IS399: Energy Efficient Design Management

Delivering energy efficiency in design projects

expertise.

The project delivery specialists

Why IS399?

- Management tools and methodologies exist to deliver project compliance in terms of:
  - Quality √
  - Schedule √
  - Cost √
  - Safety √
  - Energy efficiency X

Overview of IS 399

- Systematic approach to EED.
- Design stage opportunities provide best ROI.
- Defines project organisation & design processes.
- Continual Improvement is a key requirement.
- Can be integrated into other MSS or implemented as standalone.
- Can be applied to discreet projects.
- 3rd party certification may be attained.

Scope of IS 399

- Specifies overall requirements for MS
  Establishing, implementing, maintaining and improving.
- Relevant to investment projects.
  New, modified and renovated buildings and facilities, equipment, systems and processes…..
- Can be implemented by investors, Engineering Contractor, Suppliers, etc
- Does not apply to product development

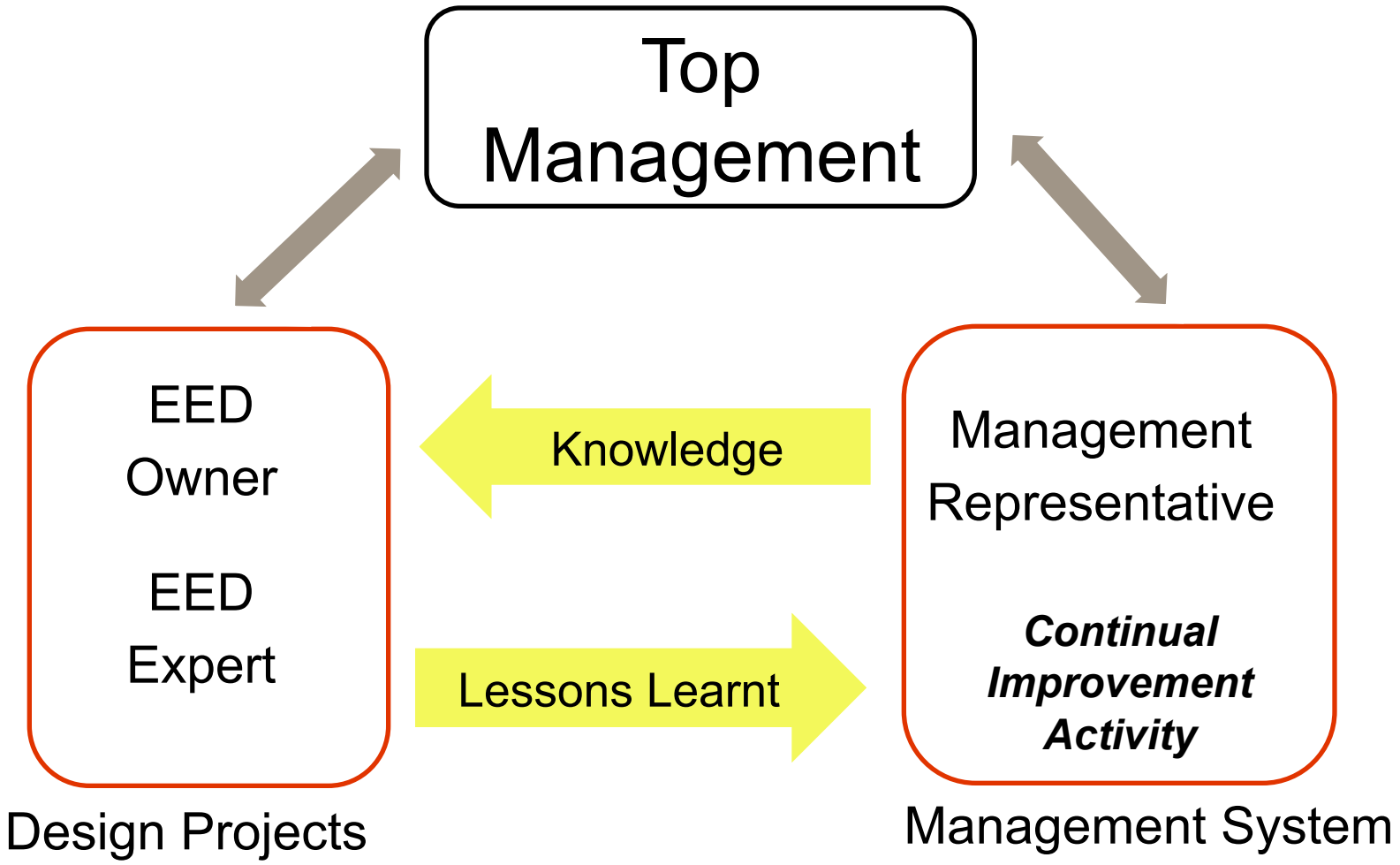
How does IS399 define Energy Efficient Design

The organisation, activities, guiding principles and control implemented in design projects for the purpose of reducing the lifecycle energy consumption of its energy use(s).

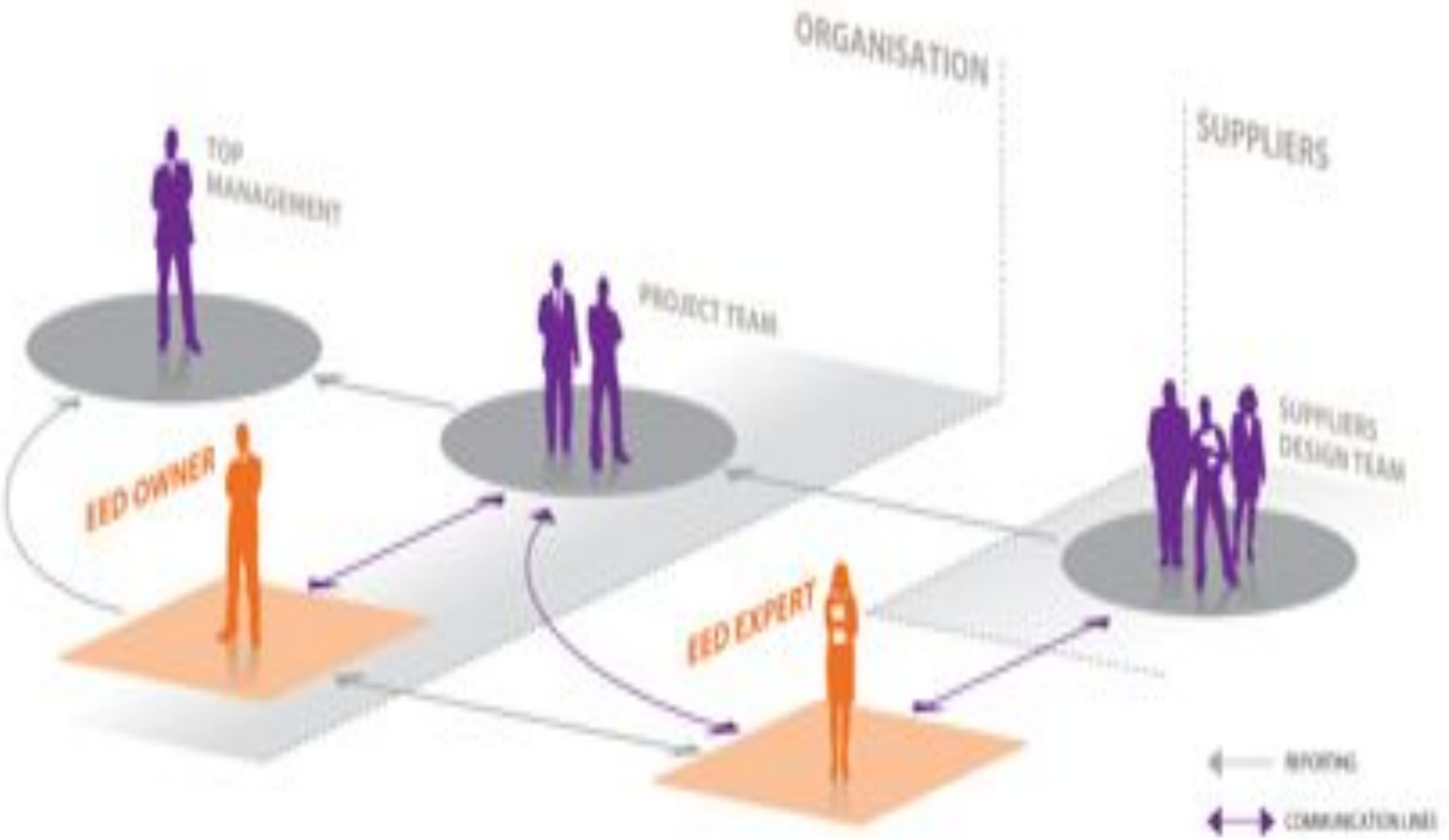
NOTE 1: Subject only to health & safety, regulatory, excessive cost or natural constraints.

NOTE 2: The output is an energy efficient design (entity)

Overview of Organisational Structure



Design Projects - Organisation



Design for Energy Performance (DfEP)

Energy Balance Study

- Concept design
- Baseline
- Energy Balance Report

Challenge & Analyse

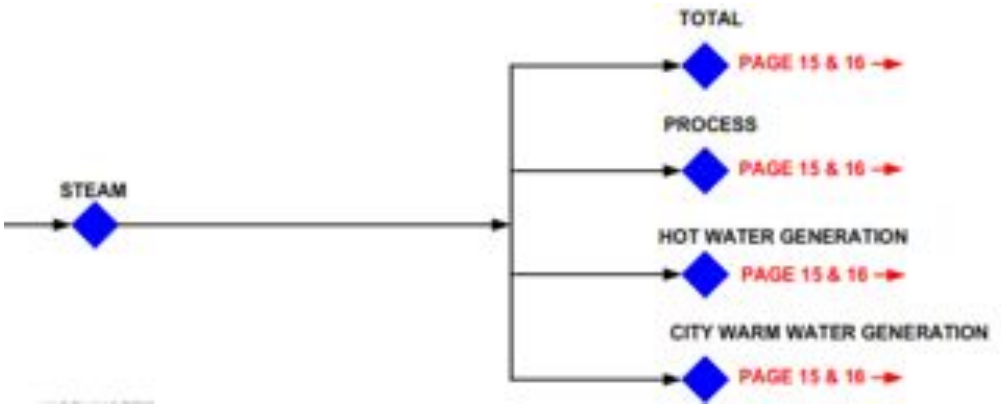
- Design Reviews
- Challenge SEUs
- Energy Savings Register
- Analyse opportunities
- Shortlist for implementation

Implementation

- Handover to design team
- Design, Construction & Commissioning activity
- Plan for Verification

Design for Energy Management (DfEM)

Energy Metering Plan

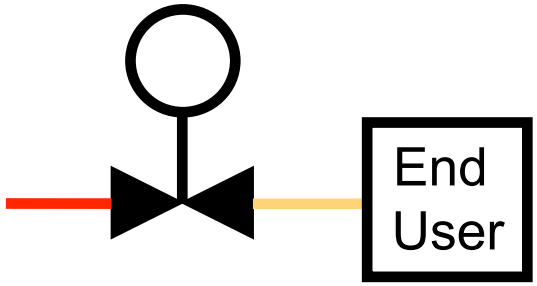


Energy Variables Review

Example:

Part load operation

Energy Performance Deterioration



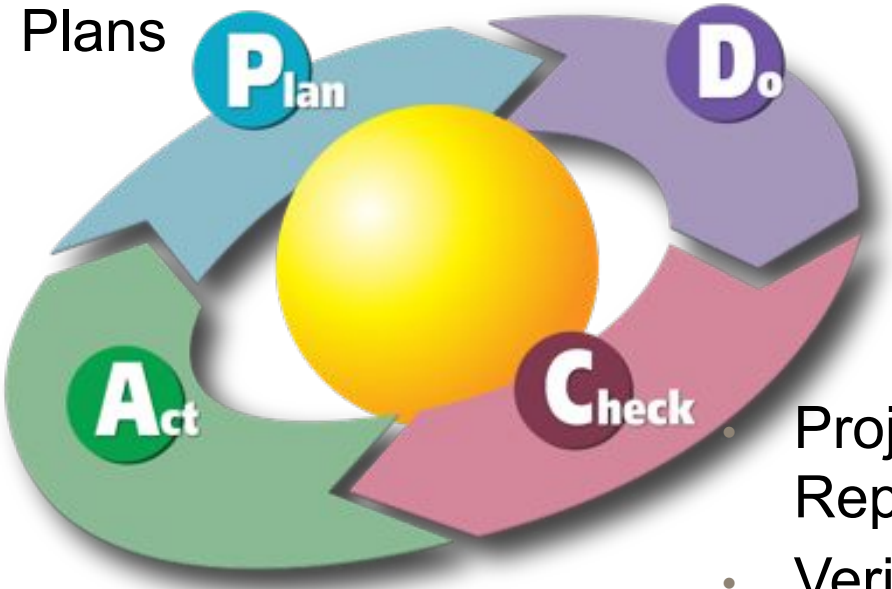
Other EED activities

- Procurement
  - Appointment of Suppliers
  - Procurement documentation
- EED Project Summary Report
  - Energy performance improvement
  - Costs
  - Lessons learnt

Continual Improvement

- Energy Balance Studies
- EED Execution Plans

- Energy Balance Studies
- Project Implementation



- Project Summary Reports
- Verification

- Standardise successful EED initiatives
- Standardise EnMS initiatives
- Challenge Corporate Standards and copy/paste designs
- Investigate new technologies/process

Continual Improvement

- Identify energy performance initiatives from recent design projects for standardisation.
- Identify energy performance initiatives within existing operations for consideration.
- Challenge corporate design standards or other constraints.
- Identify new, more energy efficient, technologies or processes for future design projects

Energy Venn Diagram

- Energy Venn Diagram: Way of visualising the factors that contribute to energy usage.
- Capacity to influence energy usage is highest at the energy service but diminishes as we move our from here.

Energy Venn Diagram

Layer	Definition	Example
Energy Service	The desired outcome that necessitates the usage of energy	Luminance level for office tasks
Process	The means by which the energy service is achieved	Natural/artificial lighting
Equipment	The constituent parts of the process	Fixtures, shading devices, sensors
Control	The control applied on the above equipment	Automation systems, switches
Operation and Maintenance	The ongoing operation and maintenance applied to the equipment	Optimal change out of light tubes, alignment to evolving occupancy patterns
Management	The ongoing management of the equipment including general housekeeping, logging etc.	Awareness campaigns, EPIs

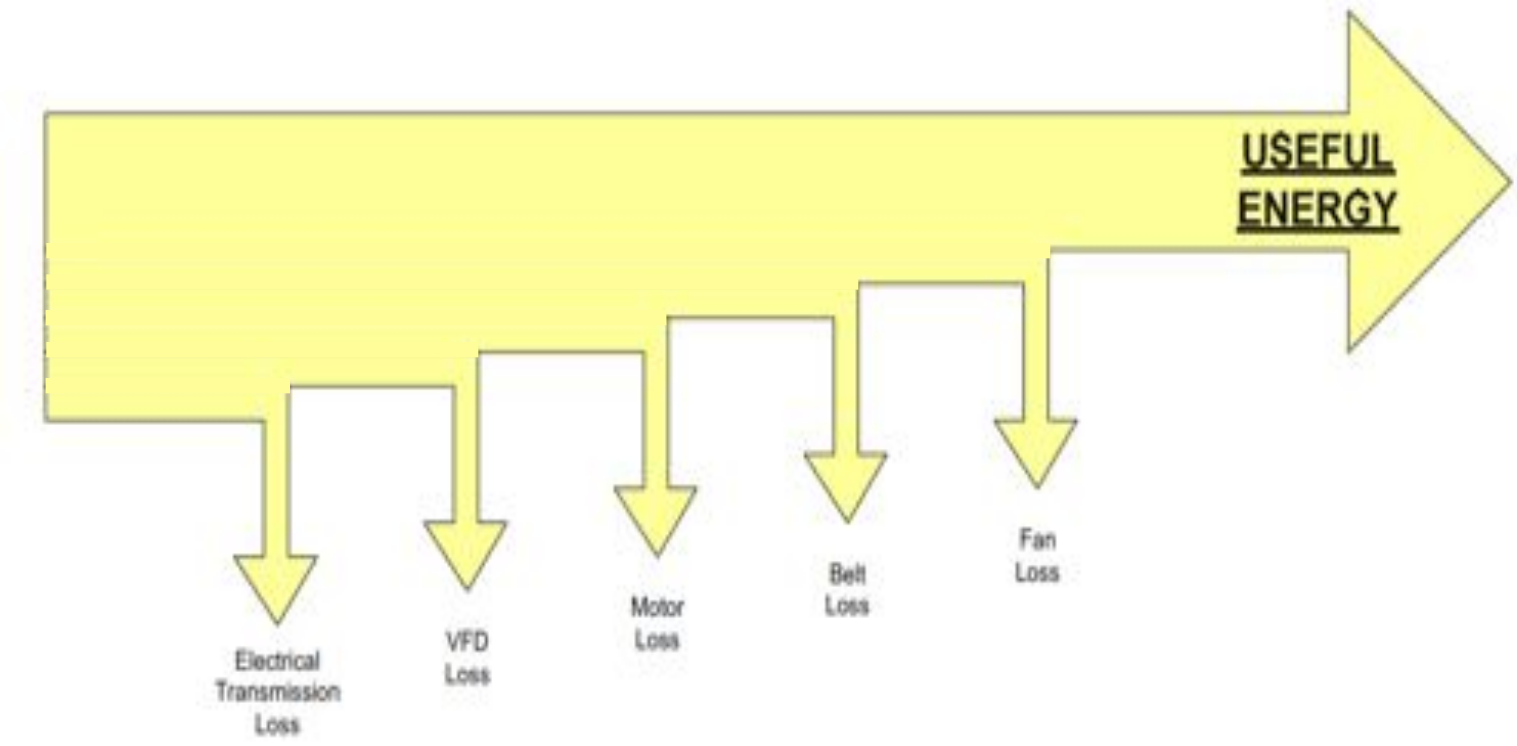
Guiding Principles of Energy Efficient Design

Optimise energy use and consumption in the following sequence;

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

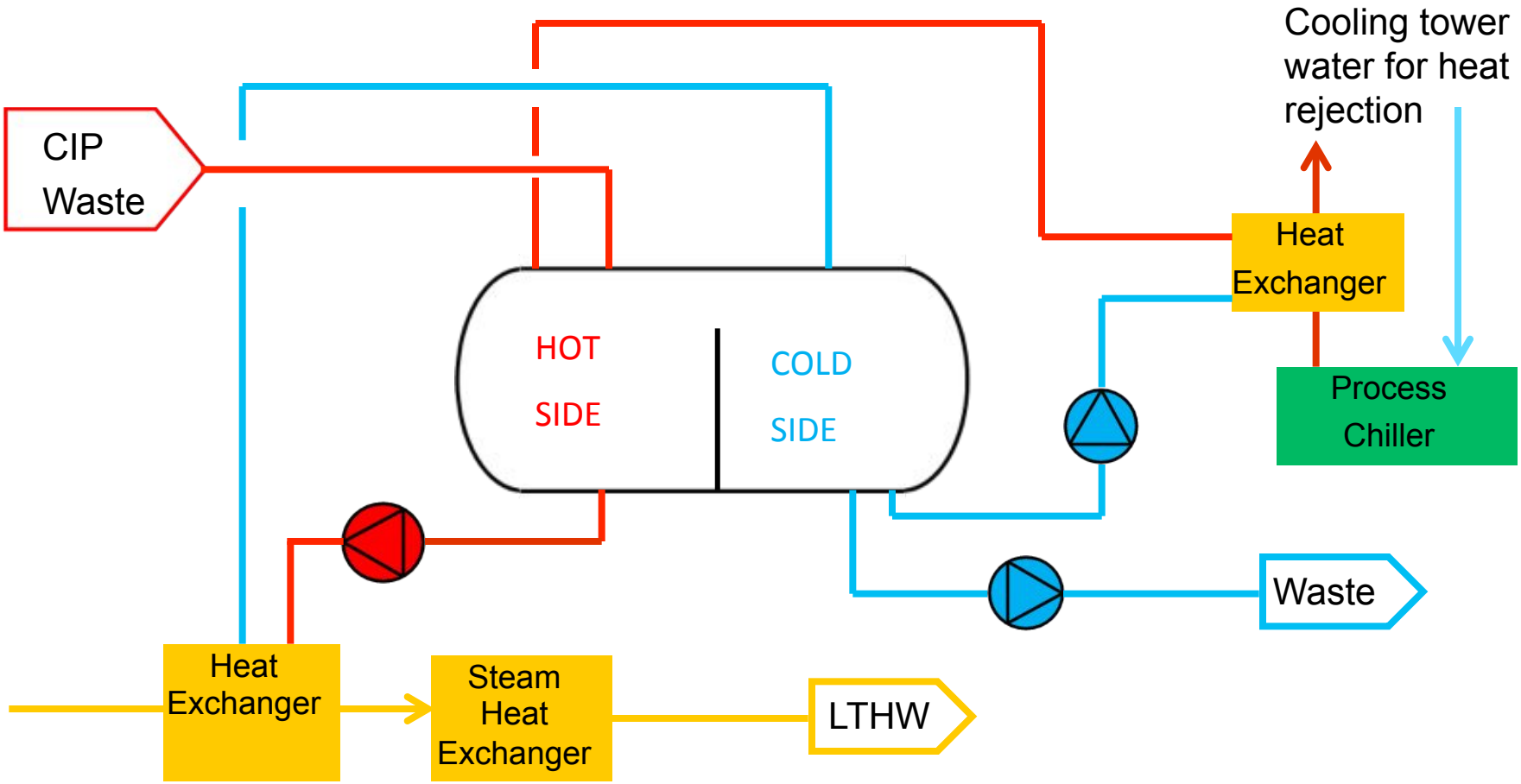
Guiding Principles of Energy Efficient Design

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



Guiding Principles of Energy Efficient Design

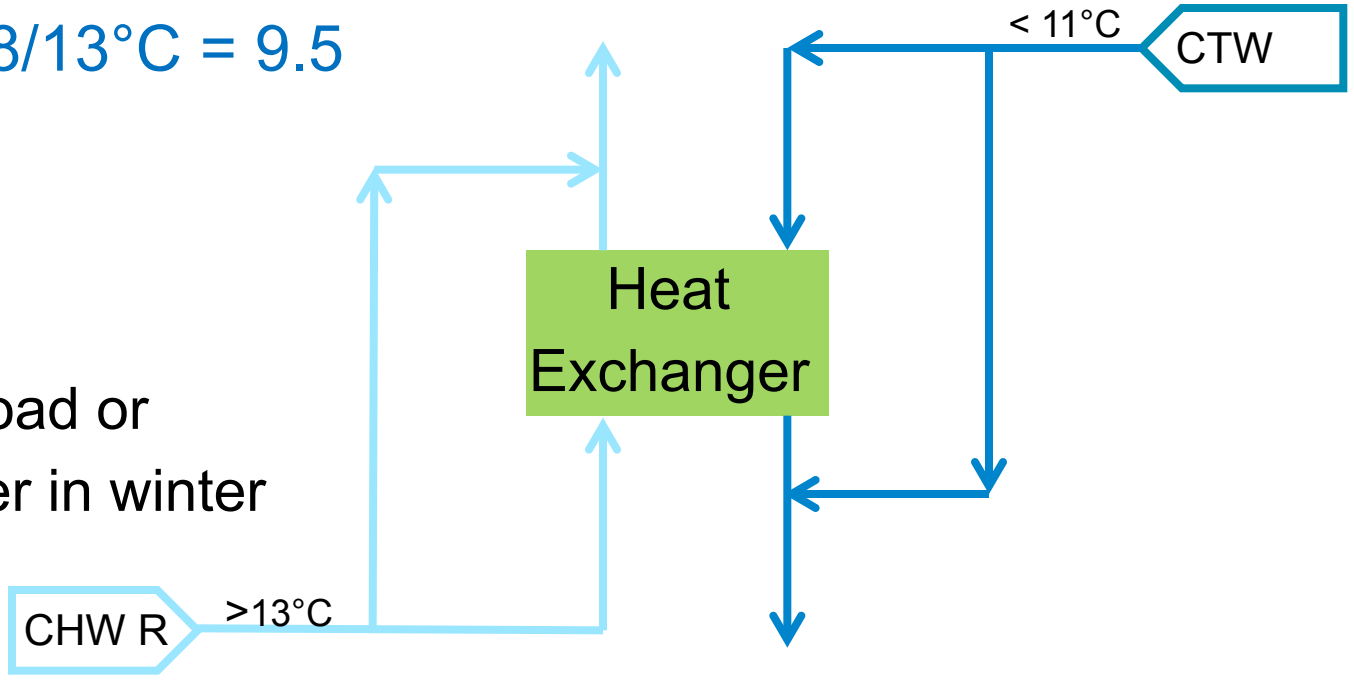
Exploit opportunities for energy recovery, for example by configuring working temperatures of various processes to effect energy recovery.



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: $X_1, X_2, X_3, X_1, X_4,\ldots$**
  - **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.