



# Energy performance measurement and improvement in industry in the context of energy management systems and ISO 50001



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# UNIDO Global EnMS-ISO50001 Programme – Dec 2017



GLOBAL ENVIRONMENT FACILITY  
INVESTING IN OUR PLANET

**Operational in 18 countries**  
**Planned activities in 10+ countries**

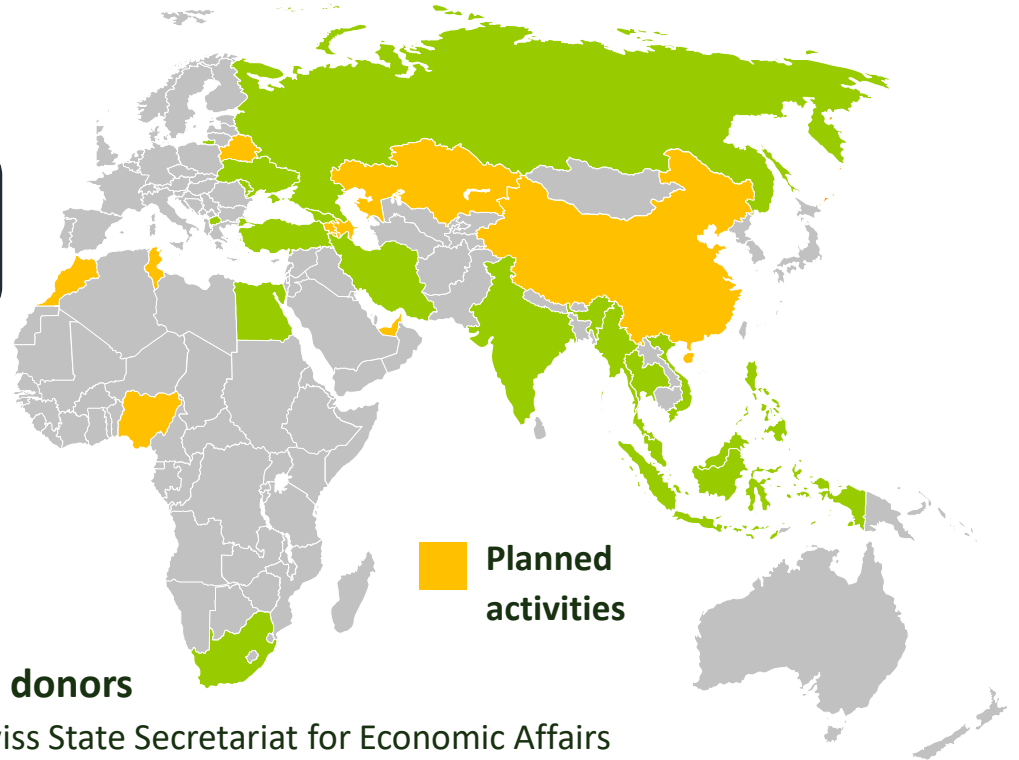
 **Projects ongoing**

- |              |           |
|--------------|-----------|
| South Africa | Indonesia |
| Moldova      | Egypt     |
| Russia       | Iran      |
| Turkey       | Ukraine   |
| Ecuador      | Colombia  |
| Malaysia     | Macedonia |
| Thailand     | Myanmar   |
| Viet Nam     | India     |
| Philippines  | Georgia   |

 **Planned activities**

**Other donors**

- ✓ Swiss State Secretariat for Economic Affairs
- ✓ UK Department for International Development
- ✓ Government of South Africa
- ✓ Government of Italy
- ✓ Government of Austria





# Why Energy Management Systems (EnMS) in Industry



# BARRIERS to Energy Efficiency in Industry

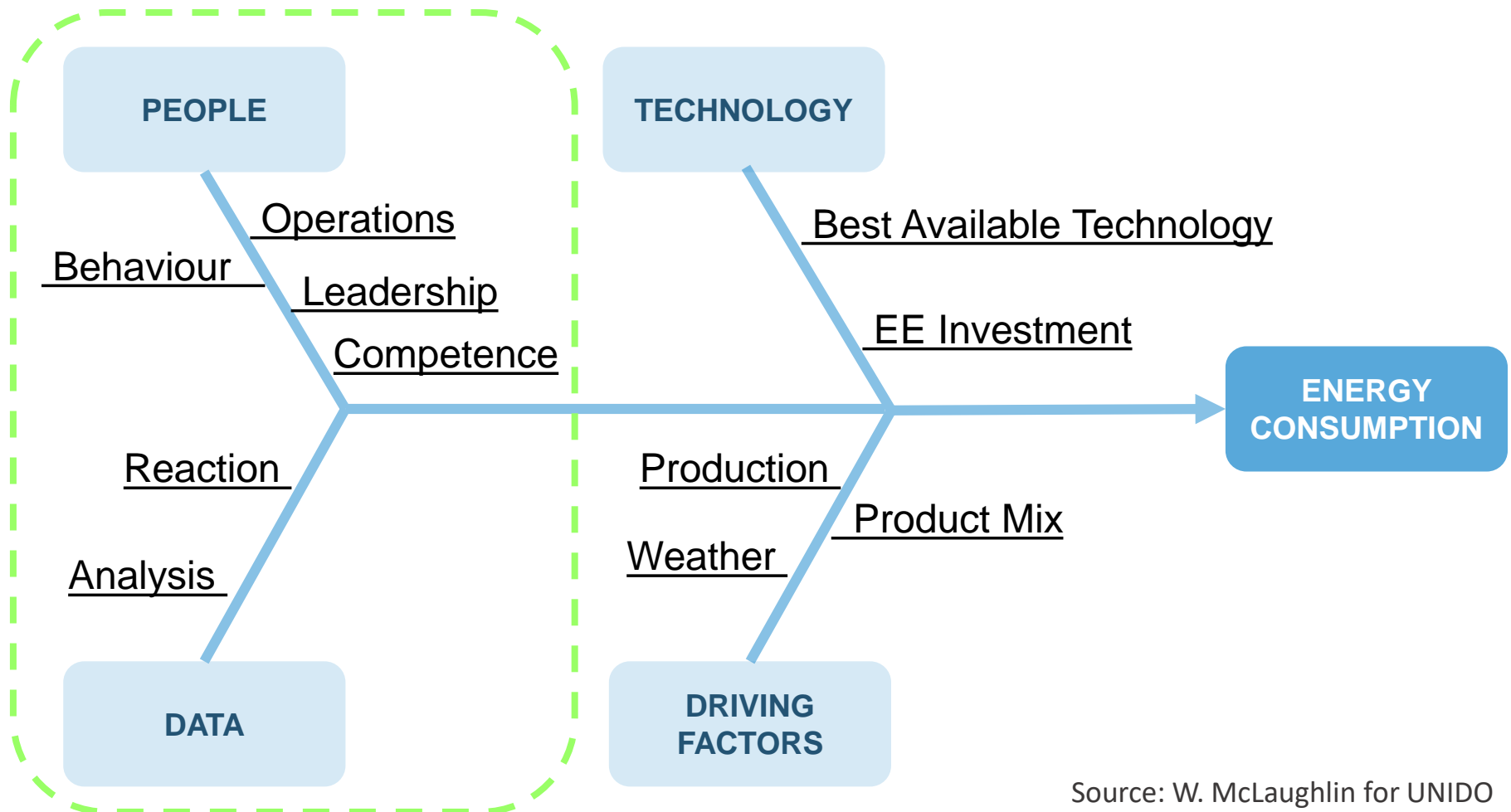
- M** • Management focus is on production & volumes, not on EE
- K** • Lack of information and understanding of own energy performance
- K** • Lack of adequate skills for identifying, assessing, developing and implementing EE measures and projects
- K** • Poor or misused monitoring systems and data
- M** • First costs more important than recurring costs → disconnection between capital and operating budgets
- M** • Staff behavior and attitude
- F** • Financing constraints
- ✓ *Production, technological, operational and staff changes over time*
- Lack or limited availability of IEE services and product

**M** Management/organizational barrier

**K** Knowledge/competency barrier

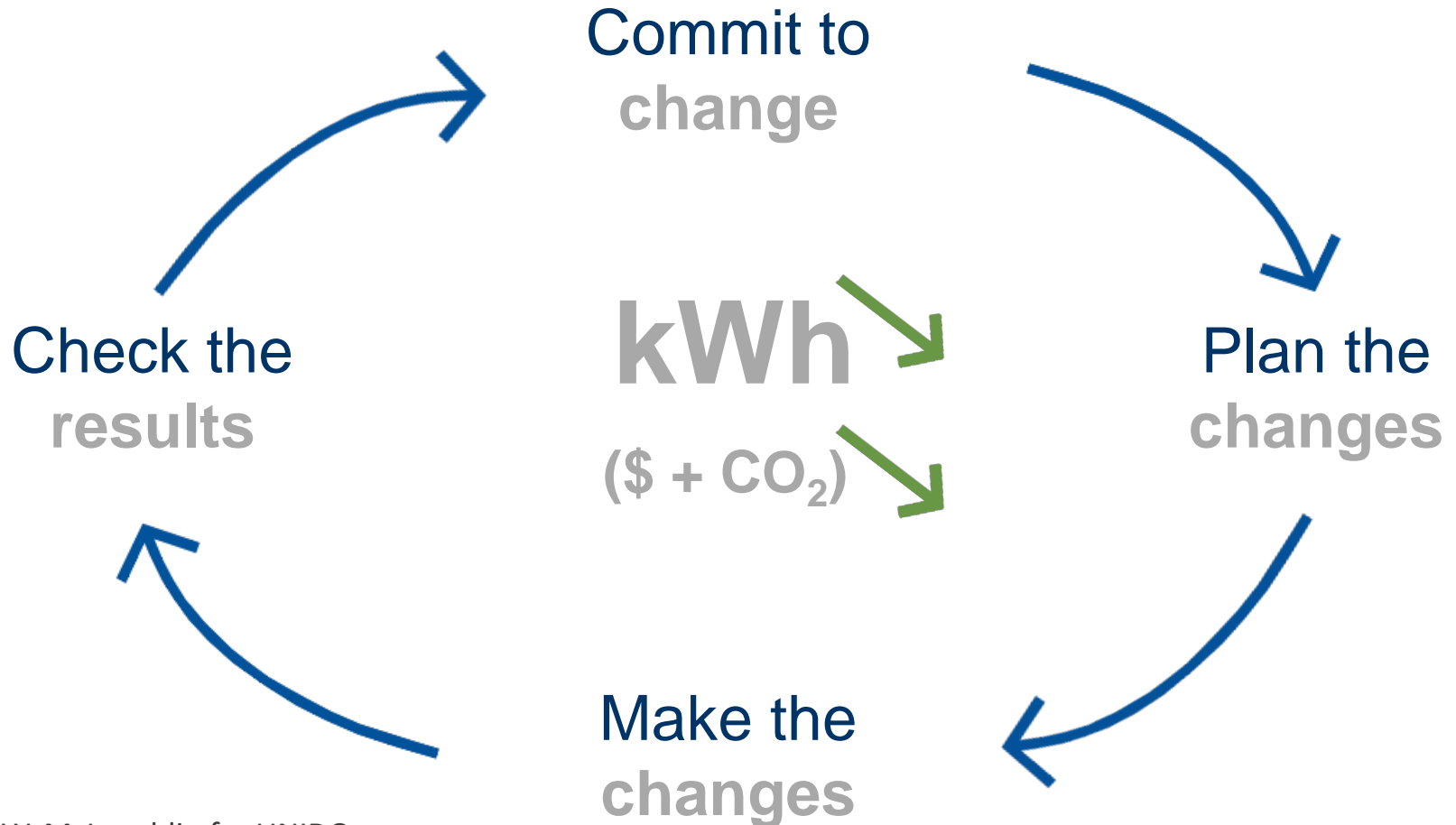
**F** Financial barrier

# Energy consumption in Industry



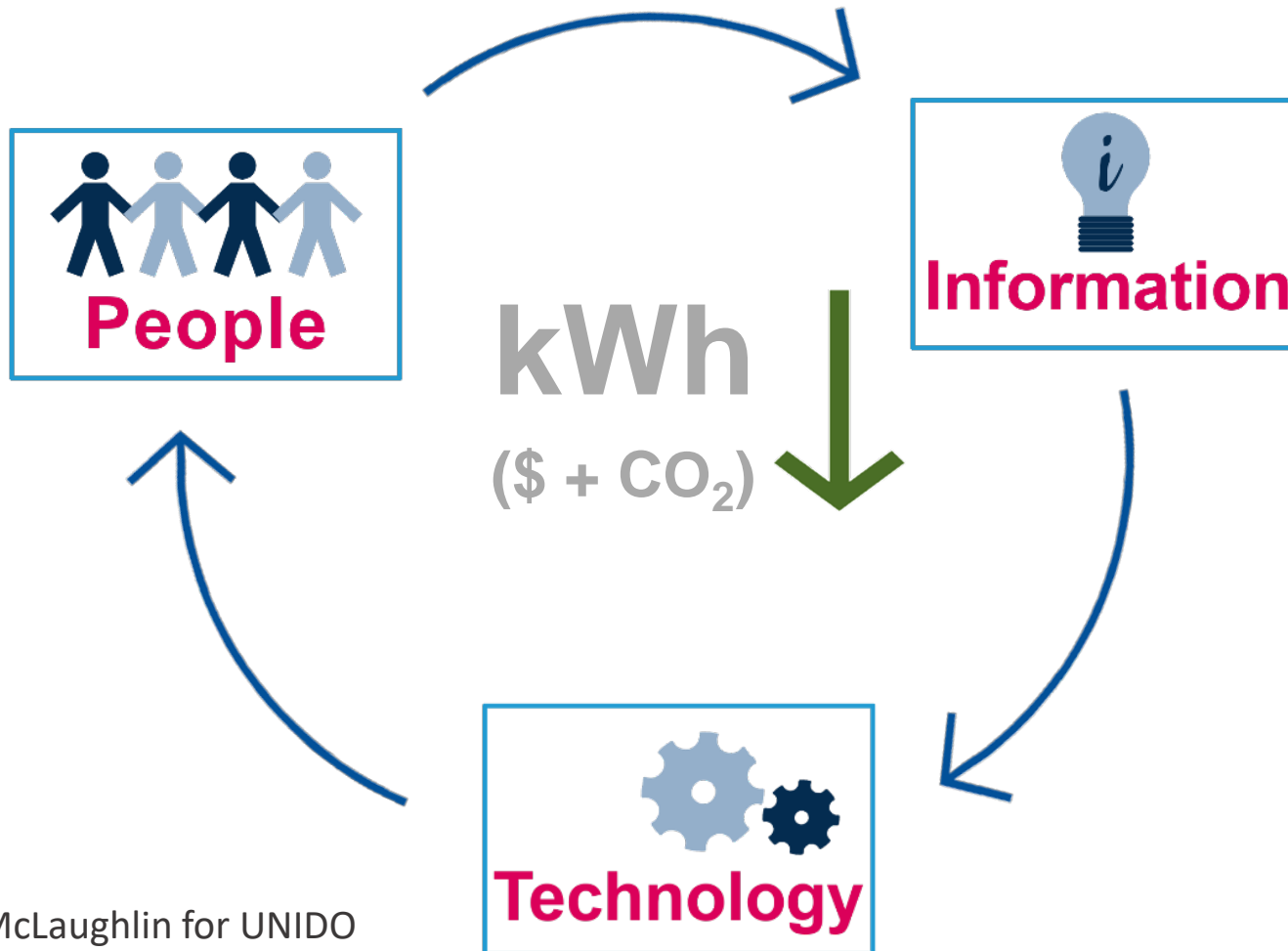
Source: W. McLaughlin for UNIDO

# ISO 50001 - EnMS Simplified



Source: W. McLaughlin for UNIDO

# EnMS – Managing and improving 3 pillars



Source: W. McLaughlin for UNIDO





# Energy performance measurement and indicators (EnPMI) in industry



# Early UNIDO EnMS-EnPMI experience showed

- ✓ Widespread use of specific energy consumption by industry and EE consultants/experts as energy performance indicators to monitor and measure performance and savings (also in OECD countries)
- ✓ Lack of knowledge in industry as well as between energy service providers about best-practices for energy performance measurement and indicators (i.e. use of regression analysis and normalization)
- ✓ Right understanding and measurement of energy performance ,and the definition of appropriate EnPIs, proved to be critical steps for driving and sustaining the implementation of effective and successful EnMS that save energy, money and create value for companies

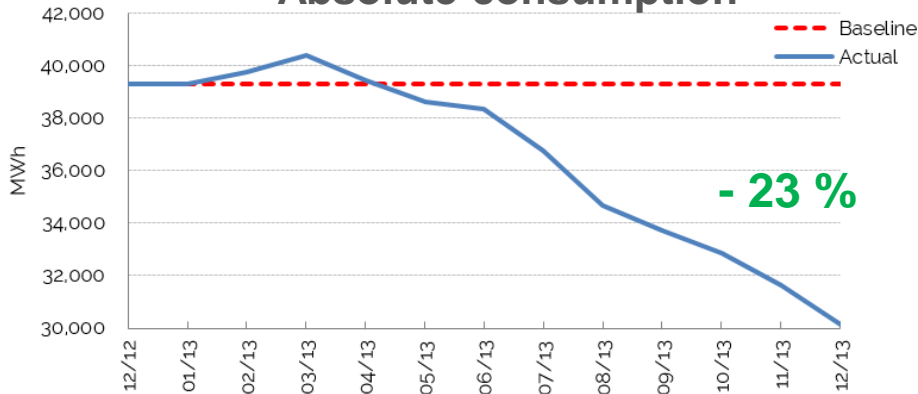
# Energy performance in industry

## BREWERY CASE STUDY

- ✓ Large brewing company with 8 production and packaging plants
- ✓ In 2012 top management hired a new Energy Manager in one of the plants to increase work on energy efficiency
- ✓ In 2012 top management approved allocation of about 500,000 Euro for 2013 for EE projects and investments in the plant.
- ✓ The plant was/is a modern facility in term of technologies, and pretty advanced, by EU standards, with regard to metering and monitoring systems.

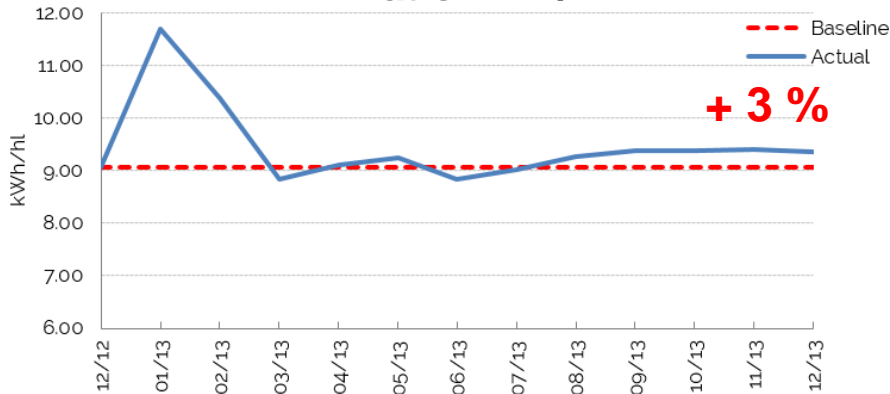
# Energy performance in industry: “View” 1

**Absolute consumption**



2013

**Ratio kWh/hl**



Source: UNIDO

If you would be the top management of this company, what would you decide with regard to the following?

1. Would you retain the new energy manager?

YES  NO

2. Would you approve additional 500k Euro for EE in 2014?

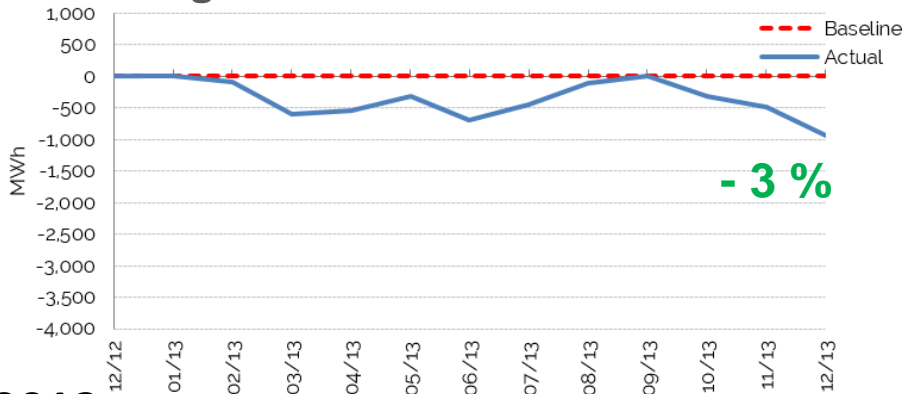
YES  NO

3. Would you consider a cash bonus for your energy team staff?

YES  NO

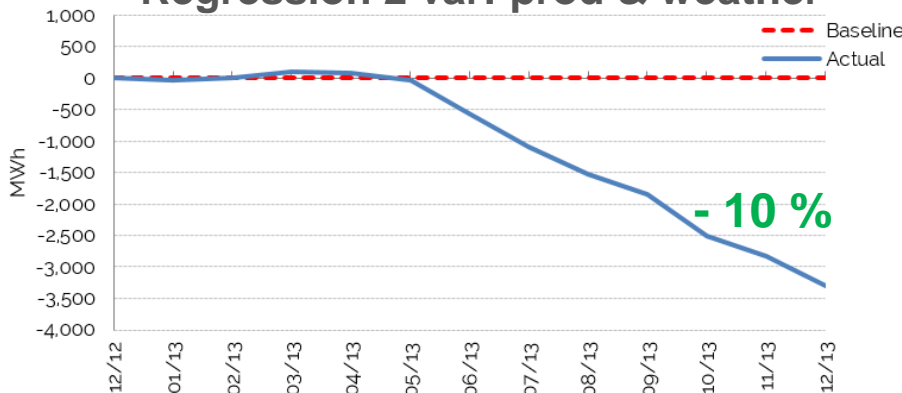
# Energy performance in industry: “View” 2

Regression 1 variable: Production



2013

Regression 2 var: prod & weather



If you would be the top management of this company, what would you decide with regard to the following?

1. Would you retain the new energy manager?

YES  NO

2. Would you approve additional 500k Euro for EE in 2014?

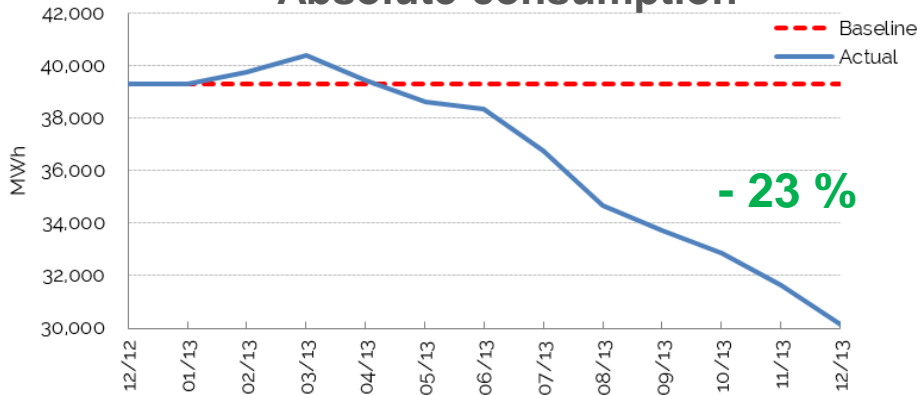
YES  NO

3. Would you consider a cash bonus for your energy team staff?

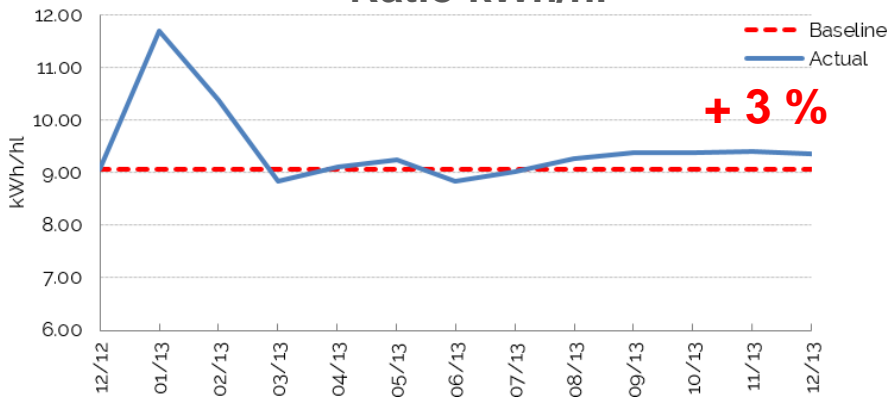
YES  NO

# Energy performance in Industry – Which is right?

**Absolute consumption**

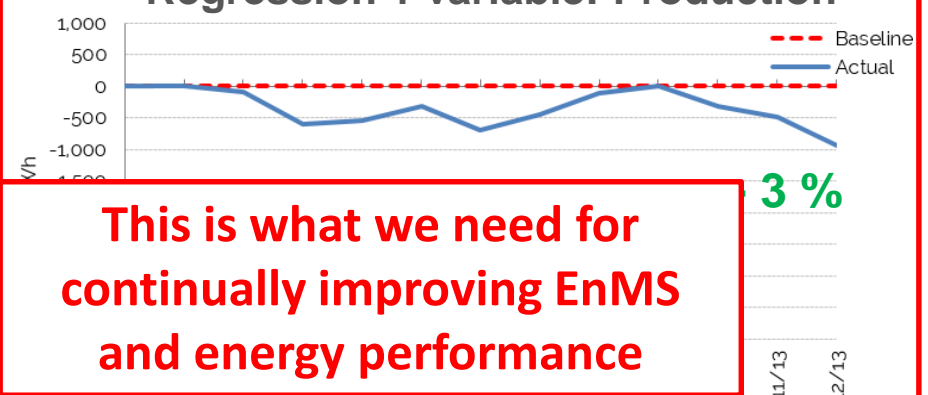


**Ratio kWh/hl**



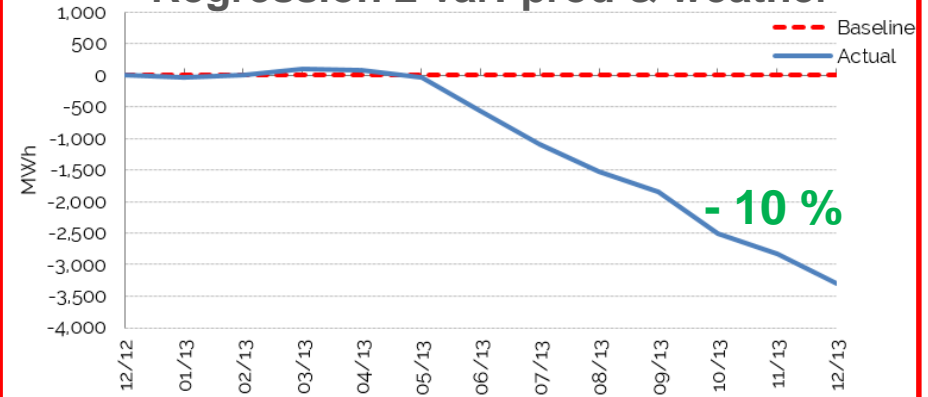
Source: UNIDO

**Regression 1 variable: Production**



**This is what we need for continually improving EnMS and energy performance**

**Regression 2 var: prod & weather**



Brewing industry



# Examples of EnMS implementation at company and programme level



# Example 1 : Iron and Steel – South Africa

**Arcelormittal**  
**Saldanha Works**



ArcelorMittal

- ✓ Electricity demand : 160 MW
- ✓ Manpower: 548 permanent employees
- ✓ Sales output: 1,2 million ton HRC/annum

Adjustments/optimization of production operations, energy systems optimization, fuels switching, etc.....  
driven by EnMS!

2012 Energy Savings (Norm.) > 100 GWh



## Energy Efficiency Achievements 2011

### Energy Management System Implemented

No. of Projects/Measures	11
<b>Total Capital Investment (USD)</b>	<b>0</b>
<b>2011 Gross Financial Savings (USD)</b>	<b>9,076,000</b>
Overall Payback Period (in years)	0
<b>2011 Energy Savings Norm. (GWh)</b>	<b>79.95</b>
2011 GHG Reductions (tons CO <sub>2</sub> )	77,000

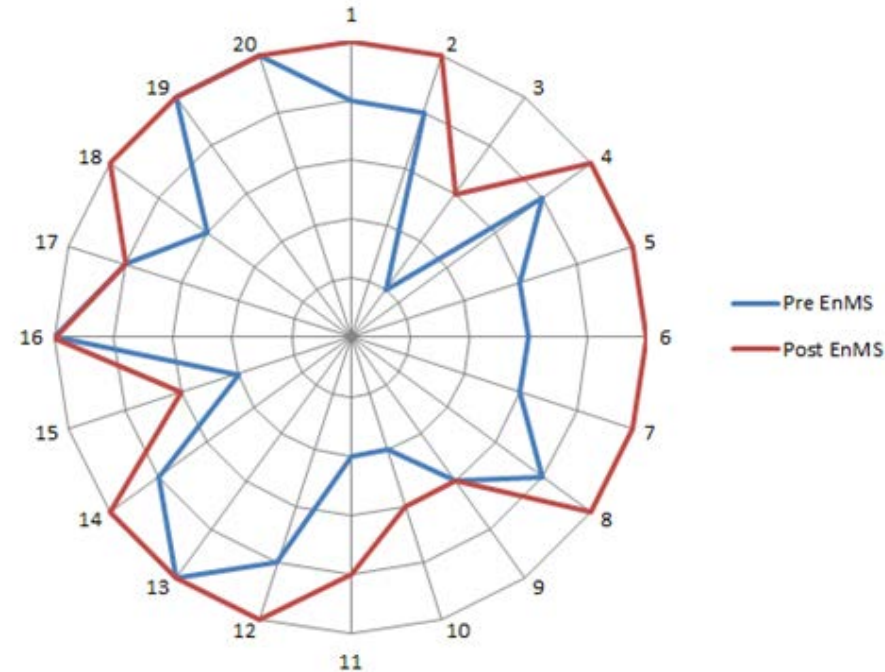




# Example 2 : Power Generation – Macedonia

## REK BITOLA

- ✓ Mining and Energy Combine (REK) Bitola meets over 70% of country's demand for electricity
- ✓ Coal-lignite thermal power plant, total installed generating capacity of 700 MW and annual generation of 4,000 GWh
- ✓ Production in 2016 was 2,685 GWh; own consumption was 286.2 GWh
- ✓ In 2016, EnMS limited to power generation facilities
- **8,700 MWh** normalized savings as of 7 Oct 2017



Improvement of Energy Management Practices

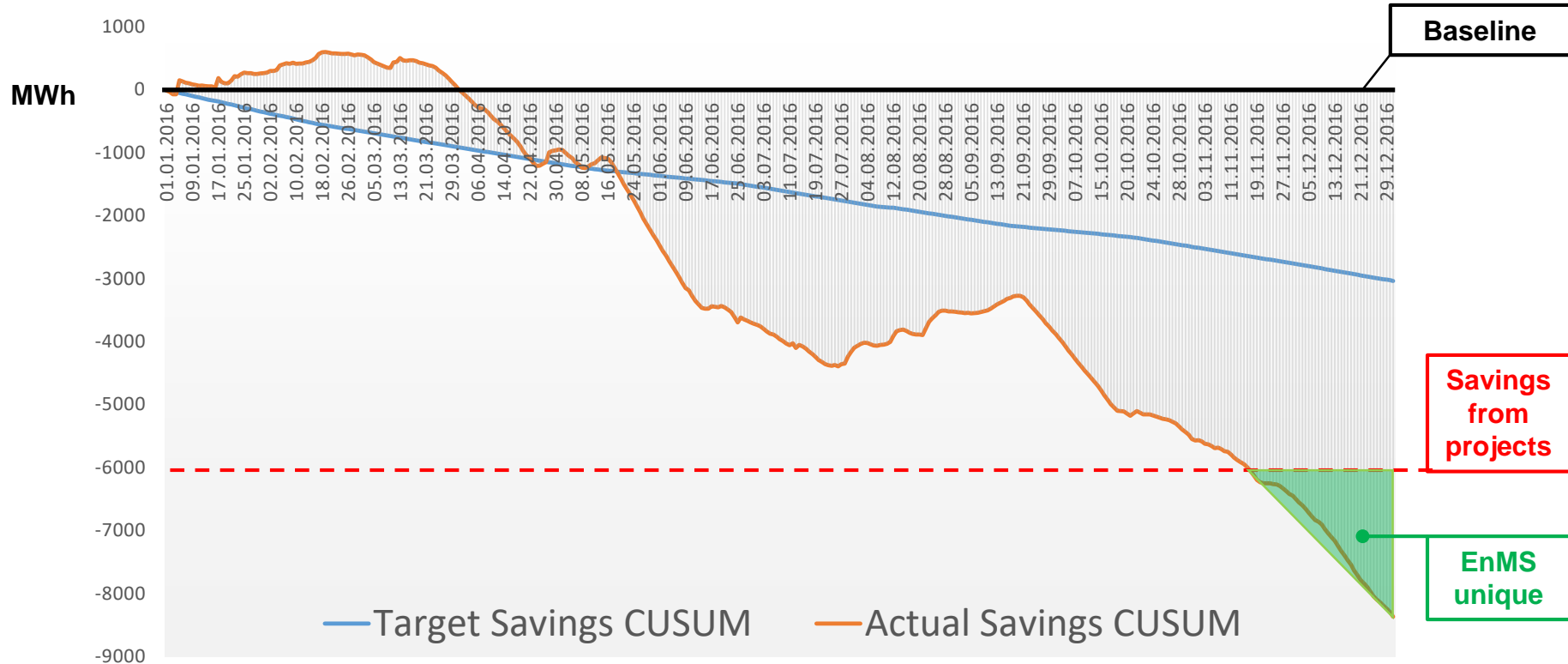
**2.97% of total consumption** ←

**Payback time: 22-24 days**

2016 Energy Savings Norm. (MWh)	8,502
2016 GHG Reductions (tons CO <sub>2</sub> )	10,528

# Example 2 : Power Generation – Macedonia

## REK BITOLA Actual savings vs Target & vs Projects - 2016



Appropriate EnPMI offer opportunities to measure impact of training, competency development, organizational measures and behavioral change

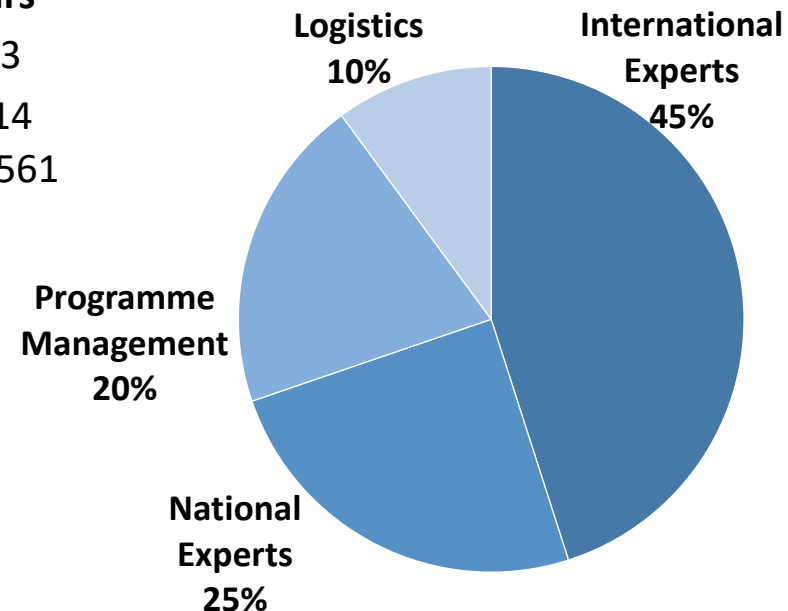
# Example 3: UNIDO EnMS CBI Programme

## Costs and Benefits Analysis - FYR of Macedonia Pilot

- 12 Partner enterprises (70% success rate)
- 23 Nat. Consultants/Expert Trainees

Benefits	Year 1 + Year 2	5 Years
Energy saved [GWh]	<b>39,7</b>	115,3
GHG emission avoided [tCO <sub>2</sub> eq]	<b>31,341</b>	89,814
Monetary benefits [EUR]	<b>1,952,650</b>	5,602,561

**UNIDO PILOT Programme  
FYR of Macedonia - COSTS  
175,632 EURO**



SUMMARY	
Indicator	Year 1 + Year 2
CE of energy saved [EUR/MWh]	4.43
CE of GHG emissions avoided [EUR/tCO <sub>2</sub> eq]	5.60
Cost-Benefit [EUR/EUR]	0.09



## Conclusions

- Energy consumption and energy performance in industry do not depend only on production volumes, but also on other factors like weather, raw material, people and organizational practices.
- EnMS-ISO 50001 requires energy savings, demonstration of energy savings, and normalisation for drivers
- Daily as well as long-term energy management and continual improvement of energy performance do require use of technically sound methodologies for measuring savings and performance, and evaluate benefits of resources invested
- Knowledge and competency gap on EnPMI found in all UNIDO countries of operation was very big → strong need to support and accelerate transition to best-practice EnPMI?





# THANK YOU!

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