

VOW



**LEADING Technology for the
HOT-DIP Galvanizing Industry**

**Electrically-
Heated
Furnaces and
their potential
for Sustainability**

Nordic Galvanizers
Annual Member Meeting 2023, Helsinki

nordic
GALVANIZERS 

The logo for Nordic Galvanizers, featuring the word 'nordic' in a lowercase sans-serif font above the word 'GALVANIZERS' in a bold, uppercase sans-serif font. To the right of the text is a circular logo containing the letters 'NG'.

Key information – Our background



Name: **Nils Erik Faulhaber**

Work: Mechanical Engineer and Project Manager for CHE



CHE is based in **Norway**, Fredrikstad



Founded in 1937

- Over **85 years of experience** with innovative solutions in Heat Treatment Industry
- Over **60 years of experience** with electric heated HDG applications
- Over **30 years of experience** with gas heated HDG applications
- Over **25 years of experience** with hybrid solutions.

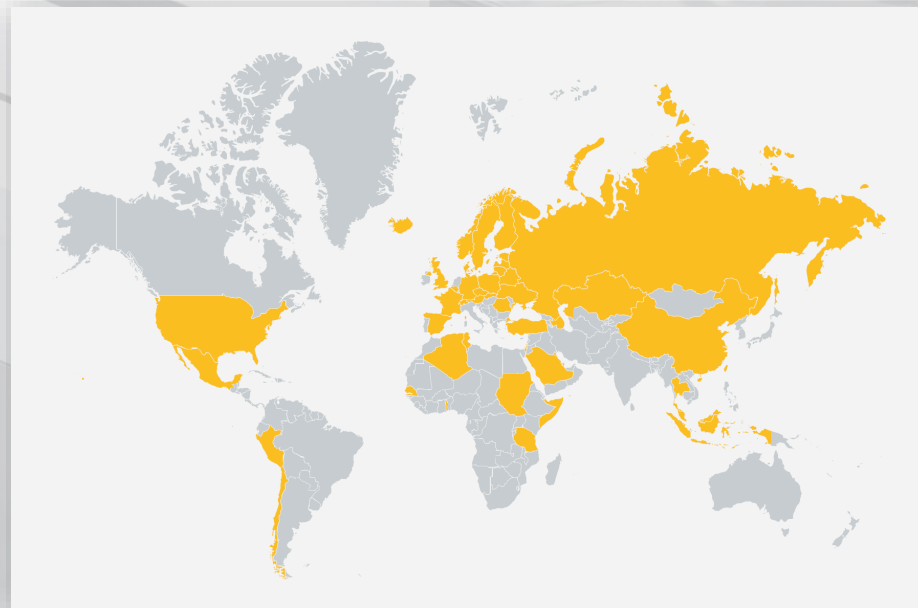


Part of **VOW ASA Group** with operations in Europe and the US. Vow is a world leading provider of technology and solutions that prevent pollution and greenhouse gas emissions (www.vowasa.com).

CHE Installations worldwide



Approx. **250 Hot Dip Galvanizing installations worldwide**, over 4.000 totally for Heat Treatment Solutions in **45 countries**



Global situation

▶ More and more Hot Dip Galvanizers are focusing on their **energy consumption** – both economically, but also related to the source of the energy and sustainability.

▶ Subjects of **discussion**:

- CO₂-foot print
- Availability
- Price
- Future
- Sustainability

▶ Possible Solution: **Electrically heated Systems**

Why electricity ?

▶ Electric energy production is **not depending on a single energy source.**

▶ **Different Energy sources** can be transformed like:

- Gas
- Waterpower
- Photovoltaic
- Geothermal energy
- Wind energy, etc.

▶ With the choice of the energy source the **CO₂-footprint** can be chosen as well.

Sustainable sources are **available.**

Challenges

- ▶ **80%** or more of all galvanizing furnaces worldwide are **not electrically heated** (estimation).
- ▶ **Infrastructure/ Availability** of electricity on site.
- ▶ Gas optimized plants **require adjustments** for change of energy source.
- ▶ **Future perspectives**
Long term goal will be carbon-neutral production.

Advantages

- ▶ **Even and homogenous heat distribution** on kettle walls (longer life span).
- ▶ **Lower nominal energy consumption** (No heat loss through chimney).
- ▶ Easy to fit two temperature **regulation zones** (less top dross).
- ▶ **Less maintenance.**
- ▶ **Long life span of heating elements**
- ▶ **Heating elements are easy to repair**
- ▶ **Less auxiliary equipment.**

Limitations

▶ In general, there are **no size limitations** for electrifying the HDG furnace or other HDG equipment.

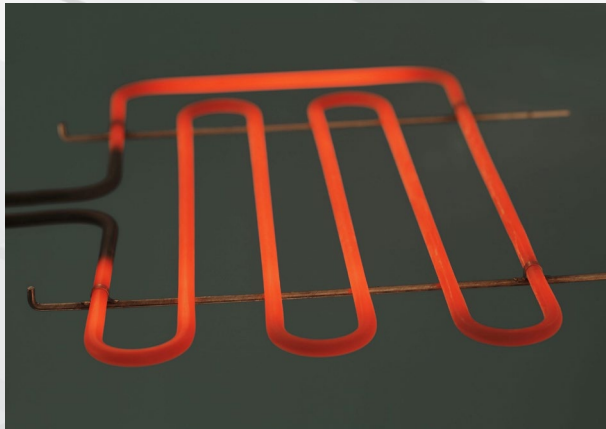
Requirements:

- ▶ **Availability** of enough electricity on site.
- ▶ **Stable grid** (can be compensated with safety measures).
- ▶ Energy load **kW/m²** same as for gas fired applications

Standard electric heating methodes for galvanizing:

Electric Resistance heating

- Heating element wire emitting radiant heat



Induction

- Induction coils induce heat

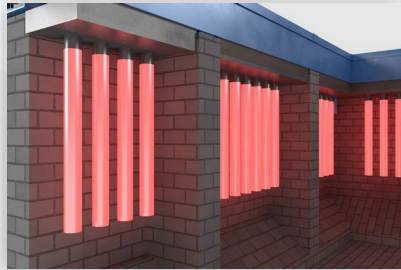


- Complicated and expensive installation on kettle/ furnace
- **5% Energy loss** for cooling inductors

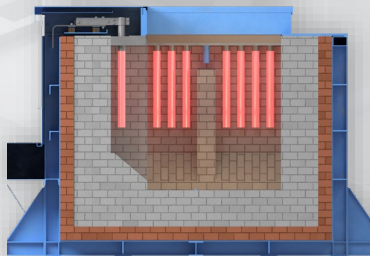
CHE Standard electric heating systems:

Immersion heating rods

- Heating rods directly immersed in liquid zinc

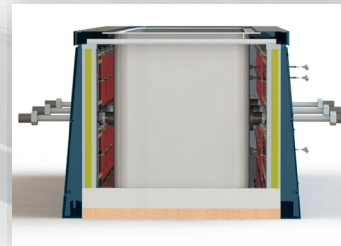


- Most efficient heat distribution with direct heat transfer, less zinc

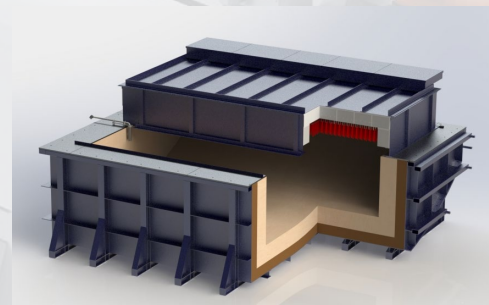


Radiant heat

- Heating elements around steel kettle wall



- Top heated systems (mostly ceramic kettle)



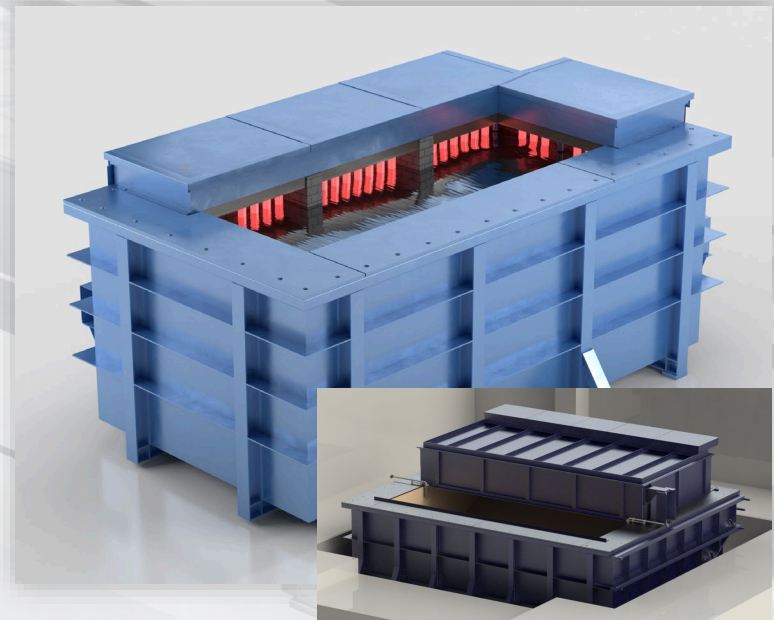
Fully electric heated HDG furnaces:

Electric heated HDG furnace with steel kettle



- Approx. 30% less nominal power required
- Independent of electricity generation min. 30% less CO₂-foot print

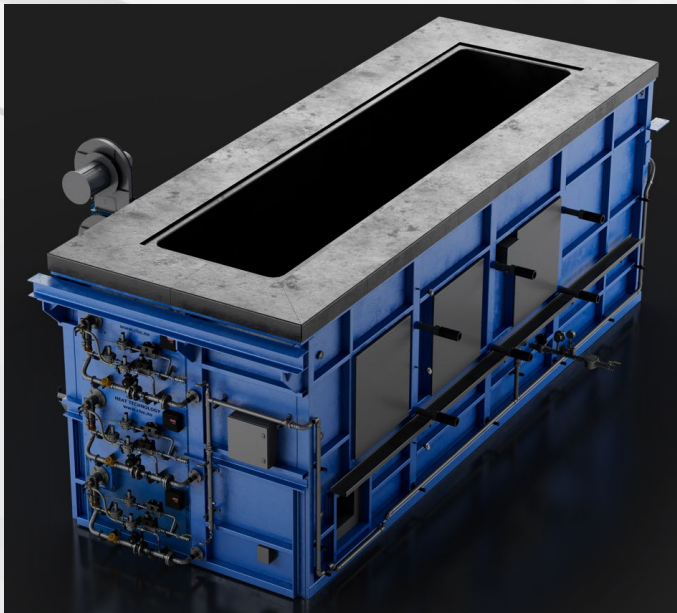
Electric heated ceramic bath



- Immersion heating rods – smaller bath dimensions, more effective heating
- Top fired, less nominal power

Hybrid HDG furnaces (gas/electric):

High velocity burners combined
with electric heating element



- Main power supply is gas
- Additional electric heating can improve CO₂-balance drastically

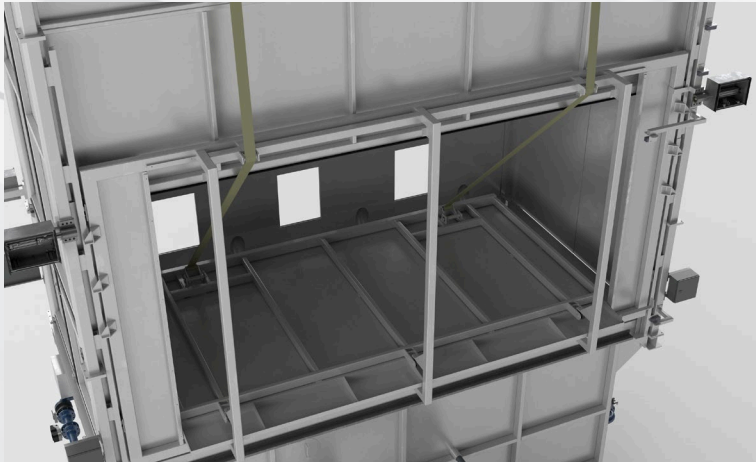
Applicable electric sources

- Direct supply from local electricity supplier
- Surplus of own electricity production from
 - Photovoltaic
 - Wind energy
 - Fuel based emergency generator
 - Etc.

➔ **Extra production security!**

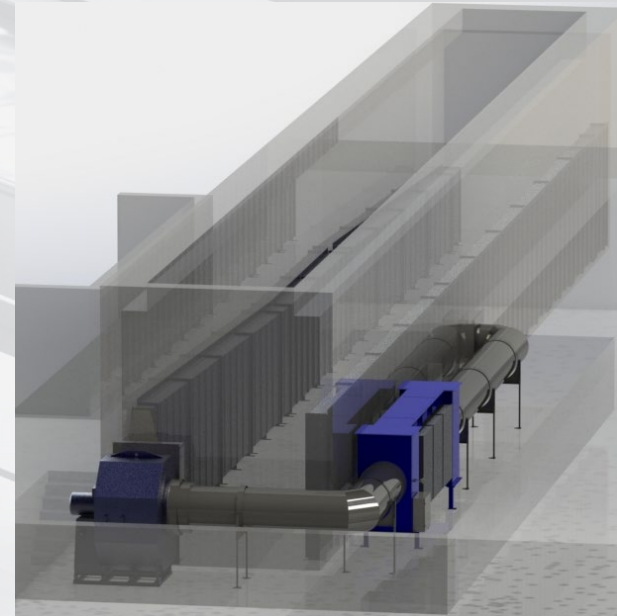
Auxiliary equipment:

Fume enclosure with integrated cover lid



- Simple covering of HDG bath in non-production hours, lunch breaks etc.
- ➔ **approx. 70% less losses over bath surface**

Fully electrically heated HDG dryer



- For fully electric HDG line.

Energy calculation

FURNACE TYPE:
IDG Furnace with steel kettle

Energy calculation

KETTLE SIZE AND CAPACITY:

Length	13,00 m
Width	1,60 m
Depth	2,60 m
Gross hourly capacity:	5,00 T
Gas consumption:	7,0 T

ENERGY CONSUMPTION

Heat losses zinc surface:	270,4
Heat losses furnace construction:	28,7
Energy for production:	345,6
Energy for zinc melting:	29,7
Security:	33,0

GAS HEATING

Installed power:	1089 kW
Calorific value, gas:	10 kW/Nm ³
Total gas consumption:	109 Nm ³ /h
No. of burners:	4
Energy loading:	11 kW/m ²

ZINC CONTENT
(Incl. 70mm, Free-Board)
363 Tons

WEIGHT
42

FURNACE TYPE:
IDG Furnace with steel kettle

ANNUAL ENERGY CONSUMPTION

Production related figures:

Annual hours total:	8 760 h
Average hourly production capacity:	5,00 tons/ h
Production hours per week:	115 h
Production weeks per year:	45 Weeks
Annual production hours:	5 175 h
Annual production:	25 875 tons
Gas consumption:	7 %

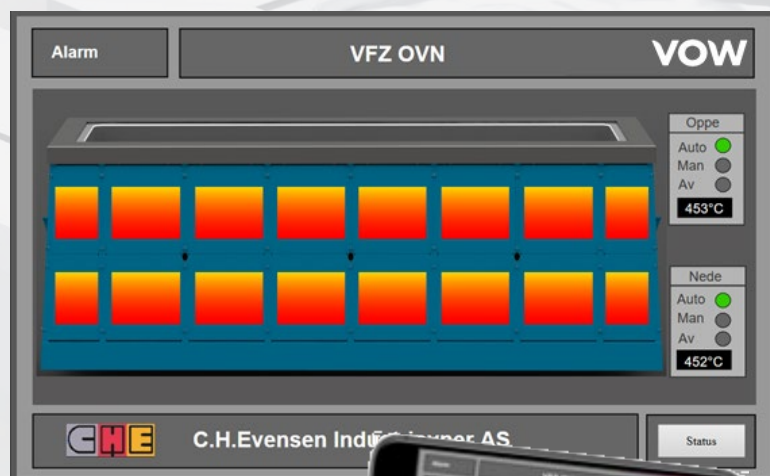
Energy consumption:

Energy loss from zinc surface production:	1 399 320 kWh
Energy loss from zinc surface covered:	149 136 kWh
Energy loss from furnace construction:	251 587 kWh
Energy for production:	1 785 375 kWh
Energy for zinc melting:	153 956 kWh
Total energy consumption, electric:	3 739 374 kWh
Specific energy consumption, electric:	145 kWh/ton
Total energy consumption, gas (65%)	5 752 884 kWh
Specific energy consumption, gas:	222 kWh/ton
	575 288 Nm ³

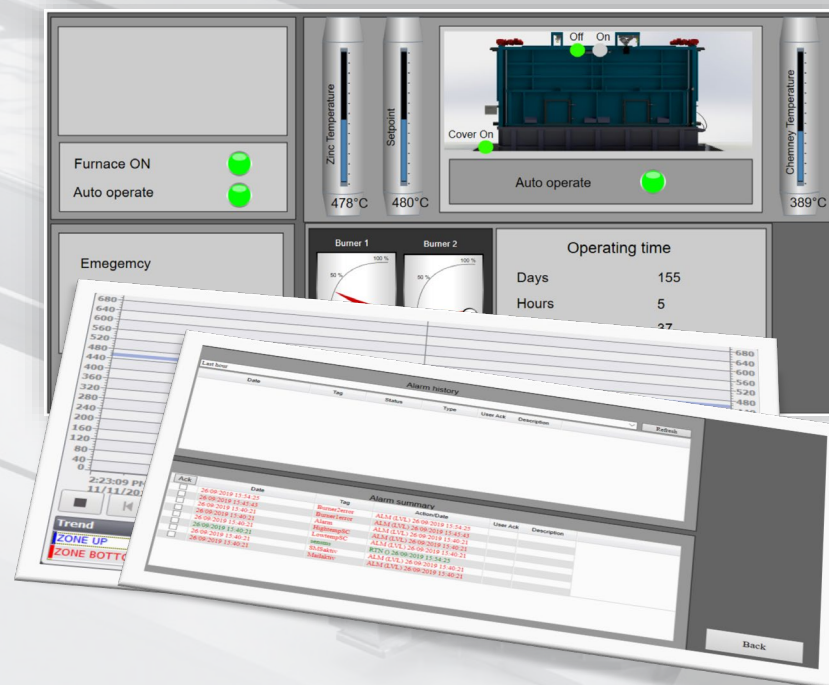
- Calculation of **Energy load** on kettle wall
- Calculation of **annual energy consumption** based on customer input
- **Clear picture** of required energy and where energy consumption and CO₂-footprint can be minimized!

Programming and control:

Remote control and remote assistance



Data logging



- Full remote control for customer and service assistance on PC and Pads
- Smart solutions possible

- Data logging of desired production parameters and information

Some of our customers



Conclusion

▶ In order to achieve a **carbon-neutral industry**, the transition to **electric heated systems** seems to be a potential solution and **feasible**.

▶ Both short-term and long-term measures can be taken.

▶ The **future will be probably be fully electric**, but in a transition period there will be electric and hybrid solutions.

▶ **CHE** delivers **gas fired, electric and hybrid solutions**.

▶ **Let's make the Hot Dip Galvanizing Industry more sustainable together and get closer to a**

Carbon-neutral Industry!



C. H. Evensen Industrier AS
Fredrikstad – Norway

**Thank you for your
attention !**