

European Seminar on Trigeneration

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TRIGENERATION MARKET PERSPECTIVES

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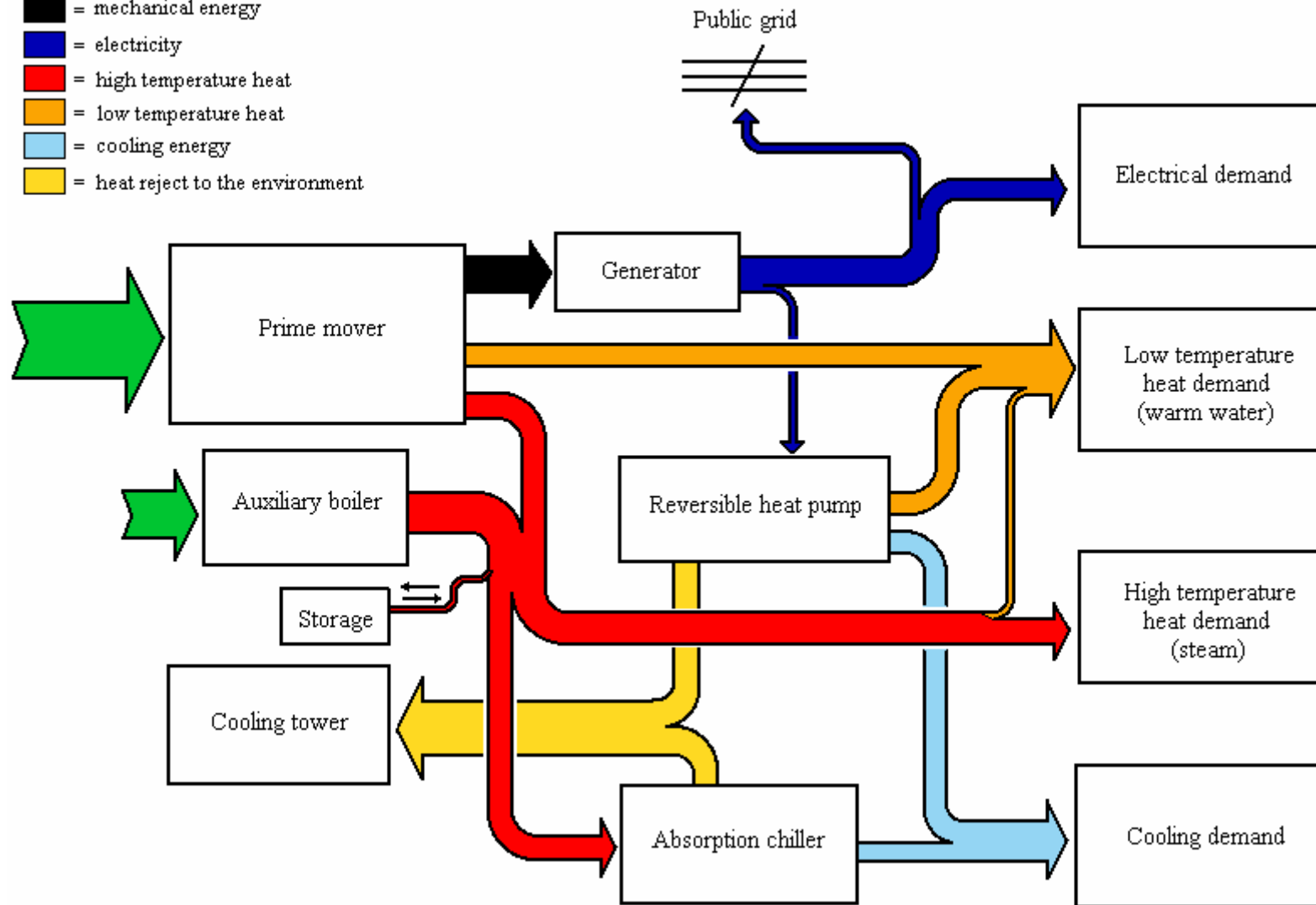
<http://www.crever.urv.es>



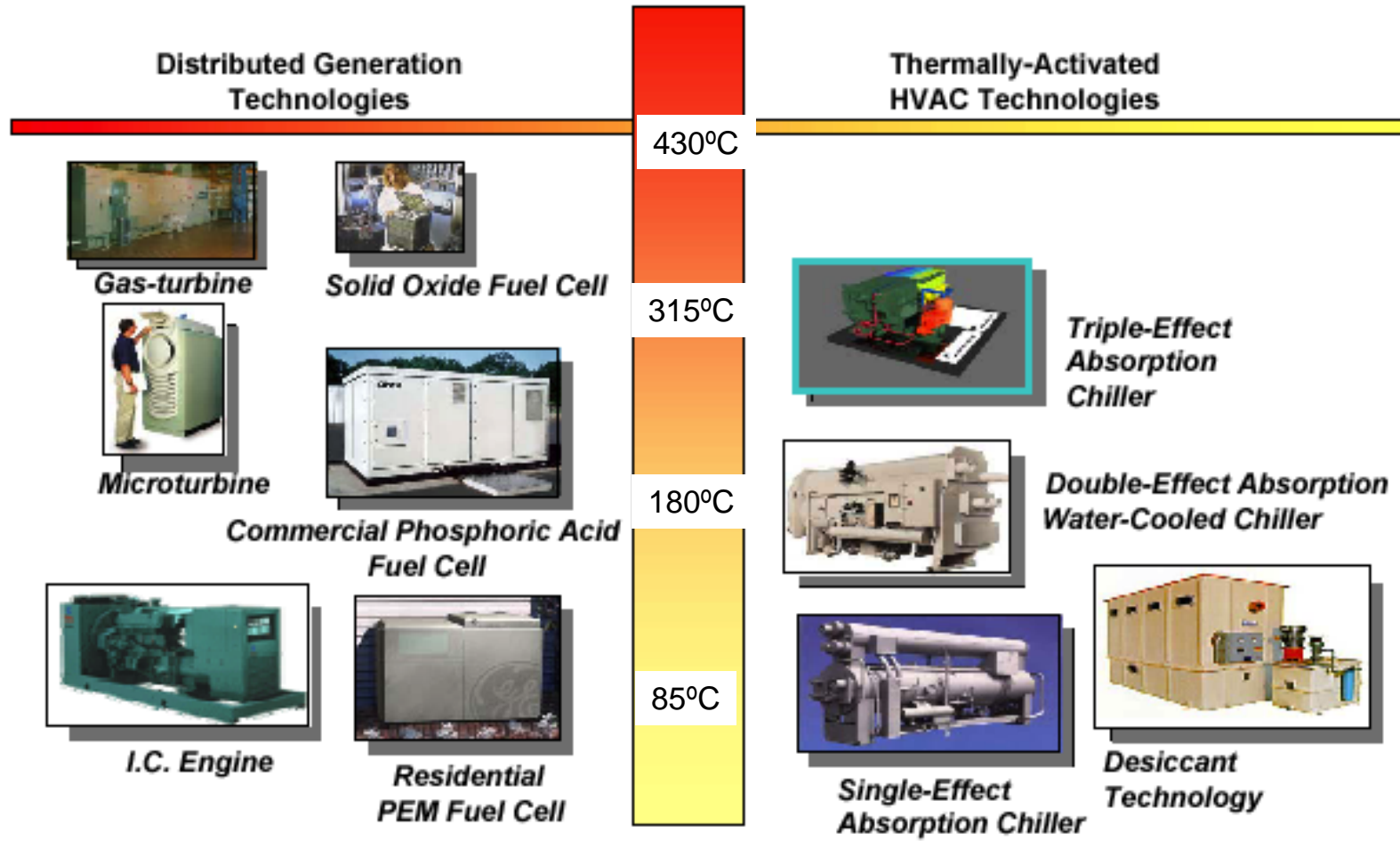
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1 – Trigeneration concept

- █ = energy input by fuel
- █ = mechanical energy
- █ = electricity
- █ = high temperature heat
- █ = low temperature heat
- █ = cooling energy
- █ = heat reject to the environment



2 – Integration of cooling technologies into CHP systems

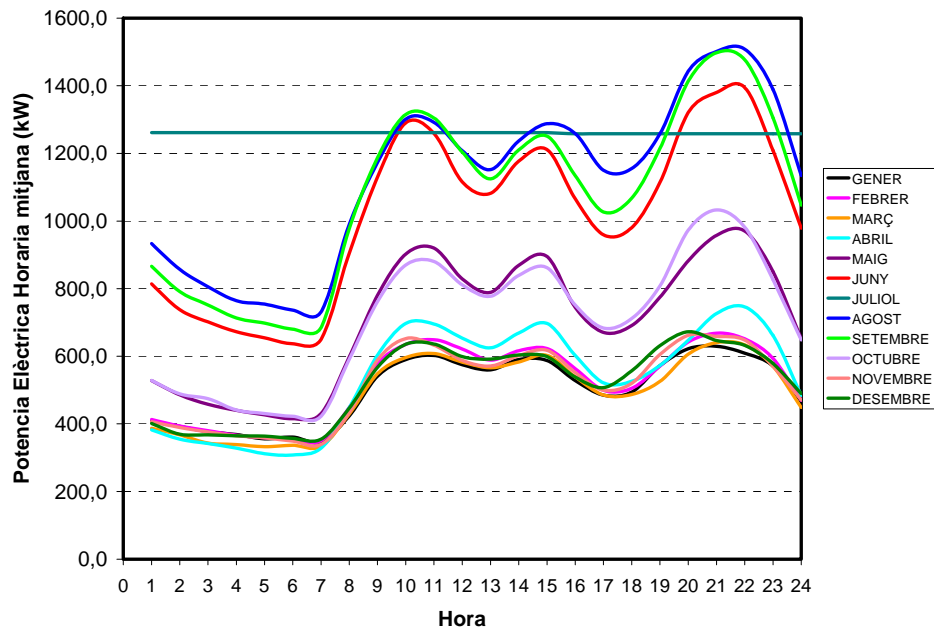


Recoverable Energy Quality (Temperature) and HVAC Technology Match

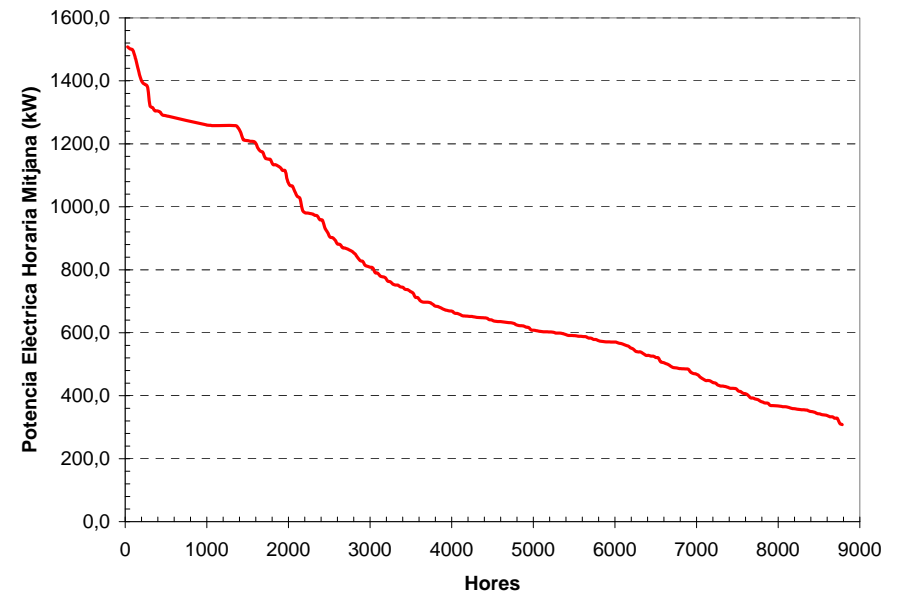
3 – Energy demand in buildings

Highly variable energy demands in comparison with industrial applications.

Example of energy consumption in a hotel in Tarragona

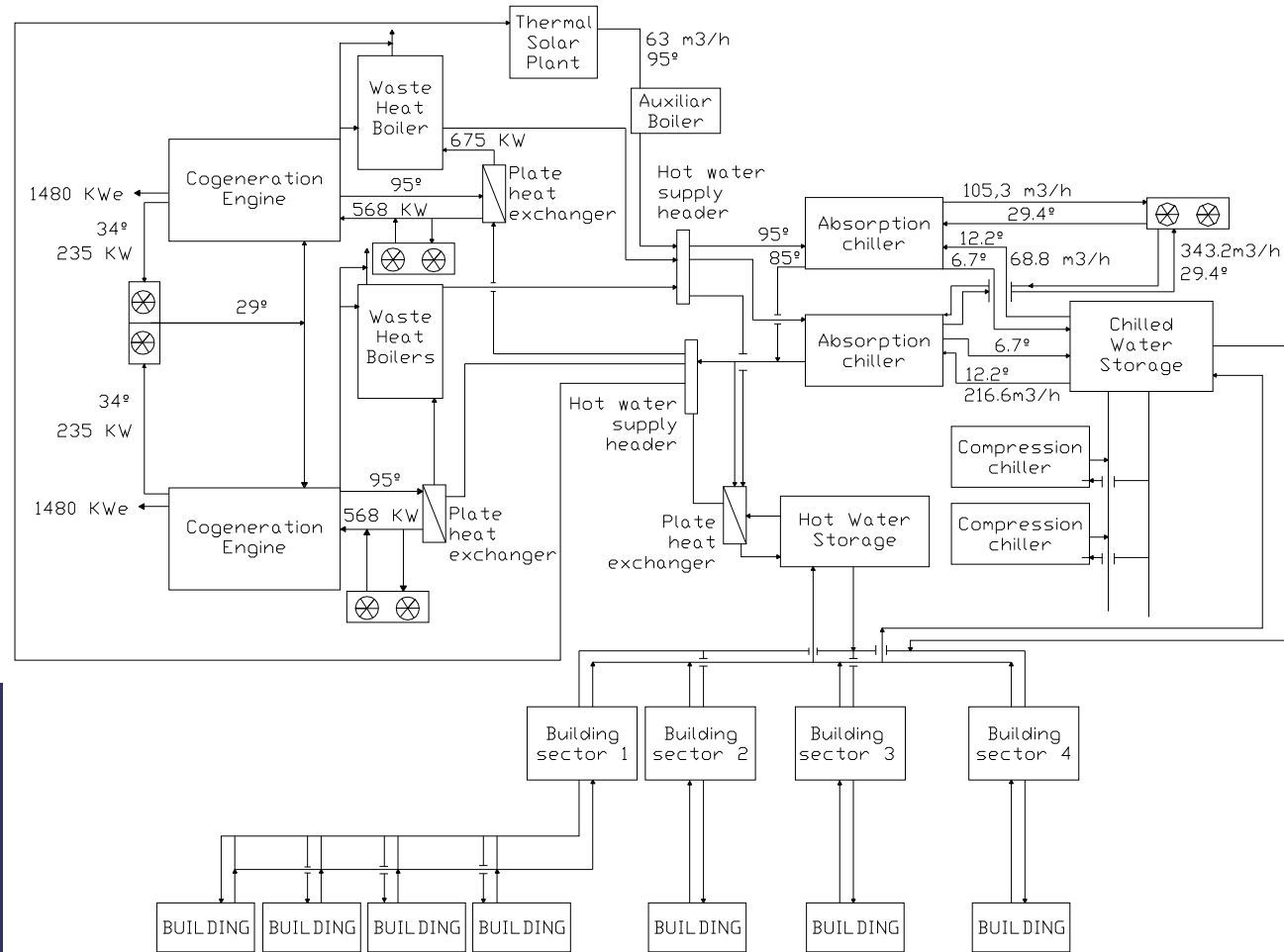


Average hourly power consumption in kW per month



Load duration curve for the power consumption

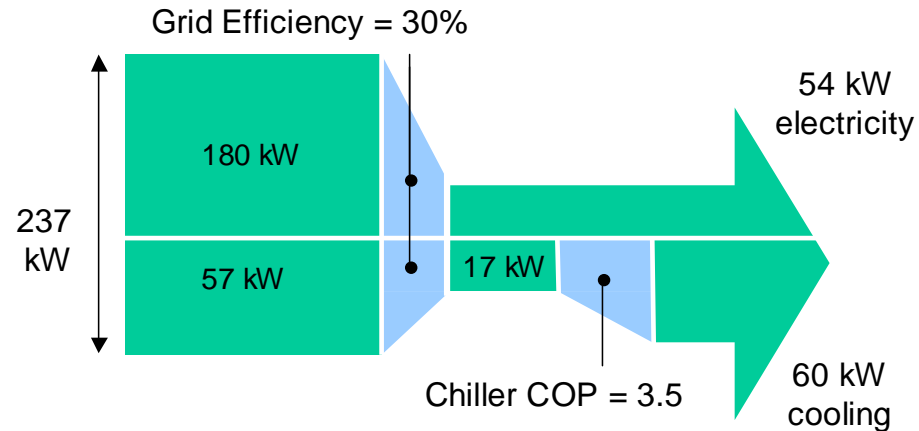
4 – Integration into DHC networks



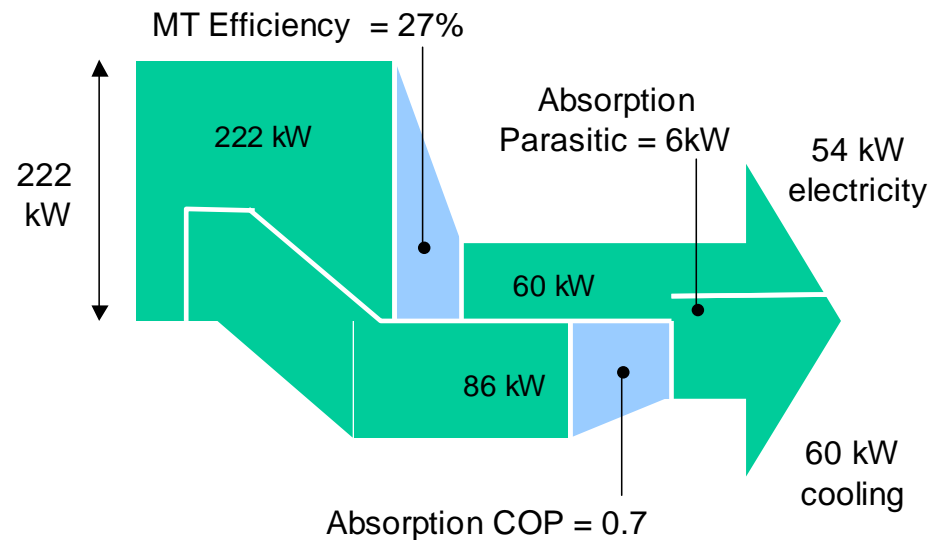
Example of the ParcBit DHC network (Mallorca) – *CAMELIA Project*

Energy efficiency

Conventional system



Capstone C60
Micro gas turbine
+
Single effect
Absorption chiller

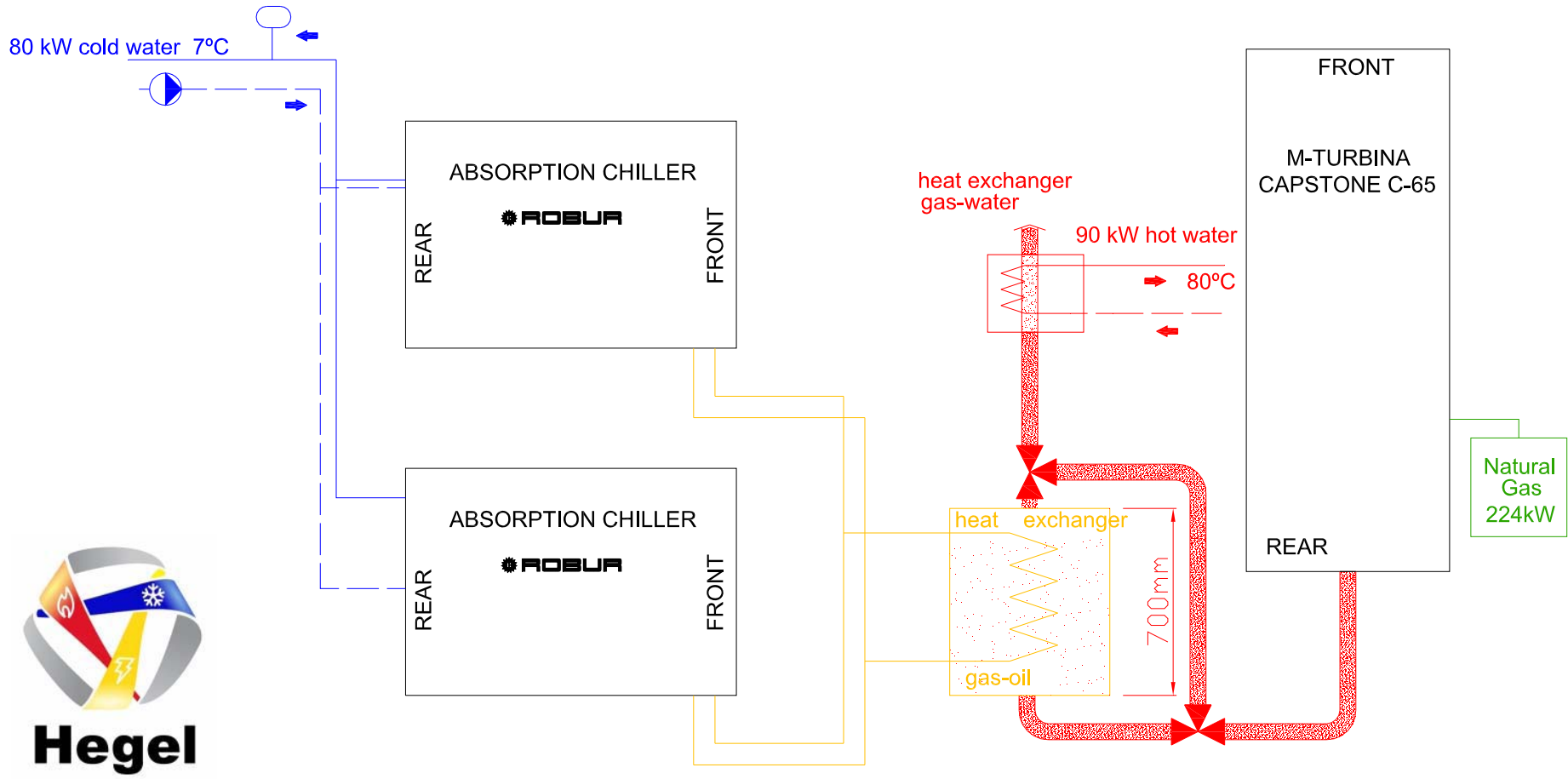




5 – Present situation for small scale trigeneration systems (II)

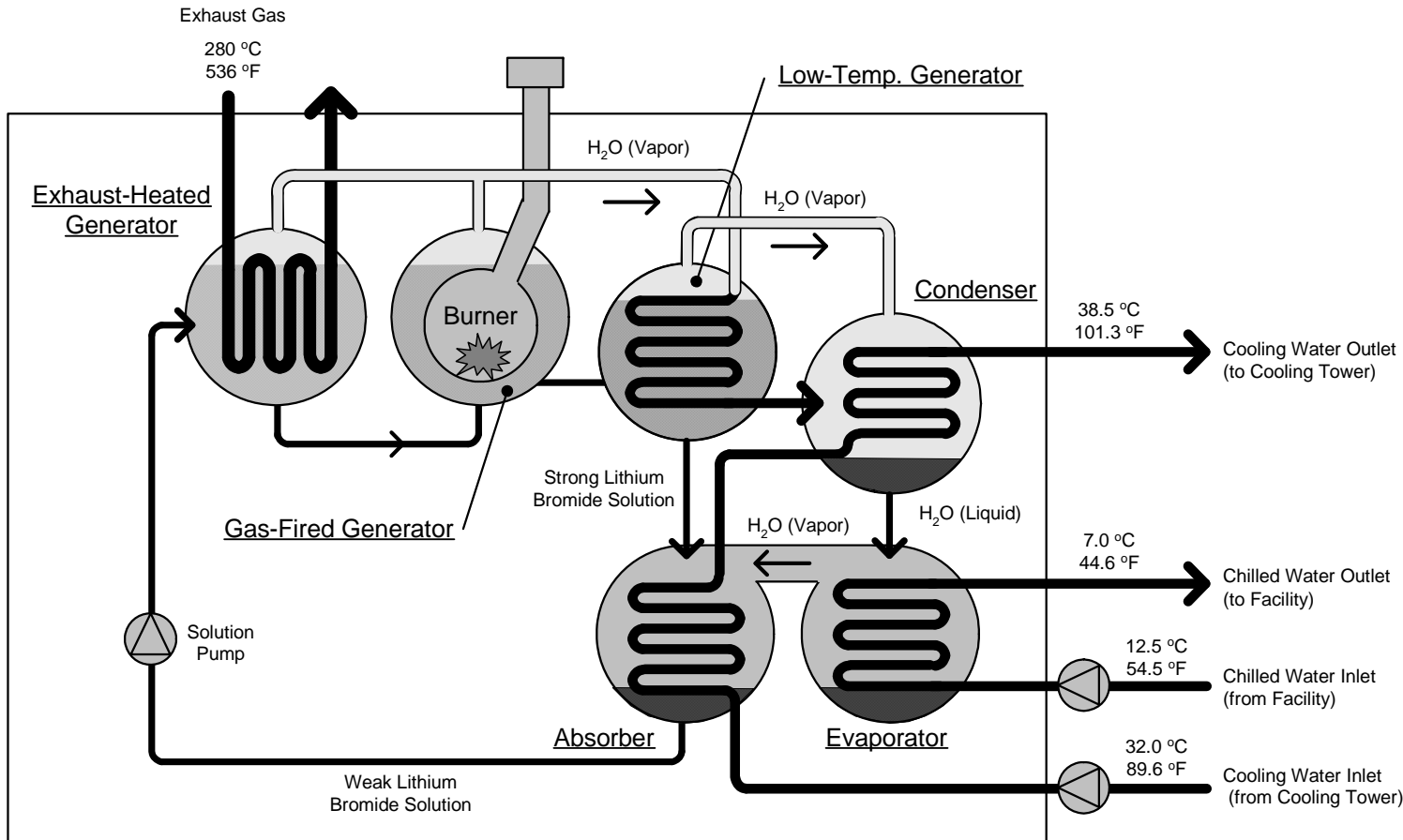
HEGEL PROJECT

MGT C65 + 2x HOT OIL DRIVEN ROBUR



6 – Direct use of exhaust gases (I)

Double Effect Absorption Chiller, Elliot/Yazaki



Dual Fired System (Burner)

140 kW of cooling capacity

COP = 1.04

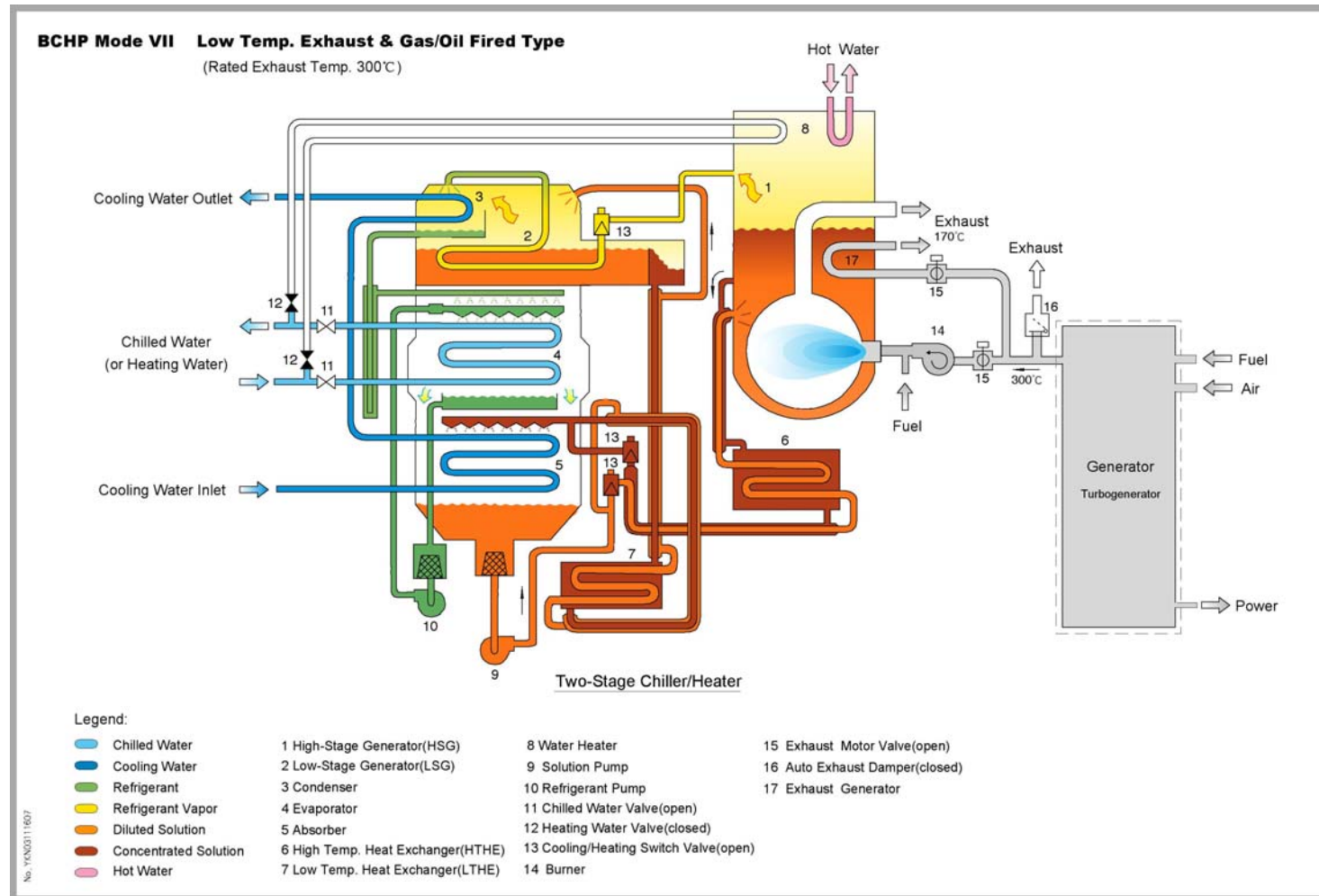


6 – Direct use of exhaust gases (II)

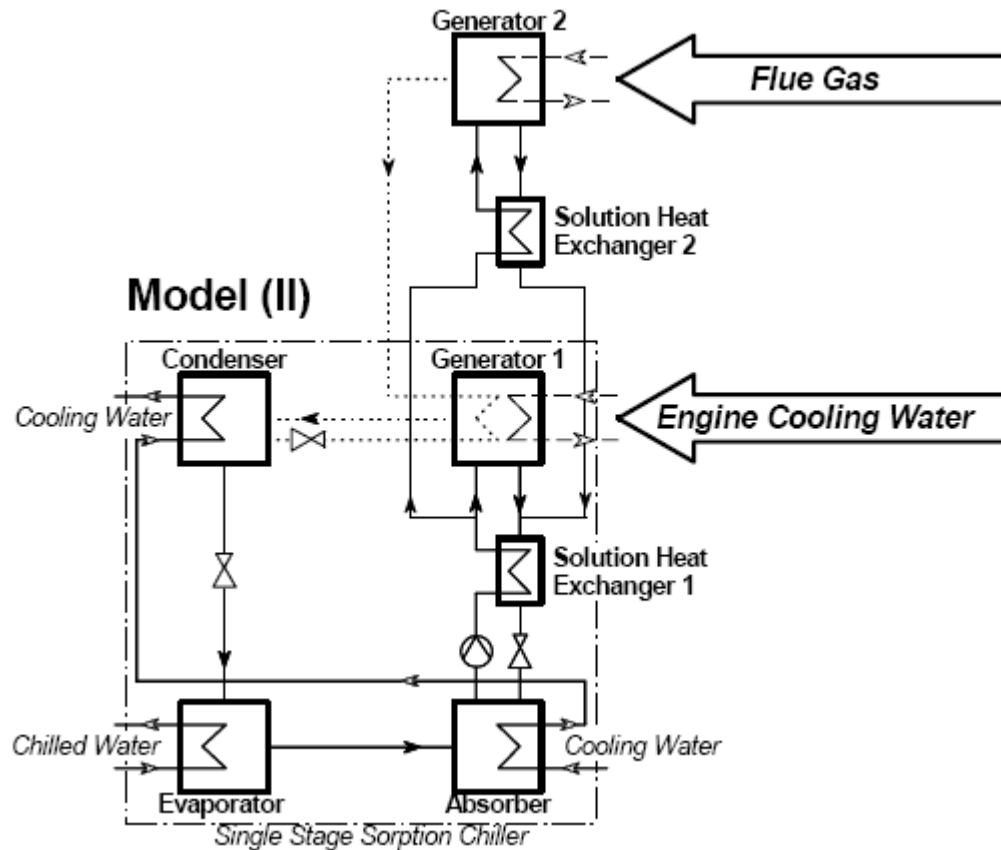
BROAD



Exhaust gas used as post-combustion air



7 – Optimal integration of CHP engines and chillers



Single/Double effect chillers

Simultaneous use of flue gas and cooling water from CHP engines

Plura, S., Kren, C., Schweigler, C.: System Concept for Efficient and Flexible Tri-Generation. *International Sorption Heat Pump Conference, June 22-24, 2005; Denver, Co, USA.*



8 – New technologies for small capacity trigeneration

CHP

Reciprocating engines (DACHS)

Stirling engines (Solo)

ORC (Enginion)

Micro gas turbines (Capstone)

Fuel Cells (Ansaldo)

Chillers

Water/LiBr Chillers (Rotartica)

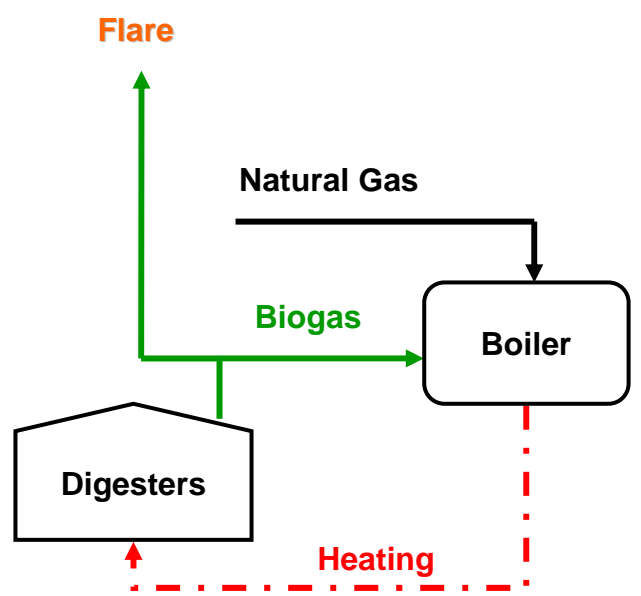
Ammonia/Water chillers (Chilli)

Adsorption chillers (Sortech)

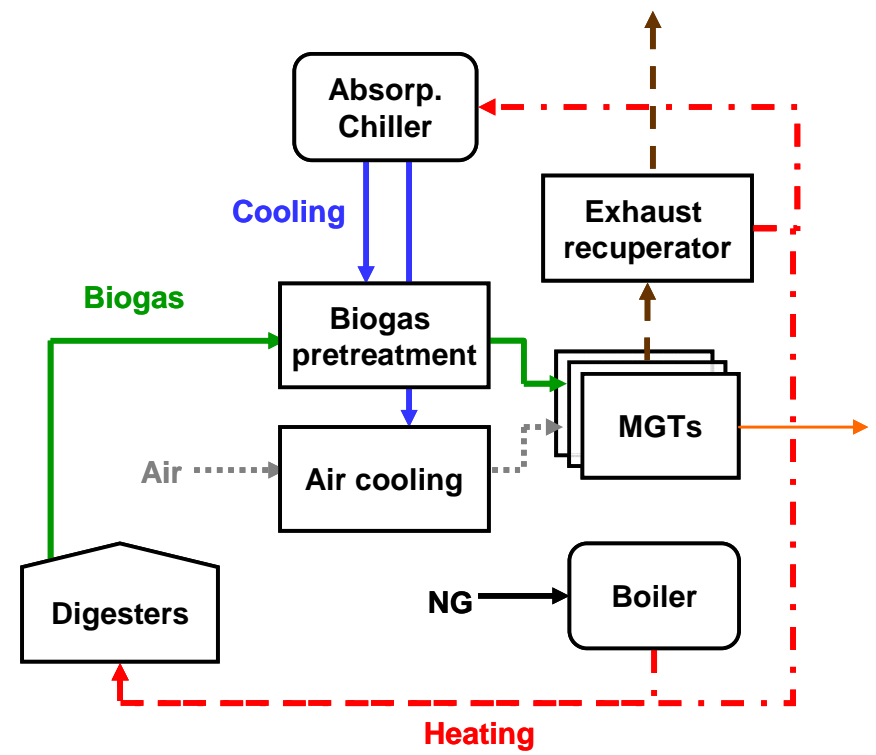
Thermochemical heat pumps
(LiCl/water)

TRIGENERATION SYSTEM IN A MUNICIPAL SEWAGE TREATMENT PLANT

Conventional situation

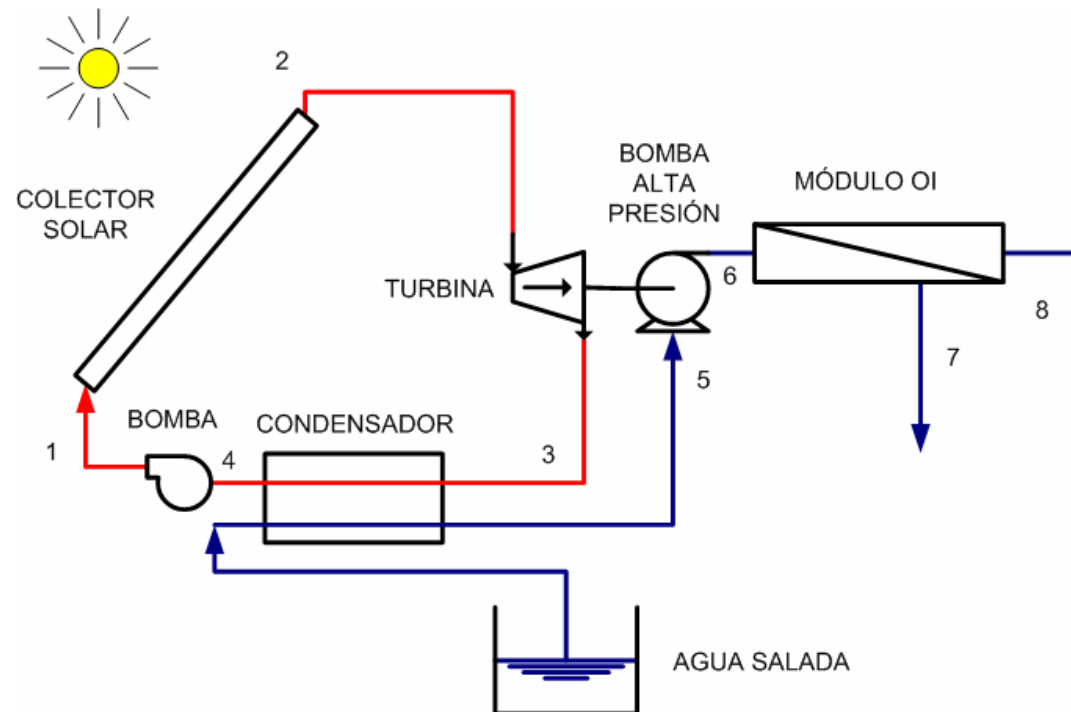


Trigeneration system



PRODUCTION OF DESALTED WATER WITH THE POTENCIAL CAPACITY TO PRODUCE ELECTRICITY, HEAT AND COOLING

OSMOSOL PROJECT







Spanish Ministry for Education and Science (OSMOSOL project ENE2005-08381-C03-03)

<https://www.psa.es/webeng/projects/joomla/osmosol>

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10 - Conclusions

-  An increasing research and development effort is made to improve the integration of CHP and sorption chillers: exhaust gases, combined use of engines cooling and gases, new SE/DE configurations, etc.
-  New commercialised or ready to market technologies are now available with a higher efficiency for small capacity trigeneration systems.
-  New trigeneration applications are being explored that can expand the market for trigeneration.
-  There is an important lack of field data on the real operation of small capacity trigeneration systems.