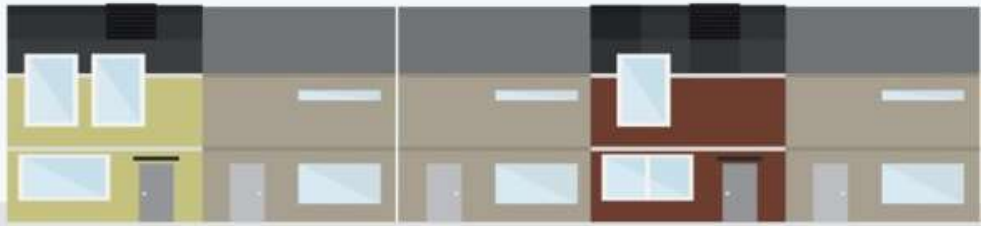
MORE — CONNECT



Experiences from EU MORE-CONNECT Pilot Projects

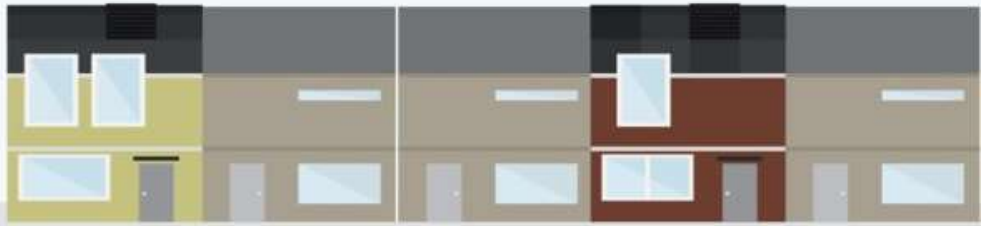
Ove C. Mørck

Cenergia - a part of Kuben Management A/S

ovmo@kubenman.dk

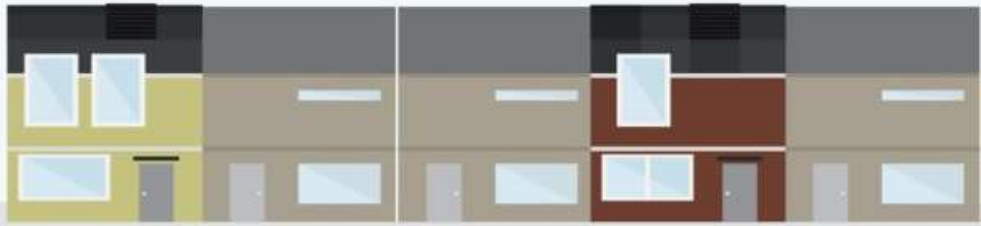
Contents

MORE — CONNECT



- Introduction – demonstrating technical solutions and concepts in:
  - pilots and
  - real life learning lab testing
- Prefabricated facade-elements – prototyping and testing
- Pilot projects – full scale testing
- Experiences

Introduction



MORE — CONNECT

Demonstrating technical solutions and concepts in:

- 6 pilot projects – Estonia, Latvia, Denmark, Ne(2) and Portugal

- 2 Real life learning lab testing
  - Czech Republic and Ne:

Testing of façade elements, Czechia

MORE — CONNECT

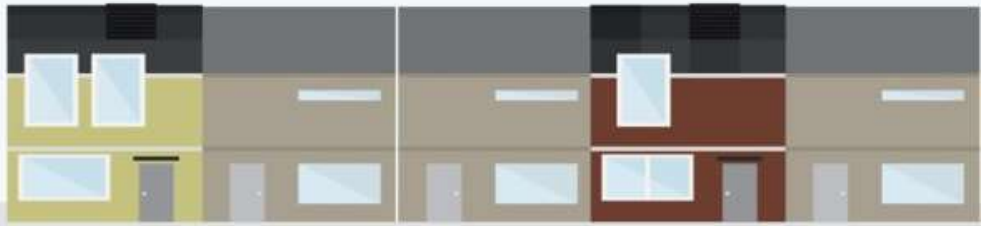
- Preparation for the assembly test – fixing the connection elements for air ducts and pipings

FULL-SCALE assembly

MORE — CONNECT

- Assembly test – lifting the the full façade element by crane and its shift to the mounting position above the bottom element.

FULL-SCALE testing



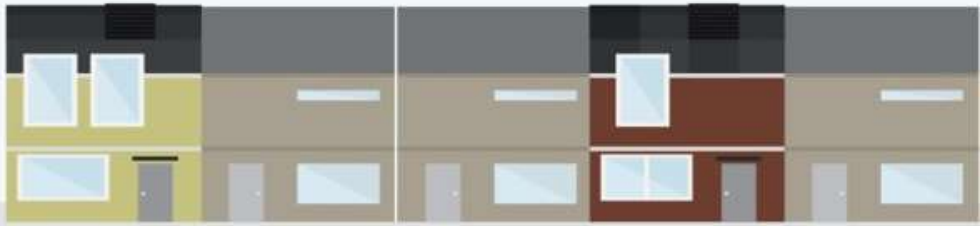
MORE — CONNECT

- Testing of prototypes of air inlets, custom made boxes for control systems and mock-up of an existing window opening (testing of airtight connection).

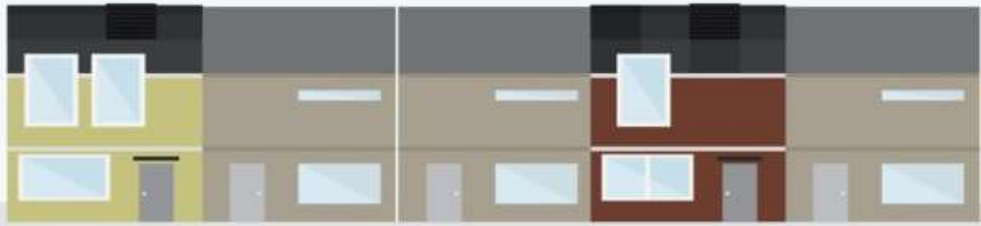
Wall simulater

MOCK-UP BUILDING, Czechia

MORE — CONNECT



Lessons learned Czechia:



MORE — CONNECT

- For the assembly is better for manipulation to take the HVAC connectors from prepared in the lower module and fit them from bellow to the upper module. Thus, for the fine manipulation of the hanging panel the workers can grip the module by the connectors in order to level it with the lower panel and to aim precisely on the HVAC tubes' positions to fit them together.
- When the HVAC tubes are fixed properly in the structure of the panels, their connectors provide quite good routing for setting the module in the proper position. So once the connectors are prepared in the inline position, and the module is lowered by several centimeters, the connectors are able to keep the module on its track so that the workers have enough time to focus on connection the pipes and pull through the cables. Therefore, it is critical to have the HVAC tubes placed very precisely and properly fastened in the structure, as they more or less define the relative positions of modules when assembled.
- At some point the workers need to put their hands between two modules, of which one is hanging in a crane. This step is dangerous, because there is risk that the hanger belts fail or wind could blow and tilt the modules and cause a serious injury. So perhaps there will be needed to have some prepared sticks, wedges or other distance keepers that would be inserted between the modules before the hand works between the panels start.
- It is quite important to calculate the position of the centre of mass of each module and locate the hanger belts evenly relative to centre of mass. Otherwise there are needed significant side forces, which might complicate the installation on site from the mobile platforms (would require more workers and would be more dangerous for them to make such operations.
- It is rather impractical to have free cables hanging from the upper module and let the workers to push them through the conduits. Better solution is to have all the cables in tight conduits and push just steer them into one conduit of a larger dimension in the lower module.
- System of thermal insulation around the water piping connections need further elaboration to prevent gaps in the thermal insulation.

Ennogie PV-roofing elements, DK

MORE — CONNECT

Prototype installation in Haderslev

Installation of the PV-roof - DK

MORE — CONNECT

The completely renovated building with PV-roof from Ennogie.

Robot development prototype

MORE — CONNECT

Milling with high precision, rendering with spray-gun and pump and 3D printing on a wall

Lessons learned from testing Robot onsite

MORE — CONNECT

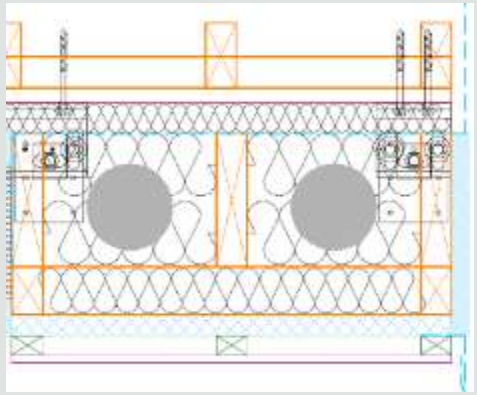
Complete prototype of insulated wall with robot made decoration and robot applied finishing.

Final decoration made with the innovative robot developed in the en
by Invela based on the experiences from the onsite testing

Prototypes and testing in Estonia

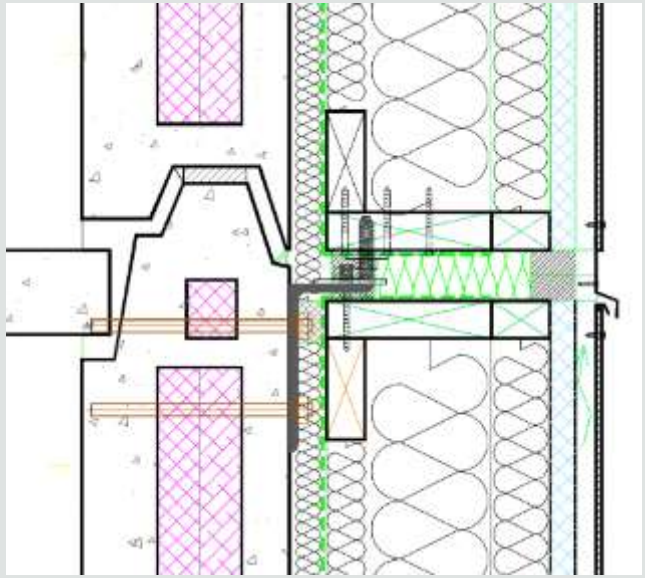
MORE — CONNECT

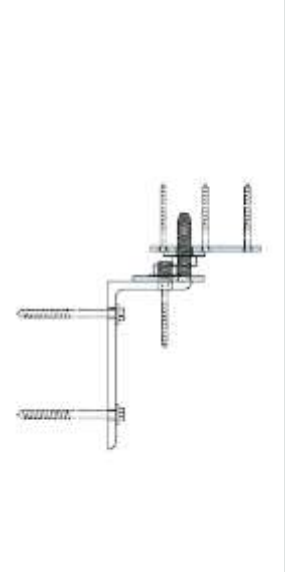
- Installation of **ventilation duct into basic modular elements for facades**

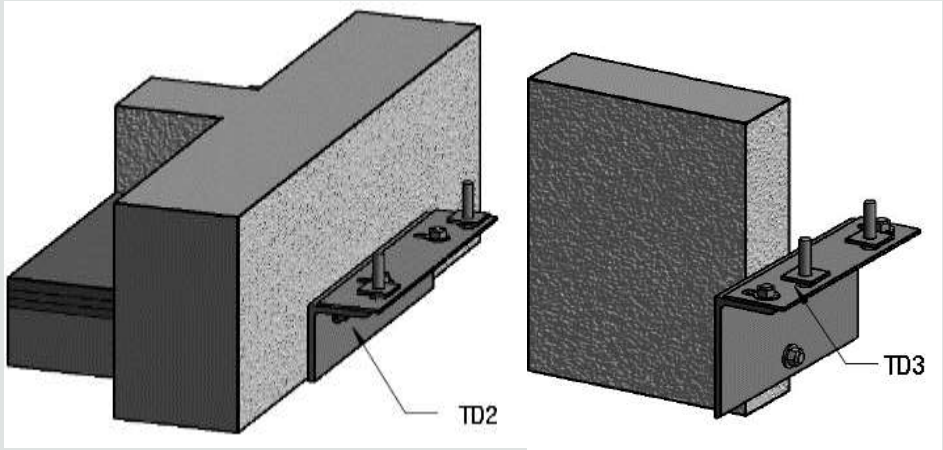


Connectors

- **3D** movable connectors for panels

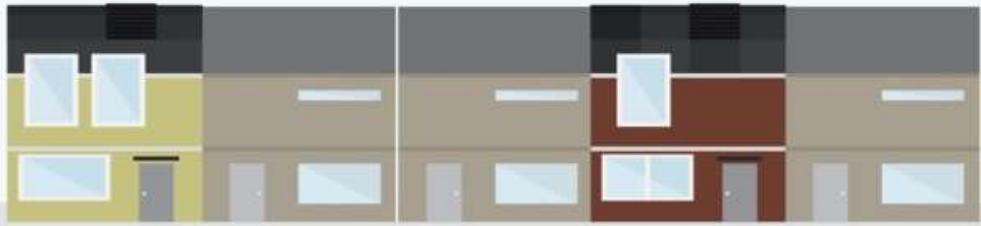






Akadeemia tee 5A pilot - Estonia

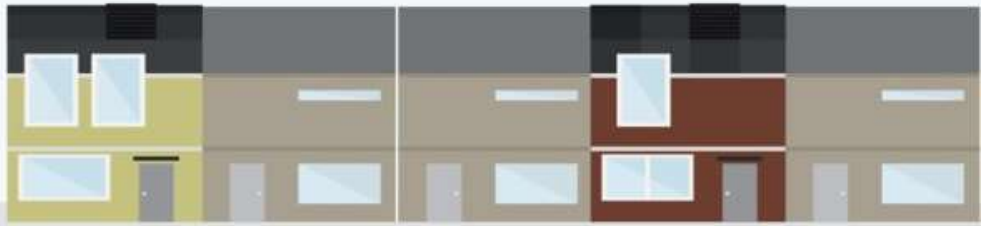
MORE — CONNECT



- Overview of the pilot building after the nZEB renovation with modular elements (autumn 2017)

Akadeemia tee 5A pilot - Estonia

MORE — CONNECT

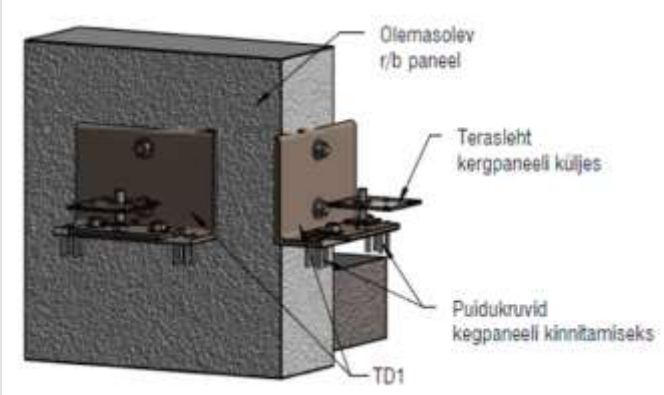


- Installation of modular elemets at the pilot building (summer 2017)

Lessons learned, Estonia:

MORE — CONNECT

Because of the un-evenness of the existing structure, the designed adjustable distance of brackets was not enough. Therefore, actual mounting works proved that the brackets should be even more adjustable.



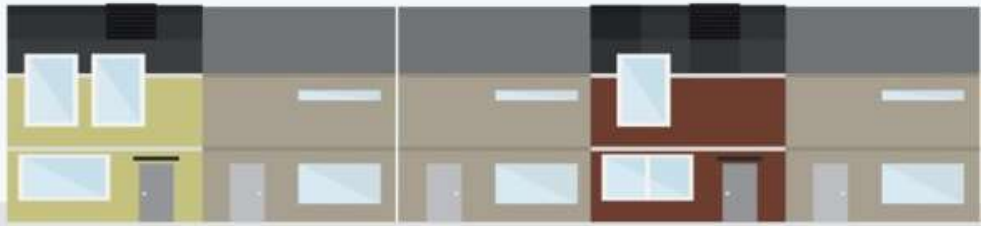
Joint sealing changed:

Before

After

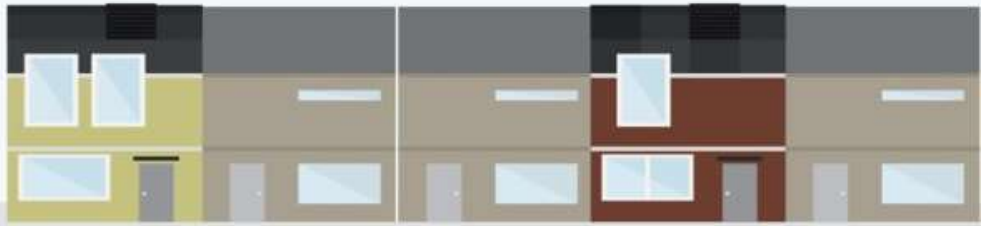
Latvia: Samples of façade elements

MORE — CONNECT



Demo samples were produced to test their durability and to evaluate possible installation solutions;

Latvian demo building



MORE — CONNECT

- After renovation

Mounting was started in July 2017. Panel mounting took 5 days including some delay in oversized panel replacement. Other construction works took 9 days.

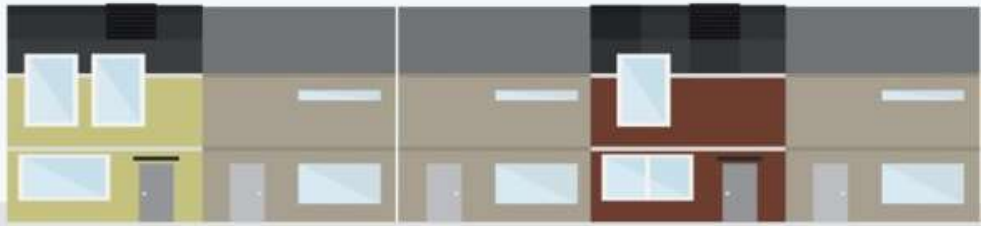
Demo and test of elements, Ne

MORE — CONNECT

The excisting walls before the new elements were attached.

Demo and test of elements, Ne

MORE — CONNECT



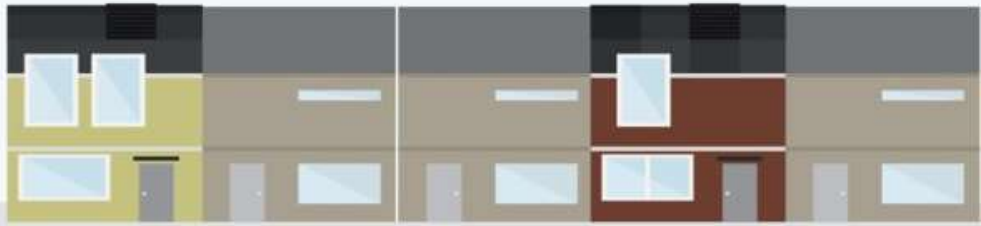
Demo samples were produced to test their durability and performance.

Different element compositions are tested on fire resistance, air and water tightness including connections between elements.

The latest development is timber frame elements without EPS reaching Passive House Level of insulation and airtightness .

Pilot Zoetermeer- NL

MORE — CONNECT



Graaf Jan straat Zoetermeer

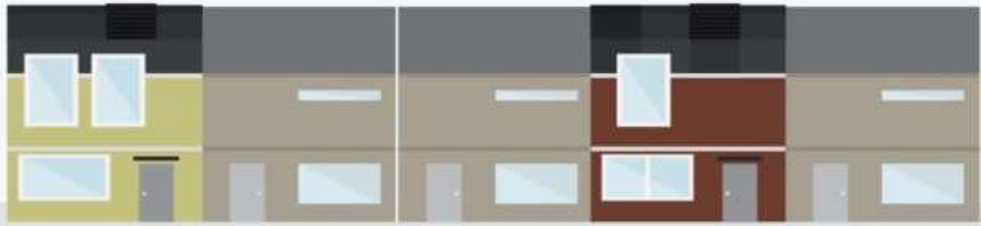
PRivate
NOM renovation in 10 days
Build in 1974
Energy overshoot

Airtighness Qv10< 0,3l/s.m2
Brine heatpump water-water
PV-cellen and
Heatwatercollector
WTW and boilerbuffer 150l
Rc roof 7, Rc wall, 5 Rc vfloor 5

Opening november 2015 by minister Blok

Arnhem Presikhaaf pilot – NL

MORE — CONNECT

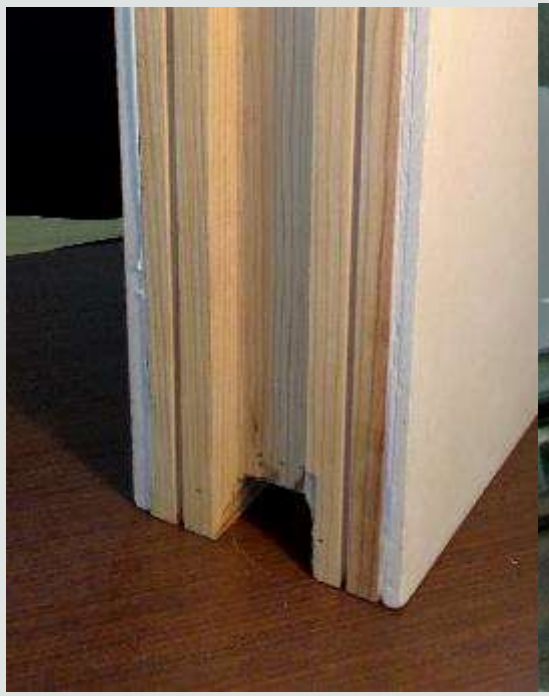


Dutch producer of elements:
”It is of extreme importance that the responsible contractor understands and trusts the prefab-element system of renovation.”

Test of elements, Pt

MORE — CONNECT

Prototype assembly of prefabricated modular panel.

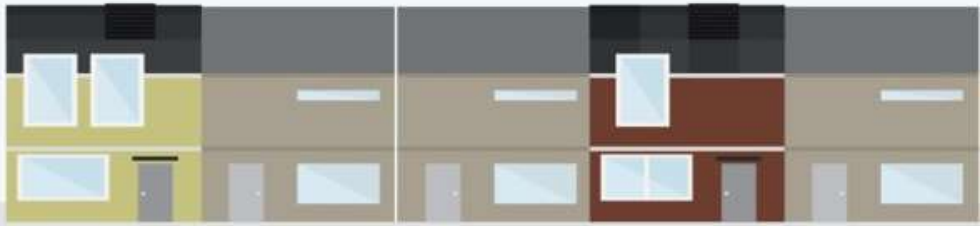


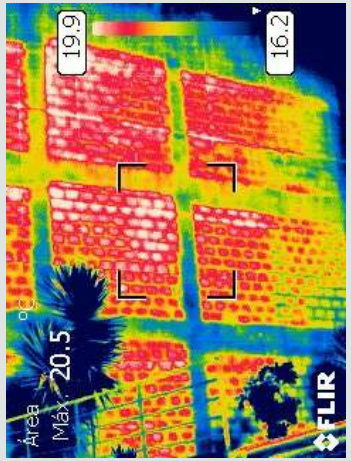
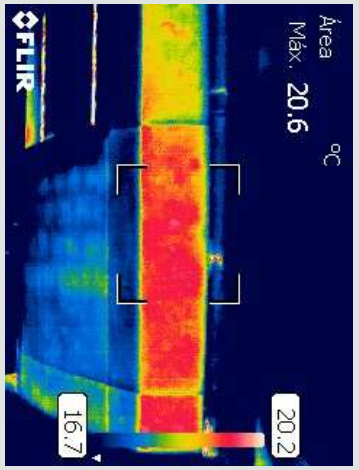
Frame detail

Prototype assembly

Demo wall for panel connection test

Edificio Mota Pinto pilot - Portugal



MORE — CONNECT

Before renovation