Hydrogen Glass Production

HRASTNIK1860
TRANSFORMING THE GLASS PACKAGING INDUSTRY

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About Hrastnik1860

Producing premium glass packaging since 1860

Steklarna Hrastnik produces the most technically demanding bottles, mostly in the spirit segment, from one of the clearest glass in the world and offers an extensive range as a full-service solution partner, from the idea, design, development, and production. Being made of top-quality glass, products are acclaimed for their perfect crystal shine and are completely free of heavy metals. All items can be customized through comprehensive decoration techniques, resulting in stunning visual results.

Style, quality and award-winning design solutions

Products are distinguished by a combination of style and quality from traditional designs to innovative, award-winning design solutions that received recognition and won awards like the 2022 Red Dot Design Award, German Innovation Award 2021, and EcoVadis Gold Medal 2022 for sustainability efforts.

- **295 t** daily production capacity
- **500** employees
- export to more than **60** countries worldwide
- **full-service** solution
- 160 years of **tradition**

Spirit references

VISION

To be the **most inspiring** and **most sustainable glass packaging** company on the planet.

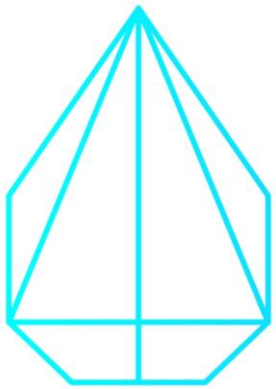
MISSION

To deliver the **glass packaging experiences** that no one else can, with an **agility**, **pride** and **passion** that no one else can match.

Values

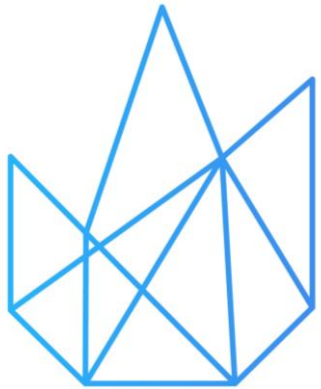
PURITY

Trust,
Honesty,
Entrepreneurship



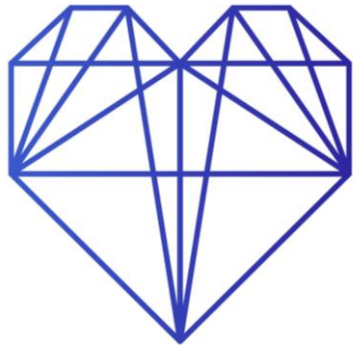
PASSION

Innovation,
Cooperation,
Excellence



HEART

Respect,
Sustainability,
Commitment

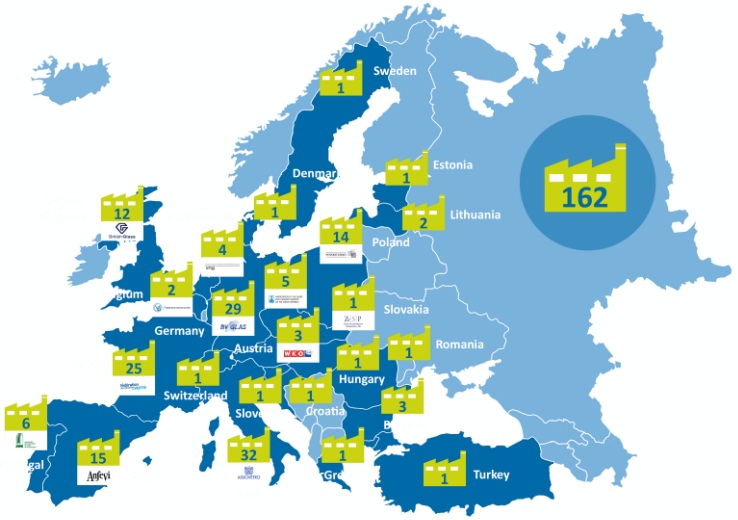


Hrastnik1860 history

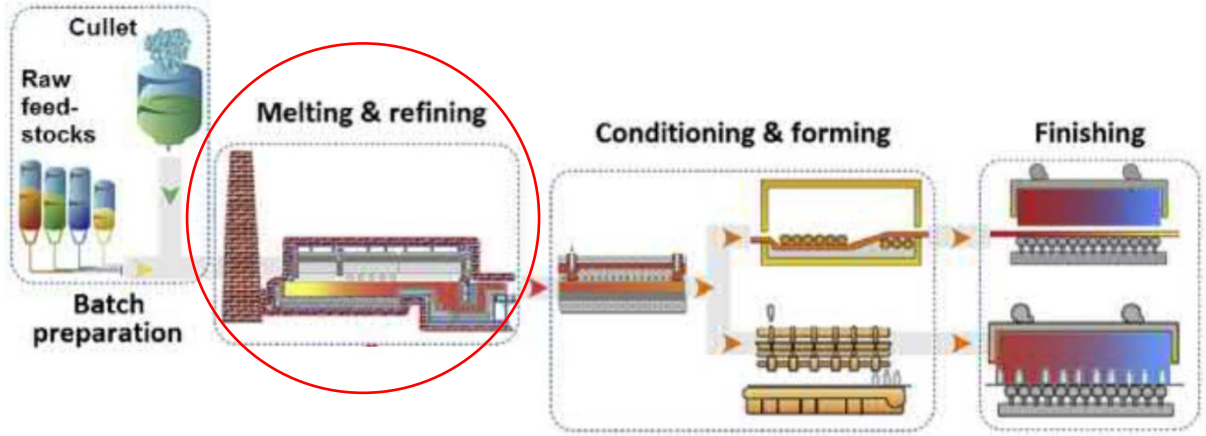
- In the heart of Europe with over 160 years of tradition
- From manual to state-of-the-art technology
- From coal to green energy sources

Sustainability Challenge

- European green deal:
  - 2030: GHG emissions reduction >= 55% (1990)
  - 2050 Climate neutrality
- Glass manufacturing an energy intensive process
- EU Container glass sector:
  - 162 plants in 23 courtiers
  - 125.000 jobs
  - EU enabled exports 250 billion EUR



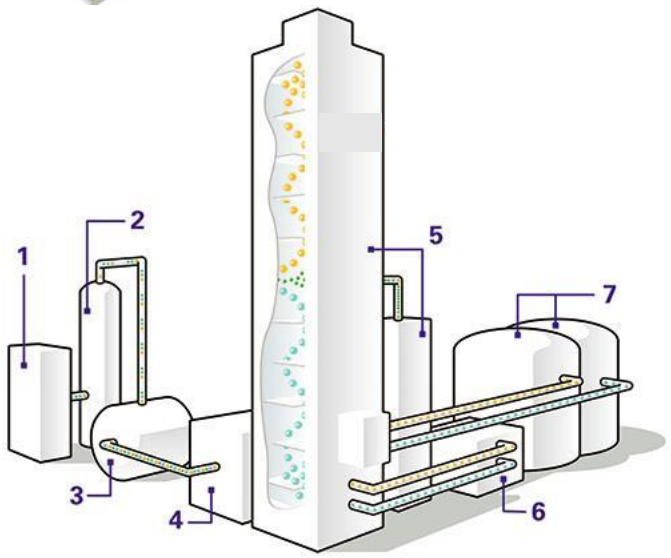
75-85% of total energy use
60-85% GHG emissions from NG combustion
15-40% GHG emissions process related



HRASTNIK1860 SUSTAINABLE CAPABILITIES

Two business units

BU Vitrum – Oxyfuel furnace



Furnace Type: Oxyfuel furnace

Year of construction: Q4 2020

Production capacity
120 tons/day

Energy consumption
Natural gas = 600 Nm3/h (6 burners)
Oxygen form on site Cryo plant = 1200 Nm3/h
Boosting = 10%

Type of glass: Extra white flint

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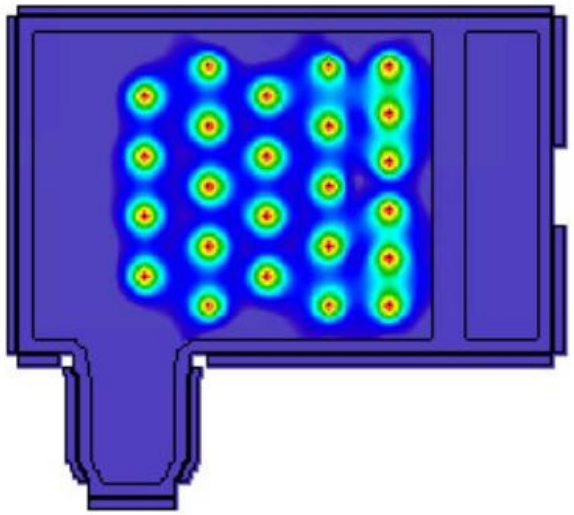
BU Special - EP Hybrid furnace

>40% boosting



Furnace Type: EP Hybrid furnace

Year of construction: Q2 2023

Production capacity
170 tons/day

Energy consumption
Natural gas = 1200 Nm3/h (2 burners)
Boosting = 4.500 kW (> 40%)

Type of glass: Extra white flint

BEAR
HYBRID REGENERATIVE GLASS FURNACE

Co-funded by the European Union

Sustainable Goals

2025

GHG Emissions

Total: **-30% CO2e**
Scope 1: **-25% CO2e**
Scope 2: **-80% CO2e**
Scope 3: **-30% CO2e**

2030

GHG Emissions

Total: **-50% CO2e**
Scope 1: **-40% CO2e**
Scope 2: **-85% CO2e**
Scope 3: **-40% CO2e**

Environmental Sustainability

Investments in Technology
60 M€ invested in last 5 years

Green innovation
10 active R&D projects, 5 international projects, 12 M€ EU funding
1st Innovation Fund Project in Slovenia

Leading-edge Melting Furnaces
First End-fired Hybrid Regenerative furnace
First Hydrogen-retrofitted Oxyfuel furnace

Green purchase
On-site oxygen plant
Green soda ash supply

Renewable energy
1.4 MWp of local RES self-supply (3%)
100 % clean electrical energy purchase

Circular economy
Up to 40% PCR campaigns (super flint)

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Hydrogen as clean fuel in glass sector

- Hydrogen combustion can offer a cleaner and more effective alternative to fossil fuels commonly used for glass melting today, especially in cases where full electrification of glass furnaces is not feasible due to production requirements.
- Hydrogen-powered glass furnaces, achieved through retrofitting existing facilities, are being explored, with trials using hydrogen as the primary fuel for short periods to assess process conditions.
- Challenges, including hydrogen-related corrosion in refractory materials, the cost of hydrogen production, infrastructure needs for transportation and storage, and safety concerns in manufacturing, must be addressed for widespread adoption in the glass industry.
- Despite these challenges, there is a growing interest in integrating hydrogen into the glass industry, driven by the potential for significant reductions in emissions, improved energy efficiency, and creation of more sustainable glass product.

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Hydrogen Pilot (2020)

Glass:
- First green hydrogen pilot in glass packaging industry
- Technology: Batch glass pilot furnace & Hydrogen/Natural gas – Air/Oxygen combustion system
- Scale: 200 kg/day

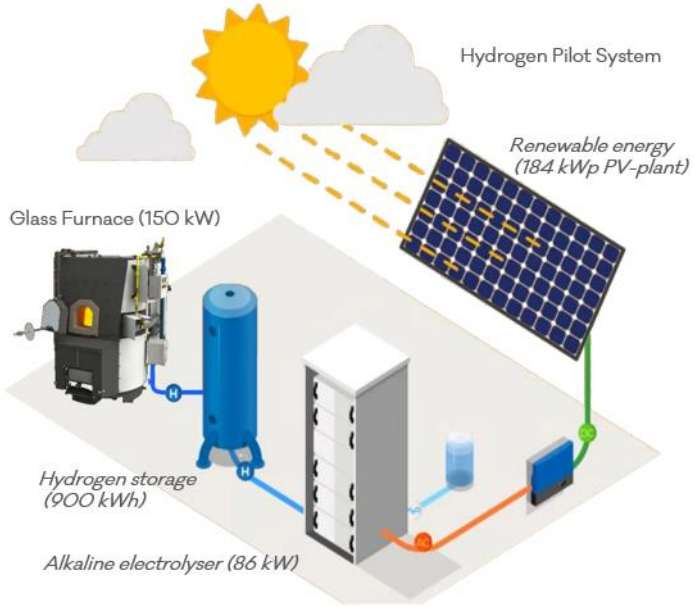
200 kg/day

Hydrogen:
- Hydrogen source: 86kW alkaline electrolyser Max hydrogen flow: 16 Nm3/h
- Hydrogen % for combustion: 100%

100 % H2
0.2t H2 used

Carbon:
- Direct CO2 emission of combustion: 100% reduction
- Enviromental impact and CO2 emissions verified with comparaitve LCA analysis
- First 100% Green Hydrogen and 100% PCR bottle produced (no scope 1 emissions)

-100 % CO_2



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First industrial hydrogen run (2023)

Glass:
- First production run with hydrogen in glass packaging industry
- Technology: Oxyfuel furnace & new hydrogen-natural gas combustion system
- Scale: 120 t/day
- Glass produced: 350t with no impact on quality

120 t/day

Hydrogen:
- Hydrogen source: hydrogen trailers and bundles
- Max hydrogen flow: 600 Nm3/h
- Hydrogen % on individual burner: up to 100%
- Hydrogen % for combustion: 62%

62 % H2
5t H2 used

Carbon:
- Direct CO2 emission of combustion: 30% reduction
- CO2 emissions verified with GHG protocol in all scopes
- Carbon neutrally certificates issued by Hrastnik1860 for the first time

-30 % CO_2

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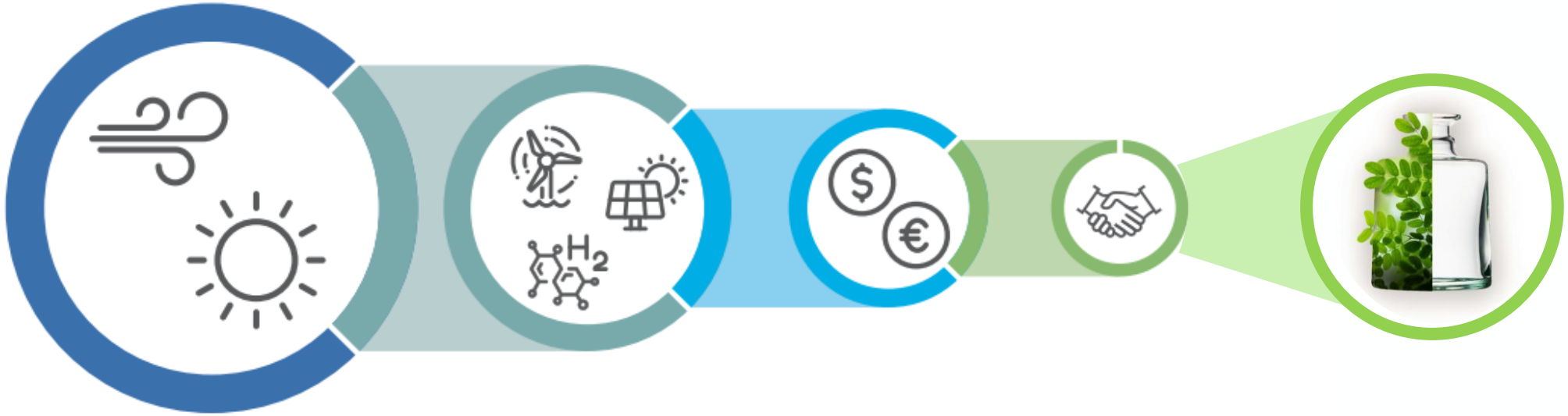
Hydrogen market development

Theoretical potential → Tehnical potential → Economic potential → Market potential → Sustainable Glass market potential



- Energy content of all wind and solar resources which could theoretically be transformed into green hydrogen.
- Solar and wind energy that can be effectively harvested through wind parks and utility-scale PV.
- Theoretical potential reduced by technology characteristics and land eligibility constraints.
- Not all hydrogen technical potential production may present competitive LCOH.
- Dictated by the presence of green hydrogen offtakers.
- Competition between direct sale of clean energy and sale of green hydrogen produced with that energy.
- Dictated by the presence of sustainable glass products offtakers
- Competition between use of hydrogen and other sustainability measures (PCR, biogas, electricity)

Without sustainable glass product offtakers, hydrogen cannot be implemented in the glass industry.

Trusted by global brands

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Q & A