THE PWI

EMPOWERING RAILWAY ENGINEERING

Warming Rail and Harvesting Wind

- Efficiency and Sustainability Though The Power of Academic Research
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5 November, Birmingham

#TRACKRENEWALS

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EMPOWERING RAILWAY ENGINEERING

Mobile Wind Turbine

SOUTH RAIL SYSTEMS ALLIANCE

The Need for a Mobile Wind Turbine

Initial Problem

Electricity generated on site by diesel power

- Not Sustainable (fossil fuel)
- Noise
- Toxic Emissions (CO2, CO)
- Maintenance
- Refueling (Fuel Spills, Logistics)
- Cost

Progress

Battery Storage Units

- Smaller Generator charges battery storage unit

Solar Harvesting.

- The electricity produced is then stored into a battery when required.
- The battery can power directly welfare units and lighting or can be used to charge other batteries for tools.

Reduced Demand

- Welfare doors and windows interlocked to turn off heaters when open
- Insulated Cabins, PIR LED Lighting, Peak load smoothing, Energy efficient appliances

In Flight

Current Problem

Solar harvesting is dependant on day light so still requires a diesel generator to keep battery storage unit charged.

Potential Solution

Use Mobile Wind Turbine to replace / supplement solar power.

Issue

Wind Turbines are large fixed plant.

Solution

A mobile wind turbine that can be transported to site and operate safely to charge battery storage units.

Who We Are

Murcott Energy Limited

- Based in Worcestershire, specialising in transportable wind turbines
- Serving rail, construction, and utilities sectors
- Also providing engineering consultancy and FEA services
- Focused on innovative, deployable renewable energy systems

How it Began

The University of Birmingham Connection

- In 2020, Murcott Energy had academic research support from the University of Birmingham ‘ATETA’ Program, to develop our wind turbine clutch mechanism.
- At time , the Murb was at TRL 6: ‘Prototype demonstration in a relevant environment’
- Nick Matthews of Network Rail approached us via University of Birmingham.
- The recommendation followed onto collaboration
- Objective: create a portable wind turbine for off-grid welfare cabins
- Designed for use across UK rail infrastructure

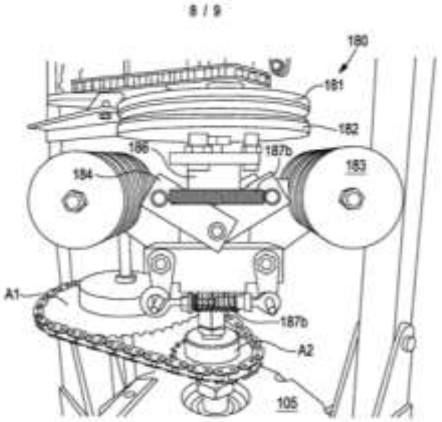


Figure 13

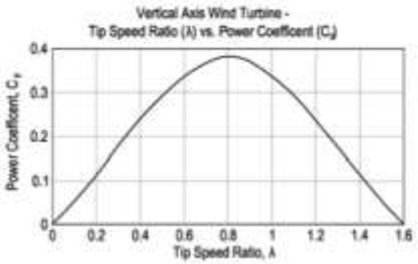
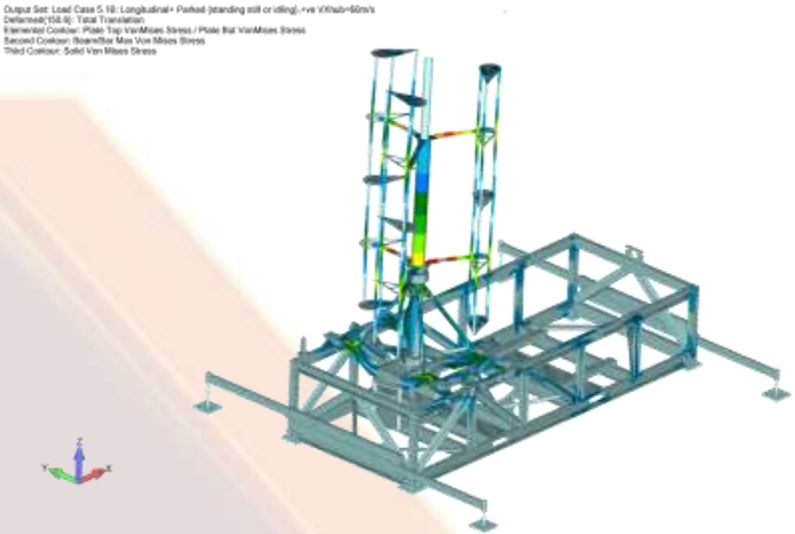


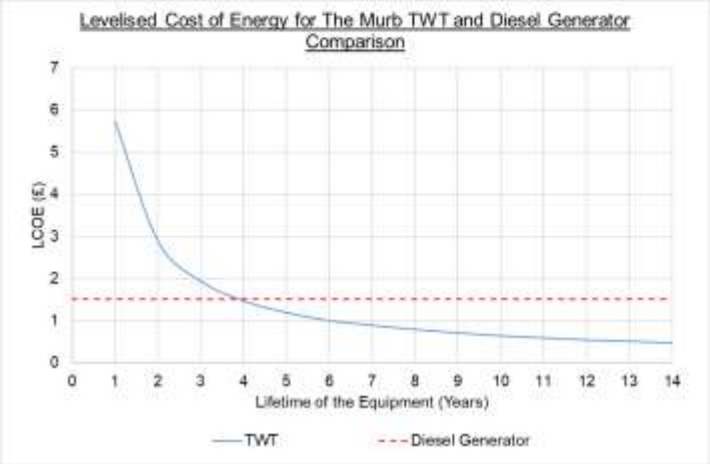
Figure 14

Design & Development



Turning Concept into Design

- Defined user and system requirements with Network Rail
- Targets: 10–15 kWh/day generation and carbon reduction
- Must be deployed within 60 minutes
- Optimised for mobility, reliability, and minimal maintenance



MURCOTT ENERGY

Design & Development

From Concept to Reality

- Wind turbine built and installed at North Pole Depot, London
- Now at TRL 7: Prototype demonstration in an operational/commercial environment
- Undergoing 6–12 months of testing, aiming for TRL 8: System completed and qualified
- Powers battery storage units for site welfare cabins
- Data collection to validate performance and durability

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EMPOWERING RAILWAY ENGINEERING

Rail Warming for Stressing

Schedule 8 minutes and costs associated with Track Renewals ESRs

Year	PfPi Minutes	PfPi Cost
24/25	1035	£43,342
23/24	3183	£220,083
Total	**4218**	**£325,425**

Other Impacts
- ESR Equipment
- Staff Costs
- Reputational Cost
- Track Access

Topic: How can track renewals heat related ESRs be minimised?
Goal: Install track with an SFT of 27ºC to 30ºC in core possession.
Reality: Leading cause for heat related ESRs in track renewals is track not being stressed in core possessions due to time constraints.
Opportunity:
- Warm rail to 27 to 30ºC on critical renewal path ahead of clipping up before top stone drop. This will save duplication by not having to unclip and re-clip the rails again for tensor stressing.
- Avoid additional stressing shift in follow up access circa £25k (£10K tensors and rollers, £1.5k RRV, £13,5k Labour)
- Potential construction savings of £20k per core.
- Minimise heat related ESR post track renewals.

What: Explore if rail warming can be used to raise rail installation temperature ahead of clipping up rail.

SOUTH RAIL SYSTEMS ALLIANCE

Possible Solutions

RIRL 3: Proof of Concept

TRL 3: analytical and experimental critical function

Use induction heating to raise the rail installation temperature ahead of clipping up the rail is a promising approach. Induction heating is efficient and can precisely control the temperature, making it suitable for this application.

RIRL 7: Initial Deployment

TRL 7: demonstration in an operational environment

Use of LPG Rail Warming to raise the rail installation temperature ahead of clipping up the rail is a promising approach. LPG heating is efficient and low cost, making it suitable for this application.

Rail warming

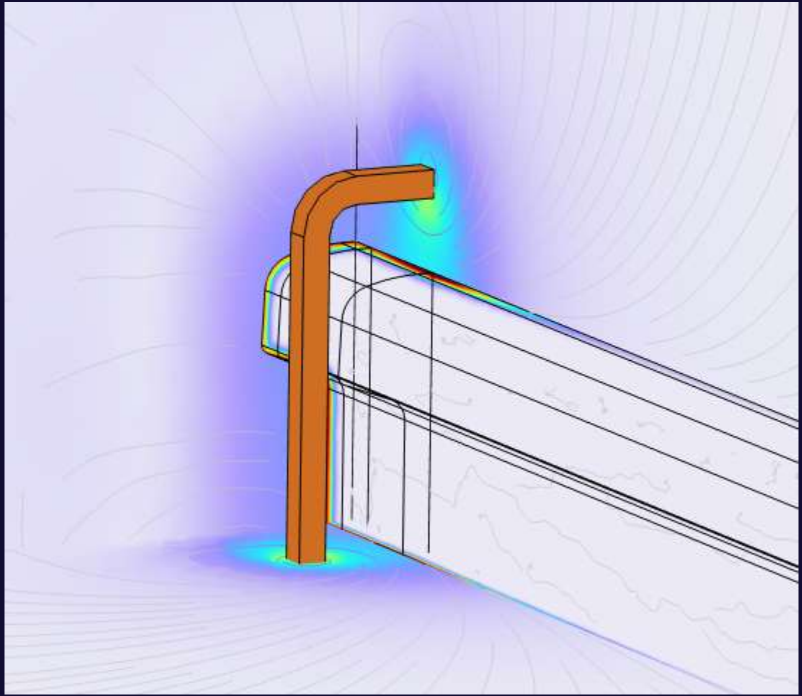
A thermo-electromagnetic simulation study for Induction heating

Name: Heather Nute

Date: 05/11/25

Exploring rail warming through simulation

A feasibility study



Introduction

The MTC & collaboration between engineering teams and Network Rail

Overview of rail warming

Simulation Technology

Use of advanced simulation tools to model rail warming effects and optimise heating strategies.

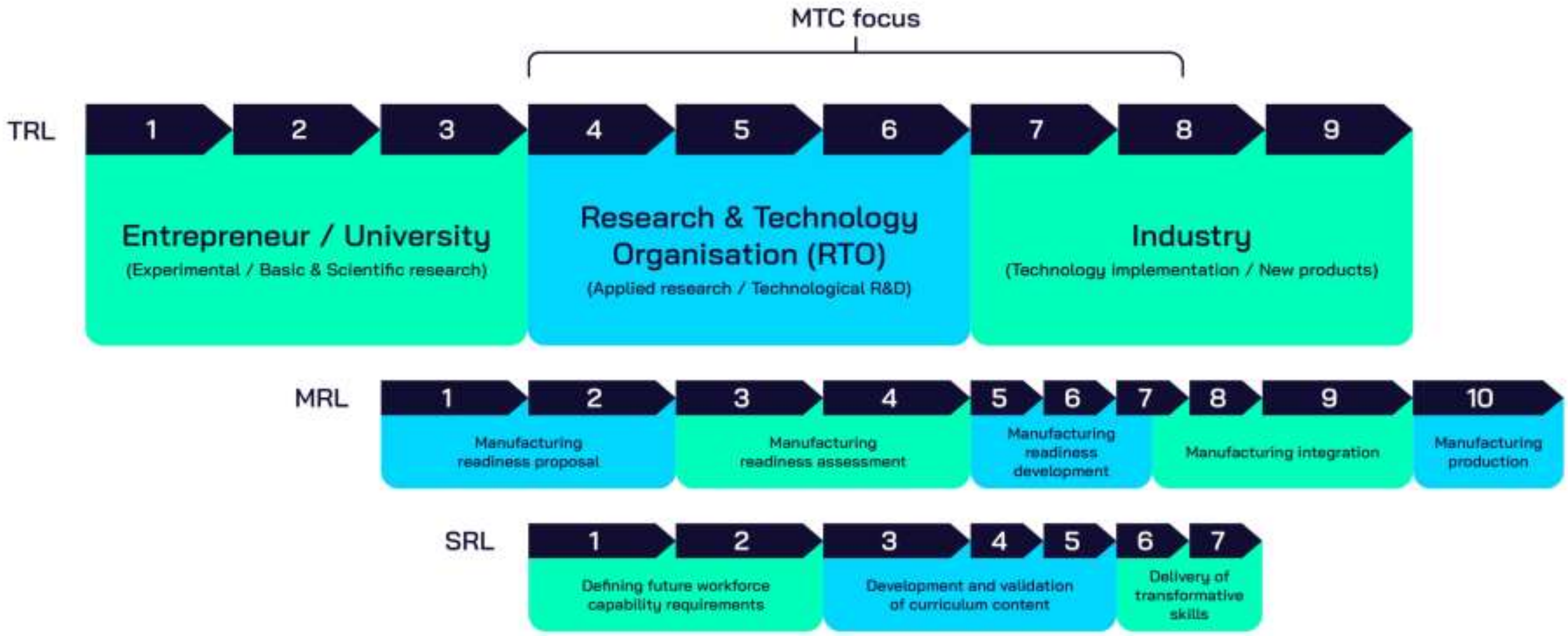
About us

Our purpose

To harness the power of our pioneering mindset and engineering excellence to positively impact society

- Independent Research Technology Organisation (RTO)
- Opened in 2011
- Opened training facility in 2015
- £120 million+ in turnover
- 1000+ staff members
  over 600 engineers & 100 apprentices

Bridging the valley of death



TRL = Technology readiness level MRL = Manufacturing readiness level SRL = Skills readiness level

Collaboration

How we work

Knowledge + capability

Partnership Overview

Network rail are members -we focus on combining expertise to achieve shared project goals.

Technical feasibility assessment

We evaluated the technical feasibility of the proposed solutions to ensure viability and effectiveness through our cross-sector knowledge and technical expertise

Business Case Development

We developed a comprehensive business case after analysis to outline benefits, costs, as project justification was a key objective of this work overall

The challenge

Thermal stress in rails

Thermal Stress in Rails

Rails experience expansion and contraction due to temperature fluctuations causing thermal stress.

Operational and Safety Challenges

Thermal stress leads to alignment issues impacting rail safety and operational reliability.

Heating during other processes?

Warming rail during thimbling/laying process saves time clipping/unclipping later.

Why Induction heating?

Induction welding to warming

Goal: warming rail to 30°C average

Fast and Precise Heating

Induction heating provides rapid and accurate heat directly within the metal, improving processing speed.

Localised Heating Benefits

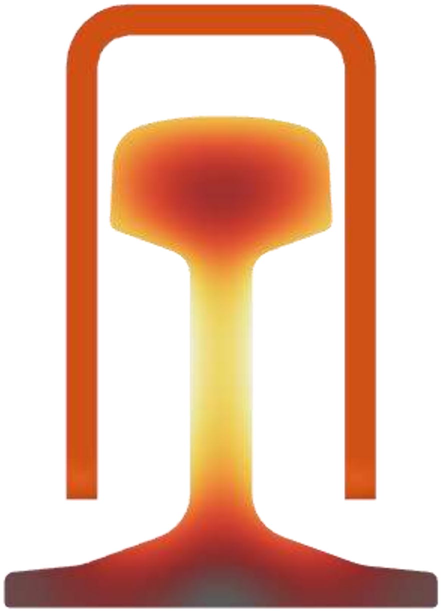
Localised heat application reduces energy waste and protects surrounding materials from damage.

Cost and Safety Advantages

Induction heating lowers costs by reducing energy usage and enhances safety by eliminating open flames.

Approach to feasibility

Simulation using COMSOL Multiphysics



Through rail temperature distribution

Simulation Methodology

Multiphysics software was used to model induction heating processes accurately for different coil designs using a quarter model of the rail and coil

Coil Design Testing

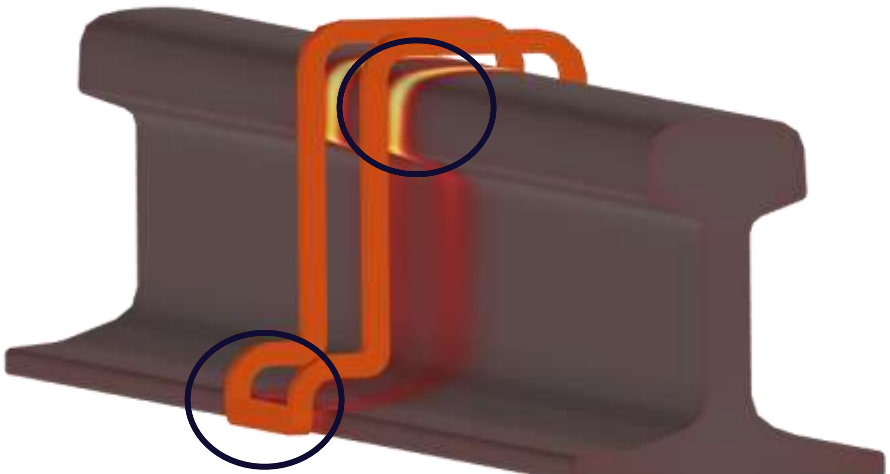
Two coil designs iterations were tested through simulation to evaluate their heating performance on rail profiles.

Heating Performance Evaluation

Heating performance for two rail profiles was assessed to improve the induction heating process.

Coil design

Iteration 1



Section of coil interference point and near-coil point

Initial Coil Design Issues

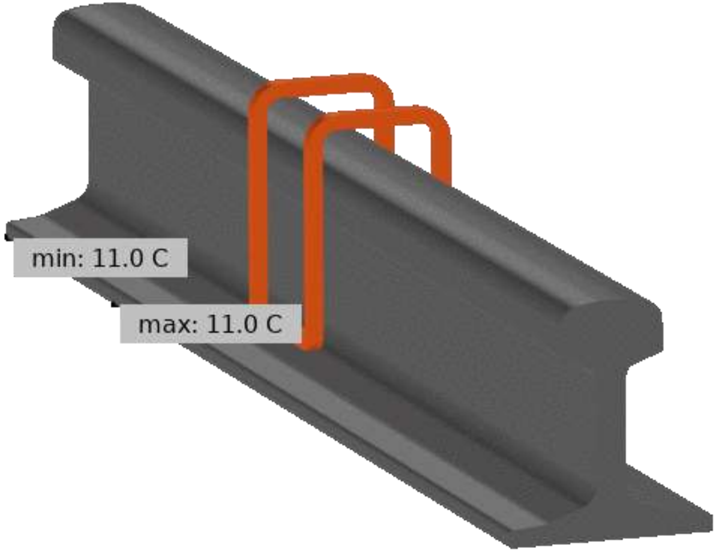
The first coil design whilst having enough power, caused uneven heating and interference with rail clips, affecting performance.

Feedback Impact

Customer feedback identified design flaws, prompting a necessary redesign to improve functionality.

Coil design

Iteration 2



EN56E1 coil design

No physical Interference

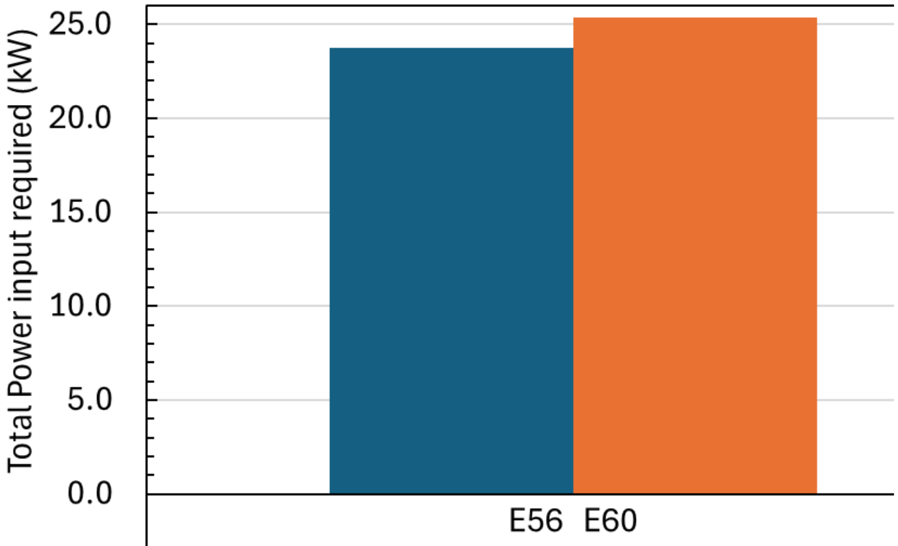
Design modifications remove interference, enabling practical usage

Improved Heating Distribution

The updated coil design achieves more uniform heating, enhancing efficiency and performance.

Moving coil scenario

Continuous heating



E56	23.8
E60	25.4

Modelling Moving Coil Heating

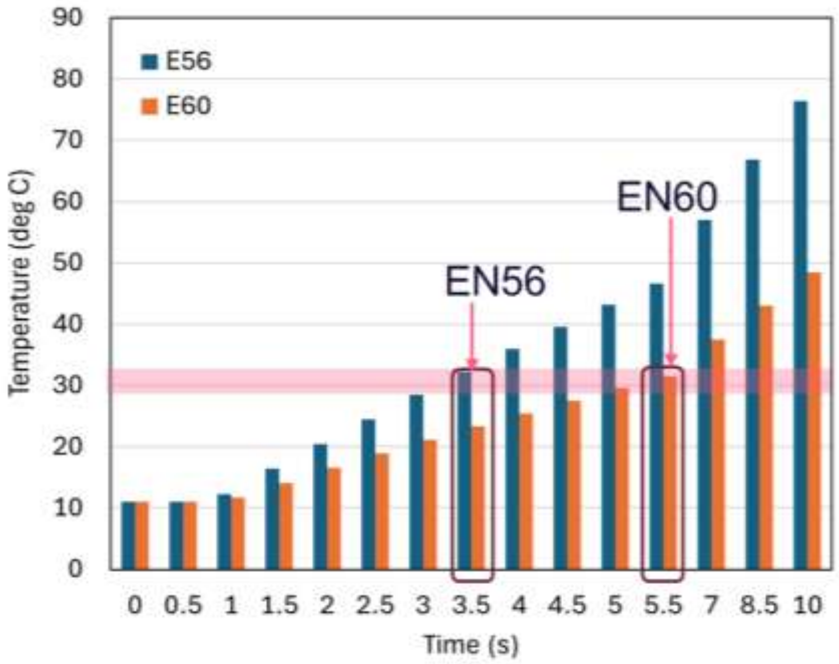
The moving coil heats a 200-metre rail over 45 minutes, demonstrating a similar performance of current technology used for the EN56E1 rail

Power Requirements

23.8-25.4kW is required to raise the temperature of the rail from 11 to 30 ºC

Results

Cross section temperature (static)



Average cross section temperature of rail under induction coil

Comparison of Rail Profiles

Simulation results compare heating efficiency between EN56E1 and EN60E2 rail profiles, highlighting differences.

Temperature Profiles Analysis

Temperature rise across rail sections reveals distinct heating patterns and efficiency metrics for each profile.

Areas for Improvement

Identified regions in rail profiles require optimisation to enhance heating performance and efficiency.

Summary

Inducting heating rail

Induction rail warming is feasible

200m of rail warmed in 45min

Further development required for optimisation

Saving of £750k/yr if implemented

Thank you

Contact: Heather Nute

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mtc where progress happens

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THANK YOU

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