

Innovation in our Workshops

Why we should reduce our carbon dioxide emissions while heating steel

WHY?

Environment, health and public perception

If we want to take our craft in an improved Future, we must be upfront for innovations like "induction" or "hydrogen Steel". The society and the politicians don't look that much to our craft because we are few and sometimes considerer medieval smiths. More and more it's necessary to enhance our pleasure, into a modern Craft in conciliate with environment and public perception.

Minimizing operating cost

Heating 1kg steel takes 0,133 kWh

Coal forge

Efficiency e

$$\eta=0,06$$

needed Power

$$Q=8000\text{kJ}(2,2\text{kWh})$$

Costs If 25kg cost 10,50€

$$0,11\text{€}$$

Induction heater

Efficiency

$$\eta=0,7(\text{steel})$$

needed Power

$$Q=564,7\text{kJ}(0,157\text{kWh})$$

Costs If 0,31€/kWh

$$0,05\text{€}$$

HOW?

Change fuel

A gas forge has a higher efficiency than the classical coal forge. And gas generates less CO₂ per kWh than coal. Besides gas emits also nearly zero respirable dust.

Precise heating

Use the smallest fire/forge you can take for your workpiece. Sometimes this might be only a torch.

Induction

Induction has a high efficiency because the heat arises directly in the workpiece. It works with a magnet field that induces an electrical current in the workpiece, so the own resistance in the material creates the heat.

Induction heating is useable with every electroconductive material.

Cardiac pacemakers next to an induction furnace are damageable.

Suggestion

Frequency

10-200 kHz

Power

10-40 kW

Water cooling

Pedal switch

Overheat
control

(Thermometer)

Links and sources

Emissions per energy

Spezifische Kohlendioxidemissionen verschiedener Brennstoffe		
Brennstoff	Emissionen in kgCO ₂ / kWh	Emissionen in kgCO ₂ / GJ
Holz ¹⁾	0	0
Holz ²⁾	0,39	109,6
Torf	0,38	106,0
Braunkohle	0,36	101,2
... Lausitz	0,41	113,0
... Mitteldeutschland	0,37	104,0
... Rheinland	0,41	114,0
Steinkohle	0,34	94,6
Heizöl	0,28	77,4
Diesel	0,27	74,1
Rohöl	0,26	73,3
Kerosin	0,26	71,5
Benzin	0,25	69,3
Raffineriegas	0,24	66,7
Flüssiggas	0,23	63,1
Naturgas	0,20	56,1

1) bei nachhaltiger Nutzung

2) bei nicht-nachhaltiger Nutzung ohne Wiederaufforstung

Quelle: Fachbuch Regenerative Energiesysteme und UBA

<https://www.volker-quaschning.de/datserv/CO2-spez/index.php>

Induction partner (a French Company)

<https://induction-partner.com/isforge/en/home-isf/>

Calculate Formula

$$Q = c \times m \times \Delta Q \quad Q = \eta \times \eta Q$$

Q = Energy

c = specific heat

m = mass

η = Efficiency

ηQ = needed energy

Online Calculator

<https://www.plustherm.ch/leistungsberechnung.html>

Facebook group

<https://www.facebook.com/groups/758762180850373>