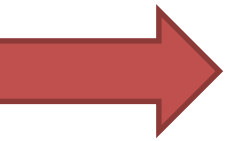
TEST Step 3 - Performance evaluation



	Step	Purpose
DO	**2. SUPPORT AND OPERATION**	Implementation of the **TEST action plan** including improvement measures and monitoring to increase performance in resource use.
CHECK	**3. PERFORMANCE EVALUATION**	Measuring and evaluating performance of important material and energy flows.
ACT	**4. IMPROVEMENT**	**Reflection on experience gained and integration of TEST into business strategies and operations.**
FOLLOW-UP AND CONTINUOUS IMPROVEMENT		

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P 3 – Performance evaluation (Monitoring)

How to use the established information system on resource efficiency to monitor, analyse and evaluate performance for continuous improvement?

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

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Table of contents

- Information system on flows already built
- Overview of step 3
- Three illustrative case studies (dairy, plastic company, beverage company)
- Exercise
- Detailed case study - cooling

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Purpose of an information system on flows

1. **Monitor overall enterprise performance** at the level of selected priority flows utilizing KPIs

1. **Measure the performance of key consumers** through OPIs, for:
   - understanding causes of inefficiency and implementing corrective measures
   - planning and setting up new targets

2. **Verify improvements in performance and savings** compared to expected benefits deriving from the implemented resource efficiency measures (TEST action plan)

1. **Make people who influence resource efficiency and pollution generation accountable** at all levels

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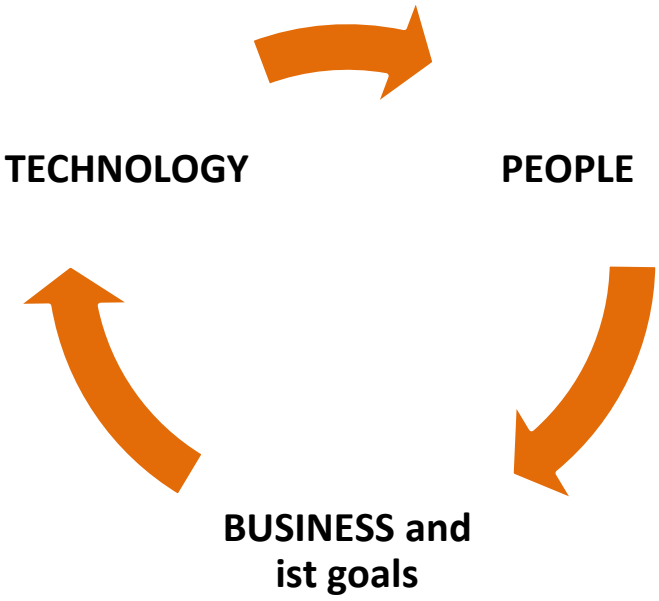
Information System on flows is build through steps 1.4 – 2



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Building an information system at different levels

Level	Purpose of monitoring	Types of indicators	Source of information	Ref. TEST step
Enterprise system boundary	Monitor material and energy flows and pollution generation (including NPOs) both volume and cost, against enterprise goals Benchmarking	Absolute KPIs Relative KPIs KPIs (both absolute and relative) for NPO costs	Bookkeeping Invoices and meters Stock management Production planning system Production statistics	**1.4 – Identifying NPOs costs and the priority flows**
Focus areas	Monitor material and energy flows (including NPOs), both volume and cost, at the level of specific focus areas	Relative OPIs Relative OPIs for NPO cost	Sub-metering system Cost accounting Waste bills	**1.5 – Setting up focus areas**
Key consumers	Monitor results of improvement measures Understand causes of inefficiency and implement corrective measures	Relative OPIs Water recovery % Yield Savings	Sub-metering system	**1.6 –Revealing sources and causes of inefficiency** **1.7 – Options generation and feasibility analysis**

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Overview of Step 3

Inputs	Activities	Outputs
Baselines calculated in steps 1.4, 1.5, 1.6 and 1.8 Information system on flows installed in step 2. Existing procedures for data collection, documentation and reporting Enterprise staff trained in monitoring and evaluation as part of implementation of information system on flows in step 2.	Compile data as per monitoring performance procedures set in the information system Analyse data and calculate KPIs and OPIs set up in the planning phase Compare actual performance report to the company's smart objectives Evaluate results Conduct management review for performance evaluation Establish new baselines of performance indicators	Routine monitoring in place (following operation control) Values of KPIs and OPIs for actual company performance Trends in resource efficiency performance Management review for performance evaluation New baseline of performance indicators (KPIs and OPIs) Reporting monitoring results to stakeholders.

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Elements of existing information system

- A set of resource efficiency indicators linked to important flows at the level of the whole company as well as to productivity bottlenecks at operational level
- Installed measurement devices (both hardware and software)
- Routine procedures for measuring, recording and analysing specific data in the production and accounting departments (MFCA recommendations)
- Monitoring plan with frequency and responsibilities for monitoring, which has been designed in step 1.8 and implemented in step 2.

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Use of information system in step 3

- Already established information system is used to measure real performance and improvements resulting from the implementation of RECP measures
- Comparing with the initial baselines is required.
- Results of this analysis are then used:
  - **as a feedback by those who operate the technology**
  - **for review of internal processes by company management**
- Monitoring requires internal human resources who should be trained on how to operate the information system, in close cooperation between engineers and accountants.

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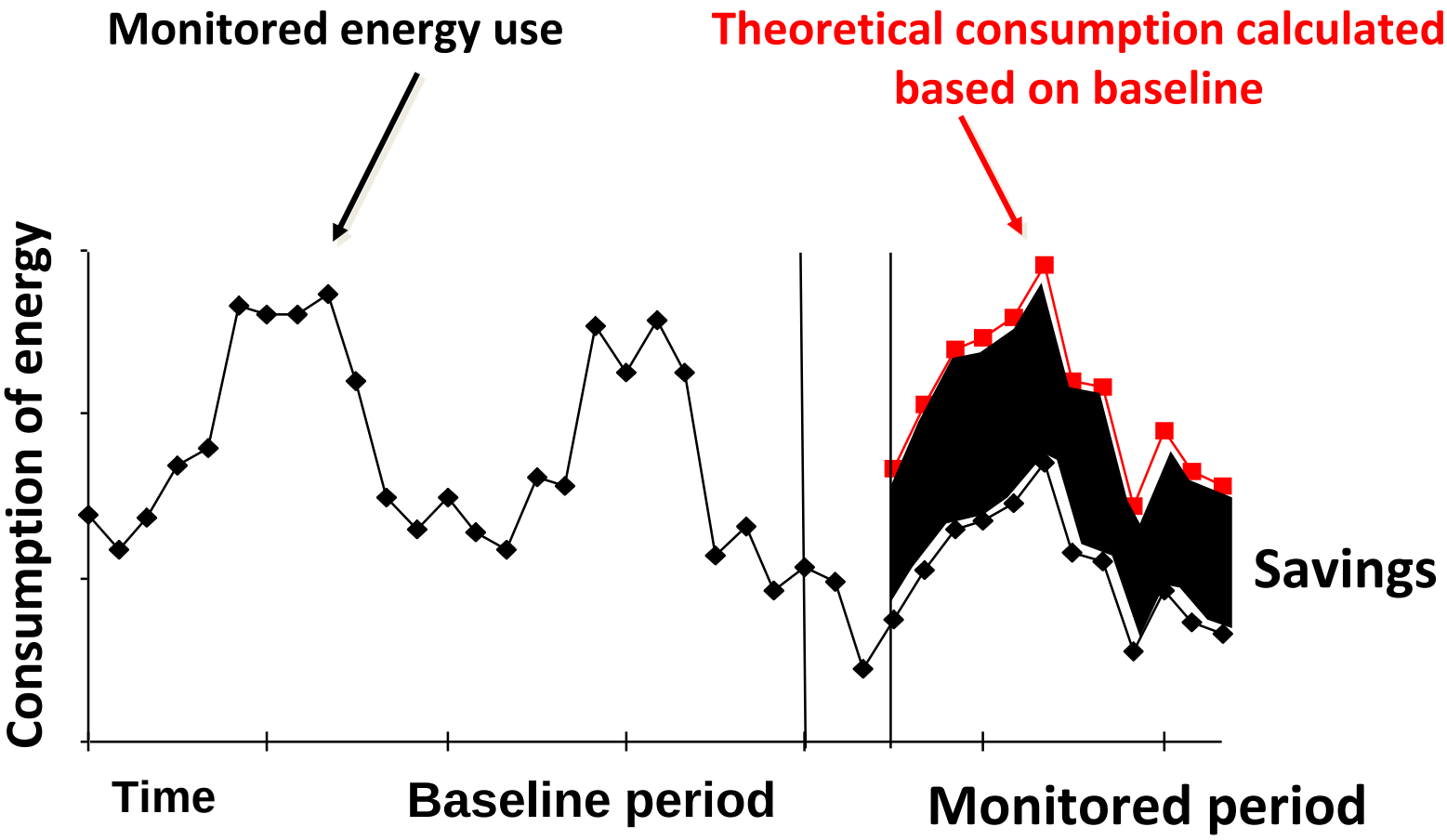
Importance of Baseline



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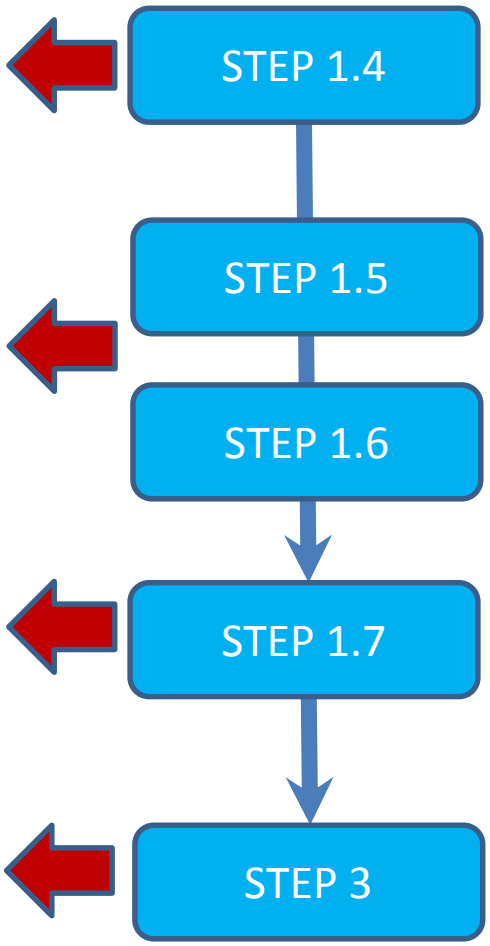
Setting up BASELINES for monitoring resource efficiency at different levels:

1. **Overall enterprise performance** for priority flows utilizing KPIs

1. **The performance of key consumers** using OPIs

1. **Calculation of performance improvements** and setting up **monitoring plan**

1. **Monitoring actual performance**



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MONITORING AND TARGETING

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Definition

M&T (TOOL) is based on setting up an effective information system to monitor the **efficiency of use** of energy and material flows

It enables **accountability of people** influencing resource efficiency and **monitoring of implemented measures**

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M & T

MONITORING and TARGETING

- Data collection

(consumption, production, other factors influencing consumption)

- Data analysis

  Understanding causes

- Accountability
- Measures
- Implementing and sustaining change

M&T TOOL

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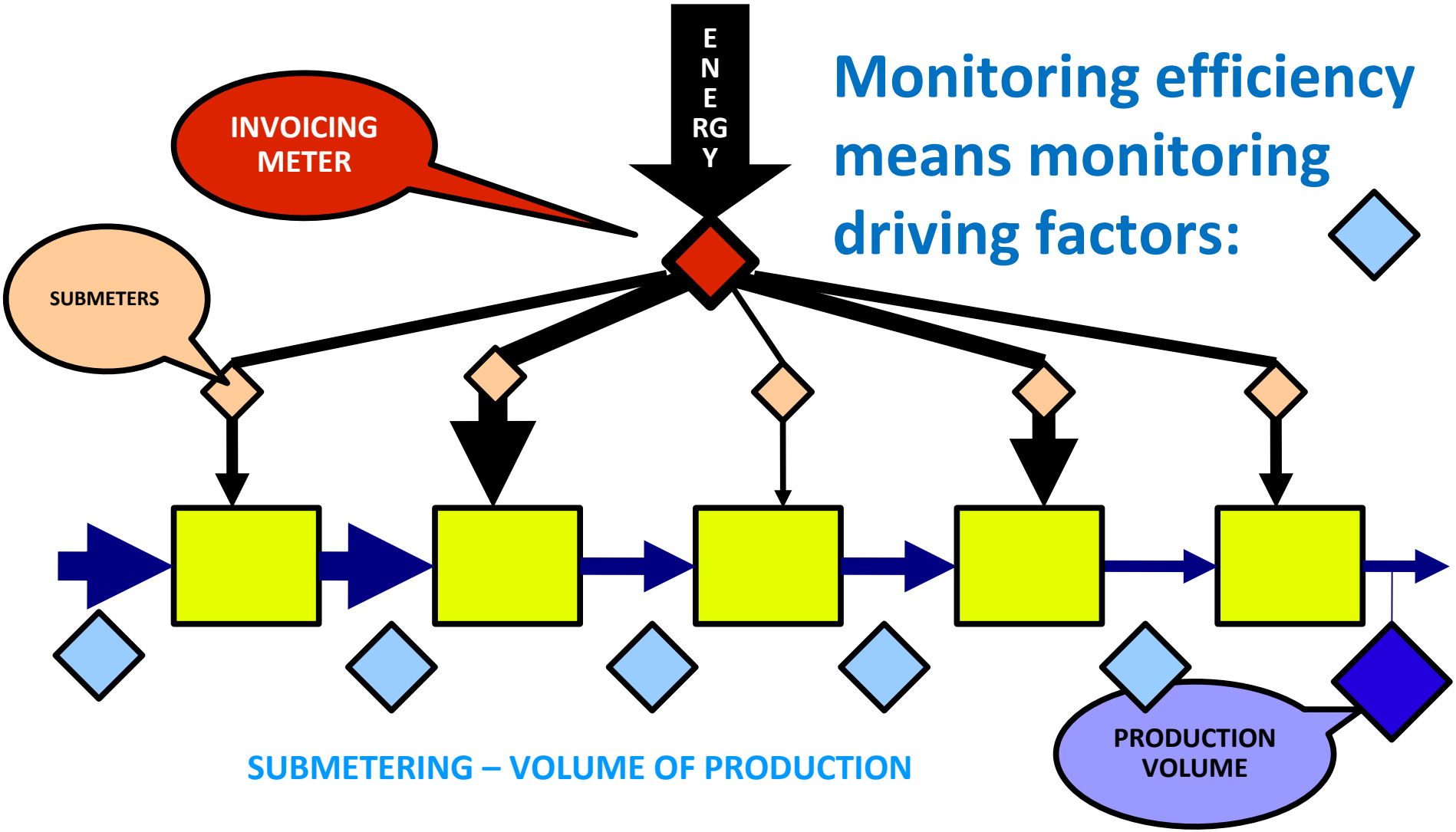
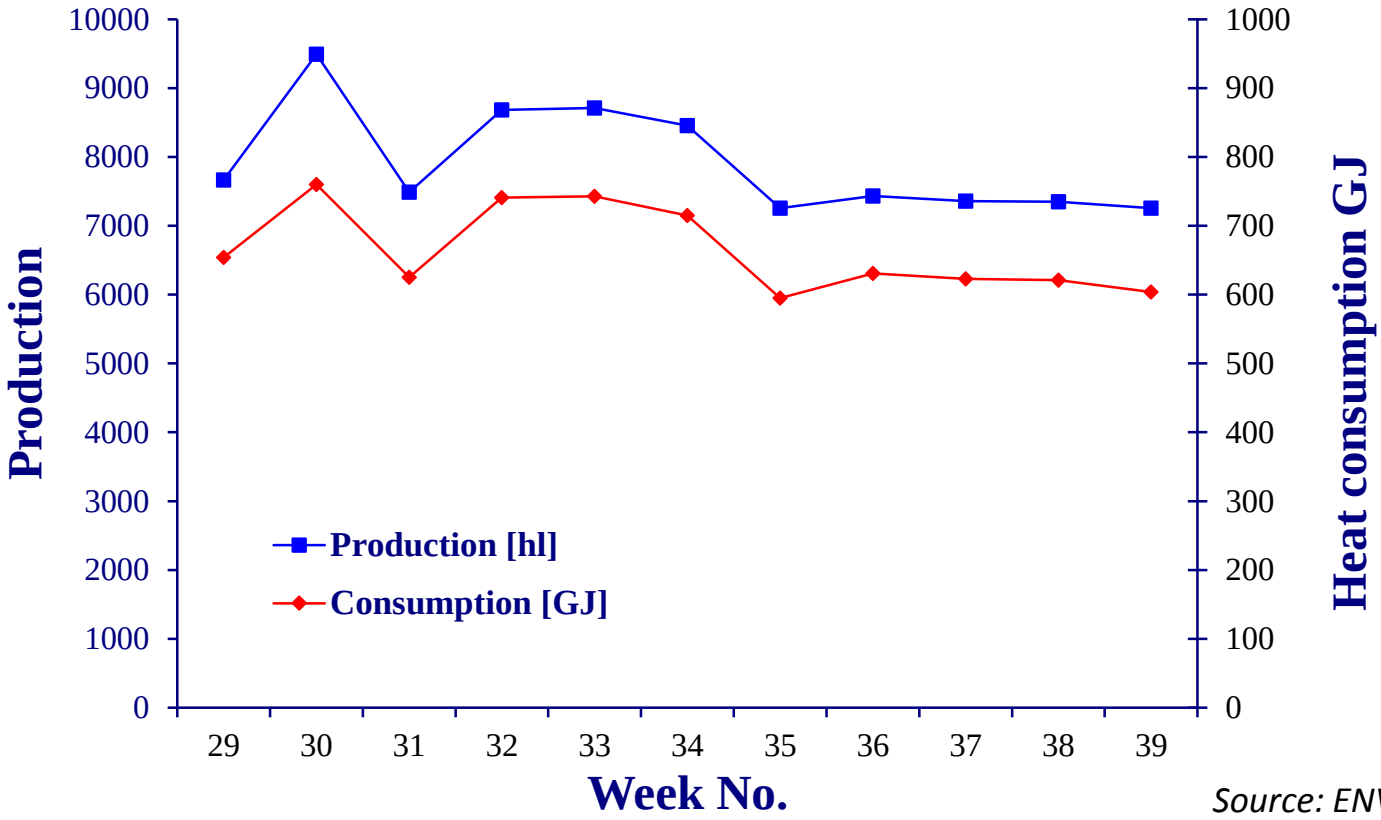
Monitoring efficiency means monitoring driving factors:



Specific cost centre:

Monitoring - example

Use of heat in drink production



Source: ENVIROS

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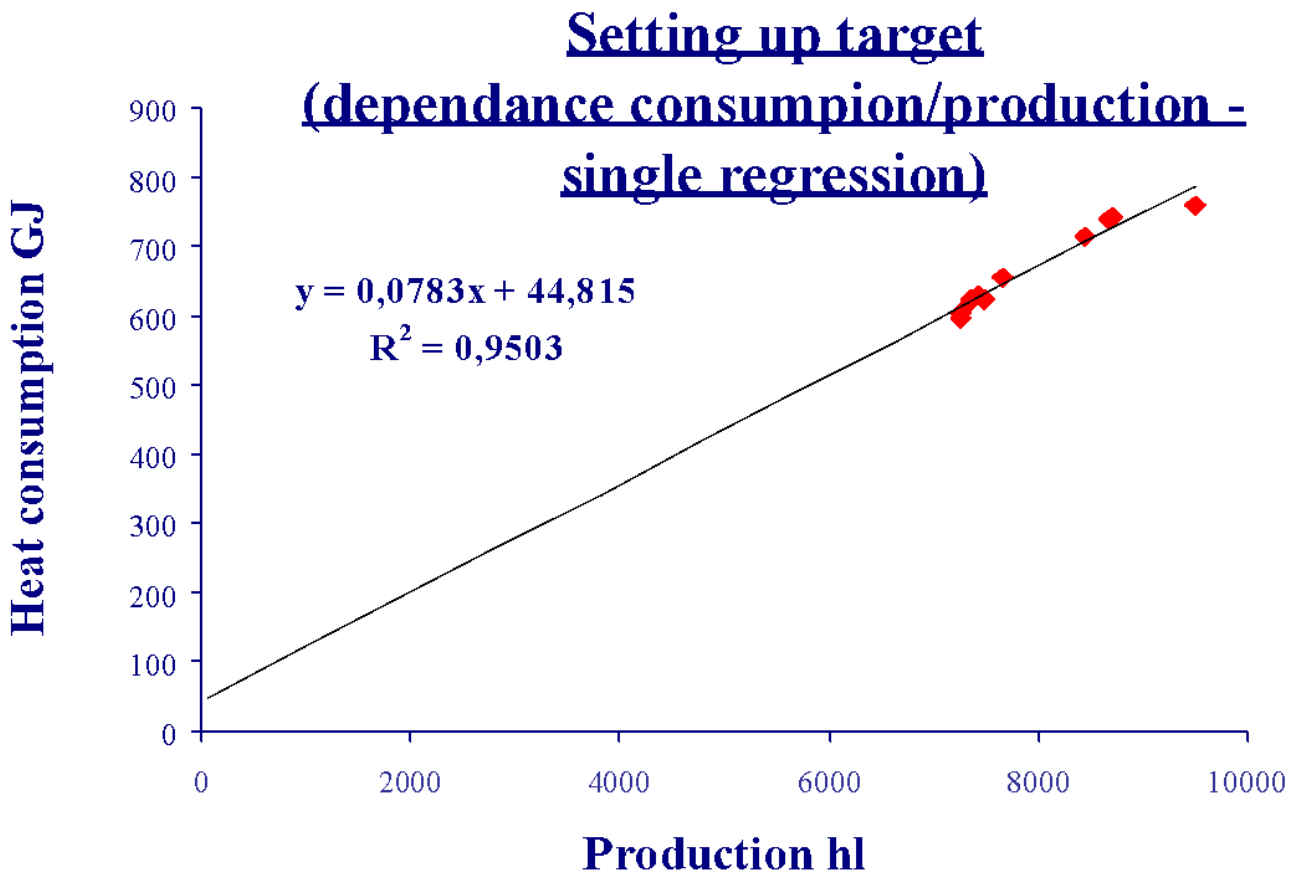
Targeting - example



Source: ENVIROS

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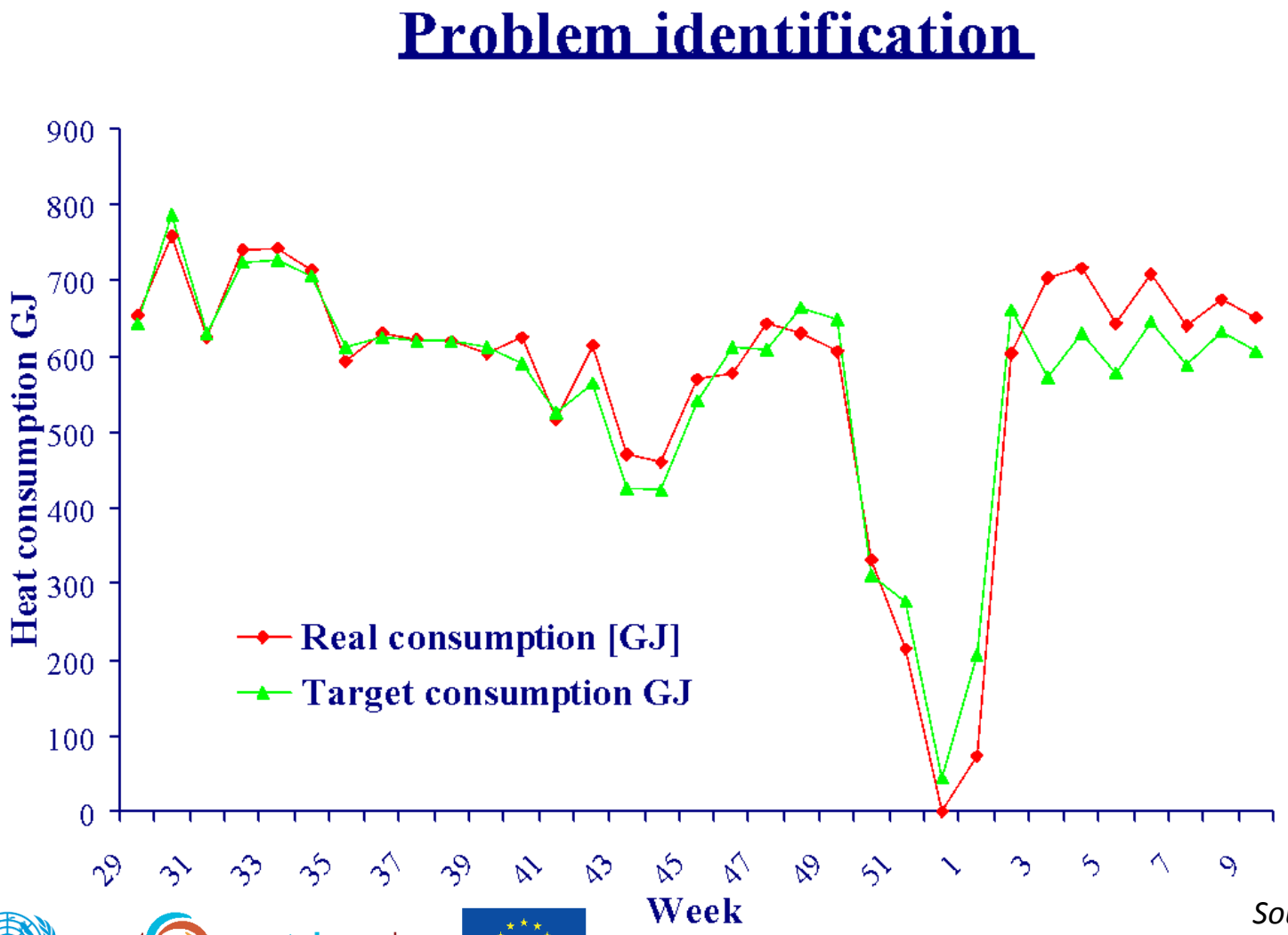
Implementing M&T - example



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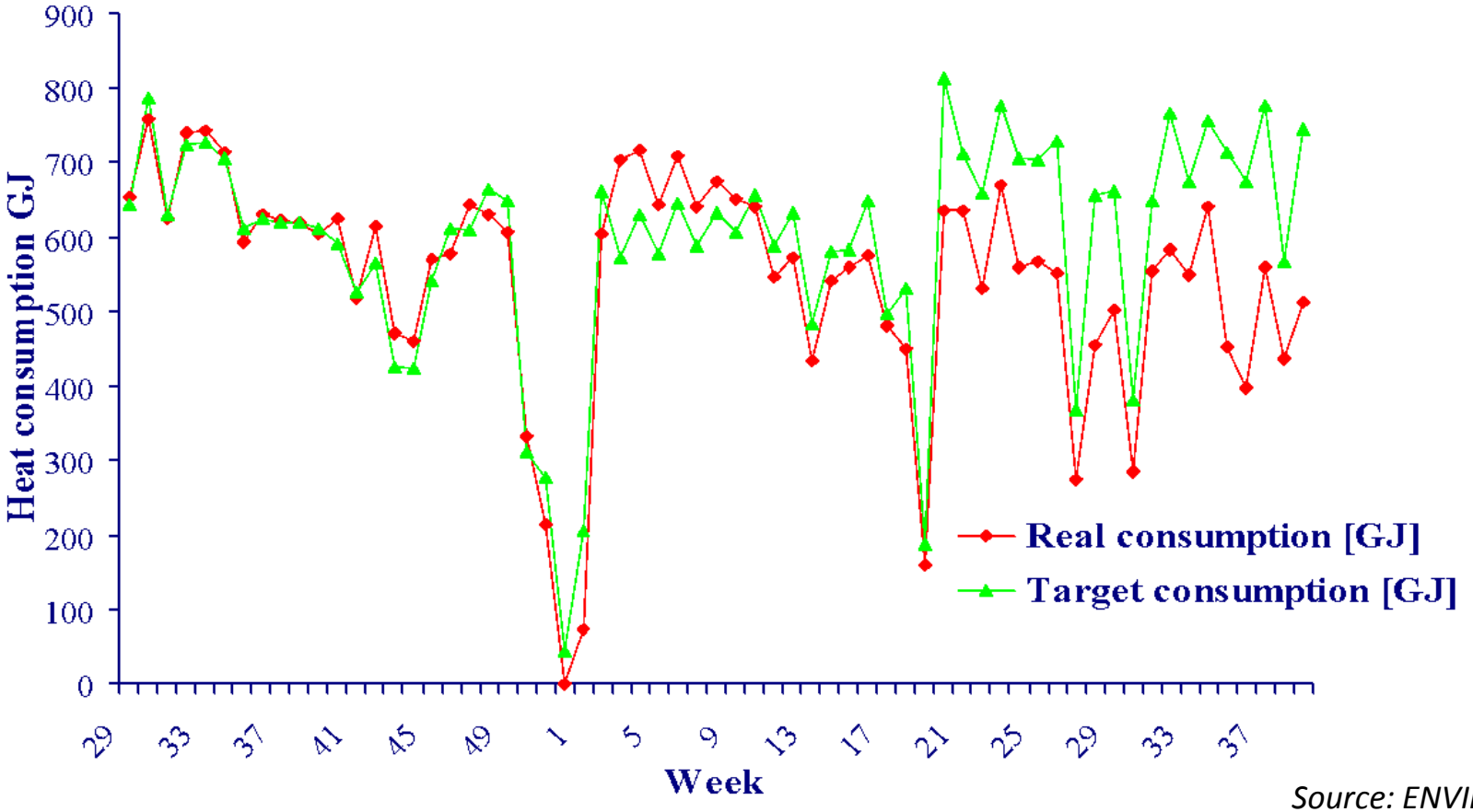
Implementation of resource efficiency measure



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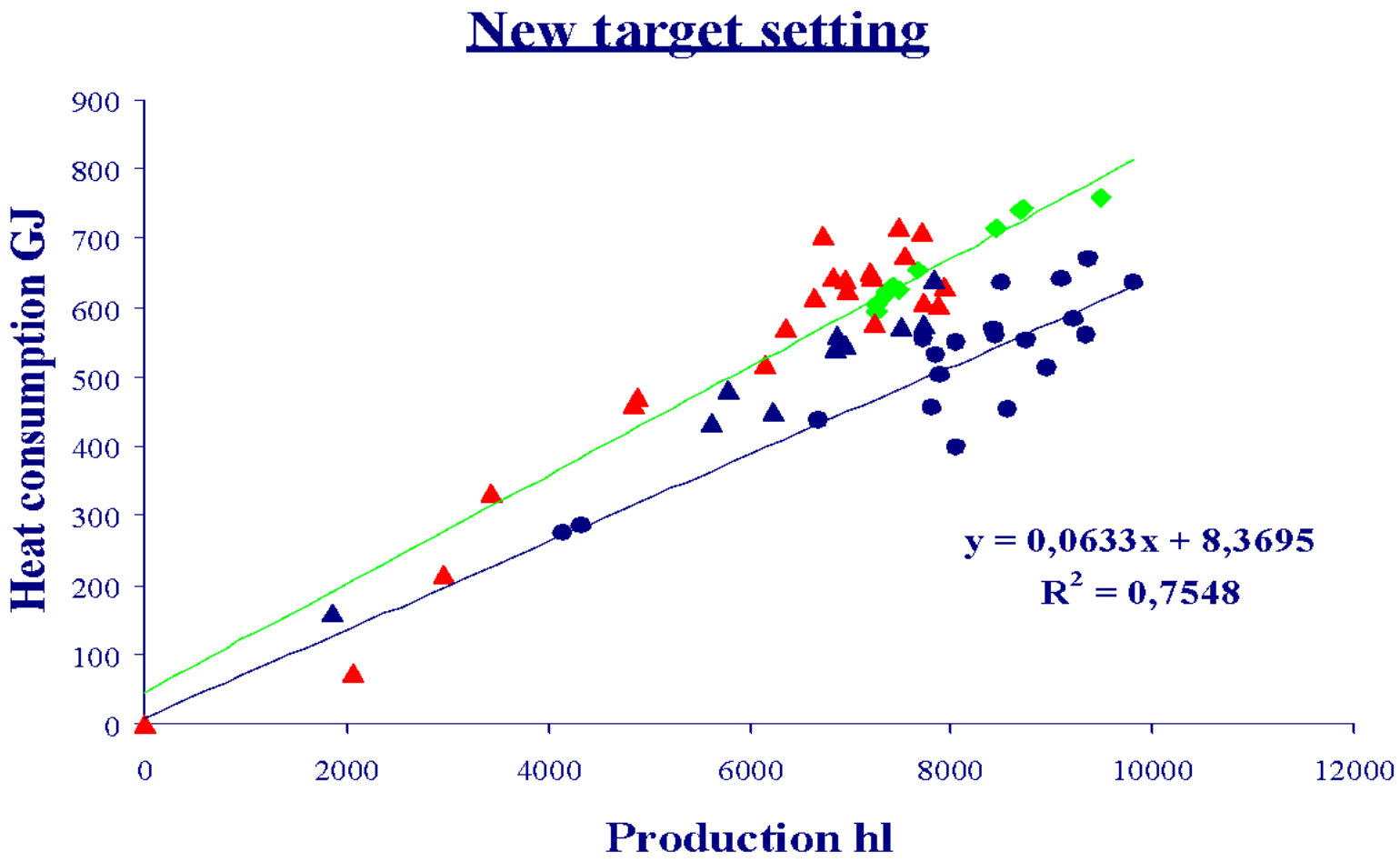
Effects of resource efficiency measures and new target setting



Source: ENVIROS

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Case Study M&T/EPC

STARTING SITUATION

- Electrotechnical Industry, site build on green field (production, storage, administration buildings)
- High ratio of costs to ensure quality of working environment
- Rising energy costs and enterprise goal to increase energy efficiency

Source: ENVIROS

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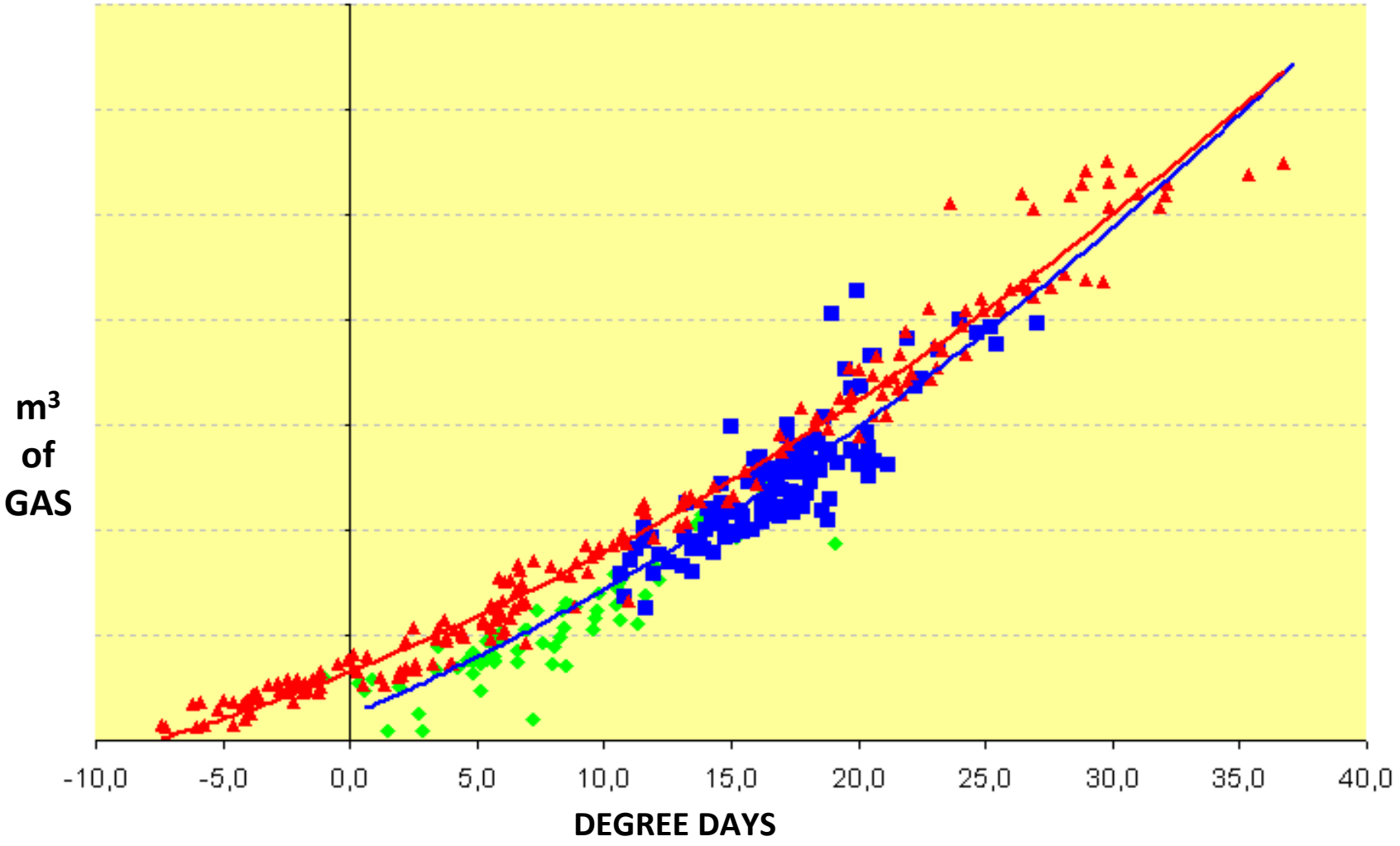
Case Study M&T/EPC POTENTIAL FOR SAVINGS



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Case Study M&T/EPC
PROJECT PHASES

- Initial Review: identification of minimum potential for savings, project proposal including financing of energy management from savings (Energy Performance Contracting (EPC))
  - Project focus on energy conservation
- Introduction of system for management of energy flows through M&T
  - Instalation of system of submeters
  - Instalation and tuning of software based information system
  - Assigning responsibility for energy efficiency to people influencing efficiency
  - Regular data analysis and resulting energy conservation measures
- Implementation of energy conservation measures
  - Amendment of systems functions, amendment of system operational parameters
  - Utilising waste heat, accumulation of cold
  - Modification of system for moisture control etc.
- Repayment of the initial costs from verified savings throug the EPC method

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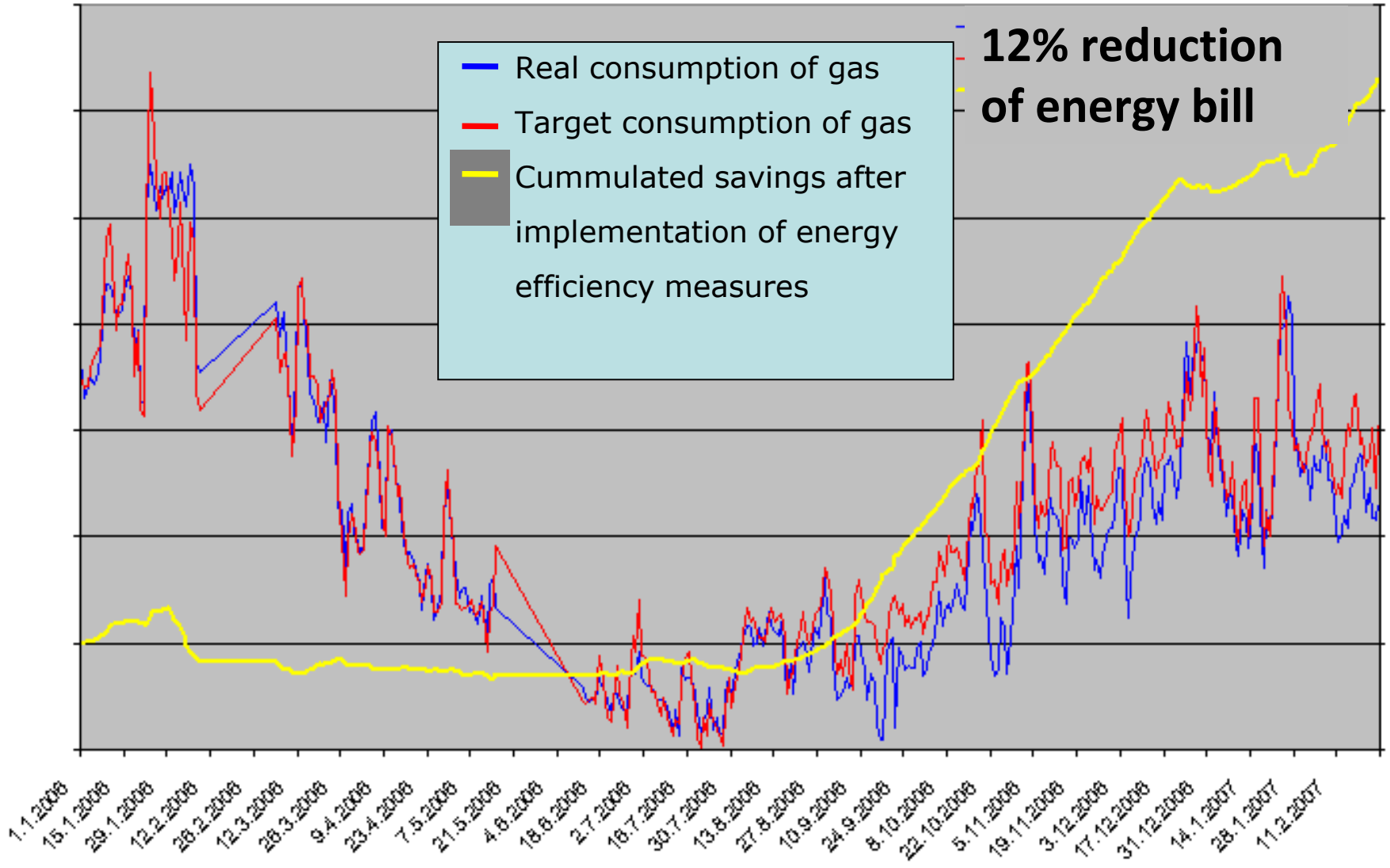
Case Study M&T/EPC
EFFECTS OF IMPLEMENTED MEASURES



Monitoring and Targeting tool enables to

- **Visualise** energy consumption and cost trends in the past
- **Estimate** potential for savings
- **Set up** performance targets for energy management programs (and to determine future energy use when planning, for example, an increase in production volume)
- **Identify** areas where energy is not utilised efficiently, **understand** causes of these losses and to **develop and monitor resource efficiency measures**

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Monitoring physical flows

Monitoring techniques should be driven by the potential for savings and common sense. Some examples:

Material flows

- traditional weighting methods
- calculation based on unit weight, the volume of the container, and its emptying frequency
- Install interfaces with accounting, production planning and stock monitoring

Water flows

- ultrasonic meters, turbine meters, rotameters and other meters,
- simple calculation method based on the volume of tanks (or of a bucket and a stopwatch)

Energy

- for electricity power clamps or standard electro meters
- heat flows can be monitored using different types of heat meters depending on the media (hotwire anemometers for air flows, infrared thermometers for surfaces, thermocouples for fluids)

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CASE STUDY – DAIRY COMPANY

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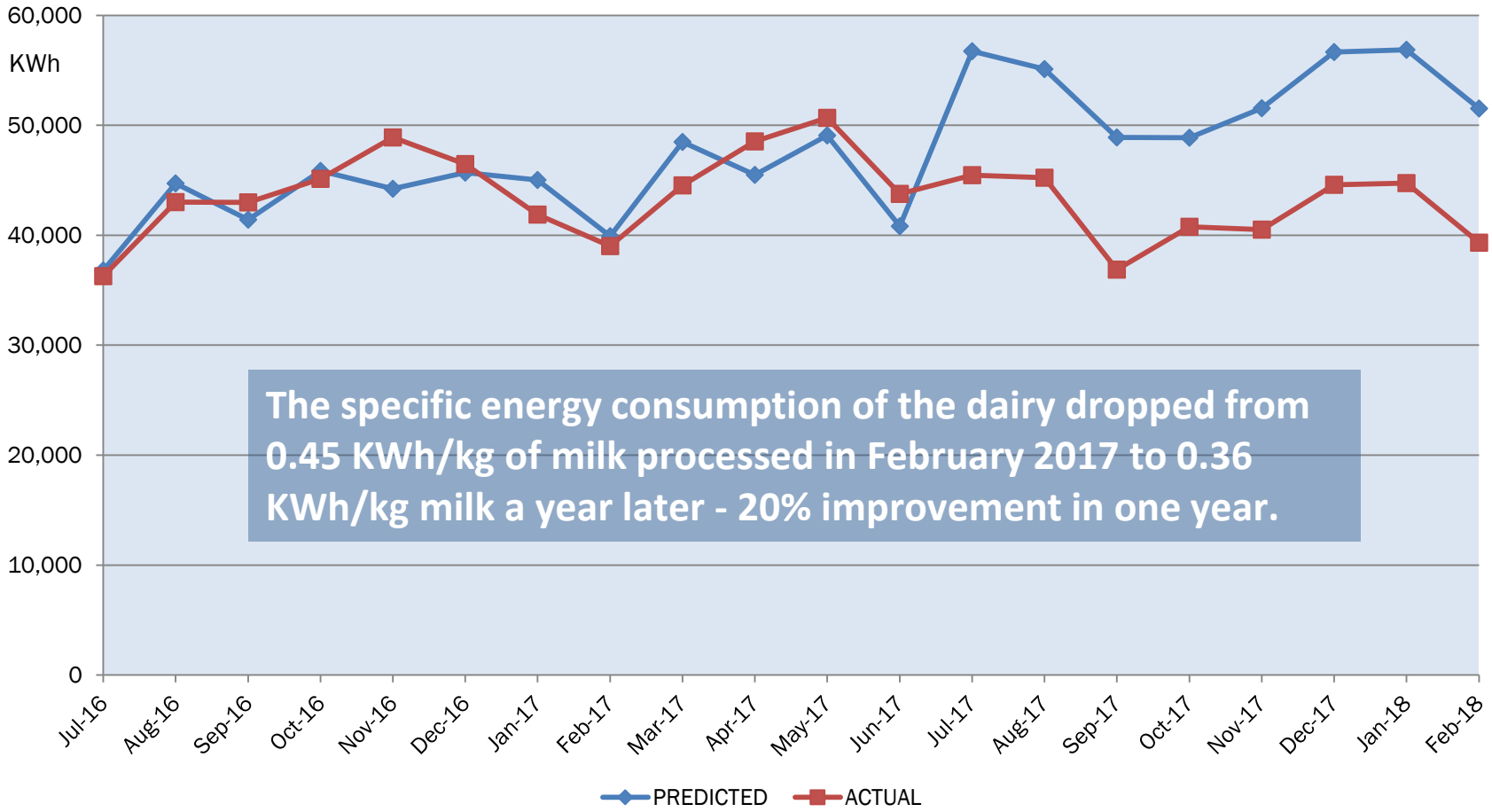
Actual and predicted energy demand of steam boilers



The specific energy consumption of the dairy dropped from 0.45 KWh/kg of milk processed in February 2017 to 0.36 KWh/kg milk a year later - 20% improvement in one year.

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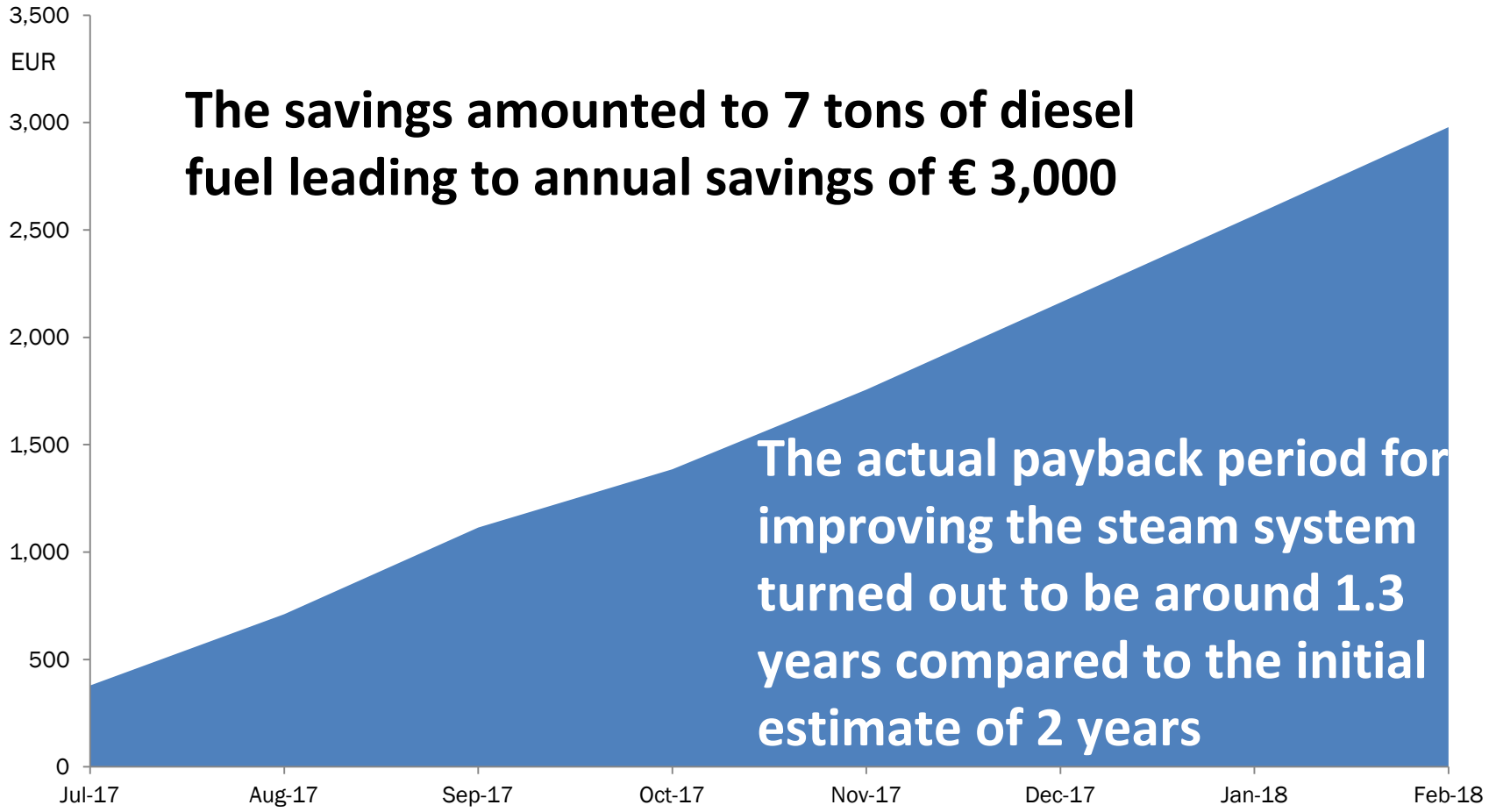
Cumulative money savings for steam system in the same dairy



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CASE STUDY – PLASTIC RECYCLING COMPANY

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Monitoring plan

- Following the top management meeting, the company started to record their KPIs and OPIs according to the defined monitoring plan.
- Only electricity efficiency KPI is shown below:

Title of the Action	Environmental Performance										Economic Savings [Euro]	
	KPI/OPI Description											
	Baseline	Planned Performance	Δ (Planned variation)	After implementation	Δ (Real variation)	Responsible for monitoring	Metering	Frequency	Reporting	Budget	Planned (Euro /year)	After implementation
Electricity efficiency KPI	997 kWh/ton	887 kWh/ton	11% saving	880 kWh/ton	11.7%	Operator	Input material weight Weight of removed labels and caps in delabeller Resin Production	Daily	Production Manager	100,000	153,000	221,913

Monitoring plan results

- After some time of steady operation, the team noted an increase in the electricity efficiency KPI exceeding the original baseline.
- Applying the knowledge gained during the TEST training, the company engineers successfully revealed the root cause of that increase, identifying two additional energy efficiency measures that would deliver significant results, improve product quality and further increase the project gains.
- Both projects are approved for financing through the EBRD/ GEFF financing mechanism.

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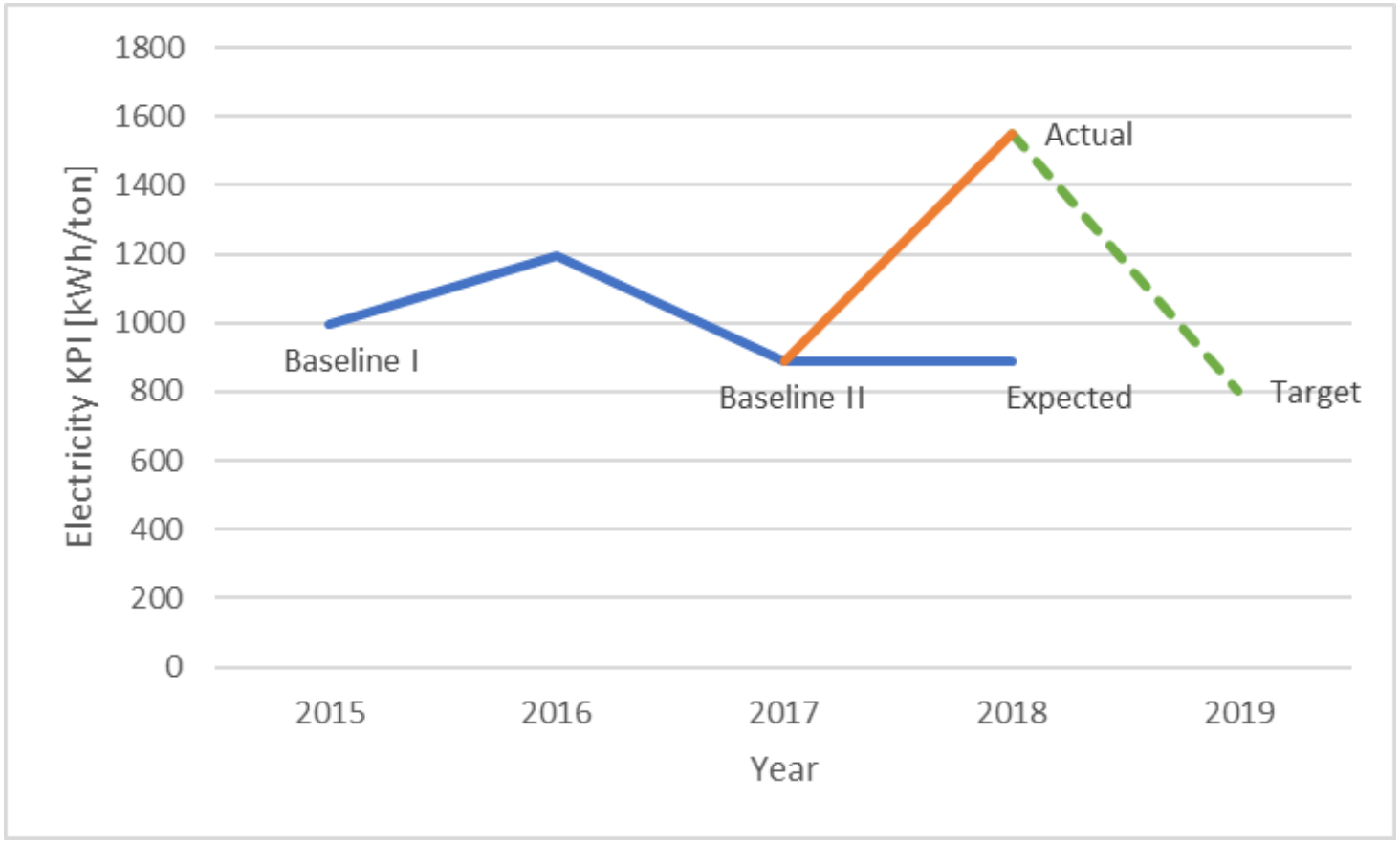
Performance Monitoring



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CASE STUDY – BEVERAGE COMPANY

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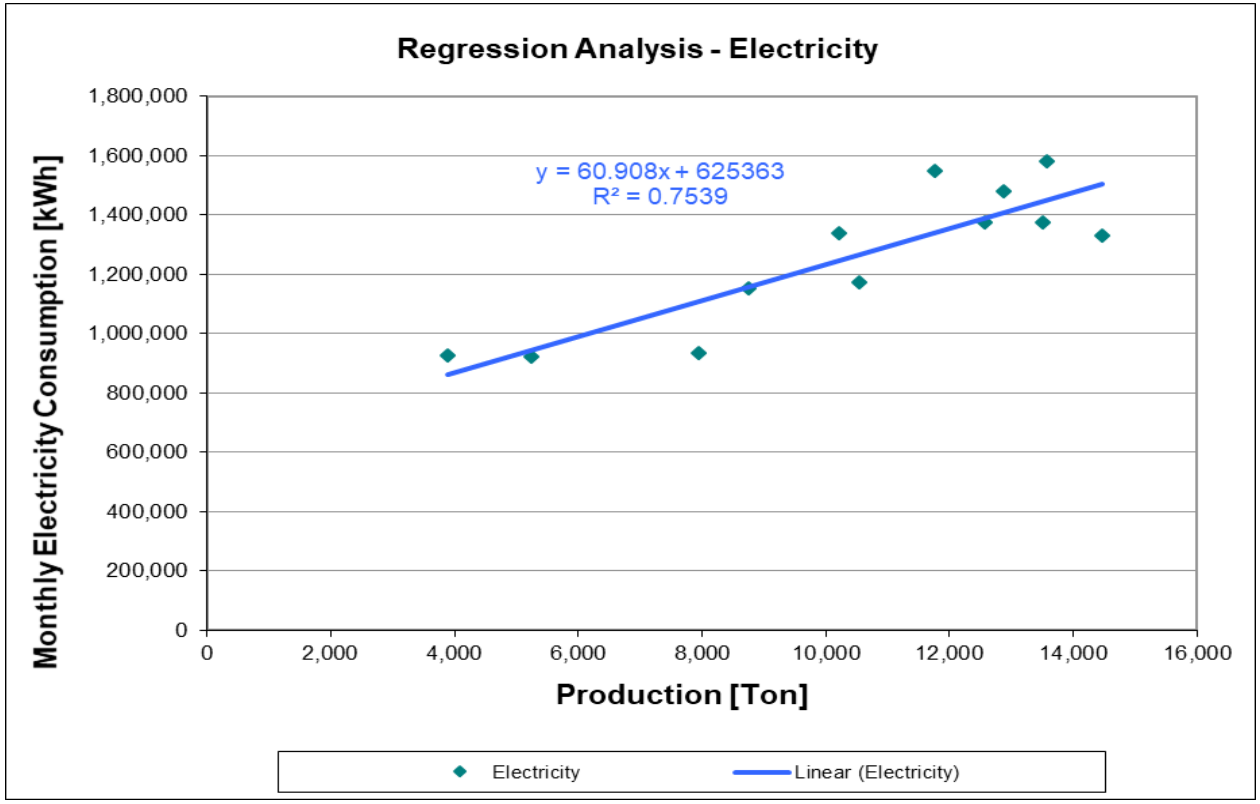
Monitoring plan

Following the top management meeting, the company started to record its KPIs against the regression equations, developed in Step 1.4.



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Monitoring plan results

- Company performance during the year that followed setting the baseline was deteriorating until the company started implementing the action plan.
- After company implemented the action plan, the performance improved bringing saving of 23% compared to the baseline consumption.
- Being able to visualize the achievement and presenting it to the top management facilitated approval of investment needing projects.
- It also urged the company and the internal team to seek further improvements (thanks to the implemented business case).

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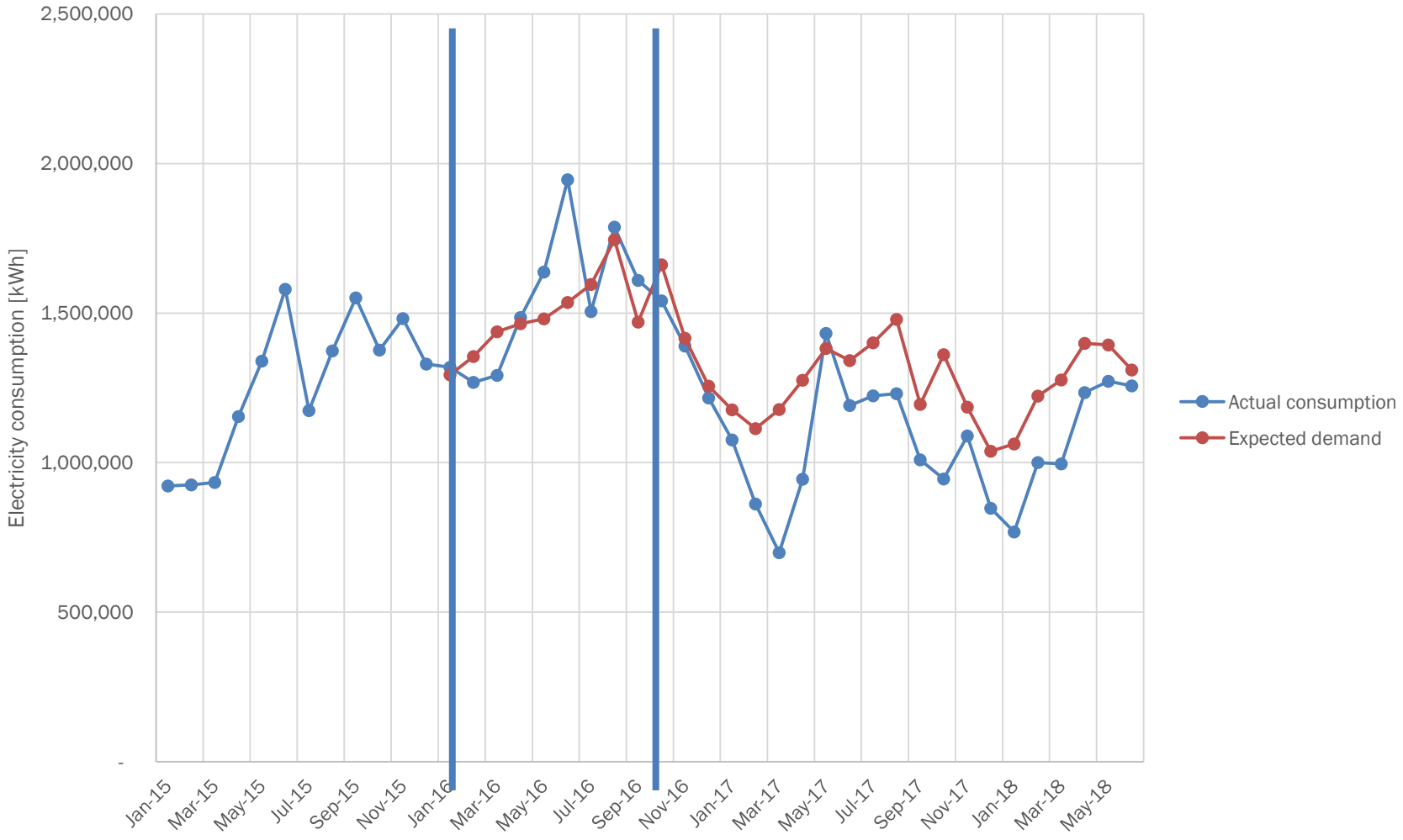
Performance Monitoring



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Monitoring and evaluation sample

Within the course of MED TEST II, performance monitoring in one of the country revealed the actual savings recorded in the KPIs after implementation as:

Company	Water consumption (m3/unit of product)			Fuel Consumption (kWh/unit of product)			Electricity consumption (kWh/unit of product)			Raw Materials (ton/unit of product)		
	Baseline I	Baseline II	Delta (%)	Baseline I	Baseline II	Delta (%)	Baseline I	Baseline II	Delta (%)	Baseline I	Baseline II	Delta (%)
Company "A"	6.12	2.14	**65%**	1,072.80	801.8	**25%**	384.1	304.1	**21%**	0.988	0.957	**3%**
Company "B"	2.3	1.7	**26%**	0.02	0.018	**10%**	0.1	0.087	**13%**	NA	NA	**NA**
Company "C"	2.1	2.0	**5%**	NA	NA	**NA**	0.47	0.31	**34%**	1.2	0.4	**67%**
Company "D"	1.85	1.42	**23%**	1.54	0.69	**55%**	6.81	5.32	**22%**	150	135	**10%**
Company "E"	0.38	0.081	**79%**	0.37	0.025	**93%**	0.42	0.05	**88%**	NA	NA	**NA**
Company "F"	29.9	10.2	**66%**	1795.6	1231.9	**31%**	217	238.3	**-10%**	NA	NA	**NA**

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Linkages with EMS

EMS Not in place

- Procedures and work instructions should be developed for data collection, processing, documentation, evaluation, reporting and for preventive and corrective action such that they can be integrated into a formalised management system.

EMS In place

- Upgrade the information system on resource efficiency
- Evaluate environmental objectives and targets
- Information on monitoring results should be included for consideration in the EMS/EnMS management system review.

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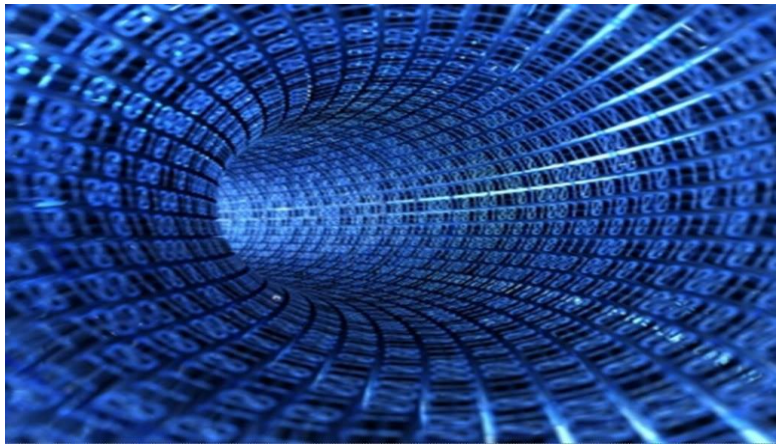
Thank YOU for your Attention



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