

**REDUCING PEAK LOAD OF  
RENEWABLE ENERGY AT DISTRICT  
LEVEL WITH PREDICTIVE TWINS**

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LINDEN

12-10-2022

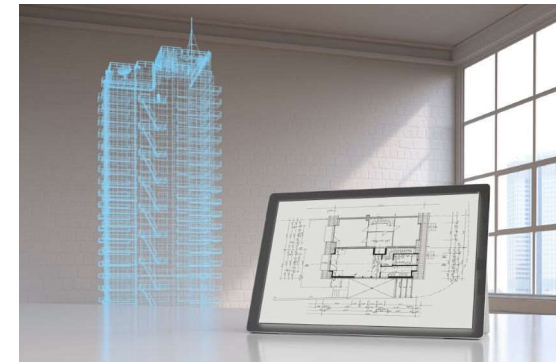
# WOUTER BORSBOOM



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INIVE.org, BDTA.

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Towards Networks of predictive twins in the Built Environment, Arjen Adriaanse, Wouter Borsboom, Rob Roef, 2021

<https://repository.tudelft.nl/islandora/object/uuid:ba8043dd-1dfc-4469-bfeb-53006de6e88a>

# NEED FOR LIMITS OF ELECTRICITY DURING PEAK HOURS

## Watch: EU Proposes Electricity Limits During Peak Hours To 'Flatten The Curve'



By **Tim Diacono**  
September 7, 2022 at 6:12 pm

Share:



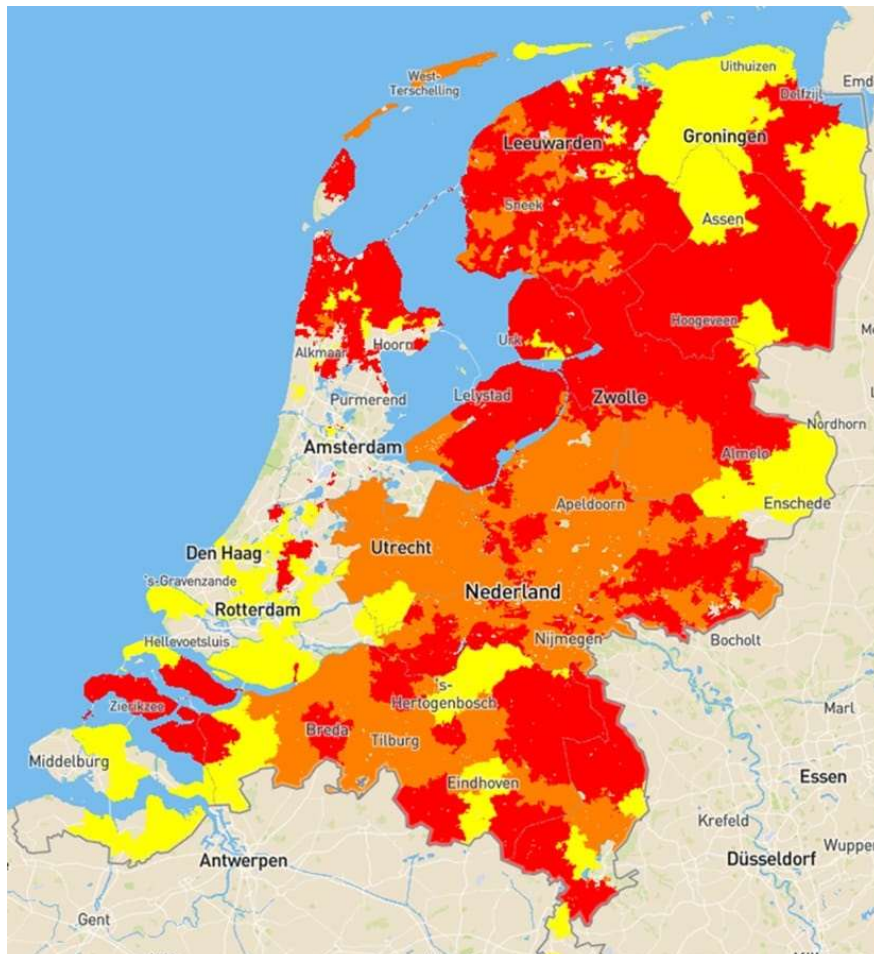
The European Commission has proposed a mandatory reduction in electricity use during peak hours, insisting the EU must “flatten the curve” and avoid peak demands.

“What has changed over the summer, because of the elements I was just mentioning, is that we see that there is a global scarcity of energy,” European Commission President Ursula von Der Leyen said today.

“So whatever we do, one thing is for sure: We have to save electricity, but we have to save it in a smart way. If you look at the costs of electricity, there are peak demands.”

“And this is what is expensive, because, in these peak demands, the expensive gas comes into the market. So what we have to do is to flatten the curve and avoid the peak demands. We will propose a mandatory target for reducing electricity use at peak hours. And we will work very closely with the Member States to achieve this.”

## › LIMITATION NETWORK CAPACITY IN THE NETHERLANDS



Yellow: transport capacity availability is limited

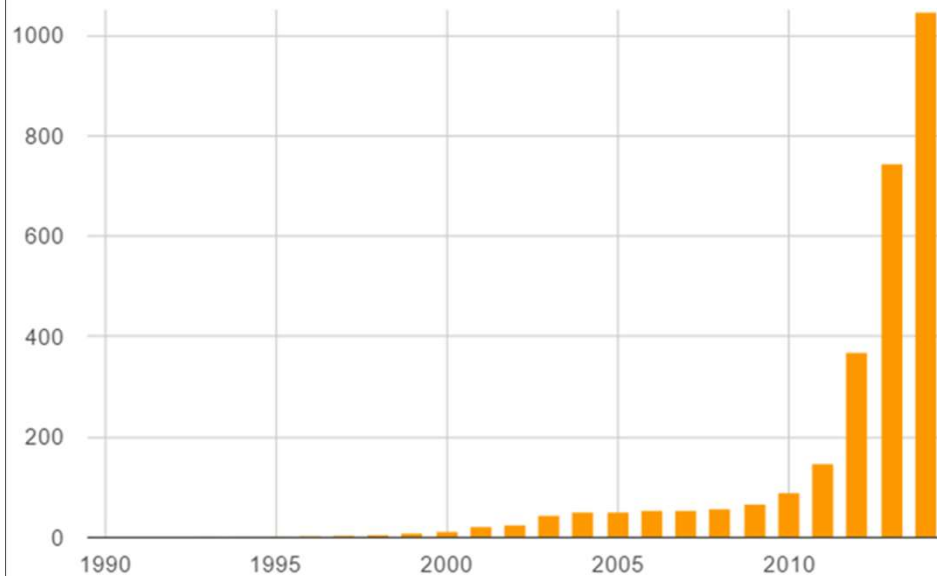


Orange: warning for structural congestion

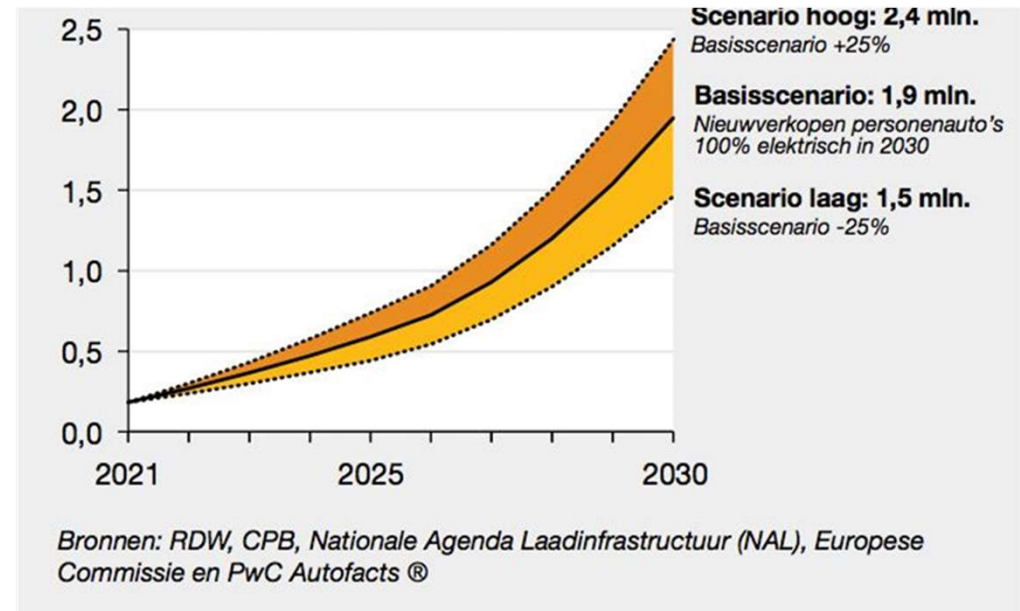


Red: structural congestion, no new connection to the grid

## FAST GROW OF SOLAR, ELECTRICAL VEHICLES, HEAT PUMPS IN THE NETHERLANDS



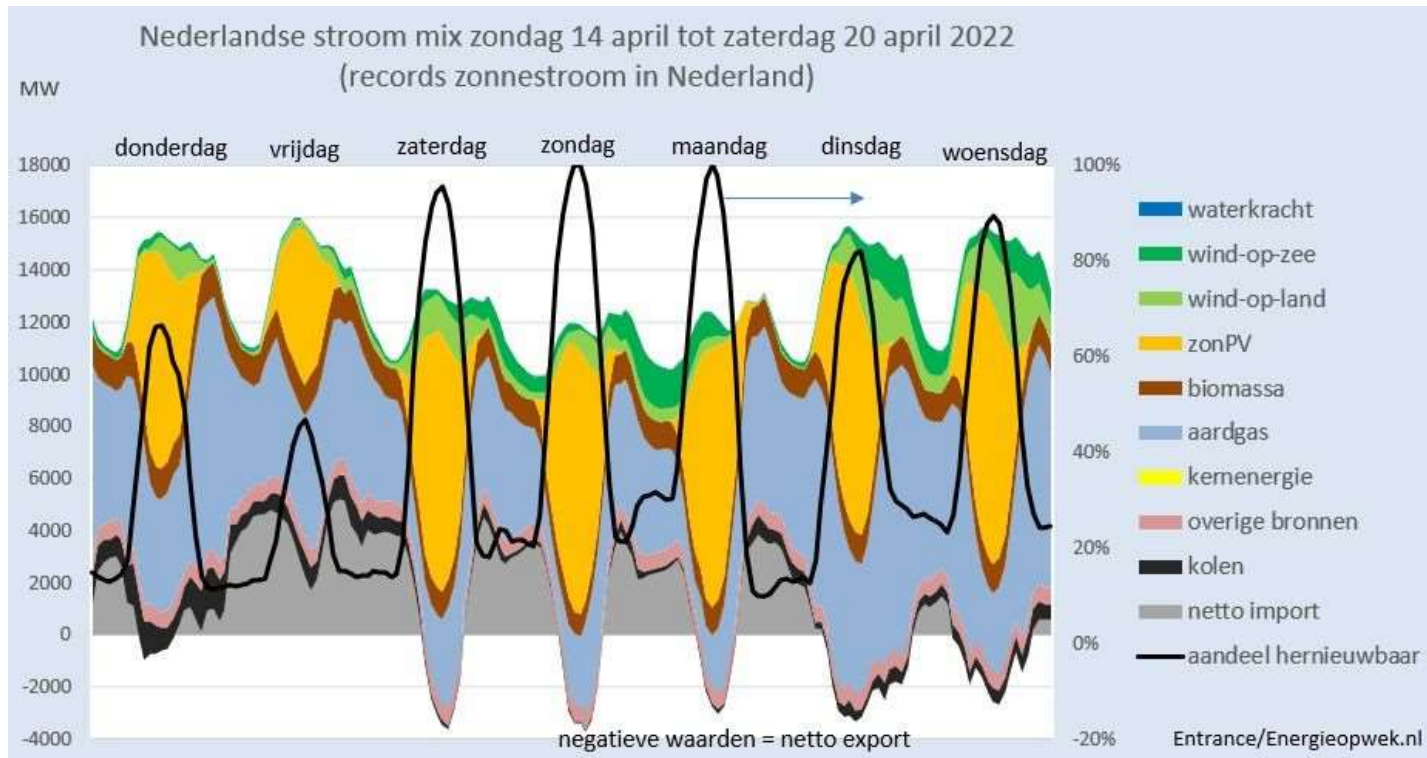
Number of solar panels



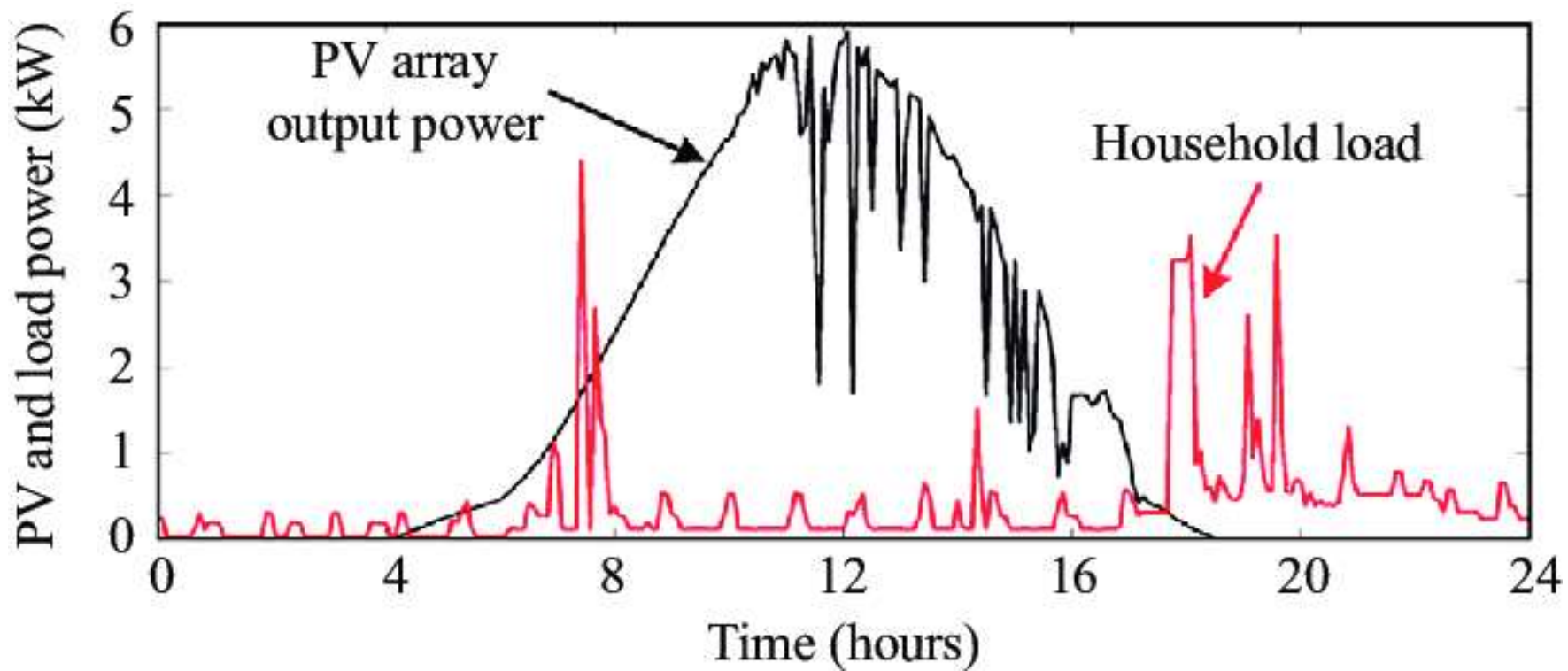
Different scenario's of electric cars in Netherland

# SOURCES OF ELECTRICITY PRODUCTION IN NETHERLANDS APRIL 2022

almost 100% solar during the day, 100% natural gas at night

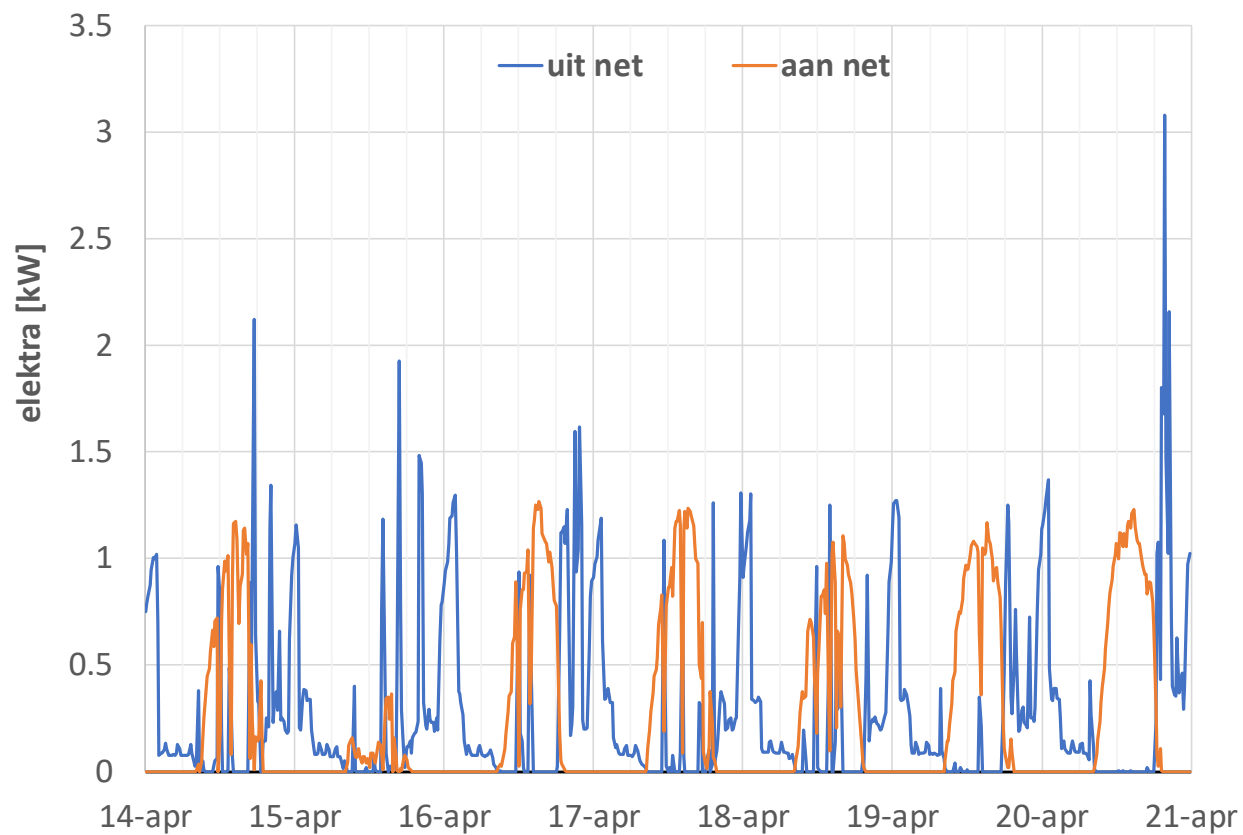




## DEMAND OF ELECTRICITY AND SUPPLY OF PV



# ENERGY SUPPLY AND DEMAND OF NERO ZERO WONINGEN

## HEAT PUMP TURNS ON MOSTLY DURING EVENING AND NIGHT

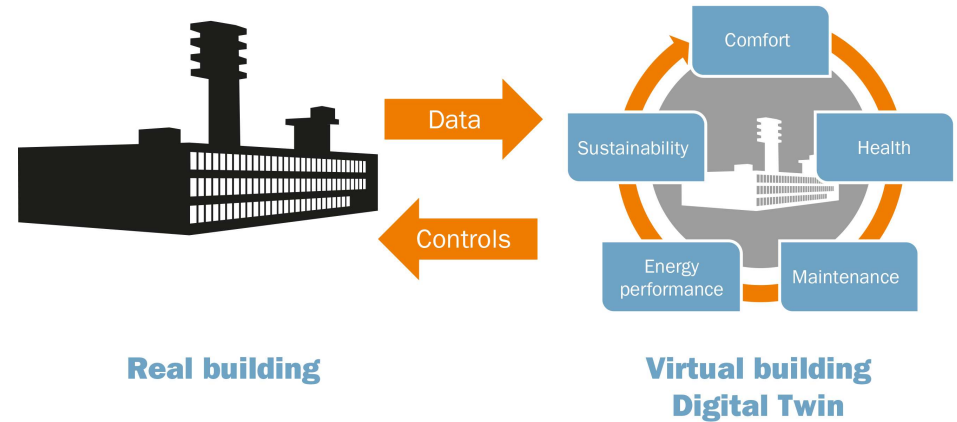
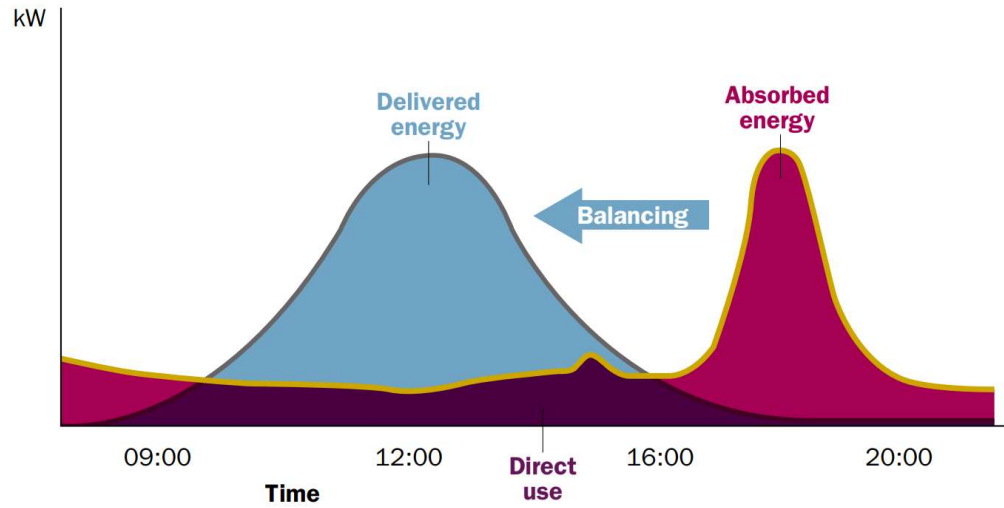


-  Energy demand: household appliances and heat pump
-  Photovoltaic supply



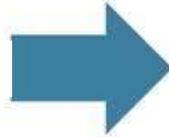
# SHIFTING ENERGY TO REDUCE PEAK LOAD WITH CONTROL

Absorbed energy versus delivered energy

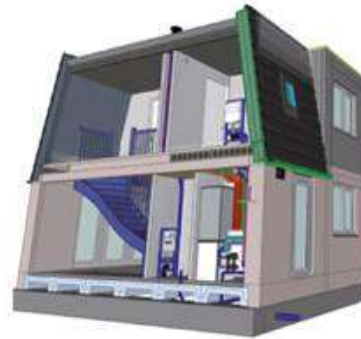


# DIGITAL TWIN SYN.IKIA: AREA APARTMENT BUILDING

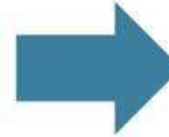
**BIM-Information**



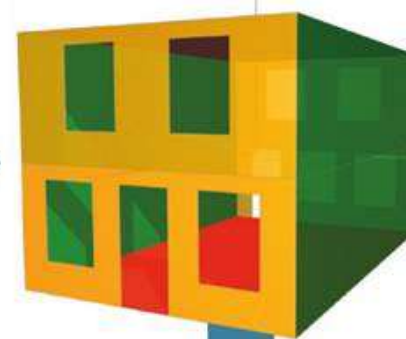
Building Information Model (BIM)



Revit



Building Energy Model (BEM)

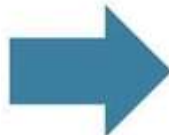


IFC / gbXML



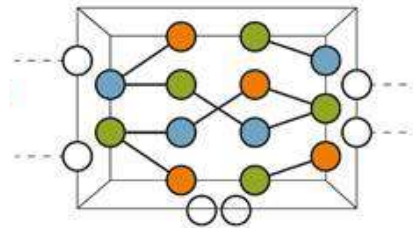
TNO Sirin-E Predictive Twin

**Dynamic data  
(measuring  
data)**

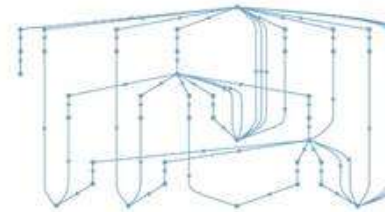


HayStack

User behaviour model (data en machine learning, Federated learning))

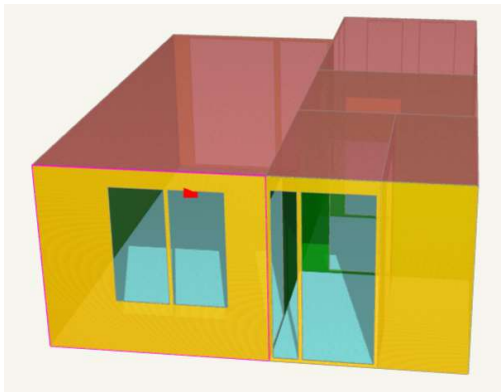


Physical model energy use



**SirinE**  
*Hybrid building model, analyze, predict, control*

## BIM INFORMATION: EXAMPLE OF GBXML 2 MODEL



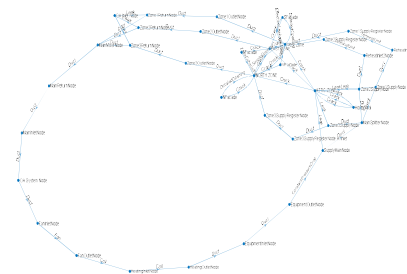
Uden gbXML apartment

gbXML data container & IDF (Energy plus)  
for installations

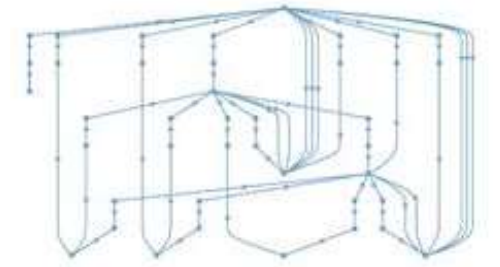
File import / data selection



Generation of a general struct containing all  
information needed for building simulation



TNO AirMaps ventilation  
model



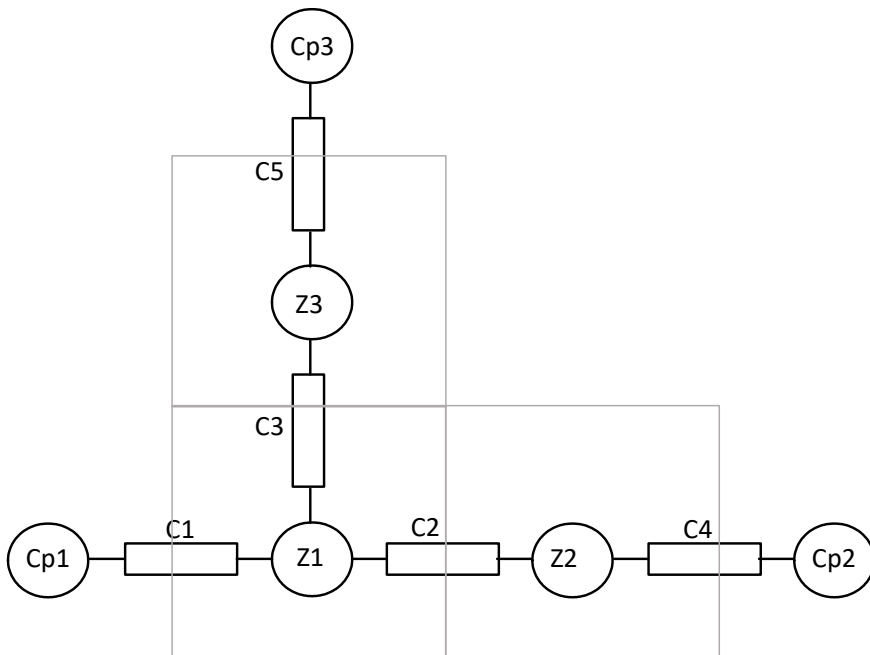
TNO Heat transfer model



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869918



## › VENTILATION MODEL



C are the zones, c are the connection and CP are the outside nodes represented by a pressure due to wind.

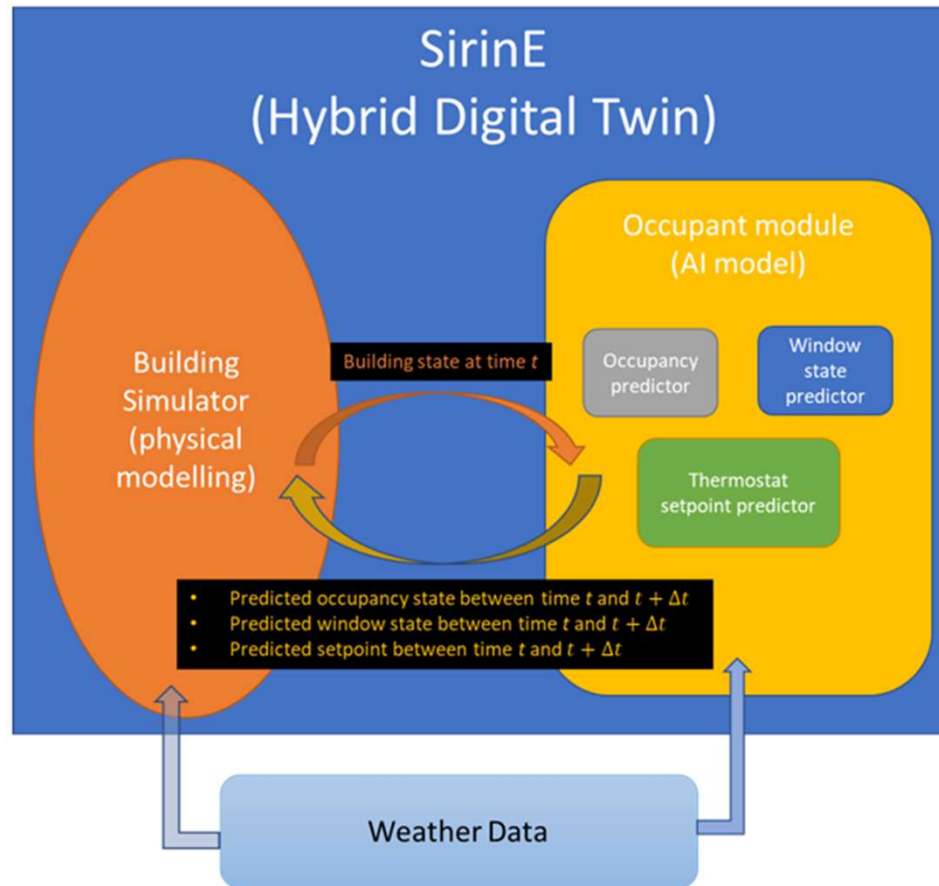
In the ventilation model AirMAPs the following driving forces are consider:

- wind
- attackthermal stack
- fans

The ventilation model AirMAPs, 3 types of connections can be modelled:

- 1) an opening (marked CR)
- 2) a test data component (denoted by TD)
- 3) an open window or door (marked OW)

## INTERACTION BETWEEN USER MODELS AND PHYSICAL MODELS





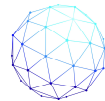
# › QUESTIONS?



Sustainable  
plus energy  
neighbourhoods



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**SPHERE**  
BIM DIGITAL TWIN ENVIRONMENT



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