Discussion about benefits of energy management systems (EnMS) and how to design policies and programmes to support implementation

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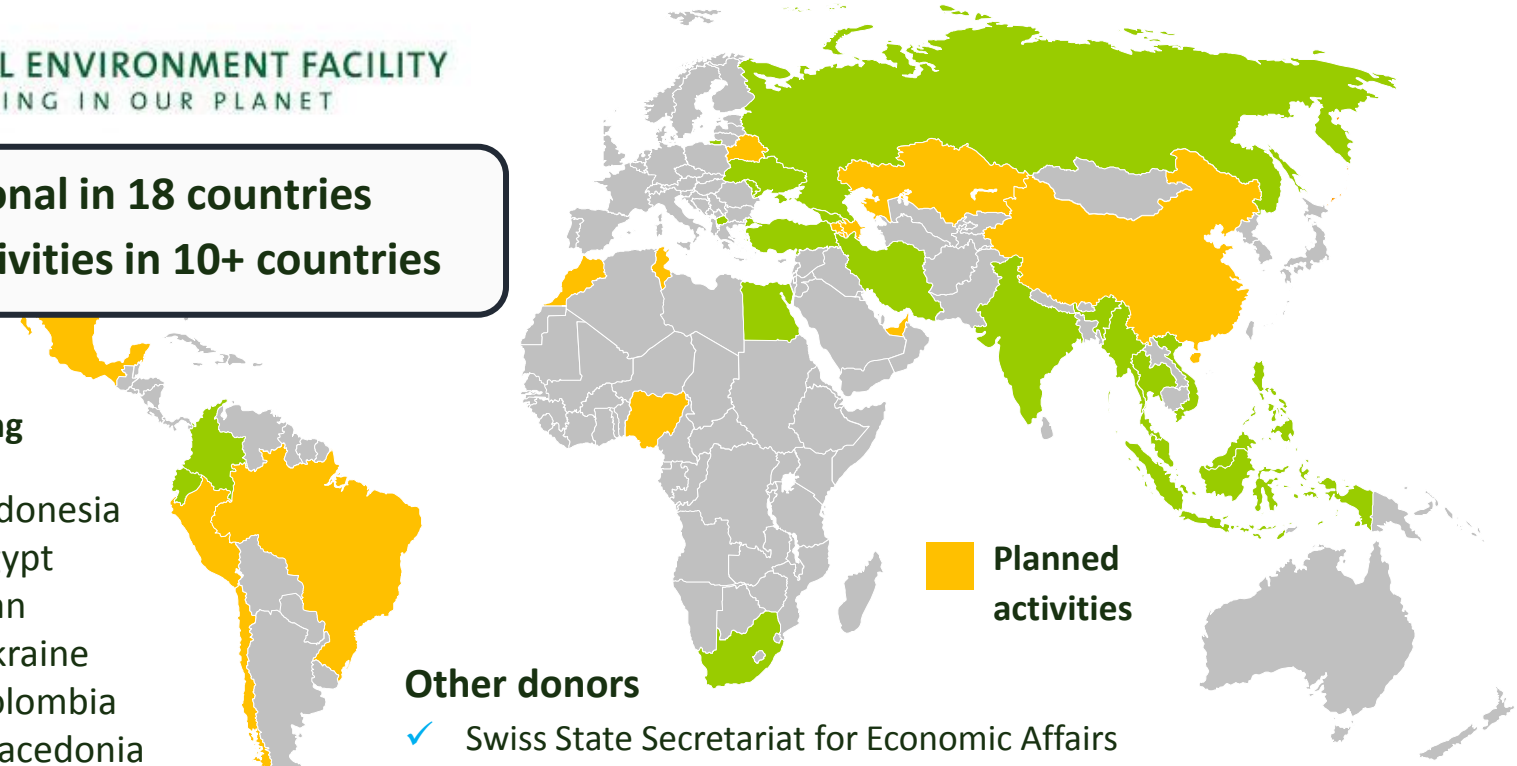
2. Why EnMS in industry
3. What EnMS can achieve
4. Policies and programmes to promote and support EnMS-ISO 50001
5. Lessons learnt
6. Success factors and Challenges

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

Other donors

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

EnMS in line with ISO 50001

Purpose of EnMS-ISO 50001

- ✓ "..to enable an organization to follow a systematic approach in achieving **continual improvement of energy performance, ..**"

Scope of EnMS-ISO 50001

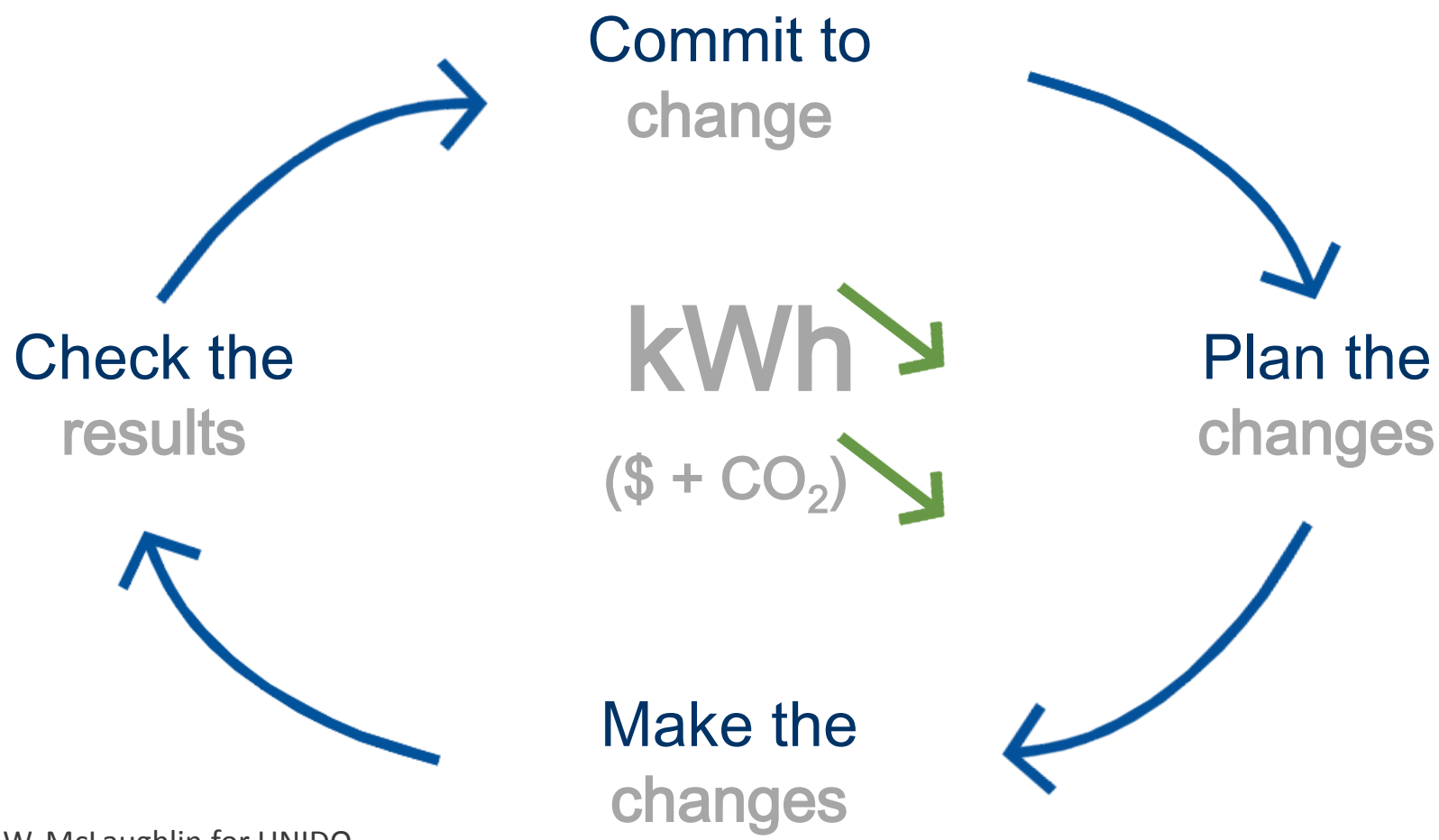
facilities	equipment	personnel
systems	processes	procurement
measurement	design	doc. & report

- ✓ It is applicable to organizations of all sizes

- ✓ **ISO 50001 targeted to**
  - Industry
  - Power sector
  - Commercial & buildings
  - Transport
  - Others

***ISO 50001 does NOT prescribe** specific performance criteria or targets with respect to energy.*

ISO 50001 - EnMS Simplified



Source: W. McLaughlin for UNIDO

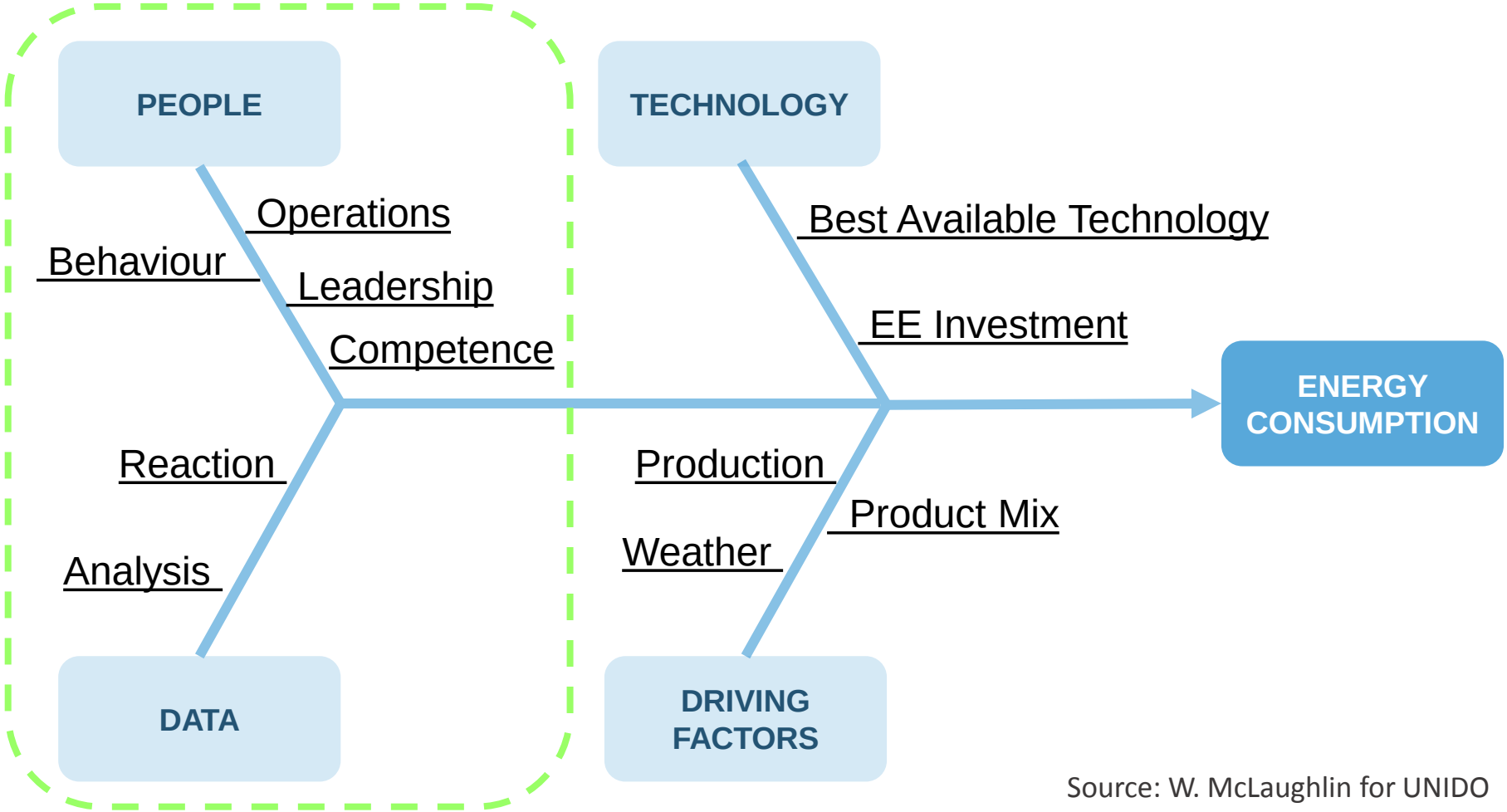
Why EnMS in industry?

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

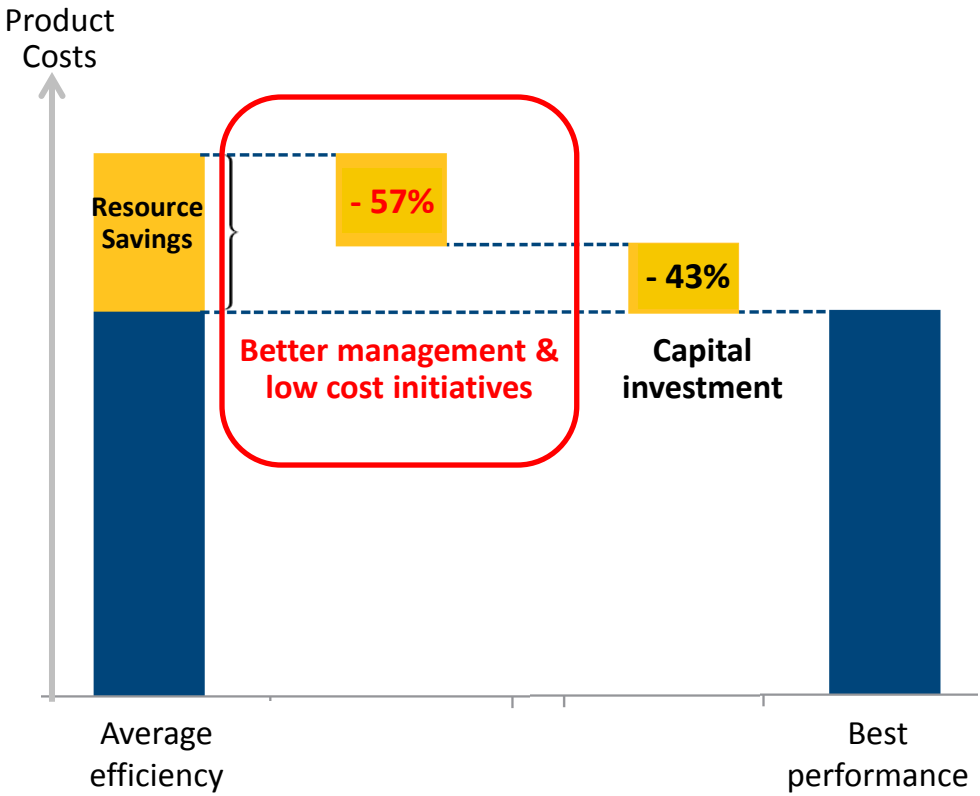
Where are opportunities for improvement?

Savings potential from EE (%)

Sector or Product	Developed countries	Developing countries
Petroleum refineries	10-15	70
Steam cracking	20-25	25-30
Ammonia	11	25
Alumina production	35	50
Iron and Steel	10	30
Cement	20	25
Glass	30-35	40
Pulp and Paper	25	20
Food and beverage	25	40
Other sectors	10-15	25-30

Source: UNIDO, 2011

Benchmarking study



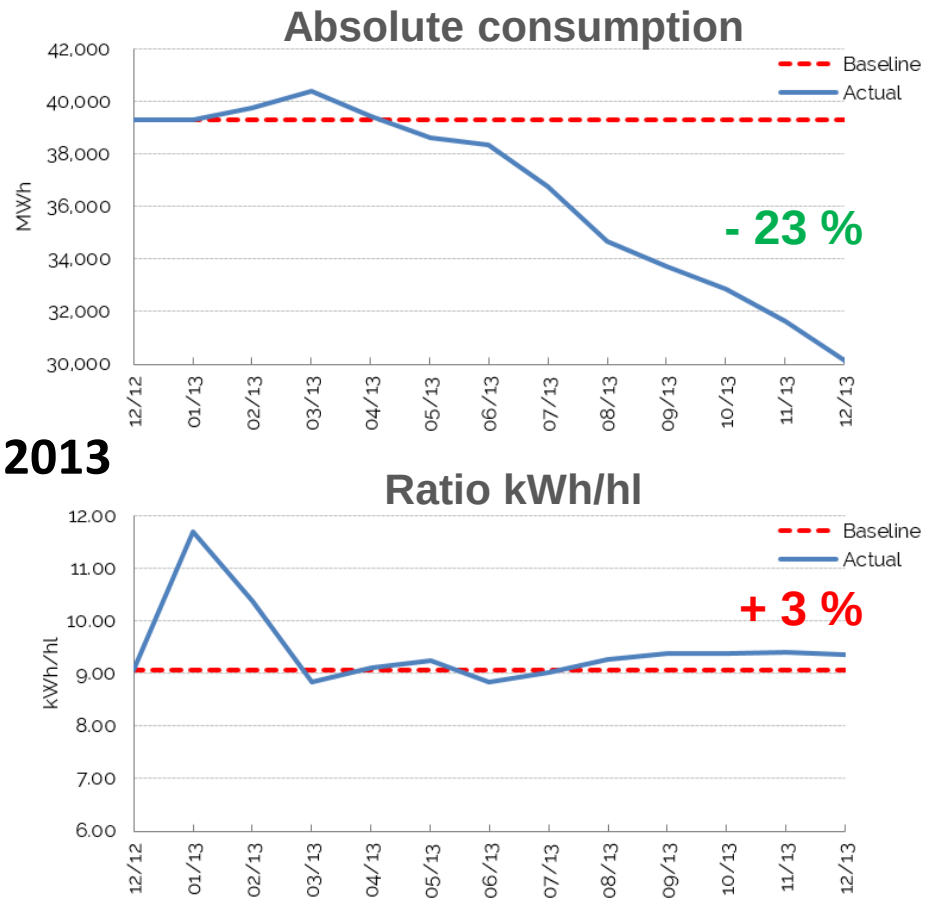
Source: Adapted from IFC, 2010

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



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 ☐

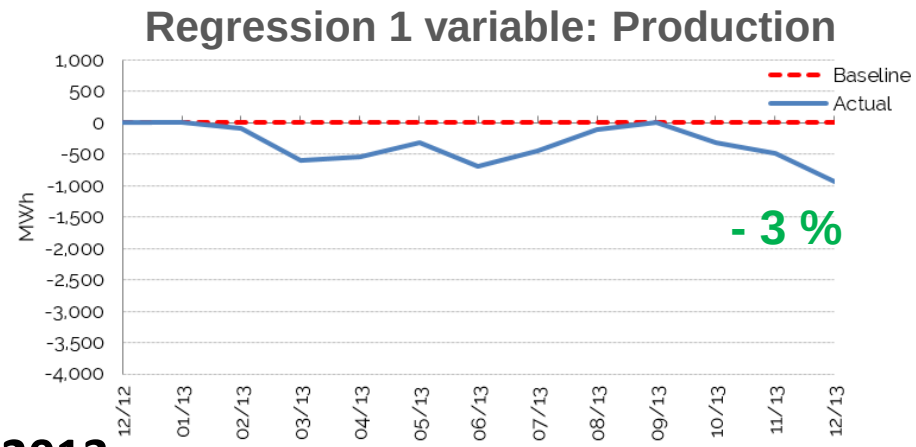
2. Would you approve additional 500k Euro for EE in 2014?

YES ☐ NO ☐

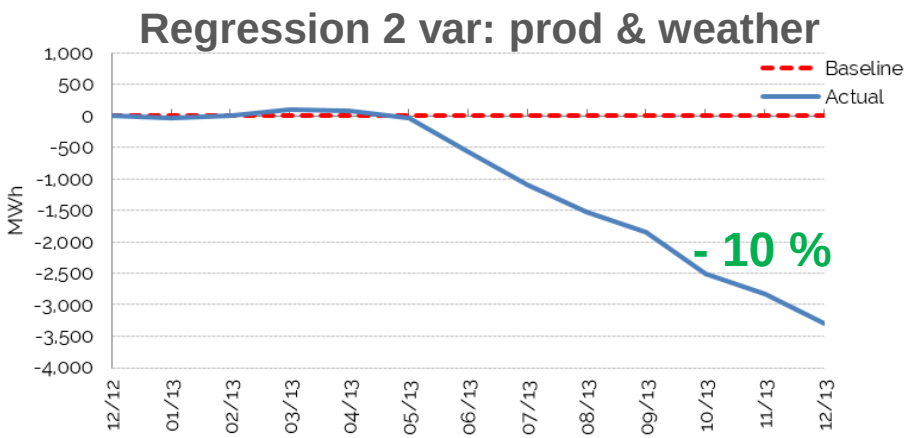
3. Would you consider a cash bonus for your energy team staff?

YES ☐ NO ☐

Energy performance in industry: "View" 2



2013



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YES ☐ NO ☐

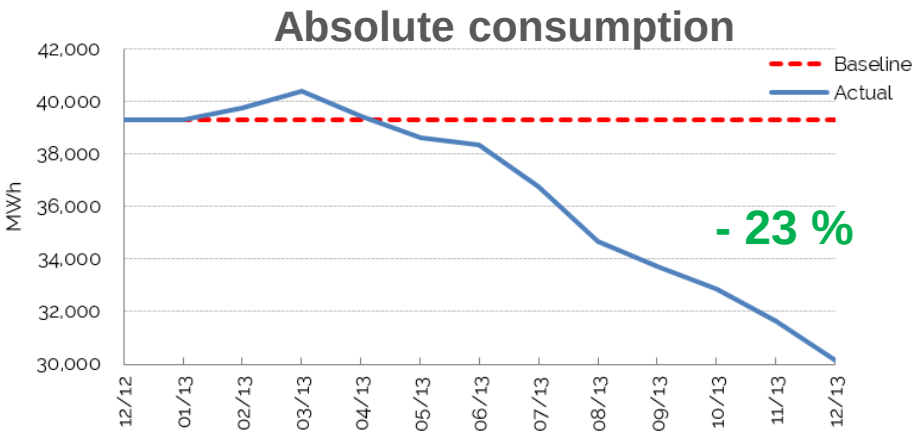
2. Would you approve additional 500k Euro for EE in 2014?

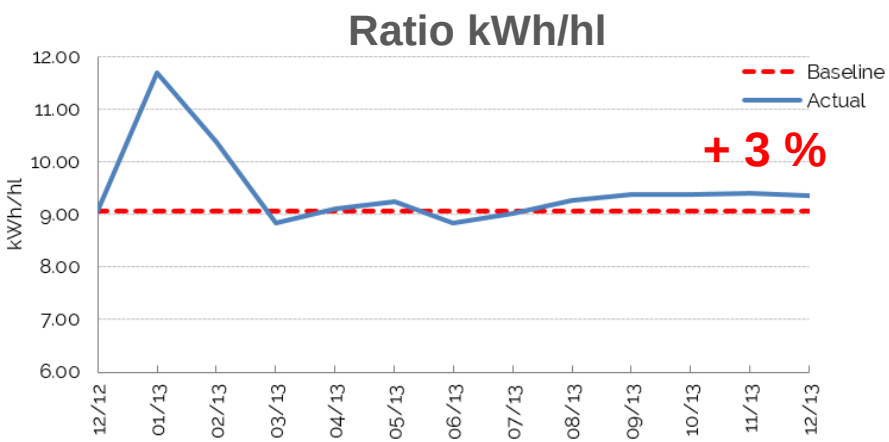
YES ☐ NO ☐

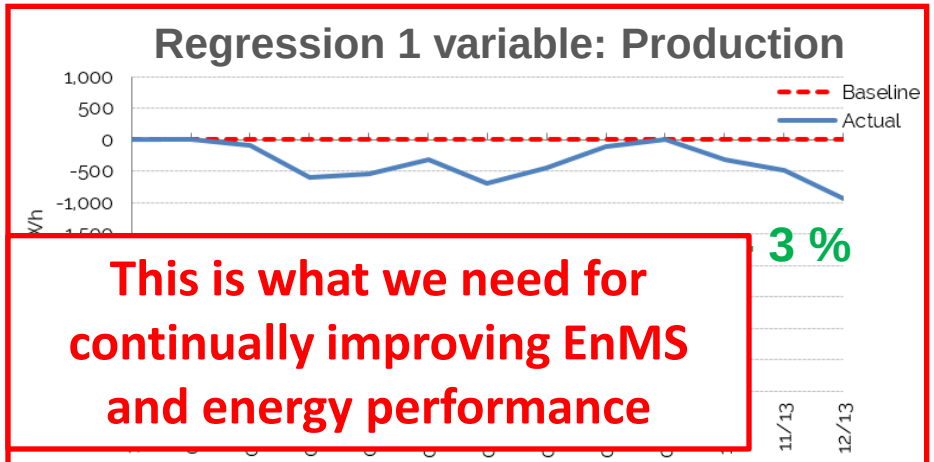
3. Would you consider a cash bonus for your energy team staff?

YES ☐ NO ☐

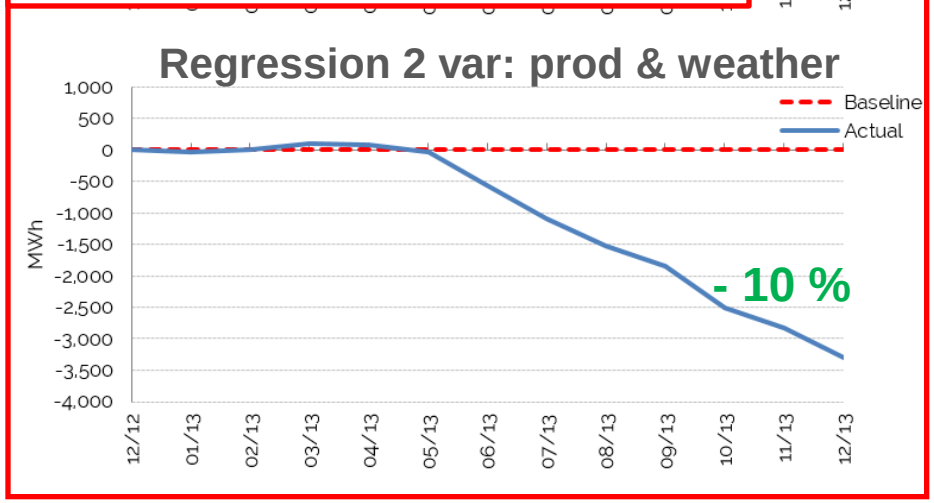
Energy performance in Industry – Which is right?







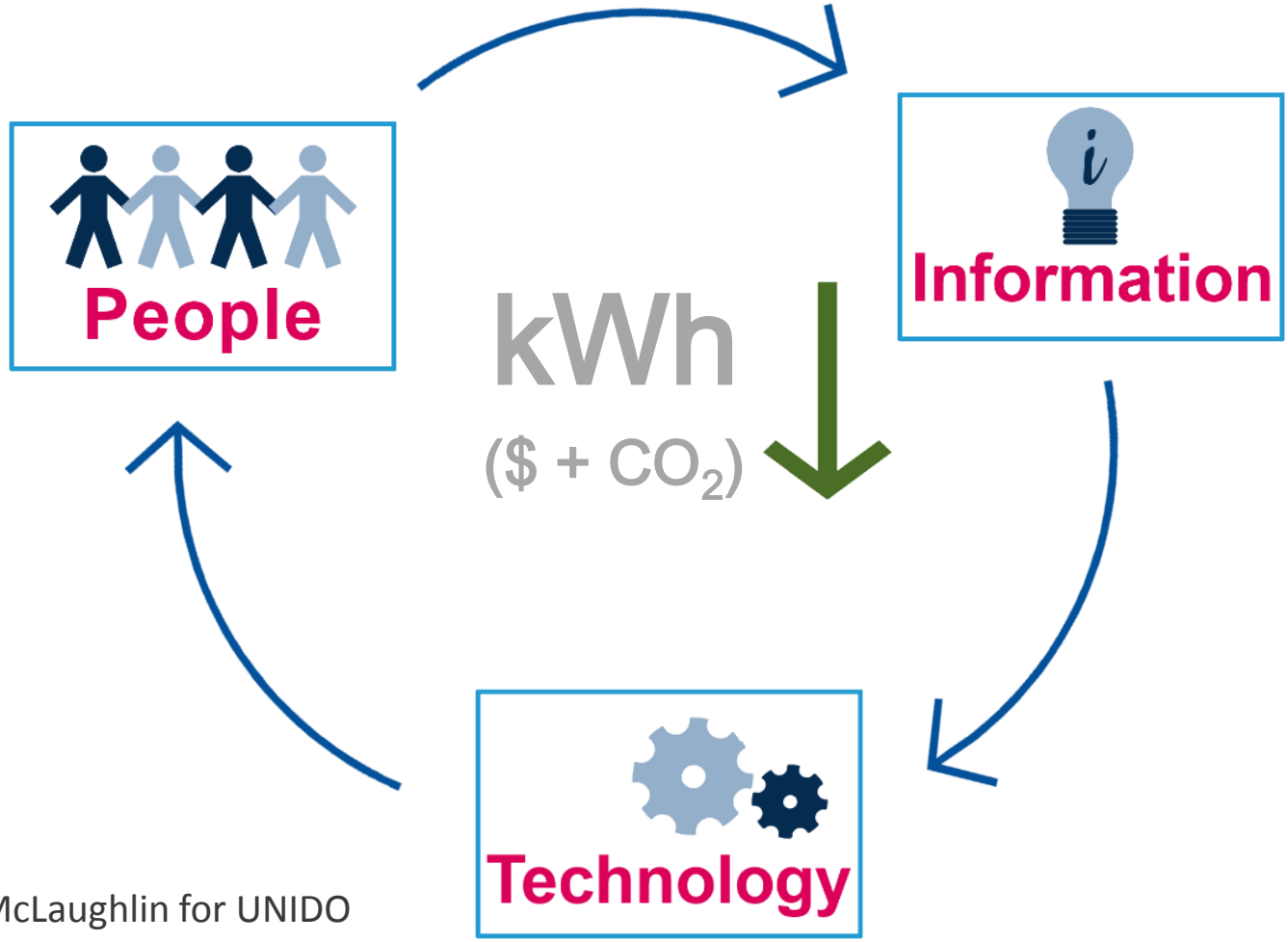
This is what we need for continually improving EnMS and energy performance



Source: UNIDO

Brewing industry

EnMS – Managing and improving 3 pillars

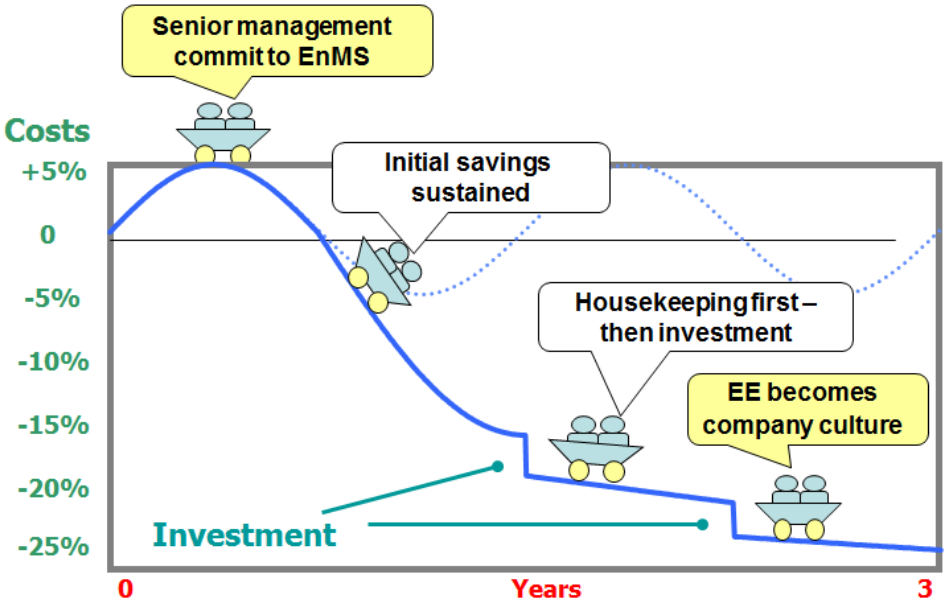


Source: W. McLaughlin for UNIDO

EnMS - Productive Change & Continual Improvement

- ✓ Top management engage in EE
- ✓ Challenge operations and established practices
- ✓ Build internal technical skills
- ✓ Data and analysis discipline
- ✓ Focus on no/low-cost measures
- ✓ <u>Continual improvement</u>

EE INTEGRATED



SUSTAINED ENERGY SAVINGS & INVESTMENTS!

What can EnMS achieve?

EnMS Quantitative Achievements

- Energy savings
- Energy cost savings
- Non-energy benefits (water savings, material savings, maintenance costs reduction, etc.)
- GHG and other pollutants emission reductions
- Resources for EE
- Reduced response time to dev.
- ……

- Most industrial <u>enterprises that implemented EnMS</u> achieved average annual energy intensity reductions of 2-3% against 1% reduction of business as usual (IRL, NET, DEN, SWE, USA)
- For companies new to energy management, savings during the first 2 years are 10-20%
- **<u>UNIDO experience</u>**: organization-wide energy savings in first 1-2 years range from 4% to 15%, with little or no capital investments

EnMS Qualitative Achievements

- Management focus for energy efficiency
- Informed decision making
- Improved control of production operations and energy/power demand
- Staff competencies development
- Behavioral/cultural change for energy efficiency and continual performance improvement
- Continuity of performance through changes of personnel, products and processes
- Improved quality of production
- Systematic and structured activities
- Positive company/corporate image (operational excellence, environmental stewardship, social responsibility, etc.)
- ……

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..... <u>driven by EnMS!</u>

2012 Energy Savings (Norm.) > 100 GWh

Energy Efficiency Achievements 2011	
Energy Management System Implemented	
No. of Projects/Measures	11
Total Capital Investment (USD)	**0**
2011 Gross Financial Savings (USD)	**9,076,000**
Overall Payback Period (in years)	0
2011 Energy Savings Norm. (GWh)	**79.95**
2011 GHG Reductions (tons CO_2)	77,000

Example 2 : Dairy – Moldova

LACTIS J.S.C

- ✓ Open joint stock company (about 10% on Moldovan market)
- ✓ 185 employees
- ✓ Management started to look into EE in 2009 to reduce production costs and impact of increased energy prices

LACTIS improvements 2012	
Energy Management System Implemented	
No. of Measures/Projects	**11**
Total Capital Investment (USD)	**6,900**
Gross Monetary Savings (USD)	**22,000**
Overall Payback Period (in years)	**0.32**
2012 Energy Savings Norm. (MWh)	**328**
2012 GHG Reductions (tons CO_2)	**160**

Value of EnMS/EE investments planned in 2012 for 2013-2014 was 410,000 USD

80% implemented

Example 3 : Refractory Material – Macedonia

Vardar Dolomit

- ✓ Production of fire restistant materials based on sintered dolomite
- ✓ 85 employees
- ✓ 29.3 GWh consumption of oil & mazut in 2015
- ✓ 3.3 GWh consumption of electricity in 2015
- ✓ EnMS scope in 2016 only electricity

- 19,655€ from electricity savings (7.5%), normalized
- 70,000 € of power purchase contract savings due to better electricity demand control and forecasting

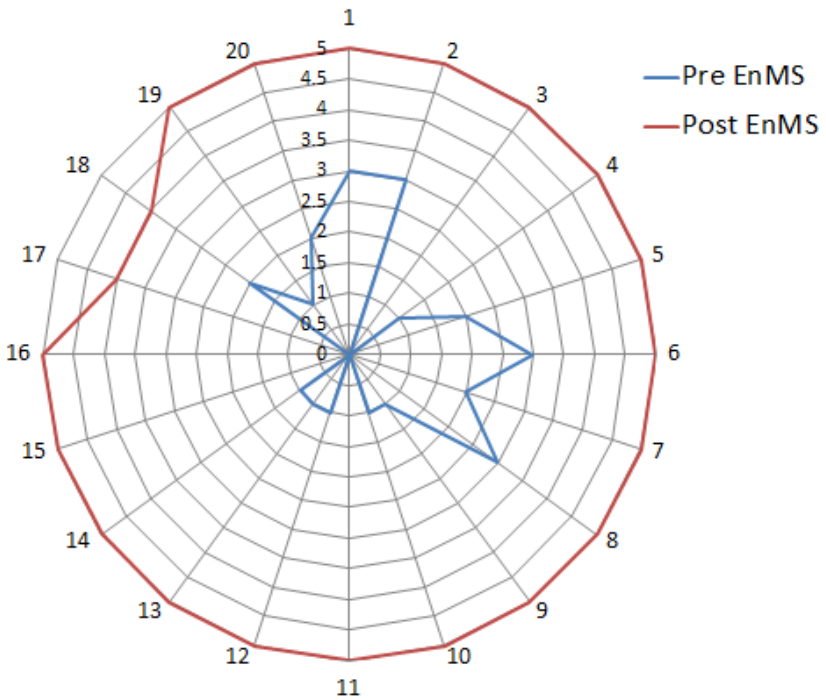
Payback time of EnMS implementation considering all experts and staff costs = 3 months

Vardar Dolomit improvements 2016	
Energy Management System Implemented	
No. of Measures/Projects	**21**
Total Capital Investment (EUR)	**5,600**
Gross Monetary Savings (EUR)	**89,655**
Overall Payback Period (in years)	**0.06**
2016 Electricity Savings Nor. (MWh)	**248**
2016 GHG Reductions (tons CO_2)	**320.7**

Example 3 : Refractory Material – Macedonia

Vardar Dolomit

- EnMS scope in 2017 electricity + oil + mazut
- 174 MWh of normalized energy savings in first 4 months of 2017, against 2016 baseline, with NO investments
- Identified a furnace malfunctioning thanks to UNIDO EnMPI methodology and prevented an explosion

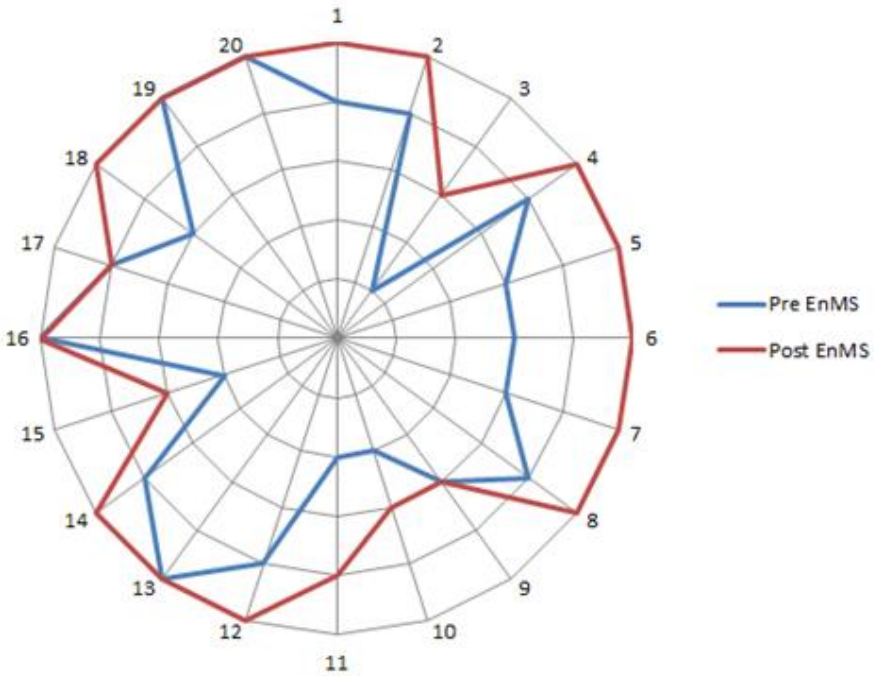


Improvement of Energy Management Practices

Example 4 : 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
- EnMS implementation being replicated in other branches of ELEM, the national largest power utility



Improvement of Energy Management Practices

2.97% of total consumption

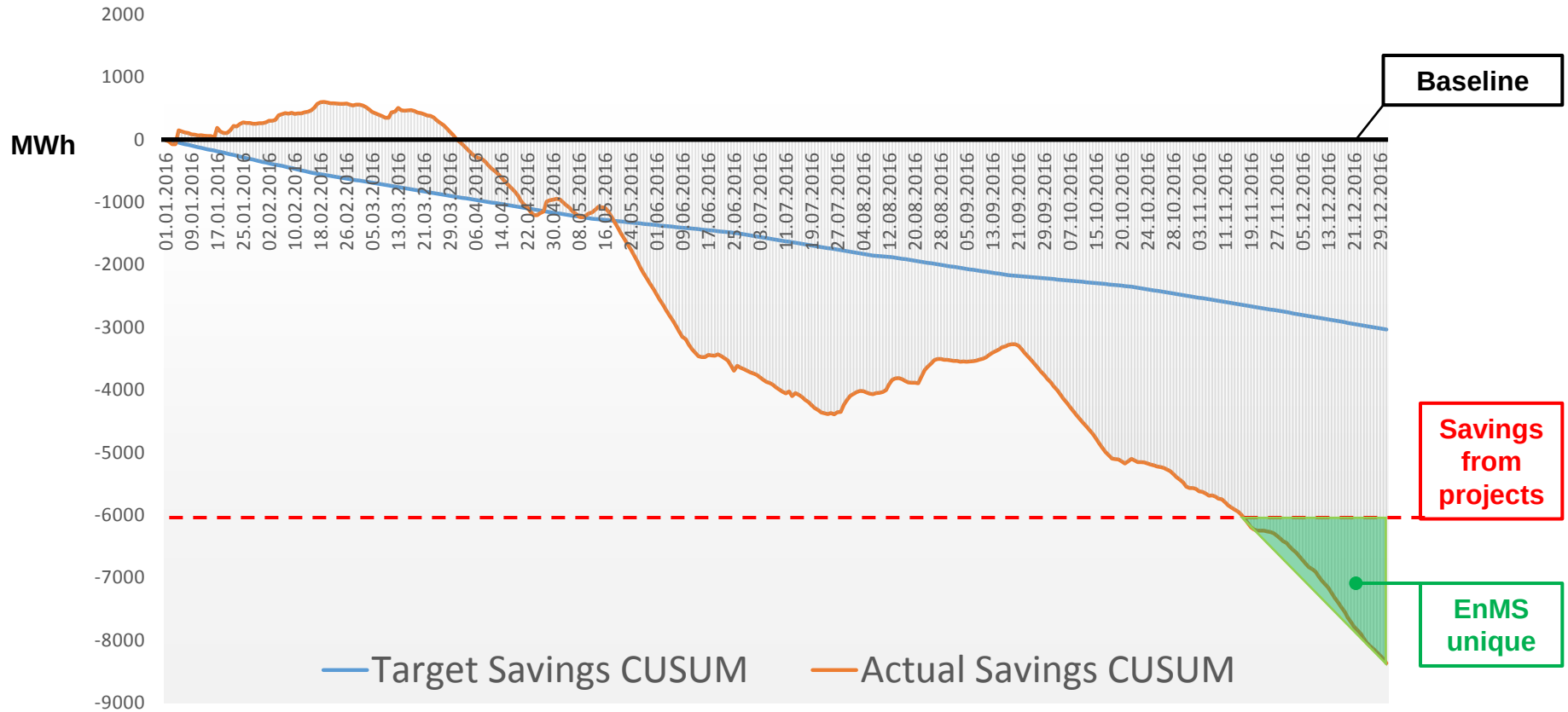
Payback time: 22-24 days

2016 Energy Savings Norm. (MWh)	**8,502**
2016 GHG Reductions (tons CO_2)	**10,528**

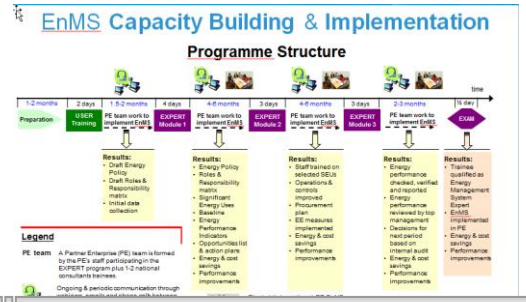
Example 4 : Power Generation – Macedonia

REK BITOLA

Actual savings vs Target & vs Projects - 2016



Example 5 : EnMS in Cities – Russian Federation

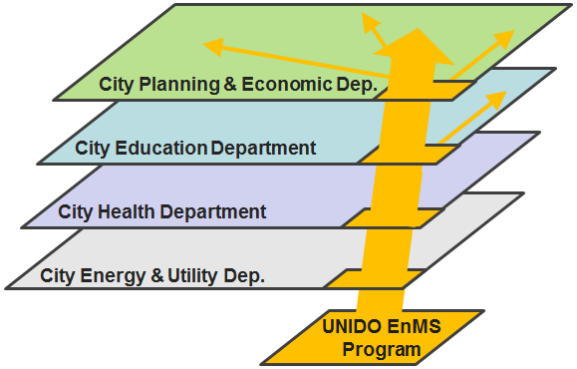


Track 1

Participants

9 companies from industry

3 companies from housing and utilities sector



Track 2

Participants

City Executive Committee

10 municipal dept./comp.

2 industrial companies

UNIDO-GEF Global EnMS-ISO 50001-ESO Programme

- Operational in 18 countries (as of Dec 2017)
  - 12 Countries at the end of 2012

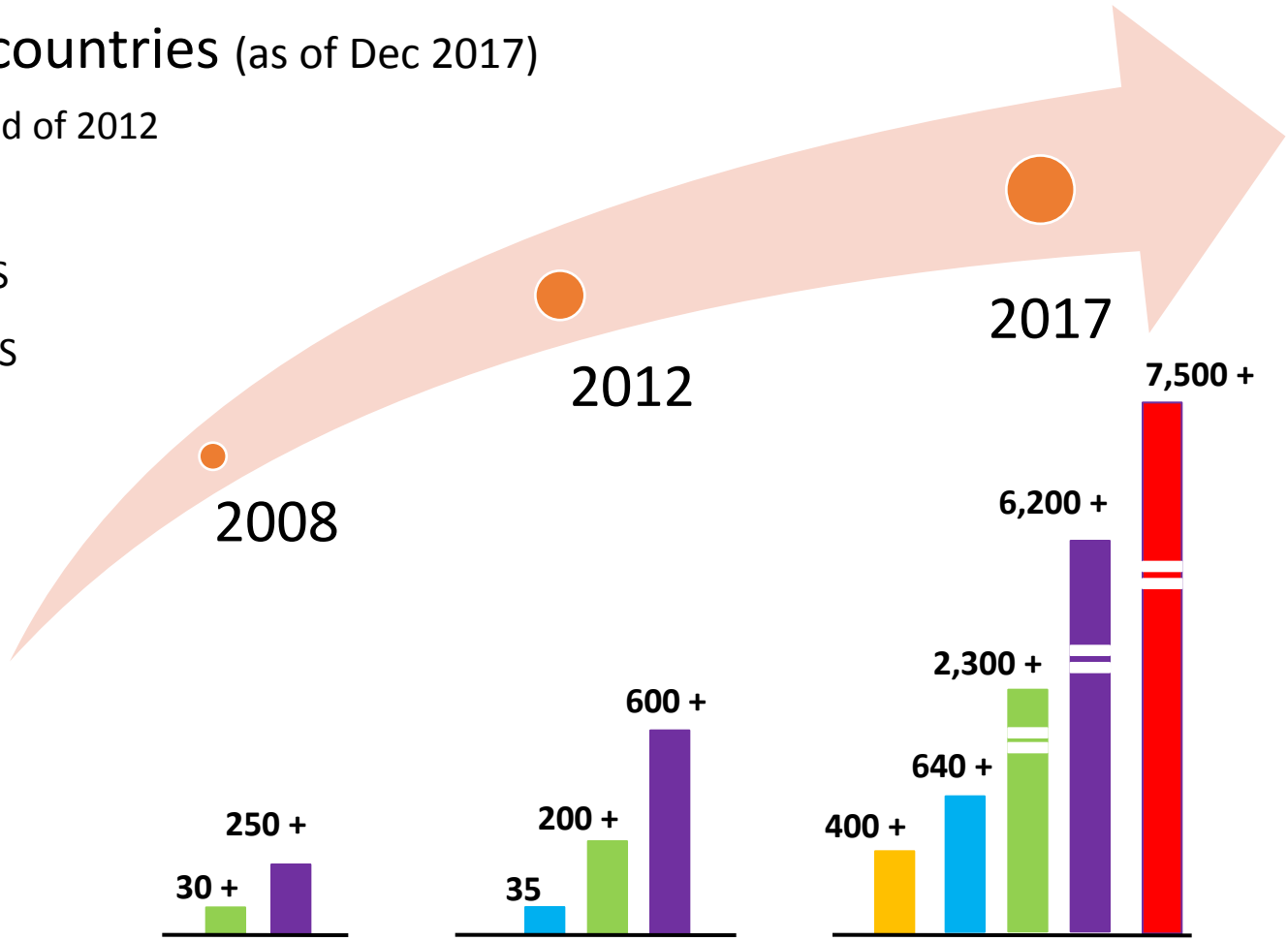
Decision-makers reached

Enterprises trained in EnMS

Consultants trained in EnMS

Enterprises with EnMS

Cumulative direct final energy savings (GWh)



Impact of UNIDO-GEF EnMS-ISO 50001-ESO Program

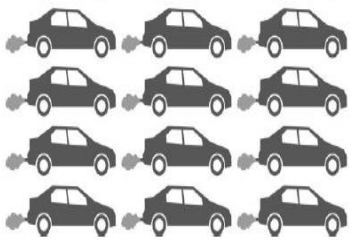
7,500 GWh of final energy savings =

Annual energy consumption of 1,230,000 EU households

OR

5 years energy production of 400 1 MW wind turbines

OR



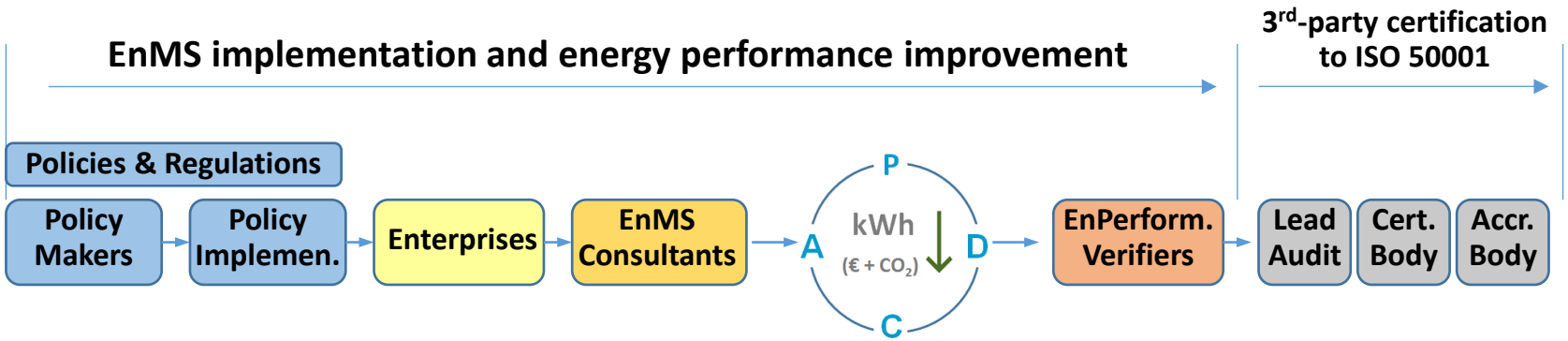
CO2 emissions of 1,875,000 middle class cars (running 12,500 km per year)

- Organization-wide energy savings in first 1-2 years range from 4% to 15%, with little or no capital investments
- Cumulative cost savings of beneficiaries companies estimated to exceed ***USD 250 mio*** without considering non-energy benefits
- Direct GHG emission reductions of more than ***4.8 million*** **tCO2**
- Sustainable pipeline of IEE investments generated

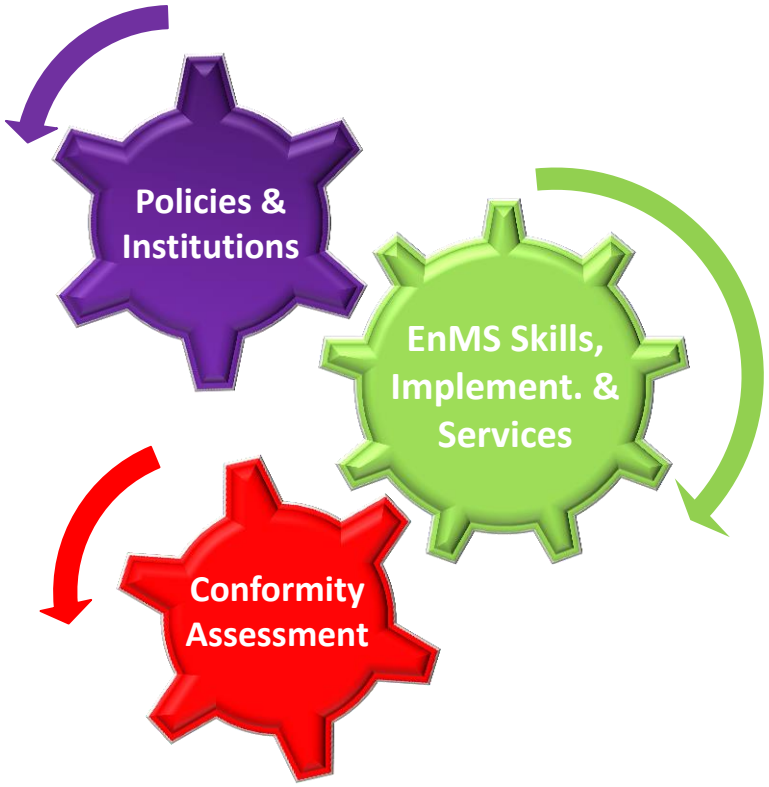
Policies and Programmes to promote EnMS-ISO 50001

Supply and value chain for EnMS-ISO 50001

Structure and Stakeholders



Success Factors for EnMS-ISO 50001 Deployment



- ✓ Level and quality of policy support, including regulation, for promotion & implementation of EnMS/ISO50001

+

- ✓ Availability of competent EnMS workforce on the "Supply" and the "Demand" sides

+

- ✓ Credible demonstration to organizations and the market of EnMS/ISO50001 tangible benefits

Policies that can support EnMS-ISO 50001

Sticks

- Energy or Carbon taxes
- Environmental legislation
- Mandatory implementation
- Energy Saving Obligation Schemes and White Certificates
- Mandatory competencies/professional requirements

Carrots

- Tax avoidance and rebates
- Cost-free or subsidized EnMS expert assistance and/or energy audits
- Funding schemes for energy management systems
- Long-term voluntary agreements
- Training and qualification programmes

Tambourine

- Peer-to-peer networks
- Award and recognition programmes

Adapted from Clemens Rohde

The importance of a Programmatic Approach

	Voluntary or Mandatory Standard	Financial incentives for Compliance	Technical Assist. Available	Penalties for Non-Compliance	Recognition Program	Linked to Voluntary Agreement	Training Avail. on Standard Compliance	Reporting to Public Entity Required	Industrial Systems Training Available	Market Penetration by Industrial Energy Use
Denmark	Vol	Yes*	Yes	Yes*	Yes	Yes	Yes	Yes	Lim	60%
Ireland	Vol	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	25%
Sweden	Vol	Yes**	Yes	Yes**	Yes	Yes	No	Yes	No	50%e
United States	Vol	No	Yes	No	Yes	No	Yes	No	Yes	<5%

Source: 2007, A. McKane for UNIDO

The importance of a Programmatic Approach

	Voluntary or Mandatory Standard	Financial incentives for Compliance	Technical Assist. Available	Penalties for Non-Compliance	Recognition Program	Linked to Voluntary Agreement	Training Avail. on Standard Compliance	Reporting to Public Entity Required	Industrial Systems Training Available	Market Penetration by Industrial Energy Use
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Sweden	Vol	Yes**	Yes	Yes**	Yes	Yes	No	Yes	No	50%e
United States	Vol	No	Yes	No	Yes	No	Yes	No	Yes	<5%
Japan^	Man	No	Yes	Yes	Yes	No	Yes	Yes	Yes	90%

Source: Adapted from A. McKane for UNIDO, 2007 & 2009

Examples of Policies Frameworks for EnMS-ISO 50001

Germany

- Energy taxes
- Mandatory energy audits for non-SME
- Funding schemes for energy management systems
- Energy efficiency networks

Netherland

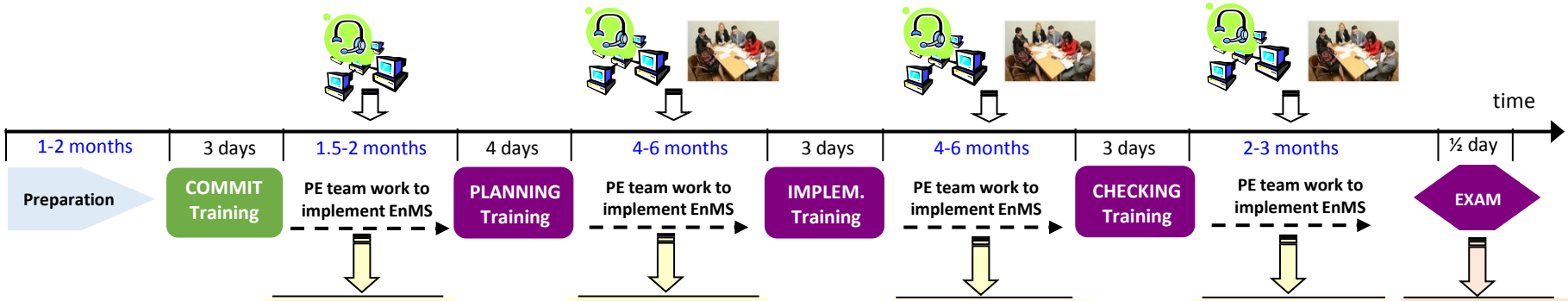
- Environmental law obligation to make IEE investments
- Long-Term Agreements including
  - ✓ TA for EnMS
  - ✓ Subsidies for audits
  - ✓ Financial incentives

Ireland

- Energy Agreements Programme including
  - ✓ Training
  - ✓ Financial support
  - ✓ Expert advice and assistance for EnMS implementation

Combining Skills Development and Results

The UNIDO EnMS Capacity Building and Implementation Programme



Results:
- Draft Energy Policy
- Draft Roles & Responsibility matrix
- Initial data collection

Results:
- Energy Policy
- Roles & Responsibility matrix
- Significant Energy Uses
- Baseline
- Energy Performance Indicators
- Opportunities list & action plans
- Energy savings & …

Results:
- Staff trained on selected SEUs
- Operations & controls improved
- Procurement plan
- EE measures implemented
- Energy & cost savings
- Performance improvements

Results:
- Energy performance checked, verified and reported
- Energy performance reviewed by top management
- Decisions for next period based on internal audit
- Energy savings & …
- Performance impr.

Results:
- Trainee qualified as Energy Management System Expert
- EnMS implemented in PE
- Energy & cost savings
- Performance improvements

Legend

PE team A Partner Enterprise (PE) team is formed by the PE's staff participating in the EXPERT program plus 1-2 national consultants trainees.

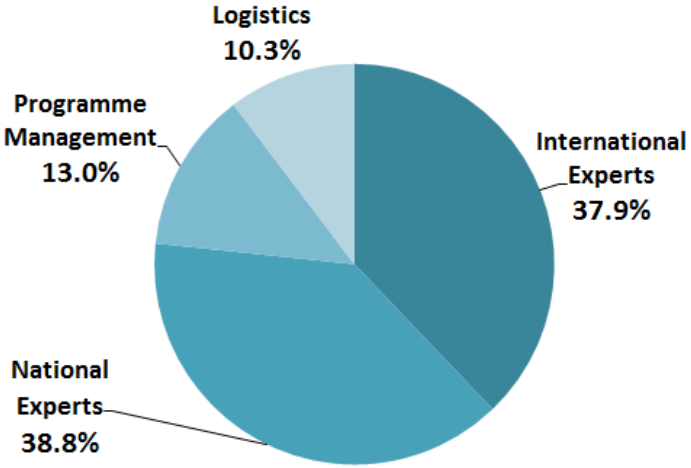
Ongoing and periodic communication through webinars, emails and phone calls between international trainers and PE teams to review progress, discuss issues and provide guidance.

Plant visits by national EE consultants trainees

Capacity Building and Implementation Programme

Costs and Benefits Analysis - FYR of Macedonia Pilot

- 12 Partner enterprises (70% success rate)
- 23 Nat. Consultants/Expert Trainees
- Full cost/value of Nat. Consultants
- Include Progr. develop. and implementation
- No inclusion of UNIDO staff & support costs
- [illegible] 13.19 GWh (67% no cost)
- **Cost-Benefit Ratio (1Yr) = 0.337**
- **Cost-Benefit Ratio (5Yr) = 0.026**
- **Money savings 5 Yr: [illegible]**
- **Without considering non-energy benefits!**



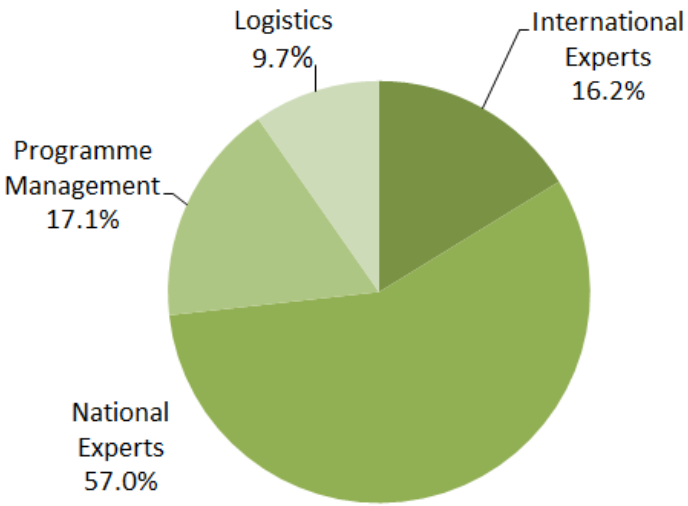
UNIDO Implementation	COST
Category	[USD]
International Experts	110,000
National Experts	112,700
EnMS CBI Programme Management	37,800
Logistics	30,000
TOTAL	**290,500**

Capacity Building and Implementation Programme

Costs and Benefits Analysis - FYR of Macedonia Replication

- 10 Partner enterprises
- 12 UNIDO National EnMS Expert
- Include Progr. preparation and implementation
- No inclusion of UNIDO staff & project support costs
- **Target Final Energy Savings 1 Yr: 10 GWh**
- **Money Savings 1 Yr: 650,000 USD (50% no cost)**
- **Without considering non-energy**

Cost-Benefit Ratio (1Yr) = 0.158



National Replication	COST
Category	[USD]
International Experts	16,750
National Experts	58,800
EnMS CBI Programme Management	17,600
Logistics	10,000
TOTAL	**103,150**

Scaling-up – Utility Programmes

FYR of Macedonia

- Partnership UNIDO IEE Project and EVN Macedonia (Power Utility)
- 6+2 new companies implementing EnMS, including EVN Macedonia
- 6 UNIDO Qualified National EnMS Experts providing support
- 7 new EnMS Expert Trainees, 2 from EVN Macedonia
- Cost-sharing of Qualified National EnMS Experts
  - 1/3 UNIDO project; 1/3 EVN Macedonia; 1/3 Beneficiary company
- 75% National Trainers – 25% International Trainers
- EVN Macedonia's Goals → Start providing EnMS-EE Services to Clients

Estimated (Replication) Cost to UNIDO ~ 10% of Pilot Program (i.e. <30,000 USD)

Scaling-up – Corporate Programmes

Ural Mining and Metallurgical Company (UMMC Holding)

9 companies in EnMS Program in 2015

1. AK Serov Metallurgical Plant
2. Coal Mining Company "Kuzbassrazrezugol" (Kedrovsky Open Surface Mine)
3. Branch Of "UMMC-Steel" - Electrostal Tyumen Metallurgical Plant
4. Joint Venture Company "Katur-invest"
5. Kirov Non-ferrous Metals Processing Plant
6. Revda Non-ferrous Metals Processing Works
7. "UMMC-Agro" - Teplichnoe
8. Shadrinsky Automobile Units Plant
9. Sukhoi Log Secondary Non-ferrous Metals Plant

Costs of energy resources in 2015 > **17 billion rubles;**

Energy resources account for **11.6%** in production costs;

Due to tariff increase, energy costs expected to account for **21,5 billion rubles in 2018.**

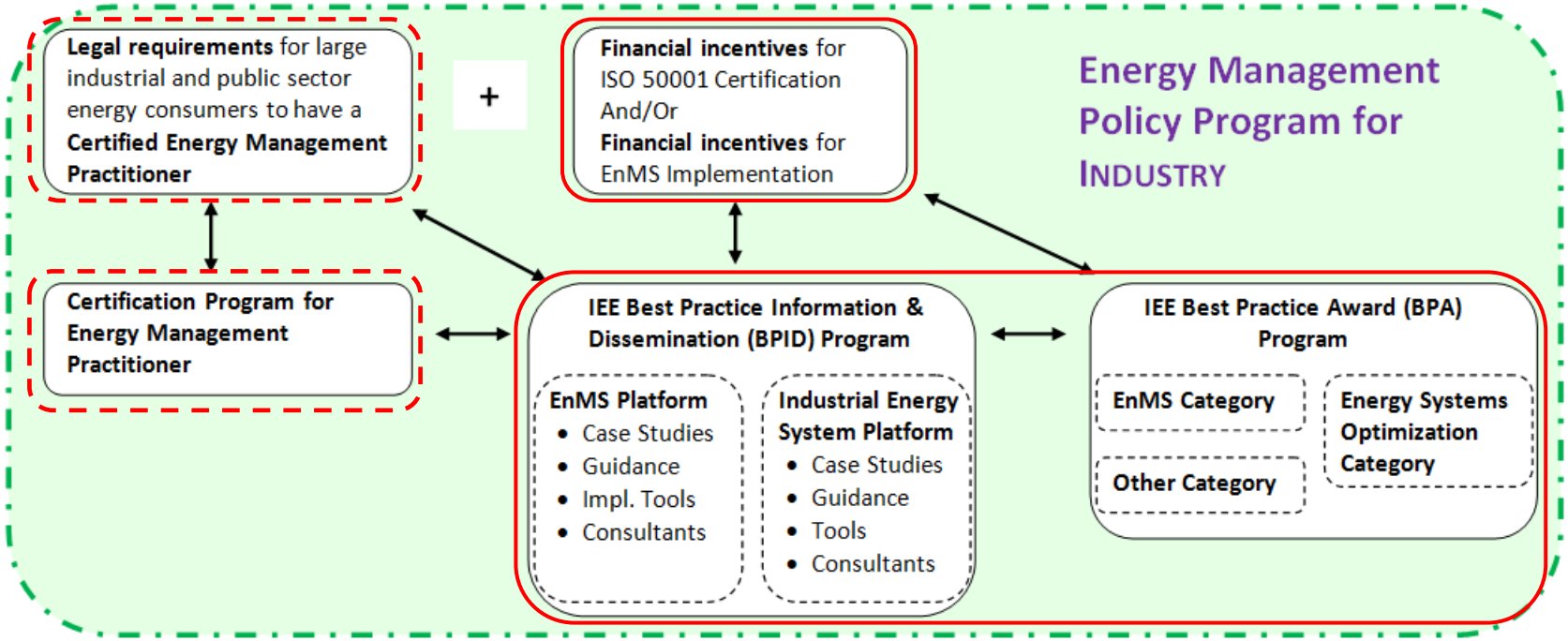
Energy consumption: (9 companies) : 1054.3 GWh of Electricity
269.1 thou. m3 of Natural Gas

2015 Final Energy savings: 78.1 GWh (7.3%)
2015 Cost savings: 86.4 mln. rub.
2015 GHG emissions avoided: 32 361 tons CO2

EnMS implemented in 10 new companies in 2016-2017. UMMC holding counts more than 70 companies.

Scaling-up – Policy Programmes

FYR of Macedonia



Lessons learnt from EnMS implementation

- ✓ Top management necessary but not always sufficient
- ✓ Context and culture important in transferring knowledge and attitude towards change
- ✓ Education, knowledge and competencies are critical
- ✓ EnMS/ISO 50001 means CHANGE .... first and foremost of organizations' processes and people's behavior than technologies
- ✓ EnMS/ISO 50001 brings about "paradigms shift" → save energy without spending money; energy management is not just one person's business; change of organization culture for EE; ....
- ✓ EnMS/ISO 50001 drives and achieves long-term sustainability of EE

Some Success Factors and Challenges

SUCCESS FACTORS

- ✓ Real top management commitment
- ✓ Openness to change
- ✓ Ability to show improvements at early stage
- ✓ Rewarding commitment and performance
- ✓ Strong consultants and supporting program

CHALLENGES

- ✓ To support change management and behavior change
- ✓ To manage and support transition from OLD to NEW energy performance measurement and indicators
- ✓ Small companies

ENERGY MANAGEMENT WORKING GROUP

PURPOSE AND MEMBERSHIP

The **Energy Management Working Group (EMWG)** is an initiative of the **Clean Energy Ministerial**, the **International Partnership for Energy Efficiency Cooperation (IPEEC)**, and the **G20 Energy Efficiency Action Plan** that aims to accelerate the adoption of energy management systems in industrial facilities and commercial buildings worldwide.

http://www.cleanenergyministerial.org/initiative-clean-energy-ministerial/energy-management-working-group

THANK YOU!

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UNIDO