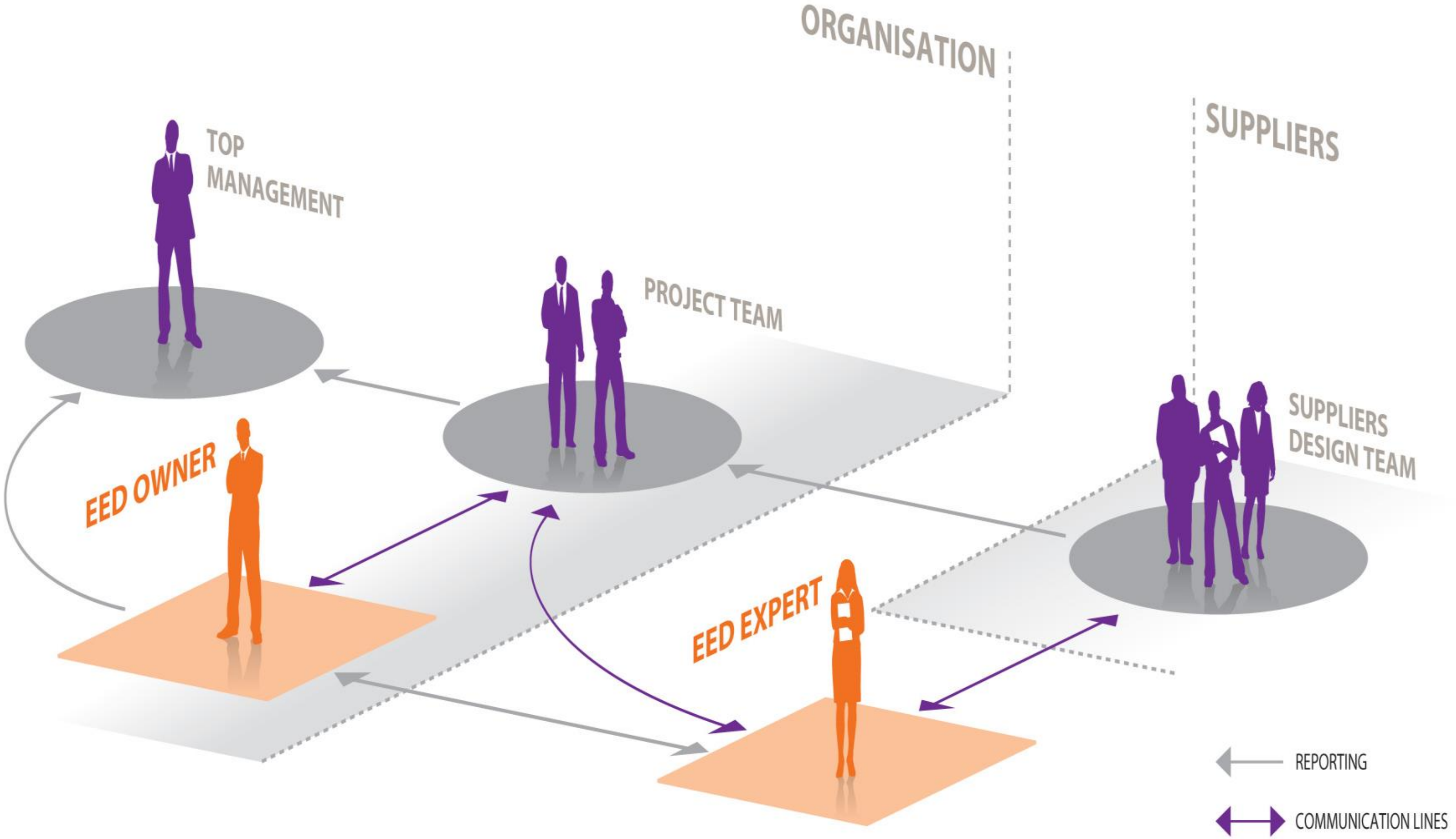
IS399 – Delivering energy perfomance

PM Group experience

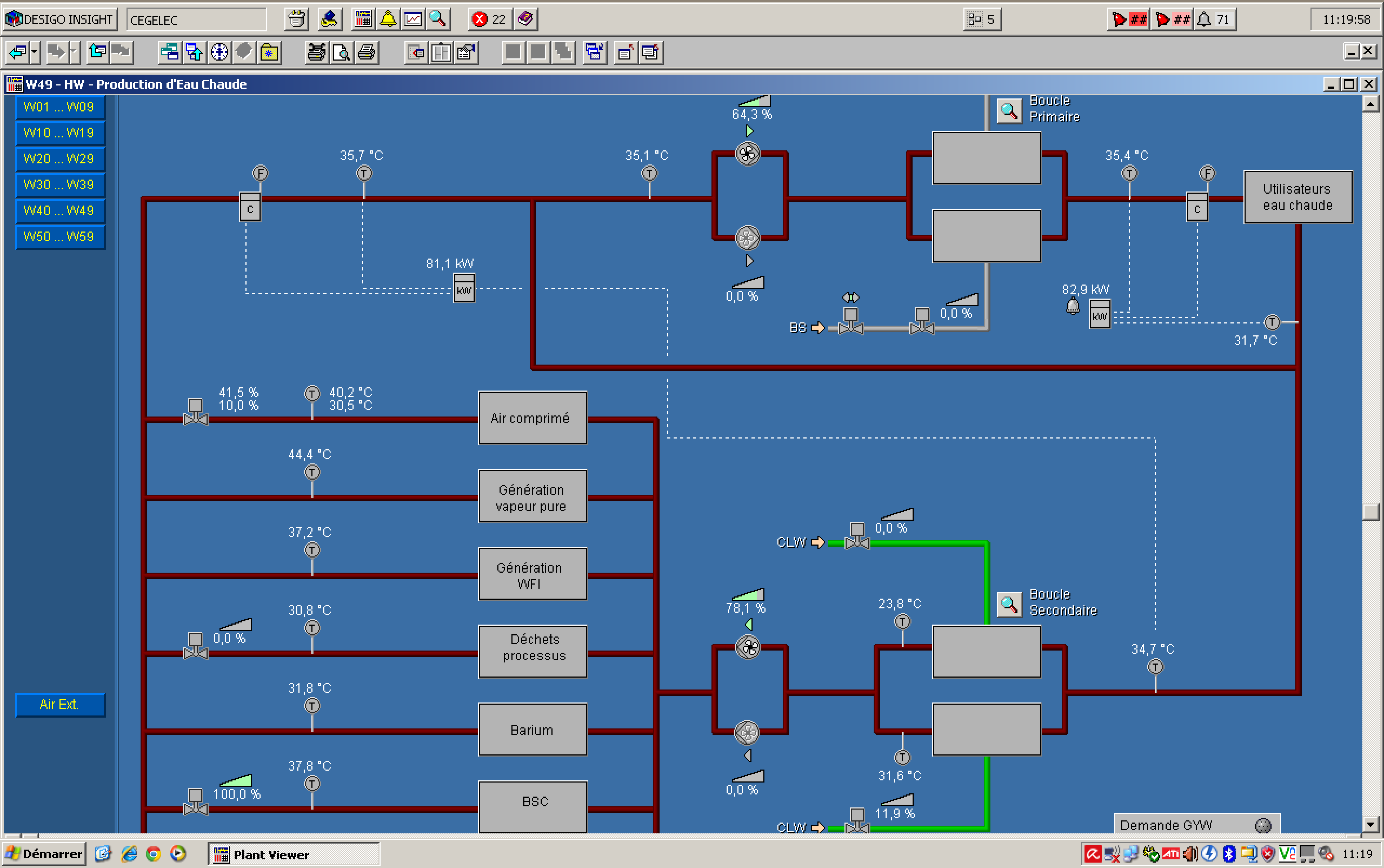
expertise.

The project delivery specialists

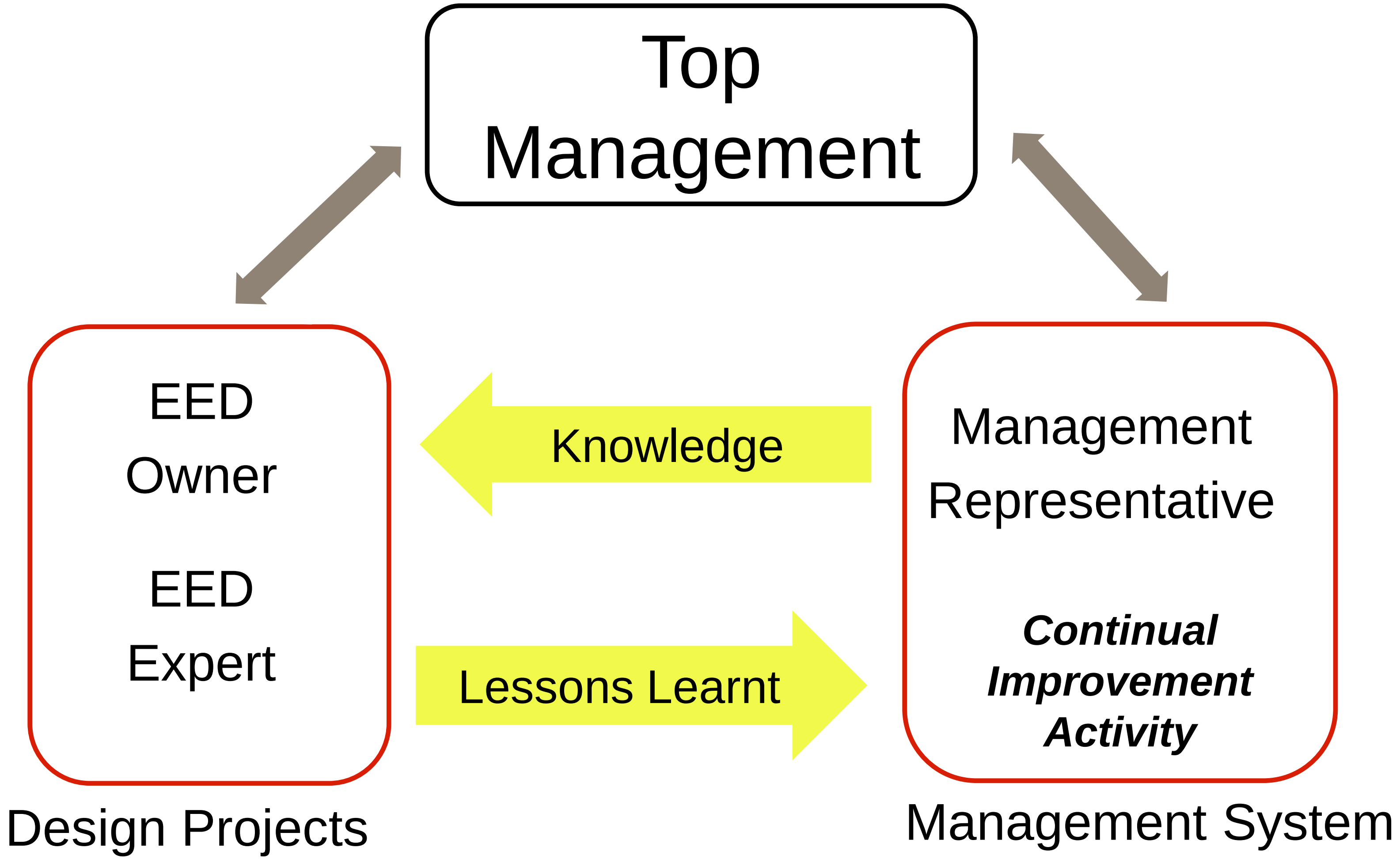
Design Projects - Organisation



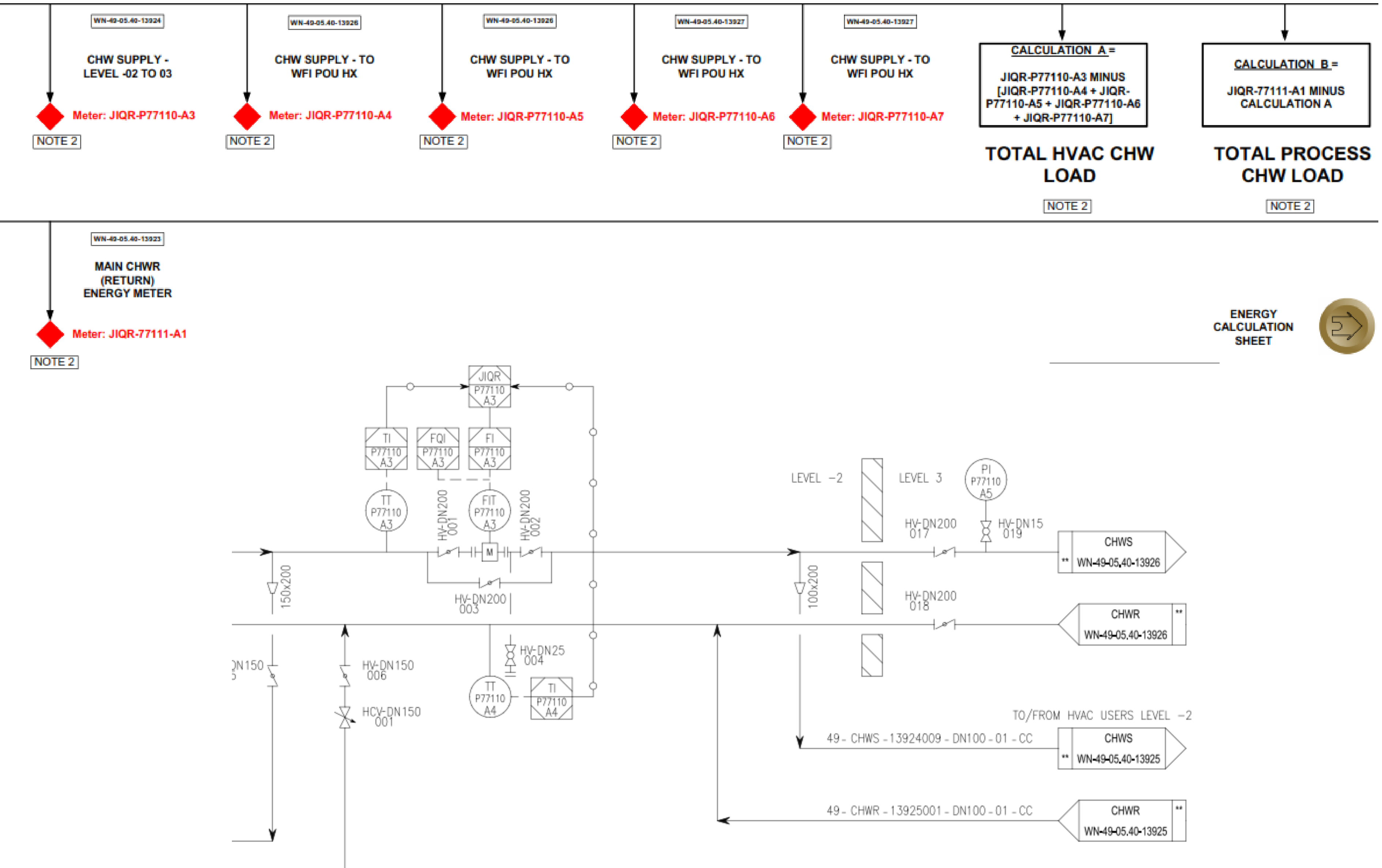
Energy Recovery through collaboration!



Organisational Structure



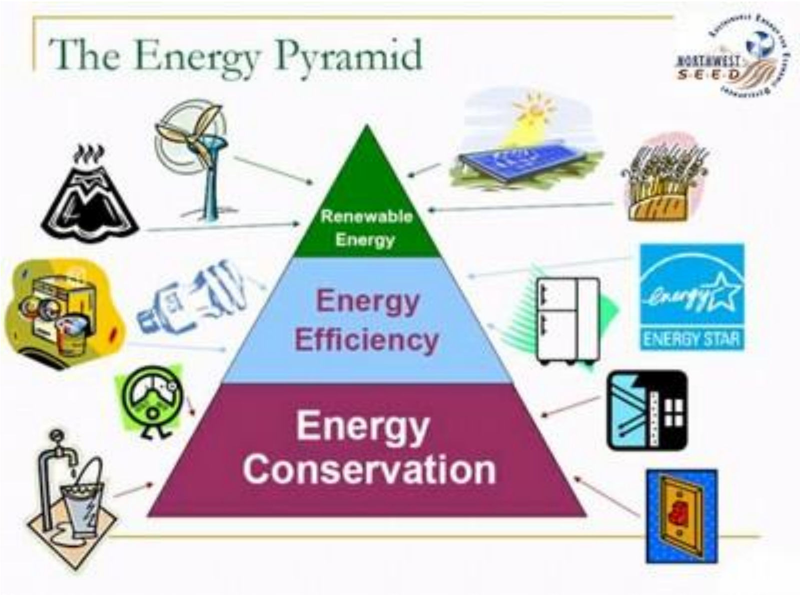
Design for Energy Management (DfEM)



Guiding Principles of Energy Efficient Design

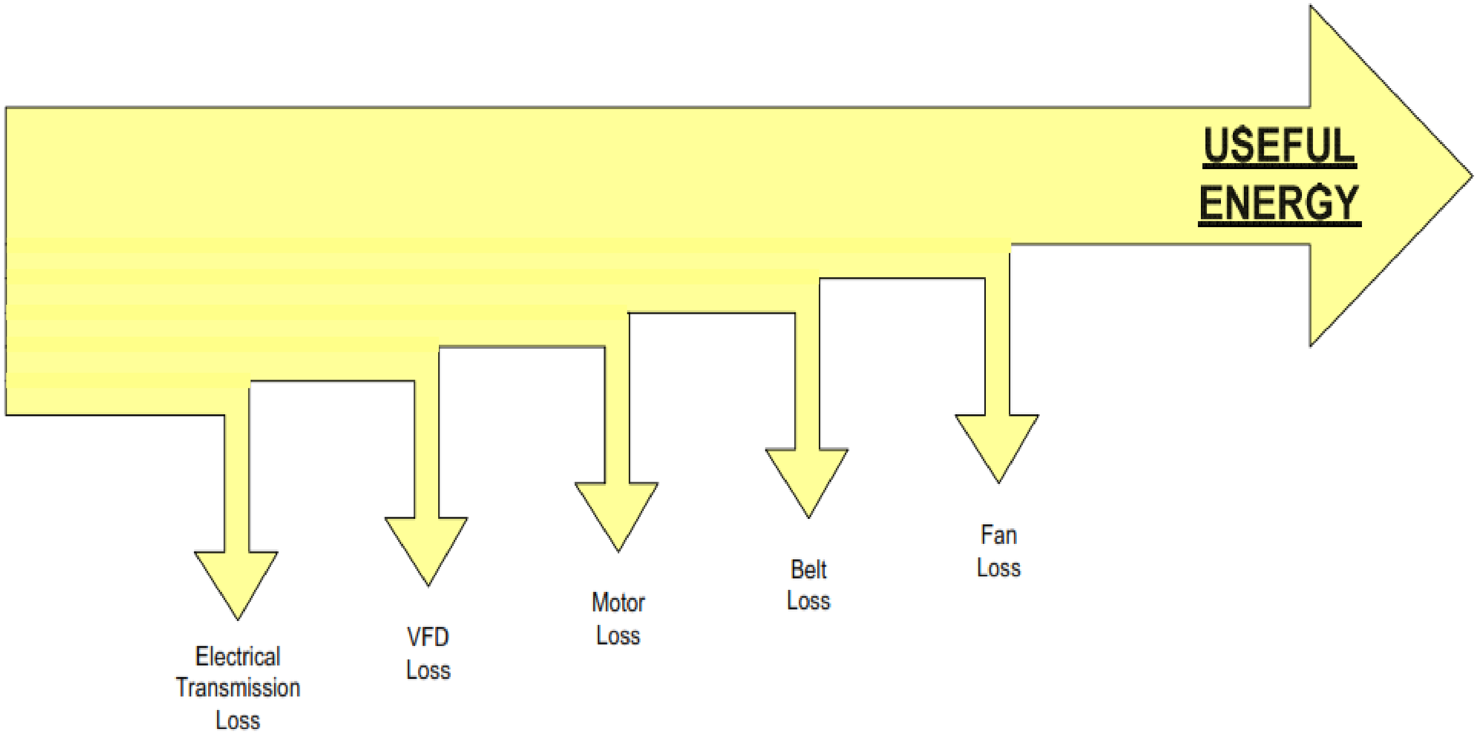
Optimise energy use and consumption in the following sequence;

- Energy Avoidance
- Energy Conservation
- Energy Efficiency
- Energy Sources



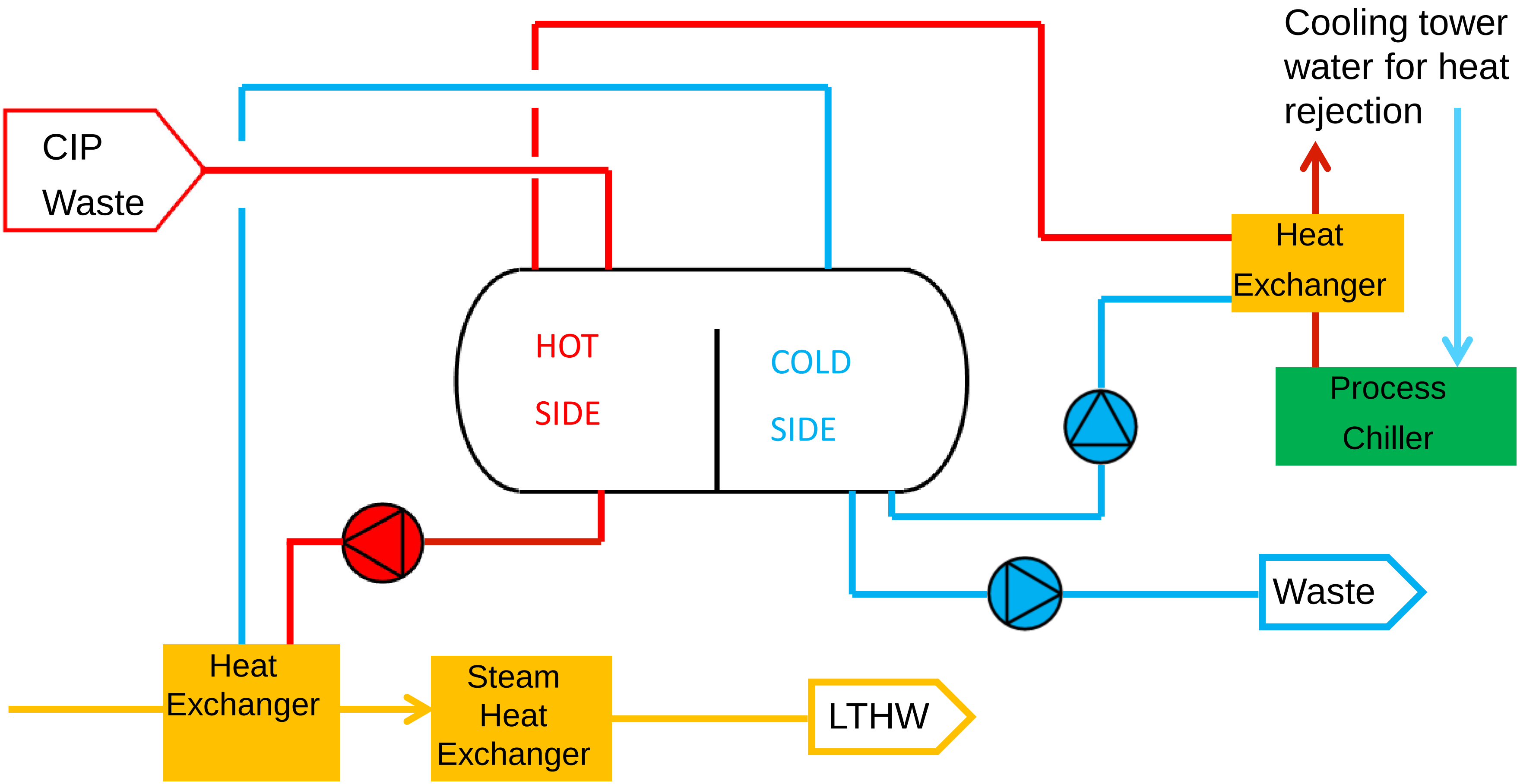
Guiding Principles of Energy Efficient Design

Assess and reduce energy losses from energy source(s) to energy use.



Guiding Principles of Energy Efficient Design

Exploit opportunities for energy recovery, for example by configuring working temperatures of various processes to effect energy recovery.

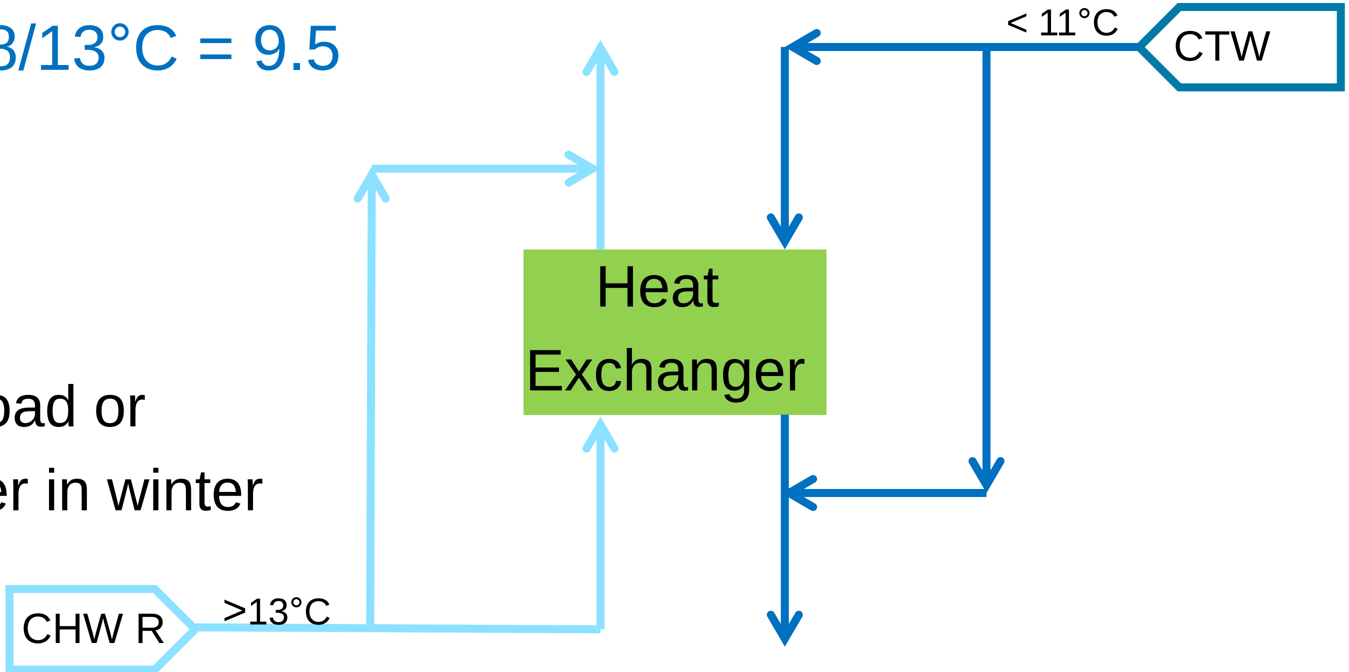


Guiding Principles of Energy Efficient Design

Use the lowest practical temperature for heating systems and the highest practical temperature for cooling systems

Impact of Chilled Water Design Temperature
IPLV @ 5/11°C = 7.8
IPLV @ 8/13°C = 9.5

HX can trim load or displace chiller in winter



Guiding Principles of Energy Efficient Design

For fluid flow consider;

- **Minimising flow rate requirements,**
- **Minimising pressure losses in the distribution network,**
- **Variable flow operation for variable load systems.**

KWhrs = f (Q, P, T, η)

HVAC Example

Q = air changes, VAV operation

P = Specific fan power, kw/m^3/s

T = Night setback

η = fan, motor, electrical efficiencies

Guiding Principles of Energy Efficient Design

Do not over-specify quality requirements for utilities.

Examples

- **Purified water or WFI**
- **Challenge Comp. air requirement**
  - **Electric instead of pneumatic actuated valves**
  - **Low pressure instead of high pressure air for drying post CIP.**

Guiding Principles of Energy Efficient Design

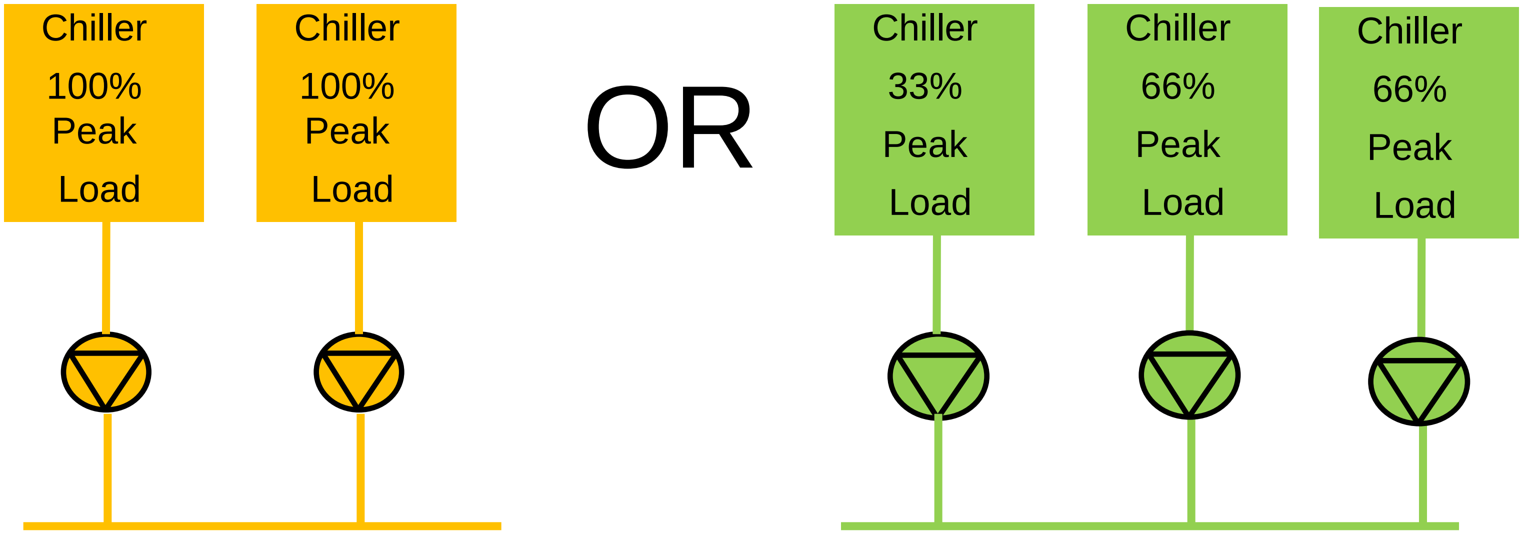
Avoid oversizing processes and equipment through excessive design margins.

Chiller example:

- **End user demand estimated by Process & HVAC engineers: X_1, X_2, X_3, X_1, X_4,…**
  - **Engineers may add margin to their calculated load**
  - **Peak external weather conditions impact HVAC loads**
- **$L_{total} \neq X_1 + X_2 + X_3 + X_1 + X_4 + \ldots\ldots$**
- **L_{total} = Peak simultaneous demand –align with production schedule**
- **Utility Engineers may add margin and then select next available chiller size(s)**

Guiding Principles of Energy Efficient Design

Configure utility systems so that they can be controlled to meet variable end-user demand without losing overall system efficiency.



When does energy efficient design BEGIN?

Layer	Definition	Cleanroom Example
Energy Service	The desired outcome that necessitates the usage of energy	Viable/Non-viable levels Temp/humidity requirements Recovery
Process	The means by which the energy service is achieved	ACPH AHU Configuration
Equipment	The constituent parts of the process	Fans, motors, heating & cooing systems
Control	The control applied on the above equipment	Control sequences
Operation and Maintenance	The operation and maintenance applied to the equipment	Filter change out frequency
Management	The management including general housekeeping, logging etc.	EnMS

} Before Design

} Design

} After Design