# Briquettes at Finnfjord

## Industrial scale testing of coal and iron ore fines briquettes

**NyKoSi agglomeration seminar, 22. November 2016**
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# This is Finnfjord

- Production capacities:
- 100.000 tons of ferrosilicon
- 20.000 tons of silica
- 340 GWh electrical power

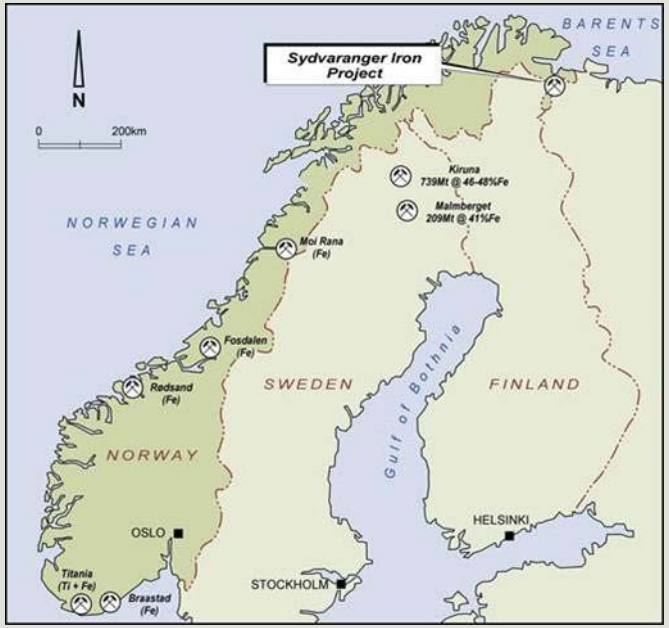
- One of the 10 largest ferrosilicon plants in the world
- Delivers 15% of the European demand for ferrosilicon.

- 130 employees
- 825 MNOK revenue (2014)

- Algae cultivation project – carbon capture

# Background

- 1994: Project initiated by AS Sydvaranger - FESIL, Finnfjord, SINTEF.
- **Briquetting of coal/iron ore fines** as a high value product for the metallurgical industry.
- Based on pilot-scale results by SINTEF (75% FeSi):
  - 10% increased silicon yield
  - 16% reduced spec. power consumption
  - Stable process conditions



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# Project goals

*To develop a coal and iron ore-briquet suited for the production of ferrosilicon, which gives a better SiO-reactivity than the traditional charge of coal and Fe-pellets.*

# Production of briquettes

Some key-points from the patent

- Ratio between carbon and (reduced) iron between 0,2:1 og 1,5:1
- The grain size of the carbonaceous particles should not exceed 5 mm with respect to agglomeration, but this depends on the particle size distribution.
- High FSI coals are preferred to achieve highest reactivity

# Production of briquettes

- Produced by AGGLONORD, France
- Binder: Bitumen (Shell):  ~ 8%
- 35x35 mm, pillow shaped.
  - Crushed down further to smaller fractions at Finnfjord plant.

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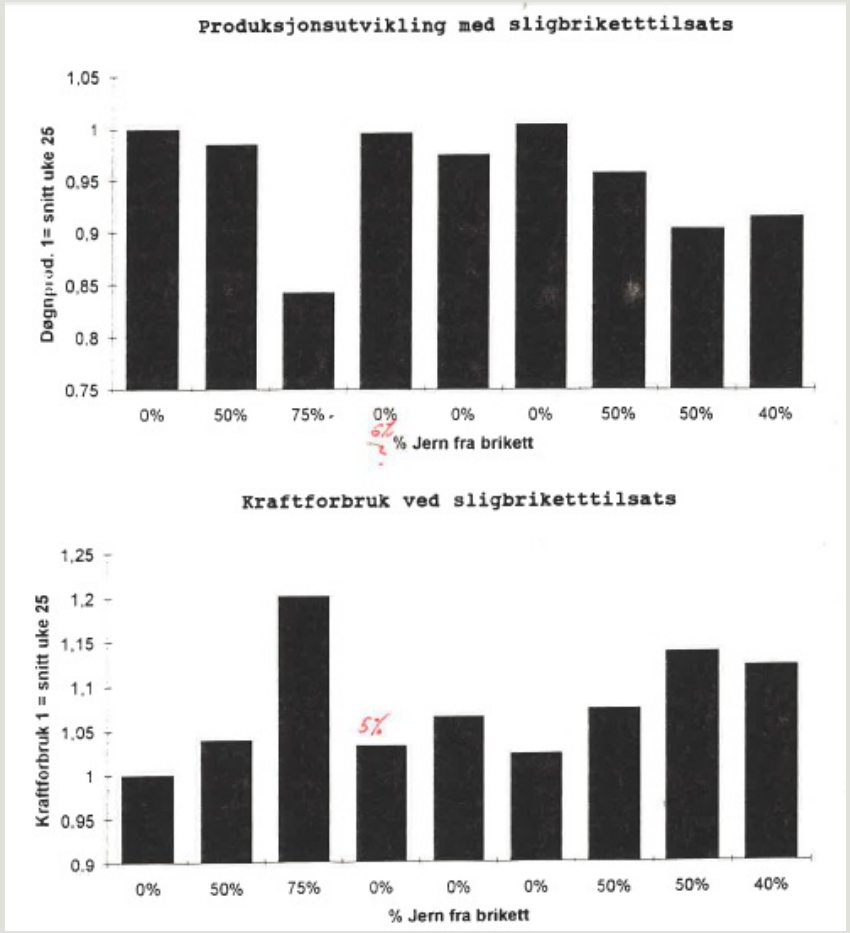
- Two tests were run at Finnfjord's plant:

  - June/July 1995, briquettes made from Moniza coal, 140 Mt

  - Nov/Dec 1995, two qualities of briquettes made from Wawel and Longyear coals (173 Mt og 196 Mt lots, respectively)




# Test 1: Results using Moniza briquettes

- Compressive strength = 80 kg
  - Not much fines generation during transport and handling.
- Furnace operation worse with increased use of briquettes.
- Decreased production.
- Low reactivity in coal. R = 1247 mL

# Test 2: Wawel/Longyear

- Some lab results from coals and briquettes:

## Wawel

- FSI: 4-5
- Reactivity: 664 mL SiO
- Vol.: 31,2%, Fix-C: 65,6%, Ash: 3,2% (d.b.)

Resulting briquettes

- Reactivity: 678 mL SiO
- Comp. Str. ~120 kg

## Longyear-kull

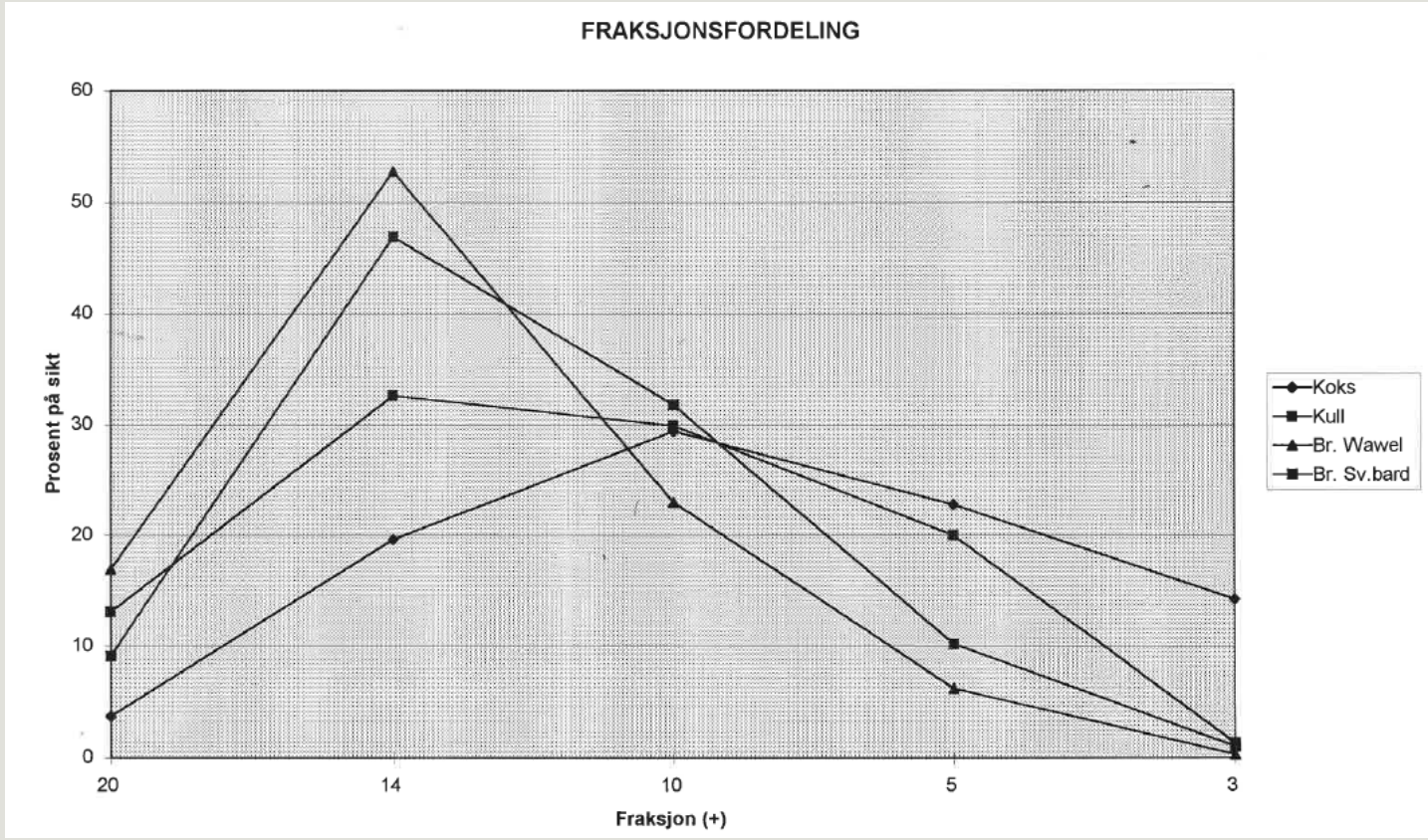
- FSI: 7-8
- Reactivity 554 mL SiO
- Vol.: 40,6%, FixC 54,8%, Ash: 4,6% (d.b.)

Resulting briquettes

- Reactivity: 799 mL SiO
- Comp. Str. ~120 kg

# Sizing after crushing

- Crushed until sizing of briquettes comparable to origin coals



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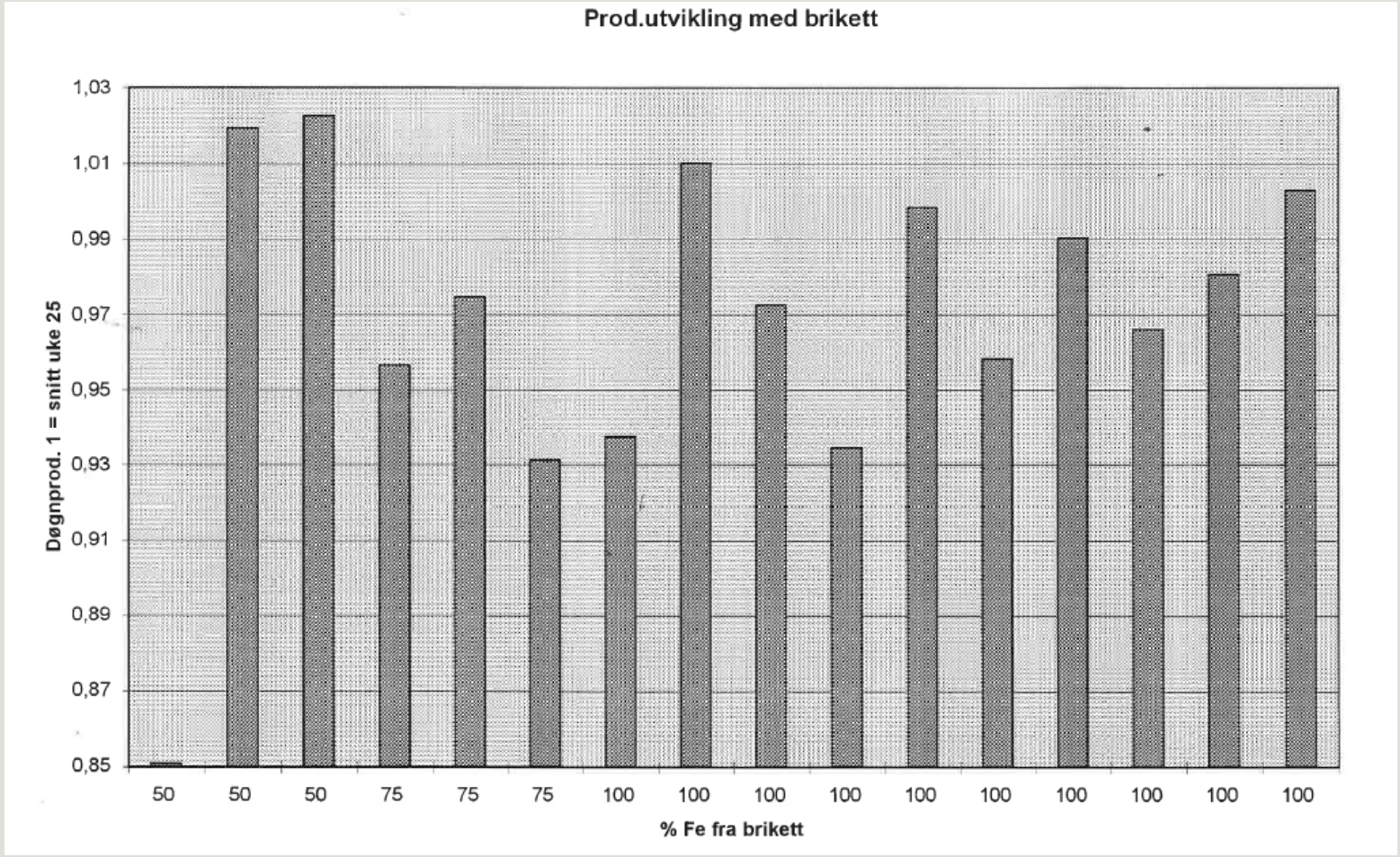
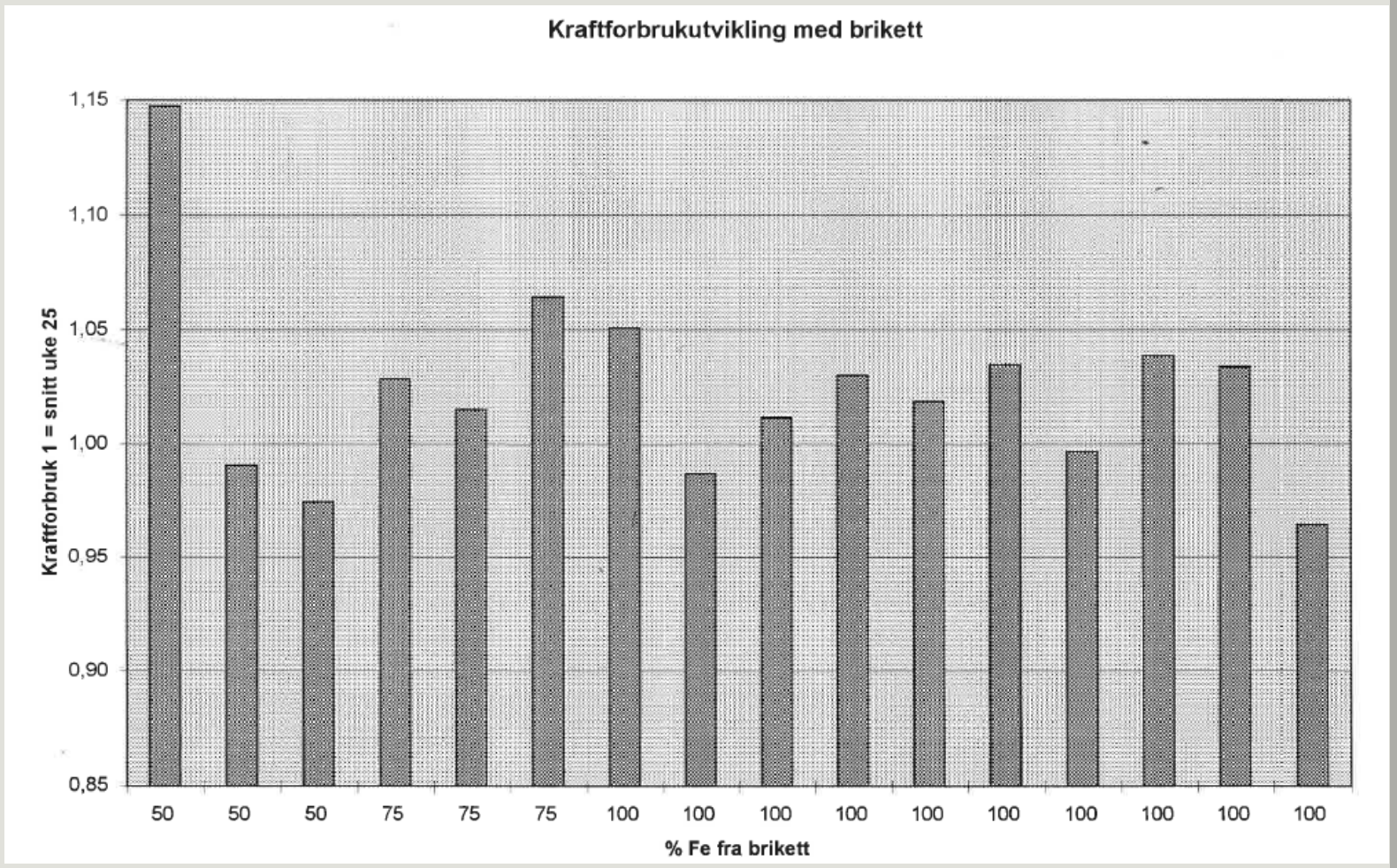



# Production quantity using Wavel and Longyear briq.



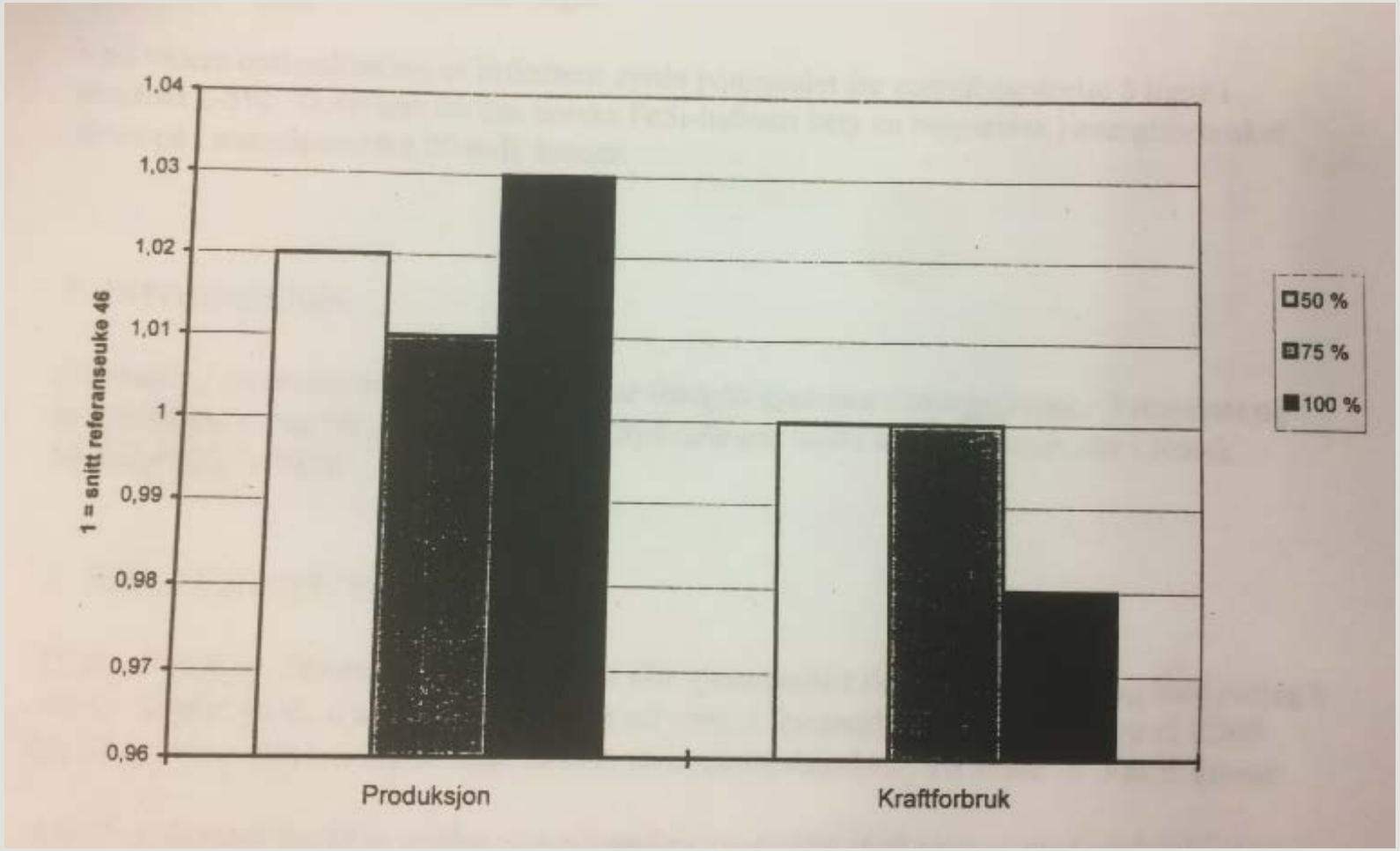

# Specific power consumption using Wavel and Longyear briq.

# Results using Wawel/Longyear

Generally good production and low specific power consumption with both types of briquettes

Visual impressions:

- Metallurgical good operation
- Favourable tapping conditions
- Even gas distribution in furnace charge




# Effects of increased ratio of briquettes

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# Conclusions

- Sizing is of crucial importance
  - Good reactivity in furnace after crushing
- Binders: too much sulphur, and too costly.
- Good mechanical strength. Durable
- Increase ratio of briquettes: small positive (or no significant) change in production
- Spec. power consumption reduced by 1-2% to referance period.
- Patent granted NO 933264 06.03.96, «Method for production of FeSi».
- Process under control with no change for the worse

# Thank you for your attention!