

**Workshop: Opportunities for financing energy efficiency projects in Macedonia,
Norsk Energi and Centre for Climate Changes - Macedonia**

Energy management improvement

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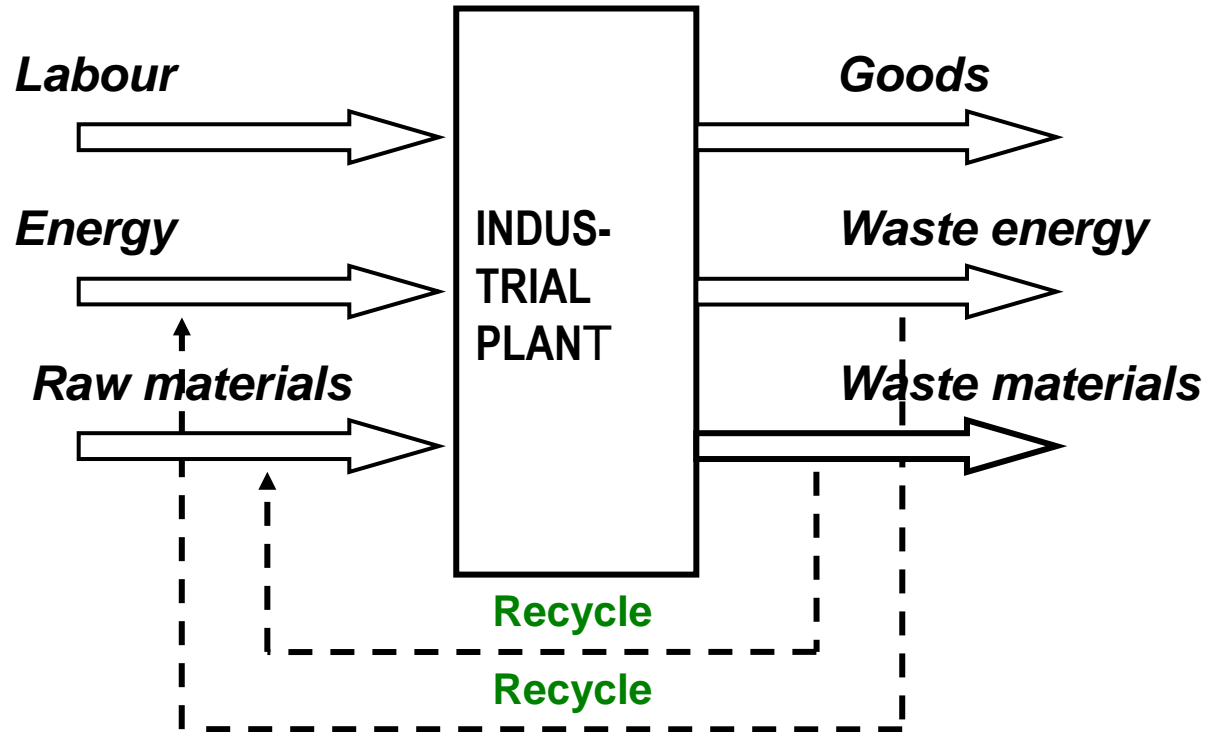
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Contents of the presentation

- **Some facts**
- **Guidelines for energy management**
- **How to establish an effective energy management**
- **Improving energy management**
- **Optimizing steam usage**

1. SOME FACTS

- Any application of the use of energy usually involves transformation between different forms of energy – a process known as energy conversion.
- Any conversion between different energy forms is imperfect.
- The converted energy output is lower than the energy input.
- The ratio: $\text{output energy} / \text{input energy}$ is a measure of energy efficiency
- Improving energy efficiency means using less energy to get the same work done.



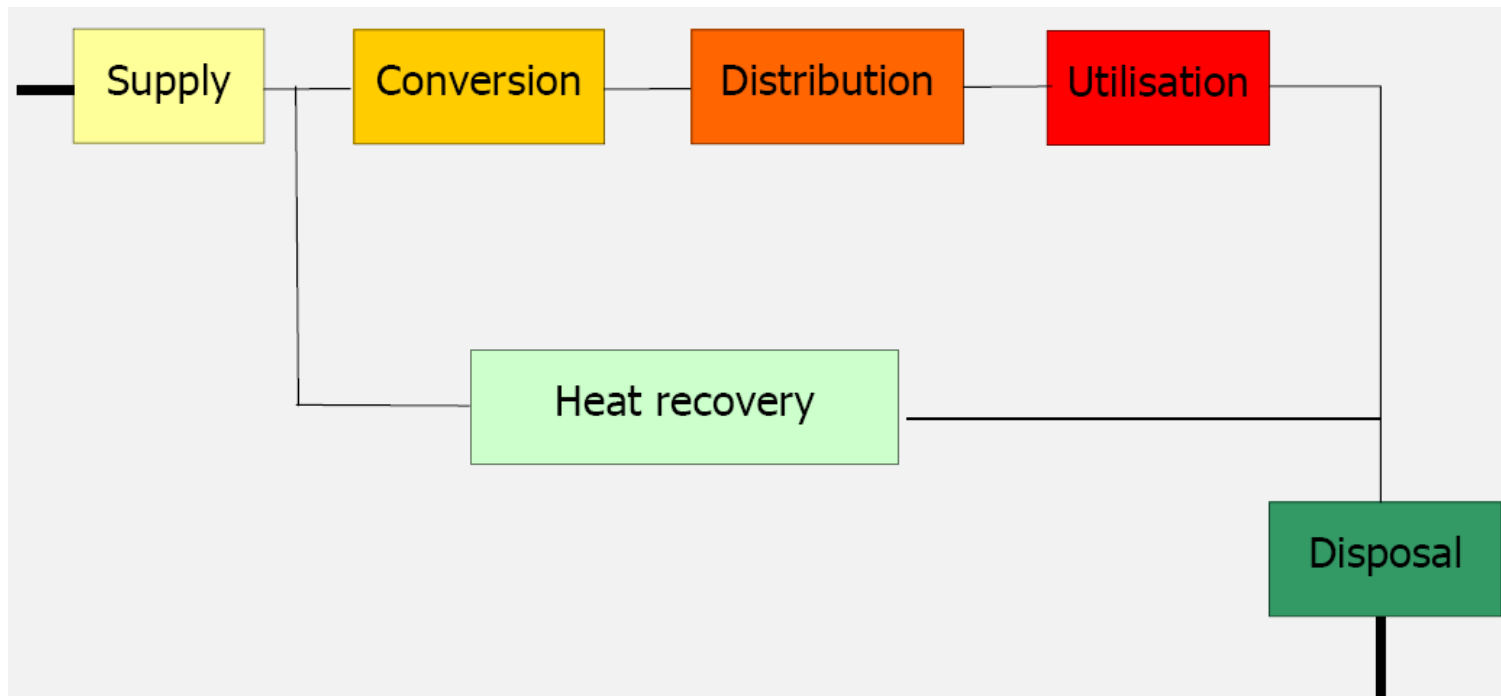
- On one side are inputs of raw materials, energy and labour, and on the other side are the output of goods, waste energy and waste materials.
- Manager goals: to maximise profits – to save energy!
- As energy is used more efficiently, product costs can be reduced and profits improved.

INDUSTRIAL PLANT AS A SYSTEM

In general, energy savings can be achieved by:

- Improving the energy conversion processes
- Recycling the waste energy
- Reusing the waste materials

STRUCTURE OF A CORPORATE ENERGY SYSTEM



INDUSTRIAL PLANT AS A SYSTEM

The ways in which energy can be saved can be classified into three general categories:

1) House-keeping measures

- **Better maintenance**
- **Optimisation of energy usage**
- **Improved production organisation**

2) Equipment and process modification

- **Equipment modification - can either be applied to existing equipment (retrofitting) or incorporated in the design of new equipment, or both.**
- **Process modification – can be made by changes in the process itself (to realizing greater efficiency) or by replacement of the process, producing the desired amount and quality of goods while using less energy**

3) Better utilisation of equipment

- **Careful examination of the production processes and proper sequencing of process operations.**
- **Rearranging schedules to utilise process equipment for continuous periods of operation, thus avoiding numerous short runs and minimising heat-up losses.**

INDUSTRIAL PLANT AS A SYSTEM – ENERGY EQUIPMENT

1) Thermal energy equipment

- **Fuels (storage and treatment) and combustion**
- **Boilers and heat exchangers**
- **Steam distribution and utilisation**
- **Furnaces and refractories**
- **Waste heat recovery**
- **Cogeneration**

2) Electrical energy equipment

- **Electricity**
- **Electric motors**
- **Compressors and compressed air**
- **Pumps and pumping systems**
- **Air conditioning and refrigeration**
- **Lighting**

3) Monitoring equipment

- **Electrical measuring instruments**
- **Thermometers**
- **Manometers**
- **Flow meters (water, steam, oil, gas, ...)**
- **Combustion analyzers**
- **Leak detectors**
- **Lux meters**
- **Tachometers**

2. GUIDELINES FOR ENERGY MANAGEMENT

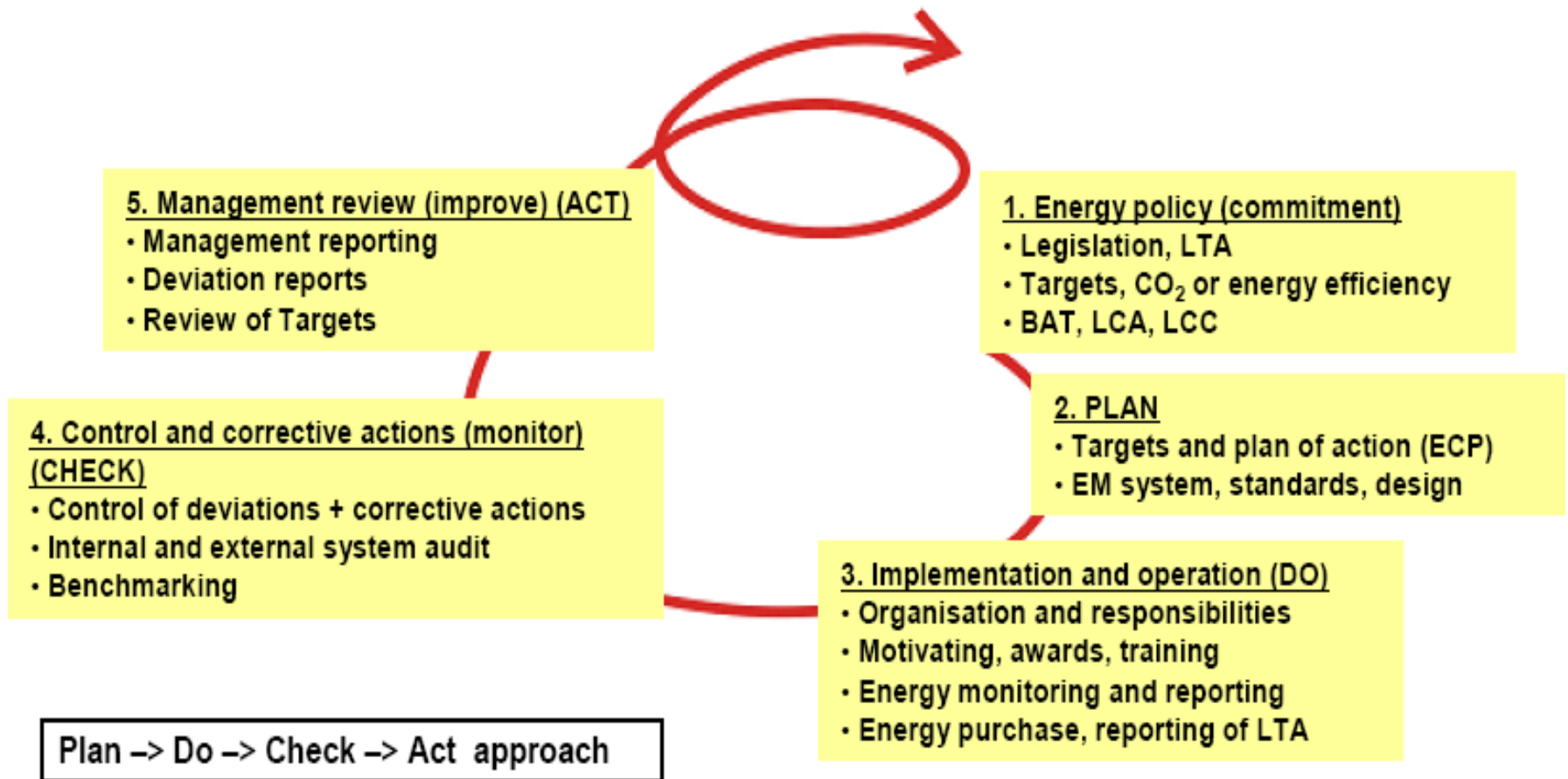
The following guidelines for energy management can assist any organisation in improving its energy and financial performance:

- 1. Make commitment**
- 2. Assess performance**
- 3. Set goals**
- 4. Create an action plan**
- 5. Implement the action plan**
- 6. Evaluate progress**
- 7. Recognise achievements**

Systematic approach:

Introduction of quality energy management is the main precondition for permanent improvement of energy use.

System approach – Permanent improvement of energy management



1. COMMIT TO CONTINUOUS IMPROVEMENT

To achieve continuous improvement it is necessary to form a dedicated energy team (appoint energy director and establish energy team) and institute an energy policy.

2. ASSESS PERFORMANCE

Assessing performance is the periodic process of evaluating energy use for all major facilities and functions in the organisation and establishing a baseline for measuring future results of efficiency efforts.

Key aspects include:

- Collect and document data over time
- Determine the starting point from which to measure progress
- Compare the energy performance of the facilities to each other and make priority list which facilities to focus on for improvement
- Compare energy data to other similar facilities (energy benchmarking)
- Analyse and evaluate the operating performance of facility systems and equipment to determine improvement potential

3. SET GOALS

To develop effective performance goals:

- Determine scope, identify organisational and time parameters for goals (What, Who, When?)
- Estimate potential for improvement
- Establish goals

4. CREATE ACTION PLAN

Successful organisations use a detailed action plan. The action plan is regularly updated on periodic (annual) basis.

The basic starting points for creating a plan are:

- Define technical steps and targets
- Determine roles and resources (determine who should be involved and what their responsibilities will be; estimate the cost for each item in terms of both human resources and capital outlay)

5. IMPLEMENT ACTION PLAN

To implement the action plan the following steps should be taken:

- **Create a communication plan**
- **Raise awareness**
- **Build capacity**
- **Motivate**
- **Track and monitor**

6. EVALUATE PROGRESS

Evaluating progress includes formal review of both energy use data and the activities carried out as a part of the action plan. Evaluation results and information is used to create new action plans and to set new performance goals.

Key steps include:

- **Set indicators: energy used per unit (mass, volume, number) product (kJ/t, kWh/t, ...)**
- **Measure results – Compare current performance to established goals**
- **Review action plan – understand what worked well and what did not in order to identify best practices**
- **Use BAT documents**

7. RECOGNISE ACHIEVEMENTS

Key steps in providing and gaining recognition include:

- **Providing internal recognition – to individuals, teams and facilities within organisation**
- **Receiving external recognition – from government agencies, media and other third party organisations that reward achievement.**

3. HOW TO ESTABLISH AN EFFECTIVE ENERGY MANAGEMENT

Independent of the company's size, a structured analysis of the energy system is very important. They include factors such as:

- Different energy sources such as: electricity, oil, natural gas, coal, etc.**
- These sources might have to be converted to a different form before they can be used, e.g. steam, hot water, hot oil, or compressed air.**
- There can have interaction between the different energy fluxes within the company. Waste heat from a process can influence the amount of required energy.**
- The development of the energy system is linked with the company's development.**

For all these reasons, it is of primary importance to get a general overview of the overall system before undertaking a detailed analysis.

ENERGY SYSTEMS MAY BE VERY COMPLEX!

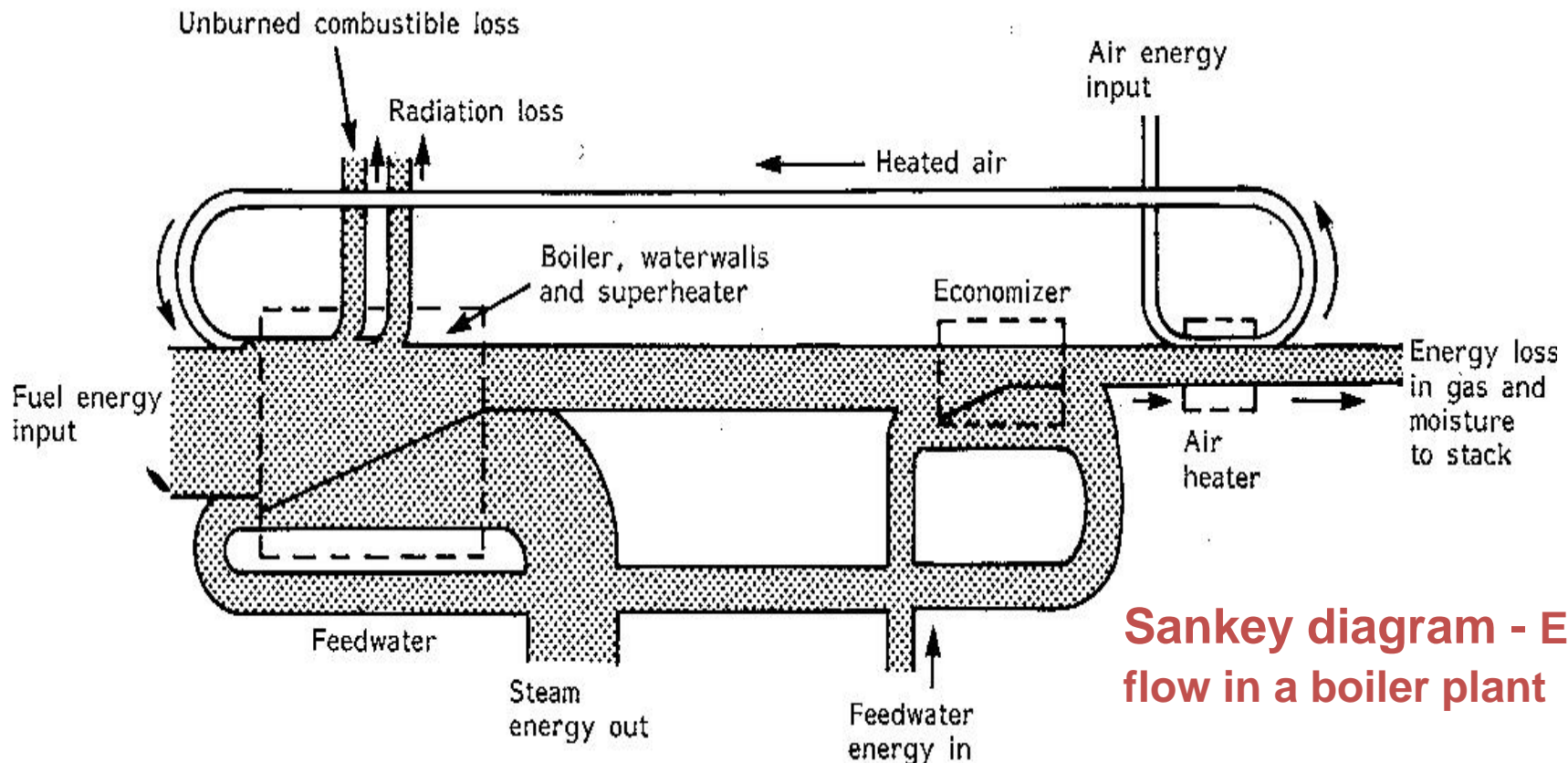
Due to the complexity of energy systems, it is recommended to follow a step by step approach:

- 1. Appoint an energy manager**
- 2. Define the goal of the analysis**
- 3. Define the system boundary**
- 4. Collect data**
- 5. Develop an Input-Output analysis**
- 6. Design a energy flow chart**
- 7. Set the basis for the Energy Information System (EIS)**
- 8. Prepare data and indicators**
- 9. Evaluate the performance of the energy management**

OUTCOME, RESULT

At the end, the organisation should have:

- An overview of the current energy system, the energy consumption, the associated costs and emissions;
- Identified biggest energy consumers and possible areas of improvement;
- Set a baseline for continuous monitoring



Sankey diagram - Energy flow in a boiler plant

4. IMPROVING ENERGY MANAGEMENT

1. ESTABLISH STANDARDS, THEN MEASURE, MEASURE...

“YOU CANNOT MANAGE WHAT YOU DO NOT MEASURE.”

Measuring the organisation's energy use is the first step to reducing it.

2. SET GOALS

Setting goals key to progress:

- Individual goals for each of the facilities
- Goal for a company-wide energy intensity reduction
- Goal for next year to reduce energy consumption by a certain percent

3. HOLD PEOPLE RESPONSIBLE

The most powerful supporters for the changes inside of the company are the employees. They are making choices that affect the company's overall energy use.

4. ESTABLISH A GOVERNANCE STRUCTURE

The governance structure is the most effective if it has support from the top management.

5. TAKE SEVERAL SMALL STEPS – THEY ADD UP

It is important to keep in mind that small changes can add up to make a significant impact.

6. INVEST IN ENERGY AND POWER SAVING TECHNOLOGIES

7. EXPLORE ALTERNATIVE ENERGY

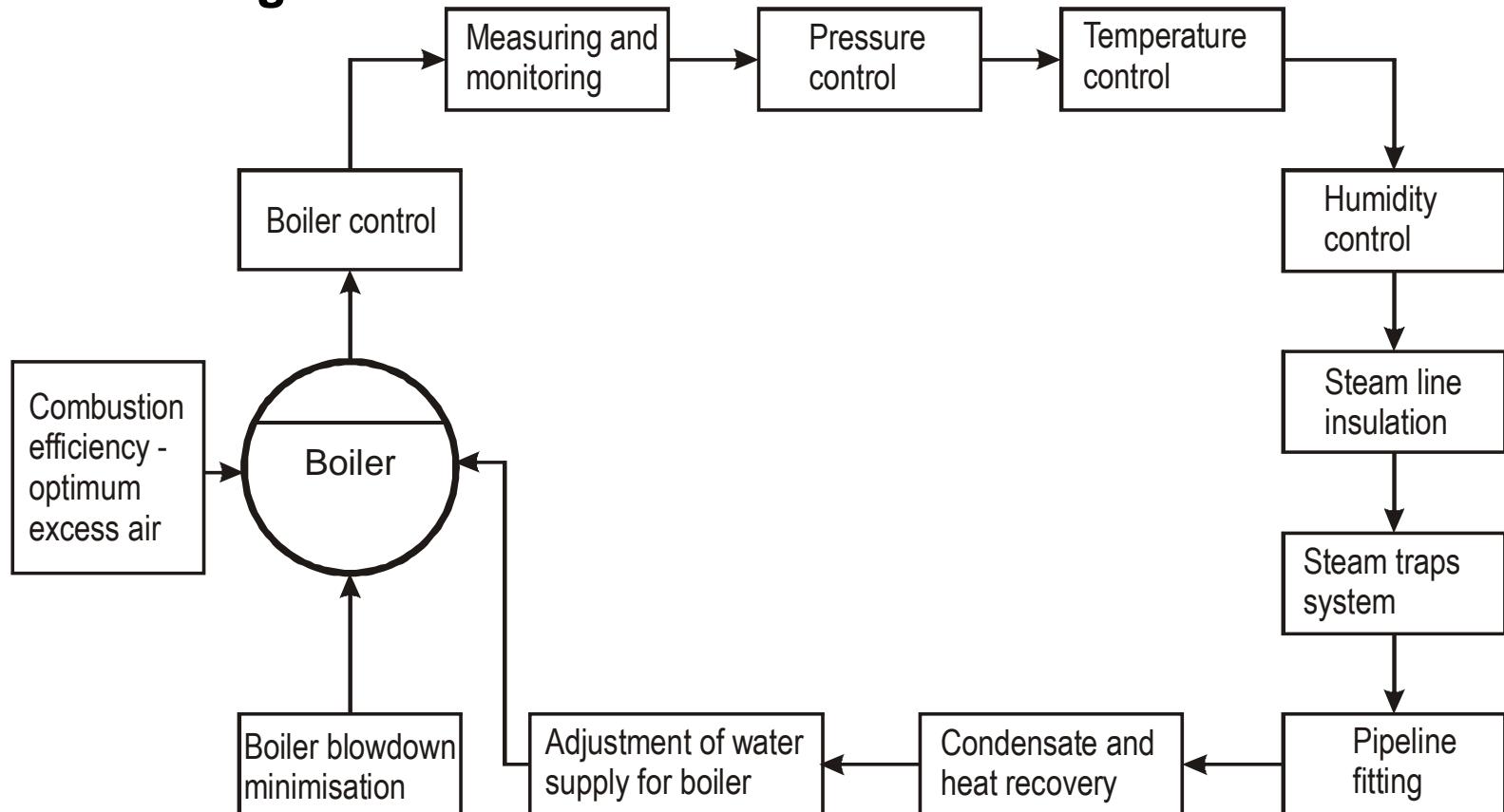
8. BE INNOVATIVE AND CREATIVE

5. OPTIMISING STEAM USAGE

One area of large energy saving potential in industrial sector is better utilisation of steam.

Reduction in energy use in steam systems can be accomplished by:

- Increasing the efficiency of the industrial boilers
- Improving the utilisation models (patterns) for steam
- Reducing steam losses



INCREASING THE EFFICIENCY OF THE INDUSTRIAL BOILERS

The areas which have major potential for efficiency improvements of the industrial boilers are:

- 1) Improving boiler operating cycles**
- 2) Improving maintenance**
- 3) Improving combustion control**
- 4) Installing heat recovery equipment**
- 5) Minimising radiation and convection losses**
- 6) Improving burners operation**
- 7) Minimising power consumption of auxiliary equipment**

IMPROVING THE UTILISATION MODELS FOR STEAM AND REDUCING STEAM LOSSES

- 1) Stop steam and condensate leaks**
- 2) Careful maintenance and frequent inspection, repairing and replacement of steam traps**
- 3) Steam condensate recovery and return to the boiler plant**
- 4) Proper maintenance of insulation – steam pipelines and condensate return pipelines**

CONCLUSION

Effective energy management – a way to improve energy, environmental and economic-financial performance of a company!

Thank You for Your attention!

