

«REFRIGERATION AS AN ENERGY SERVICE: A NEW, EFFICIENT AND SUSTAINABLE CONCEPT»

JOSÉ NIETO, INDUSTRIAL REFRIGERATION AREA MANAGER ENGIE SPAIN

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Refrigeration is necessary

Key applications



Human comfort applications (air conditioning): buildings, shopping and leisure centers, sports centers, hospitals or public meeting places.



Food industry: refrigeration is used in food processes, extends the shelf life of products, improves food safety and avoids waste. These industries include meat, dairy, fish, fruit and vegetables, ready meals and beverages.



Chemical and petrochemical industry: distillation or extraction processes, among others.



Pharmaceutical industry



Data processing centers: temperature assurance is key to the reliable operation of this equipment.

Basic types of installations

Distributed vs. Centralized HVAC Installation



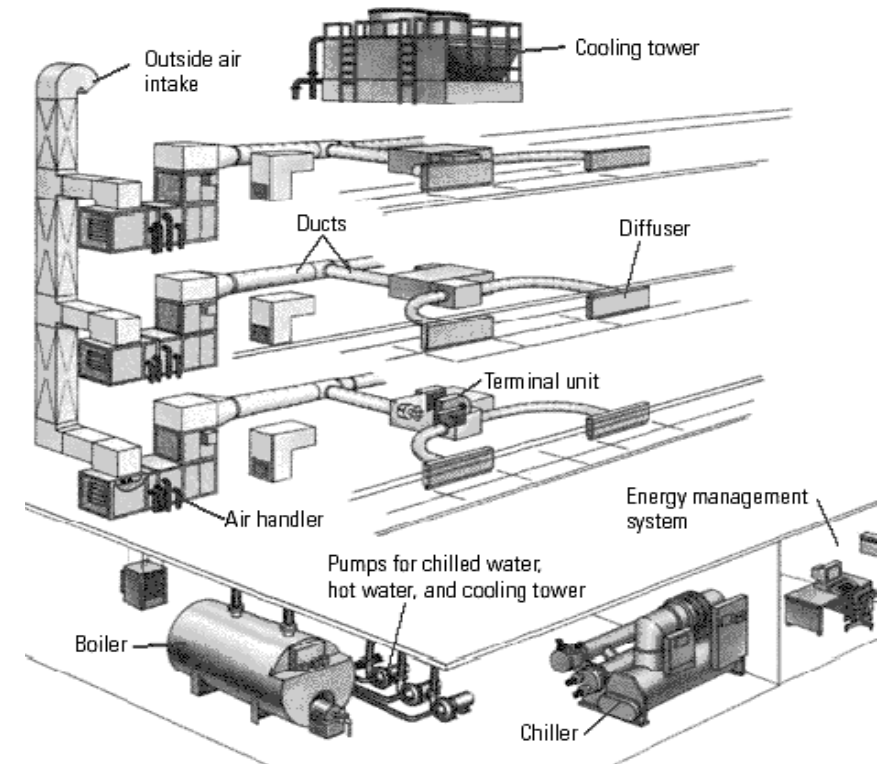
Distributed Installation

Every need has its own equipment



Centralized Installation

One system serves several needs



Basic types of installations

Distributed vs. Centralized Installation Refrigeration



Distributed Installation

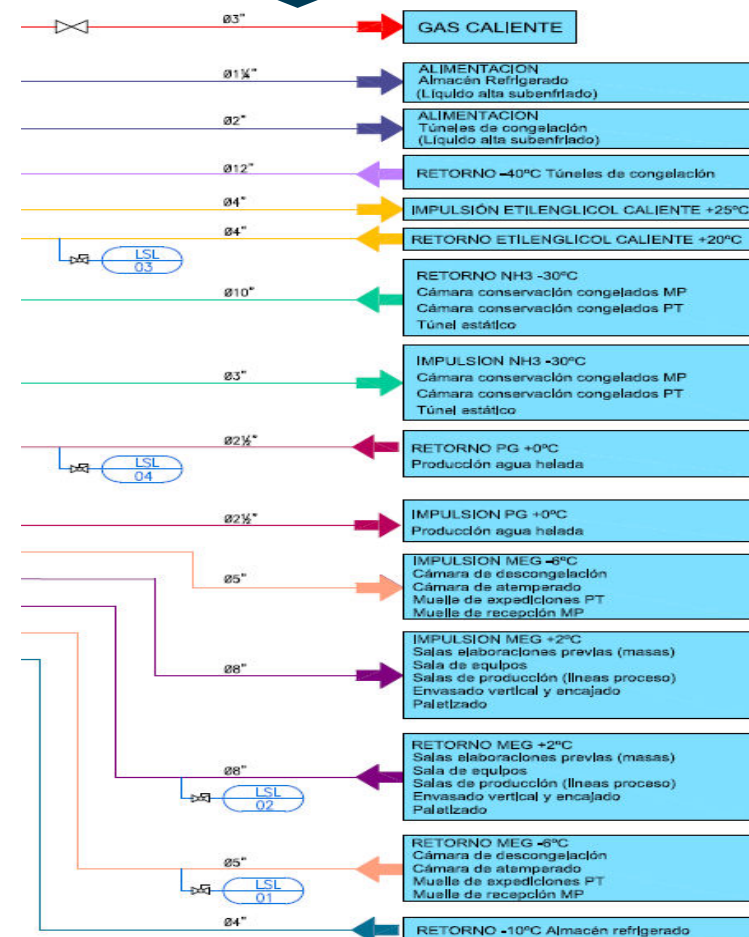
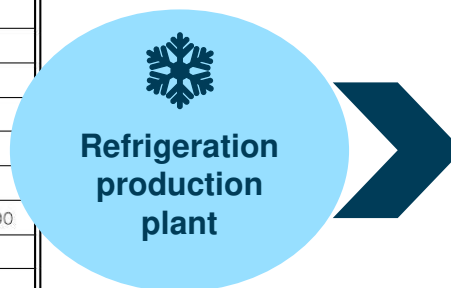
Every need has its own equipment

N° SALA	NOMBRE SALA	EQUIPO	COMPRESOR	EVAPORADOR
1	MADURACIÓN 1	CF1	BITZER 4x(6G402Y-40P)	CÚBICO + MANGA FRB 1600
2	MADURACIÓN 2	CF1	BITZER 4x(6G402Y-40P)	CÚBICO + MANGA FRB 1600
3	MADURACIÓN 3	CF1	BITZER 4x(6G402Y-40P)	CÚBICO + MANGA FRB 1050
4	CÁMARA MADURACIÓN 4	CF1	BITZER 4x(6G402Y-40P)	CÚBICO + MANGA FRB 1450
5	CÁMARA MADURACIÓN 5	CF1	BITZER 4x(6G402Y-40P)	CÚBICO + MANGA FRB 1450
6	CÁMARA EXPEDICIÓN	CF1	BITZER 4x(6G402Y-40P)	PLAFÓN + MANGA PIM 1900
7	CÁMARA SECADO	CF1	BITZER 4x(6G402Y-40P)	CÚBICO FRM 1780
8	TÚNEL 2	C4	BITZER 6GE34Y-40P	CÚBICO GRL 2600
9	CÁMARA CONGELADOS	C2	ZANOTTI BUC041A115AB025SJ	CÚBICO GRL 1600
9	CÁMARA CONGELADOS	C3	ZANOTTI BUC041A115AB025SJ	CÚBICO GRL 1600
10	SALA CONFORMADO	CF1	BITZER 4x(6G402Y-40P)	CÚBICO GRL 2600
11	TÚNEL 1	C1	BITZER HSN 8591-160-40P	CÚBICO GRX 7250
12	MOLDEO	CF1	BITZER 4x(6G402Y-40P)	CÚBICO + MANGA FRB 1600
13	SALA DE FILTROS	CF1	BITZER 4x(6G402Y-40P)	CÚBICO GRM 4600
14	ENVASADO	CF1	BITZER 4x(6G402Y-40P)	PLAFÓN PIM 2400
15	SOBRE-ENVASADO	CF1	BITZER 4x(6G402Y-40P)	CÚBICO + MANGA FRB 1450
16	MUELLE DE EXPEDICIÓN	CF1	BITZER 4x(6G402Y-40P)	PLAFÓN PIAN 160
17	REP	CF1	BITZER 4x(6G402Y-40P)	PLAFÓN PIM 3100
18	SALA CONFORMADO	CF1	BITZER 4x(6G402Y-40P)	PLAFÓN PIM 2850
19	SALA MÁQUINAS 1	C6	DORIN K-3500CC-00	EQ. BALSA
19	SALA MÁQUINAS 1	C7	DORIN K-3500CC-00	EQ. BALSA
20	ENTREPLANTA SALA BT	C8	ZANOTTI 2x 6F-502Y-40P	CENTRAL FRIG. BALSA 2
21	CUBIERTA	UTA 1-3	HITECSA/ALFA LAVAL	ENFRIADORAS



Centralized Installation

One system serves several needs



Basic types of installations

Distributed Installation



Each need is met locally with a specific small or medium-sized system



Advantages

- **Lower initial cost** (at least apparently)
- **Allows** to grow and **adapt to new demands**
- **Simpler installations** if considered individually



Inconveniences

- **Reduced capacity**, only valid in medium or small power plants.
- **Need to install more aggregate capacity** due to not being able to take advantage of demand simultaneities.
- The cooling equipment is **located in the production areas**.
- **Lower reliability**, since in case of failure a system will not be serviced
- **Higher maintenance costs** due to the higher number of equipment.
- **Difficulty in controlling and monitoring** independent equipment
- **Lower energy efficiency** due to the use of less advanced technologies.
- **It is not easy to measure energy consumption** and yields.
- **Difficult to use technologies with certain risks** (toxic refrigerants).

Basic types of installations

Centralized Installation



A shared central system produces cold that is distributed by means of a piping network to services

✓ Advantages

- Possibility to install large **equipment with important capacities**
- **Increased reliability** by having more robust industrial-size equipment
- **Intrinsic redundancy** in case of component failure
- It is possible to **measure consumption and performance**
- Design **adaptable to new demands**
- **Lower overall installed power** by taking advantage of demand simultaneousities.
- **Reduces the overall risk** of the refrigeration plant which can be installed away from the production area.
- **Ease of control and monitoring** with a supervisory system (**Scada**)
- **Low maintenance costs** vs. cooling capacity
- **Ease of maintenance** with more energy efficient equipment
- Ability to **outsource operation and maintenance**

✗ Inconveniences


- May require **higher initial investment** if industry starts with low production

Refrigerant Types

HFCs, HFOs, HCs, natural or synthetic



Historical evolution of refrigerant requirements:

	1880 – 1930	1930 – 1990	1990 – 2010	Since 2010	PRESENT
Fluid capable to work	✓	✓	✓	✓	<ul style="list-style-type: none"> • Refrigerants are chosen without limitations for the coming years. • Facilities with large HFC charge will not be designed • The refrigerant charge is minimized in the installation, for safety or price. • The centralized installation facilitates the use of natural refrigerants such as NH3 or glycol for the transport of cold.
Safe		✓	✓	✓	
Efficient			✓	✓	
Do not damage the ozone layer			✓	✓	
Without greenhouse effect				✓	
Refrigerants  <ul style="list-style-type: none"> • NH3 • CO2 • Methyl chloride • Sulfur dioxide 		<ul style="list-style-type: none"> • CFC • HCFC (R12, R11, R502) 	<ul style="list-style-type: none"> • HFC (R134a y R404a) 	<ul style="list-style-type: none"> • Allow the use of "unsafe" refrigerants: hydrocarbons or hydrofluoroolefins-HFO. • Interest in NH3 and CO2. • Safer installations (less refrigerant charge, more sealing and secondary refrigerants). 	

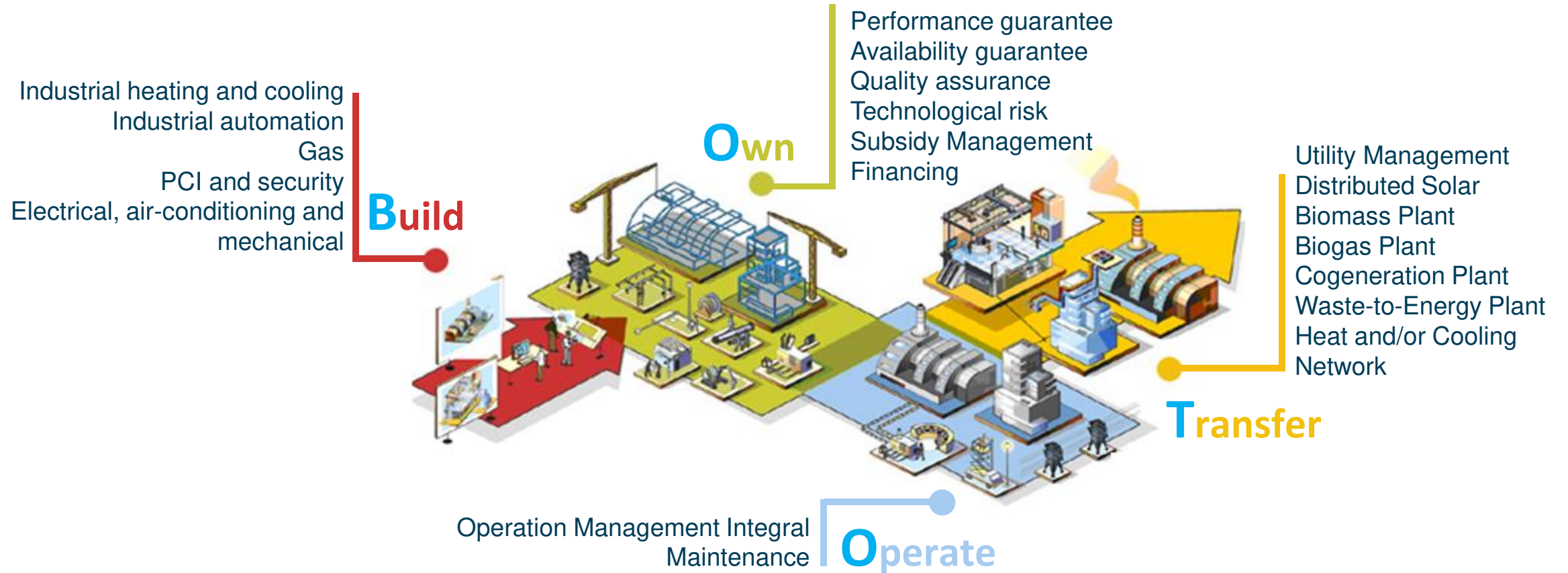
"Conventional solution"

The user invests and operates the plant



“The new model” – BOOT ENGINE

The user pays for the cooling service, and ENGIE invests in, operates and maintains



ENGIE also has the capacity to design the plant according to the user's needs.

“The new model” – BOOT ENGINE

The user pays for the cooling service, and ENGIE invests in, operates and maintains

BOOT MODEL



Accompaniment as an **energy partner** of our customers



Integrated management, guaranteeing quality and efficient supply

BUILD

ENGIE carries out the **investment, design, construction and commissioning** of the facility up to the operation phase.

ENGIE's design process follows the following guidelines: **safety, flexibility, robustness, energy efficiency and sustainability.**

OWN

ENGIE es **propietario total o parcial**, en función de la inversión en los activos construidos que el cliente quiera hacer duración del Contrato.

During this period, **ENGIE** is **responsible for the operation, maintenance and renovation of the facility** to ensure the supply of utilities.

OPERATE

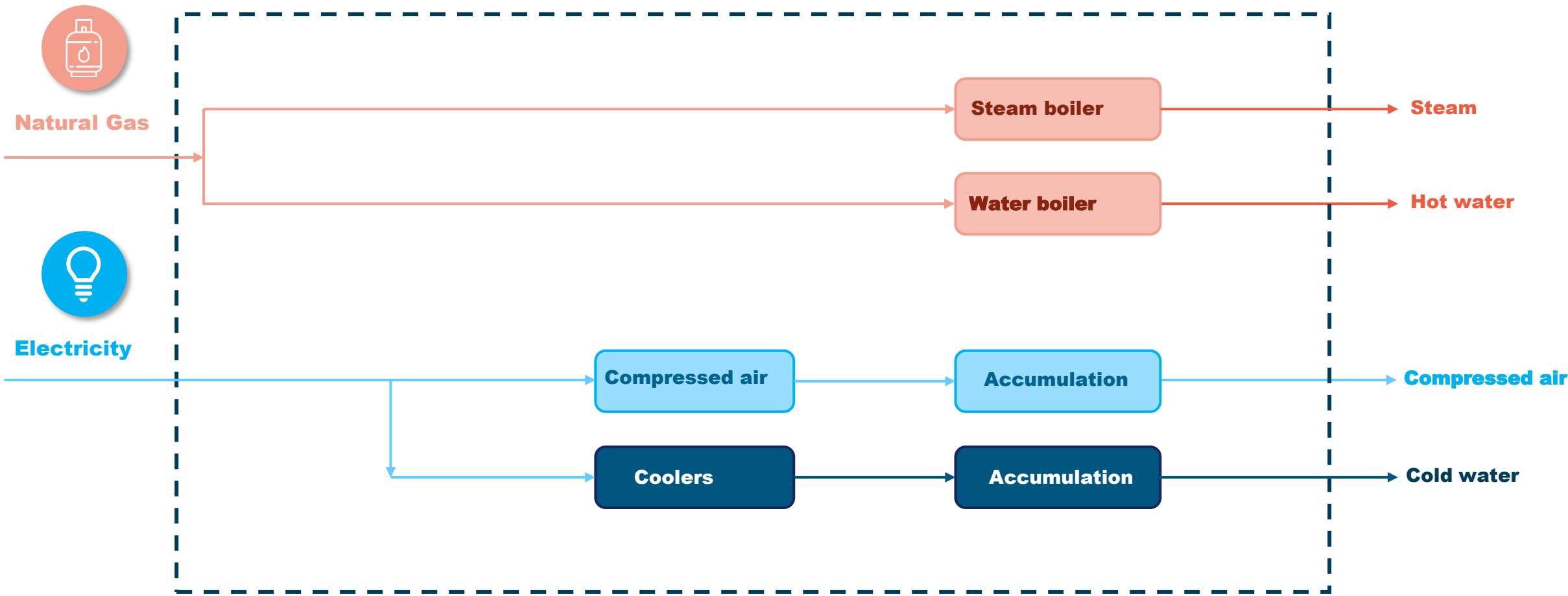
ENGIE includes in its services a **General Maintenance, Conservation and Spare Parts Plan.**

It enables the achievement of objectives such as continuity, quality of supply, personal safety and energy efficiency.

TRANSFER

Upon expiration of the contract, **ENGIE transfers the assets to the customer** in good operational condition at **zero cost.**

Energy flow and billing – BOOT ENGIE



“The new model”

Benefits for users (I)



CAPEX reduction. The user has more financial resources to devote to its core business, since the refrigeration equipment does not enter the company's balance sheet as assets.

Saving. Reduction of the energy bill and lower energy costs compared to conventional systems.

Absence of noise and vibration in the production areas.

Elimination of replacement costs of machinery.

Reduction of maintenance costs and elimination of breakdowns.

Decrease in conventional energy supply costs by being able to contract lower powers.

Elimination of risks such as legionella or refrigerant leaks, thanks to the absence of refrigeration production equipment in the production areas of the industry.

“The new model”

Benefits for users (II)



Guarantee of energy supply. The refrigeration plant has redundancies, both in terms of refrigeration production and pumping equipment.

Flexibility and adaptability. Facility to have more power available by expanding the plant's equipment. The available cooling capacity can be applied to the service that demands it at any time.

ENGIE undertakes to provide refrigeration production services and assumes the associated risks such as regulatory or service quality commitments.

Perfectly foreseeable costs associated with cold and production-related (variable).

Installation operated and maintained by specialists. The user does not need to dedicate highly trained resources to plant management, and can focus them on improving his own production process.

Case Presentation

SCHREIBER FOODS in Talavera de la Reina



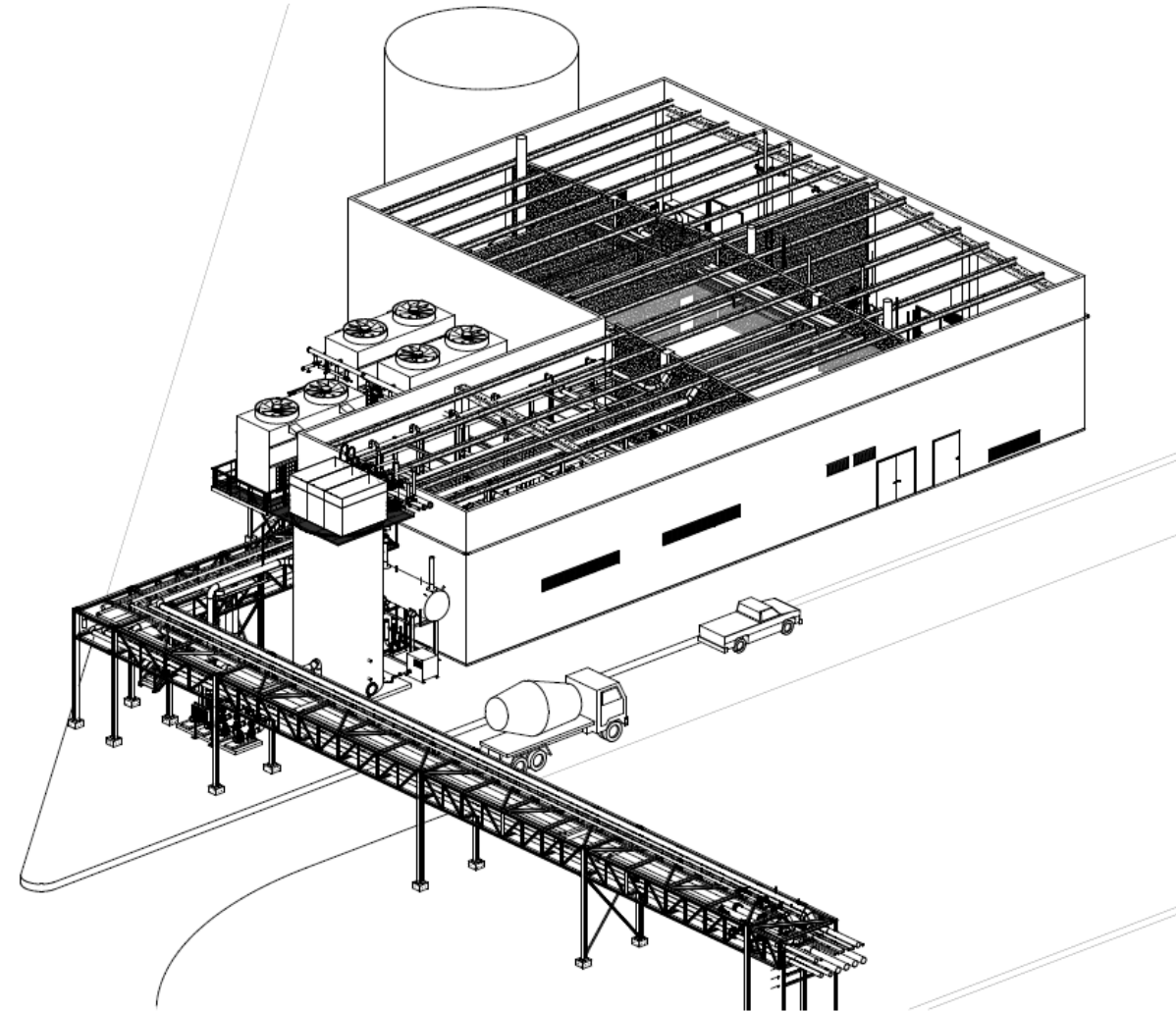
SPECIFICATIONS

Refrigeration requirements by
temperature of use

PLANT DESIGN



ENGIE ENGINEERING
AND DESIGN
DEPARTMENT



Case Presentation

SCHREIBER FOODS in Talavera de la Reina



Construction - Civil works



Case Presentation

SCHREIBER FOODS in Talavera de la Reina



Construction - Facilities



Case Presentation

SCHREIBER FOODS in Talavera de la Reina



Construction - Final stage



Case Presentation

SCHREIBER FOODS in Talavera de la Reina



Plant in service



Description of the Industrial Refrigeration Plant

Cold generation at different temperatures

- ✓ COP is optimized by adapting the cooling production to actual demand

7 NH₃ compressors

- ✓ 3 x 1000 kW GLICOLATED water at -9°C
- ✓ 3 x 1300 kW ICE WATER at 1°C (with possibility of ice generation for accumulation)
- ✓ 1 x 700 kW AIR CONDITIONED Water at 6°C
- ✓ 4 x 2000 kW Evaporative Condensers



SCADA

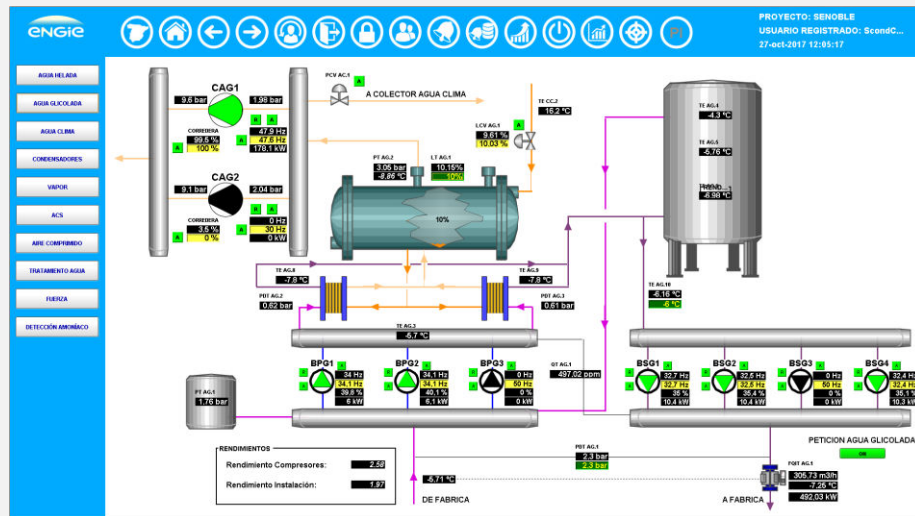
Automated plant control



Fully customized SCADA control that can be adapted to future expansions

24h/365 days a year production with 3 maintenance technicians means **reduced manpower cost**

Easy data collection to **optimize plant performance**



THANK YOU



Do you have any questions?

jose.nietofuentes@engie.com