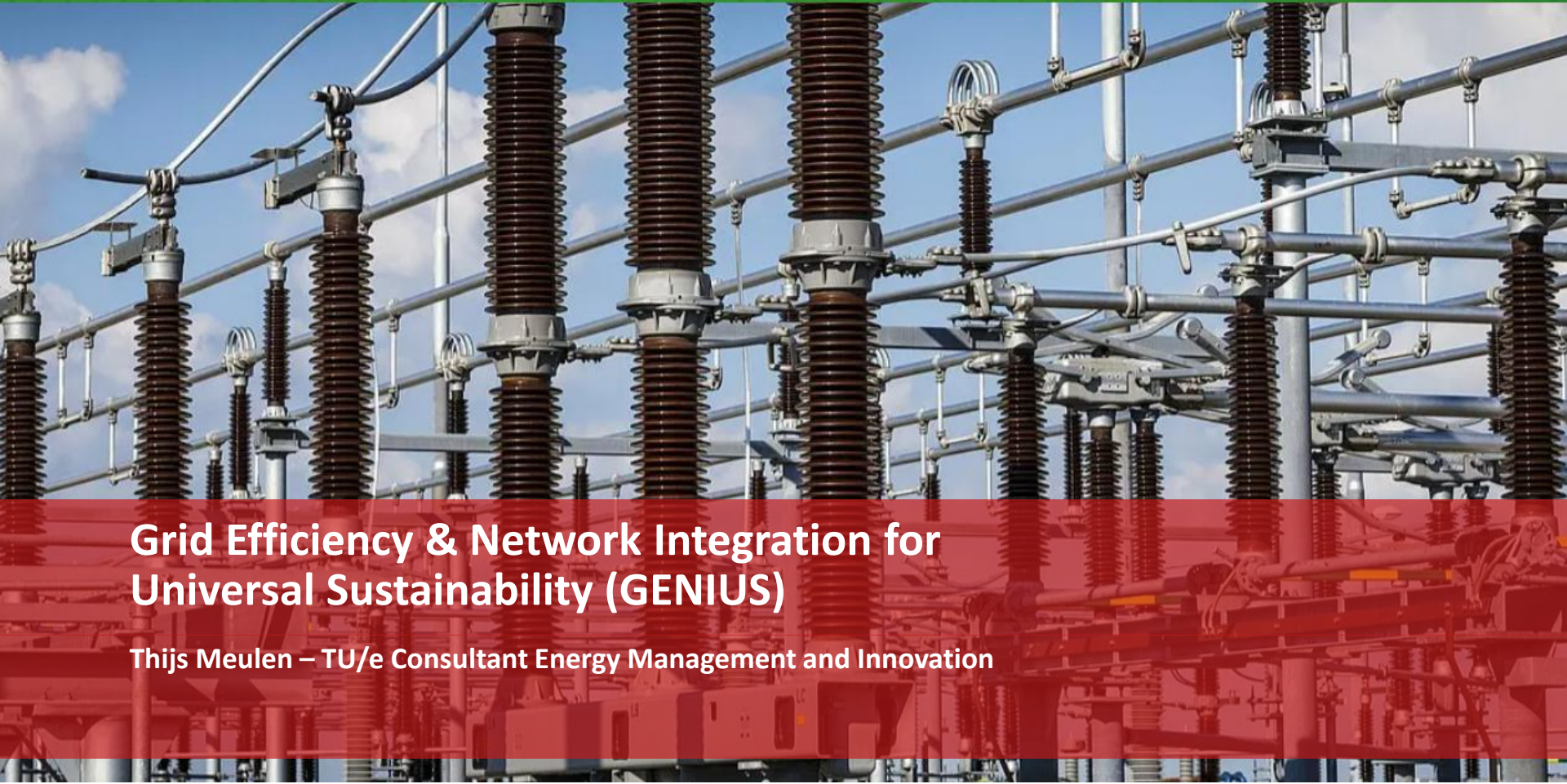

KIVI
Engineering Society
TU/e
EINDHOVEN
UNIVERSITY OF
TECHNOLOGY
TU/e
EIRES
INNOVATION STARTS TU/E WHERE

- 9 Departments
- 4 Institutes
- 9 Support Services
- 17 Student Teams
- 13.500 students
- 7.000 employees
- 3.000 daily visitors
- 4.000 daily vehicle movements
- 850.000 m2 terrain
- 50.000.000 kWh electricity
- 2.000.000 m^3 gas
- 200.000 m^3 water
- 350.000 m^2 Buildings

- 3500+ new students every academic year
- 18.000 kg dangerous substances
- 90+ nationalities
- 150+ small events every year
- 5 events (5.000+ people)
- 1.500 student houses on campus
- 11 bars
- 1 supermarket
- 100 tech companys on campus
- Continuous state of change and reconstruction
- Child daycare centre

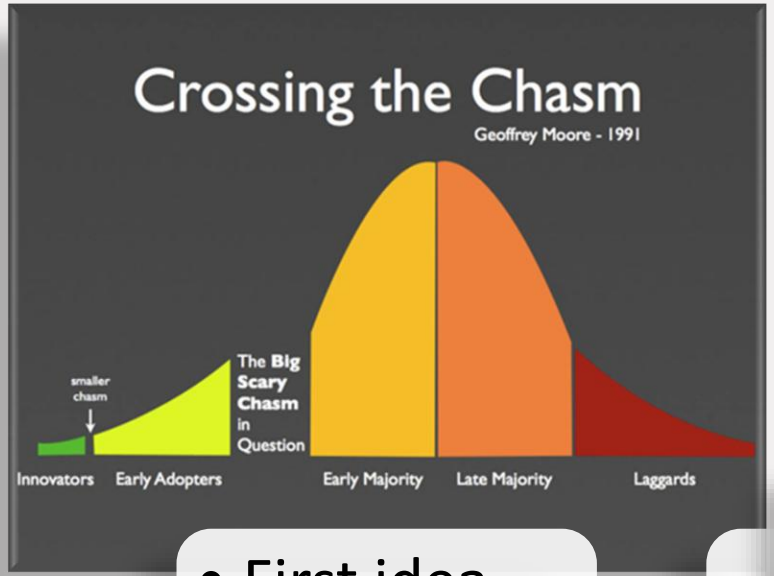
TU/e Controlling grid congestion,
lessons from the GENIUS living lab,
GENIUS meets BACH, future project.



Grid Efficiency & Network Integration for Universal Sustainability (GENIUS)

Thijs Meulen – TU/e Consultant Energy Management and Innovation

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY



- Taking up the challenge to take the research (Hink) 2 steps further.
- Facilitate innovation and seek synergy, without losing sight of reality.

Hink

- First idea

"Research"

Step

- From idea to
- First pilot

Jump

- From pilot
- To real world

"Business operations"

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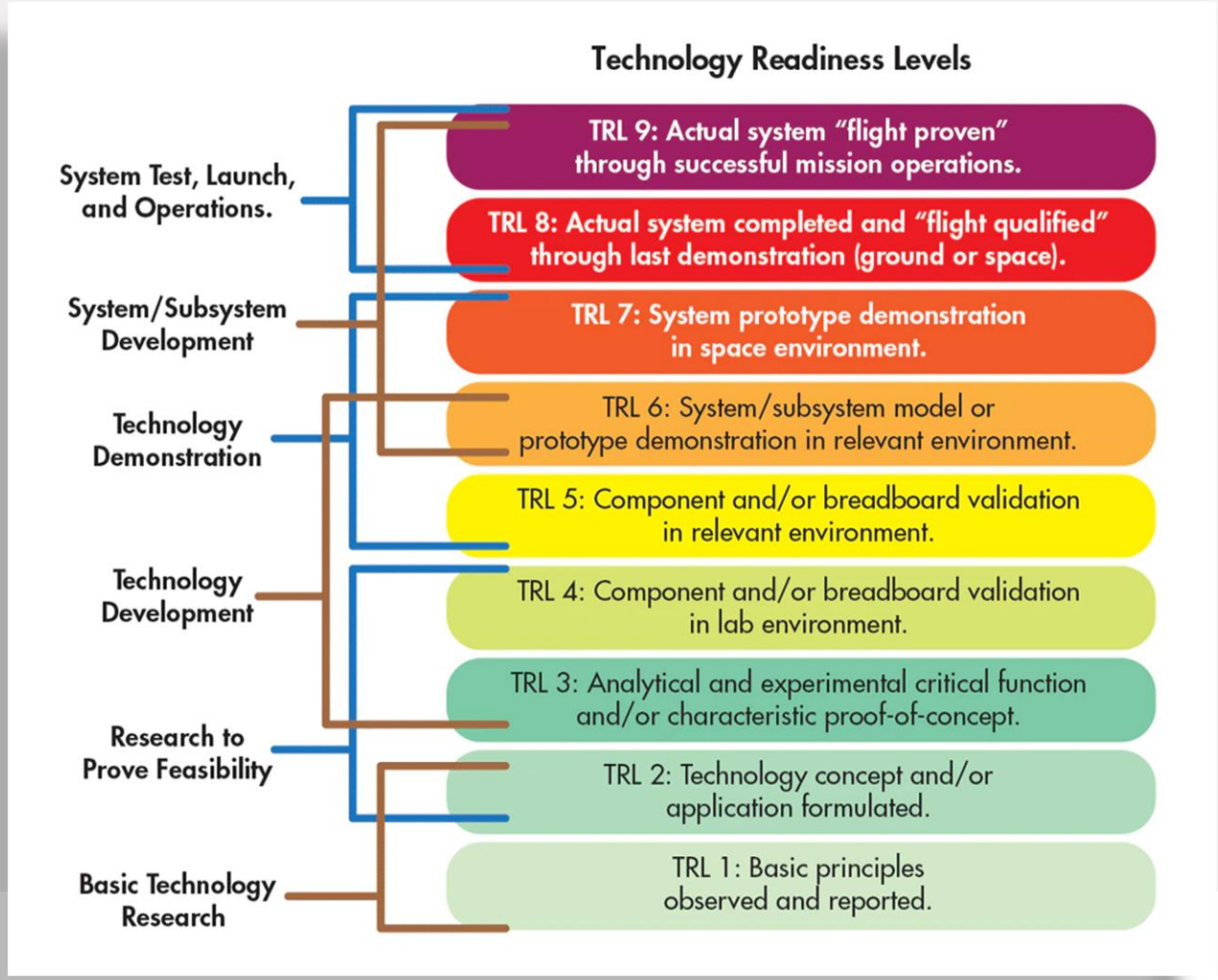

Jump

Step

Hink

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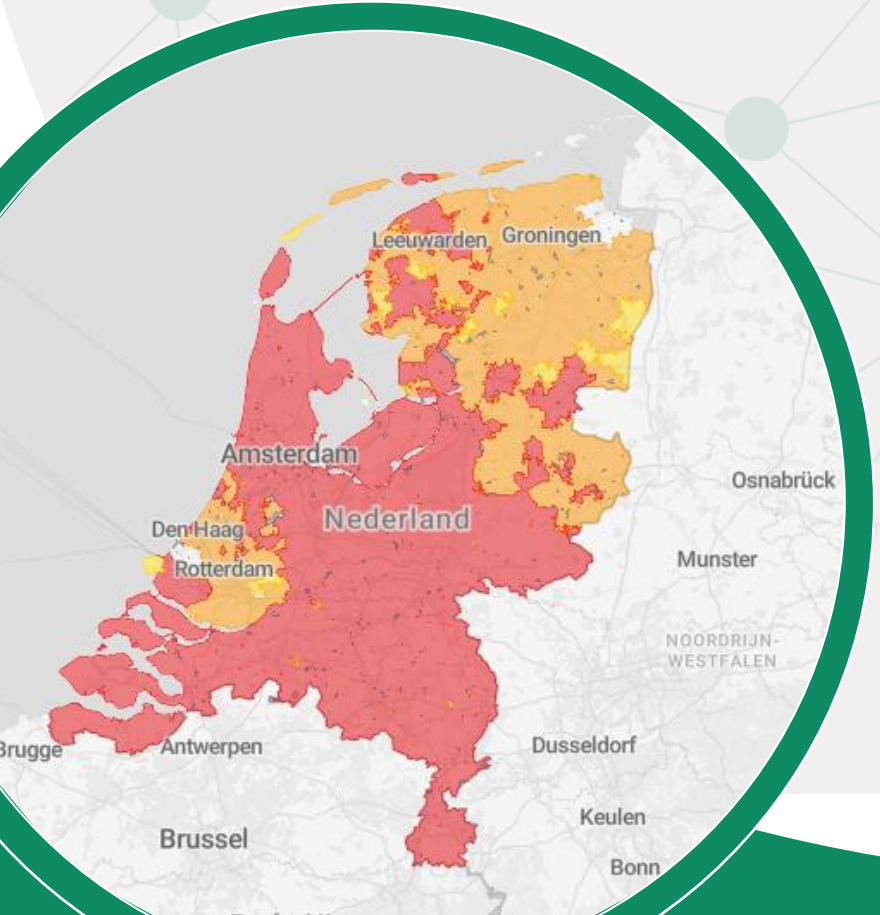


Net congestion

The Netherlands turns red!

Economic and sustainable growth is being hampered

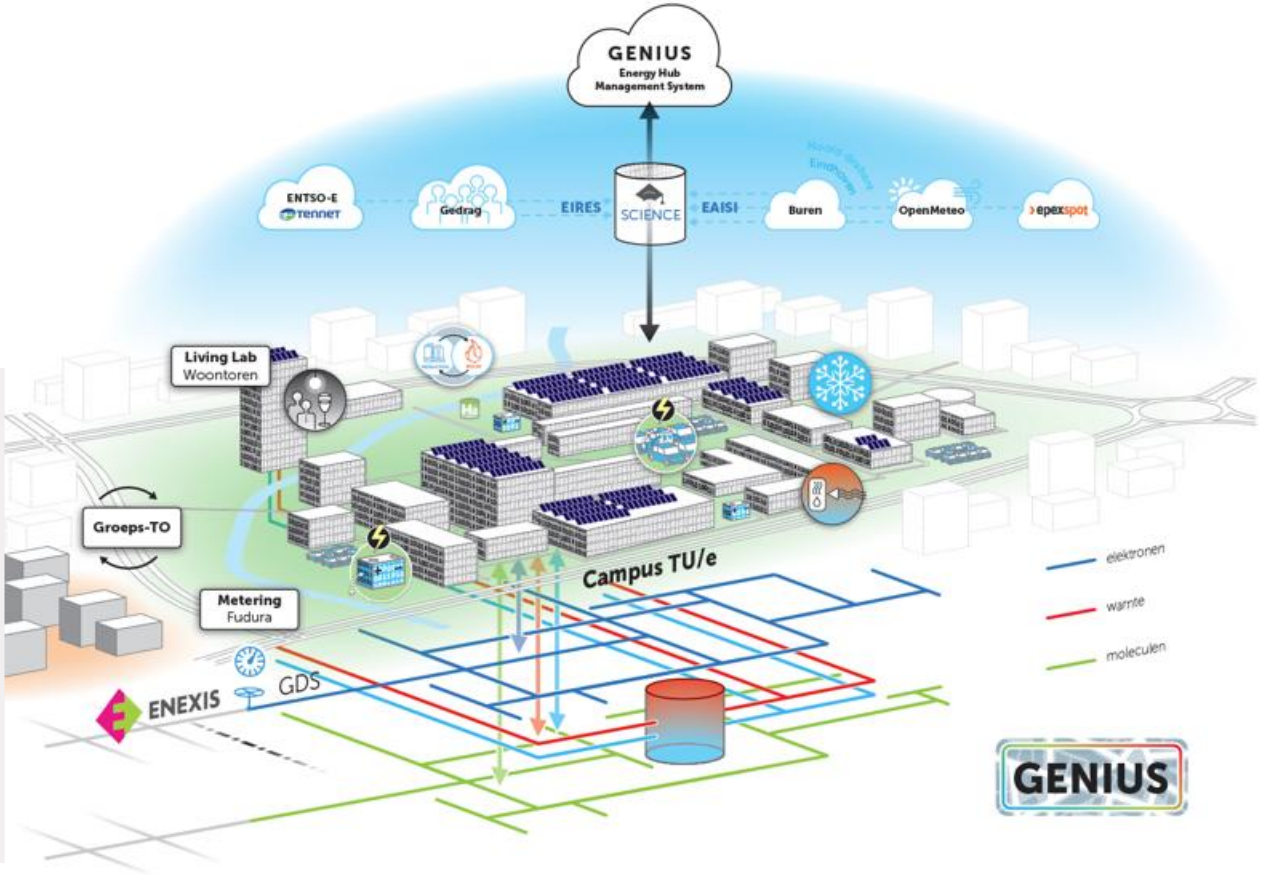
GENIUS

GENIUS

Grid **E**fficiency & **N**etwork **I**ntegration for **U**niversal **S**ustainability

OPZUID
Europees programma voor transitiegedreven innovatie

Medegefinancierd door de Europese Unie



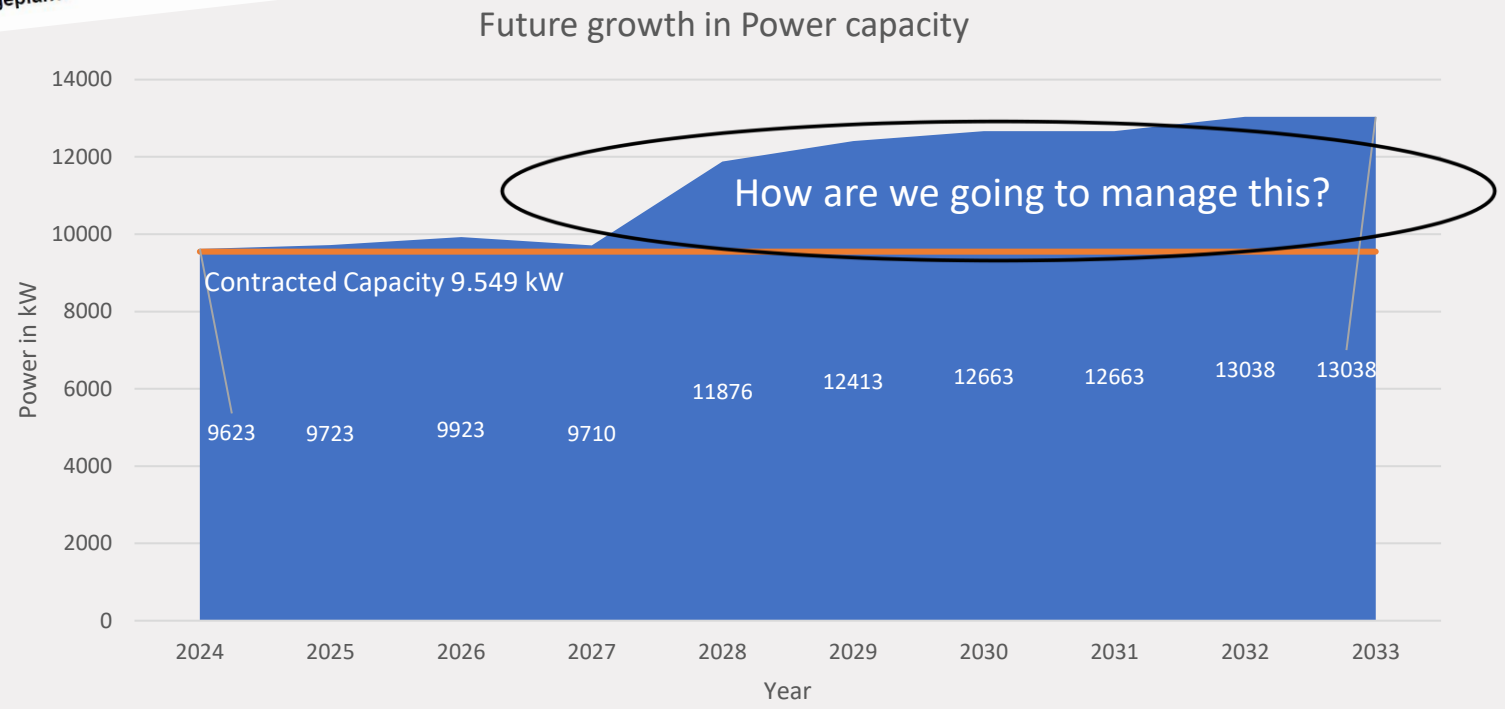
TU/e TU/e EIRES TU/e EAISI fudura cube VBoptimum

EINDHOVEN ENGINE ZEnMo simulations Voltgoed WOONBEDRIJF simpl.energy Enerzien

TU/e

PERSBERICHT TENNET

Grote uitbreidingsprojecten hoogspanningsnet Noord-Brabant duren langer dan gepland



Elektricity Grid

GENIUS

Grid Efficiency & Network Integration for Universal Sustainability

Congestion management

GDS electrical

GENIUS

Control facility based on forecasts and network congestion

Influencing behaviour

Transdef Connexxion

Battery Pack 3,5 MWh

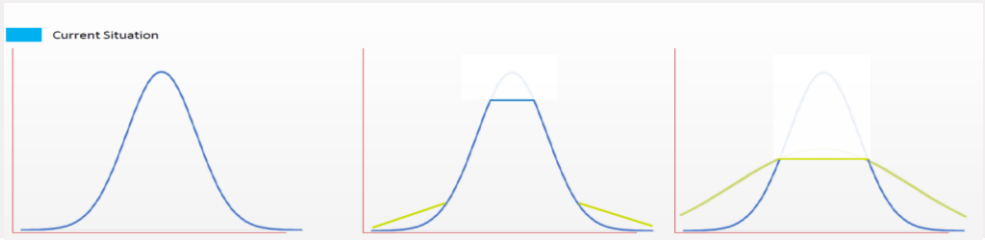
EV Charging

Heat-pumps

PV-panels

Building installations

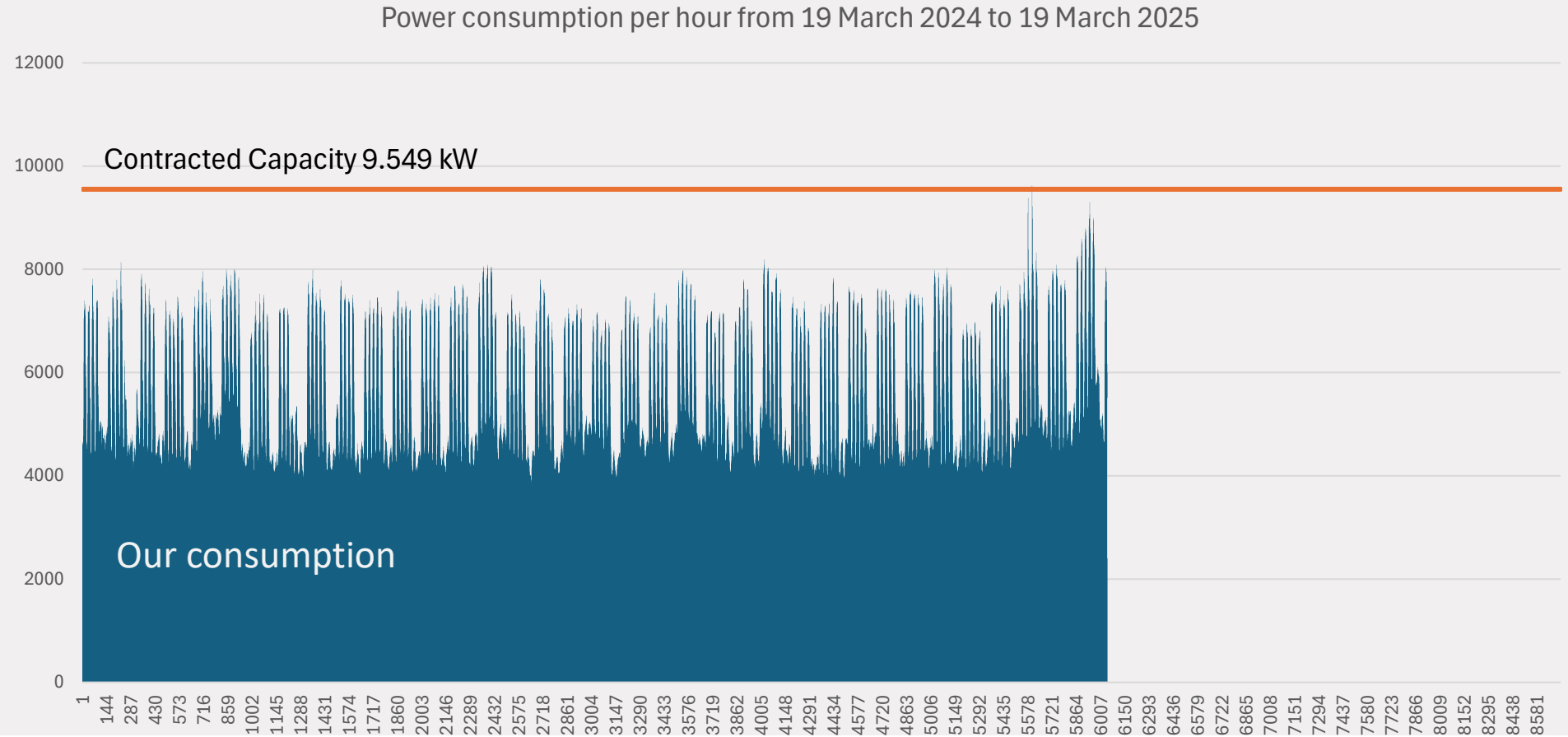
Flexible Power



With Battery

With Battery & Smart Energy management

TU/e


Power consumption per hour from 19 March 2024 to 19 March 2025
12000
10000
8000
6000
4000
2000
0
Contracted Capacity 9.549 kW
Our consumption
1
144
287
430
573
716
859
1002
1145
1288
1431
1574
1717
1860
2003
2146
2289
2432
2575
2718
2861
3004
3147
3290
3433
3576
3719
3862
4005
4148
4291
4434
4577
4720
4863
5006
5149
5292
5435
5578
5721
5864
6007
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6293
6436
6579
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7723
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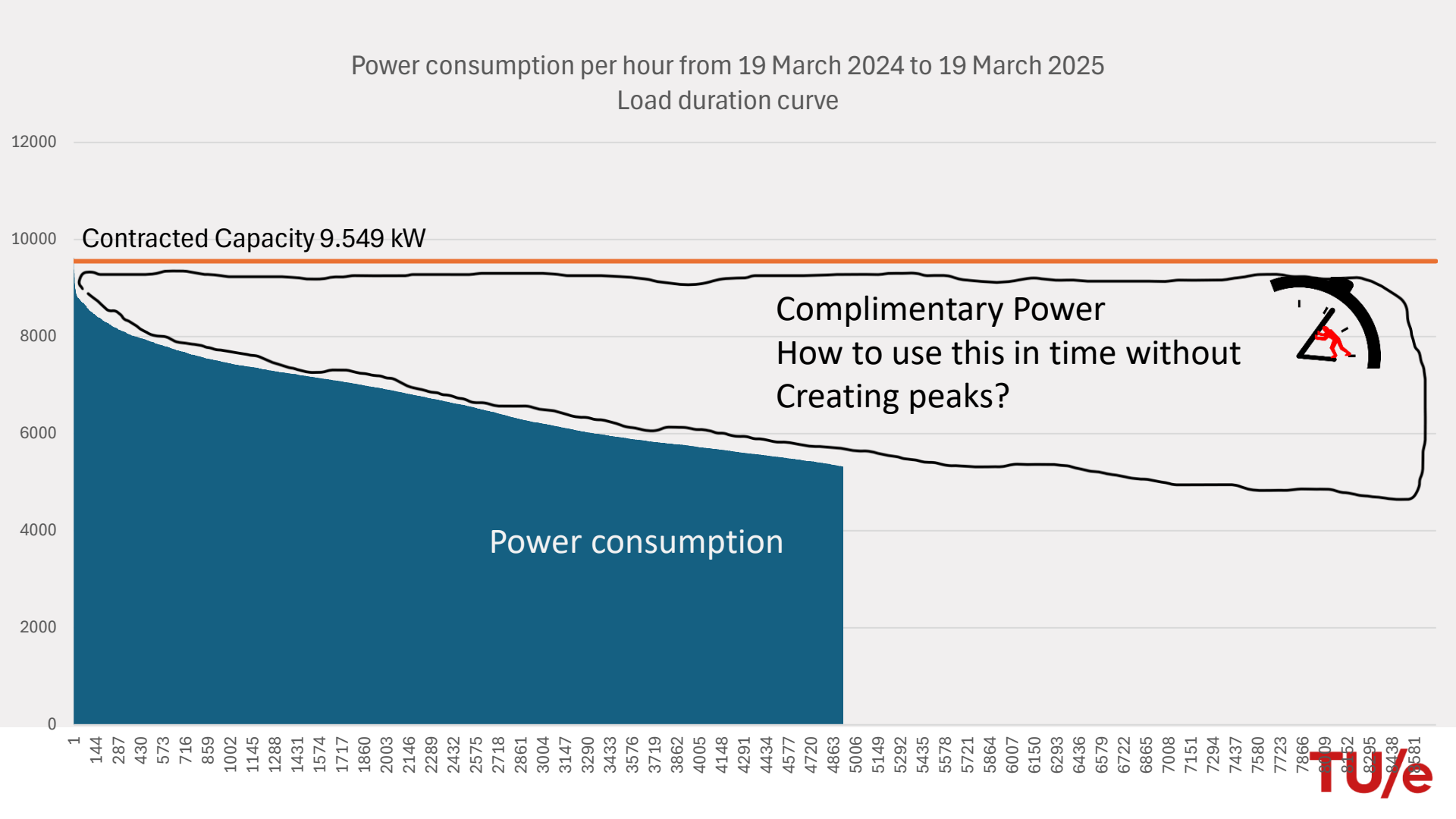
8009
8152
8295
8438
8581


Power consumption per hour from 19 March 2024 to 19 March 2025
Load duration curve
12000
10000
8000
6000
4000
2000
0
Contracted Capacity 9.549 kW
Complimentary Power
How to use this in time without
Creating peaks?
Power consumption
1
144
287
430
573
716
859
1002
1145
1288
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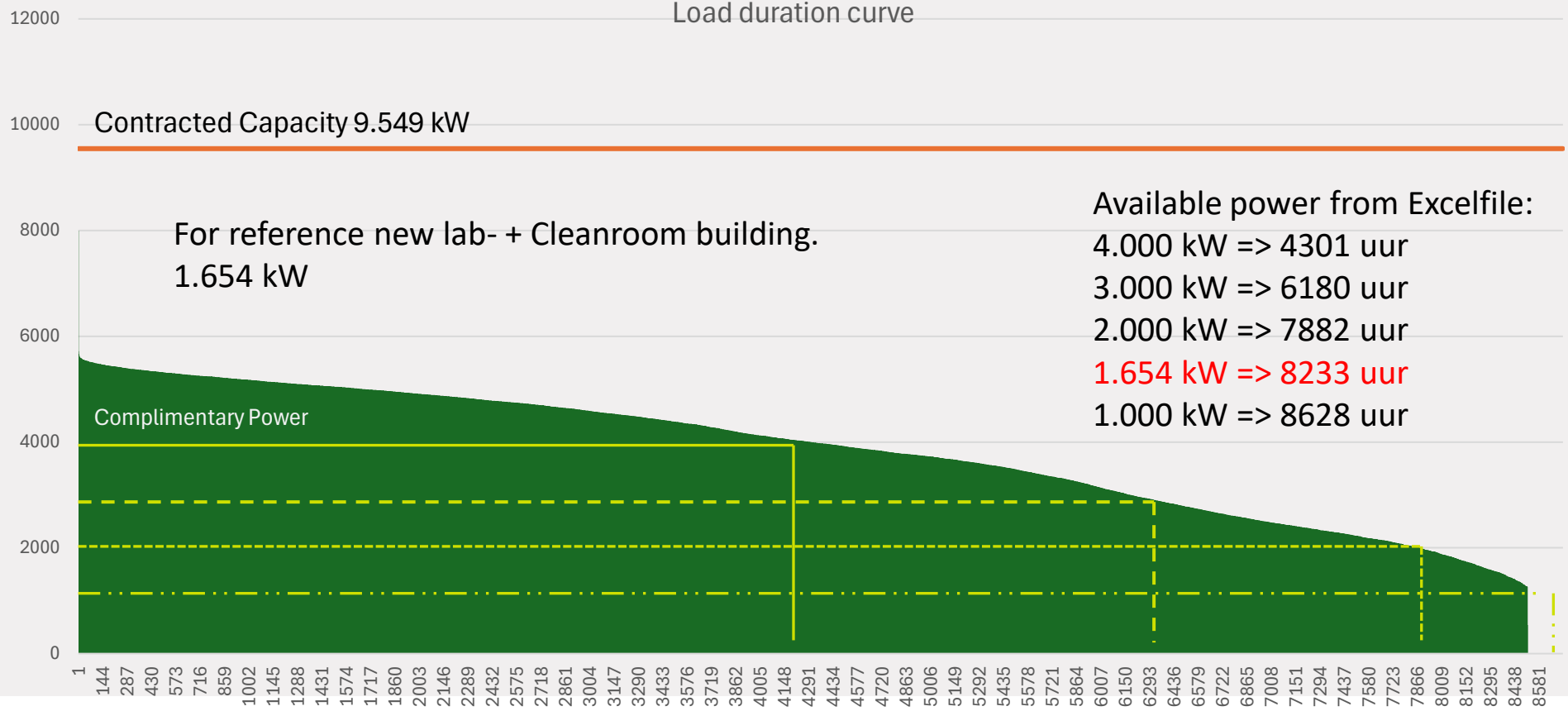
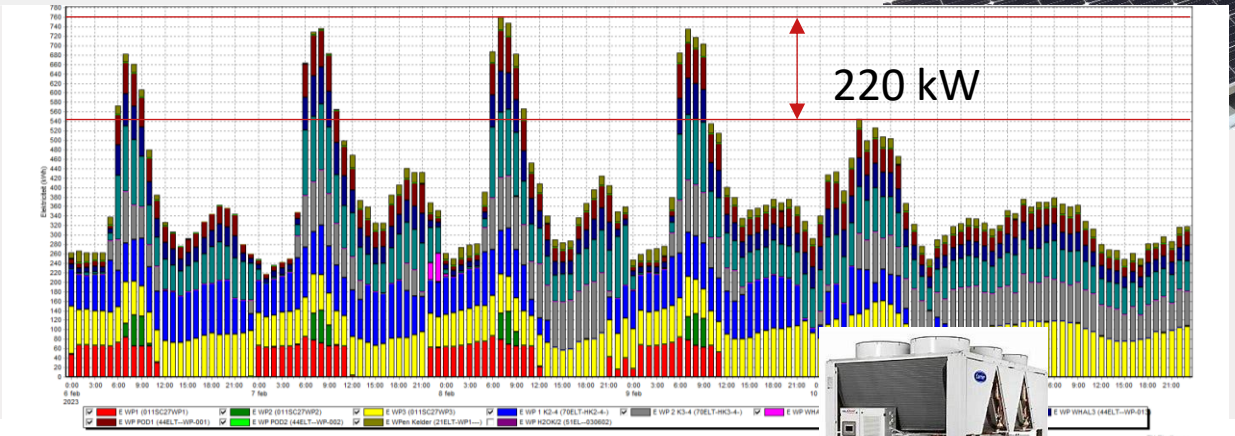
Complimentary power per hour from 19 march 2024 to 19 March 2025
Load duration curve



Flexible Power

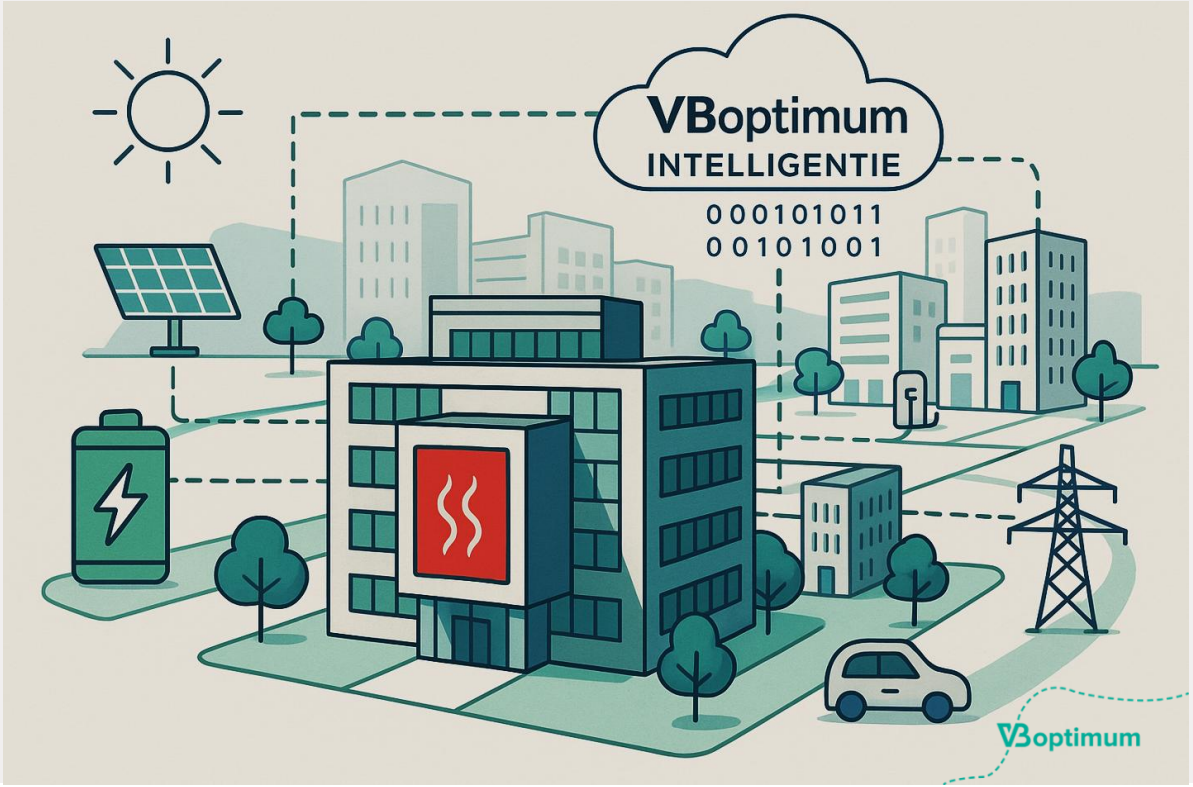


Building as a thermal battery

We use heat pumps in the buildings to store thermal energy. The building functions as a thermal battery.

We create a dependency between the buildings.

So that we can shift the peak of heat pump simultaneity over time.

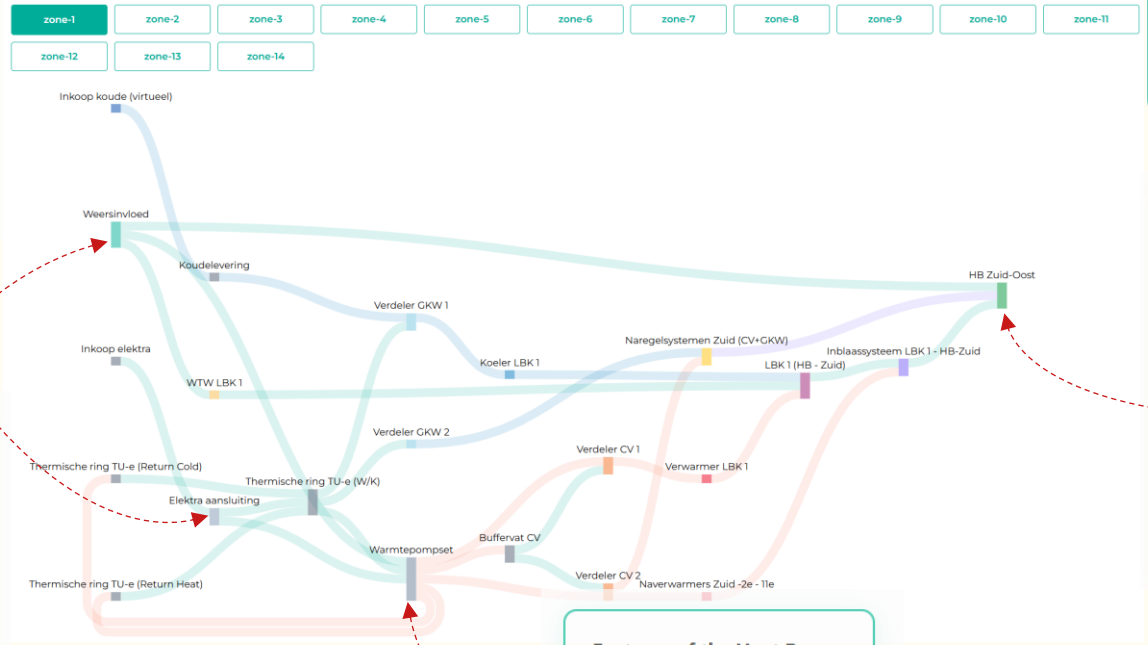


At the heart of the image is the Digital Twin of the ATLAS building's HVAC system — a smart virtual model that predicts how to use energy most efficiently.

24/7 predictive steering:

- ✓ Saving up to 40% energy
- ✓ Solve net congestion
- ✓ Optimal comfort

Zone 1 of the ATLAS building



Load shifting, when capacity is limited

Weather forecast in optimization

5.8 kW
Solar production

-1°C
Outside temp

Comfort in the building zone

zone-1	zone-2	zone-3	zone-4
zone-5	zone-6	zone-7	zone-8
zone-9	zone-10	zone-11	zone-12

Temperature bandwidth
20 - 23°C

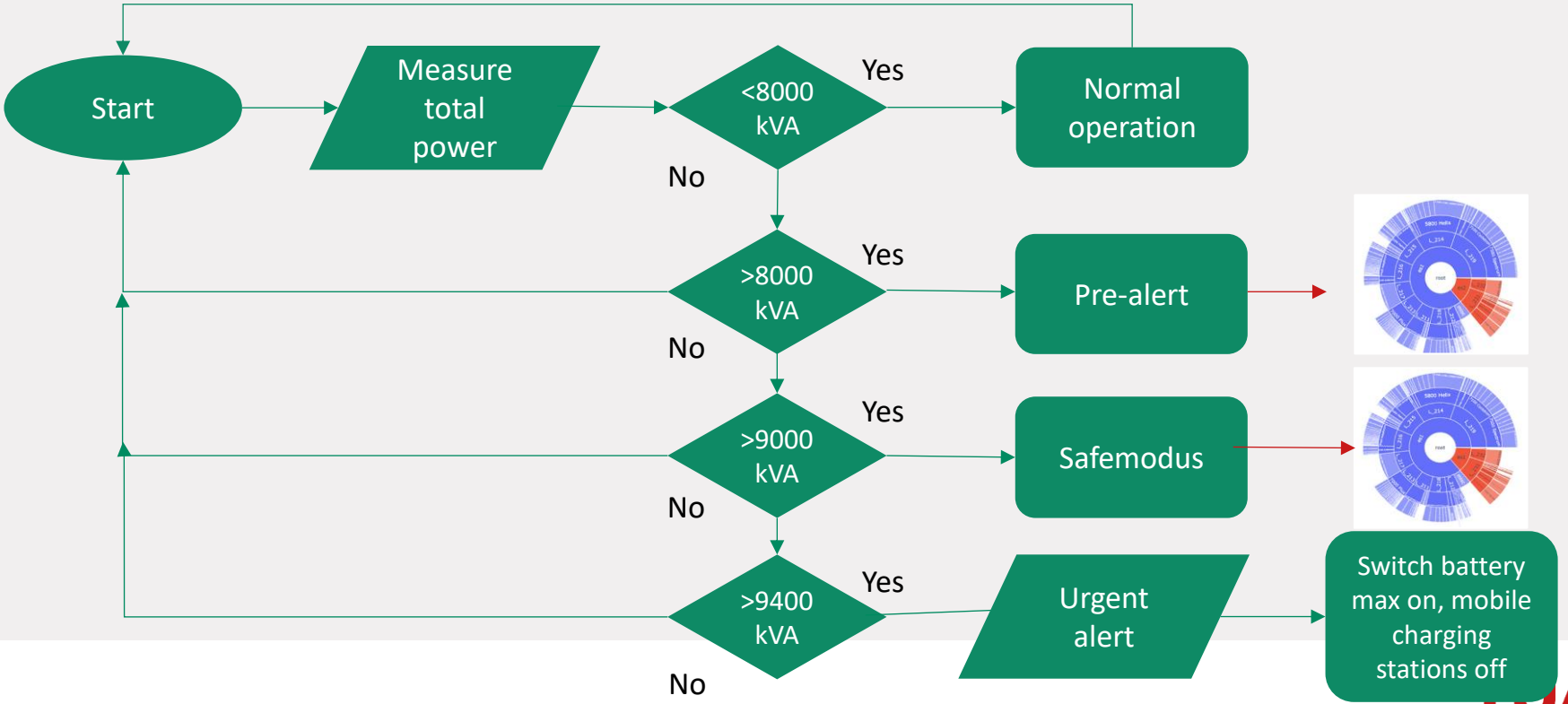
Features of the Heat Pump

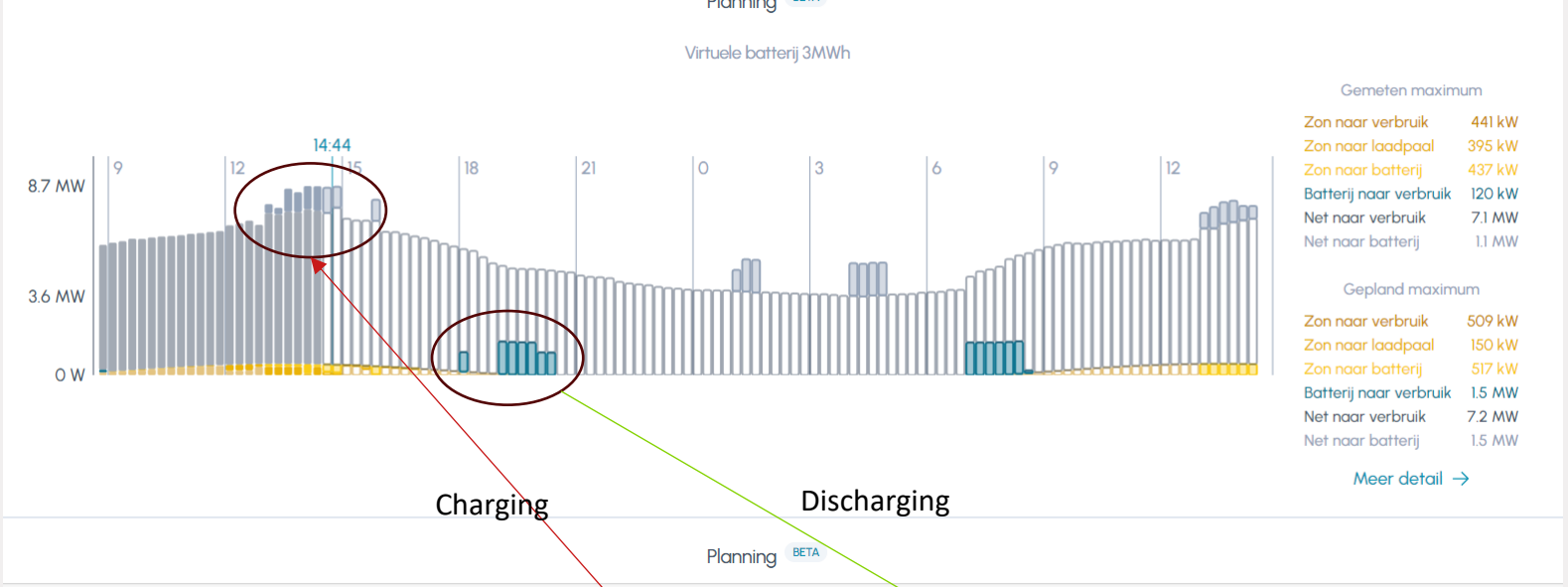
COP_heat	4.2
COP_cool	3.8
N_heatpump	2
Power_nominal	12 kW

VBoptimum

Flexible power outside the Campus!!

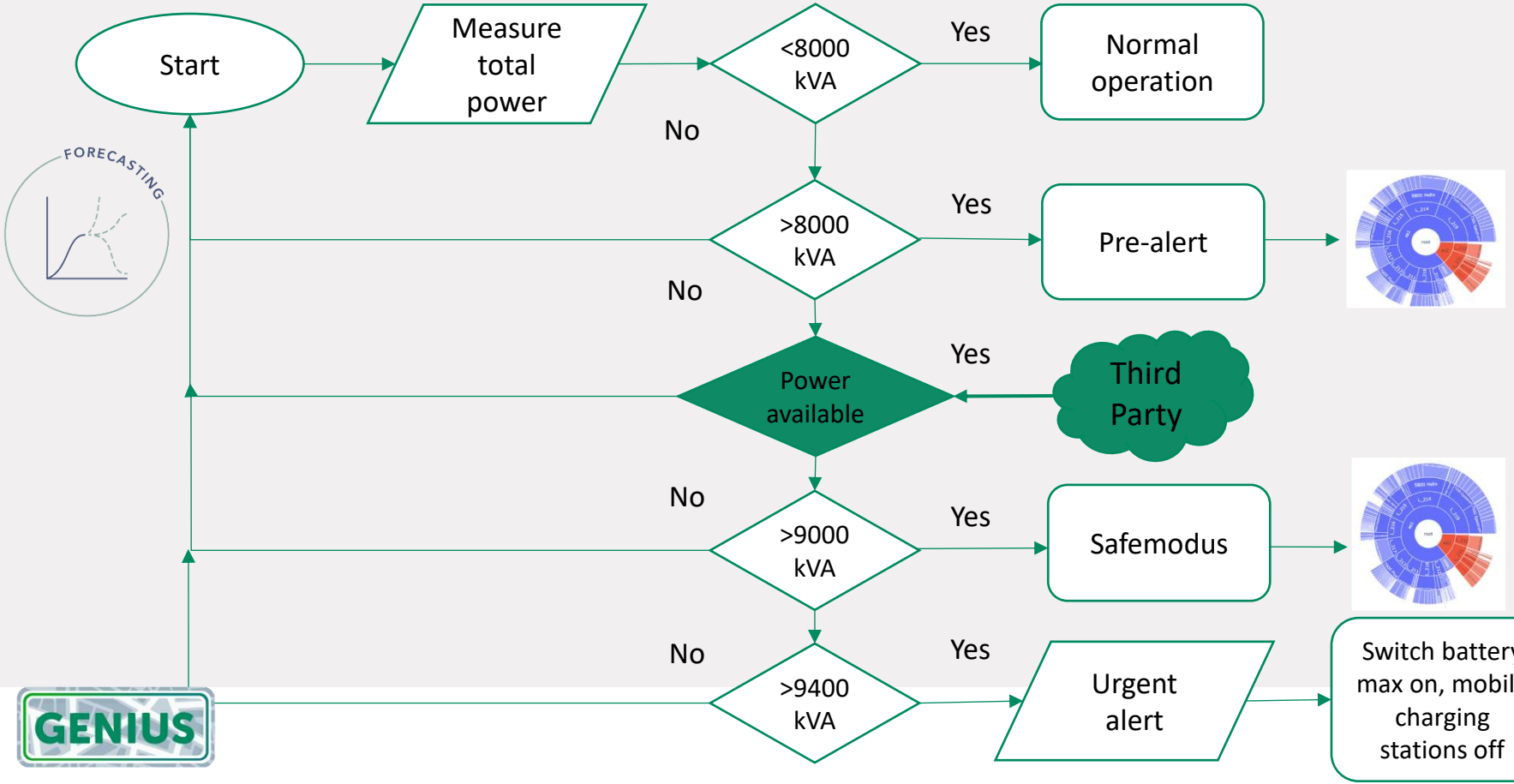
Scenario: Present situation





Normal operation

Scenario II: Flexible power from neighbours



Scenario II: Flexible power to the neighbours

Start

Measure total power

<8000 kVA

Yes

Normal operation

No

>8000 kVA

Yes

Pre-alert

No

Power Available

No

Yes

Third Party

>9000 kVA

Yes

Safemodus

No

>9400 kVA

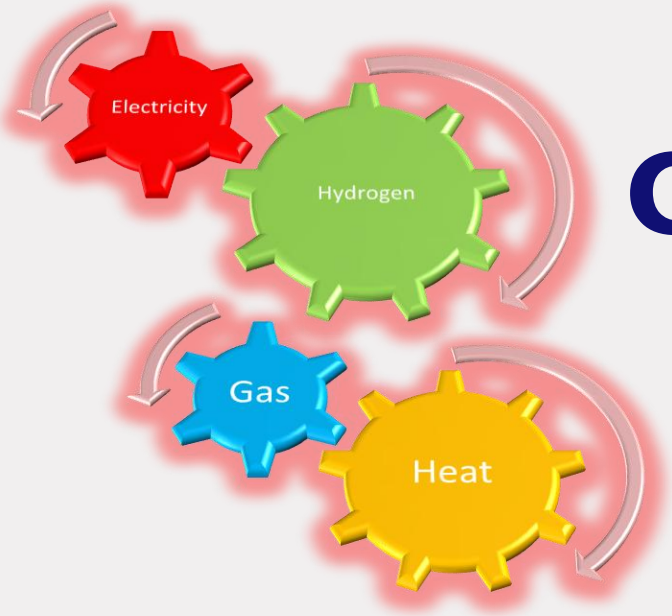
Yes

Urgent alert

Switch battery max on, mobile charging stations off

No

GENIUS



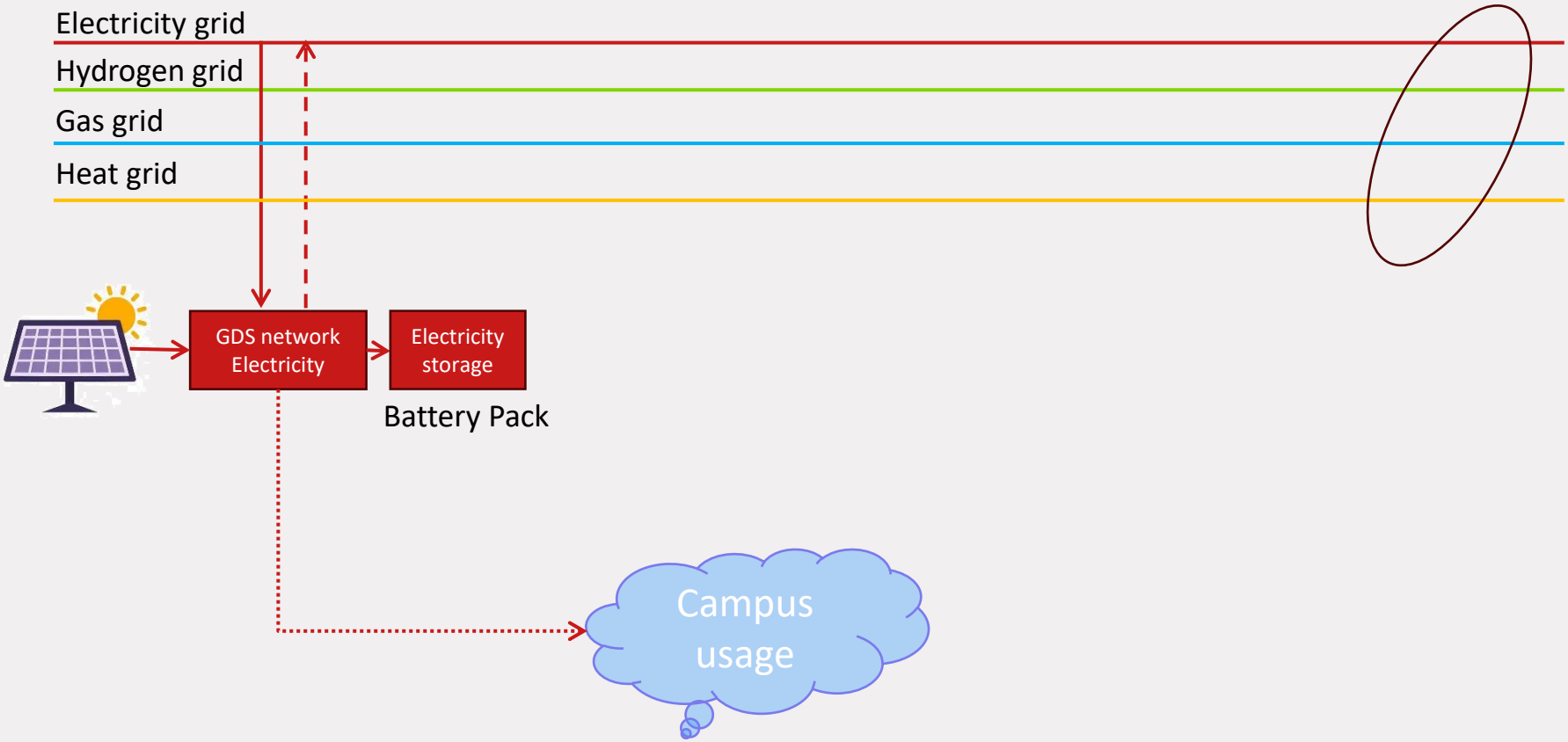
Genius meets Bach

The objective of the project focuses on cross-pollination between multiple energy carriers (electricity, hydrogen, gas and heat) to alleviate grid congestion on the electricity grid. The project demonstrates a transformation of energy carriers with storage as a solution/mitigator for grid congestion.

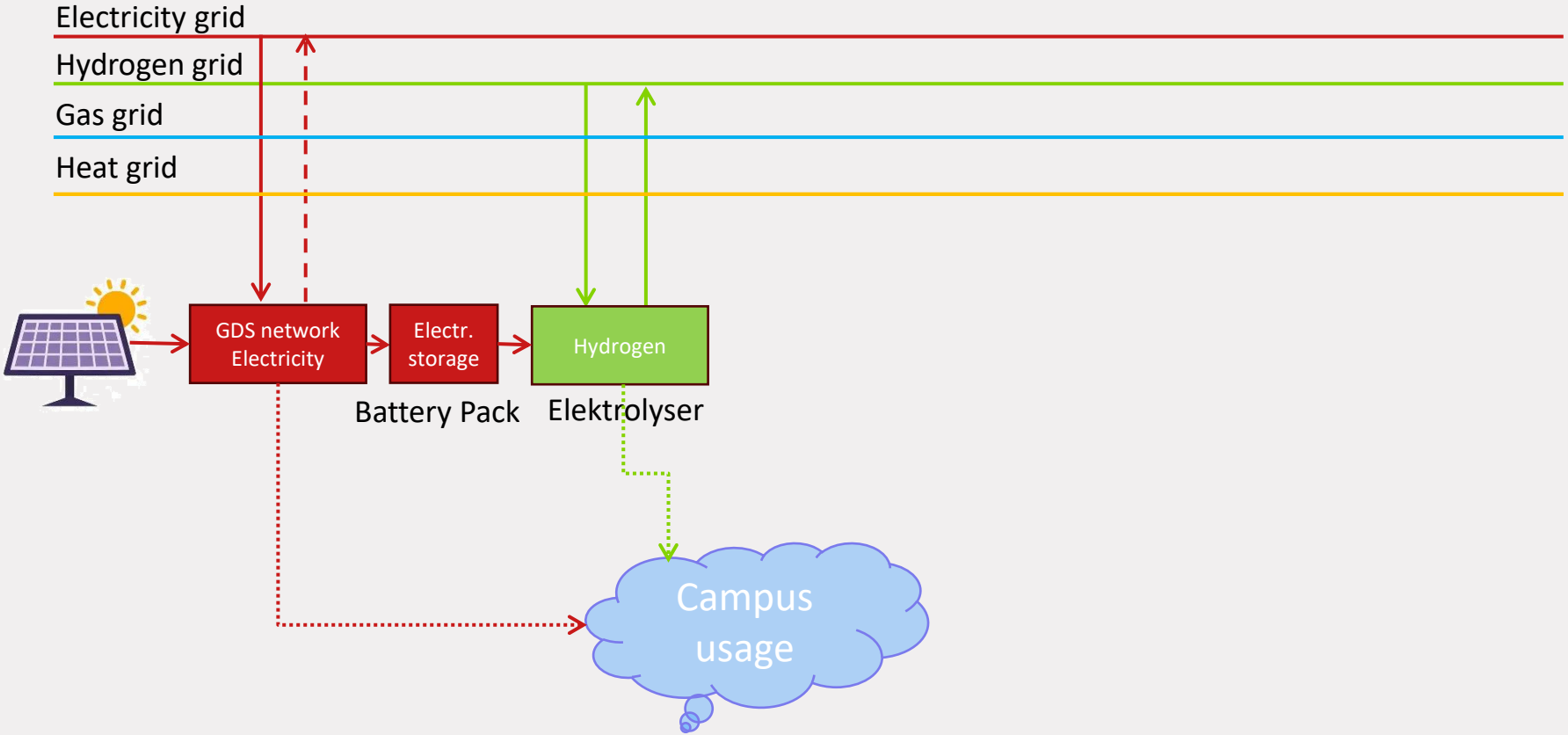
BACH =>Brainport Approach for Congestion-free Holland

TU/e

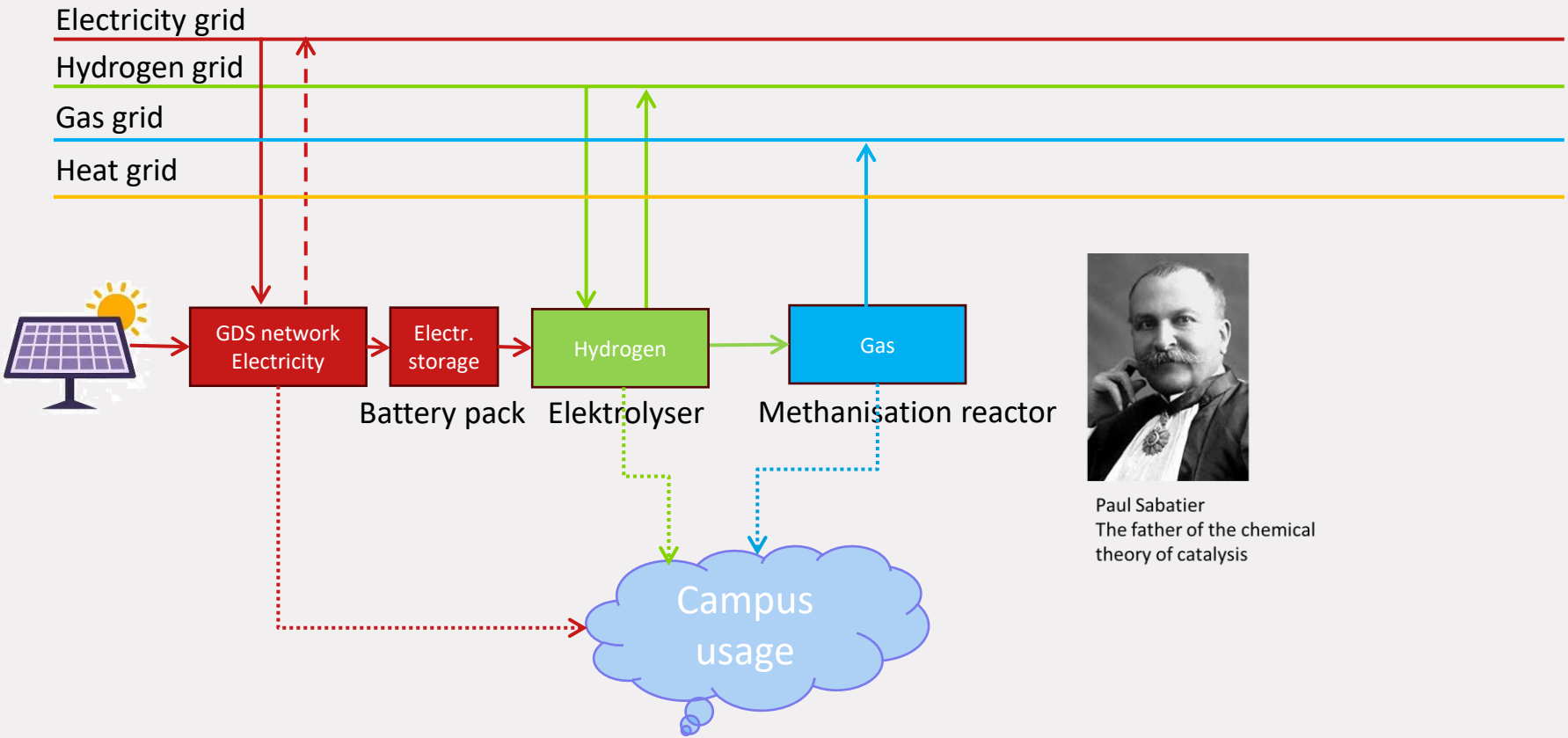
Energy transformation for grid congestion



Energy transformation for grid congestion

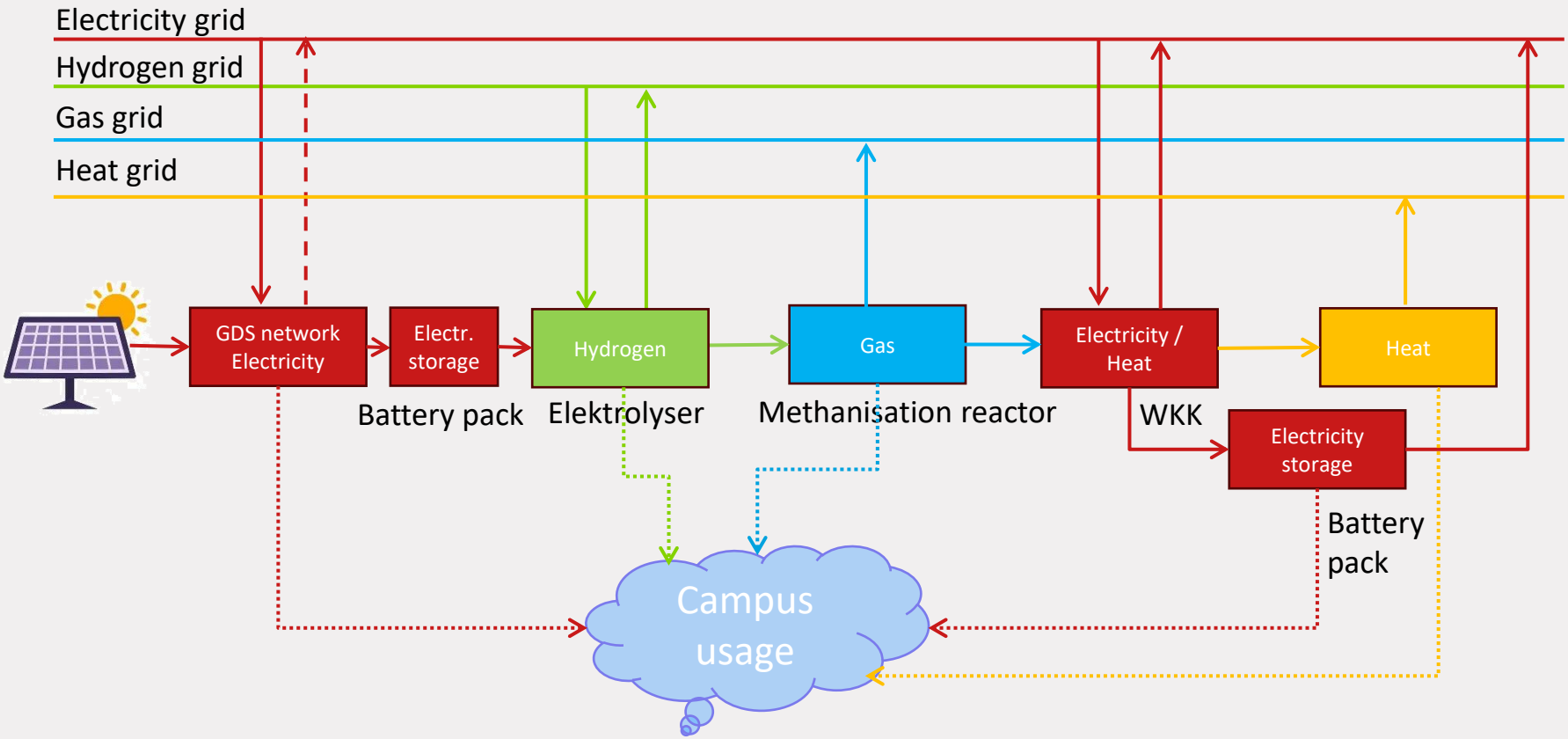


Energy transformation for grid congestion

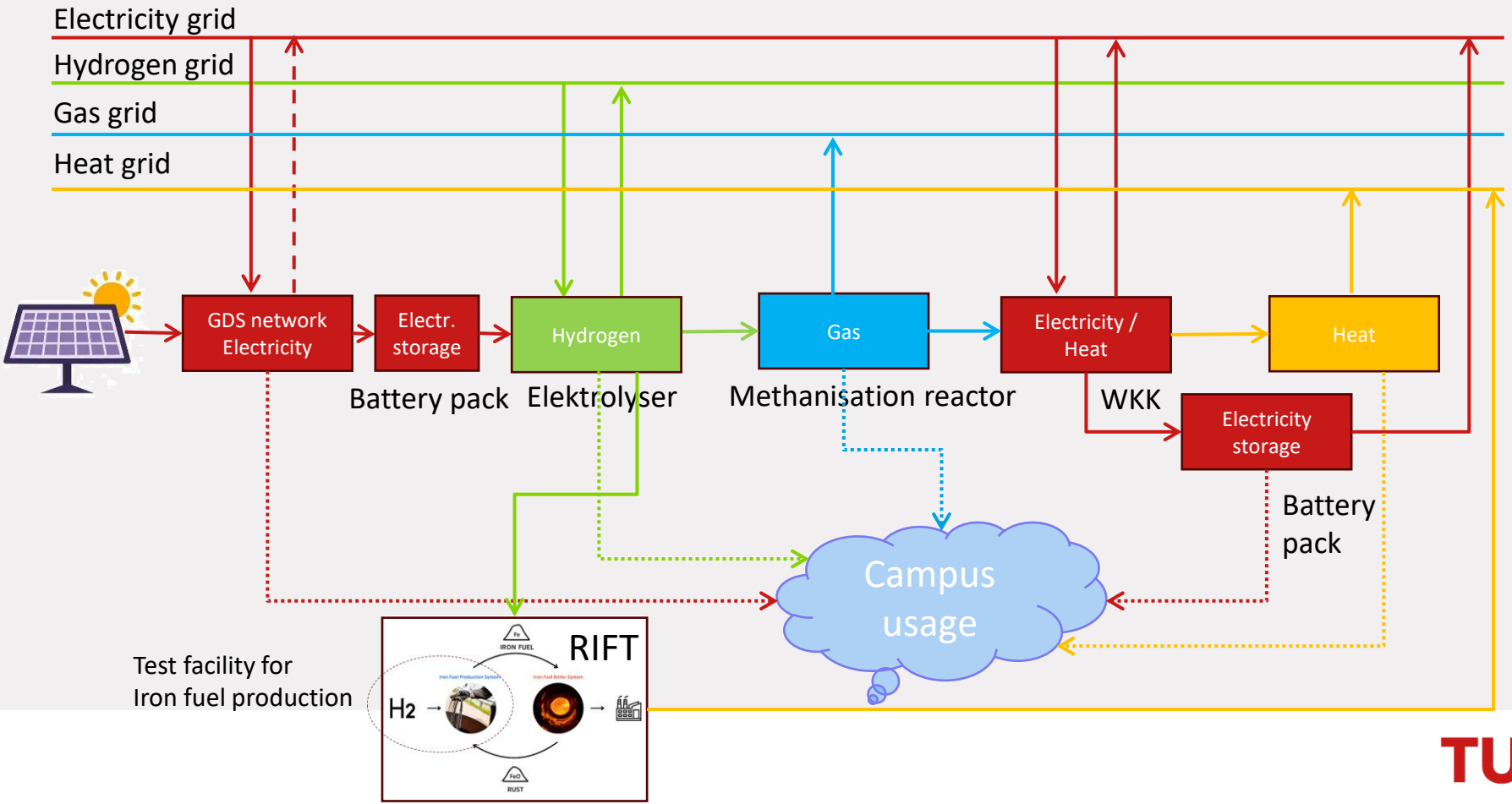


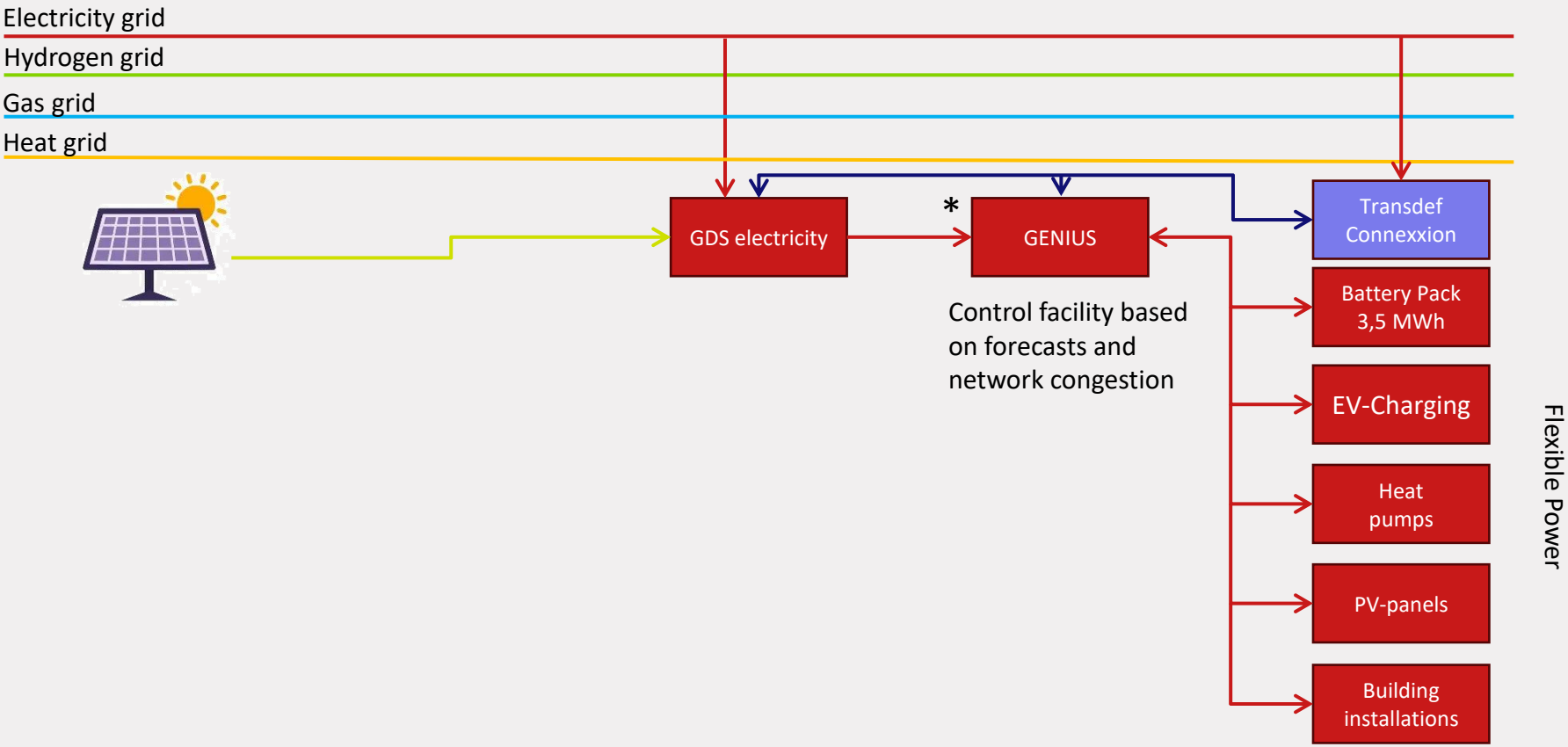
Paul Sabatier
The father of the chemical theory of catalysis

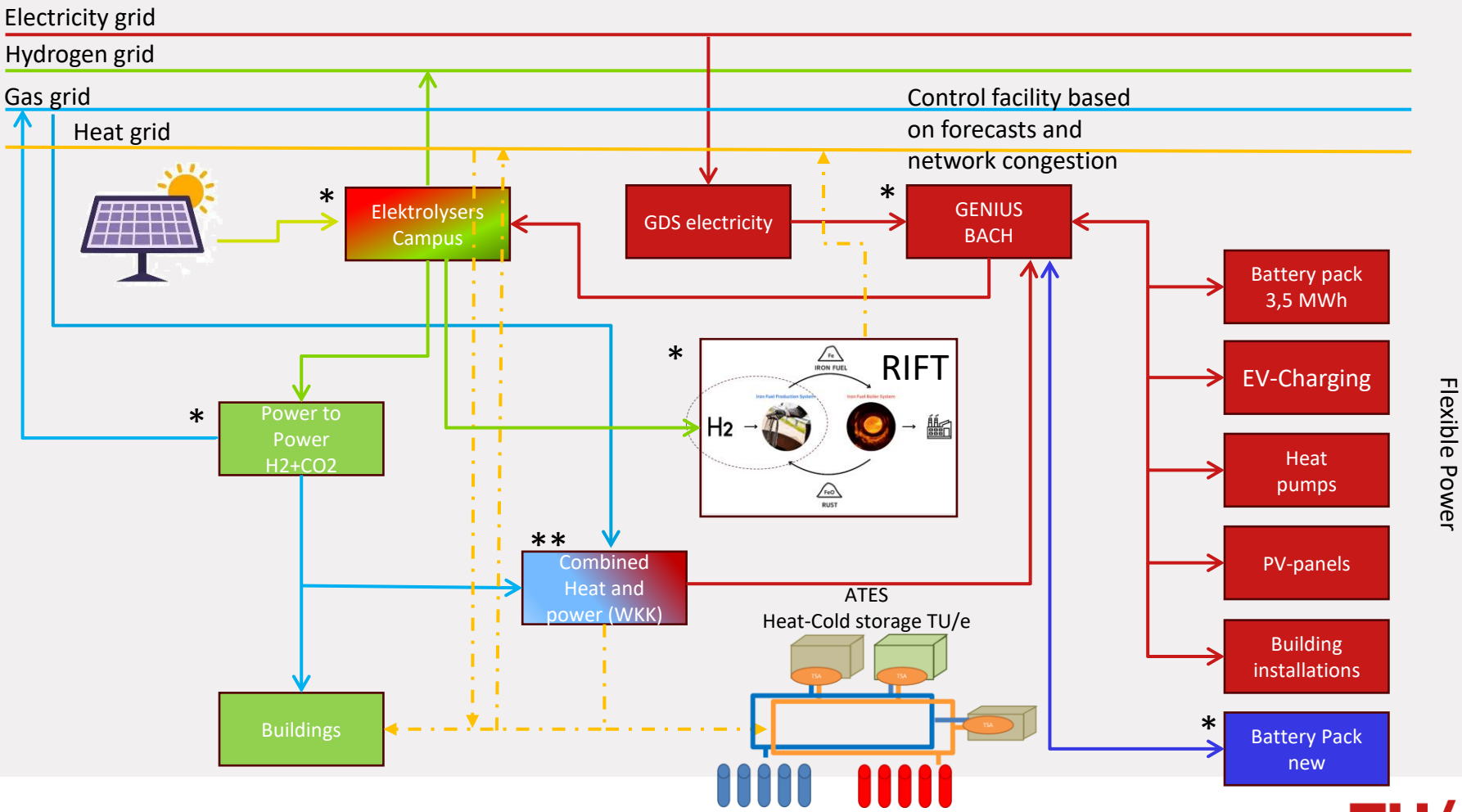
Energy transformation for grid congestion



Energy transformation for grid congestion




Electricity grid
Hydrogen grid
Gas grid
Heat grid
GDS electricity
*
GENIUS
Control facility based on forecasts and network congestion
Transdef Connexxion
Battery Pack 3,5 MWh
EV-Charging
Heat pumps
PV-panels
Building installations
Flexible Power



* BACH componenten, Brainport Approach for Congestion-free Holland

Genius is no longer just a project, but the driving force behind a long-term program centered on a new form of energy research infrastructure.

GENIUS meets BACH

Brainport Approach for Congestion-free Holland

GENIUS 2.0

https://www.tue.nl/en/research/institutes/eindhoven-institute-for-renewable-energy-systems/projects/genius

GENIUS

Grid Efficiency & Network Integration for Universal Sustainability