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National schemes for energy efficiency in SMEs

Best practices to develop more energy audits and energy management systems

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FIRE – Federazione Italiana per l'uso Razionale dell'Energia

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DEESME Project

Goals:

• helping companies to face energy transition following a multi-benefits approach;

• supporting energy efficiency policies development and implementation in the framework of EED's art.8

• promoting DEESME approach adoption by national authorities

Multi-Benefits approach

Energy audit proposed in the framework of DEESME project extends its field of applications and its results beyond energy area, including **non-energy benefits** analysis.

Energy efficiency investment is typically evaluated considering how many **euros of energy** are **saved**, what will be the **future cost of energy**, the **cost of money** and other parameters linked only to **direct savings**.

Actually, energy efficiency investment produces a **multitude of benefits** not normally evaluated within an energy audit.

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Multi-Benefits approach

Added value of the Multi-Benefits approach:

- **Maximization** of the benefits related to energy efficiency measures: deeper options analysis, proper communications to customers, consumers, communities, etc.

- **Compliance** to EU and international policies and acts such as:
    - Corporate Sustainability reporting (2014/95/EU Directive)
    - Taxonomy Regulation (852/2021)
    - Sustainable Development Goals (2030 Agenda)

- **Improving** performances in the organization management especially for specific areas such as HSE, processes efficiency, communication, marketing, supply chain, etc..

Multi-Benefits approach

Multi-Benefits approach is based on a precise knowledge of the company and, in particular, of its **"business model**". A business model is defined as:

- Description of how an organization creates, delivers and gains value;

- Description of business decisions and practices related to customers, value proposition and production of corporate offer;

- Description of how an organization creates value in order to achieve its business goals

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Multi-Benefits approach: methodology

The MB analysis is developed in 4 blocks:

1. **Business Analysis**: it shows underlying business mechanism and business priorities for value creation and improving business efficiency;

2. **Energy Analysis**: it shows opportunities to energy efficiency and emissions reduction;

3. **Multiple Benefits Analysis**;

4. **Business Model Advancement**: searching for innovation and business model improving opportunities with energy efficiency development

Multi-Benefits approach: methodology
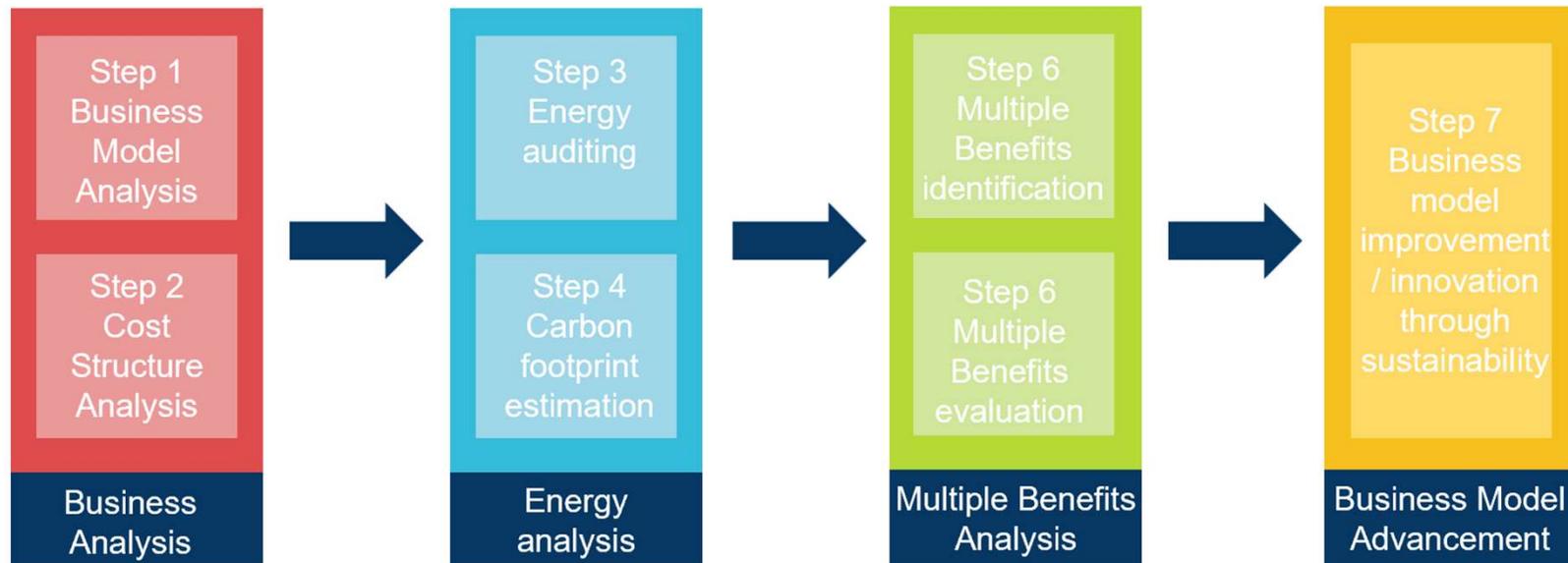
Multi-Benefits approach: methodology

The methodology can be seen as a cycle that begins and ends with the **business model analysis**.

Each iteration of the cycle leads to an improvement in the levels of energy efficiency and sustainability of the business model through introduced innovations.

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What is it?
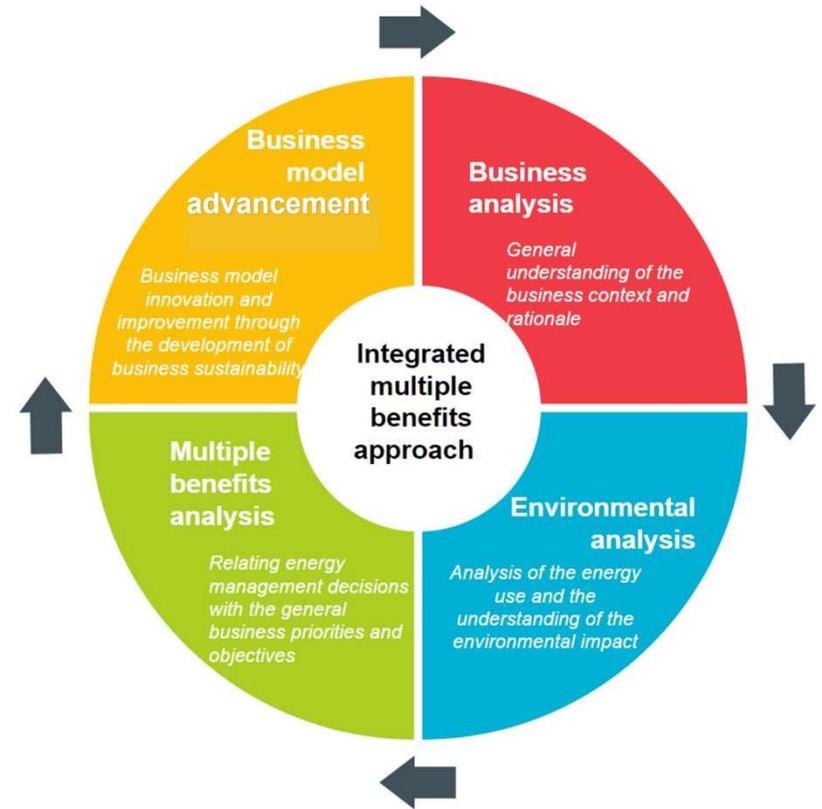
Business Model Analysis aims at:

- Provide a better understanding of the organization overall business mechanism, of priorities, strategic goals and how energy efficiency can impact these aspects;
- Express relationship between energy efficiency and organization general goals;
- Provide starting point to multi-benefits approach implementation.

In this step energy auditor, working with organization referents and other team members, will achieve a complete knowledge of organization needs and will understand how energy efficiency measures can support strategic priorities and company goals.

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Objective

→ **Goal:** achieving a global knowledge of the framework in which business thrives referring to production of value, customer needs, company procedures, partnerships and cost structure.

→ **Output:** showing main features of the company business and obtaining preliminary overview of the opportunities and barriers relating to energy efficiency measures; opportunities and barriers will be identified and analyzed in the following steps.

→ **Method:** the used method will be Business Model Canvas, which consists of a single page document with nine blocks collecting main elements of a company in a schematic representation. This method allows to customize the energy audit and energy efficiency projects on the organization needs.

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Implementation

The Business Model Canvas

Designed for: | Designed by: | Date: | Version: | Documentation:
Read Instructions
Watch YouTube video

Key Partners

Who are our Key Partners?
Who are our key suppliers?
Which Key Resources are we
acquiring from partners?
Which Key Activities do partners
perform?

Key Activities

What Key Activities do our Value
Propositions require?
Our Distribution Channels?
Customer Relationships?
Revenue streams?

Key Resources

What Key Resources do our Value
Propositions require? Physical, intellectual,
human, financial?
Our Distribution Channels? Customer
Relationships?
Revenue Streams?

Value Propositions

What value do we deliver to the customer?
Which one of our customer's problems are
we helping to solve?
What bundles of products and services are
we offering to each Customer Segment?
Which customer needs are we satisfying?

Customer Relationships

What type of relationship does each of our
Customer Segments expect us to establish
and maintain with them?
Which ones have we established?
How are they integrated with the rest of
our business model?
How costly are they?

Channels

Through which Channels do our Customer
Segments want to be reached?
How are we reaching them now?
How are our Channels integrated?
Which ones work best?
Which ones are most cost-efficient?
How are we integrating them with
customer routines?

Customer Segments

For whom are we creating value?
Who are our most important customers?

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Cost Structure

What are the most important costs inherent in our business model?
Which Key Resources are most expensive?
Which Key Activities are most expensive?

Revenue Streams

For what value are our customers really willing to pay?
For what do they currently pay?
How are they currently paying?
How would they prefer to pay?
How much does each Revenue Stream contribute to overall revenues?

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What is it?

Cost Structure Analysis identifies and analyzes cost centers; it aggregates all kinds of costs to carry out the production process. Cost Structure Analysis is critical to improving business efficiency and to identify and prioritize improving opportunities that can contribute to company goals. Cost Structure Analysis is an important step within Business Model Analysis made by energy consultants and by the company. For each cost center it should be possible:

- Identify it geographically and/or functionally
- Measure energy consumption (directly or indirectly)
- Identify one (or more) inputs and one (or more) outputs
- Calculate one (or more) energy indicators

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Objective

➔   **Goal:**
·   provide a better understanding of company costs;
·   identify which areas need a deeper analysis;
·   prioritize energy efficiency opportunities

➔   **Output:** calculation of energy costs for each cost center. Energy costs (i.e. staff, health & safety, maintenance, etc.) can be divided into multiple cost centers (e.g. if the company spends €10,000 a year on maintenance, €8,000 a year for "unit 1" and €2,000 per year for "unit 2", each expenditure can be assigned to the appropriate cost center).

Note: a cost center is an activity area, process or company plant which can actually be measured and which presents an opportunity to manage and reduce energy consumption

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➔   **Energy audit process:**

According to the European standard DIN EN 16247-1 / Energy Audits - Part 1: General Requirements

1.First contact ➤ **2.**Preliminary Meeting ➤ **3.**Data collection ➤ **4.**Site inspection ➤ **5.**Analysis

6.Report ➤ **7.**Final meeting

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What is it?

Carbon footprint analysis evaluates the greenhouse <u>gas emissions caused by the company business operations</u>. This analysis considers the energy sources mix used in the production, supply and use of a product/service, as well as non-energy related greenhouse gas emissions. The analysis helps companies estimate the carbon footprint of their major operations/products and provides guidance on how to improve it.

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What is it?

The identification of multiple benefits consists of identifying, within a given set, those that are relevant to a company.

The energy auditor, in collaboration with the company's management team, will decide which types of multiple benefits and which additional benefits are useful referring to company needs and goals.

Objective

➔ **Goal:** provide a basis to identifying business and non-energy benefits that may be related, directly or indirectly, to energy efficiency benefits and measures.

➔ **Output:** an "open" list of multiple benefits that fits each company needs, depeding on the features of the sector/sub-sector in which it operates and on its particular operation and goals

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DEESME has received funding from the European Union's Horizon 2020 Research and innovation programme under grant agreement No 892235.

02_Step 5: Multiple Benefits identification

N.B.: Energy auditor and company management will have to consider:

- *Kinds of multiple benefits relevant to the company*
- *Indicators to be used (suggested or other)*
- *Additional multiple benefits and/ or indicators that they consider useful*

DOMAIN	BENEFIT TYPE	INDICATOR
Value Proposition	1. Improved product/ service efficiency	Energy cost per unit of product/ service
	2. Introduction of new products/ services	N° of new 'green' products/ services
	3. Development or innovations	Total R&D expenses for 'energy efficiency' initiatives
Activities	4. Increased productivity	Value of output items/ Value of input items
	5. Increased utilization	Capacity utilization
	6. Improved maintenance	Maintenance Unit Cost
	7. Reduced carbon footprint	Total GHG emissions per year
	8. Improved quality	Right First Time
	9. Improved Safety	Incidence Rate
Resources	10. reduced energy consumption	Total energy consumption per year
	11. Improved raw materials consumption	Quantity of raw materials purchased
	12. Increased recycling	Percentage of total waste that is recycled
	13. Reduced waste	Waste reduction rate
	14. Increased employee satisfaction	Employee Satisfaction Index
Customers	15. Acquisition of 'green' customers	'Green' customers share
	16. Acquisition of new customers	New customers share
	17. Increased customer satisfaction	Satisfied customers share
	18. Increased customer loyalty	Loyal customers rate
Partners	19. Improved supply chain relationships	Total n° of suppliers with ISO certification for energy or environmental management
	20. Improved stakeholder relationships	Total n° of stakeholders involved in decision making
	21. Reduced litigation risks	Total amount of expenses and fines related to environmental law violations
	22. Increased regulatory compliance	N° of EU and national energy policies adopted

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Value proposition: **product/service efficiency**

➜ **Description:** efficiency in providing products/services to the market. It is relevant to the value proposition as it is often a source of value for the customer and also a source of competitive advantage for the company

➜ **Basic Indicator:** unit energy cost – it refers to total cost of energy used in a time period divided fo the number of production units in that period. It links directly energy consumtion to all business model functions.
Calculation method: Total energy cost/ number of production units

➜ **Other indicators:**
● Unit cost: basic accounting measure that refers to total expenditure (includes all fixed and variable costs) incurred to produce, store, and sell one unit of a particular product or service.

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Value proposition: **new products/services**

➔ **Description:** development of new products/services. The main benefit of developing new products/services is that these have the potential to provide a greater value to customers

➔ **Basic indicator:** new "green" products/services (number of new "green" products put on the market). For example, development of a new product/service that consumes less energy in its production process or during its use by customers can be sold as a "green" product/service

➔ **Other indicators:**
- Number of new products/services put on the market. It can be used especially when a company doesn't produce "green" products/services or to complete this indicator providing a complete vision of company performance
- New Product Introduction: effectiveness of the new product development process, for regular or "green" products/services. It is the amount of time it takes to design, develop and deliver a new product.

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Activities: **productivity**

➔ **Description:** ➔ Measurement of company process efficiency. It is defined as outputs/inputs and reveals the efficiency level with whom production inputs are used to deliver a certain outputs. Productivity is a general measurement that can be adapted to the features of various companies and in various sectors.

➔ **Basic indicator:** outputs value/inputs value
Calculation method: outputs value can be calculated as outputs quantity*price. Inputs value can be calculated as inputs quantity*cost.

➔ **Other indicators:**
- Workers productivity: (total production)/(total workers number)
- Increase of machinery productivity (total products number/total machinery used in a given period of time)

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Activities: **maintenance costs**

➔ **Description:** ➔ Maintenance and machinery repair expenditure that occurred in business cycle. This measurement is also useful to detect machinery efficiency in time.

➔ **Basic indicator:** Flexible measurement that can be applied to one or more assets or to an entire plant.
    Calculation method: (total maintenance cost)/(standard units producted)

➔ **Other indicators:**
● Maintenance cost for single machinery
● Failure rate (failures and errors machinery number in a given period of time).

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Activities: **Carbon Footprint**

➔ **Description:** ➔ Amount of carbon dioxide released in atmosphere as a result of business processes. This indicator includes the amount of greenhouse gas emissions from fuel combustion and industrial cycles.

➔ **Basic indicator:** Indicator is calculated by adding emissions resulting from company operations (production or service delivery). Usual carbon footprint calcultation is number of tons of carbon dioxide emitted per year.   Calcultation method: amount of producted CO_2 * CO_2 single unit cost

➔ **Other indicators:**
- Pollutants emissions
- NOx / SOx emissions: each one can be calculated separately.
- Water footprint

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Activities: **Quality**

➜ **Description:** ➜ Product/service capacity to meet certain standards (e.g. technical standards or user requirements). Improving quality is essential for all companies. Manufacturers tend to measure compliance quality, i.e. what is the degree of correct production (without defects), according to technical standards. Consumers, on the other hand, may focus on quality of a product/service's specifications, or make comparisons with similar products/service from competitors.

➜ **Basic indicator:** ➜ *Right First Time* - how many units are produced correctly by first time (without modifications or corrections)

➜ **Other indicators:**
- Client service cost: (number of products recall) * (product recall cost)

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Activities: **Accidents/ health and safety**

➜ **Description:** ➜ Injuries, infections and other accidents in workplace. Improving organization health and safety culture and performance means that organization pay attention to injury prevention, risk minimization, safety issues and involves all workers.

➜ **Basic indicator:** ➜ Incidence Rate: Number of health and safety accidents that occur in a standard time period. A variation of this indicator is the number of events that occur in a standard time period among a given number of people (usually 100).

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Resources: **waste**

➔ **Description:** Waste management consists of collection, transportation, treatment and waste disposal, including process control and regulation.

➔ **Basic indicator:** Waste Reduction Rate. It is a measurement that indicates what is the level at which an organzation is able to reduce its production waste. Calculation method: raw material wasted (in this period a) / raw material wasted (in the last period b) * 100

➔ **Other indicators:**
- Reduction of wasted heat
- Reduction of toxic waste

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Resources: **workers satisfaction and welfare**

➔ **Description:** measurement of workers satisfaction about their job and workplace

➔ **Basic indicator:**.Employee Satisfaction Index, based on a three questions survey: a) How satisfied are you with your current job? B) how well does your current workplace meet your expectations?, and c) how close is your current workplace to your ideal? Employees answer questions on a scale of 1 to 10 (1 being the lowest score and 10 being the highest score). Calculation method: the indicator is calculated as [(average value questions) / (maximum value questions)]*100.

➔ **Other indicators:**
● Workers loyalty: it refers to organization capability to keep their workers; it is calculated considering the average job history in the company or the loyalty rate (percentage of workers that a company keeps on a given time period)

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Customers: **Acquisition of "green" customers**

➜ **Description:** Customers preferring "green" consumption options or with higher environmental sensitivity that buy intentionally "green" products/services. Number of "green customers" can come from a customer survey or from any other form of feedback from customers or from market analysis (how many customers buy "green" products/services).

➜ **Basic indicator:** "green" customers
    Calculation method: (number of "green customers") / (total customers number) x 100

➜ **Other indicators:**

● "Green" products/services [(number of "green" products/services) / (total products/services portfolio) * 100.

● Depending on company features and its customers base, additional indicators could refer to particular cases of "green" products/services, such as percentage of recyclable or cyclical products, percentage of energy saving products/services, etc.

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Partners: **regulatory compliance**

➔ **Description:** regulatory compliance expresses an organization's adherence to regulations, guidelines and specifications relevant to its business processes. For example, the adoption of the principles and measures established in EED or RED is a index of regulatory compliance.

➔ **Basic indicator:** Number of EU and national energy policies adopted (total and last year)

➔ **Additional/alternative indicators:**
   - Regulatory violations/non-compliance detected in the last year

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What is it?

Multiple Benefits evaluation aims to evaluate relevance and potential impact of the identified NEBs on the operation and business model of companies in order to decide how it is possibile to take advantage of these NEBs.

Objective

➔ **Goal:** evaluate and prioritize the different opportunities to exploit the multiple benefits related to energy efficiency measures.
➔ **Output:** evaluation results are used in developing ideas, plans and lines of action in order to give value to the the multiple benefits associated with energy efficiency measures

Note: The multiple benefits evaluation requires collaboration between the energy auditor/consultant and the business stakeholders involved in the multiple benefits analysis. Evaluation is qualitative and is based on the knowledge, experience and suggestions provided by energy auditor/consultant.

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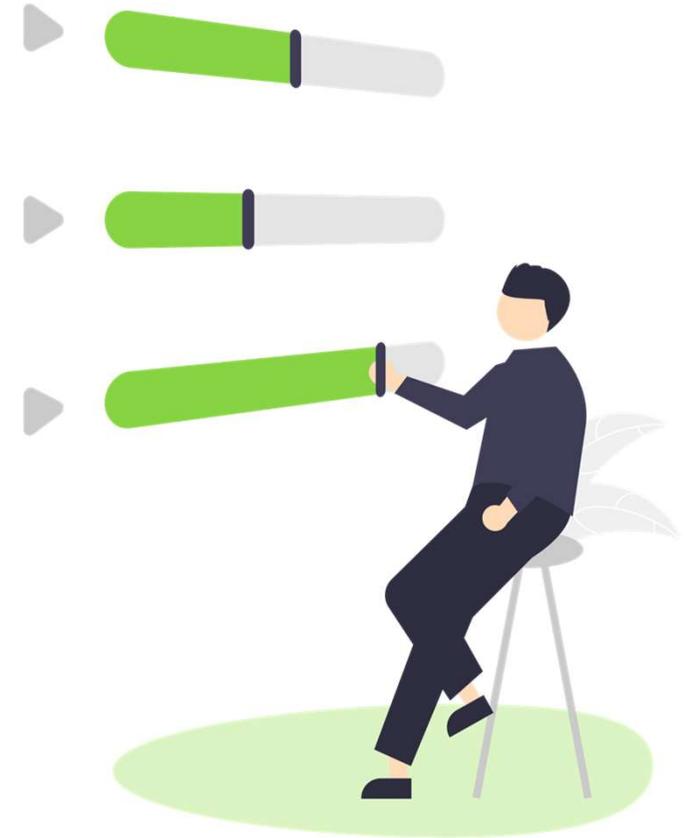**Multiple Benefits evalutation is based on two aspects:**

1. **Relevance:**
   - All multiple benefits considered in previuos steps are evaluated their relevance for the organization ("Maximum", "Minimum" o "None"). Meaningless advantages can be omitted in further analysis.

1. **Kind of impact:**
   - Impact on value production: it has strategic meaning and can introduce innovations in business model
   - Impact on company efficiency: it has operations meaning and can introduce improvements in company processes

   Impact can be evaluated as "High" o "Low". Low impact advantages can be omitted in further analysis.

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Identify or add relevant non-energy benefits and evaluate them according to their level of relevance (1) and their impact (2) on value creation and efficiency for the company. Then decide how company can take advantage of the multiple benefits with the highest rating (3).

BENEFIT	SIGNIFICANCE	IMPACT		EXPLOIT. PROPOSAL
		Value Creation	Efficiency	
1. New Products/ Services	Major	High	High	
2. Innovations	Major	High	High	
3. Market value	Minor	Low	Low	
4. Productivity	Minor	Low	High	
5. Utilization	None	--	--	--
5. Maintenance	None	--	--	--
6. Carbon footprint	Minor	Low	High	
7. Quality	Major	High	High	
9. Safety	Major	Low	High	
10. Energy consumption	Minor	Low	High	
11. Raw material consumption	None	--	--	--
12. Recycling	Minor	Low	High	
13. Waste	None	--	--	--
14. Employee satisfaction	High	High	High	
15. 'Green customers' share	Major	High	Low	
16. New customers	Minor	High	Low	
17. Customer satisfaction	Major	High	Low	
18. Customer loyalty	Major	High	Low	
19. Supply chain relationships	Minor	High	Low	
20. Stakeholder relationships	Minor	High	Low	
21. Litigation risks	Minor	Low	Low	
22. Regulatory compliance	High	Low	High	

Implementation

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Business Model Advancement aims to Business Model innovation and improvement through searching for company sustainability. It takes place after Business Model evaluation that can integrate energy efficiency measures and ends DEESME Multiple Benefits approach.

→ **Goal:** Searching for sustainability through business model innovation and improvement
→ **Output:** New improved business model provides answers to key questions for sustainable business and outlines a roadmap for a sustainable business future. It shows opportunities that can arise from adopting energy efficiency measures and developing sustainable business practices and ideas.

Note: Corporate sustainability refers to the effect of corporate activities on the environment; final scope is to do no significant harm to environment and to have a positive impact. The concept of corporate sustainability today goes beyond the corporate impact on the environment and also includes the corporate impact on the community and society

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Multi-Benefits approach to increase energy audit impact

Multi-Benefits approach can be used to increase energy audit impact, reinforcing technical-economic convenience identified measures.

Various application cases demonstrate that, by extending energy efficiency measures analysis to multiple benefits, there is an improvement in parameters such as NPV, IRR, PBT.

Industrial case study n.1

In a dairy factory, an old oil boiler is replaced by a new methane boiler. Energy management team (led by energy manager) was able to detect a series of non-energy advantages from this measure such as:

- Reduction of maintenance costs
- Higher production reliability
- Reduction of set-up time
- Reduction of local pollutants emissions

Industrial case study n.2

In a pottery factory, after combinated heat and power plant installation, there was improvement in product final quality because heat recovered flux ensures a more uniform temperature than a normal boiler.

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Industrial case study n.3

Global electrification program in the industrial site, replacing methane boilers with heat pumps.

Multiple benefits	
NEB	**Indicators**
Reduction of maintenance costs	% failure signal reduction*failure cost
Reduction of production downtimes	Missing production days*day cost
Reduction of CO_2 emissions	CO_2 emissions avoided*CO_2 ton cost
Reduction of normative compliance costs	Number of annual controls avoided*control cost

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Industrial case study n.3

Multiple Benefits evaluation impacts energy efficiency measure analysis in the final part of energy audit and improve financial indicators

Economic impacts

- Energy saving — 22%
- Maintenance costs — 33%
- Less downtimes — 24%
- Compliance costs — 1%
- CO2 emissions — 20%
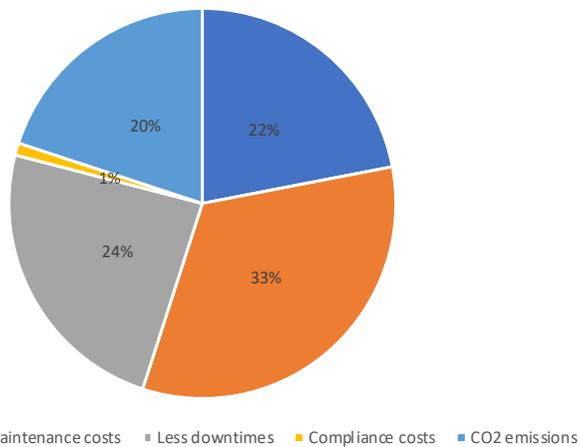
Financial analysis		
	Only energy benefits	**Multiple benefits**
NPV (€)	9.000	23.000
IRR	6%	15%
PBT (years)	11	6

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Building case study

In a commercial building, a building automation system was installed in order to manage HVAC plant. Thanks to this energy efficiency measure, it will be possible having a central control system to manage air generation and distribution in buildings rooms.

Energy benefits	
Energy savings	20 toe/year
Money savings	12.000 €/year
Public incentives	4.500 €/year

Multiple benefits		
NEB	Indicators	Money savings
Reduction of maintenance costs	% failure signal reduction*failure cost	1.900 €/year
Reduction of workers absenteeism	Absenteeism hours saved*hour cost of absenteeism	4.000 €/year

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Building case study

Multiple Benefits evaluation impacts energy efficiency measure analysis in the final part of energy audit and improve financial indicators

Financial analysis		
	Only energy benefits	**Multiple benefits**
CAPEX (€)	30.000	30.000
NPV (€)	43.000	65.000
IRR	30%	40%
PBT (years)	3.5	2.5

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More informations and details

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- LinkedIn: https://www.linkedin.com/company/deesme-h2020

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