EU MERCI

EU coordinated **ME**thods and procedures based on **R**eal **C**ases for the effective implementation of policies and measures supporting energy efficiency in the **I**ndustry

Fostering the growth of energy efficiency in the EU industry

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Examples of "Good practices" in selected industrial sectors

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Webinar B

May, 5th 2017

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 693845

AGENDA

- The concept of “Best practice” and “Good practice”
- Glass sector
  - Overview of “Good practices” from literature
  - Selected “Good practices” from EU-MERCI dataset: Furnace cluster
- Paper sector
  - Overview of “Good practices” from literature
  - Selected “Good practices” from EU-MERCI dataset
- Cement sector
  - Overview of “Good practices” from literature
  - Selected “Good practices” from EU-MERCI dataset
- Conclusions

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The concept of "Best practice" from literature

"Best practice"

A best practice is a method or technique that has been generally accepted as superior to any alternatives because it produces results that are superior to those achieved by other means or because it has become a standard way of doing things

Technically feasible?

Economical?

Applicable?

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The concept of "Good practice"

"Good practice"

It is a technique or a methodology that, through experience and research, has been proven to reliably lead to a desired result with the minimum use of resources.

EFFICIENT

ECONOMICALLY FEASIBLE

TECHNICALLY FEASIBLE

Added value: "Good practices" taken from the

REAL WORLD → **WP5 Validation**

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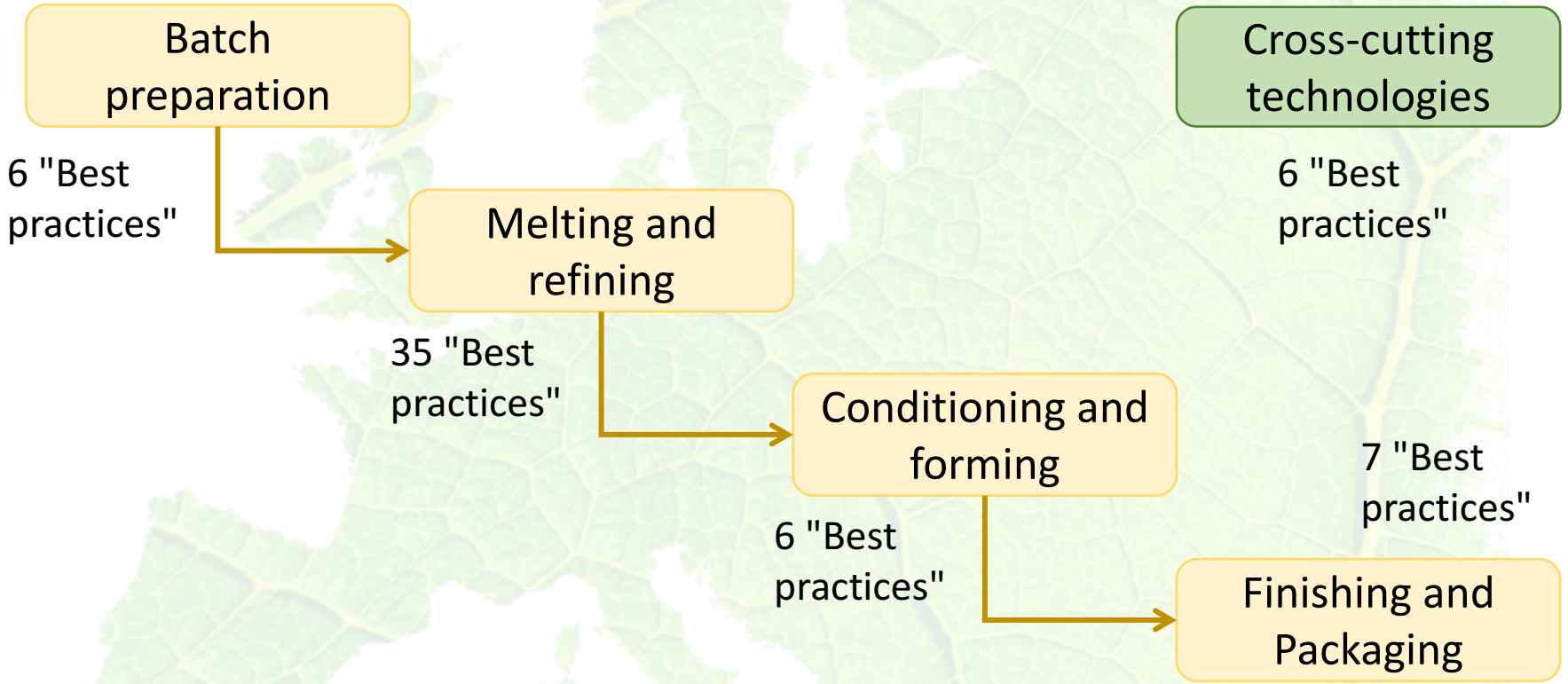
Glass sector: Overview of “Best practices" from literature

Total “Best practices” from literature: 54 sector-specific, 6 cross-cutting



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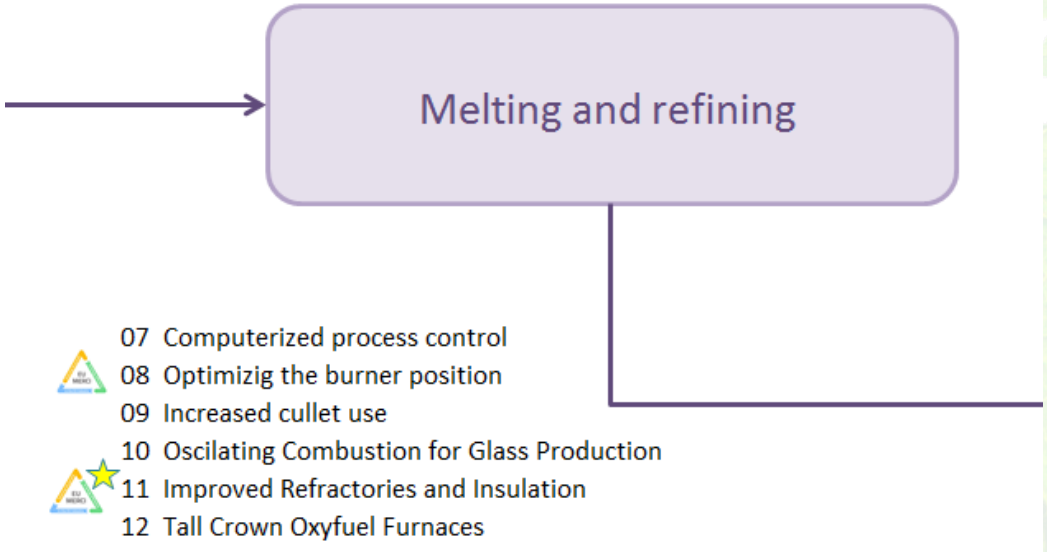
Glass sector: Overview of "Best practices" from literature



"Best practice" also available in EU-MERCI dataset

"Good practice" available in EU-MERCI dataset

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Glass sector - Selected "Good practices" from EU-MERCI dataset: Furnace cluster – Main process

Melting is the most energy-consuming process in Glass Production. 69 out of 148 records are classified in specific L2 taxonomy under «Melting and Refining».

Furnace cluster

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Glass sector - Selected "Good practices" from EU-MERCI dataset: Furnace cluster - Structure

- General description
- Different types of interventions (with description)
  - Replacement
  - Revamping
  - Introduction of Oxyfuel
- Applicability to the different types of furnaces
- Statistics about:
  - Energy Savings
  - Saved CO_2 emissions
  - Paybacktime and other economic indexes
- Comments

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Glass sector - Selected "Good practices" from EU-MERCI dataset: Furnace cluster - Example

Number of considered interventions (RSE dataset):

- Revamping: 23
- Replacement: 13
- Oxyfuel: 5

Different actions (3 to 8 actions for each record):

1. replacement of recuperative chambers;
2. surface insulation with more performing refractory material;
3. combustion optimization;
4. optimization of furnace regulation system;
5. re-layout of flue gas tubes;
6. re-layout of furnace geometry;
7. replacement of the burners in order to use low NOx burners;
8. sealing of expansion joints.

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Glass sector - Selected "Good practices" from EU-MERCI dataset: Furnace cluster - Example

Applicability of the actions to the different types of furnaces (example)

Revamping:

1. replacement of recuperative chambers → RECUPERATIVE FURNACE (n.a. when too high underground water level)
2. surface insulation with more performing refractory material → ALL TYPES
3. combustion optimization → ALL TYPES
4. optimization of furnace regulation system → ALL TYPES
5. re-layout of flue gas tubes →ALL TYPES
6. re-layout of furnace geometry → ALL TYPES
7. replacement of the burners in order to use low NOx burners → ALL TYPES
8. sealing of expansion joints → ALL TYPES

Replacement: ALL TYPES

Oxyfuel: not recuperative (oxygen is not pre-heated); availability of Oxygen supply in proximity of the plant.

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Glass sector - Selected "Good practices" from EU-MERCI dataset: Furnace cluster - Example

Statistics (average for the whole cluster)

Baseline: 10,000 toe/y

Energy savings: 2,200 toe/y

Energy consumption improvement: 25%

CAPEX for each saved CO_2 ton: 1,700 €/tonCO_2

Payback Time: 6 years

Comments

- Melting is a very energy intensive process: this clarifies why baseline and savings are so high;
- Energy consumption improvement is high due to the relative «age» of the replaced/revamped furnaces
- Payback time is high when compared to other sectors or measures but it is however about half of the life of a furnace

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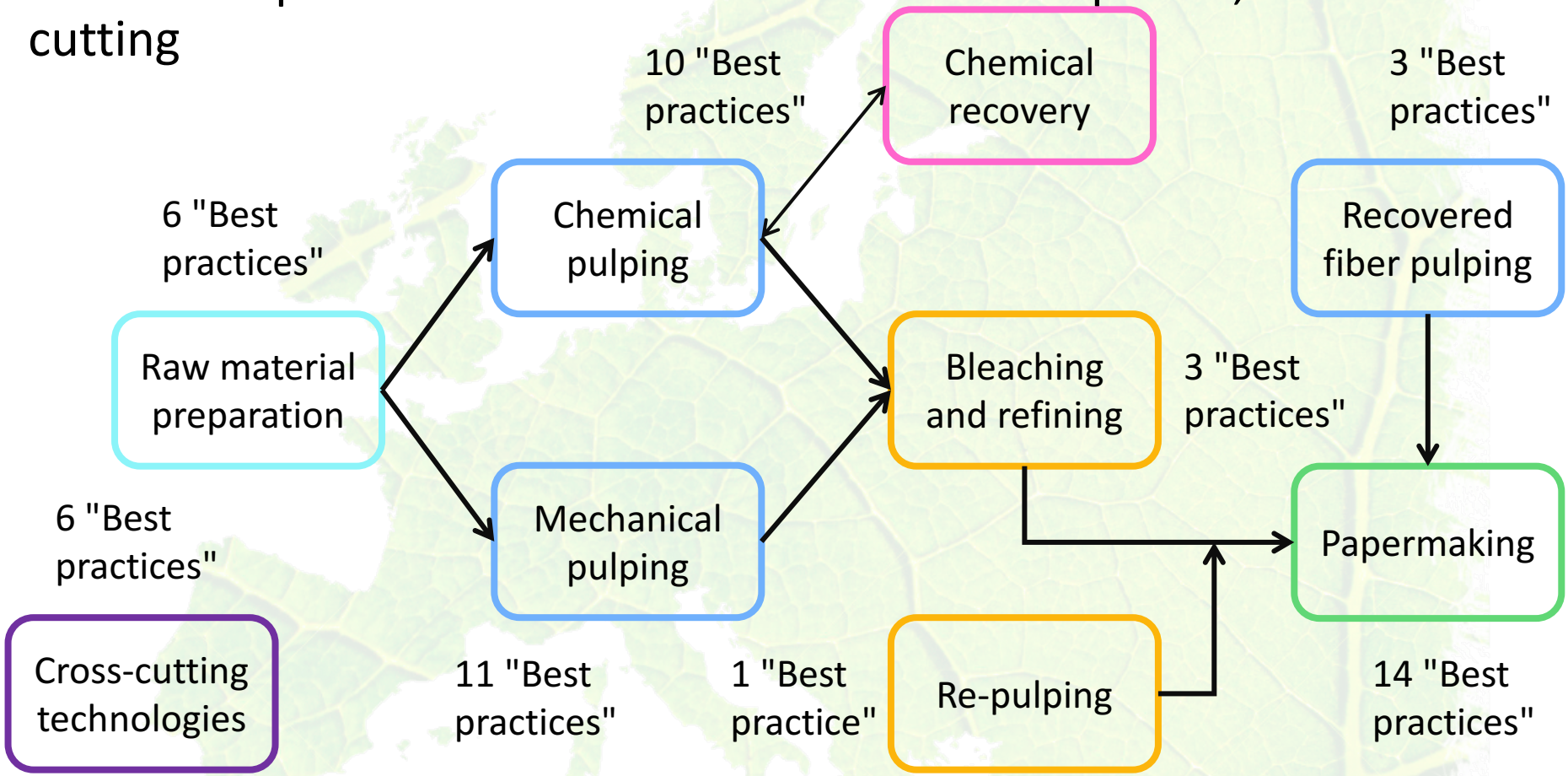
Paper sector: Overview of "Best practices" from literature

Total “Best practices" from literature: 48 sector-specific, 6 cross-cutting



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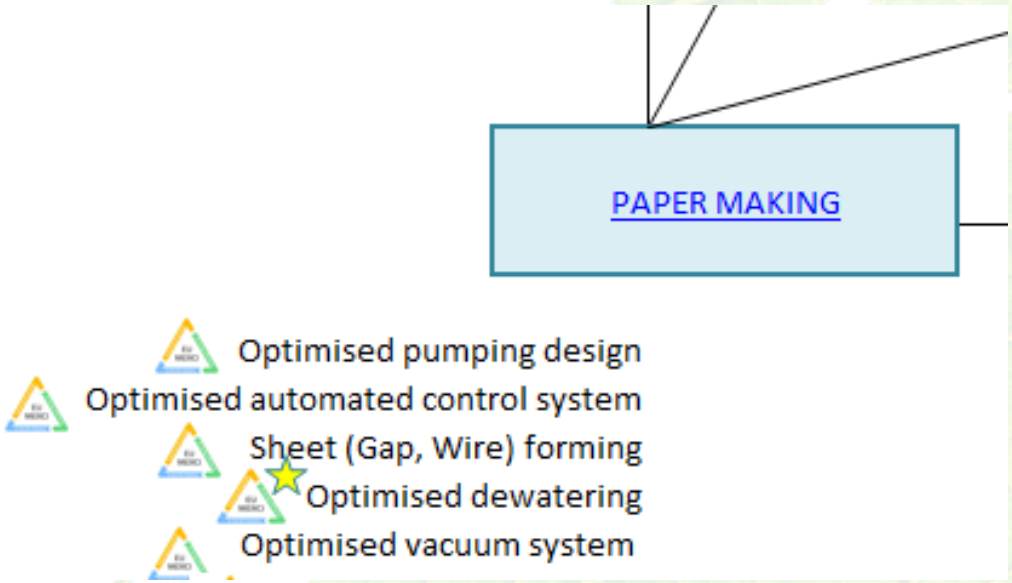
Paper sector: Overview of “Best practices" from literature



"Best practice" available in EU-MERCI dataset

"Good practice" available in EU-MERCI dataset

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Paper sector - Selected "Good practices" from EU-MERCI dataset – 1st example

Roll coating machines revamping through burners optimization

Type of measure: Combined (burners + inverters)

Subprocess: Papermaking – Roll coating

General description:

The intervention consists in the replacement of one of the 4 roll coating machines, in order to reduce natural gas and electricity consumption:

- new hot air system, with burners distributed in the drying tunnel in order to reduce heat loss and have a more homogeneous temperature distribution;
- air recirculation system;
- due to the new hot air system and the recirculation, reduction of the load on the fans, that are also equipped with inverters.

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Paper sector - Selected "Good practices" from EU-MERCI dataset – 1st example

Statistics

Baseline: 1,938 toe/y

Energy savings: 1,053 toe/y

Energy consumption improvement: 54%

CAPEX for each saved CO_2 ton: 3,098 €/tonCO_2

Payback Time: 10.5 years

Comments

- The measure is unique in the dataset, so upon engineering technical consideration has been evaluated as a «technical» good practice;
- Savings and consumption improvement are very high, so contributing positively to the objectives of the EU;
- Payback time is quite high, but this doesn't take into consideration the contribution of incentives, that, if correctly measured, can reduce it significantly.

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Paper sector - Selected "Good practices" from EU-MERCI dataset – 2nd example

Mechanical pulping defibration plate teeths

Type of measure: Single

Subprocess: Mechanical pulping

General description:

The intervention consists in the realization of a new defibration plate with teethed surface. This surface has improved cutting qualities and needs lower electricity to defiber the same amount of wood. The reduction of consumption is linked to the re-grinding phenomenon, that is the permanence of the pulp on the surface of the grinder, that increases electrical consumption. The new plate has a geometry that allows the pulp to be distributed on the sides of the grinder, so reducing re-grinding effect.

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Paper sector - Selected "Good practices" from EU-MERCI dataset – 2nd example

Statistics

Baseline: 5,883 toe/y

Energy savings: 1,150 toe/y

Energy consumption improvement: 20%

CAPEX for each saved CO_2 ton: 128 €/tonCO_2

Payback Time: 0.5 years

Comments

- The measure is unique in the dataset, so upon engineering technical consideration has been evaluated as a «technical» good practice;
- It is a simple measure that, with a low investment cost (low payback-time and low cost of investment per each ton of CO_2 saved), allows to reduce significantly the consumption of electricity.

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Paper sector - Selected "Good practices" from EU-MERCI dataset – 3rd example

Dual cleaner on drying section

Type of measure: Single

Subprocess: Drying section

General description:

Revamping of the drying section in order to improve the cleaning of the paper transport system and improve the heat exchange. The system foresees a dual cleaner. This allows to reduce energy consumption and to avoid contamination of the paper sheet with impurities on the transport system.

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Paper sector - Selected "Good practices" from EU-MERCI dataset – 3rd example

Statistics

Baseline: 10,311 toe/y

Energy savings: 661 toe/y

Energy consumption improvement: 6.5%

CAPEX for each saved CO_2 ton: 893€/tonCO_2

Payback Time: 2.7 years

Comments

- The measure is recurring at least 3 times in the dataset.
- It is very simple to implement, but it allows significant savings and it has a Payback time and CAPEX/CO_2 that are considered acceptable also with low or no incentives.

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Cement sector: Overview of “Best practices" from literature

Total “Best practices” from literature: 30 sector-specific, 6 cross-cutting

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Glass sector: Overview of “Best practices" from literature

Clinker Production and Cooling

11 Energy management and process control
12 Improved insulation
13 Combustion system improvements
14 Heat recovery for power generation
15 Addition of mineralizers
16 Low pressure drop cyclones for preheaters
17 Additional pre-heater stages
18 Converting to multistage preheater systems
19 Addition of precalciner to preheater kilns
20 Dry systems with preheaters & precalciner
21 Fluidized bed advanced kiln systems
22 High efficiency coolers
23 Optimized heat recovery
24 VSD in cooler fans

"Best practice" also available in EU-MERCI dataset

"Good practice" available in EU-MERCI dataset

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 1st example (furnace cluster)

Kiln heat recovery

Type of measure: single

Subprocess: Kiln sintering of materials
General Description:

Recovery of exhaust gas heat from the kilns during the production processes by installing a heat exchanger.
The heat may be used to pre-heat combustion air or as a supplementary source for heat drying process

Statistics (average):

Baseline: 105 toe

Energy savings: 203.5 toe/y

Energy consumption improvement: 21%

CAPEX for each saved CO_2 ton: 277.5 €/tonCO_2

Payback Time: 2.65 years

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 1st example (furnace cluster)

Kiln heat recovery

Comments:

-The measure is easily replicable and simple

-KPIs largely depend on the place of application of the recovered waste heat

-Baseline may be defined in different ways, or may not be defined at all

-The measures have acceptable PBT

-Low CAPEX-related KPIs

-The measure reoccurs at least 3 times in the dataset

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 2nd example

Sand milling plant optimization

Type of measure: single

Subprocess: Raw material grinding

General description:

Sand milling process optimisation replacement of the wet sand mixing plant with a dry sand mixing plant, with reduction of water and energy consumption, or by optimisation of the sand drying plant

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 2nd example

Sand milling plant optimization

Statistics:

Baseline: 625 toe

Energy savings: 281 toe/y

Energy consumption improvement: 40%

CAPEX for each saved CO_2 ton: 1,809 €/tonCO_2

Payback Time: 3.2 year

Comments:

-Large energy consumption improvement

-The measure reoccurs at least two times in the dataset

-Single,easily-replicable measure, which largely influences the energy efficiency of the subprocess

-Acceptable PBT

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 3rd example

Sand stockpile dewatering system

Type of measure: Single

Subprocess: Raw materials storage

General description

Sand stockpile dewatering system was installed. Thanks to the measure, the moisture amount of sand entering the process was lowered. Thus, the thermal energy demand for the drying process was lowered.

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 3rd example

Statistics:

Baseline: 1,955.7 toe

Energy savings: 72.2 toe/y

Energy consumption improvement: 4%

CAPEX for each saved CO_2 ton: 123.4 €/tonCO_2

Payback Time: 0.4 year

Comments:

-The measure is unique in the dataset.

-The Baseline is related to the sand drying process. Thus, the improvement seems relatively small.

-This measure is simple, replicable, has low investment cost and PBT.

-It is a further improvement of the sand storage cement production phase

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 4th example

Raw material preparation fuel replacement (RES cluster)

Type of measure: Single

Subprocess: Raw material drying

General description:

Fuel replacement in the raw materials preparation system. Fossil fuel – natural gas replaced with solid biofuels, like biomass – wood chips for supplying thermal energy to the raw material drying processes.

Statistics (average):

Baseline: 15,254 toe

Energy savings: 1,550 toe/y

Energy consumption improvement: 7%

CAPEX for each saved CO_2 ton: 53 €/tonCO_2

Payback Time: 0.4 year

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Cement sector - Selected "Good practices" from EU-MERCI dataset – 4th example

Raw material preparation fuel replacement (RES cluster)

Comments:

-Small or no PES – the same amount of energy is produced from different sources. It is still a good practice – biomass and other biofuels are considered '0 emmision fuels'

-Low investment costs, low PBT

-All the measures are largely replicable

-At least 3 similar records in the dataset.

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Conclusions and wrap-up

- Good practices can be defined in different ways: a first approach is to use KPIs, but also engineering expertise and statistic relevance shall be taken in consideration (some identified GPs recur several times in the dataset, some others are recurring only once but show very good performances). Using only KPIs as the way to choose "Good practices" may lead to choosing common practices (such as the installation of Variable Spees Drives or LEDs) which are largely standardized and not so innovative.
- For some sectors (e.g. Glass, Cement), there is a process that is much more energy-intensive than others: the decision has been to collect all the GPs related to such processes into clusters, that are then split into the most relevant technologies.
- Some practices, that are good both in terms of “energy” and “environmental” KPIs and engineering evaluation, show very high investment costs → higher incentives might be needed.
- Good practices related to Renewable Energy Sources are treated in a separate cluster, as KPI-based analysis in their case leads to their rejection regardless of their enviromental impact (eg. Fuel switches having 0 PES)

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Useful documents

All the information contained in this presentation will be made available in the following Deliverables:

- **D4.2**: Picture of efficiency projects implemented by the Industry sector-by- sector and process-by-process
- **D4.3**: Best practices of efficiency-aimed designs and implementations and integration in the EU context
- **EU-MERCI portal** (under construction)

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