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# MORE4Sustainability

Roadmap for Sustainable Asset Management - **Part 2**  
How to implement the Sustainable Asset Management



IN PARTNERSHIP WITH



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North-West Europe

More4Sustainability



# How to implement the Sustainable Asset Management

Now that all elements of the MORE4Sustainability Framework have been explained in the first part and, it is clear which focus areas and practices make the difference, this second part offers a practical step-by-step plan to apply Sustainable Asset Management.

For this purpose, the Implementation Roadmap, can be used. This roadmap consists of six steps (see figure 1) and those will be further explained on the following pages.

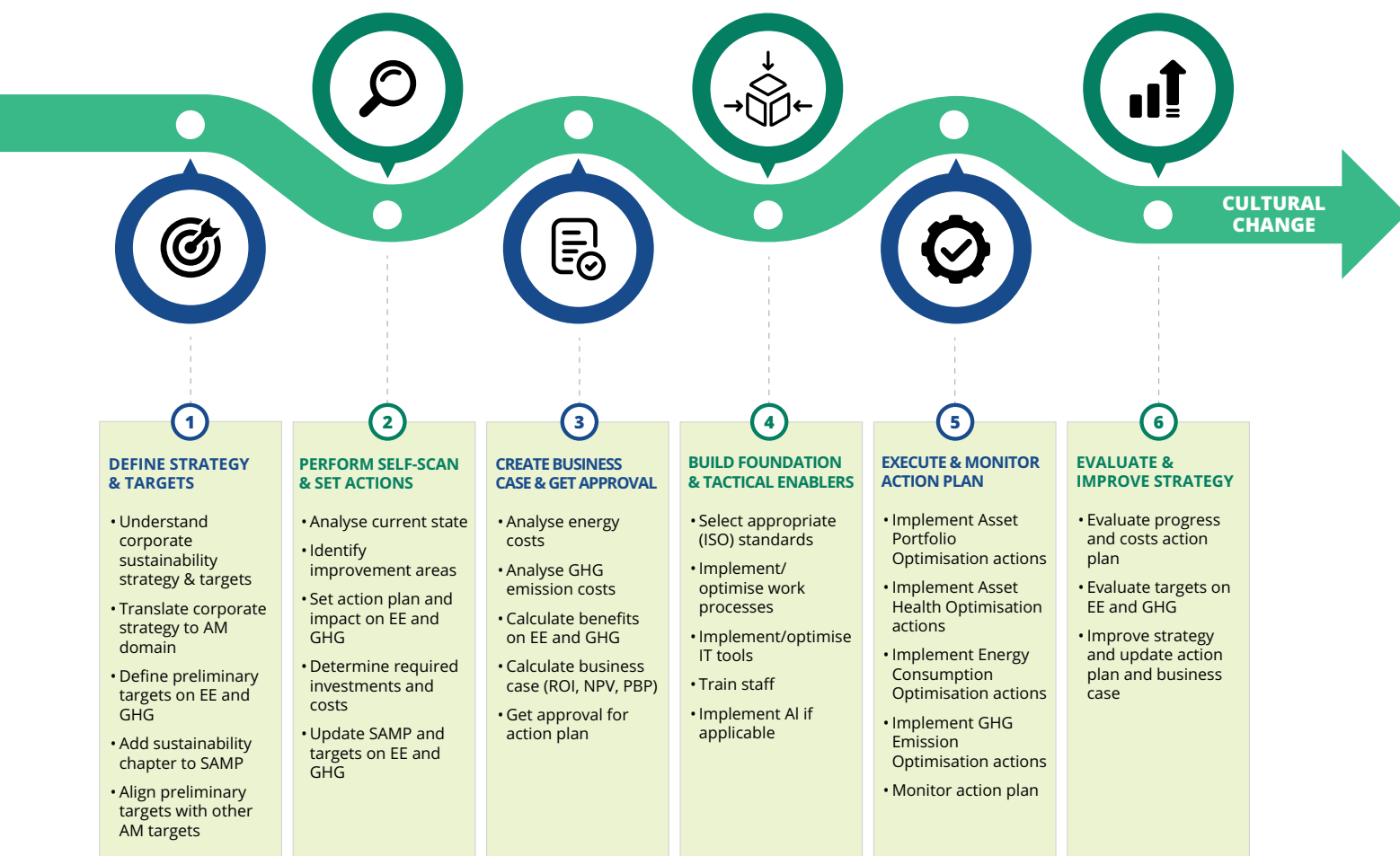


Figure 1 | The MORE4Sustainability Implementation Roadmap.



## Step 1: Define Strategy & Targets

The first step in the Implementation Roadmap is to develop a Sustainable Asset Management Strategy. This step begins with translating the corporate sustainability strategy into the Asset Management domain. The primary question that needs to be answered is: to what extent can the Maintenance and Asset Management organisation contribute to the company's objectives in terms of energy efficiency and GHG emissions?

The answer to this question is translated into preliminary targets and documented in a separate Sustainability chapter in the Strategic Asset Management Plan (SAMP). The SAMP contains all targets of the Maintenance



and Asset Management organisation related to technical availability, reliability, safety, costs, and lifespan, and describes how these targets should be achieved. By aligning the Sustainable Asset Management targets with the other targets within the SAMP, it is ensured that other stakeholders (Production, Finance, Safety & Health, Engineering) are not unexpectedly affected.



## Step 2: Perform Self Scan & Set Actions

The second step within the Implementation Roadmap is to create an action plan. This involves the actions that need to be carried out to meet targets on Energy Efficiency Improvement and GHG Emission Reduction.

For this purpose, the MORE4Sustainability Self Scan has been developed. Based on this Self Scan, companies can analyse their current situation and identify areas for improvement.

The Self Scan is built around the twelve focus areas of the MORE4Sustainability Framework and inventories the current implementation level of the underlying practices (see figure 2).



By comparing the current implementation level and ambition for 2030 with the implementation level of the early adopters, it becomes clear where the potential for improvement lies. To utilise this potential, actions must be identified. In the Self Scan, these actions are recorded and budgeted: what investment is needed and what happens to the annual costs?

**Download the MORE4Sustainability Self Scan**  
byby:

- **Clicking** this green frame
- Scanning this **QR code**
- or by using the **url** below.

<https://bit.ly/M4Sdownloads>



	% Early adaptors with full implementation	Current Implementation Level	Target Implementation Level 2030	Description of action	Required Investment (€)	Additional annual costs (€)	Energy Efficiency Improvement 2030	GHG Emission Improvement 2030
<b>1.1 Plant Electrification</b>							Early Adaptors = 1,5%	Early Adaptors = 2,0%
1.1.1 Pumps	33%	0. Not Implemented	1. Pilot Implementation					
1.1.2 Compressors	40%	2. Roll out	3. Fully implemented					
1.1.3 Heating elements	40%	0. Not Implemented	3. Fully implemented					
1.1.4 Vehicles and forklifts	53%	3. Fully implemented	3. Fully implemented					
1.1.5 Other	0%	1. Pilot Implementation	2. Roll out					
<b>1.2 Sustainable Asset Replacement</b>							Early Adaptors = 5,3%	Early Adaptors = 4,9%
1.2.1 Led Lighting	67%	1. Pilot Implementation	3. Fully implemented	Replacement of all lighting by LED	100.000			
1.2.2 Smart and adaptive lighting	47%	1. Pilot Implementation	2. Roll out					
1.2.3 High-efficiency HVAC	33%	1. Pilot Implementation	3. Fully implemented					
1.2.4 High-efficiency motors and drives	60%	0. Not Implemented	2. Roll out	Replacement of 10 motors	300.000		1,0%	1,0%
1.2.5 Life extension, refurbishment and overhaul	53%	0. Not Implemented	0. Not Implemented					
1.2.6 Circularity for sustainable replacement	40%	0. Not Implemented	0. Not Implemented					
1.2.7 Other	0%	0. Not Implemented	0. Not Implemented					
<b>1.3 Production Process Reengineering</b>							Early Adaptors = 3,0%	Early Adaptors = 2,1%
1.3.1 Process optimization and redesign	53%	0. Not Implemented	0. Not Implemented					
1.3.2 Product conversion	27%	0. Not Implemented	0. Not Implemented					
1.3.3 (Partial) plant closure	7%	1. Pilot Implementation	3. Fully implemented					
1.3.4 Building (a partial) new factory	27%	1. Pilot Implementation	2. Roll out					
1.3.5 Circularity from process reengineering	13%	1. Pilot Implementation	3. Fully implemented					
1.3.6 Other	0%	0. Not Implemented	2. Roll out					
<b>2.1 Asset Energy Efficiency Care</b>							Early Adaptors = 4,3%	Early Adaptors = 3,2%
2.1.1 Regular cleaning	73%	3. Fully implemented	3. Fully implemented					
2.1.2 Lubrication	60%	1. Pilot Implementation	3. Fully implemented	New lubrication service of supplier		20.000		
2.1.3 Filter maintenance	60%	3. Fully implemented	3. Fully implemented					
2.1.4 Operator maintenance	47%	0. Not Implemented	0. Not Implemented					
2.1.5 Routine inspections	73%	3. Fully implemented	3. Fully implemented					
2.1.6 Monitor equipment settings	53%	0. Not Implemented	0. Not Implemented					
2.1.7 Other	0%	0. Not Implemented	0. Not Implemented					
<b>2.2 Predictive Maintenance</b>							Early Adaptors = 1,8%	Early Adaptors = 0,0%
2.2.1 PdM via condition monitoring	73%	1. Pilot Implementation	3. Fully implemented					
2.2.2 PdM through integrative data analysis	33%	1. Pilot Implementation	2. Roll out					
2.2.3 PdM and prescriptive maintenance	33%	1. Pilot Implementation	3. Fully implemented					
2.2.4 Other	0%	0. Not Implemented	2. Roll out					
<b>2.3 HighPrecision Maintenance</b>							Early Adaptors = 0,2%	Early Adaptors = 0,1%
2.3.1 Precision measurement	27%	0. Not Implemented	0. Not Implemented					
2.3.2 Laser accurate alignment	33%	1. Pilot Implementation	3. Fully implemented					
2.3.3 Accurate calibration of instruments	27%	1. Pilot Implementation	2. Roll out					
2.3.4 Managing high tolerances	27%	1. Pilot Implementation	3. Fully implemented					
2.3.5 Quality assurance	13%	0. Not Implemented	2. Roll out					
2.3.6 Clear maintenance instructions	33%	0. Not Implemented	0. Not Implemented					
2.3.7 Other	0%	0. Not Implemented	0. Not Implemented					
<b>3.1 Electrical Energy Optimization</b>							Early Adaptors = 4,9%	Early Adaptors = 2,0%
3.1.1 HVAC optimisation	67%	0. Not Implemented	0. Not Implemented					
3.1.2 Lighting upgrades	60%	0. Not Implemented	0. Not Implemented					
3.1.3 Motors and drives	53%	1. Pilot Implementation	3. Fully implemented					
3.1.4 Load balancing	33%	1. Pilot Implementation	2. Roll out					
3.1.5 Power factor correction	33%	1. Pilot Implementation	3. Fully implemented					
3.1.6 Other	0%	0. Not Implemented	2. Roll out					
<b>3.2 Thermal Energy Recovery &amp; Reuse</b>							Early Adaptors = 3,6%	Early Adaptors = 3,1%
3.2.1 Heat recovery systems	60%	1. Pilot Implementation	3. Fully implemented					
3.2.2 Cogeneration systems	7%	1. Pilot Implementation	2. Roll out					
3.2.3 District heating and cooling	0%	1. Pilot Implementation	3. Fully implemented					
3.2.4 Integrate industrial processes	20%	0. Not Implemented	2. Roll out					
3.2.5 Thermal storage systems	7%	0. Not Implemented	0. Not Implemented					
3.2.6 Other	0%	0. Not Implemented	0. Not Implemented					
<b>3.3 Thermal Energy Loss Prevention</b>							Early Adaptors = 2,5%	Early Adaptors = 1,9%
3.3.1 Insulation	73%	1. Pilot Implementation	3. Fully implemented					
3.3.2 Thermal imaging and infrared thermography	40%	1. Pilot Implementation	2. Roll out					
3.3.3 Temperature sensors	53%	1. Pilot Implementation	3. Fully implemented					
3.3.4 Other	0%	0. Not Implemented	2. Roll out					
<b>4.1 Fugitive Emission Prevention</b>							Early Adaptors = 0,6%	Early Adaptors = 0,6%
4.1.1 Leak detection and repair (LDAR)	20%	1. Pilot Implementation	3. Fully implemented					
4.1.2 Sealing and repair	13%	1. Pilot Implementation	2. Roll out					
4.1.3 Emission control technologies	13%	1. Pilot Implementation	3. Fully implemented					
4.1.4 Other	0%	0. Not Implemented	2. Roll out					
<b>4.2 GHG Capturing &amp; Reuse</b>							Early Adaptors = 0,0%	Early Adaptors = 0,0%
4.2.1 Capture technologies	7%	0. Not Implemented	0. Not Implemented					
4.2.2 Transport and storage	0%	1. Pilot Implementation	3. Fully implemented					
4.2.3 Use and conversion	0%	1. Pilot Implementation	2. Roll out					
4.2.4 Biological conversion	7%	1. Pilot Implementation	3. Fully implemented					
4.2.5 Other	0%	0. Not Implemented	2. Roll out					
<b>4.3 Renewable Energy Generation</b>							Early Adaptors = 3,3%	Early Adaptors = 7,4%
4.3.1 Solar energy systems	67%	1. Pilot Implementation	3. Fully implemented					
4.3.2 Wind energy systems	47%	1. Pilot Implementation	2. Roll out					
4.3.3 Biomass energy systems	13%	1. Pilot Implementation	3. Fully implemented					
4.3.4 Geothermal energy systems	13%	0. Not Implemented	2. Roll out					
4.3.5 Other	0%	0. Not Implemented	0. Not Implemented					
<b>Total</b>							Early Adaptors = 31,1%	Early Adaptors = 28%
<b>Total action plan - Focus Areas</b>					400.000	20.000	2,0%	2,0%

Figure 2 | Screenshot of the MORE4Sustainability Self Scan, tab "Focus Areas".



Energy Consumption	Amount	Unit	Price/unit (€)	Costs (€)	ton CO <sub>2</sub> -eq / unit	ton CO <sub>2</sub> -eq
Fossil Fuels						
Natural Gas	9.000.000	m3	0,75		0,00209	
Green / Renewable Gas		m3			0,00038	
Petrol		l		-	0,00285	-
Diesel		l		-	0,00302	-
Liquefied petroleum gas (LPG)		l		6.750.000	0,00170	15.300
Compressed natural gas (CNG)		kg		-	0,00287	-
Ethanol E85		l		-	0,00106	-
Biodiesel (B100)		l		-	0,00144	-
Coal		kg		-	0,00234	-
Electricity						
Grey Electricity	10.000.000	kWh	0,23	2.300.000	0,00070	7.000
Green Electricity		kWh		-	0,00005	-

Figure 3 | Screenshot of the MORE4Sustainability Self Scan, tab “Energy Consumption”.



### Step 3: Create Business Case & Get Approval

To obtain approval for the prepared action plan, a business case must be developed. The business case is the financial justification for investment projects. Based on Net Present Value (NPV), Return on Investment (ROI), and/or Pay Back Period (PBP) calculations, it can be demonstrated that an investment is profitable. This also applies to sustainability projects!

In step 2 (Perform Self Scan & Set Actions), the costs for implementing the measures were already identified. In step 3, we primarily look at the benefits. The value of sustainability projects lies mainly in Energy Efficiency Improvement on one hand and GHG Emission Reduction on the other.

- **The benefits of Energy Efficiency Improvement** are primarily in reducing energy consumption costs. In the Self Scan, current consumption and costs per type of fuel are displayed (see figure 3). By multiplying the total energy costs with the already established improvement in Energy Efficiency Improvement (see step 2), the expected cost savings become clear.
- **The benefits of GHG Emission Reduction** are in reducing the costs of CO<sub>2</sub> emission rights.



Surplus CO<sub>2</sub> emission rights have a market value and can be traded on the EU Emission Trading System (EU ETS). In the Self Scan, CO<sub>2</sub> emissions are calculated from energy consumption, and their value in euros is determined. With the already established improvement target for GHG Emission Reduction, the cost savings on emission rights can be calculated.

Both benefits can be included in the business case (see the example of a business case calculation on the next page).

In the Self Scan, the ROI, NPV, and PBP are automatically calculated. These financial ratios are often decisive for management approval in many companies. If approval is not given, step 2 must be repeated. Then the action plan must be adjusted, the investment level lowered, and possibly the sustainability goals increased.

### Example of a business case calculation

A factory with a replacement value of € 300M and a maintenance budget of € 6M has the following energy consumption:

• <b>Gas</b>	9,000,000 m <sup>3</sup> x € 0.75/m <sup>3</sup>	=	€ 6,750,000
• <b>Electricity</b>	10,000,000 kWh x € 0.23/kWh	=	€ 2,300,000
• <b>Total</b>		=	€ 9,050,000

Based on this energy consumption, the CO<sub>2</sub> emissions would be (see figure 3):

• <b>Gas</b>	9,000,000 m <sup>3</sup> x 0.0017 ton CO <sub>2</sub> /m <sup>3</sup> =	15,300 ton CO <sub>2</sub>
• <b>Electricity</b>	10,000,000 kwh x 0.0007 ton CO <sub>2</sub> /kwh =	7,000 ton CO <sub>2</sub>
• <b>Total</b>		= 22,300 ton CO <sub>2</sub>

The total cost of CO<sub>2</sub> emissions is:

$$22,300 \text{ ton CO}_2 \times € 68/\text{ton CO}_2 = € 1,516,400$$

The company has drawn up an action plan delivering 2% energy efficiency and 2% reduction in GHG emissions by 2030 (see figure 2). The annual savings are calculated as:

• <b>Energy Efficiency</b>	2% x € 9,050,000	=	€ 181,000
• <b>GHG Emission Reduction</b>	2% x € 1,393,388	=	€ 27,878
• <b>Total</b>		=	€ 208,868

The action plan is budgeted as follows:

• <b>One-time investment:</b> new motors and LED lighting	=	€ 400,000
• <b>Additional yearly costs:</b> new lubrication program	=	€ 20,000

The business case thus becomes:

• <b>Return on Investment</b>	=	48%
• <b>Net Present Value</b> (10 years, 5% discount rate)	=	€ 1,077,384
• <b>Pay Back Period</b>	=	2 years

From the above ratio analysis it can be concluded that the investment is profitable (ROI = 48%), creates positive value (NPV = € 1,077,384) and is recouped in two years (PBP = 2 years). The project is approved for implementation.

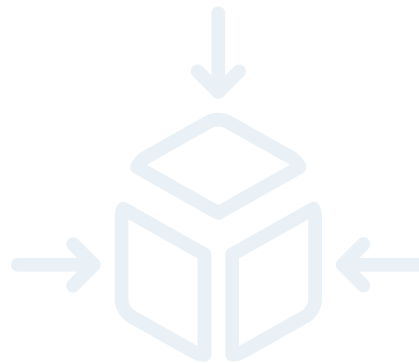
Note: this calculation example assumes 2% improvement in energy efficiency and 2% reduction in GHG emissions. Figure 1.8 shows that the actual improvement potential within companies is often much higher: 31% and 27% on average.



## Step 4: Build Foundation & Tactical Enablers

Once the action plan is approved, implementation can begin. This starts with laying a foundation at the tactical level. Chapter 2 already described that this involves the five enablers:

- **Processes:** what do we need to manage risks, implement improvement actions, and achieve lower environmental impacts?
- **Standards:** which standards can be used?
- **Tooling:** what IT systems are needed?
- **Training:** what education, skill and knowledge development is needed?
- **Artificial Intelligence:** how could AI improve efficiency and effectiveness of the new approach?



In step 2 of the Self Scan, improvement actions in these areas were already identified. In step 4, these are implemented to lay a foundation for the more technical improvement projects from the action plan. Without a good foundation in the field of processes, standards, people, and IT systems, these technical projects will not yield maximum returns.



## Step 5: Execute & Monitor Action Plan

Once the foundation is laid, the rest of the action plan can be started. These are the actions related to the twelve focus areas from the Framework, covered in chapters 3 through 6.

Each action can be considered a project in itself, with its own project management. From the Maintenance and Asset Management organisation, the coherence between the projects is monitored through a program management organisation.

Projects should be logically ordered, preferably via the 4-step sequence in the Framework: first take care that you have the right assets, then apply

good maintenance, then optimise Energy Efficiency, and finally limit GHG Emissions.

Collaboration with solution providers is strongly recommended, as there is a lot of innovation taking place in the field of Sustainable Asset Management at these companies.



### Focus areas with the biggest impact

With the benchmark study among the early adopters we investigated which focus areas within the MORE4Sustainability Framework

have the most impact on Energy Efficiency Improvement on the one hand and GHG Emission Reduction on the other. The result of this is visualized in the figure below.

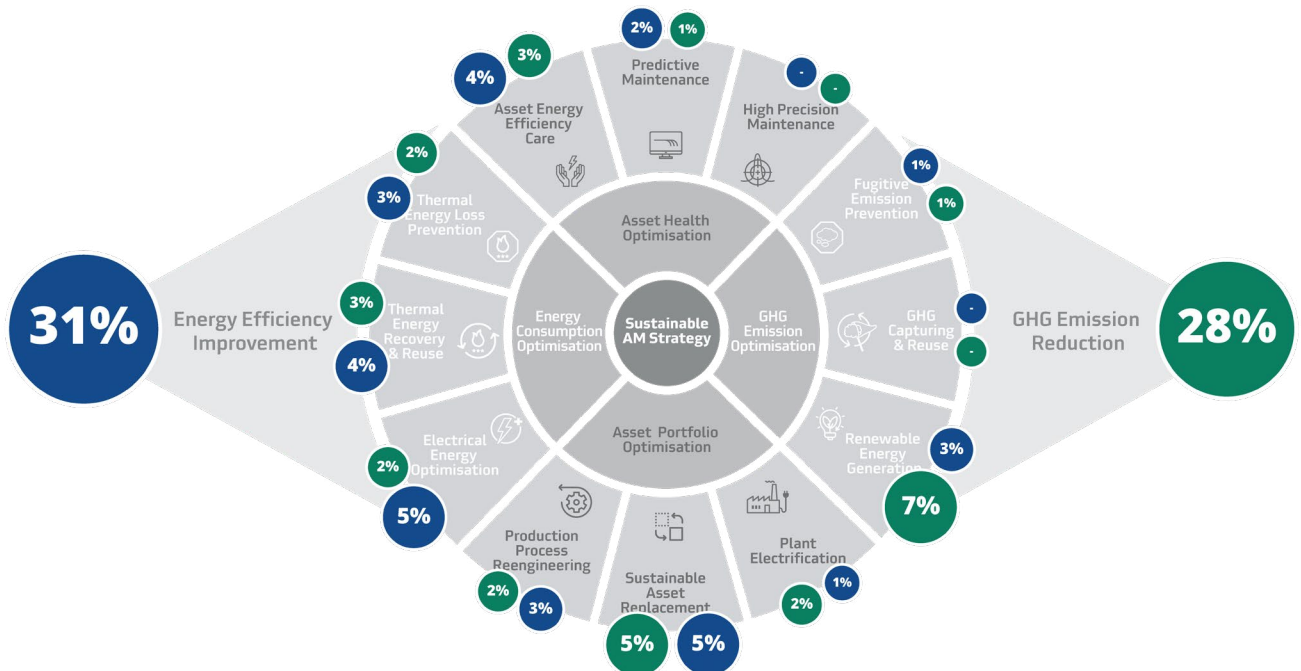


Figure 4 | Improvement potential per focus area on Energy Efficiency and GHG Emission.

Based on this overview, we can determine the following top 5 of best practices:

1. **Renewable Energy Generation** (improvement of 7% on GHG and 3% on EEI)
2. **Sustainable Asset Replacement** (improvement of 5% on GHG and 5% on EEI)
3. **Asset Energy Efficiency Care** (improvement of 3% on GHG and 4% on EEI)
4. **Thermal Energy Recovery & Reuse** (improvement of 3% on GHG and 4% on EEI)
5. **Electrical Energy Optimisation** (improvement of 2% on GHG and 5% on EEI)

When drawing up an action plan, it is useful to start with this top 5, provided that nothing has been done in these fields in the past.

Based on the benchmark data of the early adopters, an estimate can then be made of the expected impact on the Energy Efficiency Improvement and GHG Emission Reduction goals. By adding up the impacts of all individual actions, it becomes clear whether the preliminarily set targets are achievable. This insight may lead to adjustments of the targets in the SAMP.

Additionally, the Self Scan also contains an analysis of the strategic and tactical elements from the MORE4Sustainability Framework, so that improvement measures can be formulated for those elements as well.



## Step 6: Evaluate & Improve Strategy

The final step in the Implementation Roadmap is the annual improvement cycle.

Sustainable Asset Management programs often span multiple years and require periodic evaluation and adjustment. This involves measuring the progress and costs of individual projects. Deviations are evaluated and translated into corrective measures at the project level.

At the program level, it is measured whether the overall action plan meets the established improvement goals for Energy Efficiency Improvement and GHG Emission Reduction. Here too, corrective measures are initiated if the realisation deviates from the targets.

All insights are incorporated into new updates of the Sustainable Asset



Management Strategy, action plan, and business case. In effect, this restarts the MORE4Sustainability Roadmap from the beginning. The Sustainable Asset Management Strategy must be reassessed (are there new sustainability goals at corporate level?), the Self Scan must be performed again (is the current action plan still applicable?), targets must be readjusted (are we making sufficient impact?), and the business case must be updated (is the remaining budget still sufficient?).

## Cultural Change

Finally, we want to emphasise that a sustainable transition is only possible when employees are actively involved in the process. Creating support begins with involving employees early on and giving them ownership of sustainable initiatives. By providing employees insight into the choices made and their impact, a shared understanding of the objectives is created. This not only increases engagement but also the chance of successful and lasting change.

Rewarding sustainable behavior through KPIs and incentives also provides a measurable and motivating framework that encourages sustainability.

Transparency in sustainability performance helps identify areas for improvement and offers opportunities for joint optimisation. Sharing information can lead to innovative solutions that contribute to more sustainable business operations.

By promoting a clear communication strategy, a culture of ownership, and transparency, sustainability can become more than just a policy ambition and actually be woven into daily practice. This creates a resilient organisation that not only acts sustainably responsibly but is also economically future proof.



# Acknowledgement

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**Interreg**



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**North-West Europe**

**More4Sustainability**



⇒ Project website: [more4sustainability.nweurope.eu](https://more4sustainability.nweurope.eu)

## Lead partner organisation



Belgian Maintenance Association

⇒ [www.bemas.org](https://www.bemas.org)

## Project partner and leading the execution

**mainnovation**

Consultancy firm and experienced research agency

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EMC2 Competitiveness Cluster

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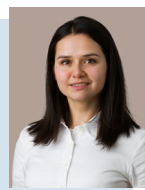
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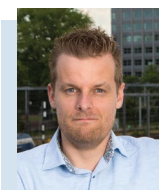
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