



United Technologies

DESIGNING INNOVATIVE SOLUTIONS

HVAC SOLUTIONS

# OPTIMAL COOLING OR OPTIMIZED SAVINGS?

THERMAL ENERGY STORAGE,  
BECAUSE YOU SHOULD NOT HAVE TO CHOOSE.

## Thermal Energy Storage Solution

# A sustainable approach to building

## OPTIMAL COOLING

The expertise to tailor-make your cooling solution

### ■ Turnkey solution

Carrier supports consulting engineers by customizing the hydraulic layout for each project: application, operating conditions and specific customer needs. When necessary, complementary technologies such as free cooling or energy recovery are integrated.

### ■ Proven Technology

Carrier has unique expertise in Phase Change Materials (PCM) based on over 30 years of Research & Development in partnership with universities and technical centers in Europe. This Thermal Energy Storage (TES) solution by latent heat allows TEWI\* benefits from 15% to 40%\*\*.

### ■ Unique expertise

Carrier engineers have unique and proven expertise, including in-depth knowledge of dual cooling and automation. The team collaborates closely with Sophia-Antipolis, Europe's largest technology park and is involved in several European research and innovation projects.

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## OPTIMIZED SAVINGS

Smart energy use for operational optimization

### ■ Reduced operating costs

By storing thermal energy during the night and releasing it during the day, the Thermal Energy Storage system consumes electricity at lowest prices and avoids peak times. By spreading thermal energy production over 24 hours, this solution can reduce chiller capacity by 30 to 70%\*\*\*.

### ■ Non-Stop support

Carrier expert engineers advise and support you daily. Thanks to regular monitoring and follow-up you can optimize the operation of your cooling installation. Carrier also offers additional services (training, on-site intervention, trending...) throughout the lifecycle of your TES.

### ■ Smart-grid ready

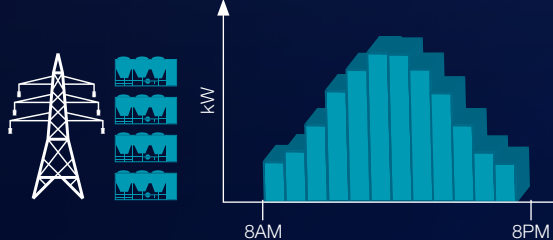
By shutting down electricity-hungry energy producers on demand and forcing the discharge of the system, the TES system regulates equipment to respond to peak electricity alerts on the power grid. This solution can also be combined with renewable energy (wind turbines, photovoltaics).

HISTOGRAM OF A BUILDING'S DAILY COOLING NEEDS  
AND ITS ELECTRICITY CONSUMPTION PROFILE

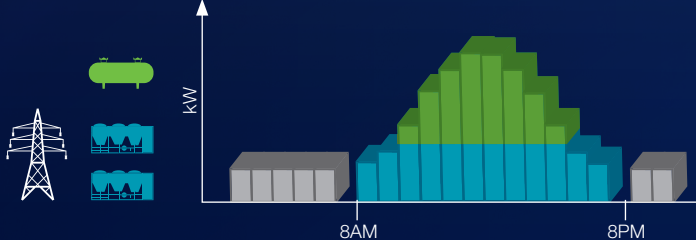
■ Discharge  
■ Direct production  
■ Charge

■ Tank  
■ Chiller

#### Without TES



#### With TES



Storage solution shifts your electricity consumption from peak to off peak hours

\*TEWI: Total Equivalent Warming Impact - \*\* / \*\*\*Source: Measured differences between equivalent systems designed with and without TES



# A cutting-edge HVAC solution

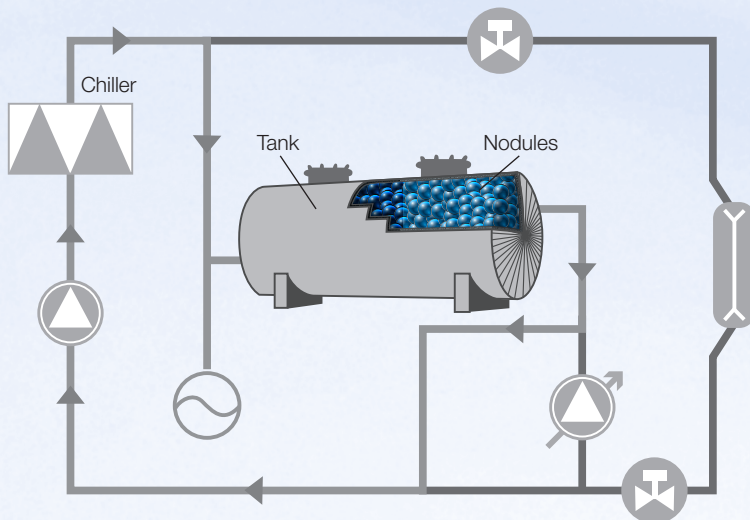
## For multiple applications

Carrier optimizes the design and the operation of your installation for all applications in both commercial and industrial buildings.



## Your Heating, Ventilating and Air-Conditioning system designed with storage

The TES system along with your chillers is composed of one or several tanks filled with spherical elements called nodules that contain the Phase Change Materials (PCM). The use of PCM in nodules provides very high energy density and power exchange.



- Nodules**
- Core TES Technology
  - Encapsulation of PCM
  - Reliability and competitiveness

**Unique global PCM expertise:**

- PCM (formulation, nucleation, characterization, durability, recyclability)
- Packaging and encapsulation of PCM
- Envelope materials (material compatibility, ageing)
- Industrial manufacturing processes

## Monitored and controlled system

The control and monitoring system optimizes the operation of the installation. It helps contractors and owners to optimize energy consumption, lower CO<sub>2</sub> and greenhouse gas emissions and reduce operating costs.

### Controls

- Operating modes automatic management
- Thermal equipment regulation
- Stored energy optimization

### Monitoring

- Local and remote monitoring
- Alarm notification
- Real-time view of operating parameters

### Auto-adaptative management module

- Daily optimization
- Predictive calculation of the daily cooling demand
- Permanent operating adaptation

# Worldwide player in Thermal Energy Storage

## Climate Control Systems Center of Excellence at Vence, France

Developing climate control systems for HVAC environment is the key activity at the Vence Center of Excellence. Our engineers focus on developing and offering technical support for smart services and on designing, engineering and implementing HVAC systems with storage solutions. Their know-how is unique and proven with dual cooling/heating and automation in-depth knowledge.

The Vence Center works closely with Europe's leading Science Park located in Sophia-Antipolis, southern France. The team is frequently involved in major European research and innovation projects.



### Smart services

- Monitoring
- Equipment control
- Plant and system management
- Climate control solutions compatible with Building Management System (BMS)



### Thermal Energy Storage

- Shift electricity consumption from peak to off-peak hours
- For peak cooling systems >500 kW
- Turnkey projects
- 100% Smart Grids compatible

+ 3 000  
CUSTOMERS  
WORLDWIDE

+ 65  
COUNTRIES

+ 500 MW  
ELECTRICITY  
SAVED

+ 6 000 000 kWh  
DAILY  
TRANSFER

Source: Estimates based on existing TES solutions at customer sites.



## Mangot Vulcin Hospital

Lamentin (Martinique), France



### CUSTOMER'S REQUIREMENT

Reduce electricity costs: hospitals have very high chilling requirements with continuous air conditioning throughout the year.  
Secure continuous electricity supply: insular environment creates critical electricity supply context especially at peak hours with high production and transmission costs.

### CARRIER'S SOLUTIONS

Nominal capacity of the cooling plant: 4 200 kW - Volume of TES: 206 m<sup>3</sup>.

Carrier installed a complete TES system with three 30GX-358 chillers (1 125 kW each) and four storage tanks filled with AC.00 modules. Control and monitoring system continuously optimizes the solution.



Electricity power reduced by 50% during peak hours demand.  
Chillers capacity reduced by 20%.

Secured cooling production for non-stop hospital activity.  
Return on investment < 3 years.