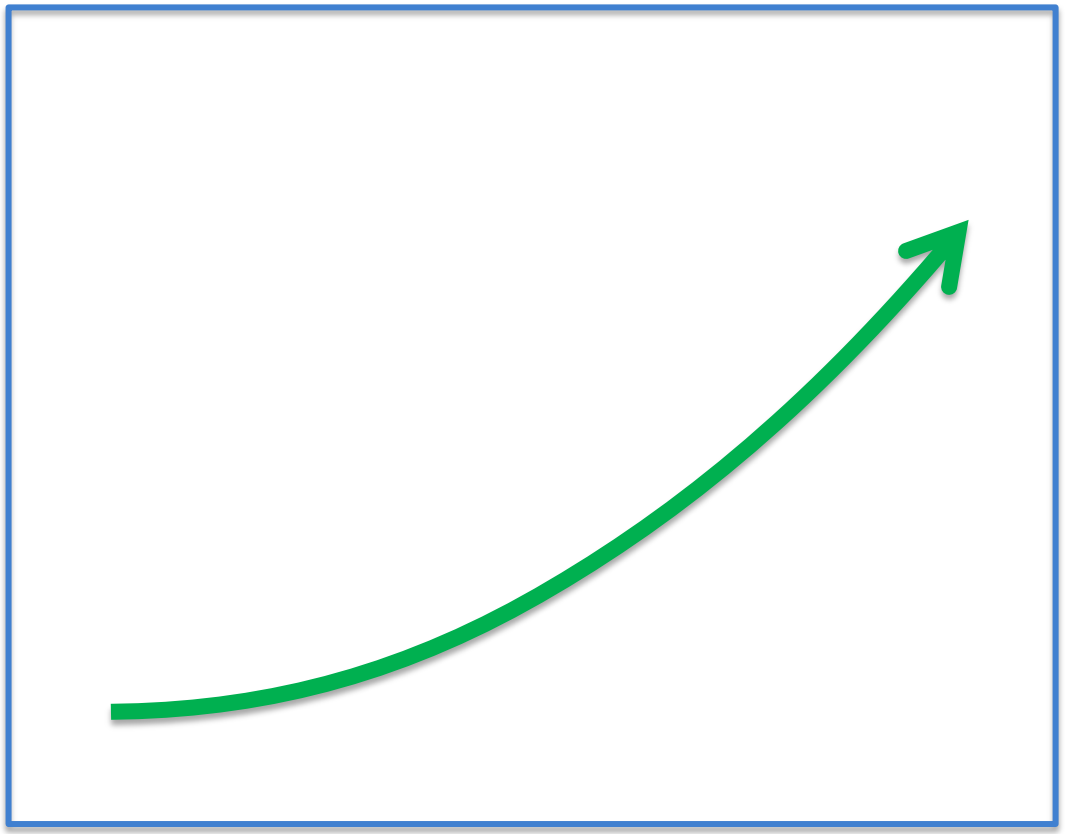
# Main factors affecting insulation life

## Sinusoidally fed:



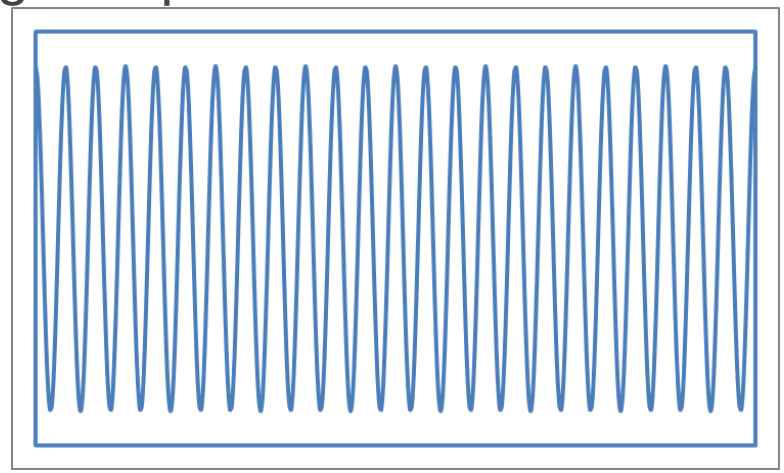
# Industry trends

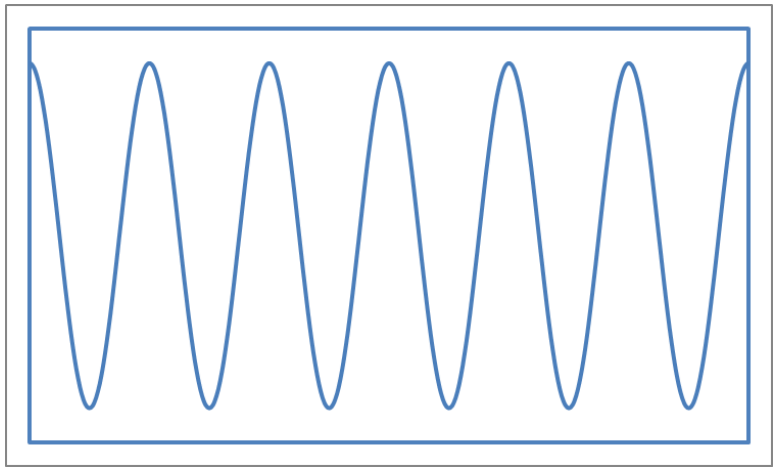
Power density
Torque density
Temperature



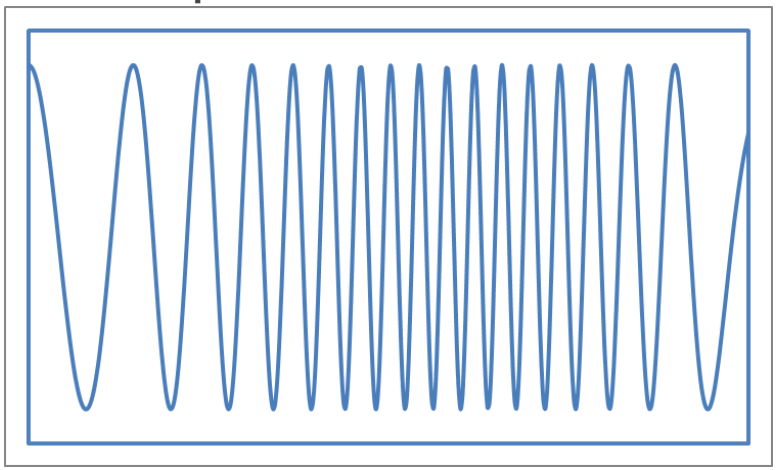
# Industry trends

Higher speed



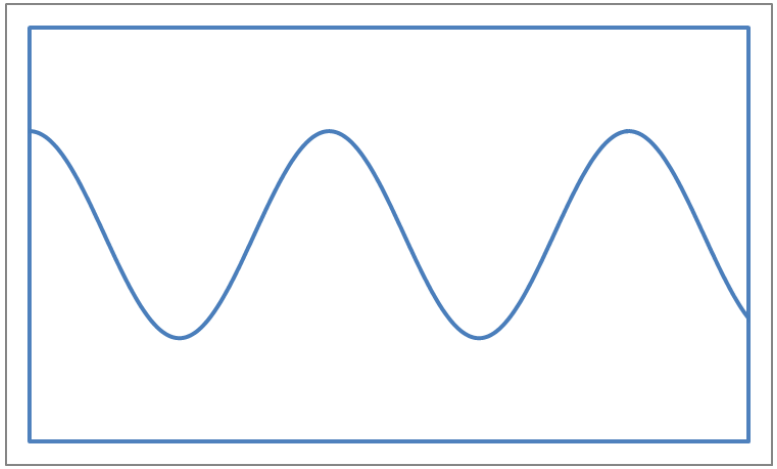


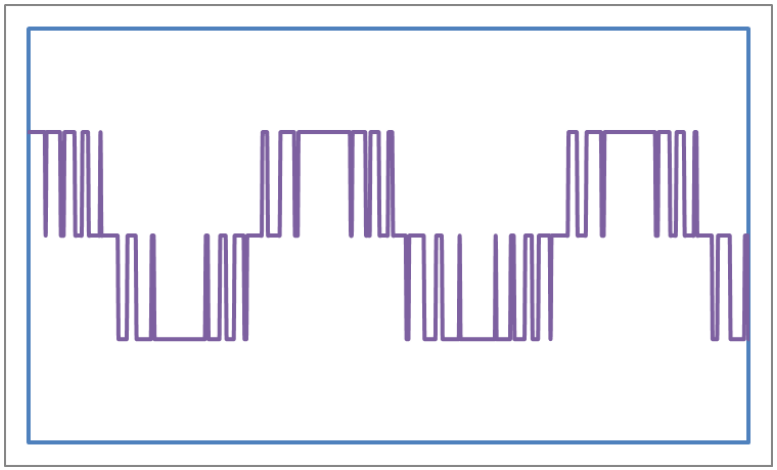
Variable speed



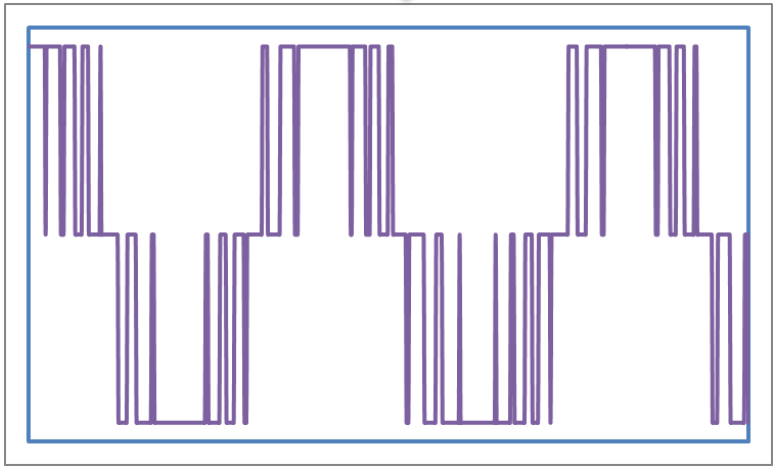
# Industry trends

Converter fed



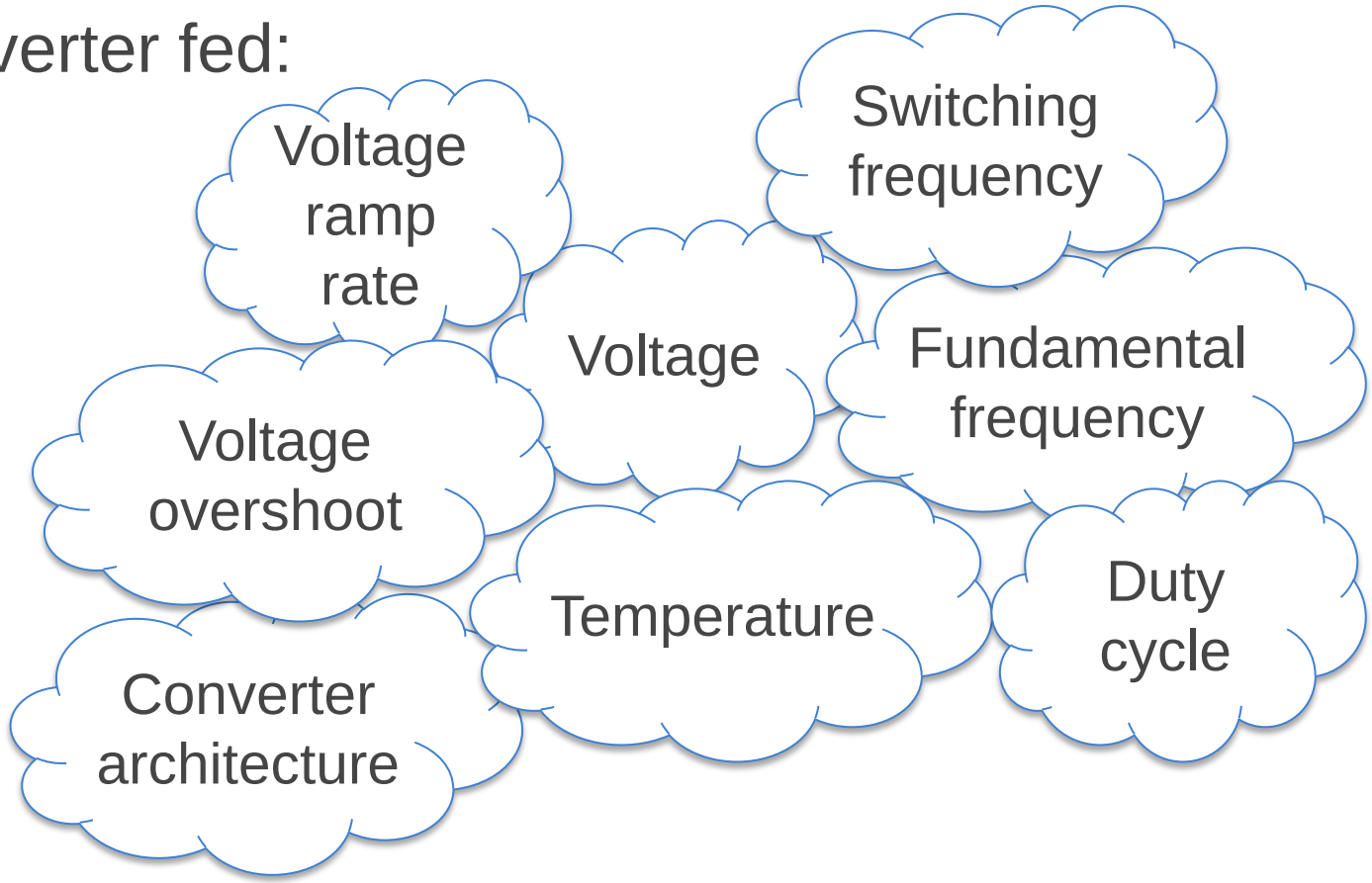


Higher voltage



# Main factors affecting insulation life

Converter fed:




Interactions among the factors generate additional complexity

# Do we need to do something? Yes!

CIGRE Study Committee A1

**PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP (1)**

| | |
|---|---|
| **WG* N° A1.53** | **Name of Convener: A. K. GUPTA (IN)**<br>**E-mail address**: akgupta07@ntpc.co.in |
| **Technical Issues # (2): XXXX** | **Strategic Directions #(3): 2** |
| **The WG applies to distribution networks (4): Yes** | |
| **Title of the Group: Guide on Design Requirements of Motors for Variable Speed Drive Application** | |

fans, condensate extraction pumps, compressors, coal conveyors, coal feeders and ventilation system equipment. As the penetration of VFDs in industry and in power stations has increased several motor failures have been reported worldwide and it has become clear that manufacturers don't have common design criteria for inverter grade motors. The variety of VFD technologies available stresses the motor insulation differently. Thyristor based

# What do we need to do?

- Could just add more insulation build…

# What do we need to do?

- Need to understand fundamentals of aging & life

$$Remaining\ Life\ = \int dt\ f(main\ factors)$$

# What do we need to do?

- Use fundamental knowledge to innovate high-voltage insulation systems
  - Turn, phase, ground, grading, and armor
  - Computational materials discover
  - Temperature, thermal conductivity, breakdown strength, endurance, PD/corona resistance
- Materials
  - New polymers/epoxies/resins and inorganics
  - Nano…
- Processes
  - New ways of using old materials
  - Materials conversion
  - Manufacturing