SoFanTES : HOLISTIC Solution for Sustainable Buildings

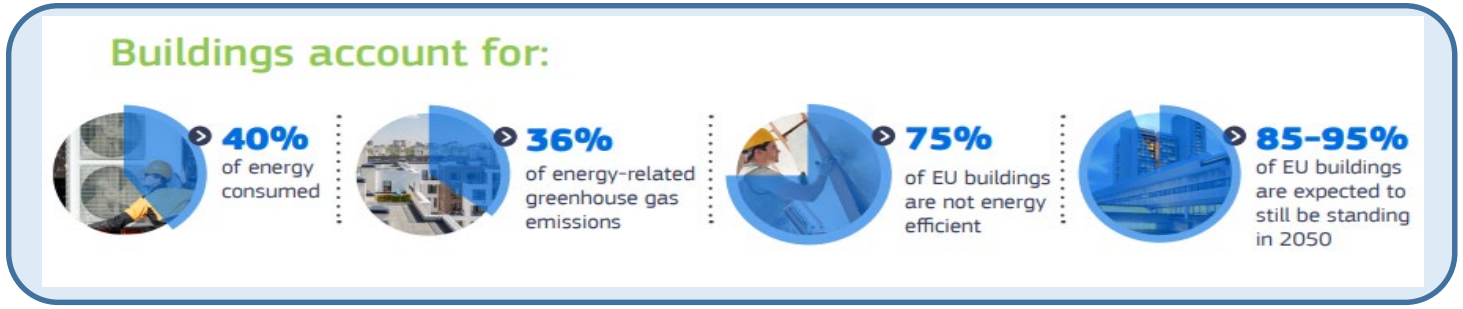
TOP RAK SMART FACADE SYSTEMS

Imagine your building façade storing solar energy with NO COST!

Project «SoFanTES»
Company : TOPRAK SMART FACADE SYSTEM ENGINEERING LTD.COM.

Ercan Başer, CEO

❑ PROBLEM: MISSING HOLISTIC Solutions For Sustainable Buildings…



Efficient **HVAC** + Efficient **Envelope** + **RES** + Energy Storage = **Holistic and Scalable Systems?** URGENT

❑ SOLUTION: Building Integrated TES

*SoFanTES, offers a solution to these challenges by combining building envelopes, energy-efficient HVACs (LowEx System) and **thermal energy storage** techniques through an integrated design approach for affordable energy efficient buildings.*

SMART FACADE + **Low temp. TES** → **Renewable Energy Storage for Buildings** SoFanTES

SoFanTES: How Big Is The Problem?

Today's Building Energy Needs:

Heating and Hot Water:

100-150 kWh/m²/year

By 2050, the Objective is to Achieve:

80-90% Reduction in Energy Consumption

Thermal Energy Need Supported from Renewable Energy Sources (RES), approximately:

100 kWh/m²/year

BUILDINGS TODAY		2050 TARGETS
 *account for almost 40%*	 *account for almost 33%*	nZEB STANDARDS
Final Energy Consumption		
200 kWh/m²/year		**30 kWh/m²/year**
85% Energy Savings		
CO2 EMISSION		
4000 MtCO2		**2000 MtCO2**
50% CO2 Savings		
Heating and Hot Water		
100-150 kWh/m2.year 0,1-0,2 €/kWh		**15-20 kWh/m2.year**

RES

«Integrating renewable energy sources (RES) into buildings poses several challenges.«

"Inconsistent Energy Supply"
"Intermittent Nature"
"Demand vs. Supply Imbalance«
«Peak Load Problem»
"Grid Dependency Issues"
"Architectural Boundaries"

TES

may be the answer, but it must be integrated into buildings in a holistic and scalable way.

SoFanTES: How Big Is The Problem?

THERMAL ENERGY STORAGE CAPACITY,CHARGING AND CHALLENGES

100-150 kWh/m2.year
Thermal Energy Capacity

75% of final energy consumed in buildings is used for space heating and hot water

TES

~100 kWh/m2.year ✓
Thermal Energy Capacity

HOW DO WE CHARGE?

We need TES to be charged by RES with a capacity of around 100 kWh/m2.year.

Winter solar irradiance in EU,
300-400 W/m2

Daily solar thermal energy: 1.2 kWh/m2.day

Yearly solar thermal energy: 100 kWh/m2.day ✓

Contrary to popular belief, solar energy can meet a significant portion of a building's energy needs even during winter months.

TES

100 kWh/m2.year ✓
Thermal Energy Capacity

But Low Temperature

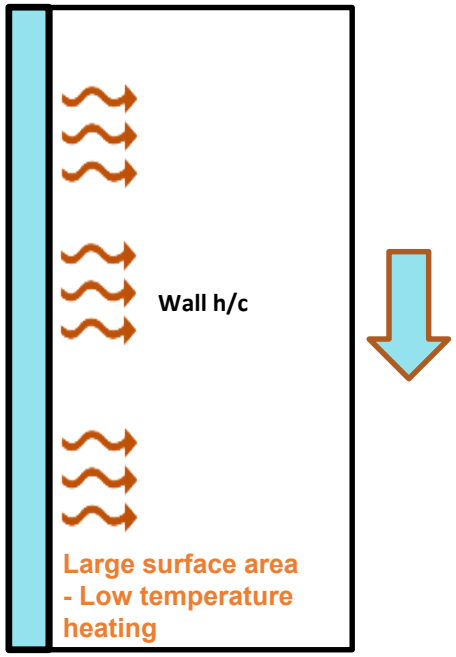
30-40 °C x

x **CHALLENGES:**
Thermal Efficiency
Cost-Effectiveness
Scalability
Building Integration
Lack of knowledge and experience
Limited Awareness

SoFanTES: Solar Facade for An Affordable TES System.

First Task;

Drop
SUPPLY TEMPERATURE!

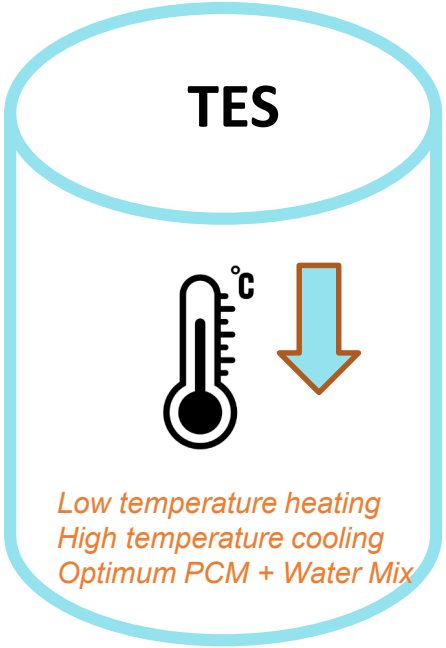


SoFanTES low supply temperature improves efficiency, reduces losses, and enables low-temperature TES.

Second Task;

Drop
TES -TEMPERATURE!

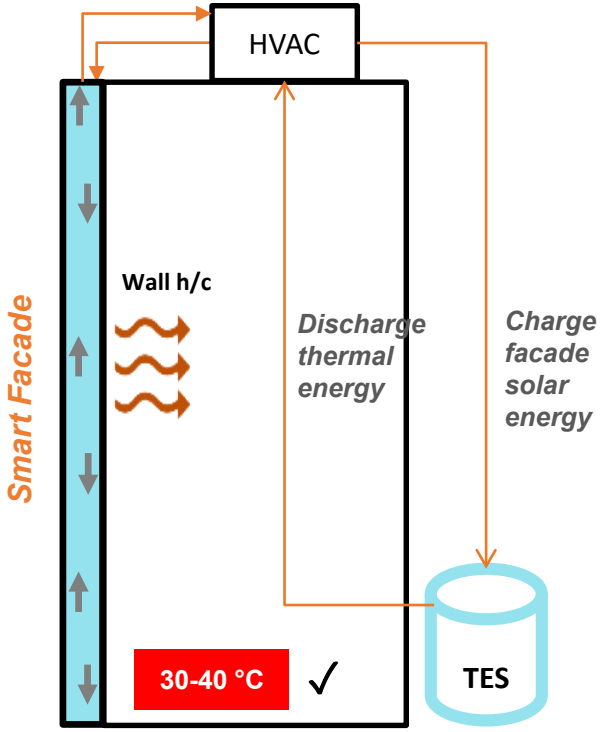
Design Affordable TES!



The most important problems of building integrated TES:*Cost*, ***Efficiency, Size* *and Weight,* ***Durability****,* ***Safety****:*

Third Task;

Building Integration
with
Smart Facade



When it is sunny, TES is charged. When there is no sun, TES is discharged.

How is Solar Energy Stored During Winter?

THEN,

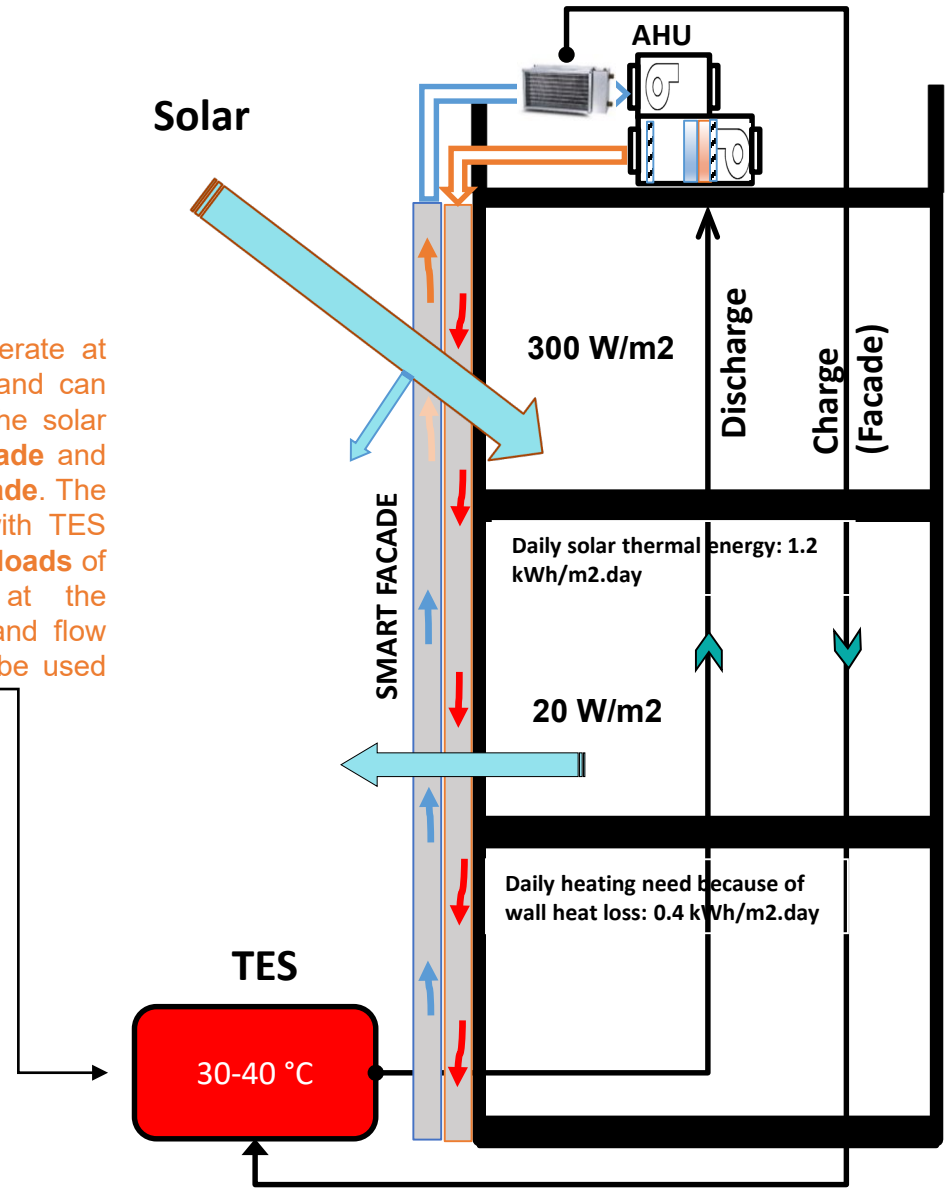
ALL WE NEED IS SUN!

HEAT LOSS:
U=1.0 W/m2.K, DT= 20 °C
Heating Load, daily ⇨ **20 W/m2**.
Ploss = 400 Wh/m2.day

HEAT GENERATION:
On a sunny day, ⇨ **Psolar = 1200 Wh/m2.day**

It is equal to roughly 3 days' worth of heating energy for the same facade. Of course, if we assume that only half of the building's facade receives sunlight, this value corresponds to approximately one day's worth of heating energy.

The **TES** system can operate at low heating temperature and can be **scaled** according to the solar energy coming to the **façade** and the heat loss from the **façade**. The HVAC system charged with TES can **manage the thermal loads** of the **façade** with air at the appropriate temperature and flow rate. Excess energy can be used for hot water needs.



SoFanTES WORKING PRINCIPLES

TRANSFORM YOUR FACADE INTO Renewable Energy Source!

Winter:

Heat storage at a temperature of 30-40 C is sufficient for the winter. The working principle is as follows:

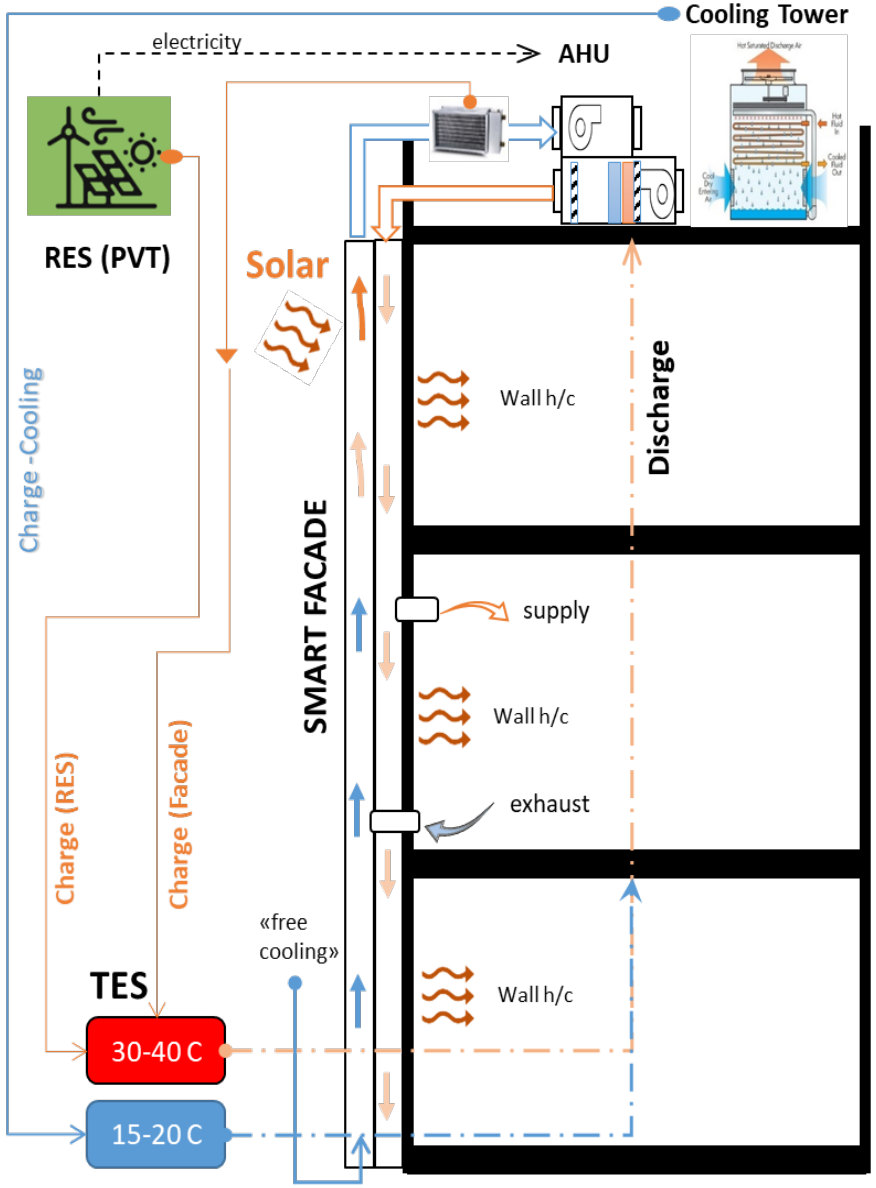
Electricity generation is provided by PVT panels. The primary source for thermal energy is PVT. The secondary source is the Smart Facade. The air circulating in the façade can reach a temperature of 40-50 C even on winter days, and excess thermal heat is stored with TES. TES collects about 3-5 days of energy on sunny days (Charge). In the absence of solar energy, this heat is discharged to the system from the storage. Thanks to the air circulating in the smart façade, the facades that are not exposed to the sun are easily heated. When there's no sun and TES isn't enough, the heat pump (HP) runs.

Summer:

Heat storage at a temperature of 15-20 C is sufficient for the summer. The working principle is as follows:

Electricity generation is provided by PVT panels. Thermal energy is stored with TES. TES stores about 2-3 days of cooling energy with a cooling tower that operates at night. When the outside air temperature is appropriate (e.g. at night), it is supplied to the façade and the façade is prevented from overheating (free cooling). Cooling is provided by daytime TES discharge. When TES is not enough, the heat pump (HP) is activated. For warmer climates, the subsoil temperature (about 15-20 C) is used to cool the façade.

Please note that, *Renewable energy sources, which are difficult to utilize normally, are easily integrated into the TES system, thanks to low temperature regime.*



What is SMART FACADE?

*It is a **patented adaptive** façade integrated with HVAC system.*

Design stages

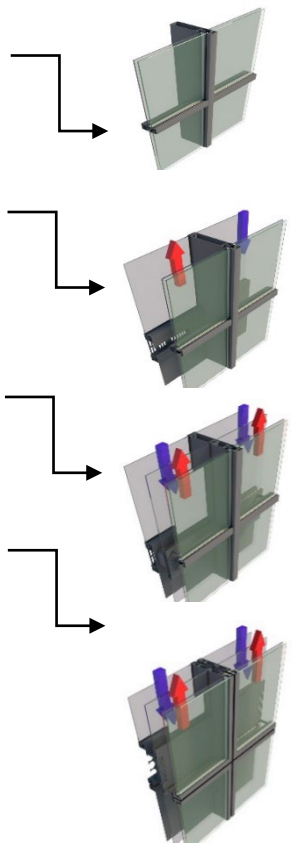
Step 1: glazed curtain wall façade

Step 2: Create a channels

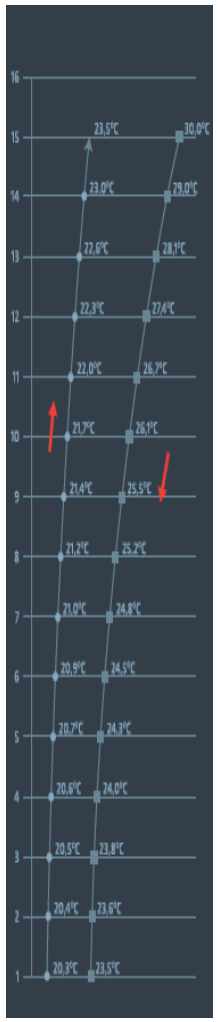
Step 3: Create a channels (double skin)

Step 4: Convert the facade from a site-built system to a prefabricated modular (unitized) system

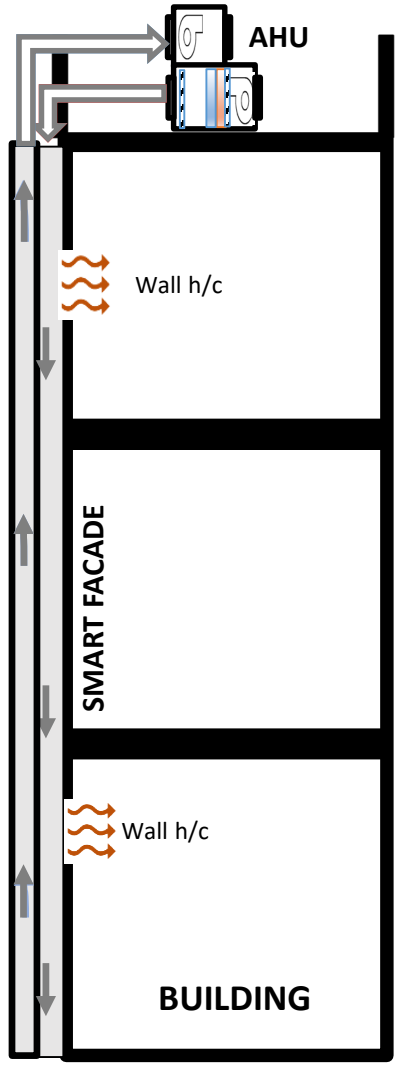
Step 5: Integrate with HVAC.
Control the airflow and temperature to provide heating –cooling-ventilation from the facade.



Design stages from traditional curtain wall to SMART FACADE



Thermal profile



INNOVATION?

SMART FACADE

Thermal Innovation:
- Integrates Seamlessly with HVAC
- Controls Facade's Thermal Profile

Architectural Innovation:
- Facilitates Air Circulation through Channels
- Features a Modular and Versatile Design
- Built with High Thermal Mass Steel

Pilot Building Construction : *Adaptive, Economic & Efficient*

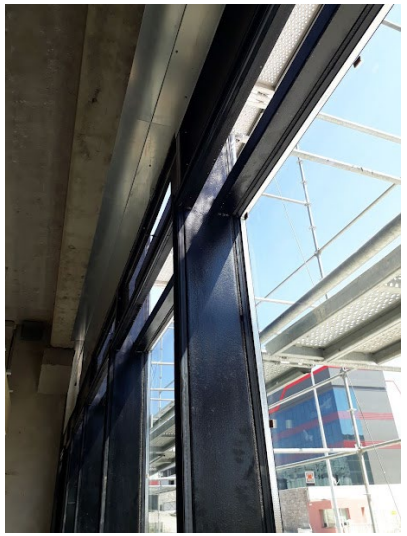
SMART FACADE

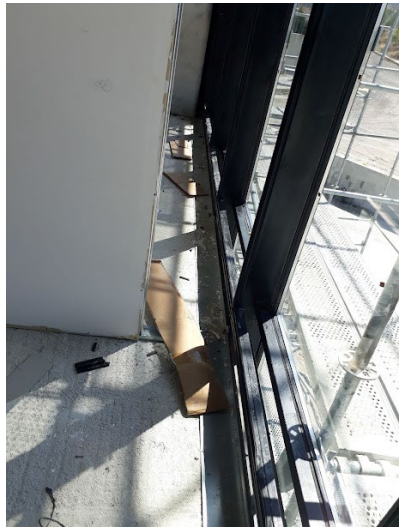
The first pilot application was carried out in **Ankara-Turkey in 2020** with all glass, steel construction and accessories, at a cost of **110 Euros/m2,** including installation labor.

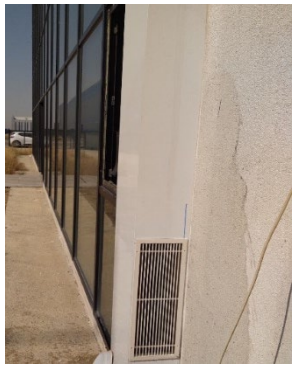
Steel construction single-walled, dynamic-adaptive air circulation.

"Smart Facade" looks just like regular curtain walls from the outside and inside.

The SMART FACADE pilot building is completed. However, it needs further development to integrate the SoFanTES system, including the setup of automation and measurement systems to ensure comprehensive year-round performance monitoring.





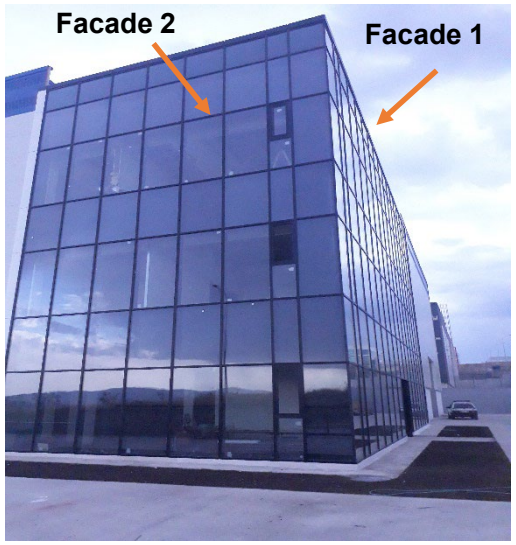


Is It Really Work?

"SMART FACADE" has already proven itself to be a good thermal energy storage tool for SoFanTES.»

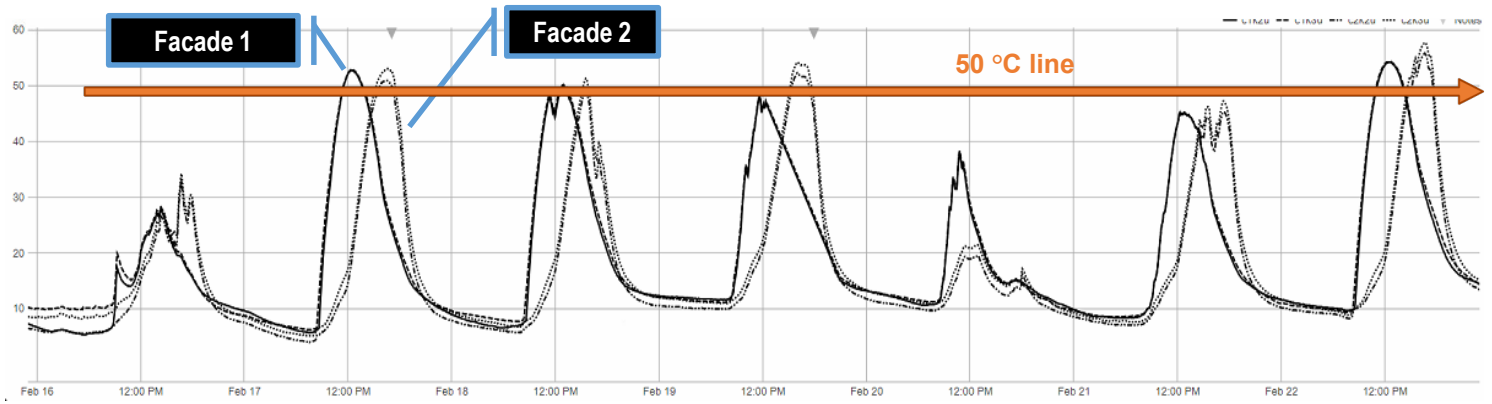
TOP RAK SMART FACADE SYSTEMS

In winter, the facade air temperature close to 50 °C was measured for 4-5 hours a day. This shows the solar thermal energy storage capacity of the Smart Facade even in winter.



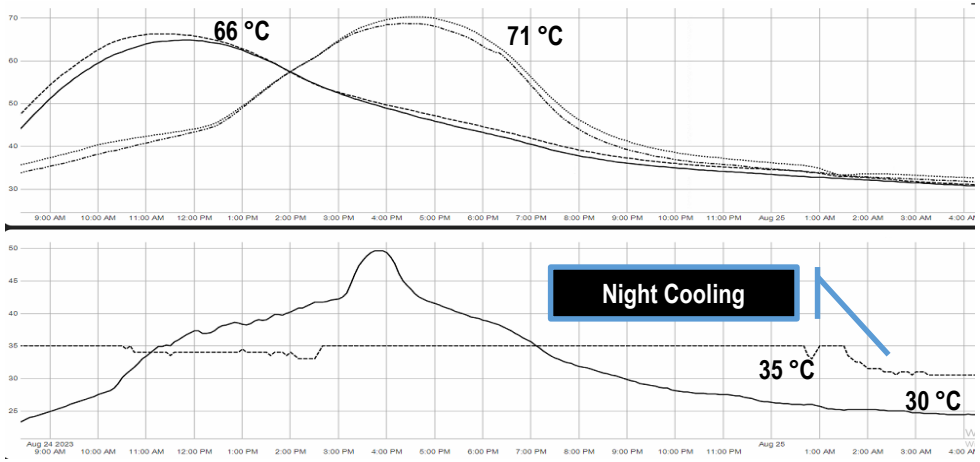
Building Southeast & southwest facades

Winter (FEB.16-24)

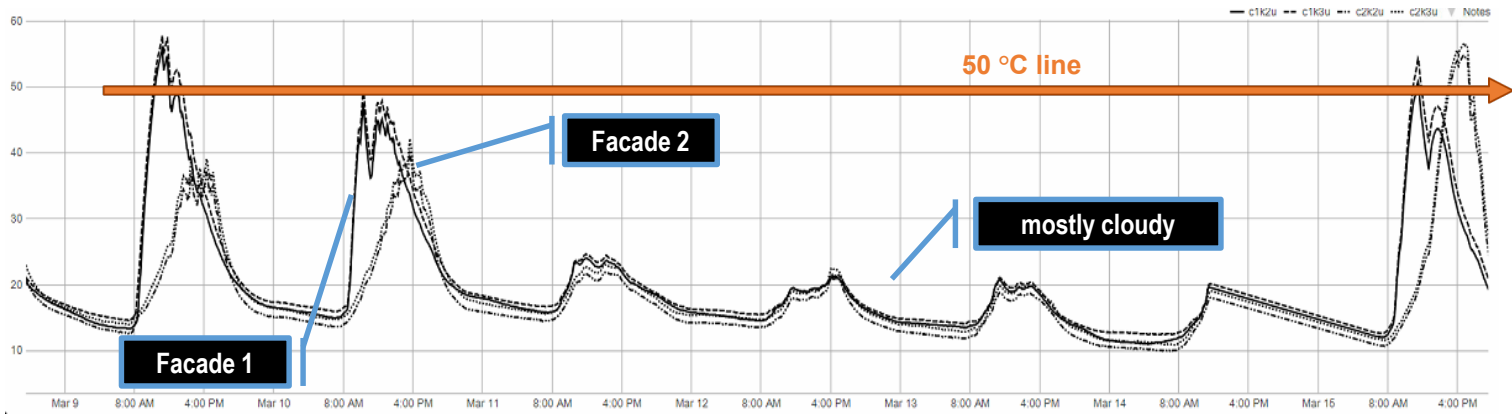


While the outside temperature in February 16-24 (2023) varies between -5 C and 10 C, the circulating air temperatures on the roof level are shown in the graph(facade1: southeast and facade2:southwest facades)

Summer?



Winter (MARCH 9-16)

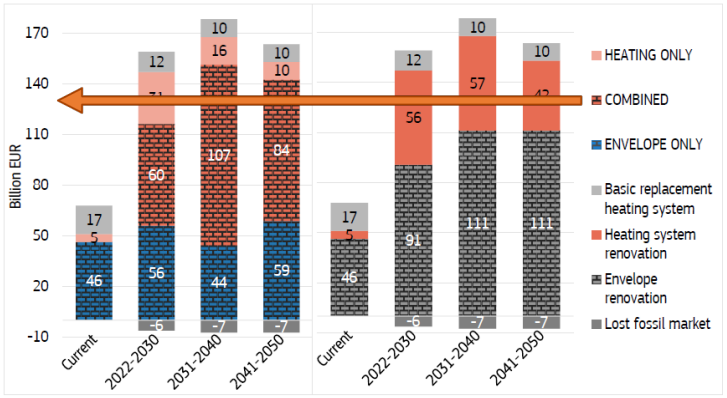


Throughout this week, no heating devices were operated. The exterior temperatures ranged from -1 to 16 °C while the interior temperatures remained between 17°C and 20°C

"SMART FACADE" has already proven itself to be a good thermal energy storage tool for SoFanTES.»

BUSINESS MODEL / *High Risk, High Potential*

Figure 45 Yearly cost of renovation in FOCUS scenario, right – splitting COMBINED renovation into components (markets)



Source: JRC.

MARKET SIZE

SoFanTES Market Size : **140 billion €**

SoFanTES targets (0,1%): **140 million €**

SoFanTES business model **is B2B.**

Entry into the market;
It will first begin with the **DESIGN business in** "Turkey" (Local Market) with strategic partners consisting of both construction companies and facade manufacturers.

Energy Consumption:

80%

CO2 Emission:

80%

Maintenance:

50%

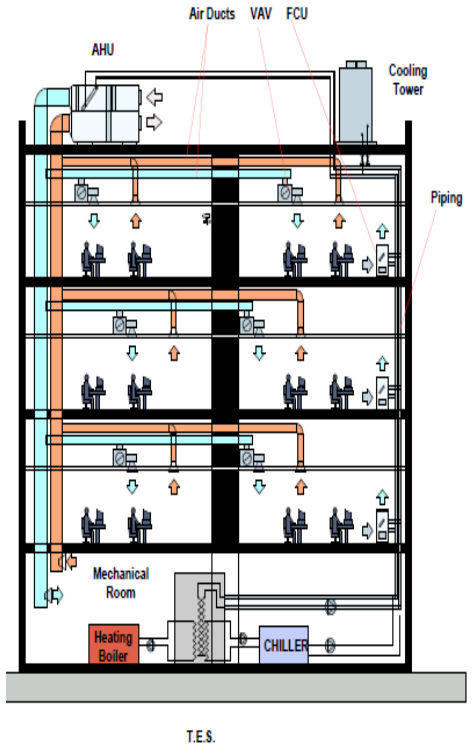
Investment Cost:

33%

Unique Selling Points:

High energy efficiency, cost efficiency, fast ROI, and environmental friendliness.

Conventional Energy Efficient Building



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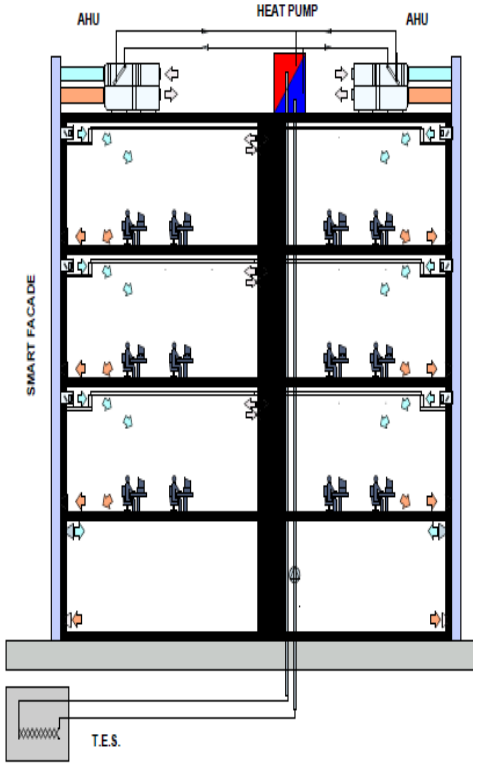

Façade Cost:	250 €/m2	275 €/m2
HVAC Cost:	150 €/m2	75 €/m2
TES Cost:	---------	40 -60€/m2
Energy Cost for 20 years:	200 €/m2	15 €/m2
Maintenance Cost for 20 years:	10 €/m2	5 €/m2
Carbon Footprint:	Higher	Lower
Construction Emissions:	Higher	Lower
Interior Infrastructure:	More	Less
Potential Height Gains:	Limited	Significant Rental Value
TOTAL COST:	**610 €/m2**	**410-430 €/m2**

SMART FACADE & SMART DISTRICTS (Future Development)

As a smart grid system, SF also offers a different solution to district heating/cooling needs. The operation of SF is as follows: Approximately 15-20 C for cooling and 25-30 C for heating. It works with water regime. Since these temperatures are very close to underground temperatures, both energy storage and insulation costs are very low compared to similar systems. The system does not require any central heating/cooling plant. Energy consumption and carbon footprint are extremely low. SF realises the heating/cooling process in two stages: In the 1st stage, the facade is heated or cooled with the air circulated along the facade. At this stage, a significant part (50-70%) of the building's heat energy requirement is met. Some of the circulating air is supplied to the interior and ventilation needs are also met. In the second stage, the rest of the thermal demand is met by the heat pump device. The waste heat of the heat pump is also used to supply the grid. The system not only transmits the waste heat of the "heat pump" to the grid; it can also charge the "cold line" in winter and the "hot line" in summer directly with the heat of the outside air. Thus, it stores the energy of the outside air in the easiest and cheapest way!