THAT IS ONE HOT TRANSFORMER!

Logan Clarke

APEX Summit 2019

Mitton ElectroNet

1

Why do we want to run transformers hard

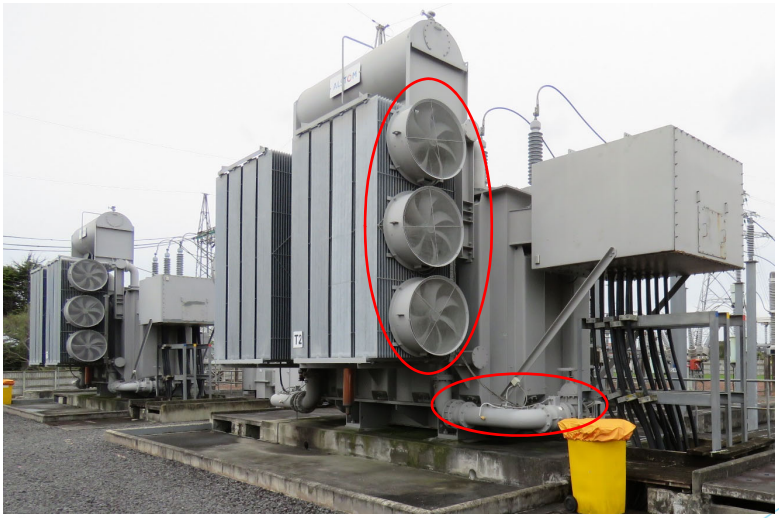
2

If transformers get too hot they fail

Mitton ElectroNet

3

How transformer cool themselves down



Mitton ElectroNet

4

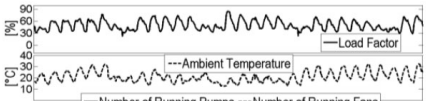
How can we measure a transformers temperature?

Mitton ElectroNet

5

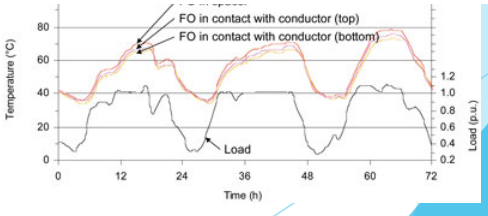
How devices do the calculations

$$\therefore \frac{dI_{DS}}{dT} = \mu_n(T_0)\left(\frac{1}{T_0}\right)^{-n}(-nT^{-n-1})C_{ox}(W/L)\{V_{GS} - V_{Th}(T_0)\}V_{DS}$$
$$+ \mu_n(T_0)\left(\frac{1}{T_0}\right)^{-n}(-nT^{-n-1})C_{ox}(W/L)\kappa T V_{DS} + \mu_n(T_0)(T/T_0)^{-n}C_{ox}(W/L)\kappa V_{DS}$$



BLACK MAGIC

$$+\left(\frac{nT_0}{T}\right)\mu_n(T_0)C_{ox}(W/L)\left(\frac{T}{T_0}\right)^{-n}\kappa V_{DS}$$
$$= \mu_n(T_0)C_{ox}(W/L)\left(\frac{T}{T_0}\right)^{-n}V_{DS}\left[\left(-\frac{n}{T}\right)\{V_{GS} - V_{Th}(T_0)\} - n\kappa + \kappa + \left(\frac{nT_0}{T}\right)\kappa\right]$$
$$= \mu_n(T_0)C_{ox}(W/L)\left(\frac{T}{T_0}\right)^{-n}V_{DS}\left[\left(-\frac{n}{T}\right)\{V_{GS} - V_{Th}(T_0)\} + \left\{-n + 1 + \left(\frac{nT_0}{T}\right)\right\}\kappa\right]$$
$$= \mu_n(T_0)C_{ox}(W/L)\left(\frac{T}{T_0}\right)^{-n}V_{DS}\left[\left\{1 - n + \left(\frac{nT_0}{T}\right)\right\}\kappa - \frac{n}{T}\{V_{GS} - V_{Th}(T_0)\}\right].$$



Mitton ElectroNet

6

What was done back in the past

Mitton ElectroNet

7

Henderson Substation - Ashridge 852

Mitton ElectroNet

8

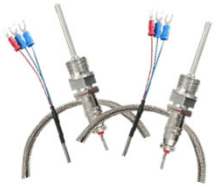
Mangere Substation – SEL2414

Mitton ElectroNet

9

Almost full redundancy

- Power supplies
- Cables
- Devices
- Oil probes
- Transformer CT's



Mitton ElectroNet

10

Questions

Mitton ElectroNet

11