



H2College

The hydrogen system and its perspectives

Lars Yde. Technical Manager

HIRC - Hydrogen Innovation & Research Centre



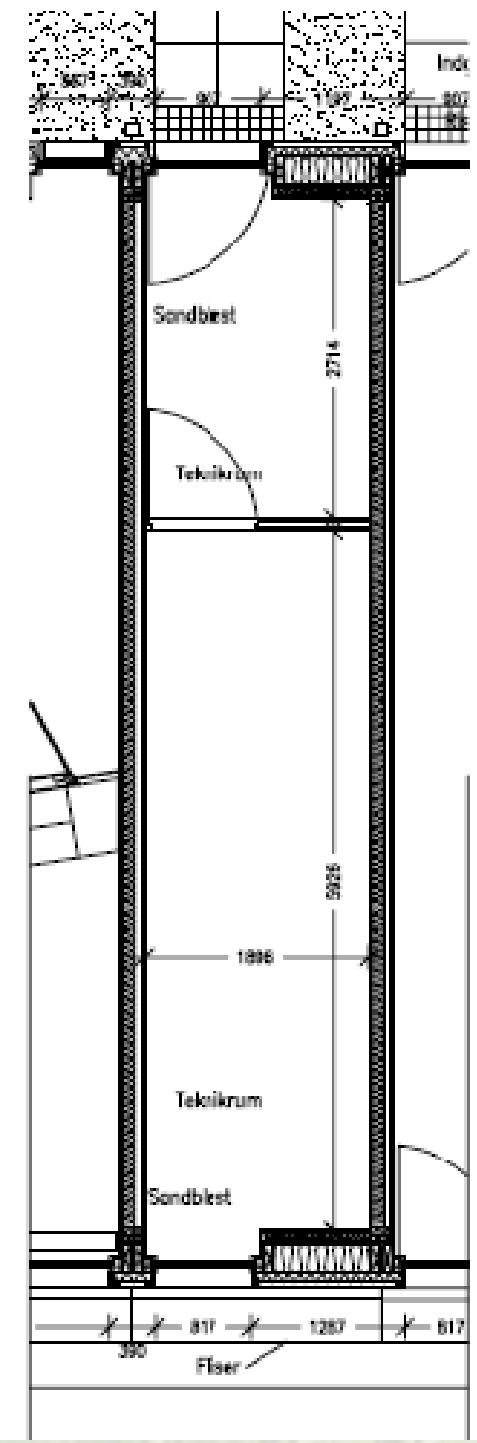
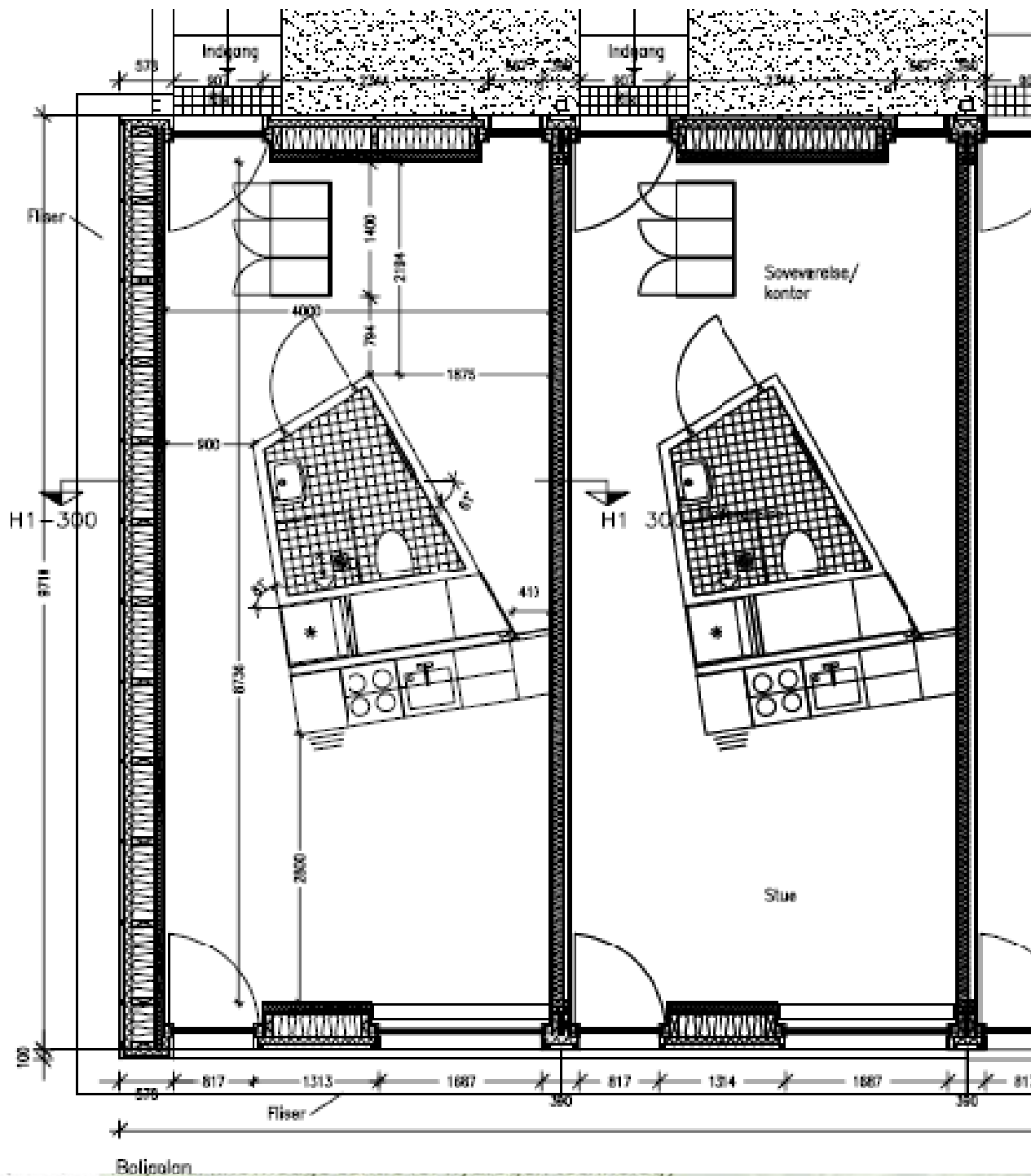
Regional knowledge centre for hydrogen technology



Regional knowledge centre for hydrogen technology



Regional knowledge centre for hydrogen technology



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- 66 apartments for students at Århus University's campus in Herning.
- Built according to the Passive House Standard.
- Supplied 100 % by wind power.
- Storage of wind power by hydrogen.
- Price of the hydrogen plant 10 million DKK.
- Financed by HIRC, Herning Municipality, Housing Society Fruehøjgaard and the all the suppliers of equipment for the plant.
- Awarded the two prizes "Dogme 2000-miljøprisen" and "Kloge m2-prisen"



Partners:

- Dantherm Power A/S
- GreenHydrogen.dk
- EnergiMidt

- Danfoss A/S
- Naturgas Midt-Nord

- NIRAS
- Boligselskabet Fruehøjgaard
- Aarhus Architects A/S
- Passiv Haus Institut Damst.
- Central Denmark
- Boel Living A/S
- EUDP
- HIRC, project principal
- Herning Kommune

Role:

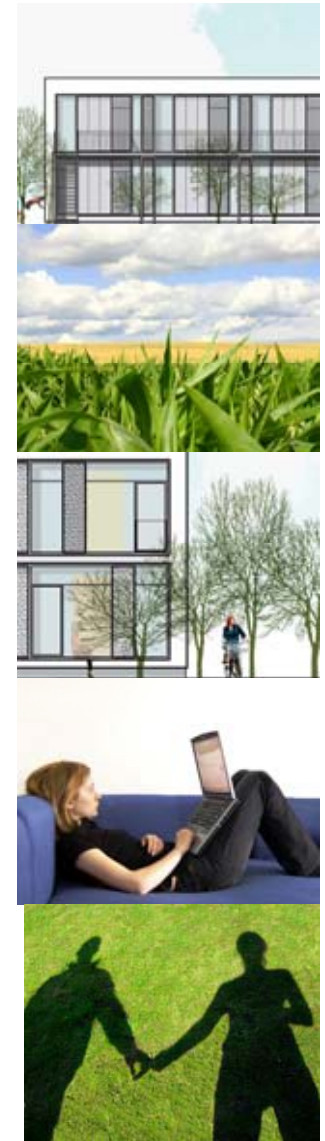
- Supplier of PEM mikro-CHP
- Supplier/developer of Elektrolyser
- Electricity supplier of windpower

- Hotwater-storage and systems
- Pipelines and storage of H₂

- Engineer consultancy
- Buildings houselord – passivhuses

- Project and passivhus-building
- Teknical consult on passivhouses
- support and co-funder
- Sponsor and knowhow, intelligente houses
- Demonstration of electrolysis

- Teknical concept – fundraiser, H₂-knowhow
- Lokal planning and sponsor on demonstration



**How can we intelligent,
supply our homes with heat and electricity
in a future 100% renewable energy system?**



100% VE

10.000 MW Wind power

6.800 MW Elektrolysis

Kilde: PhD Brian Vad Mathisen, AAU

2009

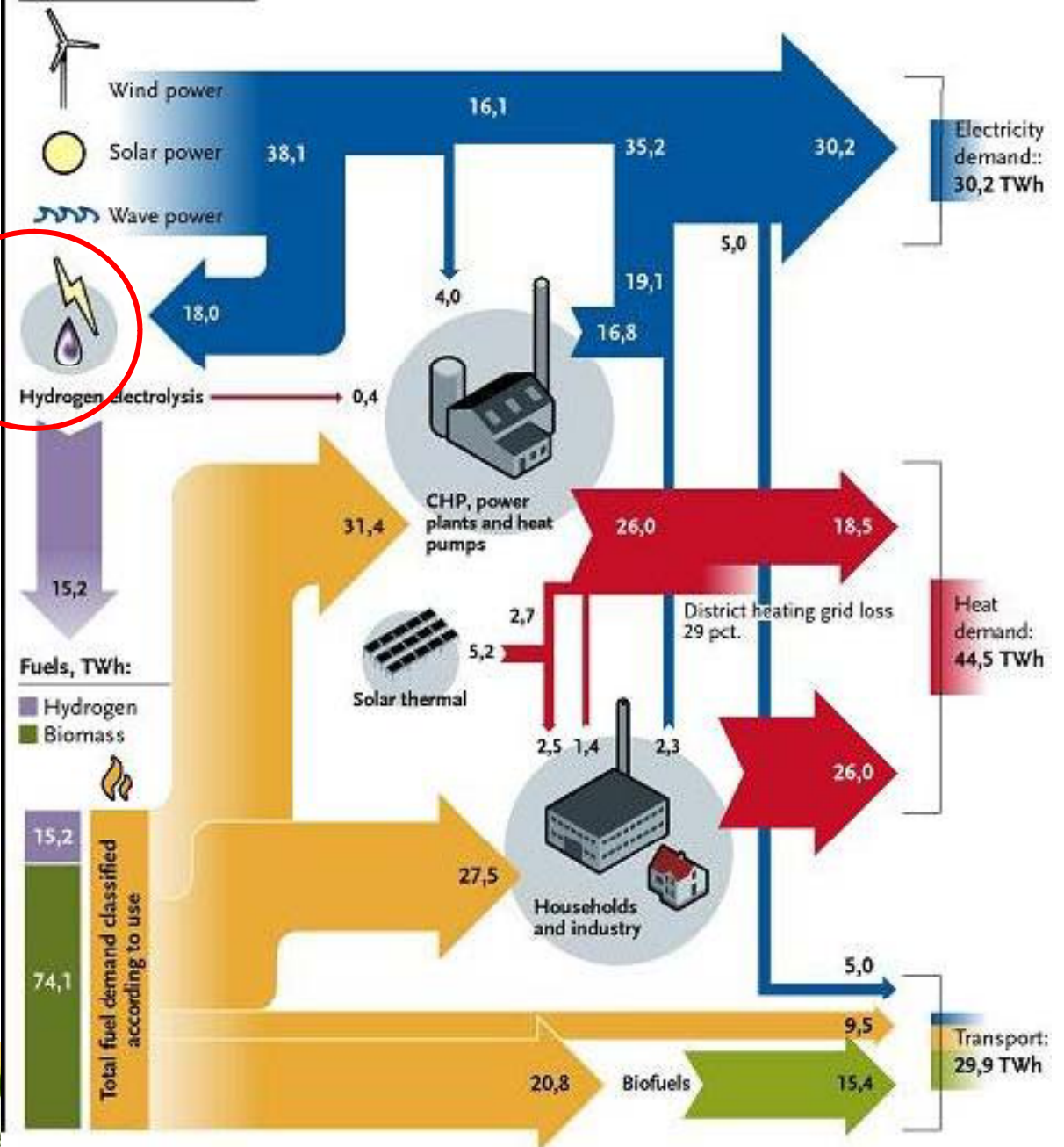
10.000 MW Central +
decentral power plants

3.200 MW Wind power

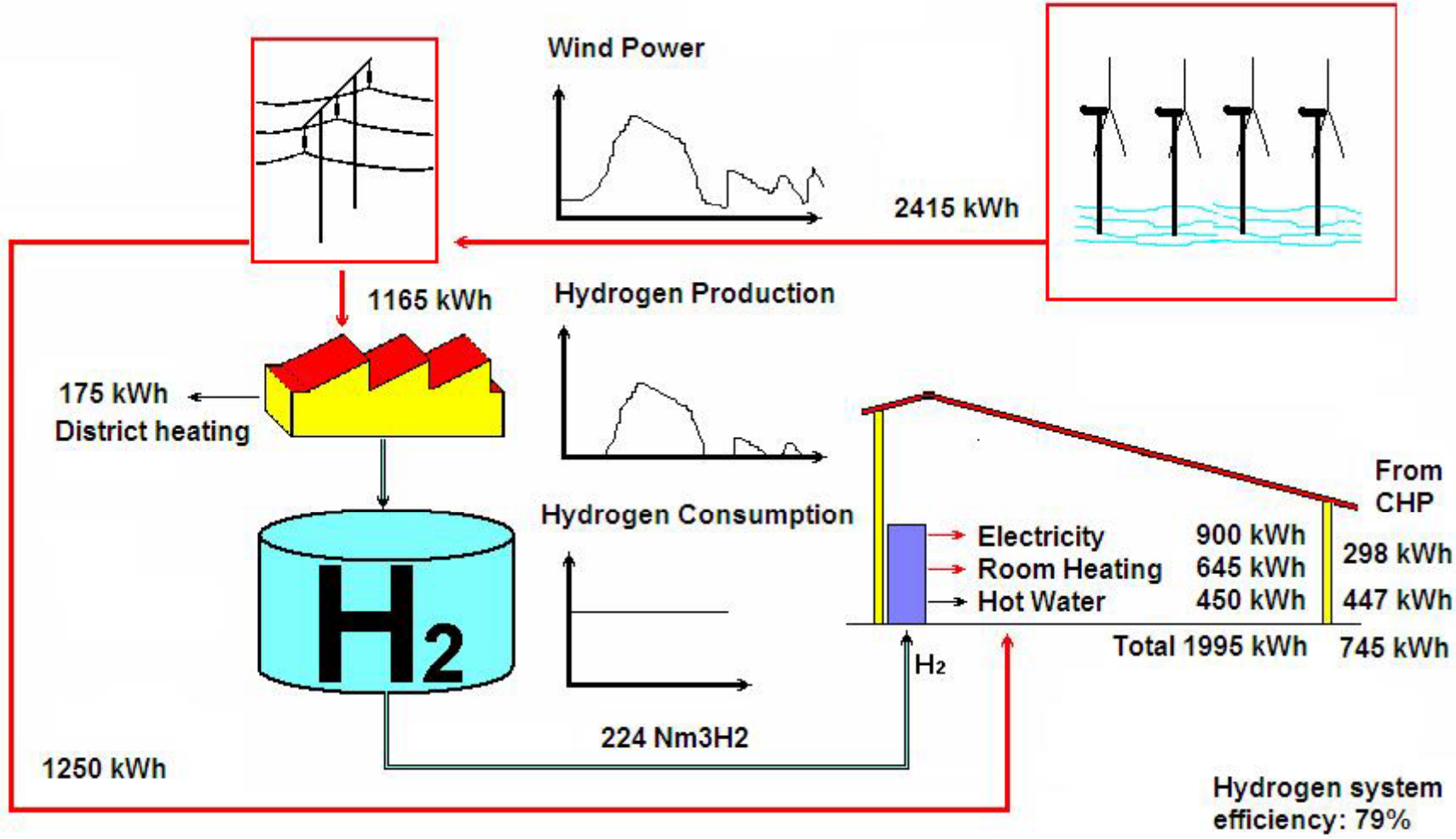
Fuel demand and renewable energy, total:

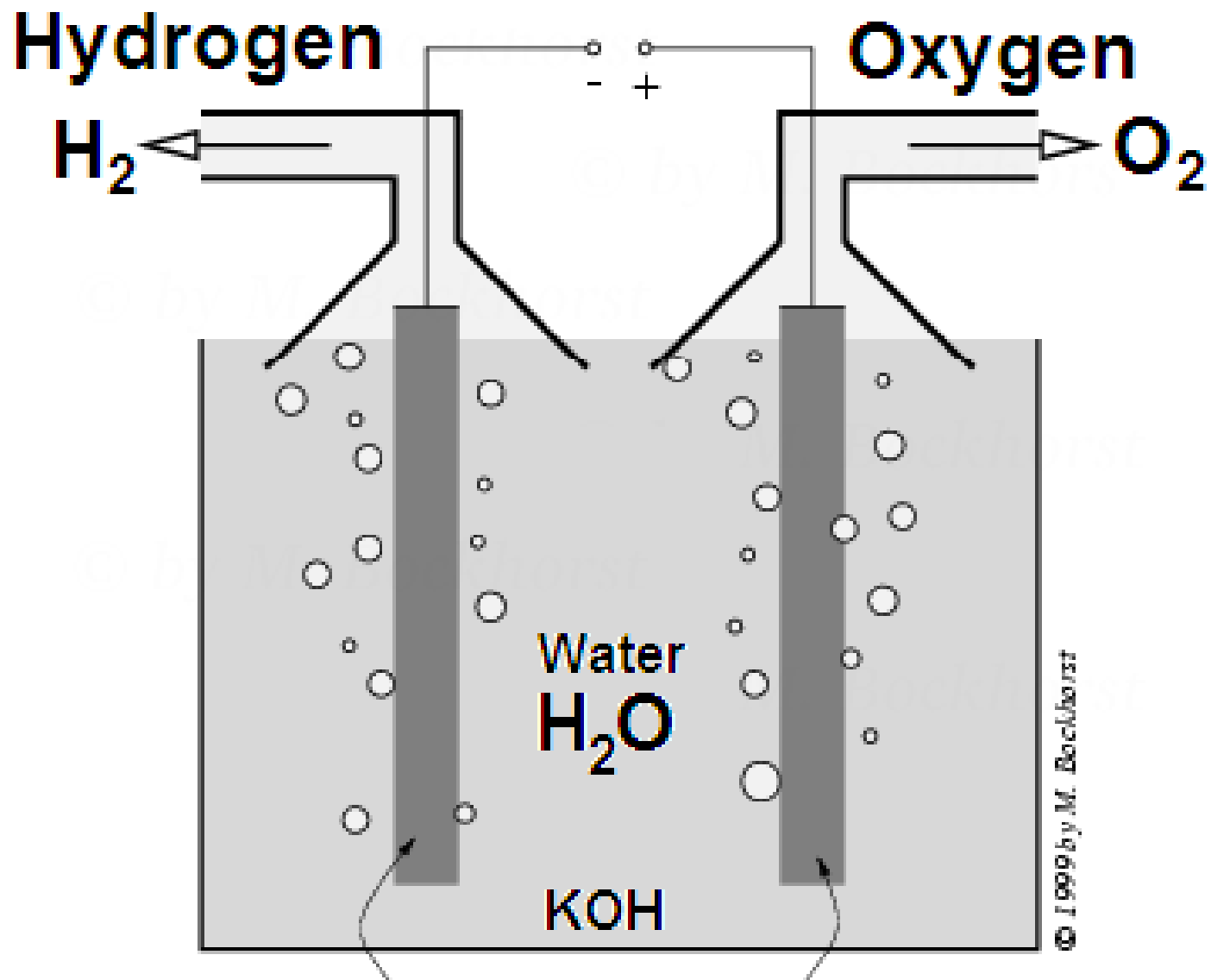
117,4 terawatt hour (TWh)

Renewable energy, TWh:



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Energy balance for one apartment in kWh per year.





© 1999 by M. Beckhorst



2nd generation electrolysis plant from GreenHydrogen

4,4 kWh electricity
1 litre water



1 Nm³ H₂

0,5 Nm³ O₂

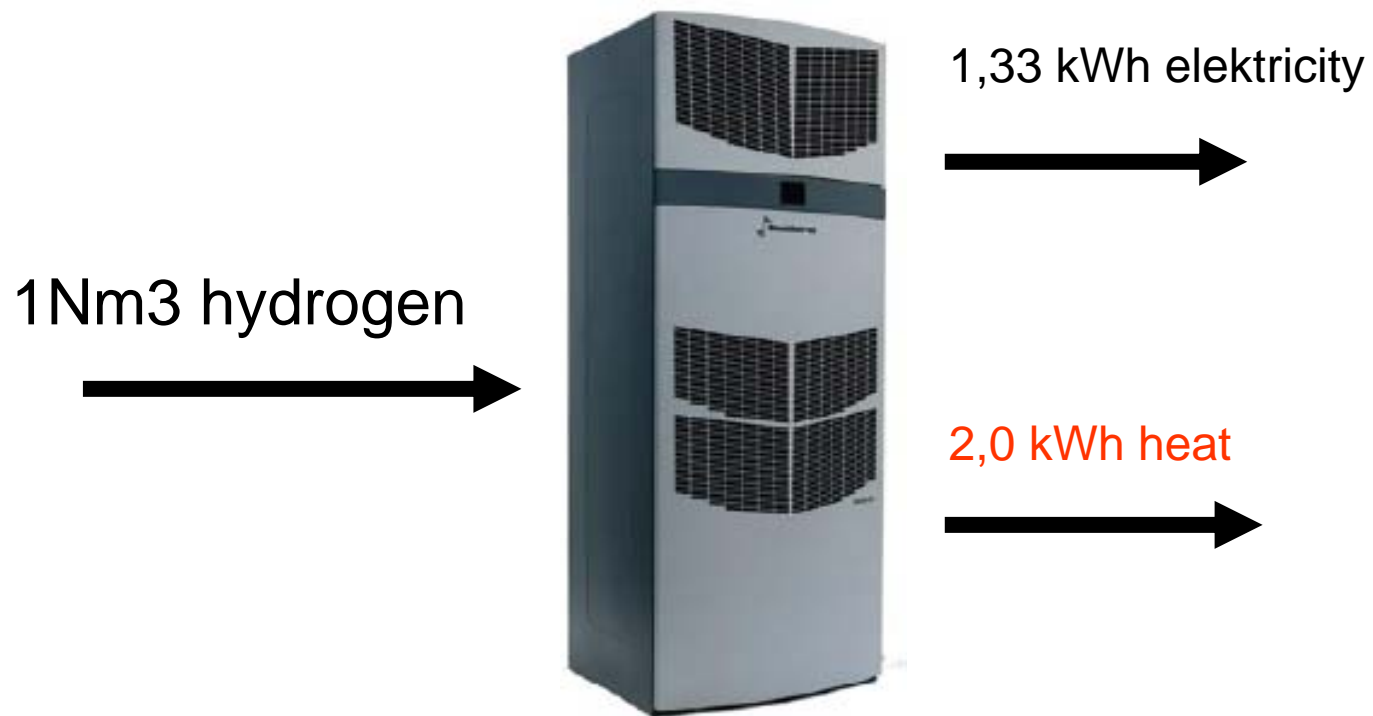
0,453 kWh heat



Energy efficiency 90%

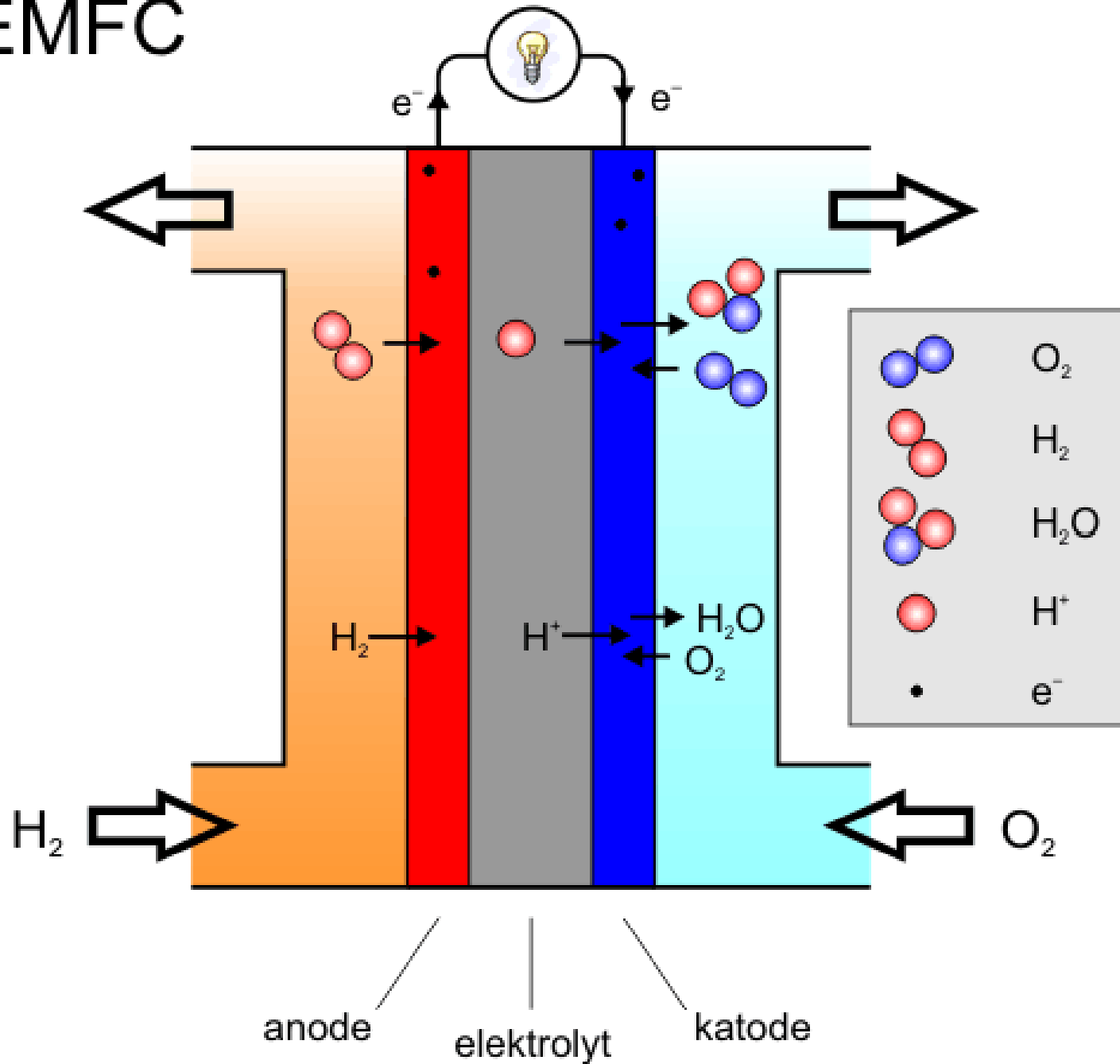






Energy efficiency 95%

PEMFC



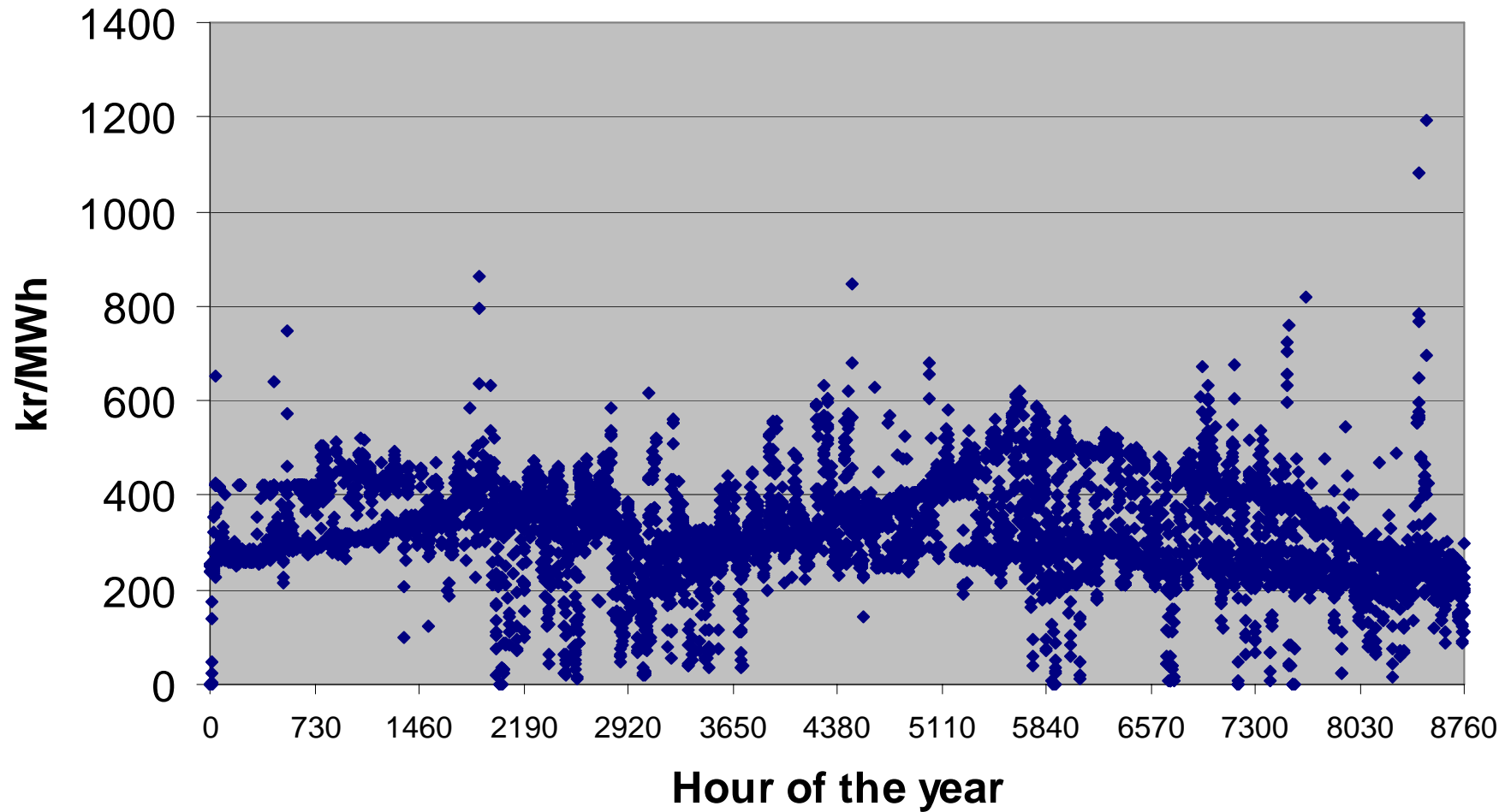
Enkeltcelle
Single cell



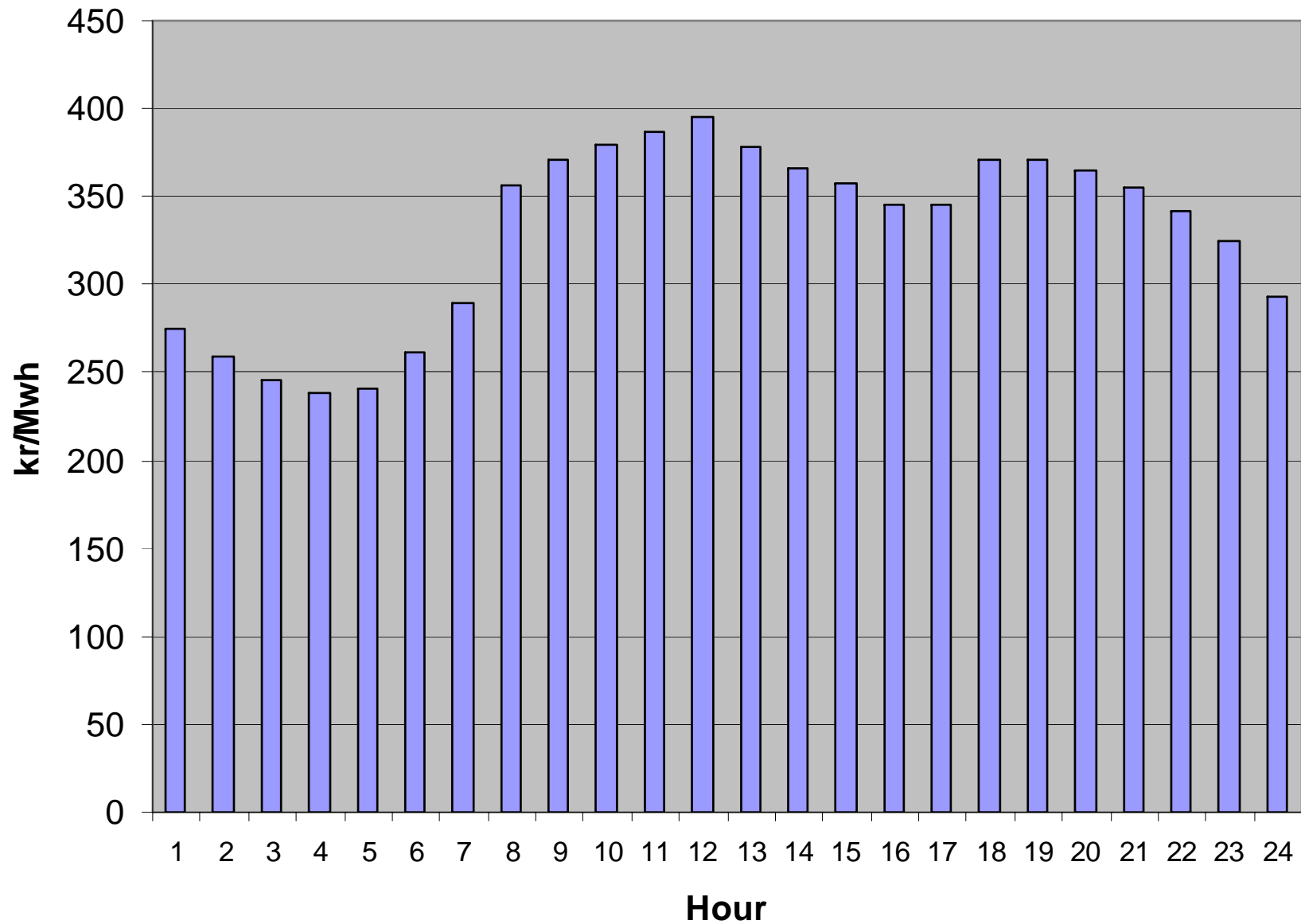
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Prices of electricity 2006



Daily average prices 2006



**How can we intelligent,
supply our homes with heat and electricity
in a future 100% renewable energy system?**

0. Reduce the consumption as much as possible.

Use wind (solar and wave) power:

1. Directly when possible.

2. Store excess wind power by production of hydrogen.

3. Use the waste heat from the hydrogen system for hot water production.



Thank you for your attention

Lars Yde. Technical Manager
HIRC
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