

# **R&D ACTIVITIES AT GEECO**

by

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**Senior DGM, R&D**

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# INTRODUCTION

- **R&D inception in the year 2014**
- **About 2500 sq. ft. of dedicated space for inhouse R&D**
- **Inhouse custom–developed test facilities**
- **Continuous efforts for improved and sustainable solutions to meet customer requirements**
- **In-depth product knowledge & expertise**
- **Optimize operating conditions to significantly improve performance & efficiency of products with cost saving**
- **Edge over competitors**

# DSIR RECOGNITION

- Department of Scientific & Industrial Research (DSIR) – only government body that grants recognition to inhouse R&D units in industrial sector
- Only 1900 recognized R&D units in India as on 31 December 2016
- Prestigious certification that benchmarks & acknowledges R&D on an international level
- DSIR Recognition since 2019

दूरभाष/TEL : 26962819, 26567373 (EPABX) : 26565694, 26562133 सूचना का अधिकार RIGHT TO INFORMATION	फैक्स/FAK : 26562134, 26562122 वेबसाइट/Website : http://www.dsir.gov.in	 सत्यमेव जयते	भारत सरकार विज्ञान और प्रौद्योगिकी मंत्रालय वैज्ञानिक और औद्योगिक अनुसंधान विभाग टेक्नोलॉजी भवन, नया महरौली मार्ग, नई दिल्ली - 110016 GOVERNMENT OF INDIA MINISTRY OF SCIENCE AND TECHNOLOGY Department of Scientific and Industrial Research Technology Bhavan, New Mehrauli Road, New Delhi - 110016
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F. No. TU/IV-RD/4459/2021  
Dated: 14<sup>th</sup> July, 2021

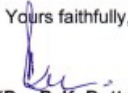
To  
M/s. Geeco Enercon Pvt. Ltd.  
No. D/C-6, SIDCO Industrial Estate,  
Thuvakudy,  
Trichy – 620 015  
(Tamil Nadu)

Subject: RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNIT(s)

Dear Sirs,  
This has reference to your application for renewal of recognition of your in-House R&D unit(s) beyond 31-03-2021 by the Department of Scientific and Industrial Research.

2. This is to inform you that it has been decided to accord renewal of recognition to the in-House R&D unit(s) of your firm at **No. D/C-6, SIDCO Industrial Estate, Thuvakudy, Trichy (Tamil Nadu)** upto **31.03.2024**. Terms and conditions pertaining to this recognition are given overleaf.

3. Kindly acknowledge the receipt of this letter.

Yours faithfully,  
  
(Dr. P. K. Dutta)  
Scientist - 'F'

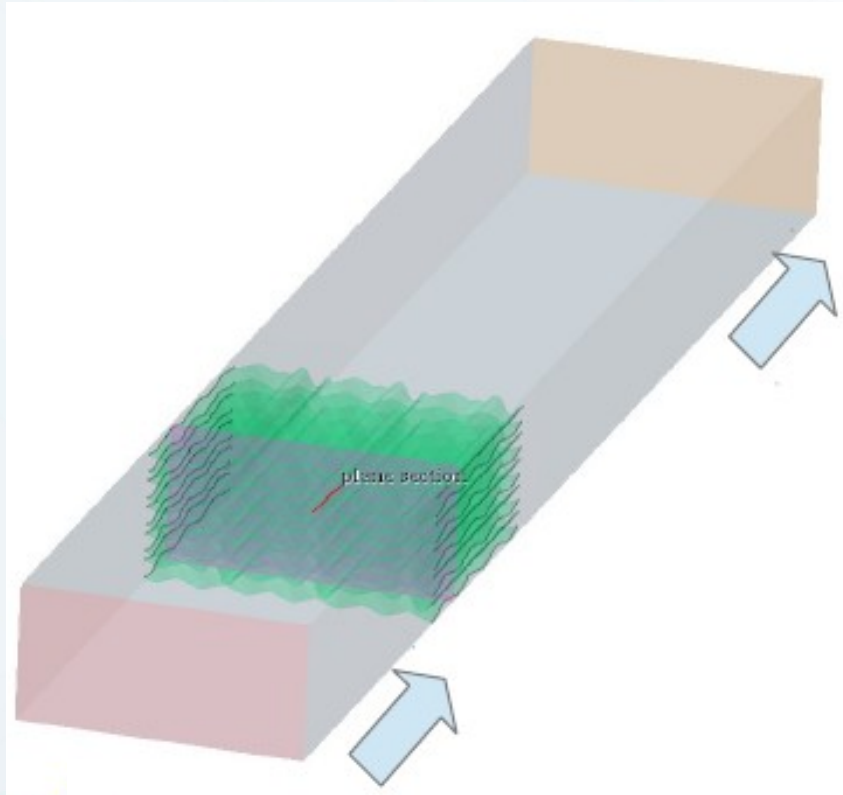
- **Forced Convection Apparatus**
- **CFD & FEA Modeling**
- **GEECO's Air Preheater (GAPH) Program**
- **Seal Test Apparatus**
- **Immersion Corrosion Testing**
- **Humidity Chamber**

# FORCED CONVECTION APPARATUS

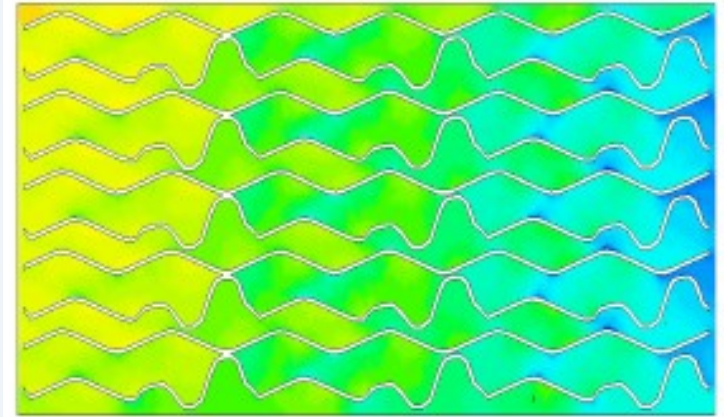
*To evaluate the performance of heating elements*



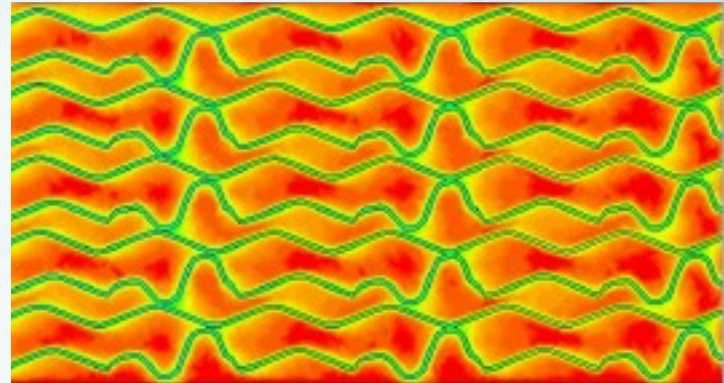
## *Flow & Heat Transfer Modeling of Heating Elements*



**PRESSURE  
CONTOUR**

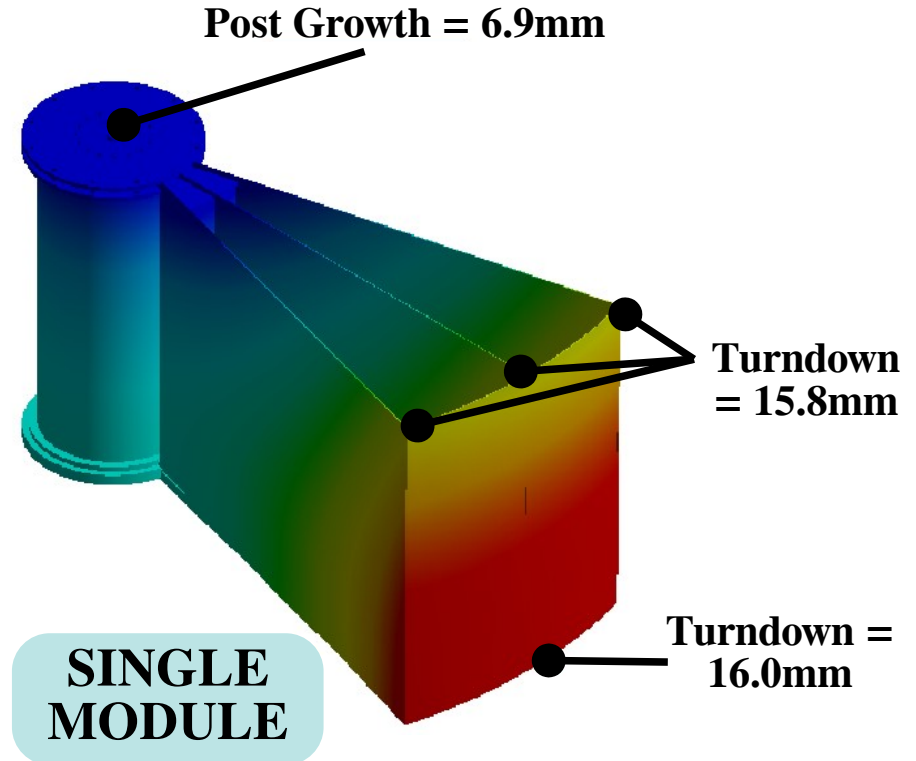
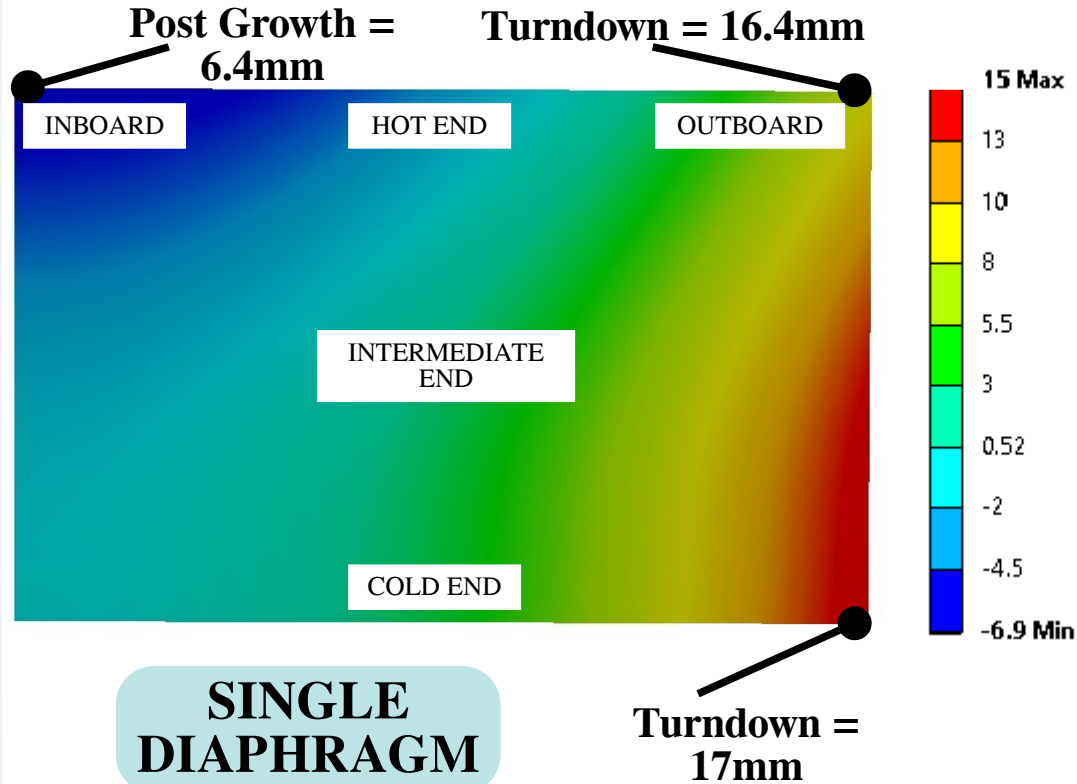


**TEMPERATURE  
CONTOUR**



# FEA MODELING

## *Rotor Expansion & Turndown Modeling*

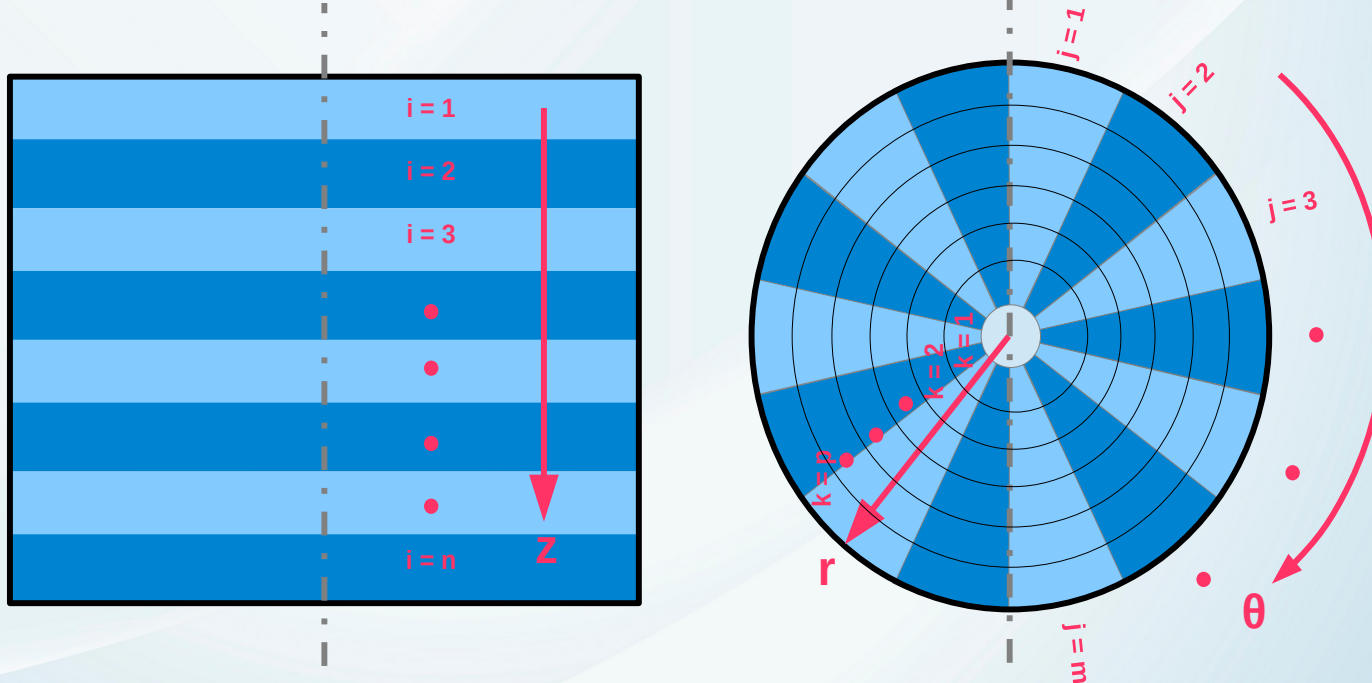




# GAPH – GEECO's AIR PREHEATER PROGRAM

- Inhouse developed program for selection & performance prediction of APHs
- Program validated by field experiments
- APH rotor discretized into cells along the height, radius & rotation directions

## DISCRETIZATION OF AIR PREHEATER



## FEATURES

- **Effect of Rotor RPM on FGET & Leakage**
- **Locate APH Areas where Metal Temperature < Acid Dew Point**
- **Predict temperature gradient along height, radius & rotation directions**
- **Predict APH performance loss for non-uniform flows**
- **Predict Rotor Turndown based on Variable Rotor Expansion due to Thermal Gradient**
- **Corrections to Flue Gas Properties based on Fuel Fired**
- **Effect of Direction of Rotation Change for Trisector APHs**

# SEAL TEST APPARATUS

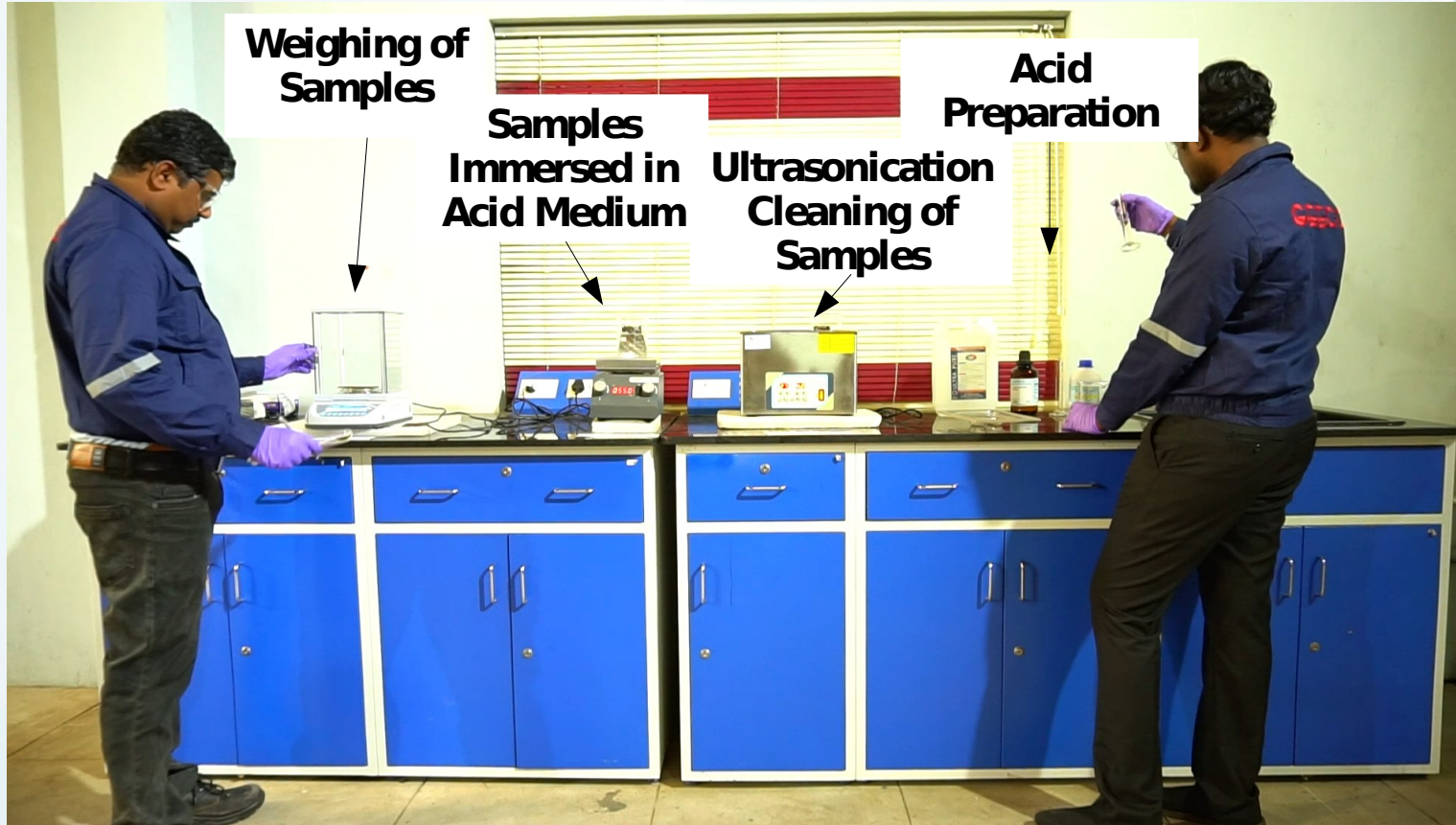
*To evaluate the performance of seals*



- Inhouse customized test setup
- Soft seals are multi-layered thin leaf metal sheets attached in addition to conventional seals that come in contact with the sector plate
- Various parameters are monitored:
  - ◆ RPM controlled through VFD
  - ◆ Shaft torque & Motor Current
  - ◆ Leaf Material
  - ◆ Leaf geometry
  - ◆ Life of soft seals
- 8 sector plates are provided to accelerate the testing time

# IMMERSION CORROSION TEST

*To evaluate the corrosion rate of materials*



# HUMIDITY CHAMBER

*To evaluate the performance of rust preventive oils*



## *Heating Element Selection Factors*

- Heat Recovery (Gas / Air Outlet Temperatures)
- Pressure Drop Across APH
- ◆ Fouling / Choking Potential
- ◆ Cleanability using Soot Blowers

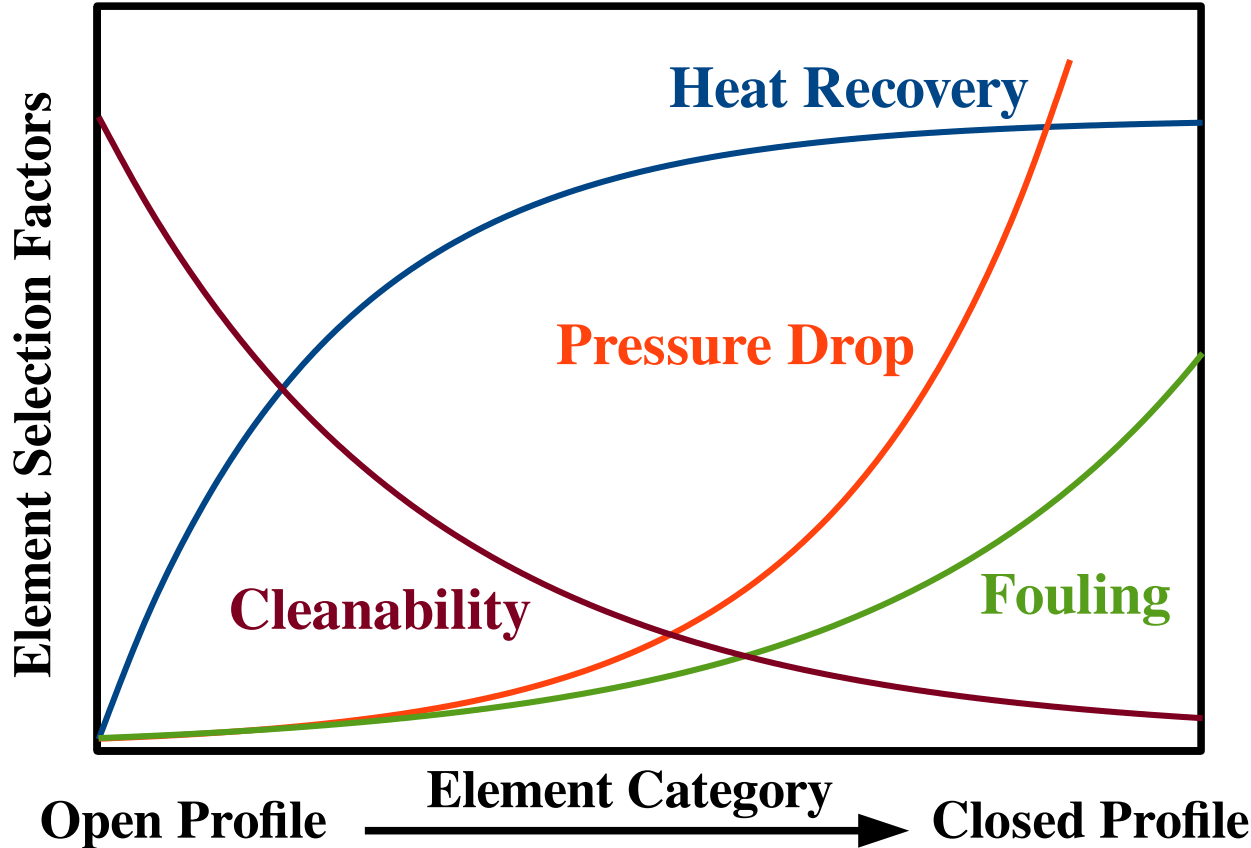
**Direct  
(Measurable)**

**Indirect  
(Non Measurable)**

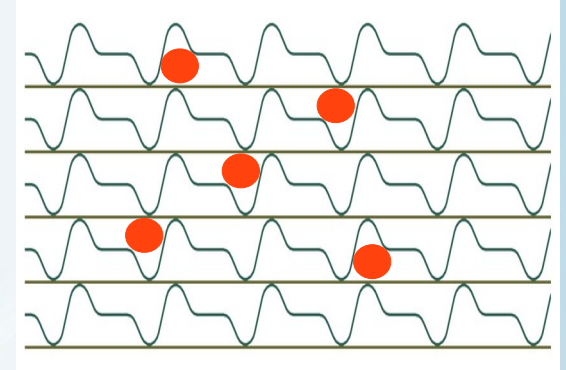
***GOAL: Consistent Long Term Performance***

**Weightage for each factor depends on type of coal (ash), element layer (hot/intermediate/cold) & overall element height**

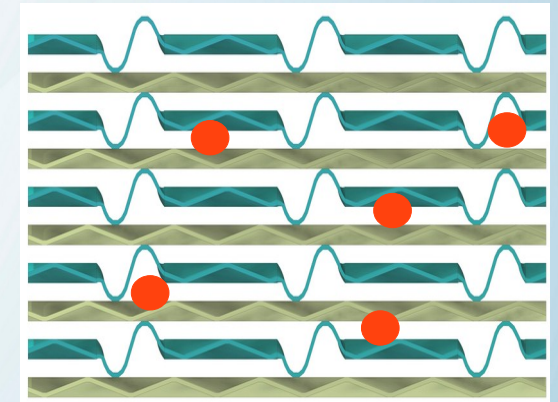
# HEATING ELEMENT OPTIMIZATION



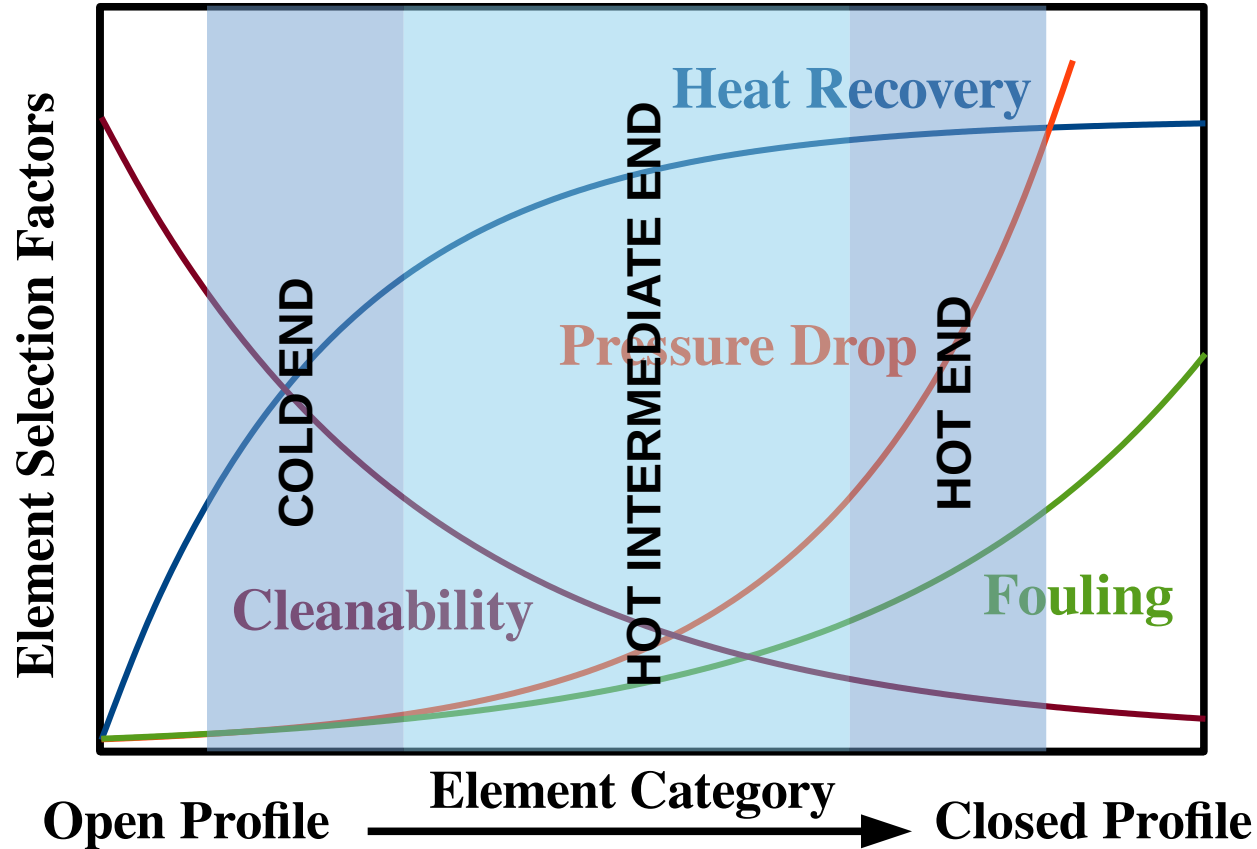
## OPEN PROFILE



## CLOSED PROFILE



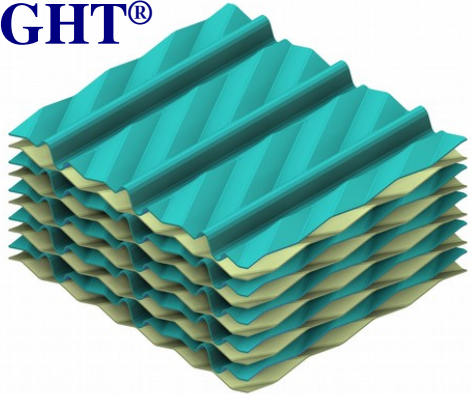
# HEATING ELEMENT OPTIMIZATION



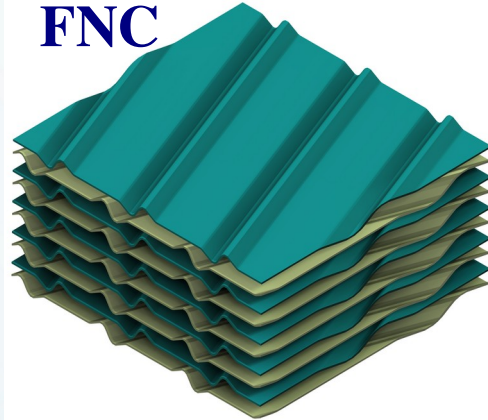


## *Hot End Layer Profile Selection*

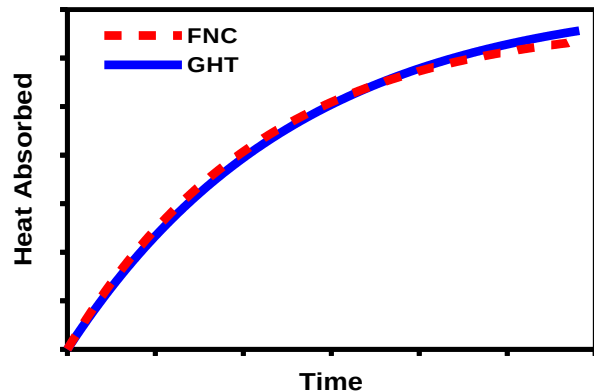
**GHT®**



**FNC**



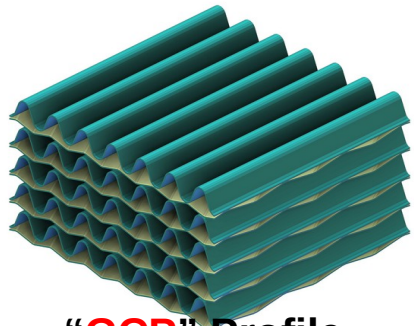
Heat Absorbed over Time



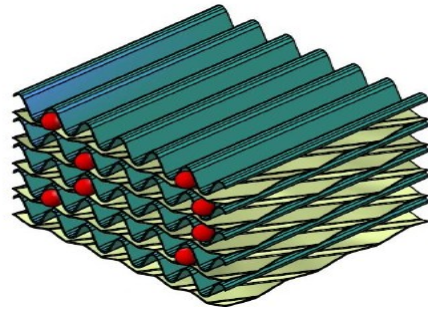
### MERITS of GHT over FNC

- Equal thermal performance
- Lower pressure drop
- 6% higher heat transfer area
- Reduced plugging, fouling or choking
- Easy to clean under soot blowing operation
- Sustained performance
- Increased life
- Higher payback for money spent

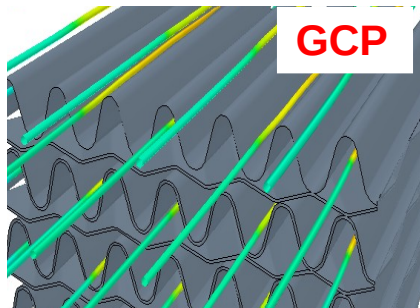
## GCP® GEECO's Good Cleanability Heating Element Profile



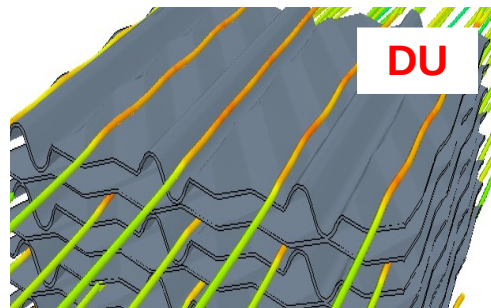
**"GCP" Profile**



Large ash particles can pass through without choking the heating elements



**Linear Flow Path**



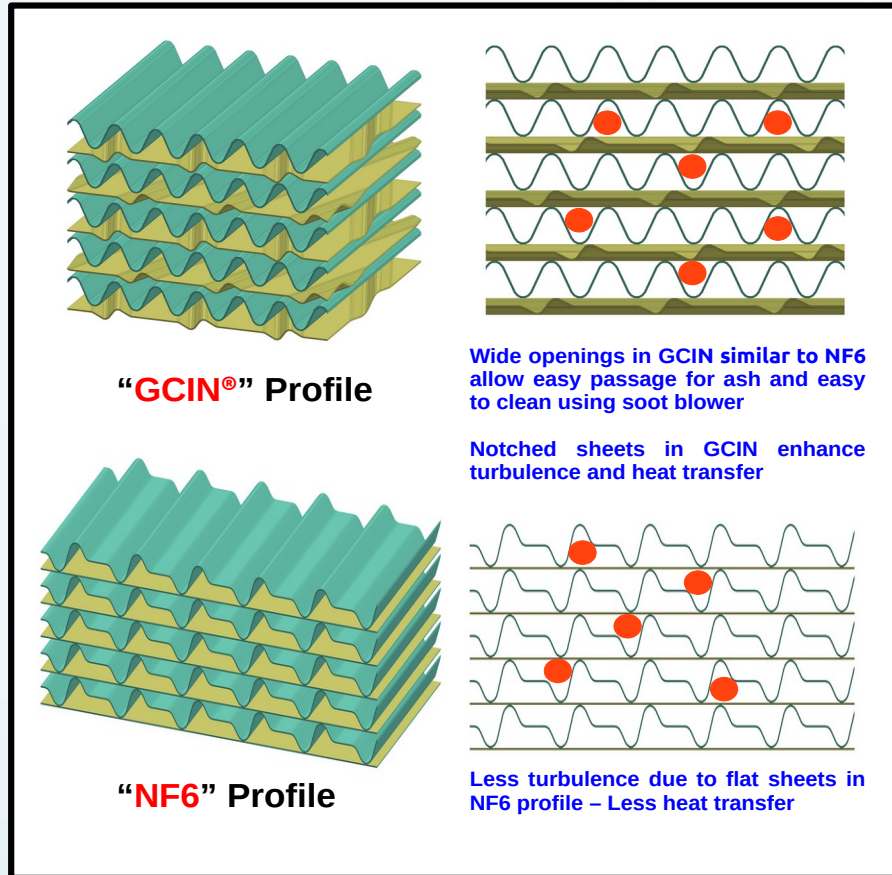
**Distorted Wavy Flow Path**

Recent times the quality of coal has worsened – high ash and sulphur content. Firing poor quality coal makes the layers of APH heating elements susceptible to fouling. Hence there is a need for an improved profile that satisfies the above criteria. GEECO's answer is the modified and improved "GCP" profile. The results are verified by CFD simulations.

### MERITS of GCP over DU

- Lower pressure drop
- Reduced plugging, fouling or choking
- Easy to clean under soot blowing operation
- Sustained performance and increased life

## GCIN<sup>®</sup> Advanced Heating Element Profile for Cold End



Recent times the quality of coal has worsened – high ash and sulphur content. Firing poor quality coal makes the layers of APH heating elements, especially cold end elements, susceptible to fouling. Hence there is a need for an improved profile that satisfies the above criteria. GEECO's answer is improved GCIN<sup>®</sup> profiles. The results are verified by CFD simulations and wind tunnel experiments.

### MERITS of GCIN<sup>®</sup> over NF6

- Good heat transfer rate. About 2-3 °C reduction in gas out temperature.
- Fouling and choking characteristic similar to NF6
- Easy to clean under soot blowing operation
- Reduced element weight by ~2%

**Fly Ash Erosion ?**

**Ans: SACRIFICING BASKET**

## Features

- Basket depth of **200 – 300 mm** to cover erosion – prone entry region
- Higher thickness (**0.8 mm**) for longer life
- Closed profile for good heat recovery
- Tall hot end baskets can be split into 200-300mm as sacrificing & balance as hot end baskets
- Future element provision can be used



## Benefits of Sacrificing Baskets

- Longer life due to higher thickness
- Protects tall baskets below from severe erosion
- Easy to replace & lower replacement cost
- Easy for off-line cleaning

# SEALING IMPROVEMENTS

## Typical Breakup of APH Leakage

- |                                    |           |
|------------------------------------|-----------|
| ■ Radial Leakage – Hot & Cold Ends | 50% + 14% |
| ■ Axial Leakage                    | 11%       |
| ■ Post Seal Leakage                | 2%        |
| ■ Entrained or Indirect Leakage    | 23%       |

**LEAKAGE**       $\alpha$       **GAP**  $\sqrt{(\Delta P)}$

Customized Solutions  
based on Plant  
Conditions

Double Sealing

# SEALING IMPROVEMENTS

- **EZ-IN™ Sector Plates**
- **GLRS® - GEECO's Leakage Reduction System**
- **Machined T Bars**
- **HiFlex™ Seals**
- **TALCON® with Hi-Life Seals**
- **SDBS® – Soft Touch Double Bypass Seals**
- **WEAREZIST™ Sector Plate**

- **Study of collection efficiency with different combinations of emitting & collecting electrodes**
- **Electrohydrodynamic (EHD) secondary flow modeling to identify optimum collecting electrode geometry**
- **New / improved emitting electrode geometry for increased corona discharge & migration velocity**
- **Optimize spacing of emitting & collecting electrodes**

# ONGOING & UPCOMING ACTIVITIES

- **New Element Profiles**
- **Element Material Upgrade**
- **Optimize Profile Geometry for Better Performance**
- **Air Preheater Design Modifications**
- **Suitable Rust Preventive Oil for Longer Storage**
- **Soft Seal Improvement for Reliable Performance & Longer Life**
- **ESP Prototype Development & Numerical Modeling**