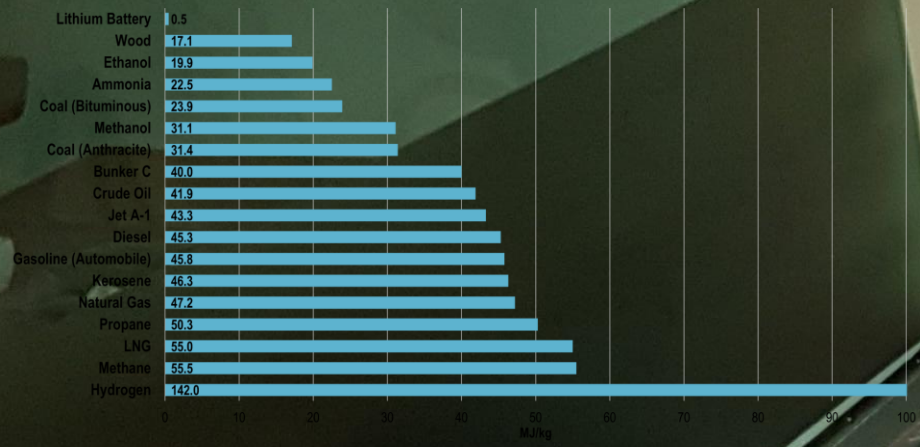
Opslagsystemen zijn overal

Vele types – maten – stofjes - footprints



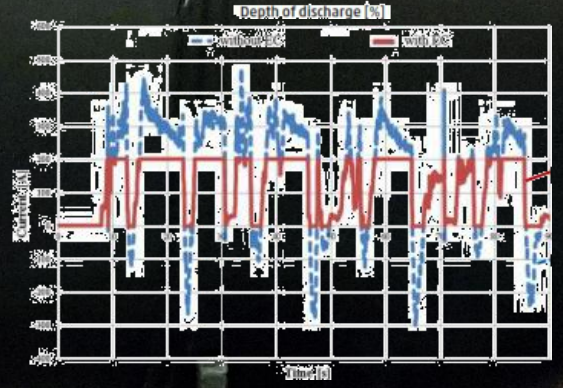
125 t_{co2}/MWh

Single value.....

+10% to include operating energy use

Vele parameters

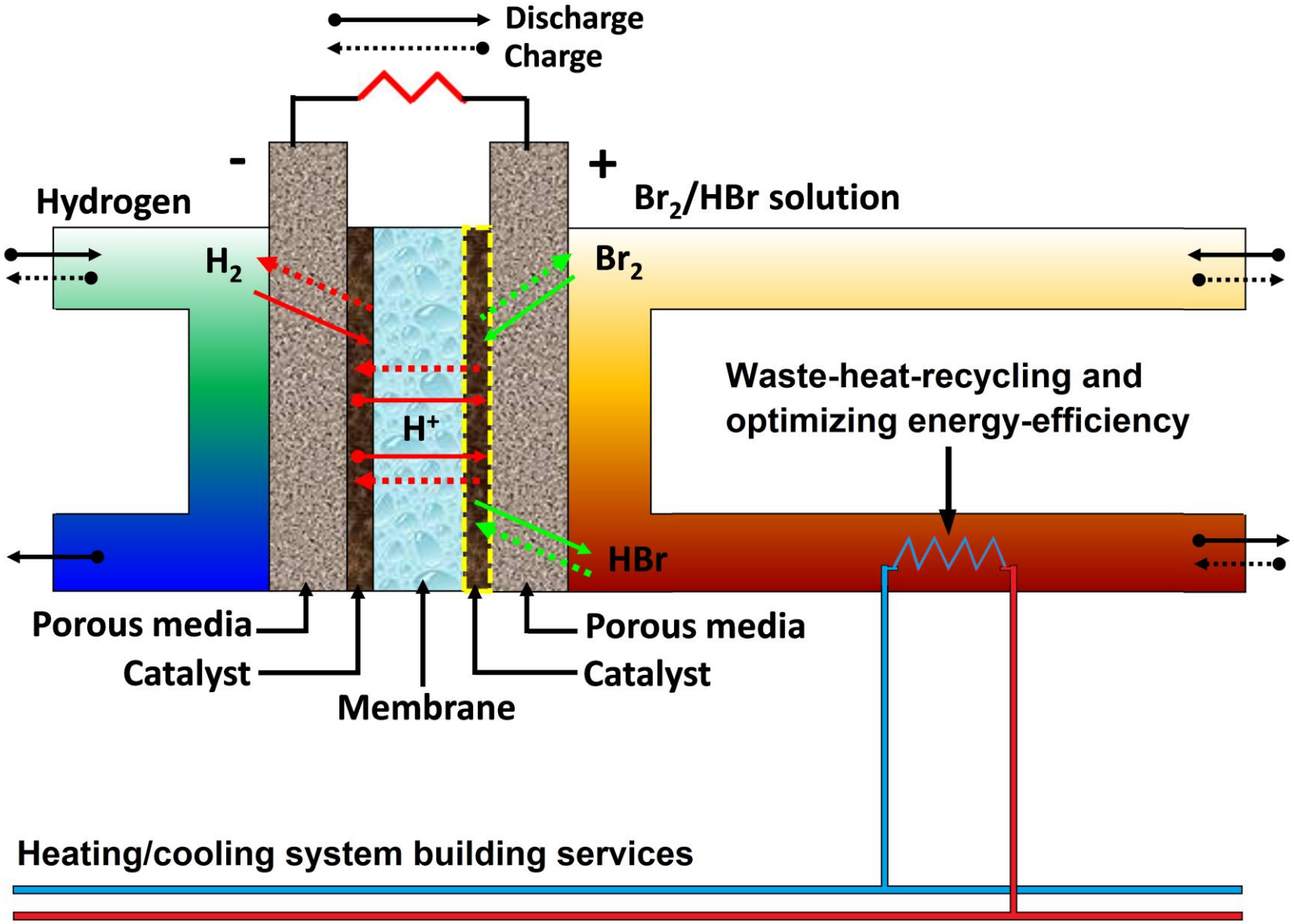
- Performances
  - Energy density
  - Power density
  - Cycle and calendar life
- Operating conditions
  - Temperature
  - Flexibility,…
- Costs and externalities
  - Financial cost
  - Security
  - Environmental impact



EROI van 100:1 of 1:4?

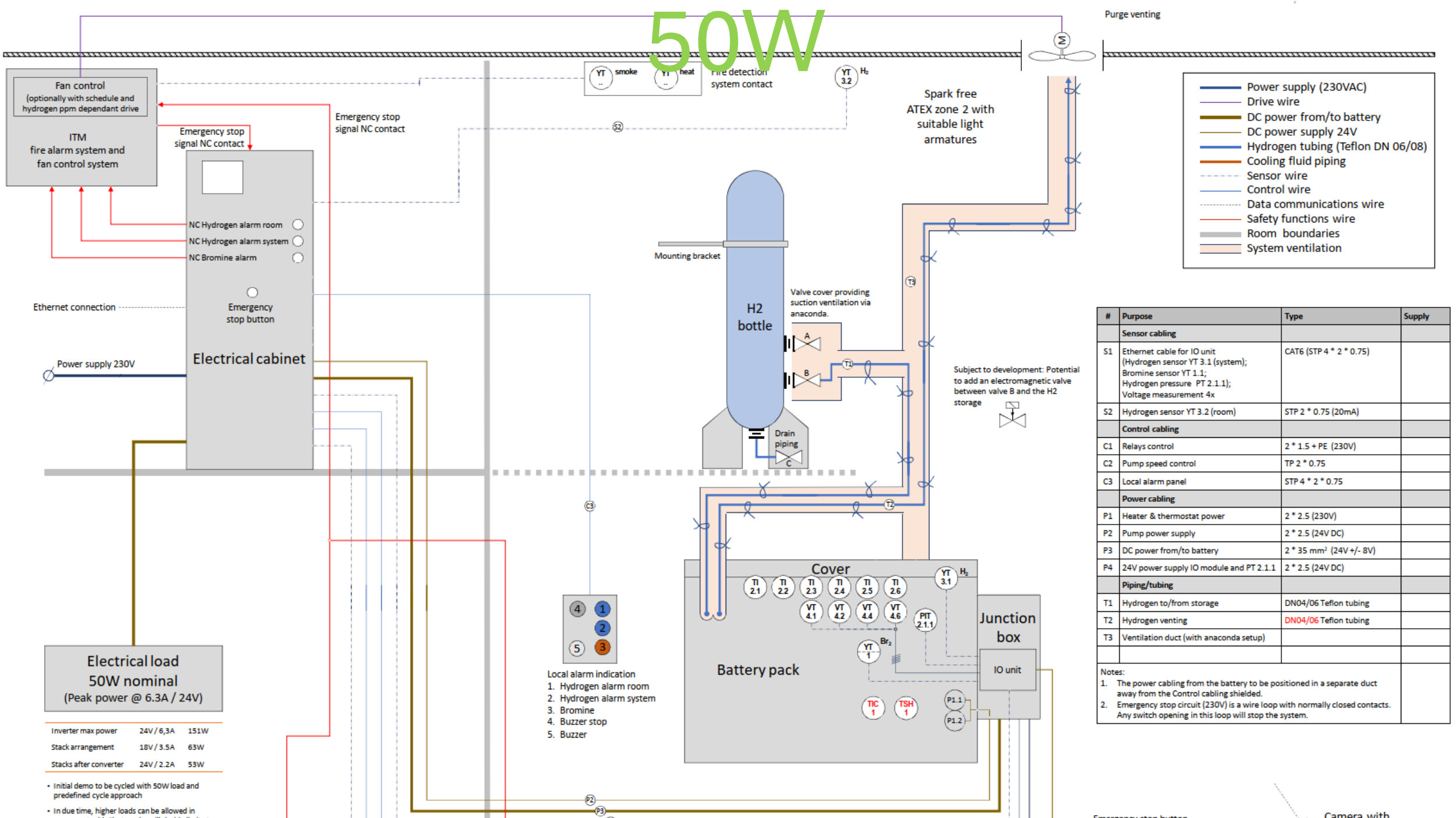
Waterkracht 84:1

Hebben twee touwtjes.. kW - kWh

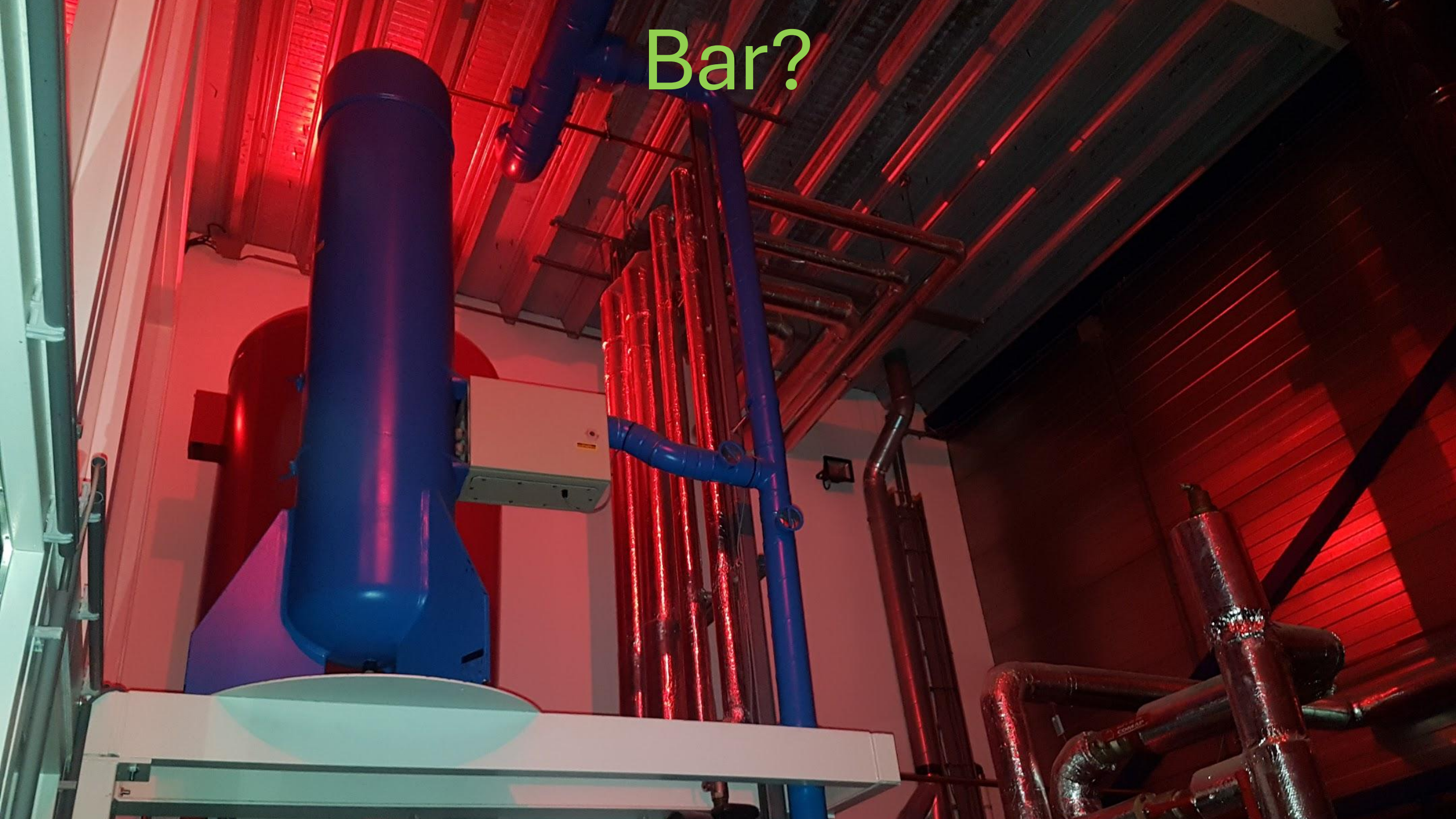



Hebben twee touwtjes

50W

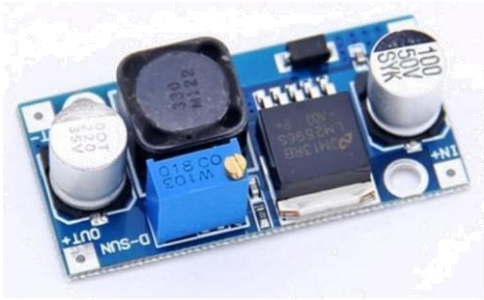


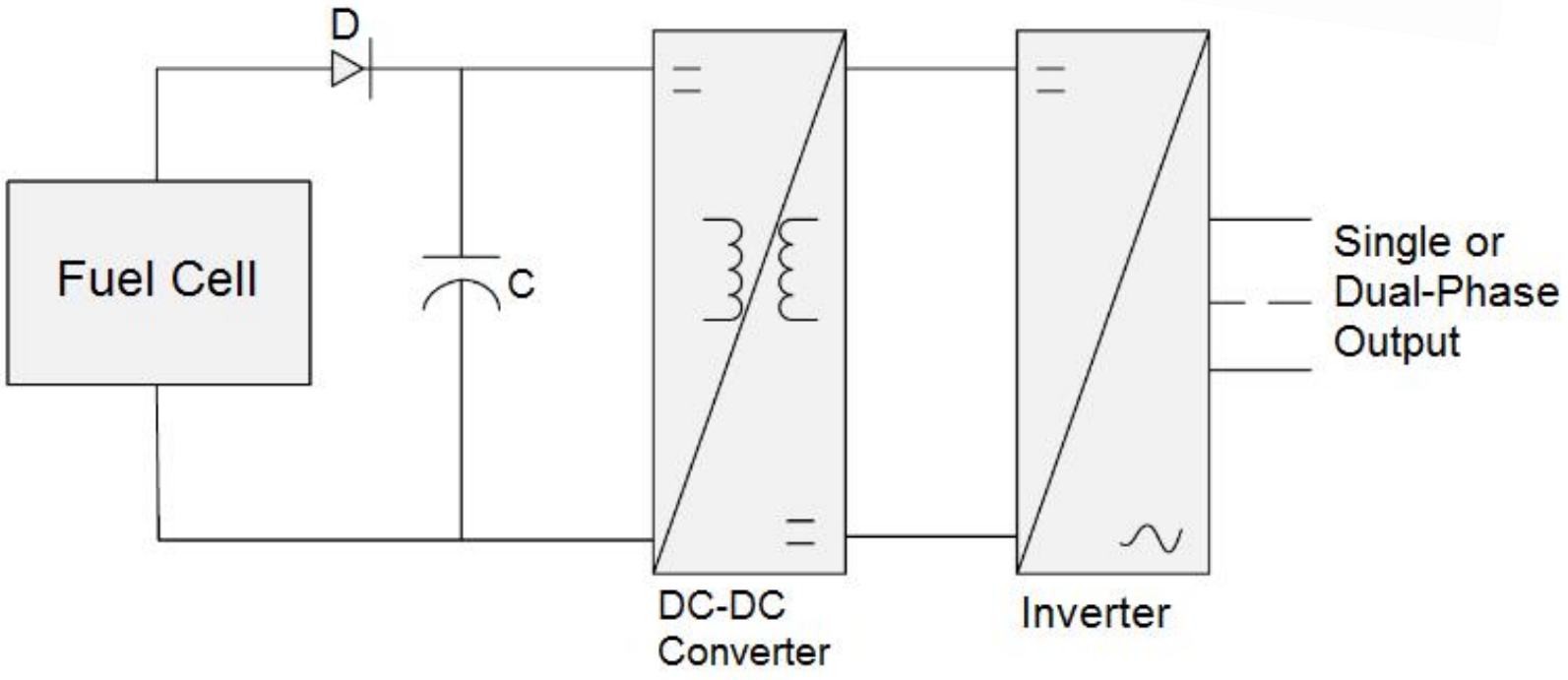
#	Purpose	Type	Supply
	Sensor cabling		
S1	Ethernet cable for IO unit (Hydrogen sensor YT 3.1 (system); Bromine sensor YT 1.1; Hydrogen pressure PT 2.1.1); Voltage measurement 4x	CAT6 (STP 4 * 2 * 0.75)	
S2	Hydrogen sensor YT 3.2 (room)	STP 2 * 0.75 (20mA)	
	Control cabling		
C1	Relays control	2 * 1.5 + PE (230V)	
C2	Pump speed control	TP 2 * 0.75	
C3	Local alarm panel	STP 4 * 2 * 0.75	
	Power cabling		
P1	Heater & thermostat power	2 * 2.5 (230V)	
P2	Pump power supply	2 * 2.5 (24V DC)	
P3	DC power from/to battery	2 * 35 mm² (24V +/- 8V)	
P4	24V power supply IO module and PT 2.1.1	2 * 2.5 (24V DC)	
	Piping/tubing		
T1	Hydrogen to/from storage	DN04/06 Teflon tubing	
T2	Hydrogen venting	DN04/06 Teflon tubing	
T3	Ventilation duct (with anaconda setup)		
Notes: 1. The power cabling from the battery to be positioned in a separate duct away from the Control cabling shielded. 2. Emergency stop circuit (230V) is a wire loop with normally closed contacts. Any switch opening in this loop will stop the system.			


Bar?

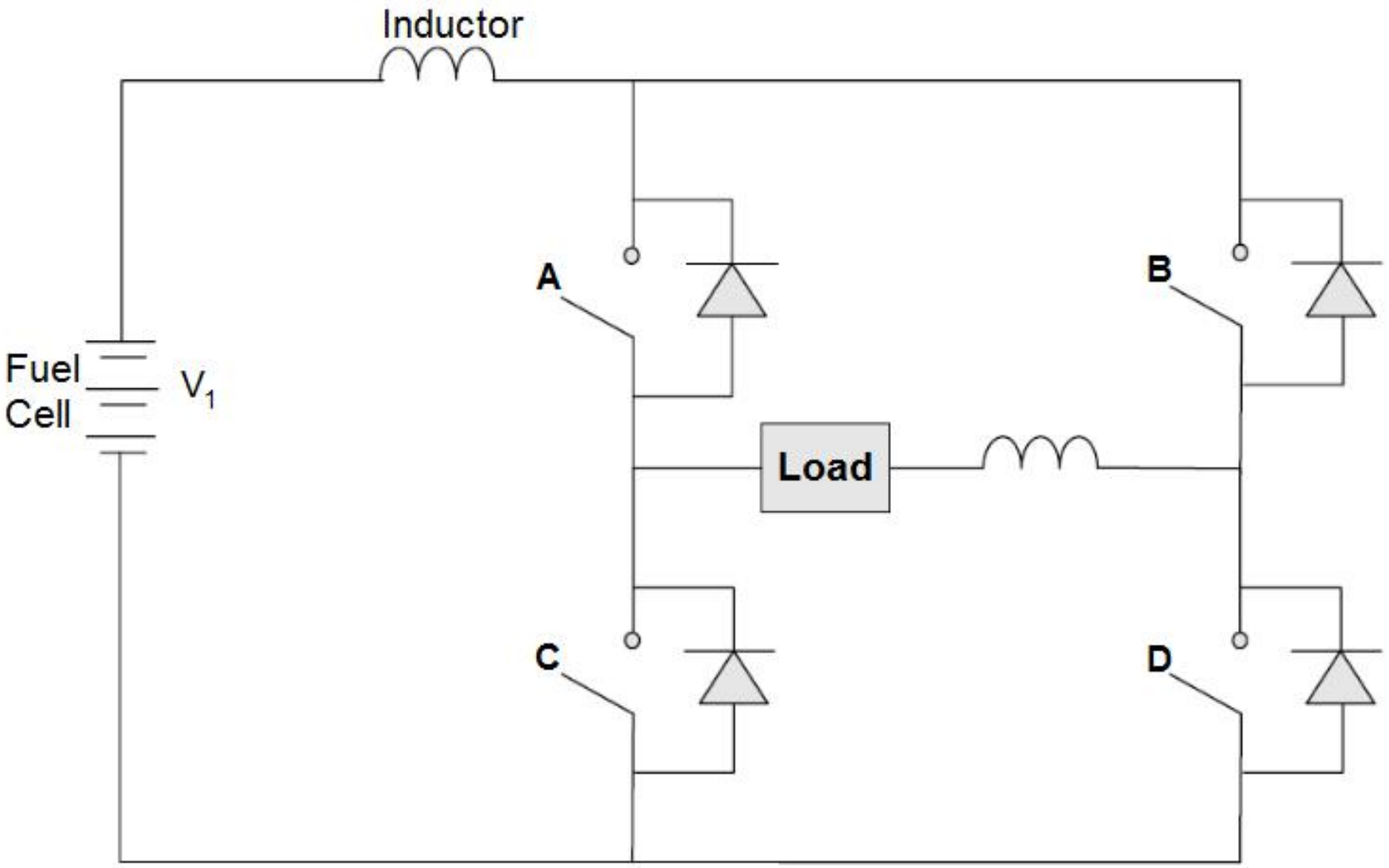
Wat doe je met DC?

Appliance	(A) Energy savings from switching to DC-compatible run on AC	(B) Energy Savings from avoided AC-DC power conversion losses
Lighting-Incandescent	73%	18%
Lighting-Reflector	71%	18%
Lighting-Torchiere	69%	18%
Refrigerators	53%	13%
Freezers	53%	13%
Dishwashers	51%	12%
Electric Water Heaters	50%	12%
Electric Space Heaters other than Heat Pumps	50%	12%
Spas	50%	12%
Central Air Conditioners	47%	11%
Electric Clothes Dryers	45%	11%
Room Air Conditioners	34%	11%
Furnace Fans and Boiler Circulation Pumps	30%	13%
Clothes Washers	30%	13%
Ceiling Fans	30%	13%
Electric Cooking Equipments	12%	12%
Lighting-Fluorescent	1%	18%
Home Audio	0%	21%
Personal Computers and Related	0%	20%
Rechargeable Electronics	0%	20%
DVDs/VCRs	0%	31%
Security Systems	0%	17%
Color TVs and Set-Top Boxes	0%	15%
Coffee Makers	0%	13%
Electric Other	0%	13%
Microwave Ovens	0%	13%
Electric Heat Pumps	0%	12%
Geothermal Heat Pumps	0%	12%
Solar Water Heaters	0%	12%
Electric Heat Pumps	0%	12%
Geothermal Heat Pumps	0%	12%
Electric Secondary Space Heaters	0%	11%
Average savings (consumption weighted)	33%	14%

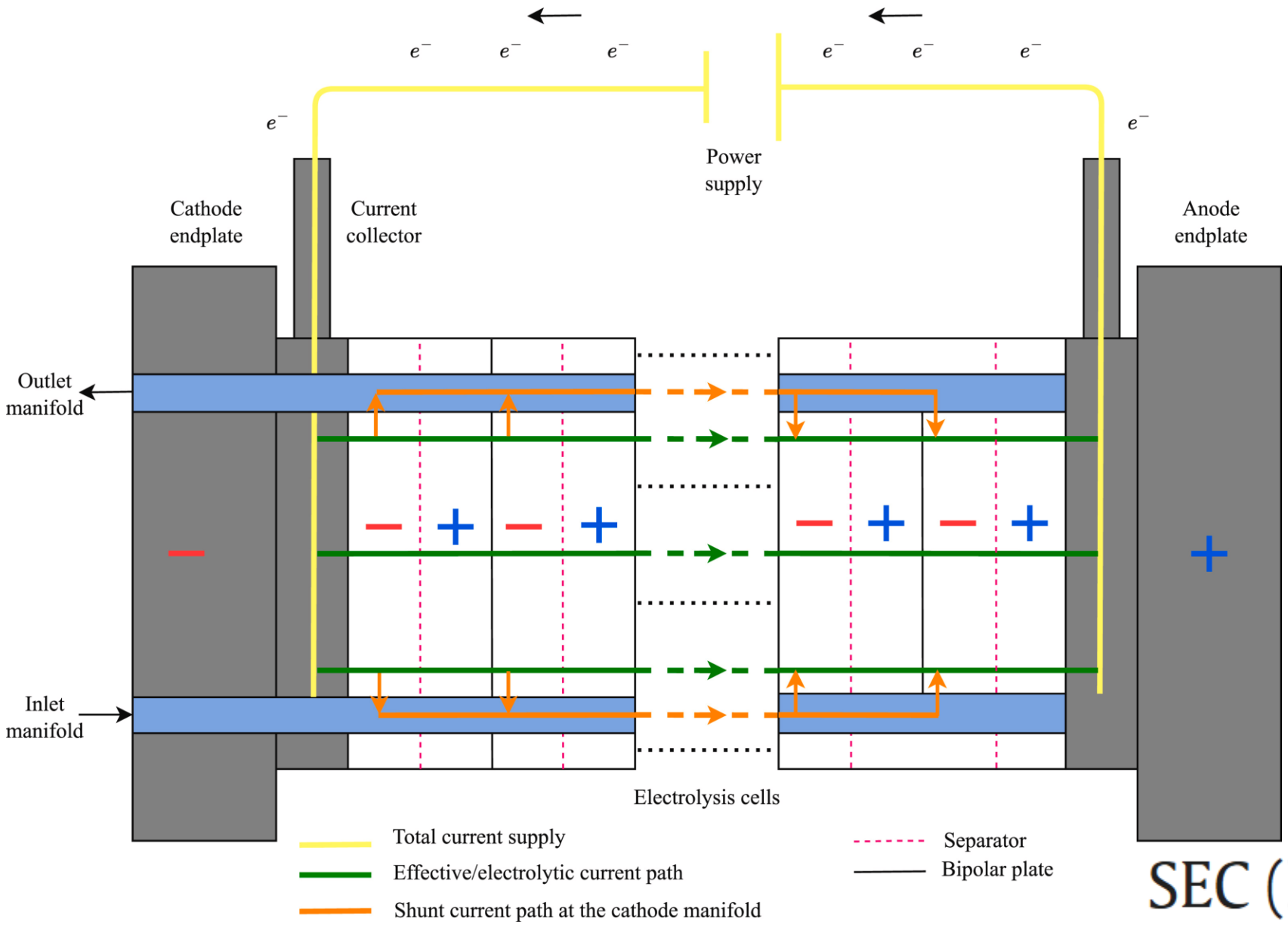




Beetje FM op DC

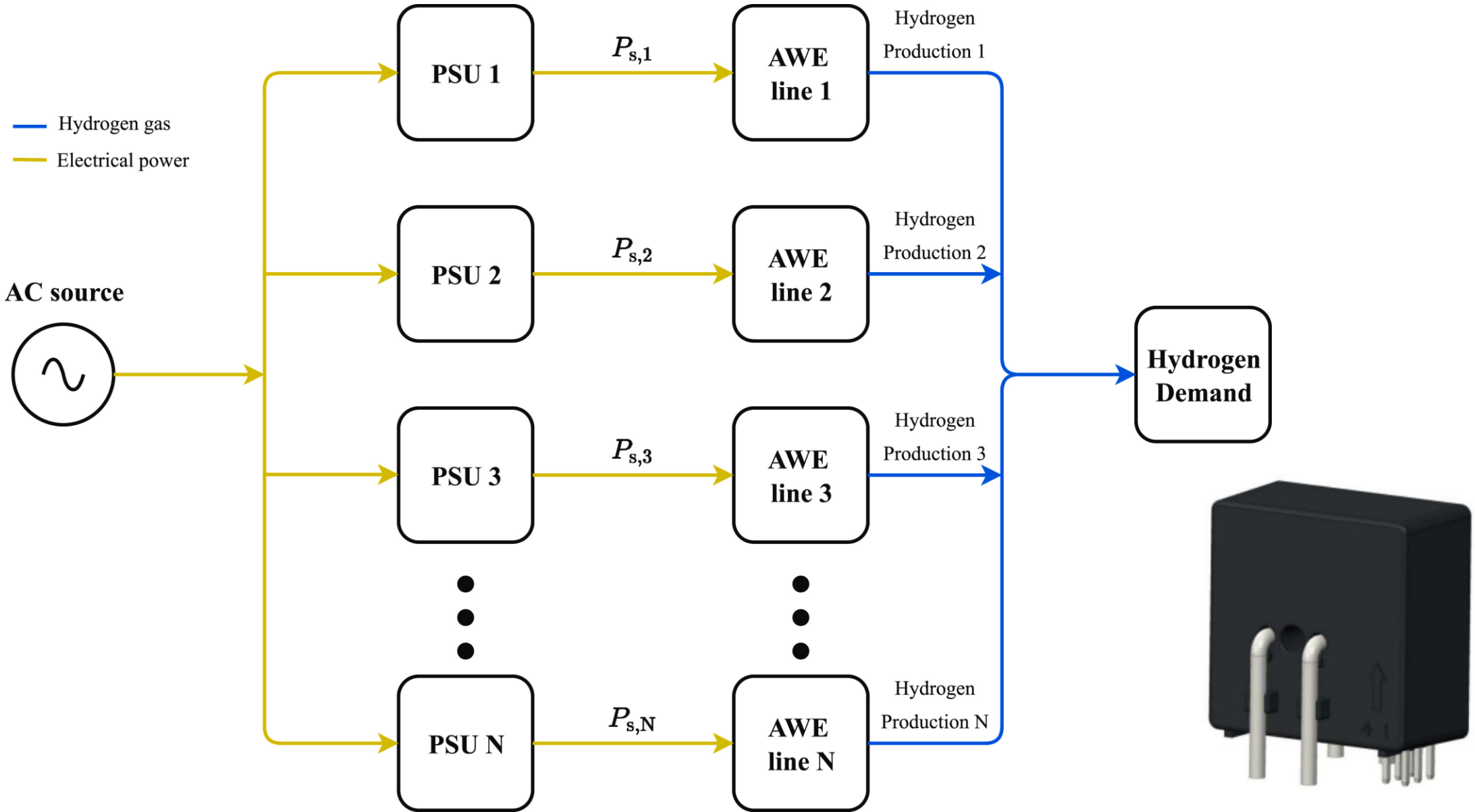


Shunt currents

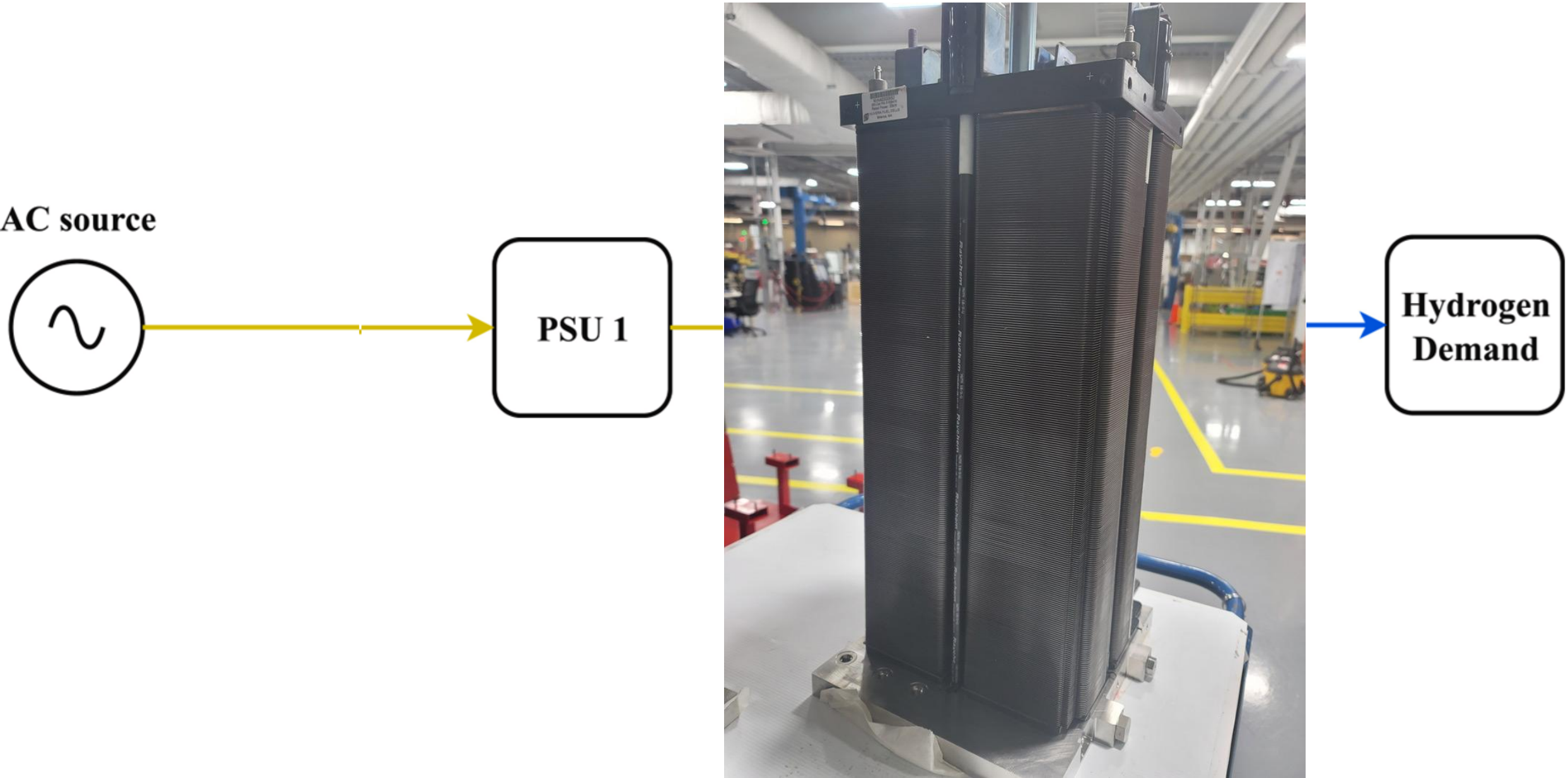


$$\mathrm{SEC}\ (\mathrm{kWh/kg_{H2}})$$

IT stelsels

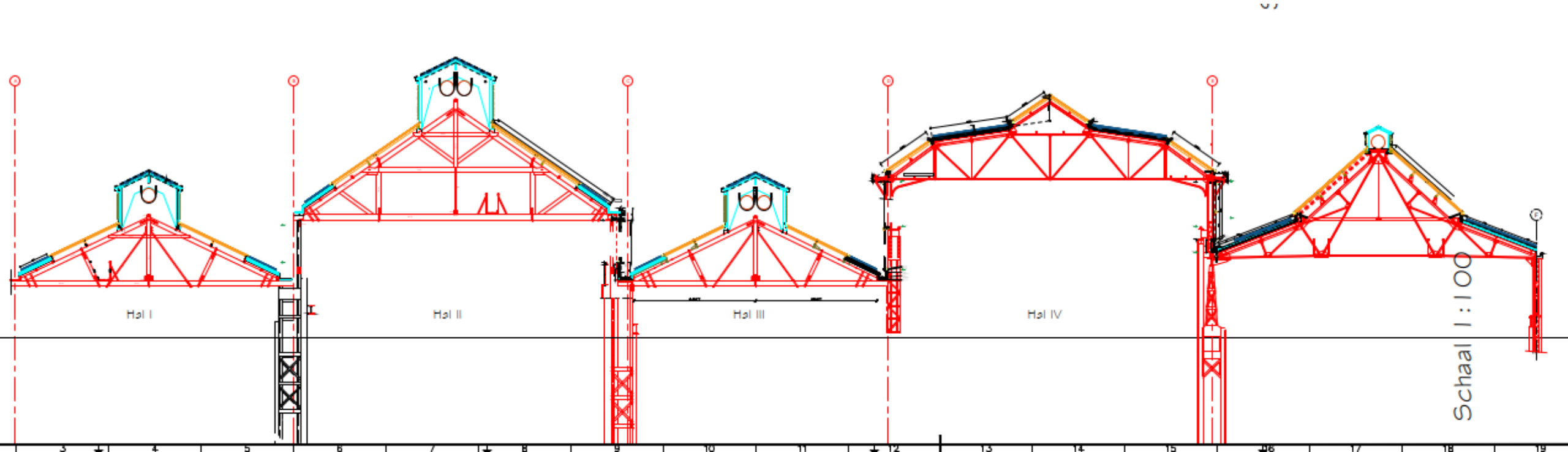

Hydrogen gas
Electrical power
AC source
PSU 1
PSU 2
PSU 3
PSU N
$P_{s,1}$
$P_{s,2}$
$P_{s,3}$
$P_{s,N}$
AWE line 1
AWE line 2
AWE line 3
AWE line N
Hydrogen Production 1
Hydrogen Production 2
Hydrogen Production 3
Hydrogen Production N
Hydrogen Demand

MPPT

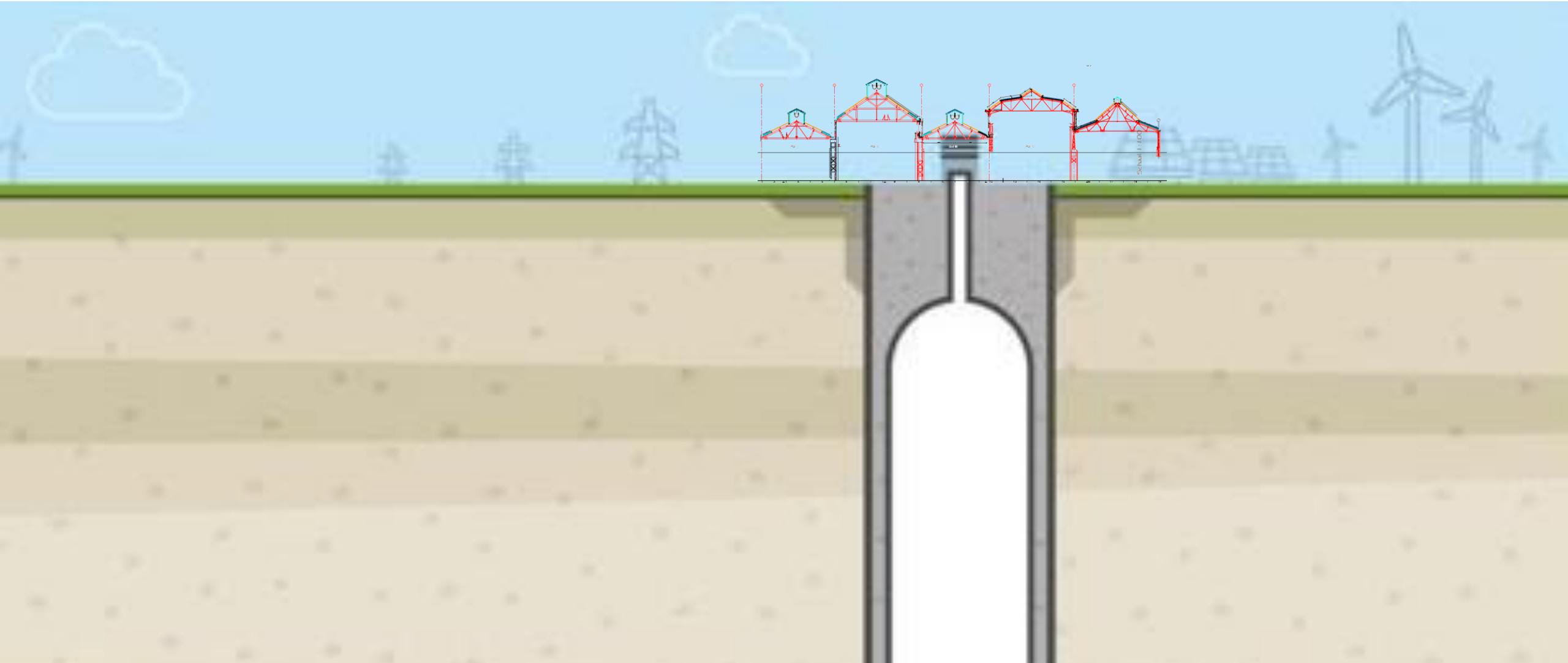


Koeling - verwarming

Cilinders



Verstopt



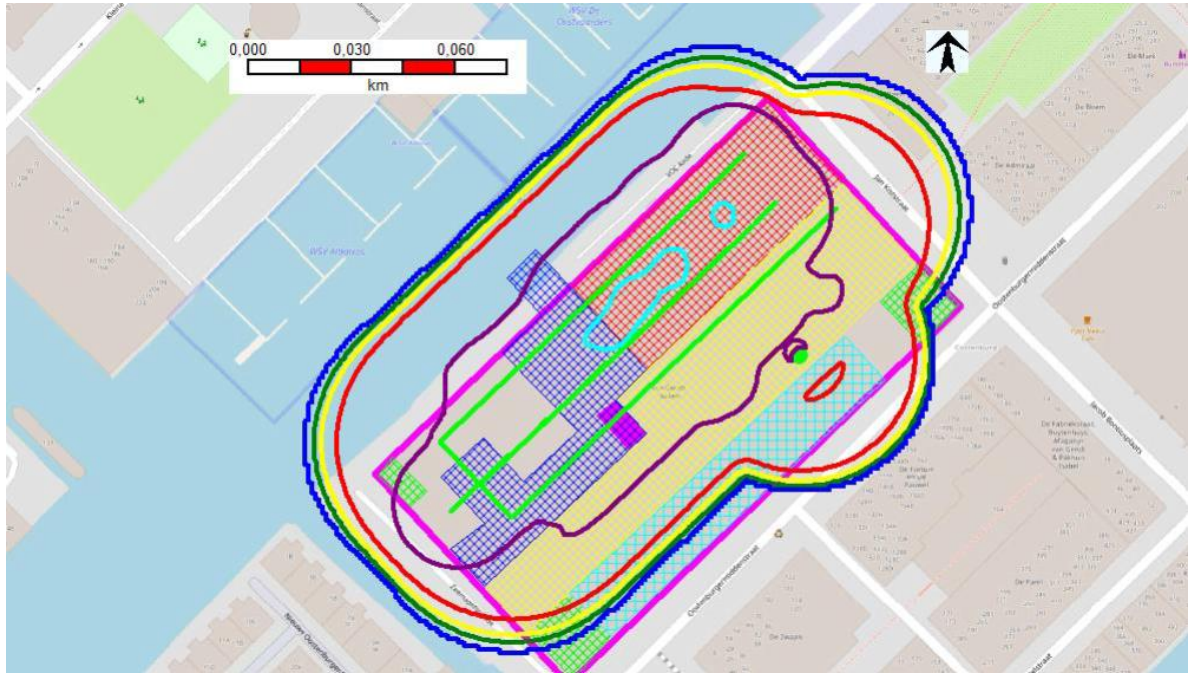
BRANDVEILIGHEIDSRAPPORTAGE QRA WATERSTOF

“350 bar = 853 liter per stuk”

Situatie

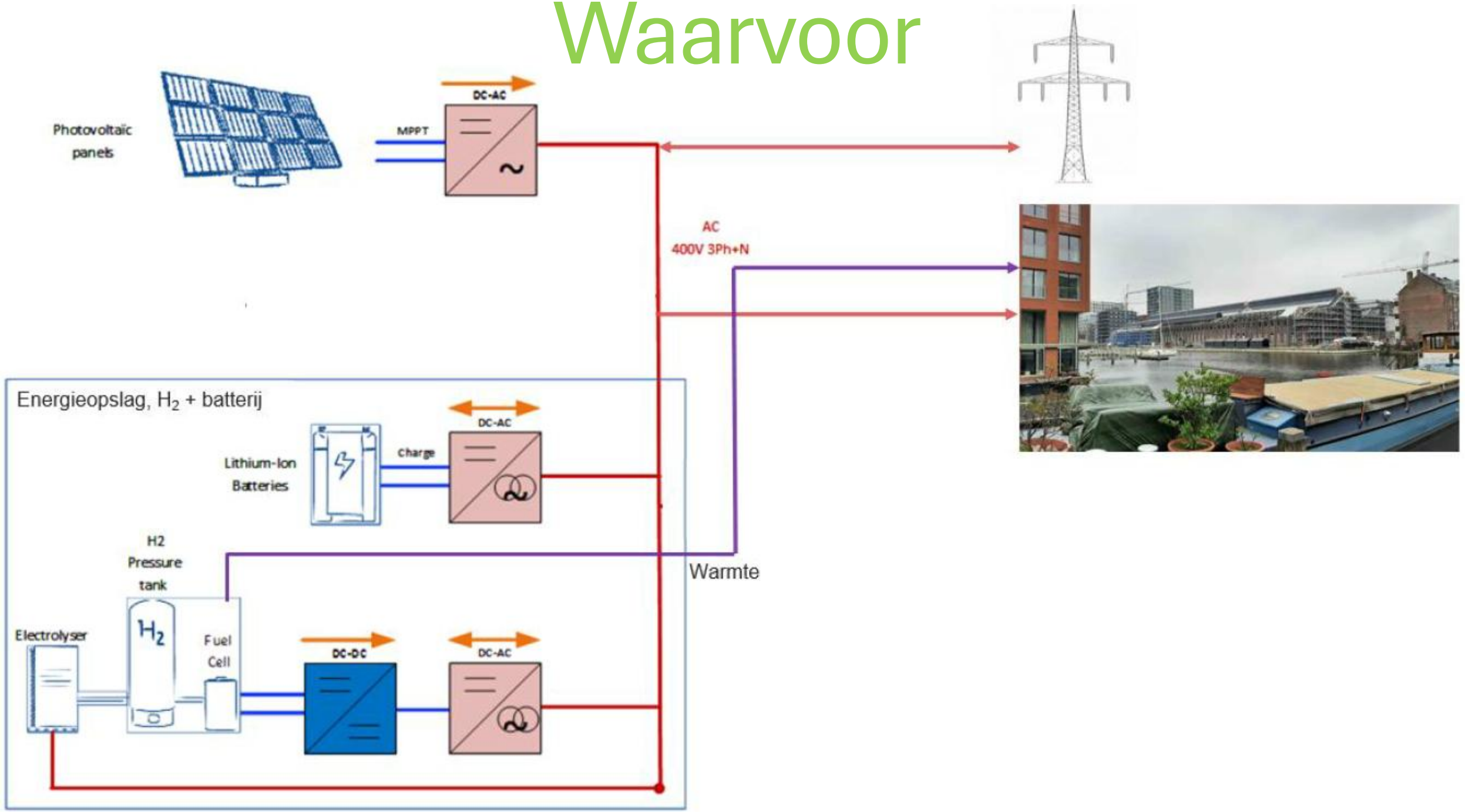
“Kans op vertraagde ontsteking bij grootste wolkomvang”

Voor de opslag van het geproduceerde waterstof komen er 276 tubes waarin in totaal maximaal 5.000 kg waterstof kan worden opgeslagen.

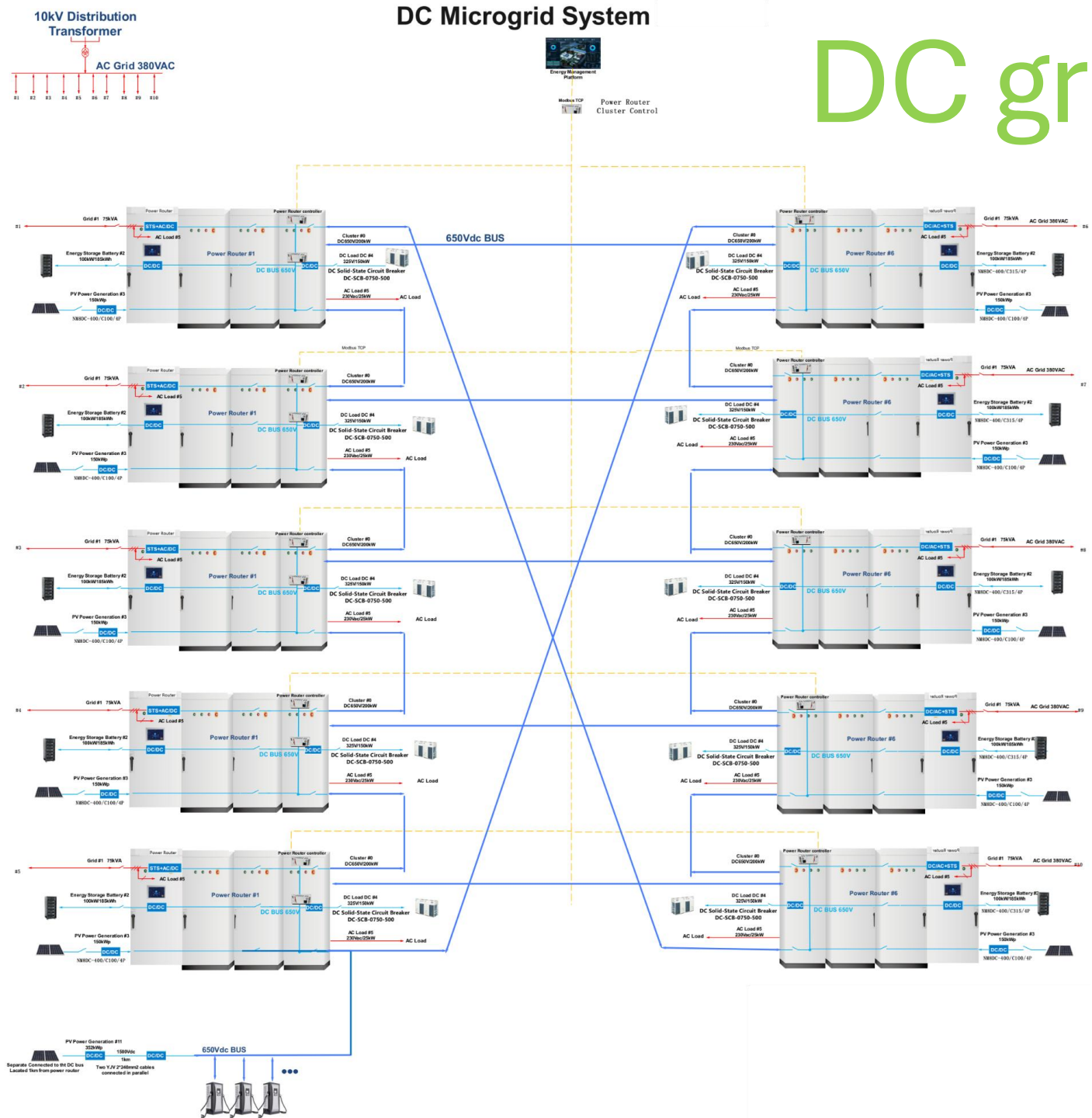


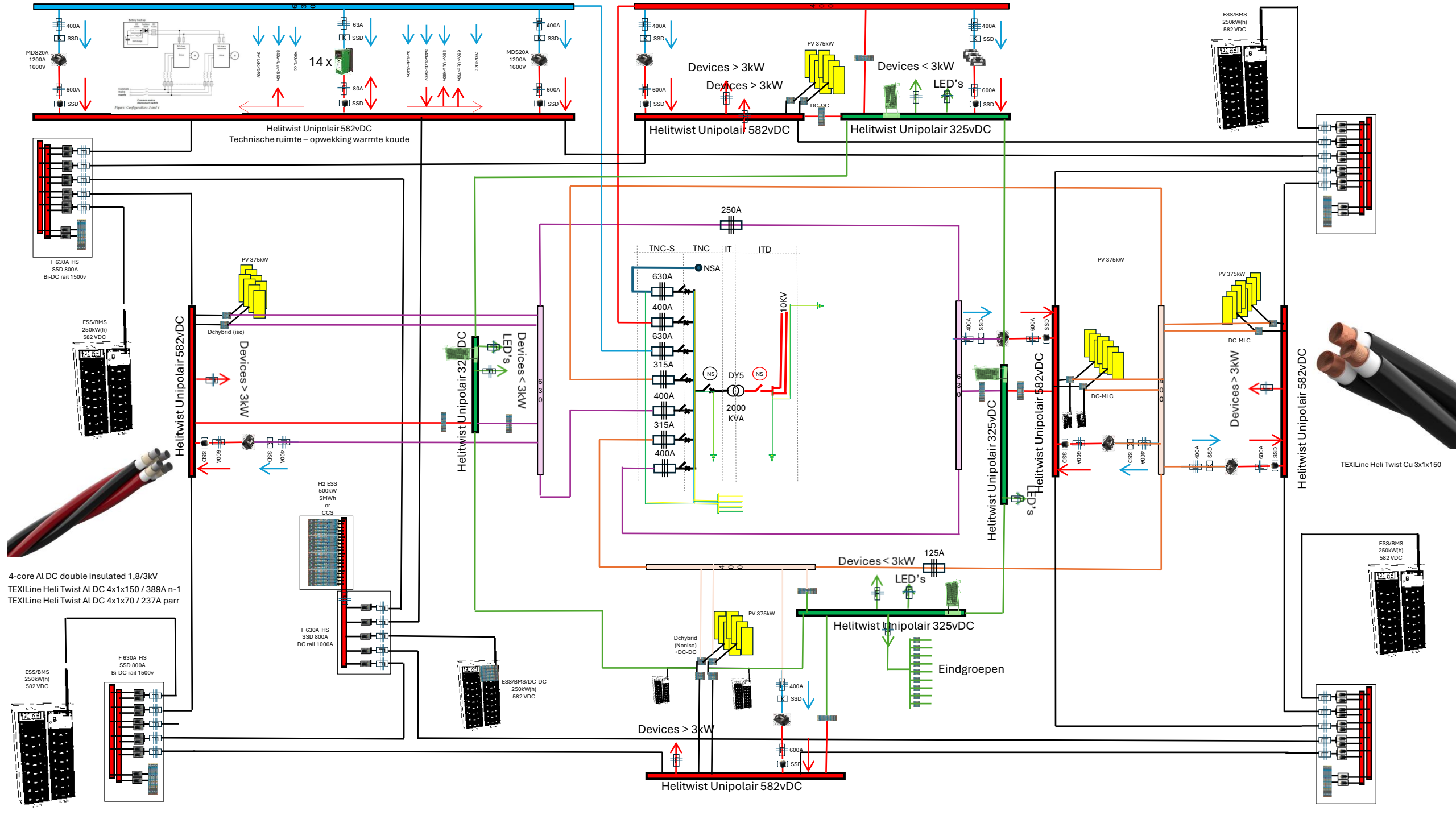
Plaatsgebonden risico:
Het grootste deel van de aanwezigen ligt binnen de PR10-5-contour.
De kantoren liggen daarbuiten, maar liggen wel binnen de PR10-6-contour. Een deel van de horeca en de sportfunctie ligt binnen de PR10-4-contour.

Waarvoor


Photovoltaïc panels
MPPT
DC-AC
AC
400V 3Ph+N
Energieopslag, H_2 + batterij
Lithium-Ion Batteries
Charge
DC-AC
H2 Pressure tank
Electrolyser
H_2
Fuel Cell
DC-DC
DC-AC
Warmte

DC grid


10kV Distribution Transformer
AC Grid 380VAC
DC Microgrid System
Energy Management Platform
Modbus TCP
Power Router Cluster Control
650Vdc BUS
Power Router #1
Power Router #6
DC BUS 650V
DC Solid-State Circuit Breaker DC-SCB-0750-500
650Vdc BUS


MDS20A
1200A
1600V
400A
SSD
600A
63A
80A
14 x
Helitwist Unipolair 582vDC
Technische ruimte – opwekking warmte koude
Devices > 3kW
Devices < 3kW
LED's
PV 375kW
DC-DC
Helitwist Unipolair 325vDC
ESS/BMS
250kW(h)
582 VDC
F 630A HS
SSD 800A
Bi-DC rail 1500v
Dchybrid (iso)
Helitwist Unipolair 582vDC
Helitwist Unipolair 325vDC
250A
TNC-S
TNC
IT
ITD
NSA
630A
400A
315A
10KV
NS
DY5
2000
KVA
DC-MLC
H2 ESS
500kW
5MWh
or
CCS
F 630A HS
SSD 800A
DC rail 1000A
ESS/BMS/DC-DC
250kW(h)
582 VDC
Dchybrid
(Noniso)
+DC-DC
125A
Eindgroepen
TEXILine Heli Twist Cu 3x1x150
4-core Al DC double insulated 1,8/3kV
TEXILine Heli Twist Al DC 4x1x150 / 389A n-1
TEXILine Heli Twist Al DC 4x1x70 / 237A parr

3~400v => 560vDC

Umin= 540 V 300Hz

400w2=566v

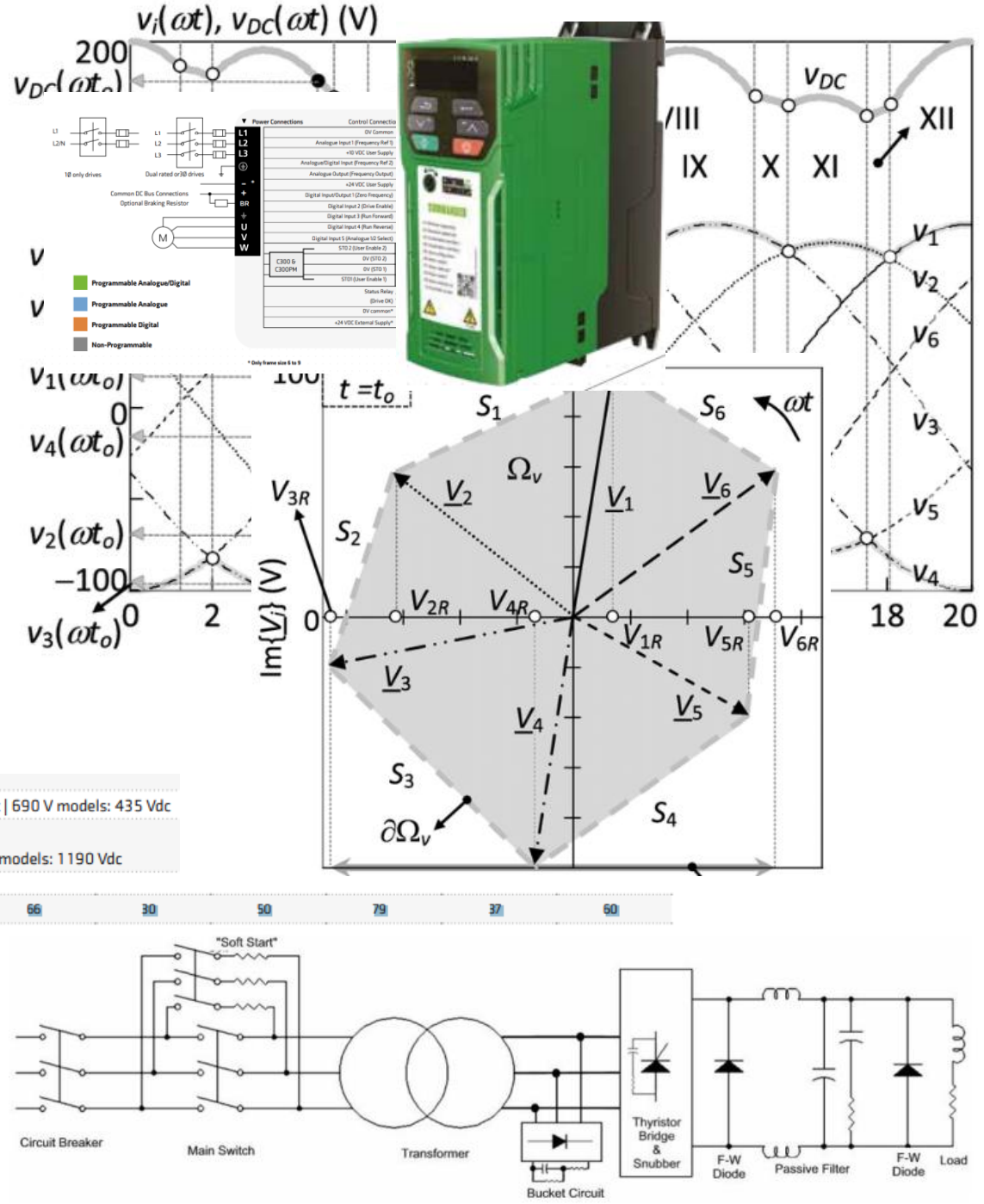
$$V_{DC} = \frac{6}{2\pi} \int_{\frac{\pi}{3}}^{\frac{2}{3}\pi} \sqrt{3} \cdot V_S \cdot \sin(\varpi t) dt = \frac{3 \cdot \sqrt{3}}{\pi} V_S = 1.654 \cdot V_S$$

Table 3: Performance parameters for some multi-phase topologies

	3-ph star (single-way)	6-ph star (single-way)	6-pulse bridge	12-pulse series br.	12-pulse parallel br.
Peak reverse voltage V_{RRM}	2.092 V_{DC}	2.092 V_{DC}	1.05 V_{DC}	0.524 V_{DC}	1.05 V_{DC}
r.m.s. input voltage V_{Srms}	0.855 V_{DC}	0.74 V_{DC}	0.428 V_{DC}	0.37 V_{DC}	0.715 V_{DC}
Diode average current $I_{F(AV)}$	0.333 I_{DC}	0.167 I_{DC}	0.333 I_{DC}	0.333 I_{DC}	0.167 I_{DC}
Form factor – FF	1.0165	1.00			
Rectification ratio – η	0.968	0.998	0.998	1.00	1.00
Ripple factor – RF	0.182	0.042	0.042	0.01	0.01
Transf. rating primary VA	1.23 P_{DC}	1.28 P_{DC}	1.05 P_{DC}	1.01 P_{DC}	1.01 P_{DC}
Transf. rating secondary VA	1.51 P_{DC}	1.81 P_{DC}	1.05 P_{DC}	1.05 P_{DC}	1.05 P_{DC}
Transf. Utilization Factor – TUF	0.73	0.647	0.952	0.971	0.971
Output ripple freq. f_R	3 f_{mains}	6 f_{mains}	6 f_{mains}	12 f_{mains}	12 f_{mains}

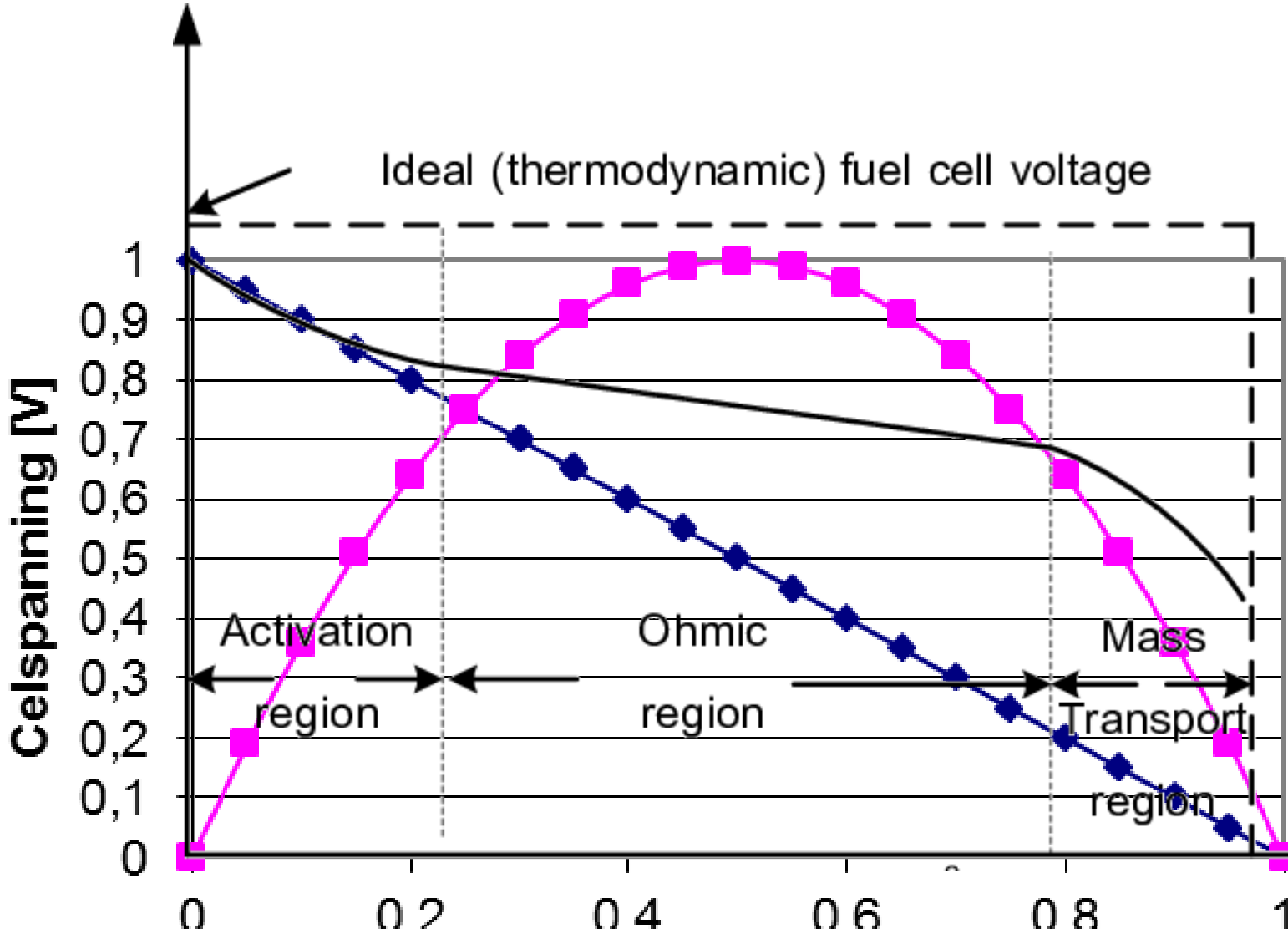
DC Bus Undervoltage Error Level	100 V models: 175 Vdc | 200 V models: 175 Vdc | 400 V models: 330 Vdc | 575 V models: 435 Vdc | 690 V models: 435 Vdc
DC Bus Overvoltage Error Level	Frame sizes 1 - 4: 100 V models: 510 Vdc | 200 V models: 510 Vdc | 400V models: 870 Vdc Frame size 5 - 9: 200V models: 415 Vdc | 400 V models: 830 Vdc | 575 V models: 990 Vdc | 690 V models: 1190 Vdc

C200-07400660A10100AB100 3 07 66 30 50 79 37 60

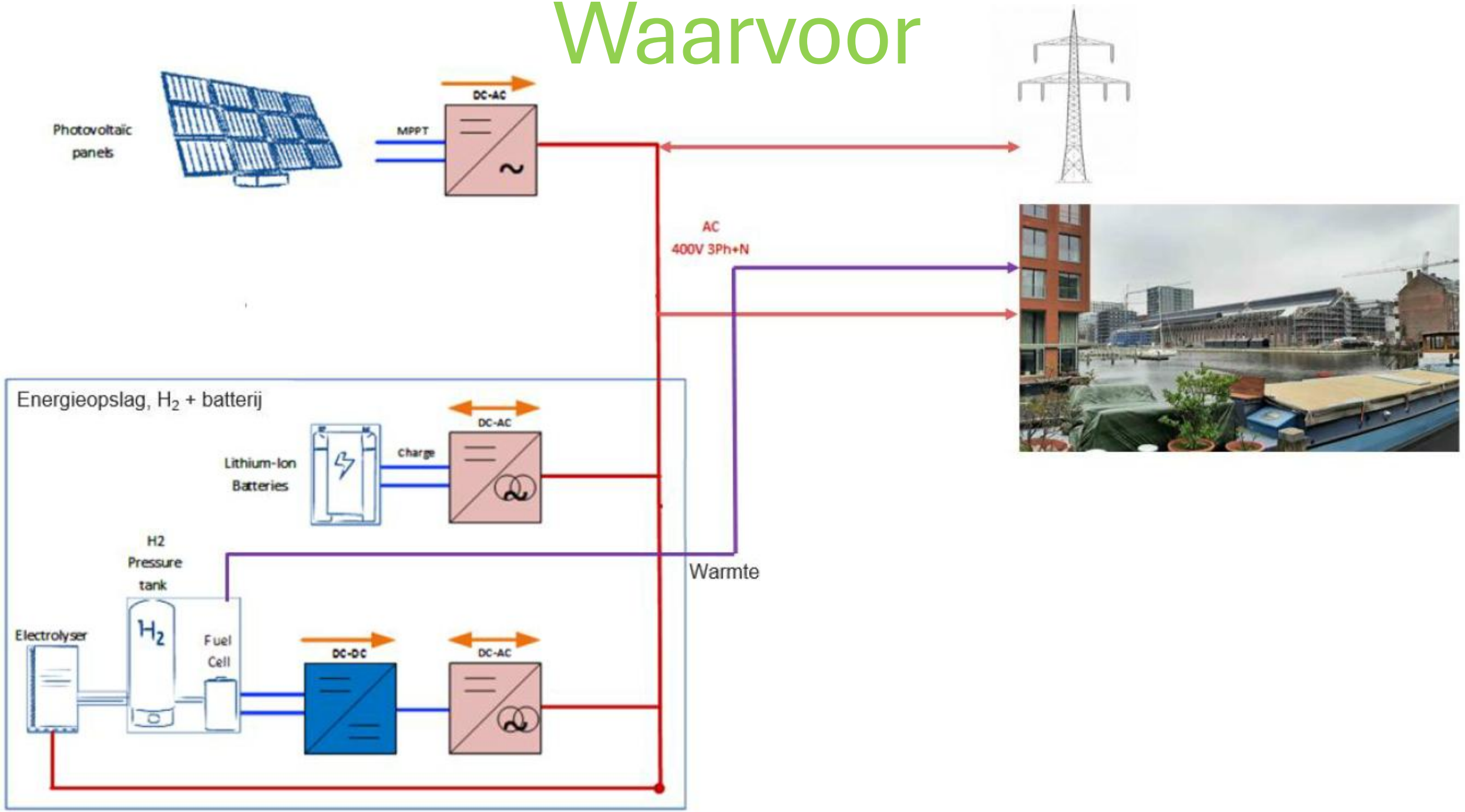


Waarmee


BrightLoop


Ideal (thermodynamic) fuel cell voltage
Celspanning [V]
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
Activation region
Ohmic region
Mass Transport region
0
0,2
0,4
0,6
0,8

Waarvoor


Photovoltaïc panels
MPPT
DC-AC
AC
400V 3Ph+N
Energieopslag, H_2 + batterij
Lithium-Ion Batteries
Charge
DC-AC
H2 Pressure tank
Electrolyser
H_2
Fuel Cell
DC-DC
DC-AC
Warmte