

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

# Sustainable Design

## Workflow

Authorized by Lars Munklee

[www.setatwork.eu](http://www.setatwork.eu)

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

# Course structure

1. Introduction
- 2. Workflow in Sustainable Design projects**
3. Tools for Sustainable Design
4. Integration with design practices
5. Organisation and stakeholders
6. Success with Sustainable Design

Authorized by Lars Munklee

2

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

# Agenda

- Introduction to concept
- Sustainable Design step by step
  - Baselineing
  - Analysis
  - Implement and quality assurance
- Case
- Why Sustainable Design is not widely used

Authorized by Lars Munklee

3

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Three phase concept

**Milestone deliveries**

- Phase three – Project benchmark
- Phase two – Saving catalogue
- Phase one – Baseline memo

4

Authorized by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Phases of Sustainable Design

- Phase 1 - Baseline
  - Mapping of energy consumption data
  - Analysis of project and energy needs
  - Identification of potential focus areas
- Phase 2 - Analysis
  - Analysis of energy services and technology
  - Optimisation of equipment and utility systems
  - Hand over the saving initiatives to design engineers
- Phase 3 - Implement and QA
  - Input to tendering and contracts
  - Quality assurance of projects
  - Evaluation of achieved savings

5

Authorized by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Phases of Sustainable Design

- **Phase 1 - Baseline**
  - Mapping of energy consumption data
  - Analysis of project and energy needs
  - Identification of potential focus areas
- Phase 2 - Analysis
  - Analysis of energy services and technology
  - Optimisation of equipment and utility systems
  - Hand over the saving initiatives to design engineers
- Phase 3 - Implement and QA
  - Input to tendering and contracts
  - Quality assurance of projects
  - Evaluation of achieved savings

6

Authorized by Lars Munklee

---

---

---

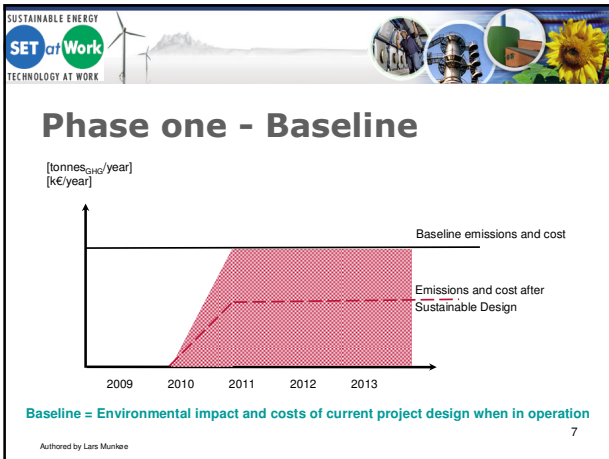
---

---

---

---

---




---

---

---

---

---

---

---

---

- 
- Baseline purpose**
- Defines project baseline design
    - Process
    - Utility systems
    - Operation key parameters
  - Quantifies environmental and energy costs of operation
  - Core of decision making basis
  - Essential for measuring achievements
- 8
- Authorized by Lars Munklee

---

---

---

---

---

---

---

---

- 
- Baseline tasks**
- Mapping of energy consumption data
    - Collect data
    - Make qualified assumptions
  - Analysis of project and energy needs
    - Assess data
    - Get the overview
  - Identification of possible focus areas
    - Decide where to spend resources
- 9
- Authorized by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Baseline structure

Utility unit costs

Production steps

Utility systems & infra structure

Operation schedules

Assumptions

Data assessment

Total operational costs (€/year, tonnes<sub>CO2</sub>/year)

Electricity (€/year, kW, MWh/year)

Thermal energy, heat (€/year, kW, MWh/year)

Cooling (€/year, kW, MWh/year)

Water (€/year, m<sup>3</sup>/h, m<sup>3</sup>/year)

10

Author: Lars Munklee

---



---



---



---



---



---



---



---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Case - Xanthan gum

- Extension project of industrial installation
- Fermented texturing agent for food products
- Used in e.g.
  - Pastry
  - Beverage
  - Toothpaste
- Produced in 120m<sup>2</sup> fermentors

11

Author: Lars Munklee

---



---



---



---



---



---



---



---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Case - Baseline

- Mapping of environment related production costs
- Breakdown of costs into
  - Resources
  - Processes
- Identification of possible focus areas

Heat

Electricity

Cooling

Water

Extraction line U1

Extraction line U2

Media preparation

IPA compressor (RMV)

Agitators

Air compressor

12

Author: Lars Munklee

---



---



---



---



---



---



---



---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Phases in Sustainable Design

- Phase 1 - Baseline
  - Mapping of energy consumption data
  - Analysis of project and energy needs
  - Identification of potential focus areas
- **Phase 2 - Analysis**
  - **Analysis of energy services and technology**
  - **Optimisation of equipment and utility systems**
  - **Hand over the saving initiatives to design engineers**
- Phase 3 - Implement and QA
  - Input to tendering and contracts
  - Quality assurance of projects
  - Evaluation of achieved savings

13  
Author by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Analysis - purpose

- Identify cleaner alternative processes/ design/ specifications to fulfil *process* requirements
- Improve energy performance of individual processes, equipment and systems
- Establish decision making basis for evaluating saving opportunities
- Agree with client on savings to implement

14  
Author by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Phase two - Analysis

- Agree on focus areas with client  
*(Sustainable Design projects have few resources)*
- Review focus areas for potential saving initiatives  
*(Address the core energy needs and involve required expertise)*
- Assess saving initiatives  
*(Get the buy-in from client and address all key issues and concerns)*
- Develop saving catalogue for client  
*(One saving initiative - one page)*

15  
Author by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Saving potentials

- Analysis uses onion diagram and main focus is energy services and process
- Optimisation of process equipment and utility systems are priority number two
- Control systems, operating strategies and maintenance should be addressed as third priority

16

Author: Lars Munklee

---

---

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Saving catalogue

- A decision making basis for clients
- Saving catalogue is a management document
- Good Sustainable Design practises address the core manufacturing process
- Utility system/building related savings should be addressed after the process needs analysis

17

Author: Lars Munklee

---

---

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Case – Focus areas

Time [h]	Pagitator [kW]
0	0
10	100
30	400
60	400

- Aerobe fermentation process is energy intensive
- Agitation and process air is 60% of total power consumption

18

Author: Lars Munklee

---

---

---

---

---


---


---

---

---

---

SUSTAINABLE ENERGY  
 TECHNOLOGY AT WORK



## Case – Saving opportunities

Baseline	Sustainable Design
4,5Bar process air to fermentors	Reduce air pressure at compressors to 1,2 bar
Air supply volumes to fermentors	Optimise air supply per batch
400kW agitators in fermentors	Optimised agitator design reduces motor sizes
Cooling of fermentors after SIP with compressed air	Cooling with cooling water in tank jackets
Waste heat sent to cooling towers or drain	Process integration from compressors and distillation column recovers energy

19  
Authorized by Lars Munklee

---

---

---

---

---


---


---

---

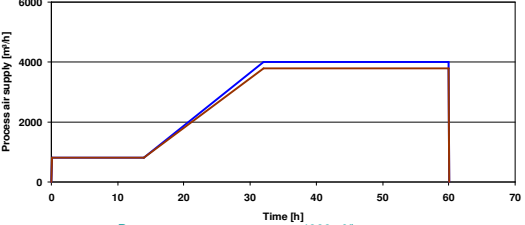
---

---

SUSTAINABLE ENERGY  
 TECHNOLOGY AT WORK



## Case – Fermentor air supply



Process parameter: 4000m<sup>3</sup>/h  
 Opportunity: 3800m<sup>3</sup>/h (no change on yield)  
 Savings: 5% per batch

20  
Authorized by Lars Munklee

---

---

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
 TECHNOLOGY AT WORK



## Phases in Sustainable Design

- Phase 1 - Baseline
  - Mapping of energy consumption data
  - Analysis of project and energy needs
  - Identification of possible focus areas
- Phase 2 - Analysis
  - Analysis of energy services and technology
  - Optimisation of equipment and utility systems
  - Hand over the saving initiatives to design engineers
- Phase 3 – Implement and QA
  - Input to tendering and contracts
  - Quality assurance of projects
  - Evaluation of achieved savings

21  
Authorized by Lars Munklee

---

---

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Implementation - Purpose

- Assure achieving the full saving potential for clients
- Improve environmental performance of equipment and systems specified in tenders
- Evaluate impact of sustainable Design activities
- Hand over saving initiatives to client or design company

22  
Author by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Implementation - tasks

- Input to tendering and contracts
  - Request suppliers to specify options for improved environmental performance
  - Review tendering documents for simple energy measures performance, e.g. EFF1 electric motors, insulation, etc.
  - Request suppliers to state annual operating costs and provide necessary information to get comparative response
- Quality assurance of projects
  - Review initiatives implemented in baseline scenario

23  
Author by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK

## Achieved savings

- Evaluate initiatives implemented and aggregate environmental savings, operation cost reductions and additional investments required
- For initiatives not implemented state comment on reasons and concerns in the saving catalogue

**Sustainable Design:**  
 -40% environment related operating costs  
 -60% greenhouse gas emissions  
 -32% fresh water consumption

24  
Author by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK



## Case – Achievements

- Implemented savings 32% of total energy costs
- Saving categories (value)
  - Power reduction 66%
  - Thermal energy reduction 33%
- Overall payback < 1 year



Authorized by Lars Munklee

---

---

---

---

---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK



## Common sense - so why not?

- Project management not responsible for future operating costs
- Uncertain process requirements
- Poor knowledge of potentials by using Sustainable Design
- Lack of know-how in engineering companies
- Copy-paste from previous projects prevents continuous improvement achievements

Authorized by Lars Munklee 26

---

---

---

---


---

---

---

---

SUSTAINABLE ENERGY  
**SET@Work**  
 TECHNOLOGY AT WORK



## The end

Thank you for your attention

Authorized by Lars Munklee 27

---

---

---

---

---

---

---

---