



Experience in Implementing and installing co-generation and energy-saving schemes

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☐ Elettra and Fermi Lightsources

☐ Trigeneration Systems

☐ Absorption Chillers

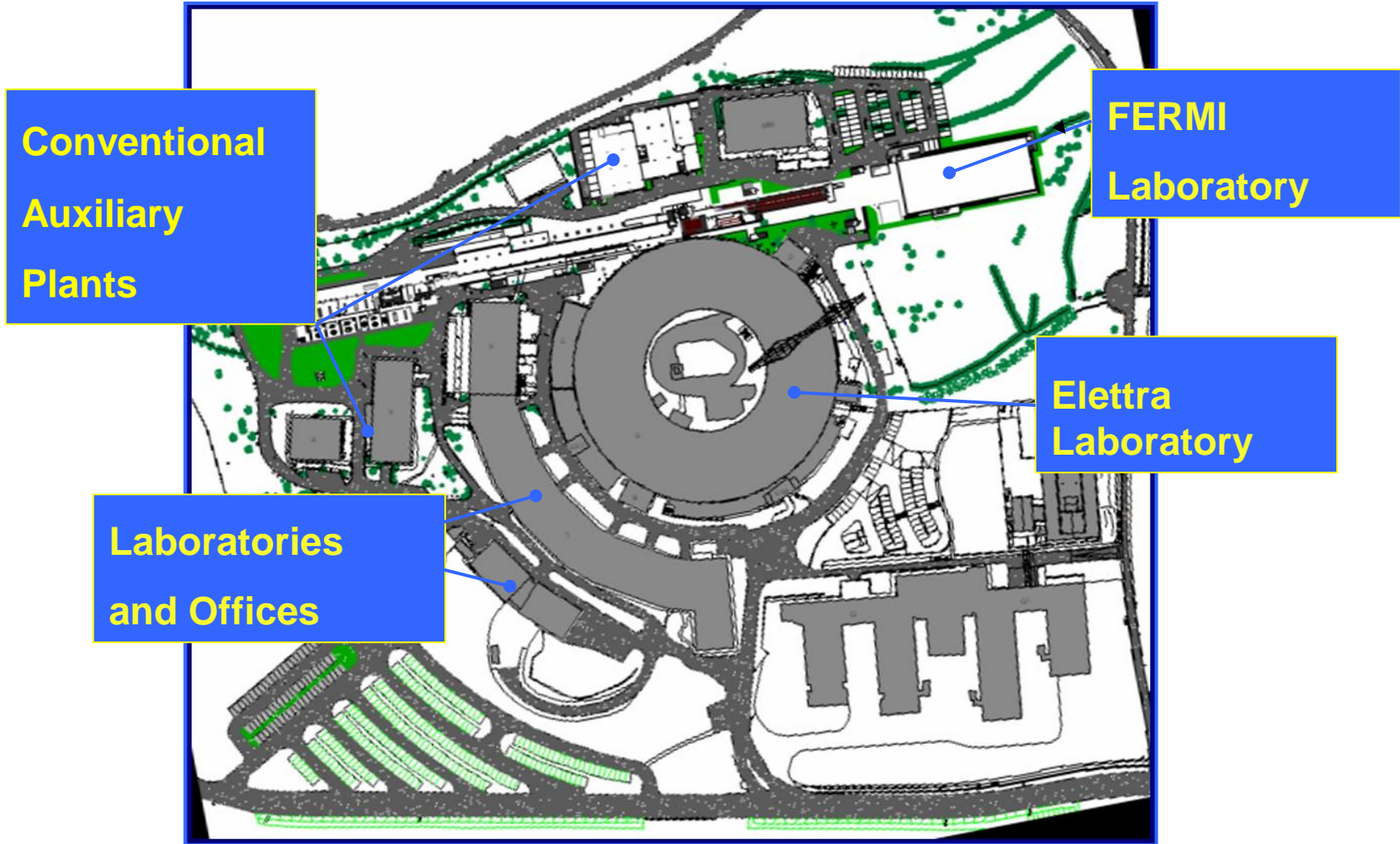
☐ Energy Supply

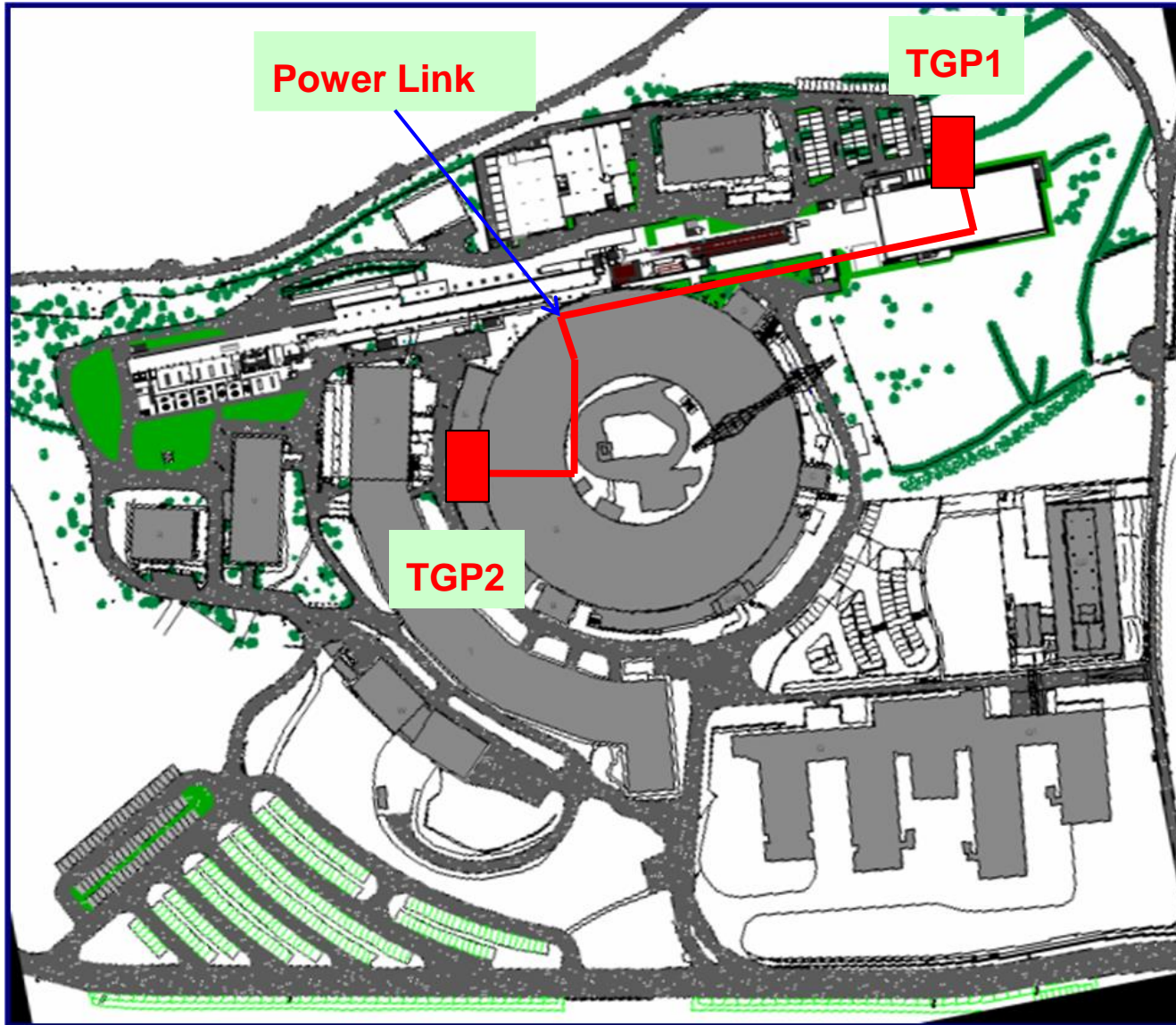
☐ Conclusion





GENERAL LAY - OUT





TGP1

 *Fermi* Trigeration system

TGP2

 *Elettra* Trigeration System

Power Link

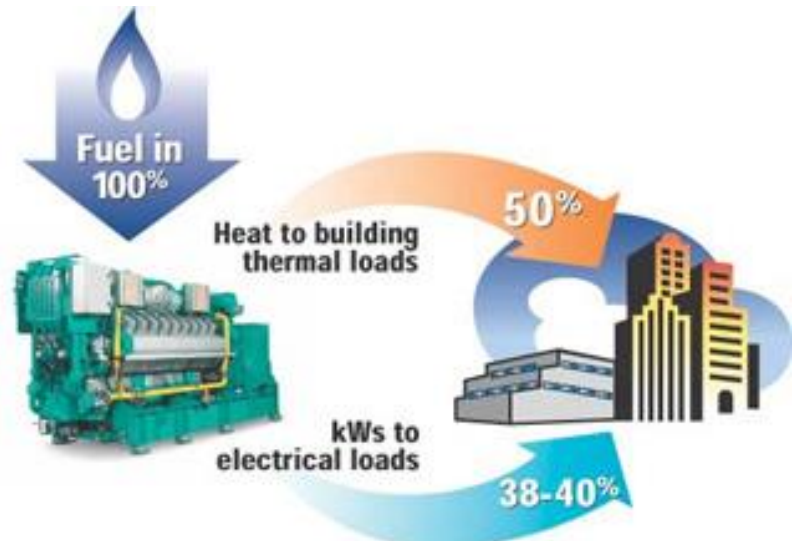
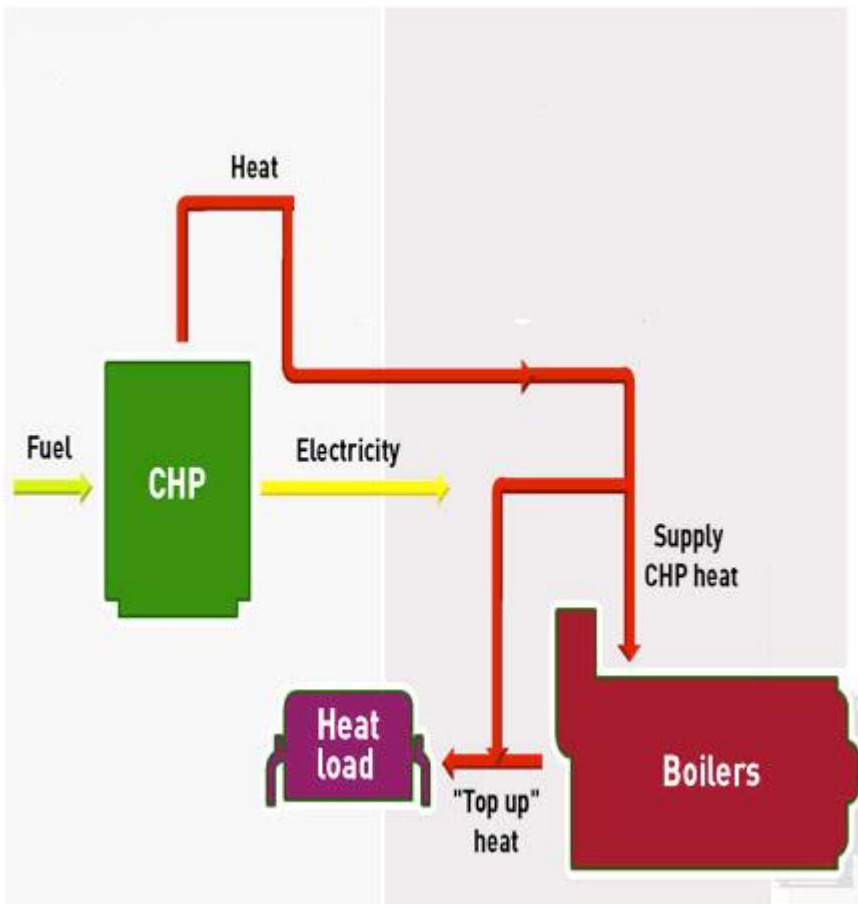
 Between Elettra and Fermi

 Electric line

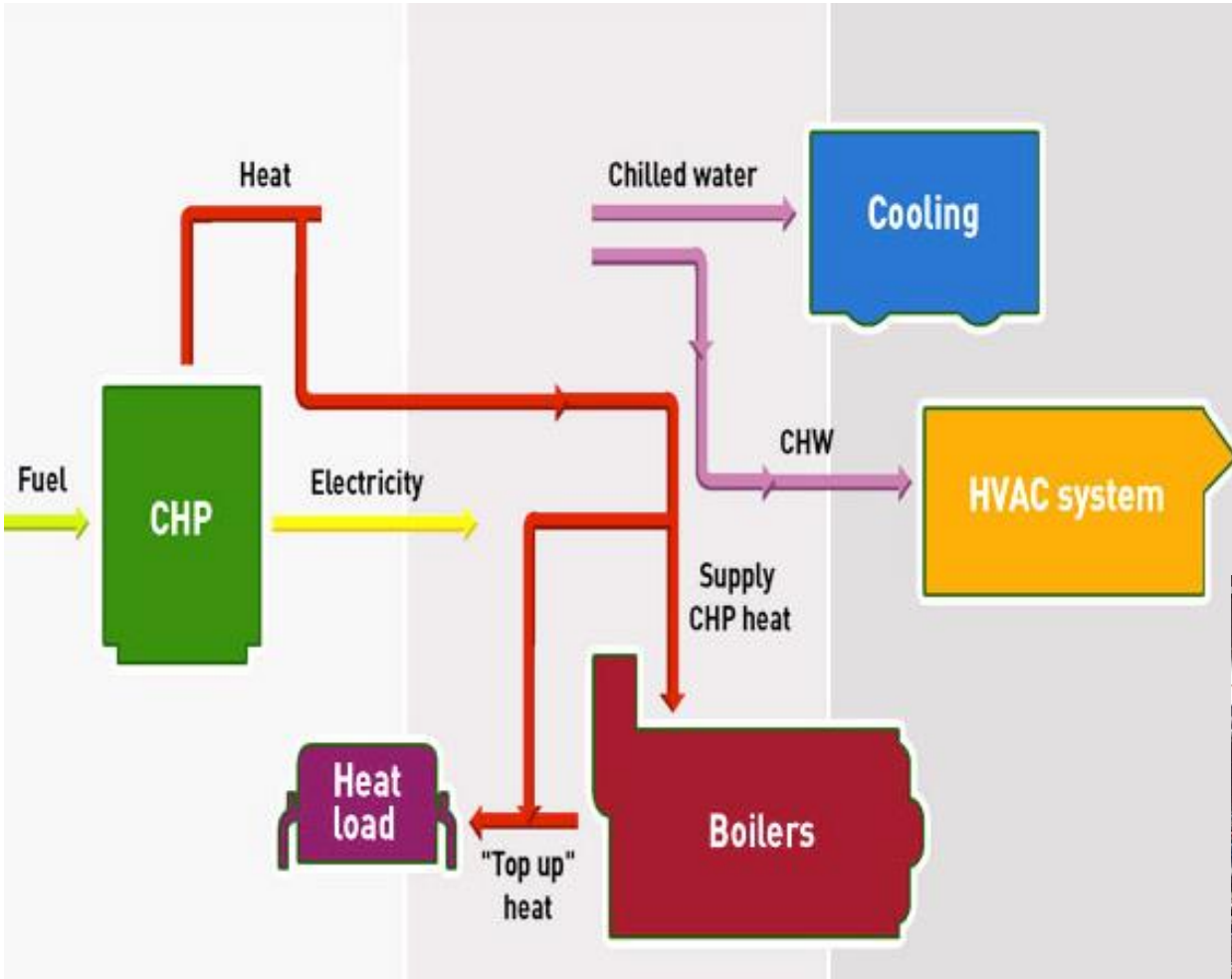
 Thermal line

Trigeneration is an evolution of Cogeneration Systems

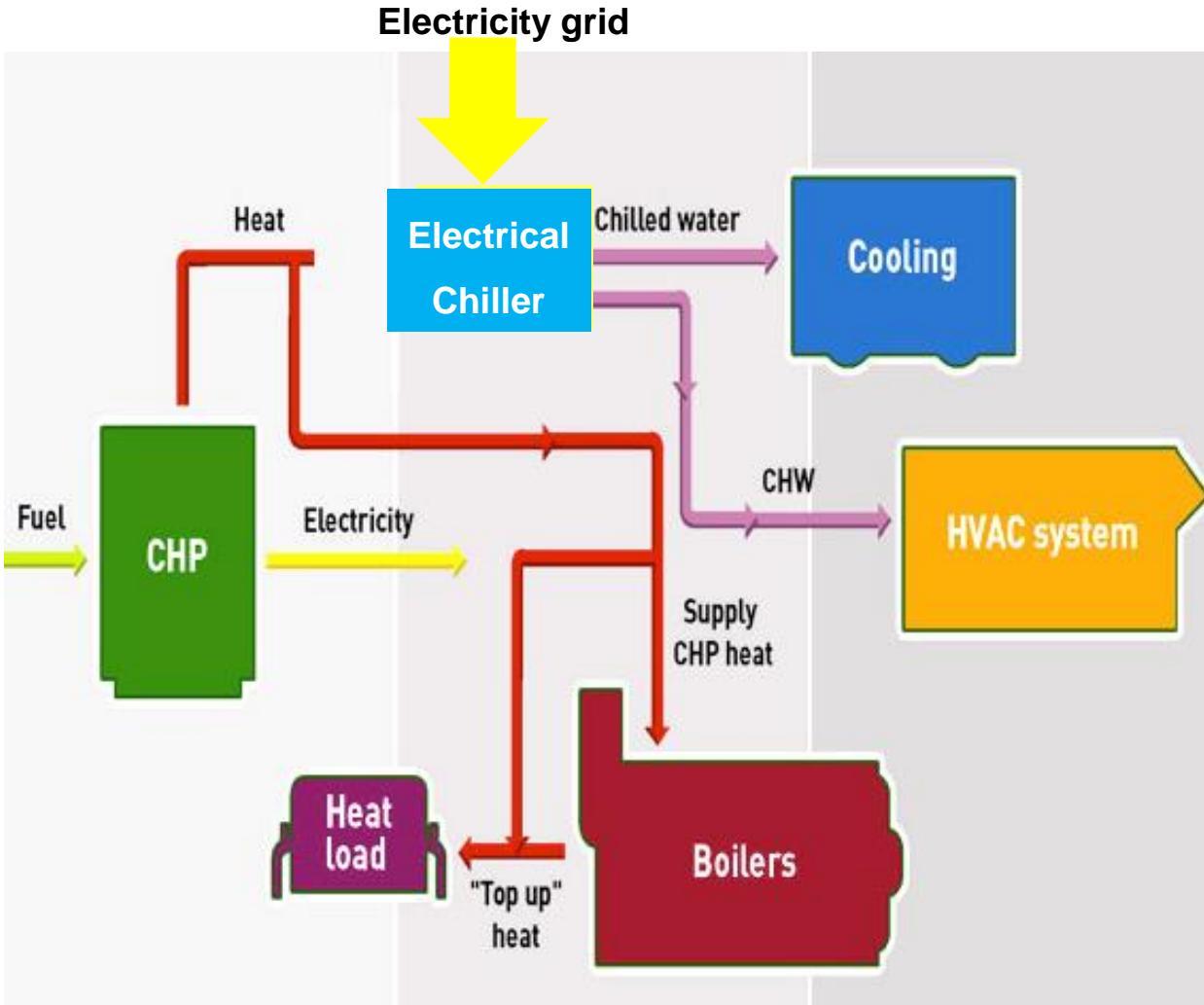
Cogeneration or **Combined Heat and Power (CHP)** is the use of a heat engine or power station to simultaneously generate electricity and useful heat.



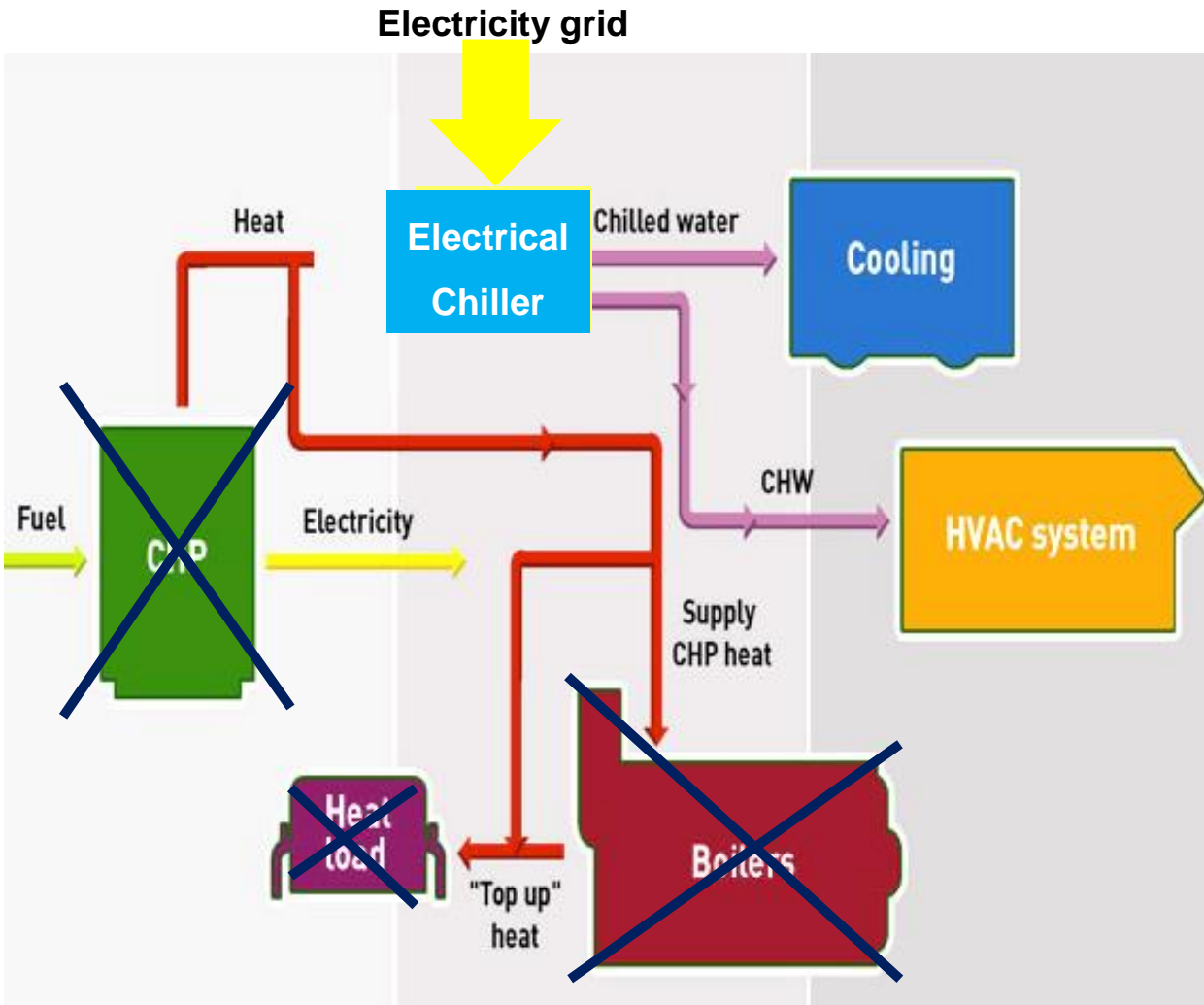
🖥️ Cooling load of the Electra or Fermi magnets



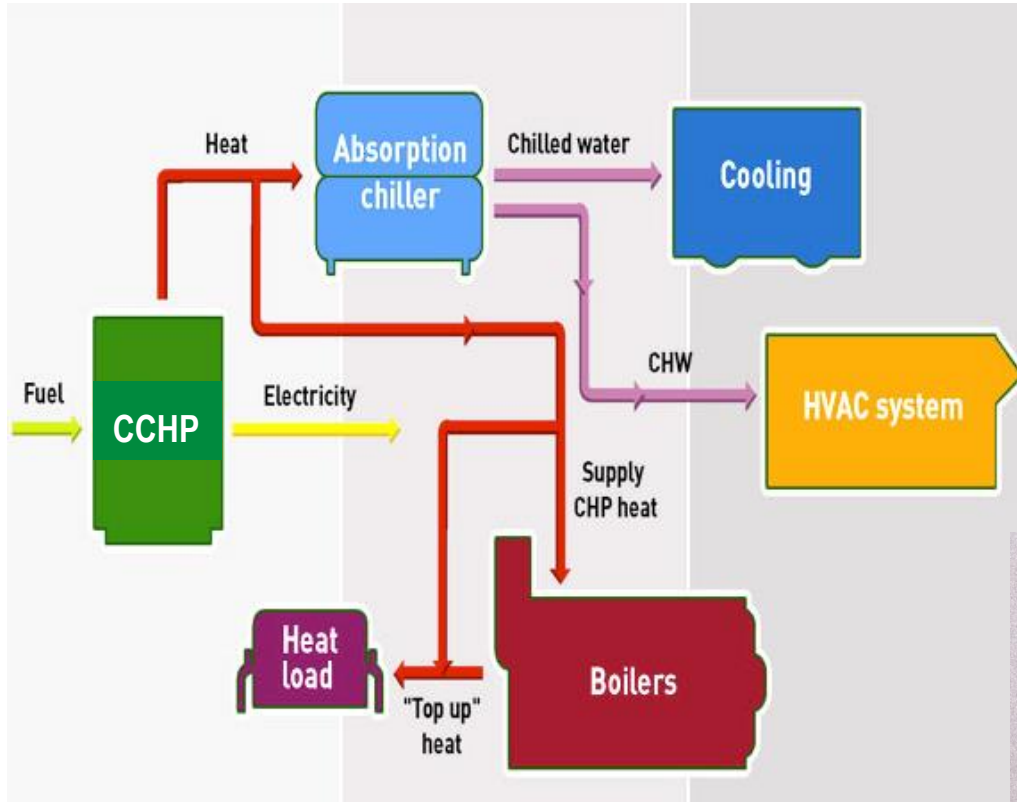
🖥️ Cooling load of the Electra or Fermi laboratory HVAC system



Winter Season



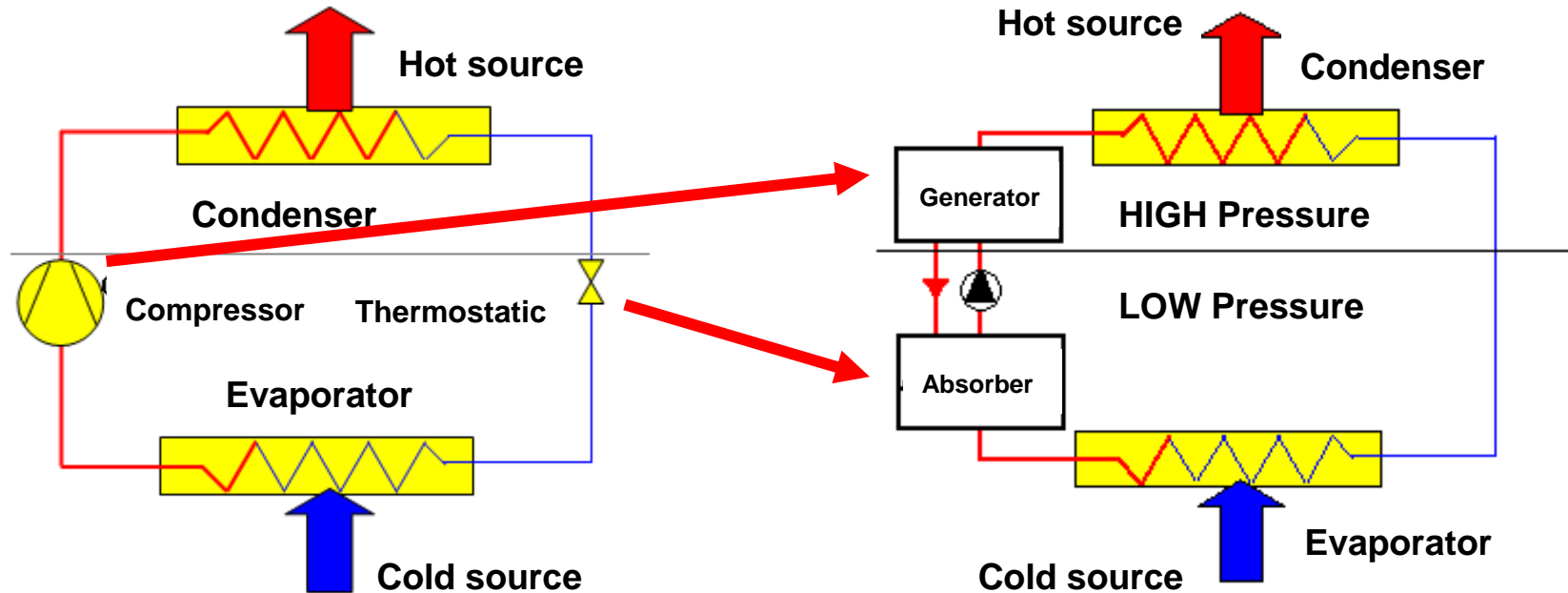
Summer and Middle Season



Trigeneration or **Combined Cooling, Heat and Power (CCHP)** refers to the simultaneous generation of *electricity* and *useful heating and cooling* from the combustion of a fuel or a solar heat collector.



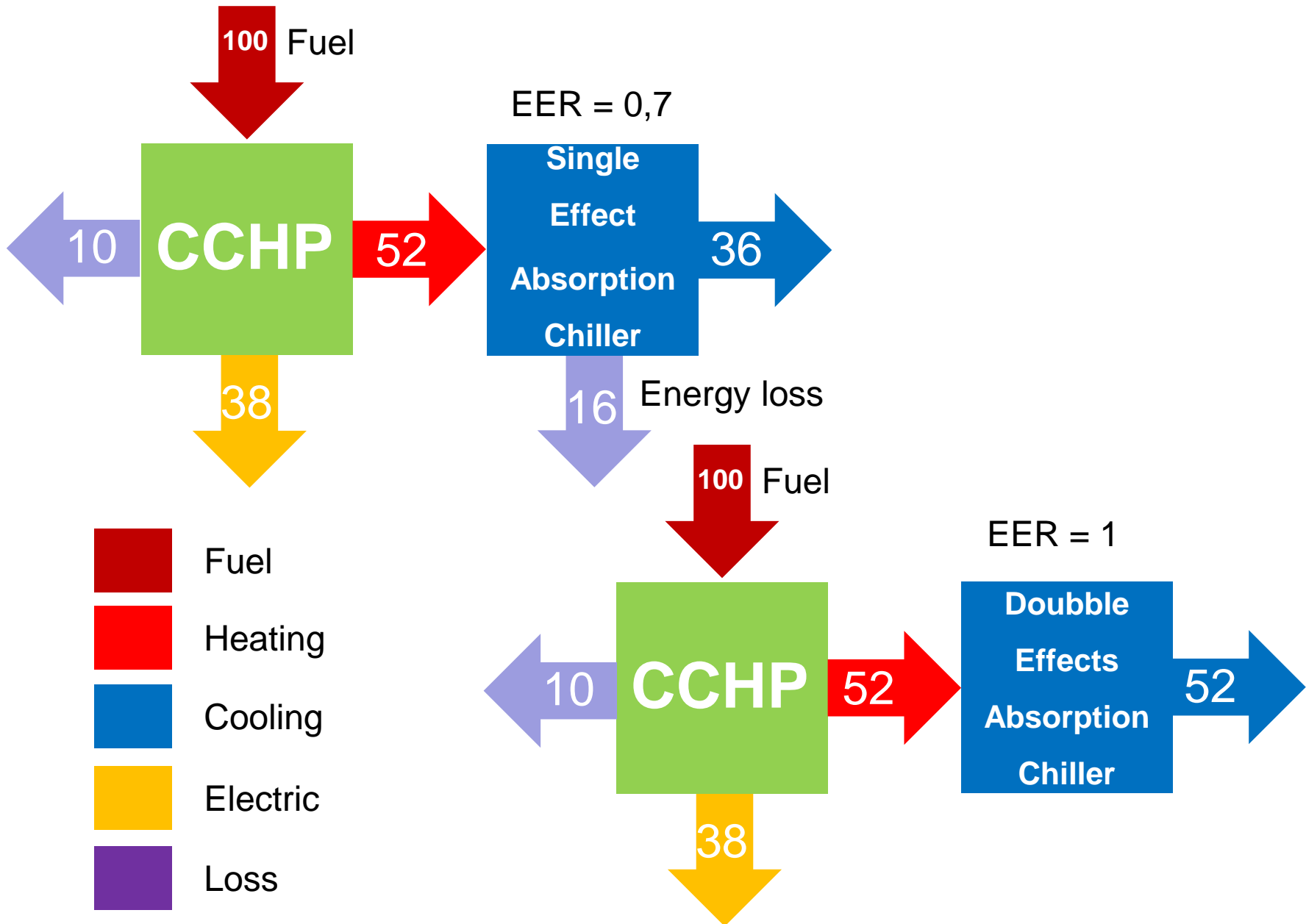
What changes in absorption chiller than vapour compression chiller...

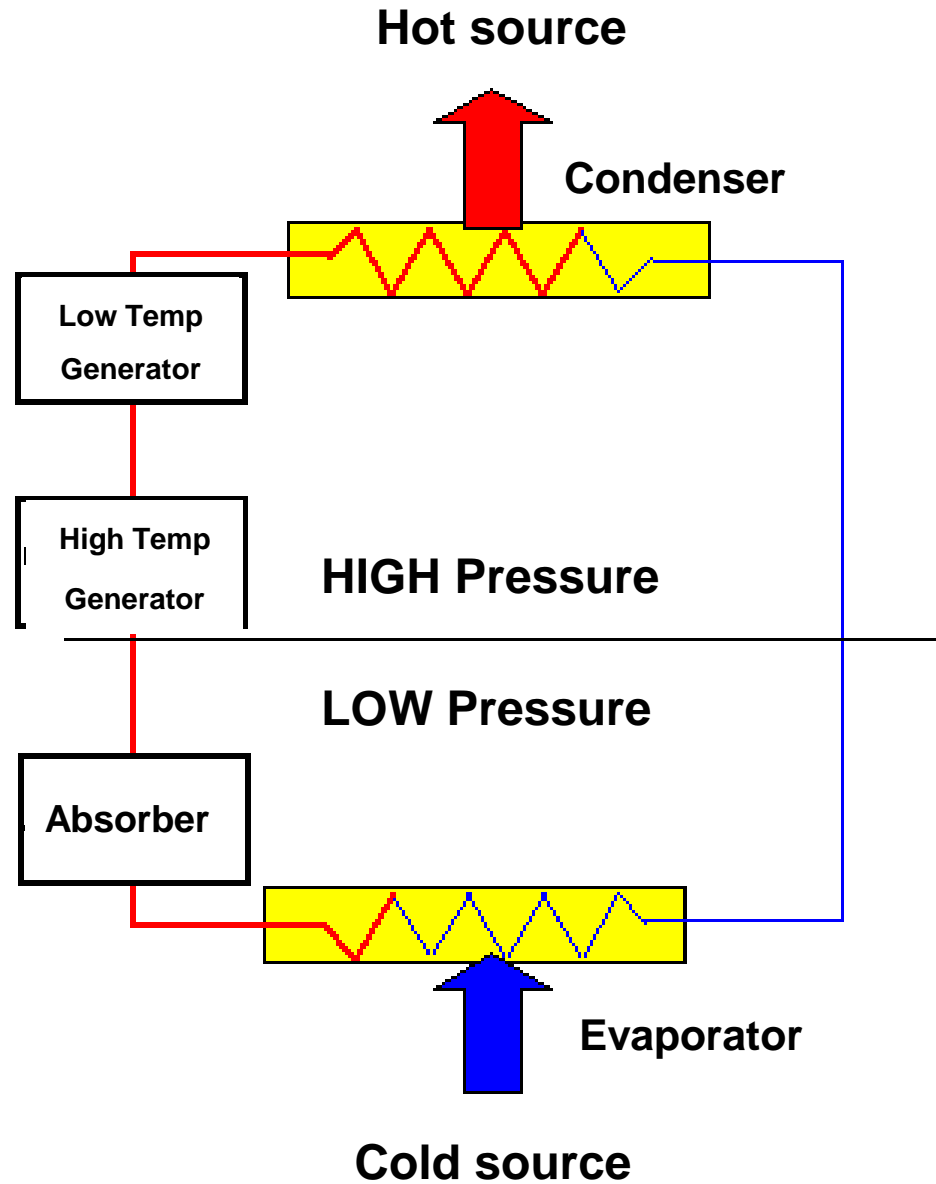


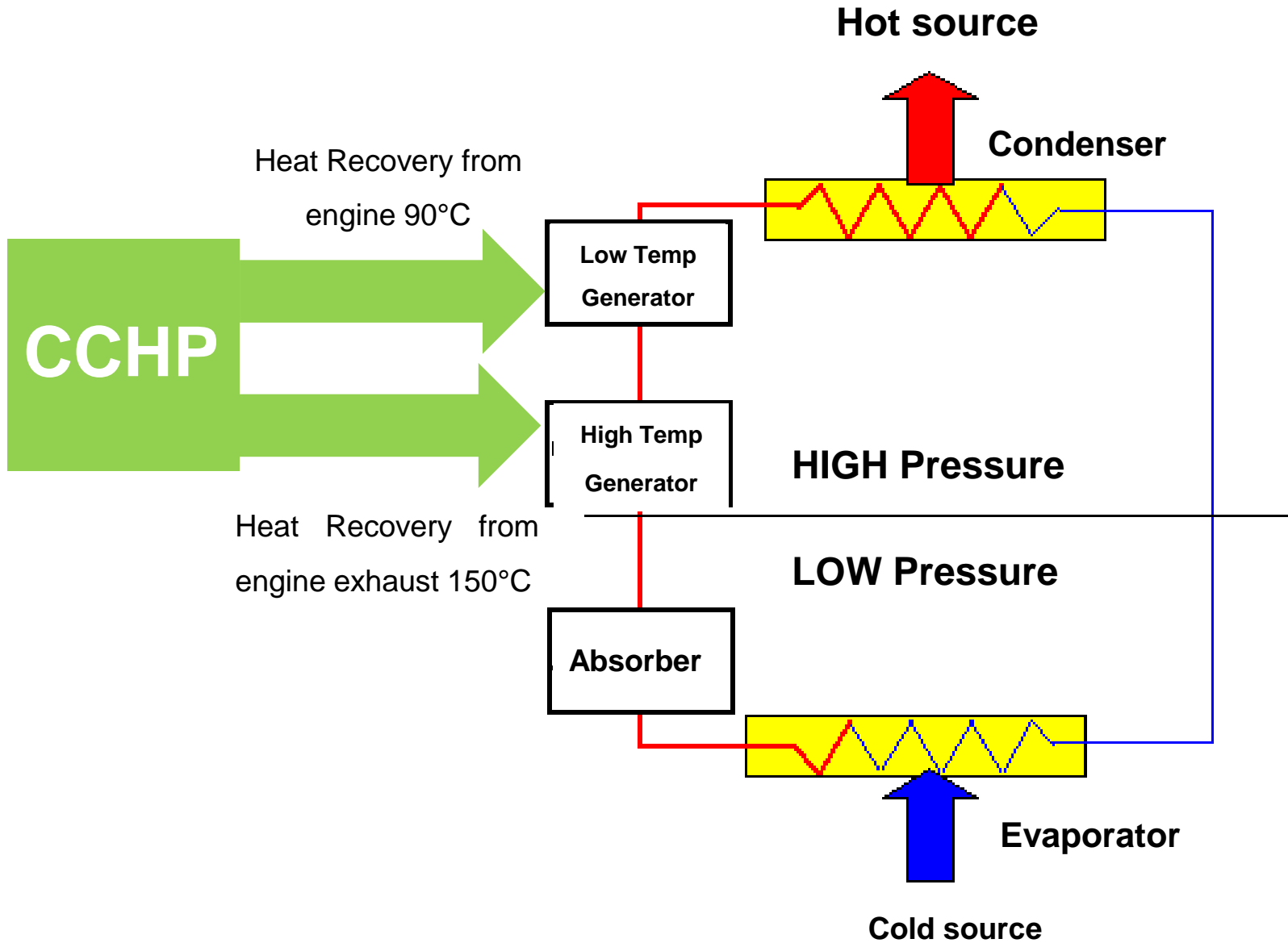
A **Vapour Compression Chiller** is a machine that removes heat from a liquid via a vapor-compression refrigeration cycle. This liquid can then be circulated through a heat exchanger to cool air or equipment as required.

The **absorption cycle** uses a heat-driven concentration difference to move refrigerant vapors (usually water) from the evaporator to the condenser. The high concentration side of the cycle absorbs refrigerant vapors (which, of course, dilutes that material). Heat is then used to drive off these refrigerant vapors thereby increasing the concentration again. Lithium bromide is the most common absorbent used in commercial cooling equipment, with water used as the refrigerant.

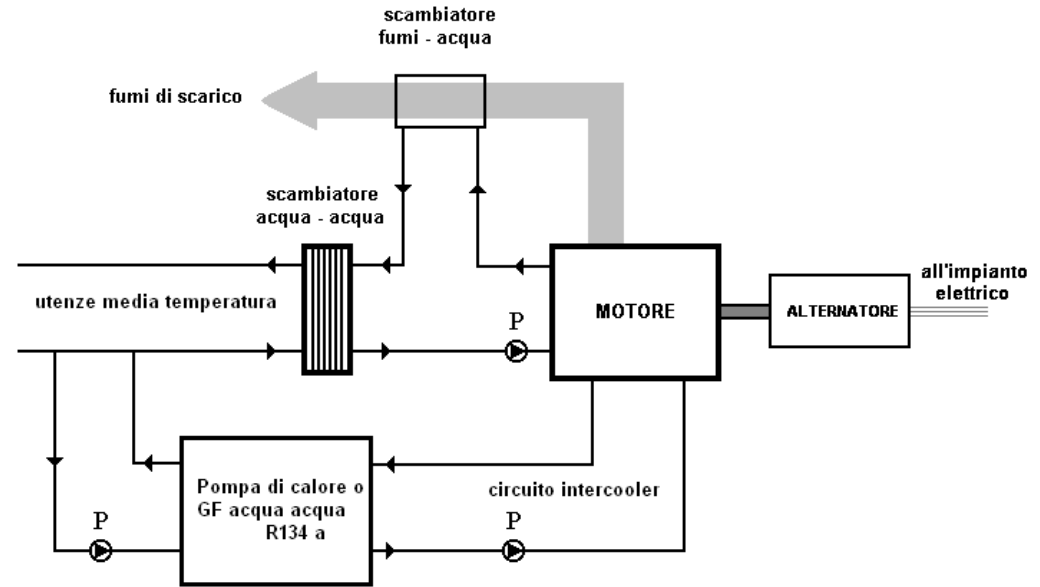
ABSORPTION ENERGY BALANCE



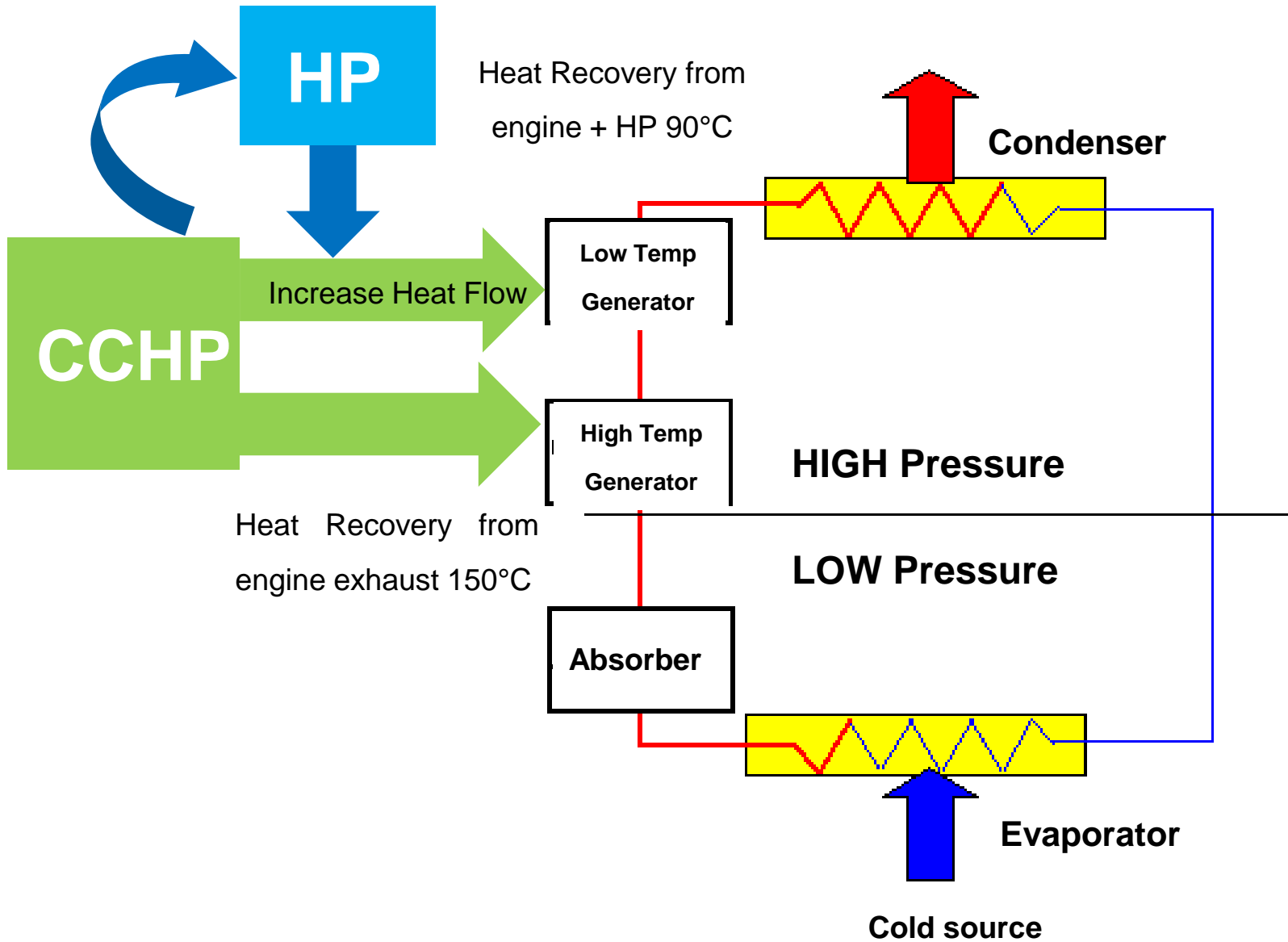




To increase the Heat recovery of CCHP, can I use a Heat Pump for cooling the cabinet and the intercoller of CCHP, and increase their heat level (45° to 90°)



A **Heat Pump (HP)** is a device that transfers heat energy from a heat source to a heat sink against a temperature gradient. Heat pumps are designed to move thermal energy opposite to the direction of spontaneous heat flow



2 * 3 Engines

Single Electric Pw: 580 kW_e

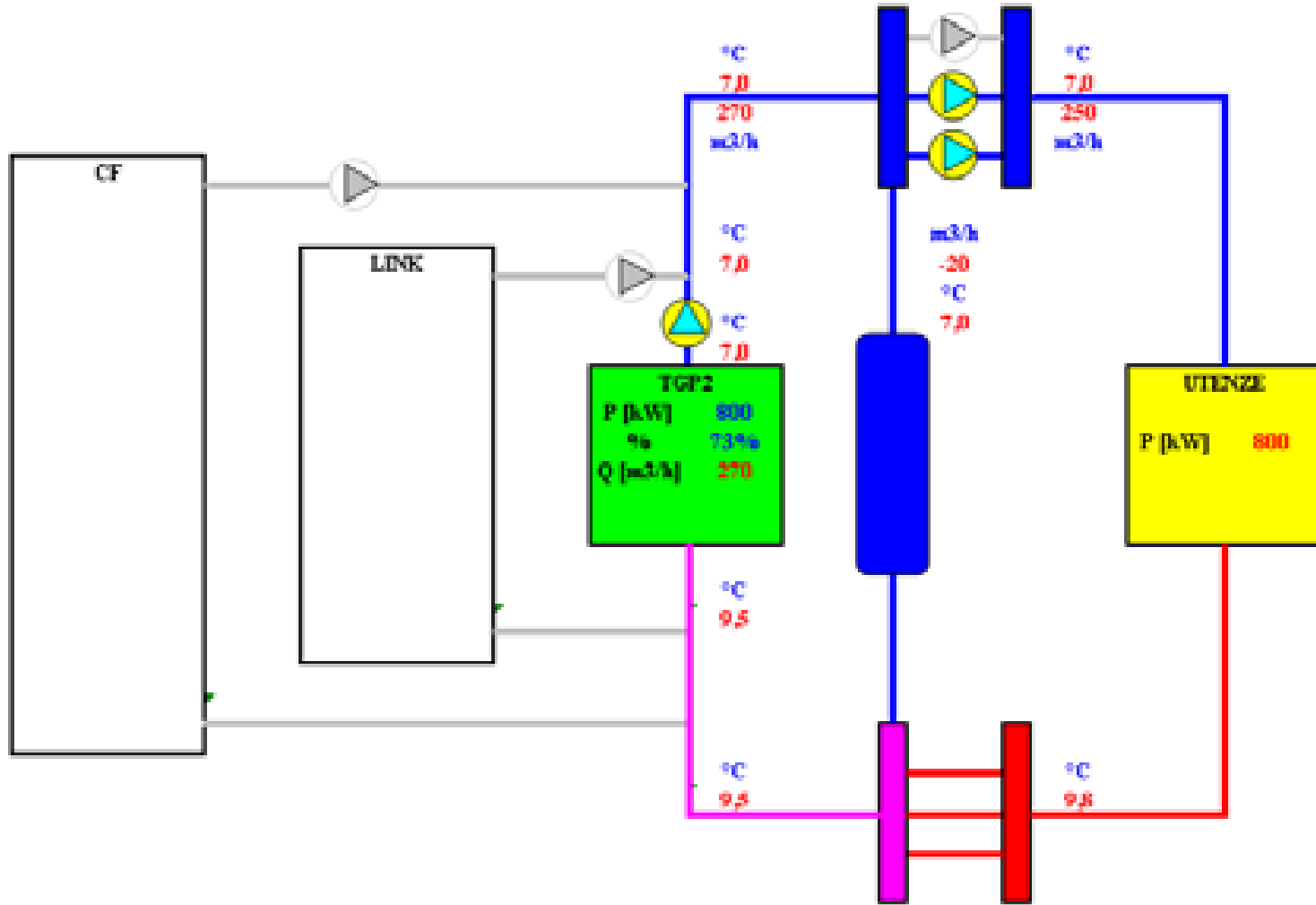
Total Electric Pw: 3,480 kW_e

Single Heating Pw: 760 kW_t

Total Heating Pw: 4,560 kW_t

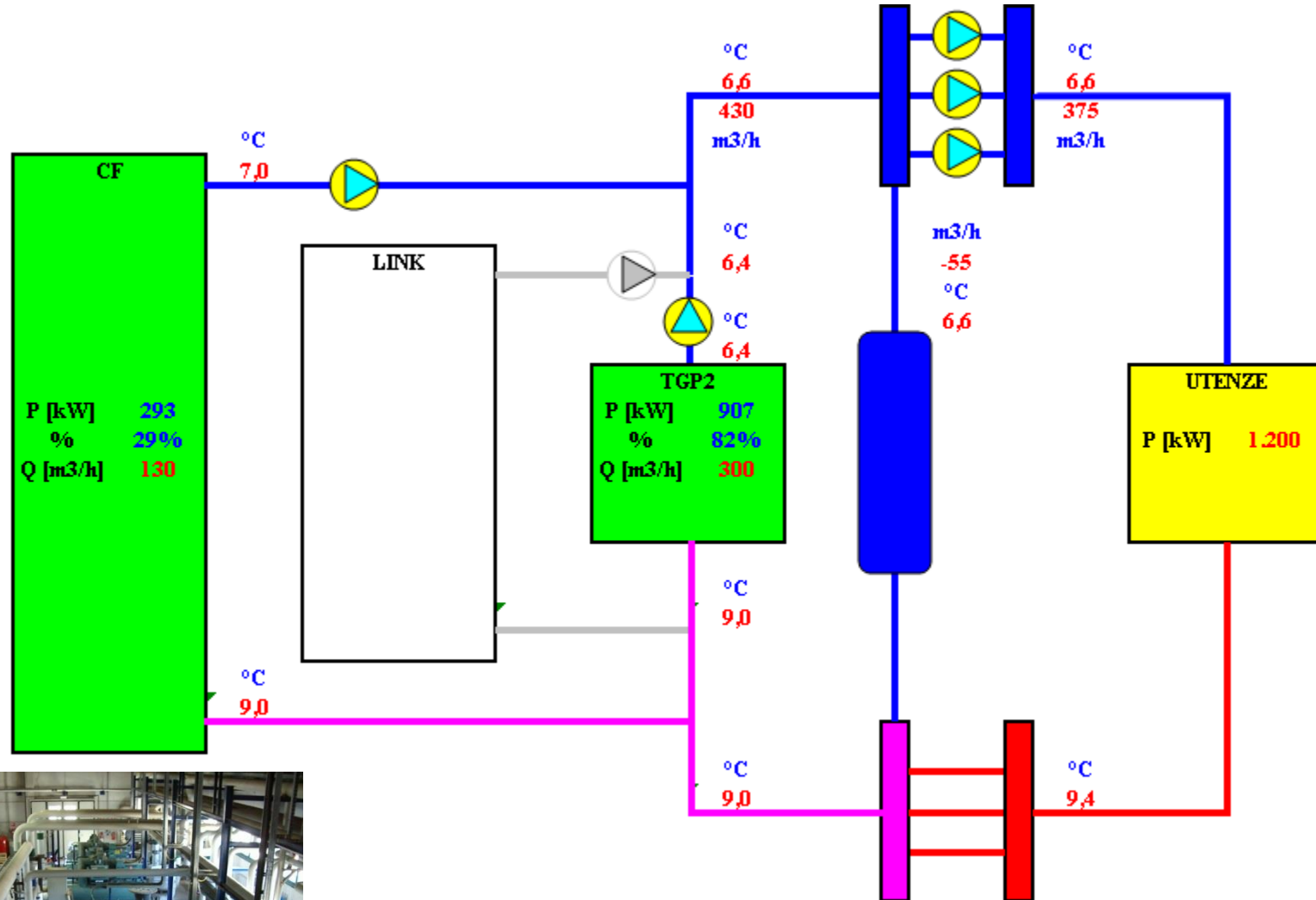
2 * 1 Absorption Chiller Pw: 1,569 kW_f

Total Cooling Pw: 3,138 kW_f



Cooling Load is minor than Absorption Chiller capacity

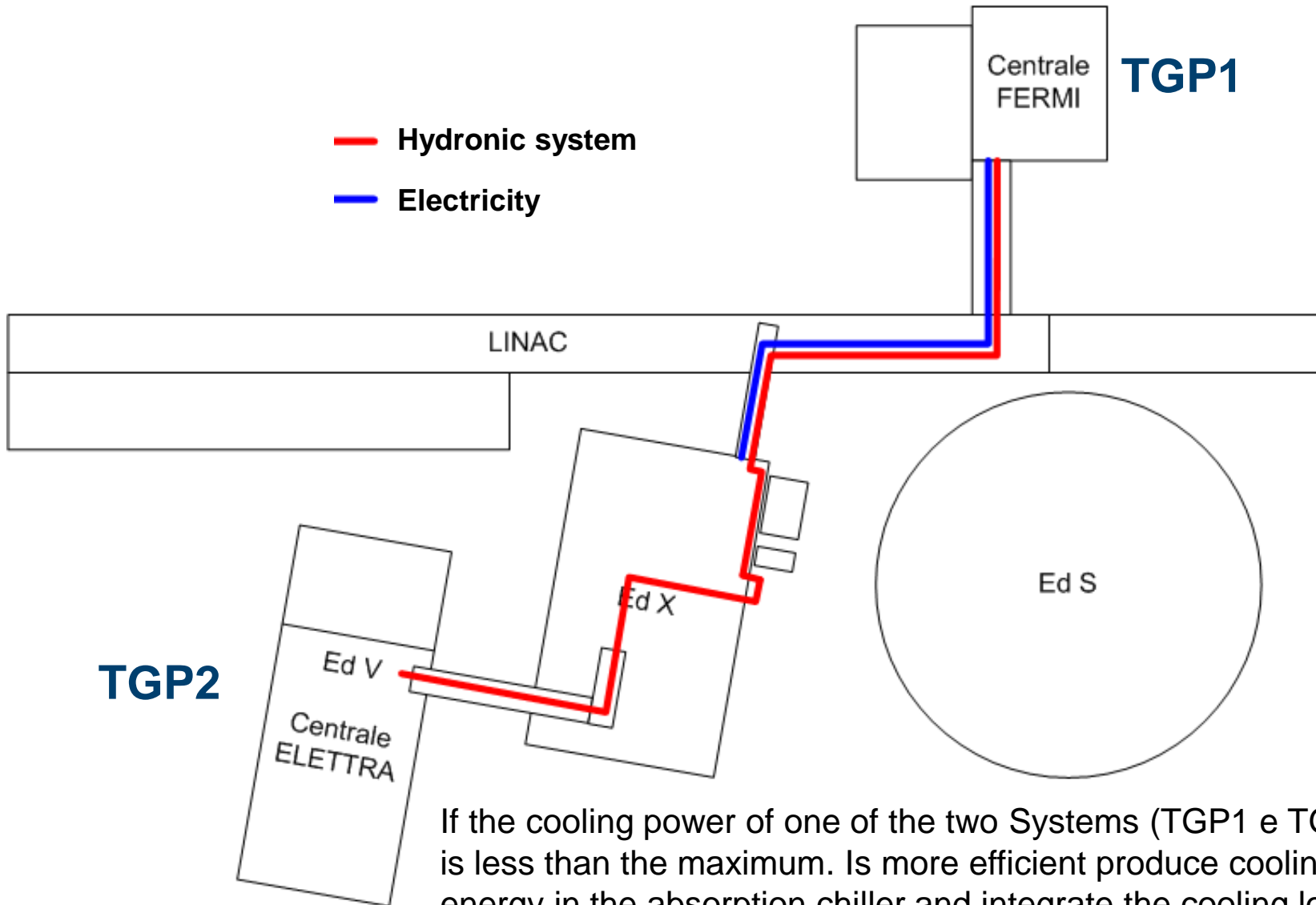
70% total time - Absorption Chiller ON and cover the cooling demand



When Cooling Load is greater than Absorption Chiller capacity

Absorption Chiller ON and Electric Chiller are ON

HOW TO WORK THE LINK BETWEEN TGP1 AND TGP2

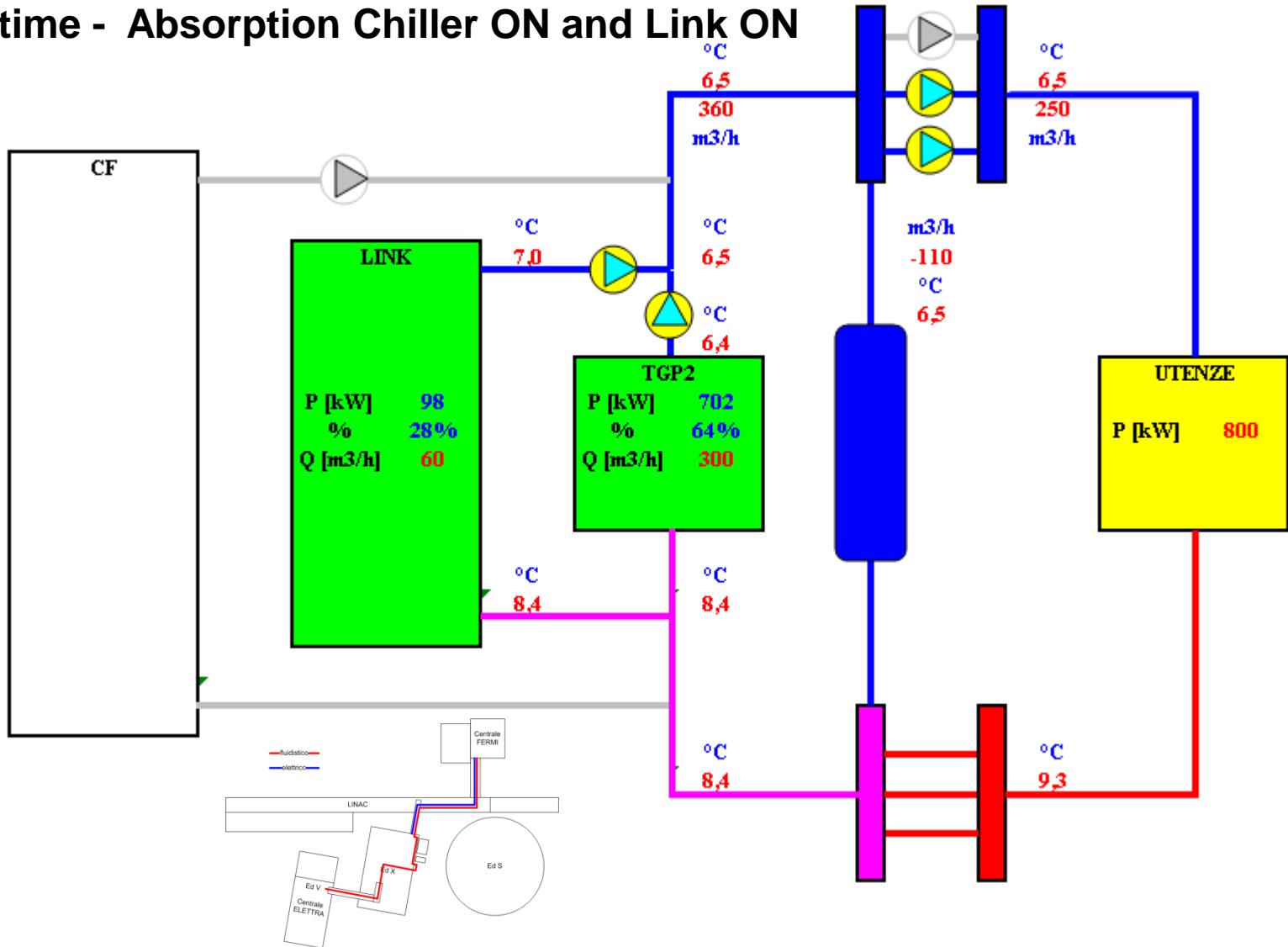


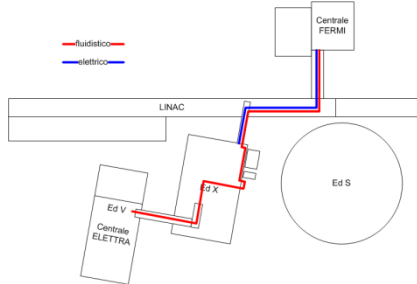
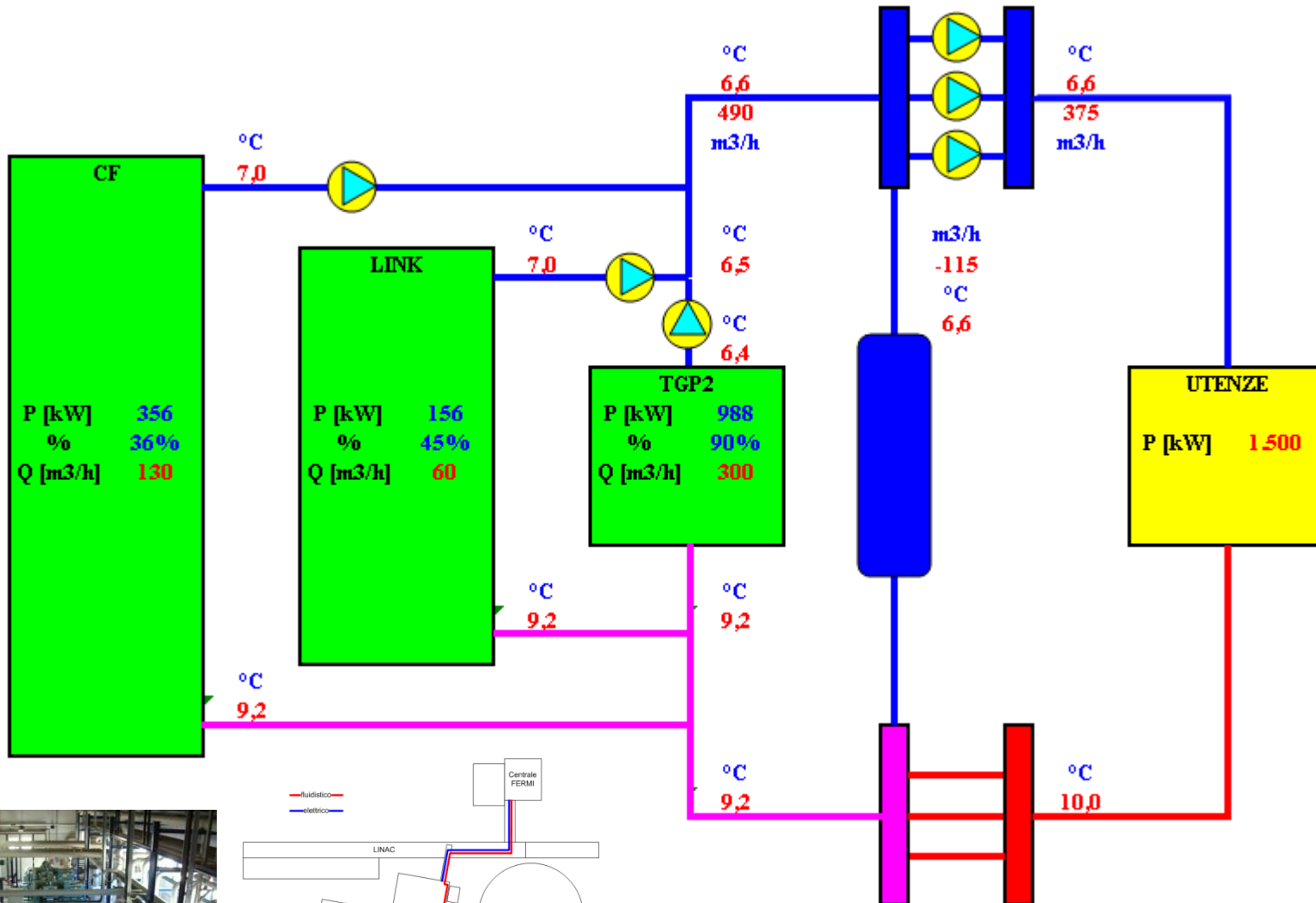
— Hydronic system
— Electricity

If the cooling power of one of the two Systems (TGP1 e TGP2) is less than the maximum. Is more efficient produce cooling energy in the absorption chiller and integrate the cooling loads, via link.

When Cooling Load is greater than Absorption Chiller capacity

20% total time - Absorption Chiller ON and Link ON





When Cooling Load is greater than Absorption Chiller and Link capacity

10% total time - Absorption Chiller, Link and Electric Chiller are ON

For Elettra and Fermi Lightsources the actions to improve energy efficiency are:

- ☐ Maximize the use of the thermal energy
- ☐ The adoption of trigeneration systems to take advantage of the heat produced in summer and middle season.
- ☐ The adoption of double-effect absorption chiller to maximize cooling capacity.
- ☐ The logics of operation and support of various systems.

At the moment we are monitoring and collecting data that will be presented soon as possible. (Parallel Session A4)



THANK YOU FOR YOUR KIND ATTENTION

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