PILOTS' EVALUATION REPORT

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SDG Striker
Scoring Goals for Sustainability

SUSTAINABLE DEVELOPMENT GOALS

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1. EXECUTIVE SUMMARY

The implementation of Sustainable Development Goals (SDGs) in grassroots sports organizations can vary based on factors such as organizational size and scope, available resources, and stakeholder support levels. This study evaluates the impact of pilot actions undertaken in the framework of the SDG Striker project (WP3) on the sustainability objectives of FAs, using the research base developed in WP2 to analyse the environmental and energy effects of the successes. **Common environmental indicators or KPIs, such as energy savings, CO_2 reduction, and runoff reduction, etc. were characterized based on the three pilots.** These key performance indicators are identified and the main variables that must be considered and measured during the evaluation testing of the different solutions to be implemented in the pilot cases to ensure the achievement of Sustainable Development Goals as SDG Striker project objectives.

As the SDG Striker project has developed different solutions, the definition of KPIs has been organized around the pilot cases to be developed and implemented during the project. Four categories have been established, (technological, economic, environmental, and social). While some of these categories are highly specific for each pilot case, an effort has been made to homogenize the KPIs definition to obtain a set of common measurements for the project. Following this objective, a global KPI matrix was prepared, which provided an overview of the entire set of SDG Striker sustainability solutions for football clubs.

The conclusions and recommendations drawn from the pilots' evaluation report provide insights into the potential benefits and challenges of integrating the SDGs into practices in grassroots sports organizations. The analysis of awareness and commitment, improving governance practices, promoting integration of the SDGs, publishing, continuously monitoring and evaluating, and stakeholder engagement provide results of the potential of integrating the SDGs into Corporate Social Responsibility (CSR) practices in grassroots sports organizations.

The survey conducted within the sports organizations provided insights into the level of awareness of the SDGs and the extent to which they are being incorporated into current practices, whereby there is an increase to be achieved.

The challenges and barriers to incorporating the SDGs into current practices: The results of the case studies (energy efficiency and energy poverty, photovoltaic potential and feasibility of sports facilities, alternatives to conventional infill for artificial football pitches to reduce microplastic pollution) provided information on the challenges and barriers faced by grassroots sports organizations in integrating the SDGs into their governance practices based on real-world practical solutions and their implications.

A detailed set of key performance indicators was developed and tailored to the case studies to measure the success and implications in a quantitative and qualitative way, applicable to non-expert staff resources, and to provide recommendations for success.

2. INTRODUCTION AND OBJECTIVES

This report focuses on the **evaluation of the impact** of pilot implementation on the sustainability practices of partner federations in football and aims to **validate the process** of improving sustainability practices in these organizations. The benchmarking process and in-depth analysis conducted in phases 2 and 3 of the evaluation and validation within the SDG Striker projects help to assess the positive impact of the implemented measures on grassroots sports organizations' sustainability. It also provides capacity building for WP5, and communication hooks for WP6. The validation process allowed the FAs to provide feedback on how the process works in real life and how the guidelines (IO1) can be improved.

In the first 12 months of the SDG Striker project, this activity focused on the **baseline definition** of potentially relevant Key Performance Indicators (KPI) in the framework of WP 4. The second half of the project work in WP 4 focused on the **initial data gathering, analysis, and characterization** of the pilot cases, along with the key performance indicator **evaluation** alongside the design and implementation of the pilots.

Besides the methodology, conclusions, references, and annexes, this report comprises **three sections**: one for each pilot case to be developed during the project, a KPI matrix that allows the identification of the corresponding KPI applicable to each pilot case, and a dedicated section for the replication potential of the pilots. Each pilot section is divided into four sub-sections according to the four categories in which the KPI have been classified: 1) technological, 2) environmental, 3) economic, and 4) social.

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3. METHODOLOGY

For each pilot case in the project, different KPI were defined. These KPI have also been classified into **four categories** (technical, environmental, economic, and social). Each KPI is defined by following the same **structure**: name, description, formulae, and input list with units.

For the pilot cases, demonstration and calculation activities will allow obtaining the required data for the KPIs calculation to be carried out at the end of evaluation WP4. For each pilot case section, the specific activities where it is expected to gather the data for KPIs calculation at each pilot site are indicated.

The **KPI matrix** provided in the following section provides an overview of the global KPI's to be calculated. After the KPI's are calculated, the most relevant ones are selected for use in **replicability studies**. Replicability studies of the pilot cases will be performed according to these KPIs to assess the feasibility of implementing SDG Striker solutions in other places and football clubs.

Each of the KPI categories and their corresponding approaches are described in the following sections.

Key steps in the process

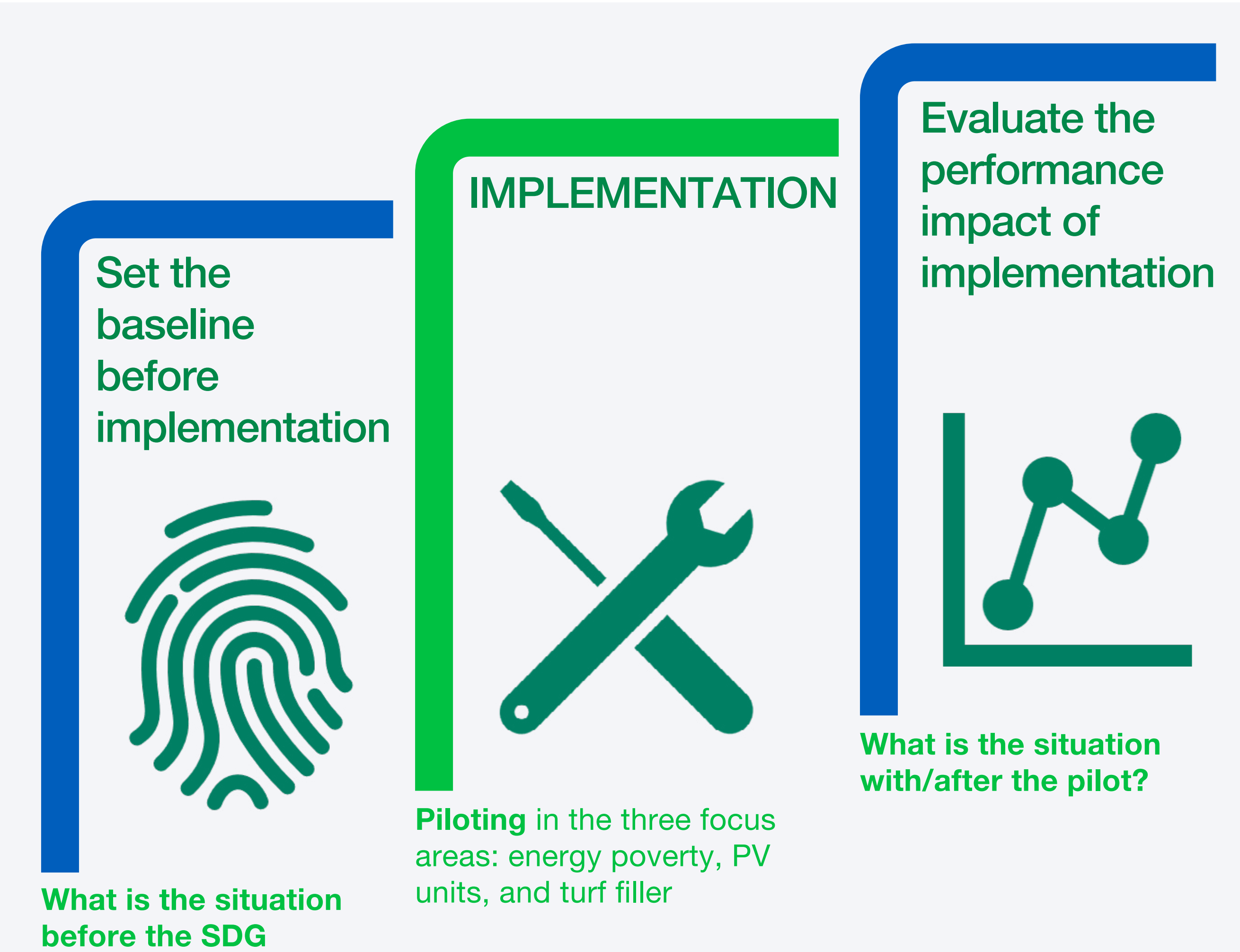

Figure 3-1: Method of implementation impact analysis.

3.1. Technological

A set of technological KPIs have been defined, adapted to each one of the solutions to be implemented in SDG Striker project, considering the characteristics of each one of them.

3.1.1. Self-sufficient ratio (SSRt)

This KPI is the main measure used to evaluate energy self-supply, for example via a PV plant. It indicates the share of own electricity demand in the total demand until time t, following equation **(1)**

$$SSR_t[\%] = \frac{CEI^{own}_{sys,\,t}}{CEI^{dem}_{sys,\,t}} \tag{1}$$

Where CEIt (cumulative electricity) indicates the total electricity demand in [Wh]

3.1.2. Maximum external demand (MEDt)

Peak demand for electricity over a given period, measured in kW. MED is typically calculated from a moving average (typically over 15 min) using the following equation **(2)**

$$MED_t[kW] = \int_{t-15}^{t} \frac{EI_t^{grid}}{15\ dt} \tag{2}$$

Where t is measured in minutes.

3.1.3. On-site generation demand ratio (OGDRt)

Indicates the share of cumulative own electricity demand on total on-site generated electricity until time t, as shown in equation **(3)**

$$OGDR_t[\%] = \frac{CEI^{own}_{sys,\,t}}{CEI^{own}_t} \quad (3)$$

This measure is complemented with equation **(4)**, showing the share of on-site generated electricity fed back into the grid.

$$1 - OGDR_t[\%] \quad (4)$$

3.2. Environmental

Environmental KPIs are also global, focusing on the reduction of emissions and primary energy consumption. Any additional specific KPIs for each pilot case or modifications regarding those globally defined are detailed in the corresponding sections.

3.2.1. GHG emissions reduction

A global KPI regarding GHG emission reduction **(5)** is presented here. This initial definition was adapted, if needed, for each pilot case.

$$GHGReduction_T[tCO_2e / FU] = \frac{GHGemissions_{INITIAL,\ T}\,[tCO_2e] - GHGemissions_{FINAL,\ T}[tCO_2e]}{FunctionalUnit\ \ [FU]} \quad (5)$$

Where:

- T: subindex representing each technology
- $GHGemissions_{INITIAL}$ are the average GHG emissions before the SDG Striker project in tons of carbon dioxide equivalent.
- $GHGemissions_{FINAL}$ are the average GHG emissions measured during the pilot case implementation, in tons of carbon dioxide equivalent.
- *FunctionalUnit* is the functional unit used to normalize the results. Their units depend on the specific pilot case (e.g., timeframe and service capacity).

3.2.2. Primary Energy Savings (PES)

A generic KPI regarding the primary energy savings was defined according to equation **(6)**

$$PESSavings[\%] = \frac{PE\ consumption_{FINAL,\ T}[MW/FU] - PE\ consumption_{INITIAL,\ T}[MW/FU]}{PE\ consumption_{INITIAL,\ T}[MW/FU]} \quad (6)$$

Where:

- T: subindex representing each technology
- $PE\ consumption_{INITIAL,\ T}$ is the amount of energy (fossil/renewable) used before the SDG Striker project in MWh.
- $PE\ consumption_{FINAL,\ T}$ is the amount of energy (fossil/renewable) used during and after the pilot case implementation in MWh.
- *FunctionalUnit* is used to normalize the results. Their units depend on the specific pilot case (e.g., timeframe and service capacity).

3.3. Economic

The KPIs adopt a more general approach and focus on the savings that can be obtained through the SDG Striker solutions to be implemented. Some global indicators, such as the operational cost savings, and widely used economic indicators, such as the Payback or the ROI (return on investment), have been defined below, leaving more dedicated indicators in the section of the corresponding pilot cases.

3.3.1. Levelized Cost of Energy (LCOE)

One of the main objectives of a pilot case is to demonstrate the feasibility of a PV system. Beyond technical feasibility, whose achievement can be monitored through power output and availability, economic feasibility is a crucial aspect in understanding the replicability of the project itself.

In this regard, the LCOE is a KPI widely applied for power-producing equipment[1,2], where is the discounted lifetime cost of ownership and use of a generation asset, converted into an equivalent unit of cost of generation in €/MWh according to Eq. **(7)**:

$$LCOE = \frac{NPV_{cost}}{NPE} = \sum_{t=1}^{n} \frac{C_t + O_t + V_t}{(1+d)^t} \Big/ \sum_{t=1}^{n} \frac{E_t}{(1+d)^t} \quad (7)$$

Where:

- t is the period ranging from year 1 to year n,
- C_t the capital cost in period t (including decommissioning),
- O_t the fixed operating cost in period t,
- V_t variable operating cost in period t (including fuel cost, carbon costs, and sometimes taxes),
- E_t the energy generated in period t,
- d the discount rate,
- n the final year of operation.

As defined in **(7)**, this method considers costs over the life of a project and thereby derives a lifetime cost of energy, while the operational costs are implicit; thus, operational cost savings have not been included.

To assess this KPI, the value of electricity provided by the pilot case (either purchased from the grid or self-produced with other technologies) was compared with the LCOE obtained.

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1 E. de Visser, A. Held, Methodologies for estimating Levelised Cost of Electricity (LCOE): implementing the best practice LCoE methodology of the guidance (2014)
2 Nuclear Energy Agency, IEA, OECD Projected costs of generating electricity 2015. OECD Publishing (2015)

3.3.2. Operational costs savings

A KPI to measure the reduction in operational costs owing to the implementation of the different SDG Striker solutions for the different pilot cases **(8)** will be calculated according to the operation costs computed for each pilot case in their corresponding section.

$$RelativeCostReduction_T = \frac{OperationCosts_{FINAL,\,T}[€/FU] - OperationCosts_{INITIAL,\,T}\,[€/FU]}{OperationCosts_{INITIAL,\,T}\,[€/FU]} \tag{8}$$

Where:

- T: subindex representing each pilot case / SDG Striker solution
- $OperationCosts_{INITIAL}$ is the operation cost, including the energy costs associated with the usage of different energy vectors before the SDG Striker project. It was calculated in € per functional unit (€/FU).
- $OperationCosts_{FINAL}$ is the operation cost, including the energy costs associated with the usage of different energy vectors after applying the corresponding technology. It was calculated in € per functional unit (€/FU).

3.3.3. Payback

The payback period refers to the amount of time required to recover the cost of an investment. This KPI is calculated by dividing the cost of the investment in the corresponding pilot case by the savings in terms of operational costs. **(9)**

$$Payback_F = \frac{Investment\ _T[€]}{OperationCostsSavings_F[€/FU] + ImpactCO_2Bill_F\,[€/FU]} \tag{9}$$

Where:

- F: subindex representing each pilot case / SDG Striker solution
- *Investment*: is the required investment for the implementation of the technology.
- *OperationCostsSaving*: is the reduction in operation cost due to the implementation of the pilot case/ SDG Striker solution.
- *FunctionalUnit* is the temporal unit in this particular KPI.

3.3.4. Return on Investment (ROI)

This KPI can be applied to all SDG Striker solutions and pilot cases to be implemented. It is a conventional economic indicator that shows the ratio between the benefit and cost of an investment according to equation **(10)**.

$$ROI_T = \frac{B_{T,\,i}}{C_{T,\,i}} \tag{10}$$

- T: subindex representing each pilot case / SDG Striker solution
- B_T, is the benefit obtained from investment in the corresponding solution, taking into account the specific characteristics of each solution.
- $C_{T,i}$ is the investment cost of the pilot case / SDG Striker solution

3.4. Social

The Social Life Cycle Assessment (SLCA) methodology could be applied in order to evaluate and quantify the following social Key Performance Indicators (KPIs), i.e.

- user satisfaction;
- easy to implement;
- easy to maintain;
- efforts in stakeholder's involvement;
- solution transfer; replication potential
- jobs;
- training and qualification;
- health & safety.

All KPIs could be associated to relevant "stakeholder categories", "subcategories" (or theme of interest) and "indicators", as foreseen by the guidelines of this methodology.

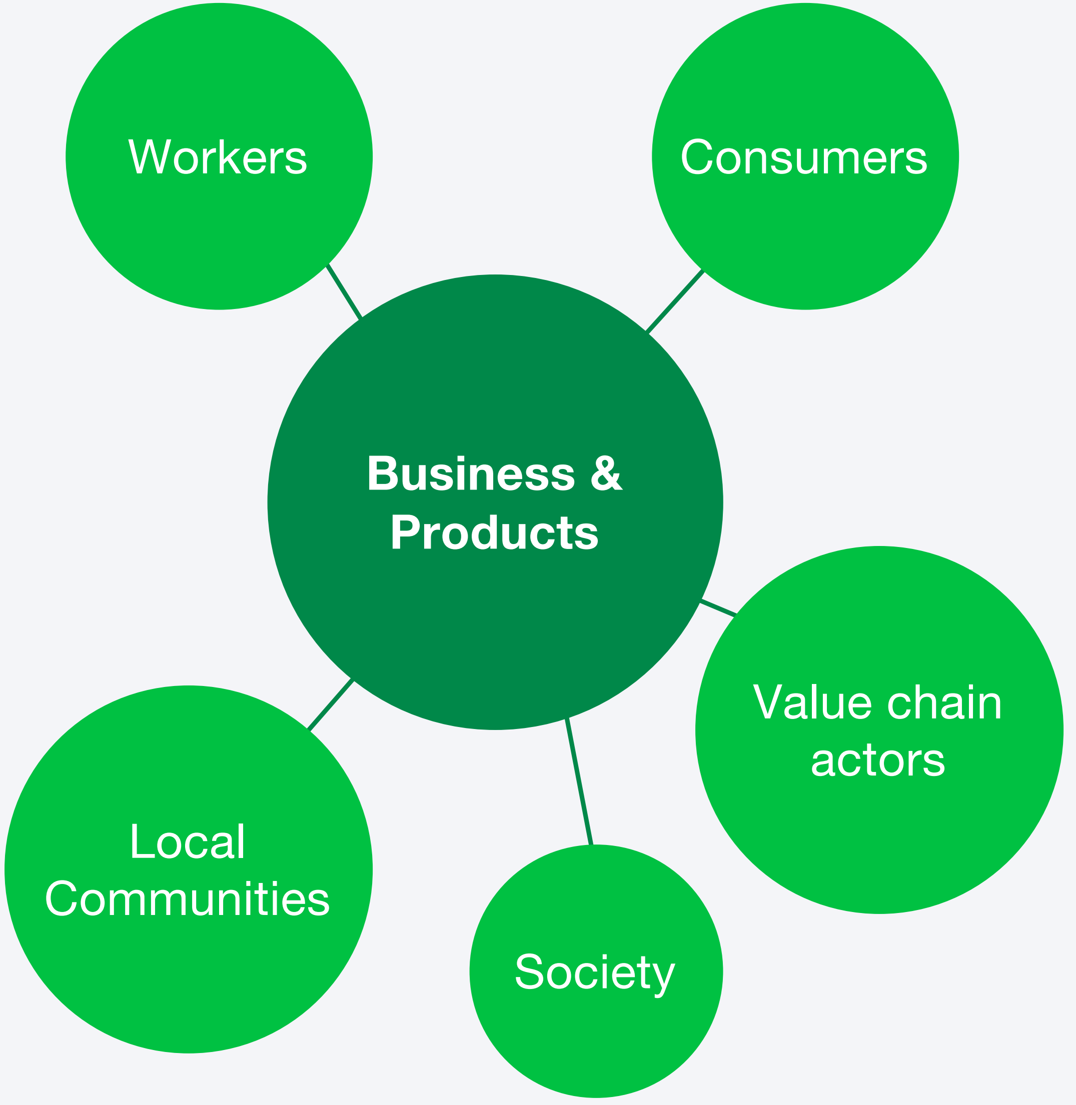

Figure 3-2: Main stakeholder categories

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A **stakeholder** category is a cluster of stakeholders that are expected to have shared interests because of their similar relationships with the investigated product systems. Stakeholder categories (Figure 3-2) are deemed the main group categories potentially impacted by the life cycle of a product.

Each stakeholder category has subcategories (social themes of interest) that are socially relevant characteristics or attributes to be assessed. Several social and socioeconomic indicators were used to represent and assess each subcategory.

All significant stakeholder groups and subcategories should be considered in a comprehensive study; however, it is also justifiable to focus on a few or just one stakeholder or subcategory, depending on the goal of the study. Subcategories and indicators were described in the UNEP/SETAC methodological sheet[3,4]. Proper selection must be performed for each lifecycle step. The determination of appropriate indicators to measure the status of a specific subcategory is not straightforward and the selection of indicators is individual.

Table 3-1 reports, for each KPI, the stakeholder of interest and relevant subcategories, as well as the related indicators selected for the purpose of this document are reported below. The selection has been made with the scope to quantify the identified KPIs.

[3] UNEP/SETAC guidelines: “Guidelines for Social Life Cycle Assessment of products, 2009”
[4] UNEP/SETAC guidelines: “The methodological Sheets for sub-categories in Social Life Cycle assessment (S-LCA), 2013”

Table 3-1: Stakeholder, Subcategories and indicators considered for each KPI

KPIs	Stakeholders	Subcategories	Indicators
User satisfaction	Consumer (end users)	Feedback mechanism	Presence of practices related to customers satisfaction, including results of survey measuring customers satisfaction (by online questionnaires)
Easy to maintain	Consumer (end users)	Easiness to use	Description of the easiness to use for the consumers
Easy to implement	Workers	Easiness to implement	Description of the easiness to implement for the workers
Efforts in stakeholders' involvement	All (Local community mainly)	Community engagement	Presence of written policies on community engagement at club/facility level
			Description of community engagement of the club/facility
Solutions transfer	Society	Solutions development	Involvement of the association/club in solutions transfer projects
Jobs	Local community	Local employment	Percentage of unemployment in the country/region
			Percentage of workforce hired locally
	Society	Job creation/ jobs relocation	Description of the job creation, in terms of direct (directly involved and indirect jobs
Training and qualification	Workers	Training and qualification	Presence of written training reporting the guidelines for the implementation (number of hours of training and number of people attending the training)
Health & safety	Workers	Health and safety	Description of potential main origins of danger and protection measures (Number of incidents related with the operation of the new equipment)
	Consumer (end users)		Potential risk of the product regarding consumer health and safety
	Local community		Description of potential main origins of danger and protection measures (Number of incidents related with the operation of the new equipment)

Then, each indicator considered has to be analysed (from a qualitative point of view) and characterized for this specific purpose, collecting data (directly measured or extracted from literature). Through the collected data, the status of each indicator was characterized.

Data collection and characterization of the status of the indicator steps are followed by **Performance Assessment (PA)** steps[5,6]. **PA** is performed according to the status of each indicator and the so-called "performance reference point". Performance reference points may be internationally set thresholds, or goals or objectives, for each indicator according to conventions and best practices.

Performance reference points must be transparent, documented, and defined at an advanced stage of the project. To gain as much objectivity as possible, the social assessment is based on international standards such as ILO labour standards, ISO 26000, and OECD Guidelines for Multinational Enterprises as performance reference points.

During the Performance Assessment, each subcategory was assessed using a colour system ranging from very good to very poor performance. In addition, a specific factor was assigned to each colour to quantify the impacts. The rating scale for the performance assessment is presented in Table 3-2.

Table 3-2: Rating scale of performance assessment

Performance assessment	Colour	Factor
Very good performance		1
Good Performance		2
Satisfactory Performance		3
Inadequate Performance		4
Poor Performance		5
Very Poor Performance		6

[5] ISO 14040:2006: Environmental management – Life cycle assessment - Principles and framework.
[6] ISO 14044:2006: Environmental management – Life cycle assessment - Requirements and guidelines.

Table 3-3: KPIs evaluation

KPIs	Stakeholders	Subcategories	Indicators
User satisfaction	Consumer	Feedback mechanism	Presence of practices related to customers satisfaction, including results of survey measuring customers satisfaction (by online questionnaires)
Easy to maintain	Consumer	Easiness to use	Description of the easiness to use for the consumers
Easy to implement	Workers	Easiness to implement	Description of the easiness to implement for the workers
Efforts in stakeholders' involvement	All (Local community mainly)	Community engagement	Presence of written policies on community engagement at club/facility level
			Description of community engagement of the association/club
Solutions transfer	Society	Technology development	Involvement of the association/club in solutions transfer projects
Jobs	Local community	Local employment	Percentage unemployment in the country/region
			Percentage of workforce hired locally
	Society	Job creation/ jobs relocation	Description of the job creation, in terms of direct (directly involved and indirect jobs
Training and qualification	Workers	Training and qualification	Presence of written training reporting the guidelines for the implementation (number of hours of training and number of people attending the training)
Health and Safety	Workers	Health and safety	Description of potential main origins of danger and protection measures (Number of incidents related with the operation of the new equipment)
	Consumers		Potential product consumer safety risk of the regarding health.
	Local community		Description of potential main origins of danger and protection measures (Number of incidents related with the operation of the new equipment)

According to Table 3-3, the detailed list of social KPI's is detailed as follows:

3.4.1. User satisfaction

This KPI will measure pilot site satisfaction regarding the corresponding implementation results and performance by means of surveys measuring customer satisfaction (through online questionnaires), according to the defined scale.

3.4.2. Easy to maintain

A description of the ease of use for consumers is provided in the surveys.

3.4.3. Easy to implement

This KPI is expected to measure how easy it is to implement the corresponding solution in a pilot case.

3.4.4. Efforts on stakeholder involvement

This KPI measures community engagement in two aspects: the presence of written policies on community engagement at the club level and the description of the community engagement of the club or facility.

3.4.5. Solutions transfer

The KPI measures the involvement of the association/club in solution transfer projects according to the defined scale.

3.4.6. Jobs

The percentage of unemployment in the region and the percentage of the workforce hired locally are assessed to define the indicator. A description of job creation in terms of direct and indirect jobs will also be included in the surveys.

3.4.7. Training & qualification

In this section, the presence of written training reporting the guidelines for implementation (number of hours of training and number of people attending the training) will be measured.

3.4.8. Health & safety

The KPIs related to health and safety are divided into three categories, namely the workers, consumers, and local community, for which the number of incidents related to the operation of the new equipment, potential risks of the products, and main origins of danger and protection measures, respectively, will be assessed.

3.4.9. Replication potential

For each of the solutions to be implemented on the SDG Striker project, the replication potential in the rest of the pilot cases involved in the project (real and potential ones) and on sites of the same group will be assessed in this section.

For each solution, a European replication potential KPI **(11)** was defined with a rating scale from 5 to 1, with 5 meaning "highly replicable" and 1 meaning "very low replicability."

$$\mathit{ReplicationPotential}_T = \mathit{from}\ 1\ \mathit{to}\ 5 \tag{10}$$

Where T denotes the corresponding solution for each case. In addition, KPI's have been defined to measure the replication potential of SDG Striker solutions in other places in the same group as the pilot case in which the corresponding solution has been implemented, such as the number of sites in the group where the specific solution could be applied.

$$\mathit{Number}\ [\#]\ \mathit{of\ sites\ where\ the\ specific\ solution\ could\ be\ applied} \tag{11}$$

4. KPI MATRIX – BASELINE

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The following tables provide a condensed list of potentially relevant KPIs per each pilot case to define the baseline. The baseline represents the status before the actual realization of the individual pilot activities; the target is to **test the applicability of the designed KPIs** and provide as much quantitative information (numbers) and qualitative information (description) as possible on the status quo.

From that baseline, the progress until the end of the project was tracked to evaluate the impact of the SDG Striker pilot implementation. This makes it possible to document the before-and-after effect both quantitatively and qualitatively, and thus, to a certain extent, to **make the success of the project tangible.** In the following section, reference is made as best as possible to the status quo per pilot case, and this is characterized qualitatively and, wherever possible, quantitatively.

For the KPIs developed in the method description section, a fundamental evaluation is carried out to determine whether they can also be used in practice for the respective pilot case and how the situation is before the SDG Striker pilot case is implemented.

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4.1. Pilot case 1 – PV implementation – Portugal

Indications on the pilot characteristics

The planning for the **photovoltaic (PV) plant** at the Benfica Lisbon football stadium involves the installation of a 221 kWp PV system on the roof of the training center and car park. This system is expected to generate electricity from solar energy, which can be used to power the operation of a stadium. Currently, 39 solar thermal panels are installed that heat hot water. With the addition of the PV system, the stadium aims to become more energy-efficient and sustainable, with the **goal of self-consuming 99.5% of the energy produced**.

The installation of the PV system is expected to **payback** in approximately five years, which makes it a sound investment for stadiums. The energy generated by the PV system is used to power the stadium's operations and reduce the need for external sources of electricity. By installing the PV system on the roof of the training center and car park, the stadium efficiently uses the available space and minimizes its impact on the surrounding area. The installation of the PV system is also a visible demonstration of the stadium's commitment to sustainability and environment.

Overall, the planning of a photovoltaic plant at the Benfica Lisbon football stadium involves the installation of a cost-effective and sustainable energy source, which will enable the stadium to become more **energy-efficient and reduce its carbon footprint**.

Baseline before implementation

Annual production	**> 315 MWh**
Investment costs UPAC (220 kWp)	> 194 000 €
Energy cost savings	> 35 299 €
Payback	> 5.5 years

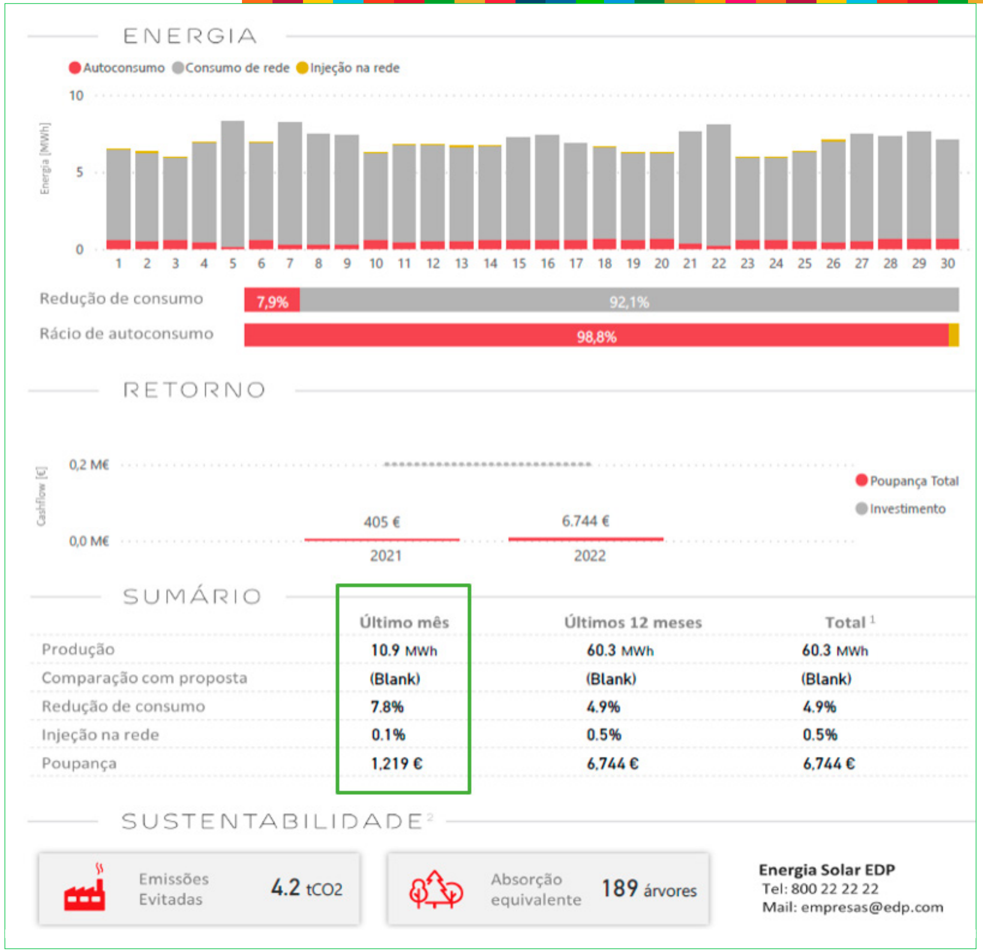

Figure 4-1: Baseline of PV installation planning before pilot implementation.

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KPIs baseline

Type KPI	KPI	BASELINE – Description / Quantification
Technological	Self-sufficient ratio	It is not possible to quantify the **self-sufficient ratio** of these photovoltaic installations without additional information on their size, efficiency, energy demand, and other factors. However, in general, photovoltaic installations can help to significantly reduce the energy demand and costs of a building, and to promote sustainability. The actual self-sufficient ratio will depend on the specific circumstances of each project and will vary accordingly.
	Maximum external demand	Without knowing the specific details of a particular photovoltaic installation, it is not possible to quantify the **maximum external demand**. However, the maximum external demand is typically limited by the capacity of the system and the regulations and policies governing energy generation and distribution. In many cases, the maximum external demand may be equal to the maximum capacity of the system, but it can also be lower depending on the energy demand of the building or facility and other factors.
	On-site generation demand ratio	The **on-site generation demand ratio** of photovoltaic installations refers to the proportion of the total energy demand of a building or facility that is met by the solar energy generated by the photovoltaic system. This ratio is often expressed as a percentage, and it can vary widely depending on several factors, including the size and efficiency of the system, the weather conditions, and the energy demand of the building. In general, a high on-site generation demand ratio indicates that the photovoltaic system is able to meet a significant proportion of the energy demand of the building or facility, and that it is helping to reduce the energy costs and promote sustainability. The actual on-site generation demand ratio will depend on the specific circumstances of each project and will vary accordingly. However, a well-designed and properly sized photovoltaic system can typically achieve a high on-site generation demand ratio and make a significant contribution to the energy efficiency and sustainability of a building or facility.

Type KPI	KPI	BASELINE – Description / Quantification
Environmental	**Primary energy savings (PES)**	The **primary energy savings (PES)** of photovoltaic installations in Portuguese football clubs can be quantified by comparing the amount of energy generated by the solar panels to the amount of energy that would have been consumed from the grid if the photovoltaic system were not installed. To quantify PES, the total energy generated by the photovoltaic system over a given period of time is subtracted from the energy that would have been consumed from the grid over the same period. The resulting energy savings represent the PES achieved by the photovoltaic installation. The exact amount of PES will depend on several factors, including the size and efficiency of the system, the weather conditions, the energy demand of the building, and the cost of electricity from the grid. However, a well-designed and properly sized photovoltaic system can typically generate significant PES, helping to reduce energy costs, promote sustainability, and support the transition to a low-carbon energy system.
	GHG emissions reduction	The **greenhouse gas** savings of photovoltaic installations in Portuguese football clubs can be quantified by determining the reduction in emissions of carbon dioxide and other greenhouse gasses that results from the use of solar energy instead of fossil fuels and strongly depends on the carbon intensity of the energy mix in the grid.
Economical	**Operational cost savings**	The **cost savings** of photovoltaic installations in Portuguese football clubs can be quantified by comparing the cost of the energy generated by the photovoltaic system to the cost of energy from traditional energy sources, such as grid-supplied electricity or fossil fuels. The exact amount of cost savings will depend on several factors, including the size and efficiency of the system, the cost of energy from traditional sources, and the amount of energy consumed by the club. However, in general, a well-designed and properly sized photovoltaic system can generate substantial cost savings by reducing or eliminating the club's dependence on grid-supplied electricity or fossil fuels, and providing a reliable, low-cost source of energy. It is important to note that while the upfront costs of installing a photovoltaic system may be higher than traditional energy sources, the long-term savings on energy costs can offset this initial investment and result in significant cost savings over the life of the system. Additionally, the environmental and sustainability benefits of using solar energy can have positive effects on the club's reputation and its standing in the community.
	Payback	
	Return on investment (ROI)	
	LCOE	

Type KPI	KPI	BASELINE – Description / Quantification
Social	**User satisfaction**	Provide user satisfaction by generating electricity on-site and reducing energy bills, as well as providing a sustainable and environmentally friendly energy source.
	Easy to maintain	Relatively easy to maintain due to the lack of moving parts, requiring only occasional cleaning and visual inspection of the panels. Inverter maintenance may also be required.
	Easy to implement	PV installations can be relatively easy to implement, with modular panels that can be installed on various surfaces and integrated into buildings.
	Efforts on stakeholder involvement	PV installations require stakeholder involvement in terms of permitting and approvals for installation, as well as potential engagement with energy providers and utilities.
	Solution transfer	PV installations can be replicated in other locations and contexts, with potential for local manufacturing and employment opportunities.
	Jobs	PV installations can provide job opportunities for design, installation, and maintenance of the systems.
	Training & qualification	Need for training and qualifications in the design, installation, and maintenance of PV installations to ensure safe and effective implementation.
	Health & safety	Photovoltaic installations have low risks for health and safety, as they do not produce emissions or noise during operation. However, there are some potential risks related to electrical safety, such as falls from heights during installation or maintenance.
	Replication potential	The exact count of stadiums and football facilities in Europe is subject to change and could not be elaborated, but it is estimated that there are several thousand stadiums in Europe with a high replication potential for PV installations especially in the southern countries.

4.2. Pilot case 2 – Energy Efficiency and Energy Poverty – Scotland

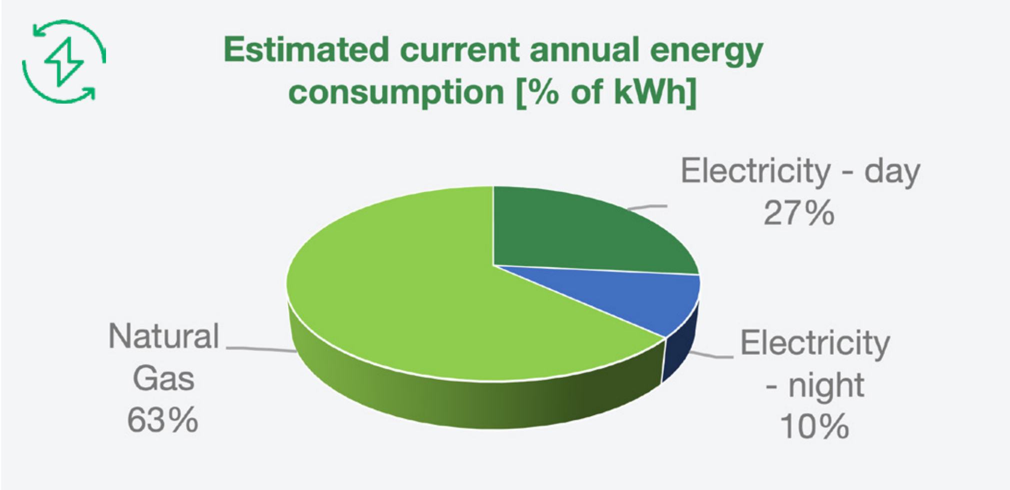
Indications on the pilot characteristics

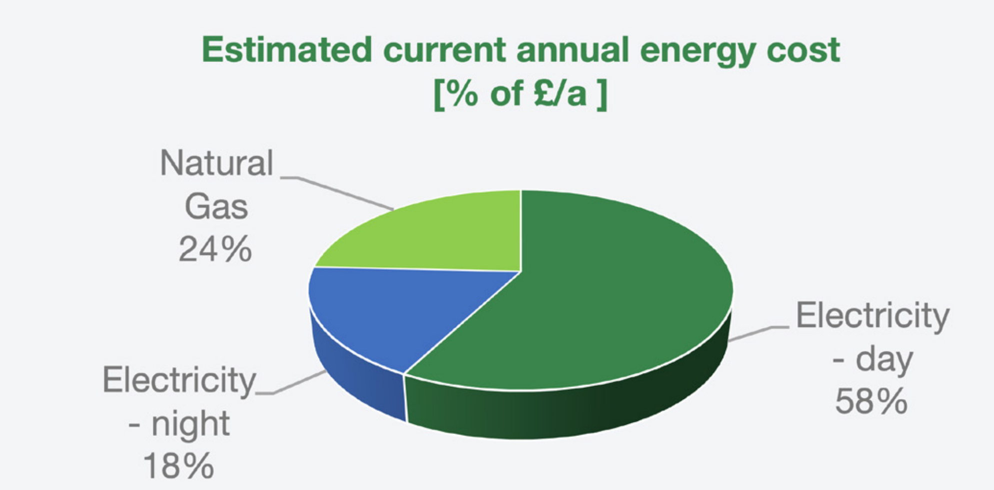
The planning of the pilot on **energy efficiency and energy poverty** involves the collaboration of Zero Waste Scotland, the Scottish Football Association (SFA), and multiple football clubs across Scotland. The primary goal of the pilot was to bring the participating clubs into a network for training, education, and awareness-raising in sustainability actions. Zero Waste Scotland will lead energy audits for clubs to identify areas of improvement and provide guidance on how to become more energy efficient. There are already 23 clubs that have responded to Zero Waste Scotland energy audits, and the network of participating clubs is expected to grow. The SFA has made sustainability one of its main strategic aims, highlighting the importance of this pilot project and its potential to significantly impact the Scottish football community.

Through the pilot, the clubs will be able to learn from each other and share best practices for energy efficiency and sustainability, and to tackle energy poverty. The project will also provide opportunities for training and education for club staff and volunteers, raising awareness, and promoting sustainable practices throughout the Scottish football community.

Overall, the planning of the pilot study on energy efficiency is a collaborative effort to promote sustainability and energy efficiency in Scottish football clubs. By bringing the clubs together in a network and providing resources and guidance, the project has the potential to reduce the carbon footprint of the Scottish football community significantly. Some of the undertaken actions are listed below.

- **Celtic Park**, home of Celtic Football Club, has installed LED lighting and solar panels, reducing their energy consumption and costs.
- **Hampden Park**, home of the Scotland national football team, has implemented energy efficient HVAC systems and building insulation to reduce energy use.
- Aberdeen Football Club's **Pittodrie Stadium** has installed energy efficient appliances and equipment to lower energy costs.
- Heart of Midlothian Football Club's **Tynecastle Stadium** has incorporated a water efficient landscaping system, reducing water usage.
- Kilmarnock Football Club's **Rugby Park** has implemented an energy management system to monitor and control energy usage.
- Motherwell Football Club's **Fir Park Stadium** has installed dual flush toilets and low flow showerheads, saving water and reducing costs.





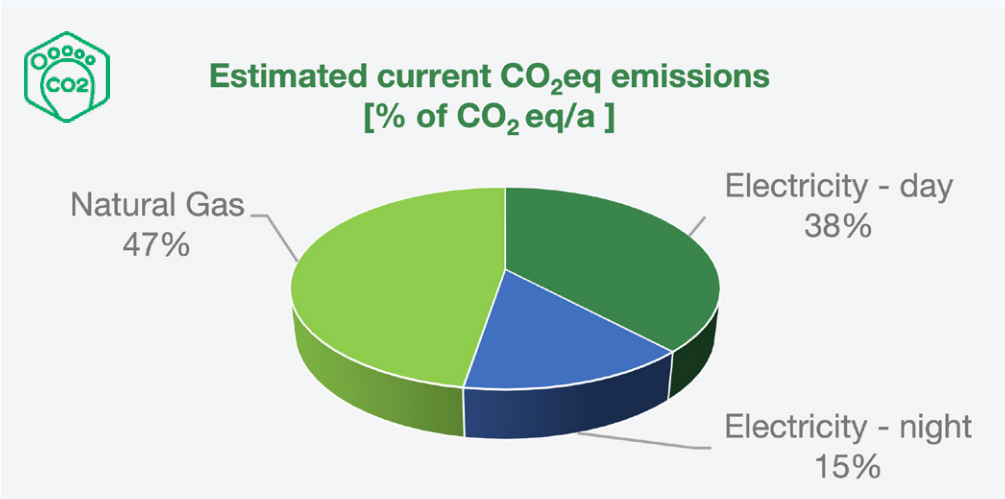


Figure 4-2: Energy consumption baseline characteristics for Hampden park station.

Source: Energieinstitut based on Mark Tamburrini of Tamburrini Energy Consultants (2019) Resource Opportunity Assessment provided by Corrie Campbell, Scottish FA, 10/10/2022

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KPIs baseline

Type KPI	KPI	Description / Numbers
Technological	**Primary energy savings (PES)**	Quantifying the primary energy savings related to these examples can be difficult due to many factors such as the specific equipment used, building design, energy consumption patterns, and local energy costs. However, the following are some estimated energy savings based on industry standards and averages: • LED lighting can save up to 80% on lighting energy costs compared to traditional lighting. • Energy efficient HVAC systems can reduce heating and cooling energy costs by up to 50%. • Building insulation can reduce energy loss by up to 30%. • Energy management systems can result in energy savings of 5-20% depending on usage patterns. • Dual flush toilets and low flow showerheads can save up to 30% on water costs, reducing energy costs for water treatment and pumping. • Water efficient landscaping can reduce water usage by up to 50%. • Renewable energy sources can provide significant energy cost savings compared to traditional energy sources, especially in areas with high energy costs. • Energy efficient appliances and equipment can reduce energy costs by up to 30%. These are rough estimates and actual savings will depend on specific circumstances and conditions.
Environmental	**GHG emissions reduction**	Quantifying the greenhouse gas savings related to these energy efficiency measures can be difficult due to many factors such as the specific equipment used, building design, energy consumption patterns, and local energy mix.

<table>
<tr><th>Type KPI</th><th>KPI</th><th>Description / Numbers</th></tr>
<tr><td rowspan="4">Economical</td><td>Operational cost savings</td><td rowspan="4">Quantifying the economic savings related to these energy efficiency measures can be difficult due to many factors such as the specific equipment used, building design, energy consumption patterns, and local energy costs. However, the following are some estimated economic savings based on industry standards and averages:

LED lighting can result in lighting energy cost savings of 50-80% per year.
Energy efficient HVAC systems can result in heating and cooling energy cost savings of up to 50% per year.
Building insulation can result in energy cost savings of up to 30% per year.
Energy management systems can result in energy cost savings of 5-20% per year depending on usage patterns.
Dual flush toilets and low flow showerheads can result in water cost savings of up to 30% per year.
Water efficient landscaping can result in water cost savings of up to 50% per year.
Renewable energy sources can provide significant energy cost savings compared to traditional energy sources, especially in areas with high energy costs.
Energy efficient appliances and equipment can result in energy cost savings of up to 30% per year.

These are rough estimates and actual savings will depend on specific circumstances and conditions. The initial investment in energy efficiency measures may be offset by long-term cost savings, creating a positive return on investment over time.</td></tr>
<tr><td>Payback</td></tr>
<tr><td>Return on investment (ROI)</td></tr>
<tr><td>Investment cost</td></tr>
</table>

Type KPI	KPI	Description / Numbers
Social	**User satisfaction**	Energy efficiency measures can improve indoor air quality, temperature control, and lighting, leading to increased user satisfaction.
	Easy to maintain	Energy efficient equipment and systems are often designed for easy maintenance, reducing downtime and maintenance costs.
	Easy to implement	Some energy efficiency measures, such as LED lighting and low-flow showerheads, can be relatively easy to implement with low upfront costs and immediate energy savings.
	Efforts on stakeholder involvement	Involving stakeholders, such as building owners, occupants, and staff, in energy efficiency efforts can increase awareness, buy-in, and overall success of the measures.
	Solution transfer	Energy efficiency measures can be replicated and transferred to other buildings and locations, promoting sustainability and reducing carbon footprint.
	Jobs	Energy efficiency measures can create jobs in installation, maintenance, and manufacturing related to energy efficiency.
	Training & qualification	Energy efficiency measures may require specialized training and qualification for installation, maintenance, and operation, providing job opportunities and professional development.
	Health & safety	Energy efficiency measures can improve indoor air quality, temperature control, and lighting, leading to improved health and safety for building occupants.
	Replication Potential	The replication potential of energy efficiency initiatives in football facilities is high If successful energy efficiency measures are implemented, documented, and shared as best practices, they can serve as examples for other facilities to replicate. This includes measures such as LED lighting, efficient HVAC systems, energy management systems, and renewable energy integration.

5.3. Pilot case 3 – Artificial turf filler – Norway

Indications on the pilot characteristics

The pilot plans for **wood-based artificial turf** substitutes in Norway include an agreement with a medium-sized city to install four 7-per-side pitches, one of which will have a new woodchip infill. The recipe for the woodchip infill was developed and improved during the project and testing periods. The infill was produced by a Norwegian company by using Norwegian wood. At the start of the project, the situation was in the planning stage, and the installation had not yet been completed. Additionally, a mobile application will be developed for players to provide inputs and feedback on the new wood-based artificial turf.

There are several ways to avoid microplastics from artificial turf in clubs, including:

- **Regular cleaning and maintenance:** Regular cleaning and maintenance can reduce the amount of microplastics released into the environment.
- **Proper disposal of turf debris:** Proper disposal of turf debris can reduce the amount of microplastics released into the environment.
- **Use of non-toxic infill materials:** Using non-toxic infill materials, such as coconut coir or cork, can reduce the amount of microplastics released into the environment.
- **Use of permeable synthetic turf:** Using permeable synthetic turf can reduce the amount of microplastics released into the environment by allowing for natural drainage and reducing the need for irrigation.
- **Use of alternative surfaces:** Using alternative surfaces, such as natural grass or hybrid grass, can reduce the amount of microplastics released into the environment.

These steps can help reduce the environmental impact of artificial turf and promote sustainability in football clubs.

Baseline before implementation

GOE BIO granules:

- Heartwood is machined into particles of a small size.
- Further processed and preserved.
- 15mm layer on artificial turf fields.
- Under 100 birch trees are needed to fill a full-size football pitch.
- GOE BIO granules tested according to FIFA procedures.
- 2021 test fields (a total of 9,000m2) at Sukkevann sports facility just outside of Kristiansand.
- 42,000 artificial grass fields in Europe
- 10% needs rehabilitation every year – 4,200 fields
- GOE – productions market goal is to service 10% of these fields in 2023/2024.

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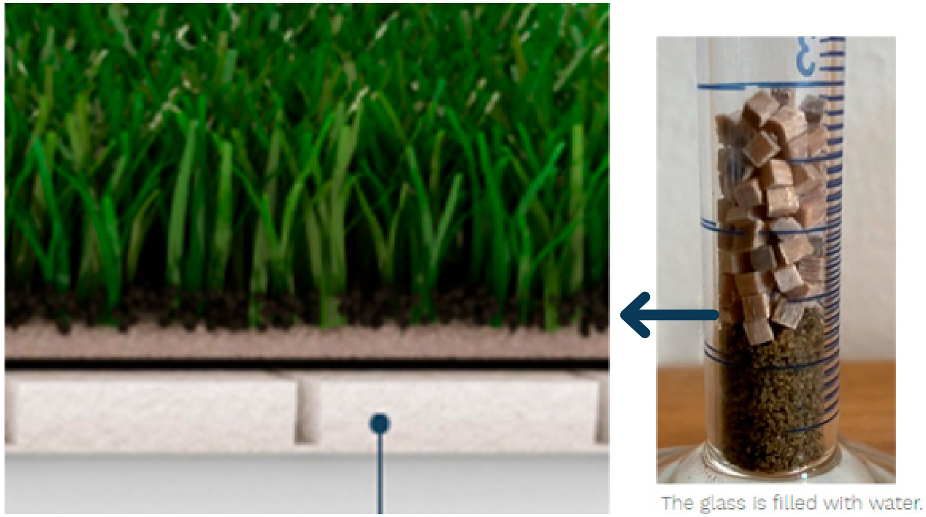

Figure 4-3, 4-4, Table 4-5: GOE BIO granules technical information. Source: https://en.goe-production.no/, accessed 25/10/2022

Technical data	
Type	Synthetic grass carpet for a filled performance system, gau " gauge tufted, straight stitch pattern
Pile content	100% polyethylene monofilament, UV-resistant, Diamond shape, 15.600 / 6 dTEX, 410 microns
Primary backing	Double 100% PP Thiobac, black, UV-stabilized, weight ca. 252gr / m²
Secondary backing	Latex compound with a base of styrene-butadiene with drainage holes
Pile height	40 mm
Total thickness	62 mm
Stitch rate per LM (width)	63
Stitch rate per LM (length)	135

Number of tufts / m²	8,505
Number of filaments / m²	102,060
Pile weight	1,278 gr / m²
Weight primary backing	252 gr / m²
Weight secondary backing	1,000 gr / m²
Total weight	2,530 gr / m²
Roll width	According to seaming plan
Roll length	According to seaming plan
Tuft bind	≥ 40 newton
Water permeability	≥ 500 mm / h
Color fastness	Xenon test: blue scale> 7, gray scale> 4

KPIs baseline

Type KPI	KPI	Description / Numbers
Technological	**Quality & durability of the material**	Quantifying the quality and durability of materials in relation to the examples provided is difficult, as it depends on several factors, including the type of material, the manufacturer, the installation process, and the climate conditions in which it is used. However, some general factors that can affect quality and durability include: • **Material composition:** The composition of the material can impact its durability and quality, with some materials, such as coconut coir or cork, being more durable and long-lasting than others. • **Installation process:** The quality of the installation process can impact the quality and durability of the material, with proper installation ensuring optimal performance and longevity. • **Climate conditions:** The climate conditions in which the material is used can impact its quality and durability, with some materials being more suitable for certain climates than others. It is important to consider these factors and to select materials based on the specific needs and goals of each club, with a focus on quality, durability, and sustainability.
Environmental	**GHG emissions reduction**	Quantifying the greenhouse gas savings related to the examples provided is difficult, as it depends on several factors, including the type of material used, the manufacturing process, the installation process, and the usage patterns. However, some general factors that can impact greenhouse gas savings include: • **Material composition:** Some materials, such as coconut coir or cork, can have a lower carbon footprint than others, reducing the overall greenhouse gas emissions. • **Manufacturing process:** The manufacturing process of the material can impact its carbon footprint, with some processes being more environmentally friendly than others. • **Installation process:** The installation process can impact the carbon footprint of the material, with some processes requiring less energy and resources than others. • **Usage patterns:** The usage patterns of the material can impact its carbon footprint, with some materials requiring less maintenance and less energy for irrigation and lighting. It is important to consider these factors and to select materials based on the specific needs and goals of each club, with a focus on reducing greenhouse gas emissions and promoting sustainability. The actual savings will vary and depend on the specific circumstances of each club.

Type KPI	KPI	Description / Numbers
Environmental	**Other environmental benefits**	Quantifying the environmental benefits of the examples provided is difficult, as it depends on several factors, including the type of material used, the manufacturing process, the installation process, and the usage patterns. However, some general environmental benefits that can be associated with these examples include: • **Reduction of waste:** Using alternative materials, such as coconut coir or cork, can reduce the amount of waste generated from the production and disposal of synthetic turf. • **Improved water management:** Using permeable synthetic turf or alternative surfaces can improve water management, reducing the need for irrigation and minimizing runoff. • **Increased biodiversity:** Using alternative surfaces, such as natural grass or hybrid grass, can increase biodiversity and provide a habitat for wildlife. • **Reduced reliance on non-renewable resources:** Using alternative materials, such as coconut coir or cork, can reduce but also increase the reliance on non-renewable resources, such as oil, used in the production of synthetic turf.
	Reuse & recycling options	Quantifying the reuse and recycling options related to the examples provided is difficult, as it depends on several factors, including the type of material used, the manufacturing process, and local recycling and waste management infrastructure. However, some general factors that can impact reuse and recycling options include: • **Material composition:** Some materials, such as coconut coir or cork, can be more easily reused and recycled than others. • **Manufacturing process:** The manufacturing process of the material can impact its recyclability, with some processes being more environmentally friendly and generating less waste than others. • **Local recycling infrastructure:** The local recycling infrastructure can impact the recyclability of the material, with some areas having better systems in place to recycle and repurpose waste. It is important to consider these factors and to select materials based on the specific needs and goals of each club, with a focus on promoting reuse and recycling and reducing waste. The actual options for reuse and recycling will vary and depend on the specific circumstances of each club and the local area.

Type KPI	KPI	Description / Numbers
Economical	**Investment cost**	Quantifying the cost of various artificial turf options can vary widely, as it depends on several factors, including the type of material used, the manufacturing process, the size of the project, and the location. However, some general estimates can be provided based on a range of factors: • **Synthetic turf:** The cost of synthetic turf can range from $5 to $20 per square foot, depending on the type of material and the quality of the product. • **Hybrid grass:** The cost of hybrid grass can range from $10 to $30 per square foot, depending on the type of material and the quality of the product. • **Natural grass:** The cost of natural grass can range from $10 to $30 per square foot, depending on the type of grass, the quality of the soil, and the location.
	Operational cost	
	Maintenance cost	

Type KPI	KPI	Description / Numbers
Social	**User satisfaction**	User satisfaction can be improved by selecting a material that meets the specific needs and requirements of the users, and by involving them in the selection process.
	Easy to maintain	Some alternative materials, such as synthetic turf, can be easier to maintain than others, as they may require fewer maintenance activities and less specialized equipment.
	Easy to implement	Some alternative materials, such as hybrid grass or natural grass, can be easier to implement than others, as they may require less complex installation processes and fewer specialized tools and equipment.
	Efforts on stakeholder involvement	Involving stakeholders in the selection and implementation process can improve their satisfaction with the outcome and increase their engagement with the project, promoting sustainability and long-term success.
	Solution transfer	Transferring knowledge and experience from one project to another can help to improve the quality and sustainability of future projects and can create new jobs and training opportunities.
	Jobs	Some alternative materials, such as natural grass or hybrid grass, can create new jobs and training opportunities in the maintenance, installation, and operation of the system.
	Training & qualification	Some alternative materials may require specialized training and qualifications to install and maintain, creating new job opportunities and promoting sustainability and long-term success.
	Health & safety	Some alternative surfaces, such as natural grass or hybrid grass, can be safer for players and users than synthetic turf, reducing the risk of injury and promoting health and well-being.
	Replication potential	The UEFA estimates that there are 42,000 artificial turf pitches in Europe and that 30,000 of these pitches will be affected by a current proposal for a complete ban of the use of rubber granulate in artificial turf pitches from the Commission[7]. The replication potential of the SDG Striker pilot is consequently enormous.

[7] Press release 06/10/2022: EU Announcement starts debate on the dispersal of microplastics from artificial turf pitches with rubber granulate as infill, https://www.genan.eu/eu-announcement-starts-debate-on-the-dispersal-of-microplastics/

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5. KPI MATRIX – EVALUATION OF PILOTS

The design and implementation of the three example pilot projects and the superordinate incorporation of the SDGs in the corporate social responsibility (CSR) framework to improve governance in grassroots sports organizations are documented in the following section. This implementation is evaluated and validated from an academic perspective based on the developed methodology and the baseline set of KPIs documented in the previous section.

5.1. Pilot case 1 – PV implementation – Portugal

Evaluations on the pilot

Description:

The photovoltaic installation at the Benfica Lisbon Stadium, also known as Estádio da Luz, has several positive impacts. Here are some of them:

- **Reduced carbon emissions:** The installation generates renewable energy, which means that less energy needs to be sourced from non-renewable sources like fossil fuels. This reduces the carbon footprint of the stadium and helps to mitigate the effects of climate change.
- **Energy savings:** By generating its own energy, the stadium can reduce its reliance on the grid and potentially save money on energy bills. The installation at Estádio da Luz can generate up to 1.4 MW of energy, which is enough to power around 1,500 homes.
- **Public awareness:** The installation serves as a visible example of renewable energy in action, which can help to raise public awareness and promote sustainable energy practices. This can inspire others to consider installing similar systems and contribute to the transition to a low-carbon economy.
- **Positive brand image:** By implementing sustainable practices, the stadium can enhance its brand image and reputation as a socially responsible organization. This can help to attract customers and investors who prioritize sustainability and contribute to the overall success of the stadium.

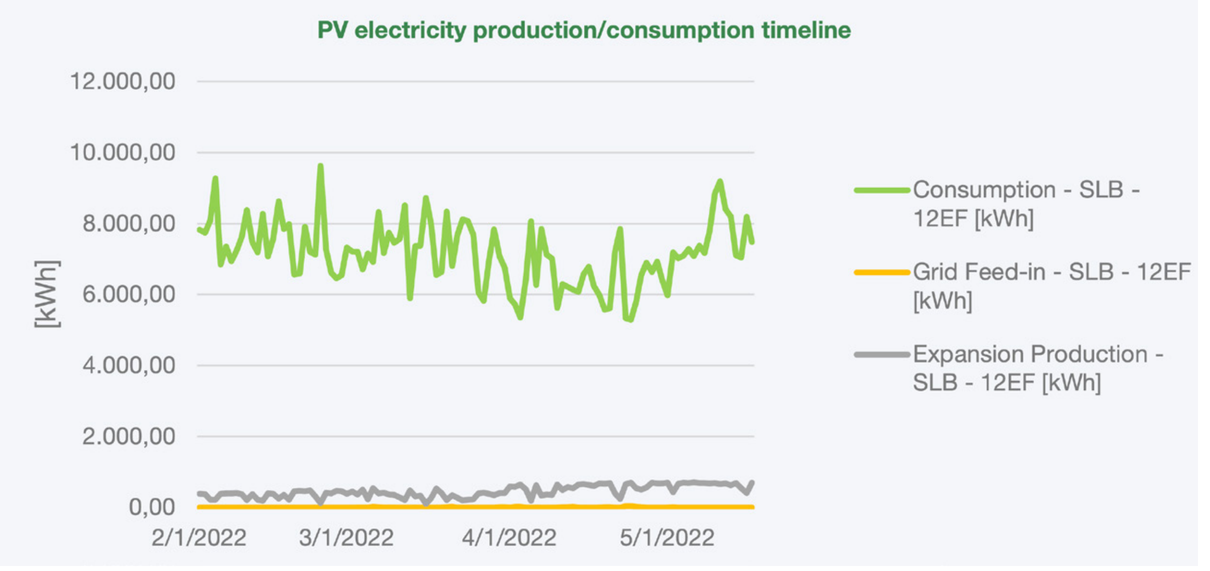

Figure 5-1: Detailed PV pilot electricity production & consumption data for 4 months of operation.

Some technical characteristics of the photovoltaic plant are summarised in the following table:

Table 5-1: Basic economic data on PV pilot installation.

Annual production	**> 315 MWh**
Investment costs UPAC (220 kWp)	> 194 000 €
Energy cost savings	> 35 299 €
Payback	> 5.5 years

The system was installed and maintained by an external contractor, and appropriate data monitoring recorded power generation and feed-in. The plant has a maximum degree of self-use in the football facility. An evaluation of the first months of operation and an annual balance sheet for 2022 are presented in the following figures and tables.

Table 5-2: Detailed PV pilot electricity production & consumption data for 4 months of operation. Source: Energieinstitut based on Data provided by Francisca Araújo, Portuguese FA, 04/08/2022

	Consumption - SLB - 12EF [kWh]	Grid Feed-in - SLB - 12EF [kWh]	Expansion Production - SLB - 12EF [kWh]
TOTAL	758 246	287	48 004
AVERAGE	7 153	3	453
MEDIAN	7 162	0	417
MAX	9 628	38	703
MIN	5 289	0	103

The evaluation of the first complete operating year, 2022, compares its own generation (in green) with grid procurement (yellow).

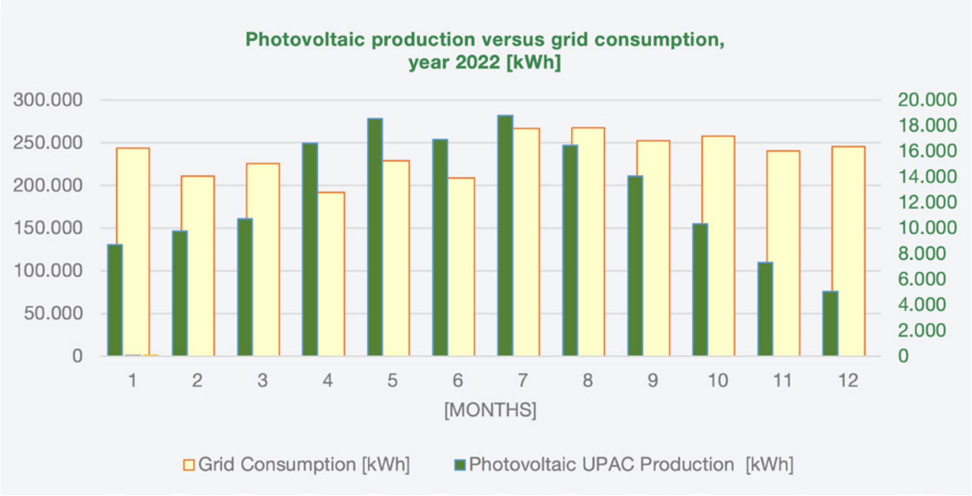

Figure 5-2: Detailed PV pilot electricity production & consumption data for the year 2022.

The following figure shows own generation (in green) as a percentage saving and the resulting monetary electricity cost savings (yellow).

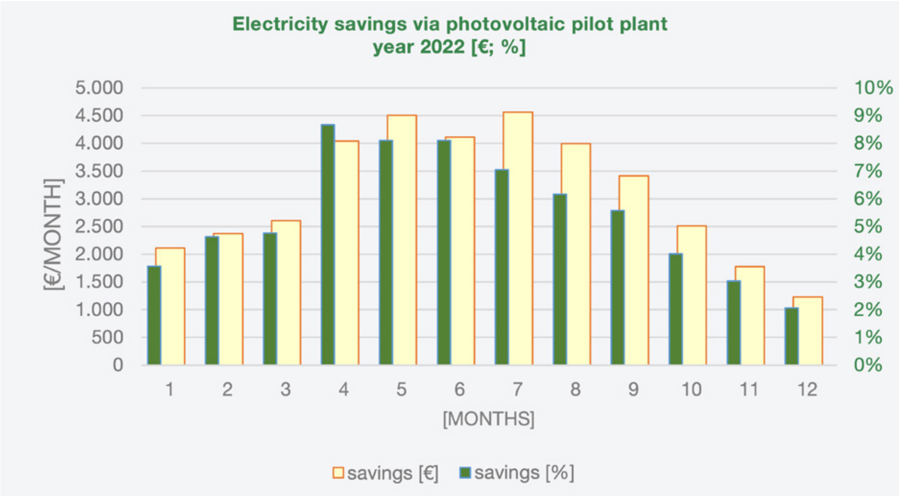

Figure 5-3: PV pilot electricity savings data for the year 2022.

The following table evaluates the pilot activity, considering the applicable KPIs and the baseline characterized in the previous section.

Type KPI	KPI	SDG STRIKER pilot evaluation
Technological	**Self-sufficient ratio**	In order to quantify the self-sufficient ratio of a photovoltaic plant specific information about the installed capacity and energy output in ratio to the electricity consumption of the stadium or facility is required. Based on this the **self-sufficient** ratio can be calculated as follows: Self-sufficient ratio = (energy produced by the photovoltaic plant / total energy consumed by the stadium or facility) x 100% For example, the photovoltaic plant installed at the pilot produced 153,254 kWh of energy in 2022, and the stadium and facility consumed 2,838,464 kWh of energy per year, then the self-sufficient ratio would be: Self-sufficient ratio = (153,254 kWh / 2,838,464 kWh) x 100% = 5.40% This means that the photovoltaic plant is able to meet 5.40% of the facilities energy needs, making it partially self-sufficient. In other installations, values in the order of > 30% are reported, but of course it depends entirely on the ratio of electricity consumption versus the size of PV system installed.
	Maximum external demand	To calculate the **maximal external demand** or peak demand of electricity over a given time period for a PV plant like the pilot, additional information such as the capacity factor of the PV plant, the location and the time period under consideration. The peak demand of electricity occurs when the electricity grid experiences the highest level of demand during a specific time period. This value is typically calculated using a moving average, which is usually over 15 minutes. During this period, the demand for electricity is highest due to factors such as extreme weather conditions, increased use of electrical appliances, or high industrial activity.
	On-site generation demand ratio	To quantify the on-site generation demand ratio of the pilot PV plant installed information about the plant's installed capacity, energy output, and the facilities total energy demand. Based on that information, the **on-site generation demand ratio** can be calculated as follows: On-site generation demand ratio = (energy produced by the photovoltaic plant / total energy consumed on-site) x 100% For example, the photovoltaic plant installed at the pilot produced 153,254 kWh of energy in 2022, and the stadium and facility consumed 2,838,464 kWh of energy per year, then the on-site generation demand ratio would be: On-site generation demand ratio = (153,254 kWh / 2,838,464 kWh) x 100% = 5.40%; 100% - 5.40% = 95.6 % This means that the photovoltaic plant is able to meet 5.4% of the facilities energy demand on-site, without exporting any excess energy to the grid. The remaining 95.6 % of the facilities' energy demand would need to be met by the grid or other sources. In other installations, values in the order of < 70 % are reported, but of course it depends entirely on the ratio of consumption compared to the PV system installed.

Type KPI	KPI	SDG STRIKER pilot evaluation
Environmental	**Primary energy savings (PES)**	To quantify the **primary energy savings** (PES) of a photovoltaic plant installed at the pilot specific information about the plant's installed capacity, energy output, and the energy mix of the grid from which the stadium or facility takes its electricity is required. Based on that information, the primary energy savings (PES) can be calculated as follows: PES = (energy produced by the photovoltaic plant / (energy produced by a reference power plant x primary energy factor)) x 100%. Where: Energy produced by the photovoltaic plant is measured in kWh. Energy produced by a reference power plant is the amount of energy that would be required to generate the same amount of electricity as the photovoltaic plant using a conventional power plant. Primary energy factor is a measure of the efficiency of the energy conversion process, taking into account losses in generation, transmission, and distribution. For example, taking the production of approx. 150.000 kWh of energy per year from the pilot, and the energy mix of the grid has a primary energy factor of 2.5, then the PES would be: PES = (150,000 kWh / (150,000 kWh / 2.5)) x 100% = 200% This means that the photovoltaic plant is able to generate twice the amount of primary energy savings as e.g., a conventional power plant with fossil solid fuels would generate to produce the same amount of electricity. In other words, for every unit of energy produced by the photovoltaic plant, two units of primary energy are saved due to the lower losses in the generation process compared to a conventional power plant.
	GHG emissions reduction	The **GHG emissions reduction** of the pilot photovoltaic plant depends on the amount of electricity it generates and displaces from the grid, as well as the GHG emissions intensity of the grid electricity it replaces. Assuming an average GHG emissions intensity of grid electricity in Portugal of around 0.347 kg CO2e/kWh (based on data from the International Energy Agency for 2020), and using the estimated electricity generation of 153,254 kWh from the photovoltaic plant, the GHG emissions reduction can be calculated as follows: GHG emissions reduction = 153,254 kWh x 0.347 kg CO2e/kWh = 53,179 kg CO2e. Therefore, the pilot photovoltaic plant reduces GHG emissions by approximately 53 tons CO2e per year.

Type KPI	KPI	SDG STRIKER pilot evaluation
Economical	**Operational cost savings** **Payback** **Return on investment (ROI)** **LCOE**	The **operational cost savings** of the pilot photovoltaic plant at the football facility depends on the amount of electricity it generates and displaces from the grid, as well as the cost of grid electricity it replaces. Assuming an average cost of grid electricity in Portugal of around 0.24 €/kWh at the time, and using the estimated electricity generation of 153,254 kWh from the photovoltaic plant, the operational cost savings can be calculated as follows: Operational cost savings = 153,254 kWh x 0.24 €/kWh = 36,781 € per year Therefore, the photovoltaic plant at the football facility actually saves close to 40,000 € per year in operational costs. However, this estimate does not take into account any maintenance or insurance costs etc. associated with the photovoltaic system. The **payback period** of a photovoltaic plant depends on several factors, including the initial cost of installation, the amount of electricity generated, the electricity cost savings, and any incentives or subsidies available. Assuming an estimated installation cost of €194,000 for the pilot photovoltaic plant and using the estimated annual electricity generation of 153,254 kWh, we can calculate the annual electricity cost savings as: Electricity cost savings = 153,254 kWh x 0.24 €/kWh = €36,781 Using these figures, the payback period of the photovoltaic plant can be calculated as: Payback period = Initial installation cost / Annual electricity cost savings Payback period = €194,000 / €36,781 per year; Payback period = 5.3 years Therefore, based on these simplified but illustrative example, it takes approximately 5.3 years for the photovoltaic plant to pay back its initial installation cost through electricity cost savings. However, it is important to note that this calculation does not take into account any incentives, subsidies, or the potential for electricity price increases over time, which could potentially reduce the payback period. This means that the cost of producing electricity via the PV system is always a fraction of the cost of purchasing electricity from the grid. Typically, **LCOE values** for photovoltaic plants can range from 0,03 to 0,1 €/kWh per kWh, depending on factors such as location, technology used, and subsidies available.

Type KPI	KPI	SDG STRIKER pilot evaluation
Social	User satisfaction	The photovoltaic plant at the pilot facility proofed to be reliable, an upscale if possible is recommendable to produce sufficient energy to meet the needs of the facility. Consequently, it is likely that **users are satisfied** with the system. Additionally, if the savings on electricity bills are most significant, this could lead to increased satisfaction among users, as well as positive publicity for the stadium and the club.
	Easy to maintain	The experience shows that the **maintenance of a photovoltaic plant is relatively straightforward**, if it is carried out on a regular basis by qualified personnel. The photovoltaic panels themselves are designed to be durable and require little maintenance, with no moving parts or fluids that could leak or wear out. However, some routine maintenance tasks are recommendable to be carried out, such as inspecting the panels and their mounting systems for damage or wear and checking the electrical connections and wiring for signs of damage or corrosion. Potentially cleaning the panels to ensure maximum efficiency. In addition, regular performance monitoring and data analysis should be conducted to identify any issues or areas for improvement. Overall, the maintenance requirements of a photovoltaic plant as shown in the pilot case is relatively low, but it is important to ensure that proper maintenance procedures are in place to maximize the plant’s performance and lifespan.
	Easy to implement	The **ease of implementing** a photovoltaic plant at a football facility depends on several factors, including the size of the system, the complexity of the installation, and the availability of skilled labour and materials. In general, the installation of a photovoltaic plant at the pilot site involved several steps, including site assessment, design and engineering, procurement of materials and equipment, installation, commissioning, and maintenance. Each of these steps requires different levels of expertise and resources. For a **small-scale installation**, such as a rooftop system at the stadium, carpark or other facilities, the implementation process is relatively straightforward, if the necessary permits and approvals are obtained and there are no significant structural or electrical issues that need to be addressed. Skilled labour and materials are widely available in the market for such installations. For a **larger-scale installation**, such as a ground-mounted system, the implementation process may be more complex and require more resources. Site preparation, such as land grading and excavation, may be necessary, and additional electrical infrastructure may need to be installed. The availability of skilled labour and specialized equipment may be a limiting factor for larger installations. With proper planning and execution, however, the installation and operation of a photovoltaic plant can provide significant benefits in terms of energy savings, emissions reduction, and cost savings.
	Jobs	Jobs created are both **direct** (e.g. installation, operation, and maintenance) and indirect (e.g. supply chain, logistics, and administrative) related to the pilot photovoltaic plant at the football facility.

Type KPI	KPI	SDG STRIKER pilot evaluation
Social	**Efforts on stakeholder involvement**	Efforts on **stakeholder involvement** in the implementation of the pilot photovoltaic plant have been significant. The stakeholders involved in the project include the club organization as the owner of the facility, the contractor responsible for the installation of the solar panels, the energy supplier, and the regulatory authorities. Throughout the project, the club organisation engaged with the **contractor** to ensure that the design and installation of the photovoltaic plant met their expectations and requirements. They also worked closely with the **energy supplier** to ensure that the electricity generated by the plant could be fed into the grid and that any excess power could be sold back to the supplier. The **regulatory authorities** were involved in the project from the beginning and permits and approvals were obtained before the installation began. This ensured that the project complied with all relevant regulations and standards. In addition to engaging with these key stakeholders, the project also sought to involve the **local community** in the project. They communicated regularly via the nation football association with other clubs about the project, including the benefits it would bring in terms of reducing carbon emissions and promoting renewable energy. They also invited members of the community to visit the stadium to see the solar panels in operation. Overall, the stakeholder involvement in the pilot photovoltaic plant was crucial to the success of the project. By working closely with all stakeholders, the initiators were able to ensure that the plant was designed and installed to meet their needs while complying with all relevant regulations and standards.
	Solution transfer	The solution transfer of the pilot photovoltaic plant involves **sharing the knowledge and experience gained** during the installation and operation of the plant with other organizations and stakeholders. This transfer occurs in several ways, such as: • **Direct consultation:** Representatives from other organizations and stakeholders are invited to consult with those responsible for the photovoltaic plant at the pilot football facility to learn about the details of the installation, operation, and maintenance of the plant. • **Conferences and workshops:** Presentations about the photovoltaic plant at the pilot football facility is made at conferences and workshops to share the experience and knowledge gained during the project. This can be an opportunity for interested stakeholders to ask questions and learn from the experts involved in the project. • **Publications:** Reports and other publications are produced to document the details of the photovoltaic plant at the pilot football facility, like this report. These publications are be made available to interested stakeholders and serve as a reference for future projects. • **Collaboration with partners:** The organizations involved in the pilot photovoltaic plant at the football facility collaborate with other partners, such as suppliers or research institutions like the creators of this report, to develop new solutions and improve the technology used in the project. This can lead to the creation of new knowledge and innovation that can be shared with other stakeholders.

<table>
<tr><th>Type KPI</th><th>KPI</th><th>SDG STRIKER pilot evaluation</th></tr>
<tr><td rowspan="2">Social</td><td>Training & qualification</td><td>Technical training for the installation and maintenance of the photovoltaic plant: This would require training for engineers, electricians, and other technical personnel who will be responsible for the installation and maintenance of the plant. The training cover topics such as PV system design, installation, testing, and troubleshooting.
Safety training: Safety training is crucial for personnel working with or around the photovoltaic plant. This training includes topics such as electrical safety, working at heights, and the use of personal protective equipment.
Job creation: As mentioned earlier, the installation and operation of the pilot photovoltaic plant creates jobs in various fields such as installation, maintenance, and operation.
Qualification of the workforce: The implementation of the pilot photovoltaic plant leads to additional qualification of workforce. This is because technical personnel require specific qualifications and certifications to work on the photovoltaic plant or on replication cases.
Knowledge transfer: The implementation of a photovoltaic plant leads to knowledge transfer between technical personnel, installers, and other stakeholders involved in the project. This transfer of knowledge helps to build a local workforce with the skills required to maintain and operate the plant.
The exact quantitative impacts of training and qualification depend on the size and complexity of the photovoltaic plant, as well as the level of involvement of local personnel in the installation and maintenance of the plant.</td></tr>
<tr><td>Health & safety</td><td>The installation and operation of the pilot photovoltaic plant has various health and safety impacts. The potential impacts can be both positive and negative. Here are a few examples:
Positive impacts:
Reduced air pollution: The use of solar power generated by the PV plant reduces the need for electricity generated from fossil fuels. This can, in turn, reduce air pollution and improve the overall air quality, which can have positive impacts on public health.
Reduced risk of fire: PV systems generally have no moving parts and do not require any fuel, which reduces the risk of fire.
Safe disposal of hazardous waste: Unlike some other forms of power generation, solar power does not produce any hazardous waste that requires special disposal methods.
Negative impacts:
Safety risks during installation: Installing solar panels on the roof of a building can be risky, especially when working at height. It is essential to follow proper safety procedures and provide appropriate personal protective equipment to workers.
Health risks during maintenance: Workers who perform maintenance on the PV system may be exposed to electrical hazards. It is necessary to provide appropriate training and equipment to minimize the risk of injury.</td></tr>
</table>

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5.2. Pilot case 2 – Energy Efficiency and Energy Poverty – Scotland

Evaluations on the pilot

Description:

Energy efficiency measures in representative Stadiums like Hampden Park can have several positive impacts, including:

- **Reduced energy costs:** By implementing energy efficiency measures, the football facility can reduce its energy consumption and associated costs. This can result in significant savings for the stadium over time.
- **Improved comfort for spectators:** Energy efficiency measures can help to improve the indoor environment of the stadium, making it more comfortable for spectators. This can include measures such as improved insulation, more efficient heating and cooling systems, and better lighting.
- **Reduced carbon emissions:** By reducing energy consumption, the stadium can also reduce its carbon footprint and contribute to efforts to mitigate climate change. This can have positive impacts on the environment and help to improve the stadium's reputation as a socially responsible organization.
- **Compliance with regulations:** Energy efficiency measures may be required by regulations and standards, such as building codes and environmental certifications. By implementing these measures, the stadium can ensure compliance with these regulations and avoid penalties or fines.
- **Demonstrating leadership:** By implementing energy efficiency measures, a stadium like Hampden Park demonstrates leadership in sustainability and inspire others to follow suit. This can help to promote sustainable practices and contribute to the overall transition to a low-carbon economy.

The following table evaluates the pilot activity, considering the applicable KPIs and the baseline characterized in the previous section.

KPIs

Type KPI	KPI	Description / Numbers
Technological	**Primary energy savings (PES)**	According to the International Energy Agency (IEA), energy efficiency measures in buildings can result in **primary energy savings** of 30-50%[8]. This range is based on the types of measures implemented and the extent to which they are applied.
Environmental	**GHG emissions reduction**	According to the United Nations Environment Programme (UNEP), energy efficiency measures in buildings can result in **GHG emissions reductions** of 10-30%[9]. This range is based on the types of measures implemented and the extent to which they are applied. For example, measures such as building insulation, high-efficiency lighting, and efficient heating, ventilation, and air conditioning (HVAC) systems can all contribute to significant GHG emissions reductions.
Economical	**Operational cost savings**	According to the United States Environmental Protection Agency (EPA), energy efficiency measures in buildings can result in **operational cost savings** of 30% or more[10]. This range is based on the types of measures implemented and the extent to which they are applied. For example, measures such as building insulation, high-efficiency lighting, and efficient heating, ventilation, and air conditioning (HVAC) systems can all contribute to significant operational cost savings.
	Payback	According to the United States Department of Energy (DOE), energy efficiency measures in buildings can have a **payback period** ranging from 1 to 10 years, with the average payback period being 3-5 years[11]. This range is based on the types of measures implemented and the extent to which they are applied. For example, measures such as building insulation, high-efficiency lighting, and efficient heating, ventilation, and air conditioning (HVAC) systems can all have different payback periods.
	Return on investment (ROI)	
	Investment cost	In general, energy efficiency measures can have a wide range of costs depending on the scope of work required. For example, simple measures such as installing LED lighting or programmable thermostats can be relatively inexpensive, while more complex measures such as upgrading HVAC systems or replacing windows can be more costly.
Social	**User satisfaction**	It is important **to involve stadium users** in the energy efficiency process and communicate the benefits of the measures implemented, such as improved comfort, better air quality, and reduced energy costs. This can help to increase user satisfaction and encourage support for further energy efficiency initiatives. In addition to surveys, monitoring energy performance metrics, such as energy consumption and cost savings, can also provide an indication of the effectiveness of the energy efficiency measures implemented.

[8] IEA (2022) Buildings – Sectoral overview, https://www.iea.org/reports/buildings, CC BY 4.0.
[9] UNEP (2022) Global Status Report for Buildings and Construction (Buildings-GSR), https://globalabc.org/our-work/tracking-progress-global-status-report
[10] United States Environmental Protection Agency (EPA) (2022) Rules of Thumb Energy Efficiency in Buildings, State and Local Climate and Energy Program, link
[11] Pacific Northwest National Laboratory (2021) Cost Effectiveness of the Residential Provisions of the 2021 IECC, Prepared for the U.S. Department of Energy, link

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Type KPI	KPI	Description / Numbers
Social	Easy to implement	These considerations help for ensuring that the measures are **easy to implement**: **1.** Conducting a thorough energy audit – in the case of the pilot supported by external expertise (Energy Trust Scotland) - helps to identify areas of energy waste and prioritize the measures to be implemented. This helps to ensure that the measures are targeted and effective and reduce implementation time and costs. **2.** Choose measures that are easy to install: For example, measures like LED lighting and programmable thermostats can often be installed without significant disruption to normal stadium activities. **3.** Ensure compatibility with existing systems: This helps to reduce the need for costly upgrades or modifications to existing systems. **4.** Engage with experienced contractors: This helps to ensure that the measures are installed correctly and efficiently and helps to reduce implementation time and costs.
	Efforts on stakeholder involvement	**Stakeholder involvement** helps to ensure that the measures implemented are well-received and supported by key stakeholders, including stadium owners, management, staff, and fans. These efforts are characterized by: **1.** Collaboration and communication: Effective stakeholder involvement involves collaboration and communication between all parties involved via regular meetings, consultations, and feedback sessions to ensure that all stakeholders are kept informed and involved in the energy efficiency process. **2.** Clear and concise messaging: The benefits of the energy efficiency measures are clearly communicated to stakeholders in a way that is easily understandable. This helps to increase support for the measures and encourage participation in energy-saving behaviours. **3.** Education and training: This ensure that all stakeholders understand the importance of energy efficiency measures and are equipped with the knowledge and skills necessary to participate in energy-saving activities including training staff on proper equipment use and maintenance and providing education programs for fans on energy-saving behaviours. **4.** Incentives and recognition: Providing incentives and recognition for energy-saving behaviours helps to encourage stakeholder participation in energy efficiency efforts. This includes rewards for staff who identify energy-saving opportunities and recognition programs for fans who participate in energy-saving initiatives.

Type KPI	KPI	Description / Numbers
Social	**Solution transfer**	**Solution transfer** include documenting successful energy efficiency measures along with any challenges and lessons learned. The pilot stadiums share best practices with other stadiums or commercial buildings that are interested in implementing energy efficiency measures (information on energy audits, energy management systems, and other energy-saving practices). **Networking** with other stadium or commercial building operators and energy efficiency experts facilitates solution transfer. This includes **attending conferences**, webinars, and other industry events to share information and learn from others. **Providing training and education** on energy efficiency measures also help to facilitate solution transfer including offering workshops, seminars, and online training programs to teach other stadium & facility operators.
	Jobs	Implementing energy efficiency measures at the stadium and facilities can create **job opportunities** in several ways: The installation can create job opportunities for electricians, HVAC technicians, and other skilled tradespeople. Conducting energy audits create job opportunities for energy auditors, engineers, and other professionals. The production of energy-efficient equipment and materials, such as LED lighting or insulation, can create job opportunities in manufacturing facilities.
	Training & qualification	Providing **training programs and certification courses** in the various aspects of energy efficiency measures at the stadiums & facilities including energy auditing and management, installation and maintenance of energy-efficient equipment helps to develop a skilled workforce in this area.
	Health & safety	Implementing energy efficiency measures help to **improve health and safety** conditions at Hampden Park stadium and create a safer, healthier environment for workers and visitors via e.g., proper ventilation and consequently improved indoor air quality or improving electrical safety via new installations.
	Easy to maintain	**Easy maintenance** is reached by the selection of durable and low-maintenance materials, the design of accessibility, regular inspections and cleaning and use automation and remote monitoring.

5.3. Pilot case 3 – Artificial turf filler – Norway

Evaluations on the pilot

Description:

Artificial turf is a common alternative to natural grass for sports fields, particularly in areas with harsh weather conditions or limited space for maintaining a natural grass field. Traditionally, the filler material used in artificial turf has been made of rubber granules, which have been linked to health and environmental concerns. However, a testbed of wood-based artificial turf filler substitutes at a Norwegian pitch can have several positive impacts, including:

- **Reduced environmental impact:** Using wood-based artificial turf filler substitutes can significantly reduce the environmental impact of artificial turf fields. Unlike rubber, wood is a renewable resource that can be sustainably harvested, and it does not release harmful chemicals or microplastics into the environment.
- **Better playing conditions:** Rubber granules can become overheated and cause burns or abrasions can become hard and compacted over time, wood-based fillers provide a more natural feel underfoot and can help to reduce injury rates among players.
- **Positive impact on local economy:** Using wood-based fillers can have a positive impact on the local economy, particularly in areas with a strong forestry industry. It can create jobs, support local businesses, and help to develop a more sustainable and resilient community.

Overall, the testbed of wood-based artificial turf filler substitutes at a Norwegian pitch can have a range of positive impacts on the environment, player safety, playing conditions, and local economy. It can serve as a model for other communities looking to transition away from traditional rubber-based fillers and towards more sustainable and safe options.

The following table evaluates the pilot activity, considering the applicable KPIs and the baseline characterized in the previous section.

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KPIs

Type KPI	KPI	Description / Numbers
Technological	**Quality & durability of the material**	Testing in the pilot pitches revealed that: • The wood-based substitutes can in principle have similar quality and durability than traditional rubber-based artificial turf filler. • First material tests revealed that the wood-based fillers provided lower levels of shock absorption and playing performance as rubber. • Wood-based fillers can maintain their shape and properties over time with proper maintenance and regular grooming, while rubber can become compacted and lose its resiliency. • Further quality and durability tests of wood-based fillers and improved manufacturing process, tailored towards and climate and usage conditions are planned in the post SDG Striker project phase. • Proper installation, maintenance, and monitoring are crucial for optimal performance and longevity of any artificial turf system, regardless of the filler material used.
Environmental	**GHG emissions reduction**	Wood-based fillers instead of traditional rubber-based fillers can lead to significant **GHG emissions reductions**. EI-JKU has conducted a full LCA study on the material which will be presented at a Conference in September 2023 in France. Another life cycle assessment (LCA) study conducted by the Norwegian research institute SINTEF estimated that using cork-based filler instead of rubber-based filler could reduce the carbon footprint of an artificial turf field by up to 70%. Another LCA study commissioned by the French Football Federation found that replacing rubber with coconut-based filler could reduce the field's GHG emissions by up to 27%.
	Other environmental benefits	Wood-based fillers **do not contain microplastics** and do not contribute to microplastic pollution. Therefore, replacing rubber with wood-based fillers can significantly reduce the amount of microplastics released from artificial turf fields. For example, a study conducted by the Norwegian research institute NILU estimated that using cork-based filler instead of rubber-based filler could reduce the release of microplastics from an artificial turf field by up to 95%. Another study conducted by the University of Berkeley found that replacing rubber with coconut-based filler could reduce the release of microplastics by up to 90%.
	Reuse & recycling options	In general, wood-based fillers are **biodegradable** and can decompose naturally at the end of their life, reducing the amount of waste generated. Recycling into other products, such as mulch or biofuel is well conceivable but not guaranteed based on the chemical impregnation of the material.

Type KPI	KPI	Description / Numbers
Economical	**Investment cost**	In general, the **upfront investment cost** of wood-based fillers may be higher than rubber-based fillers. For example, cork-based fillers can be more expensive than rubber-based fillers, but the cost can vary depending on the supplier, volume purchased, and other factors.
	Operational cost	However, the **operational and maintenance costs** of wood-based fillers can be lower than rubber-based fillers in the long run. Wood-based fillers can require less frequent replacement than rubber-based fillers, reducing the need for ongoing investment. Additionally, wood-based fillers can require less watering and fertilization than natural grass fields, reducing water and chemical costs.
	Maintenance cost	Maintenance costs for wood-based fillers can also be lower than rubber-based fillers, as wood-based fillers can require less frequent grooming to maintain their properties. Proper grooming and maintenance practices, such as regular brushing and top-dressing, can help ensure optimal performance and longevity of the field.
Social	**User satisfaction**	In general, wood-based fillers need to provide a similar or better playing experience than rubber-based fillers, with comparable shock absorption, ball bounce, and overall playing performance to sustain in this application. Some studies have suggested that cork-based fillers can outperform rubber-based fillers in certain aspects, such as reducing the risk of injury and improving drainage. Here, the new material must first prove itself in long-term use. In addition to performance, **user satisfaction** can also be influenced by factors such as aesthetics, comfort, and environmental impact. Wood-based fillers can provide a natural look and feel, which some users may prefer over the synthetic look of rubber-based fillers. Additionally, wood-based fillers are potentially cooler to the touch than rubber-based fillers, which can provide greater comfort for users in hot weather conditions. From an environmental perspective, the use of wood-based fillers can contribute to greater user satisfaction among those who prioritize sustainability and eco-friendliness in their purchasing decisions.
	Easy to maintain	Wood-based artificial turf filler substitutes can be relatively e**asy to maintain** and can be less prone to compacting and flattening than rubber-based fillers, which can help to maintain their performance properties over time. Regular grooming is still recommended for wood-based fillers to ensure optimal performance and longevity of the field. However, this can be achieved with relatively simple tools and practices, such as regular brushing to redistribute the filler material and prevent matting or compaction.

Type KPI	KPI	Description / Numbers
Social	**Easy to implement**	**Replacing the filler material** in an existing synthetic turf field can be a relatively straightforward process, as it generally involves removing the old filler and replacing it with the new material. However, this may require specialized equipment and expertise to ensure proper removal and disposal of the old material, as well as proper installation and grooming of the new material. For **new field installations**, the use of wood-based fillers can be integrated into the design and construction process with relative ease, provided that the necessary materials and expertise are available. This may require additional planning and coordination to ensure that the proper materials are sourced and that the installation and maintenance processes are properly aligned with the use of wood-based fillers.
	Efforts on stakeholder involvement	Efforts on **stakeholder involvement** for wood-based artificial turf filler substitutes vary depending on the specific project or initiative, but typically involve engaging a range of stakeholders in the planning, design, and implementation processes. Key stakeholders in the use of wood-based fillers for synthetic turf systems include sports field managers, facility owners, manufacturers, suppliers, researchers, and community members. Engaging these stakeholders help to ensure that the project goals and outcomes are aligned with their needs and interests, and that potential concerns or challenges are addressed in a timely and effective manner. Stakeholder involvement efforts may include activities such **as public outreach and education**, stakeholder meetings and workshops, surveys and feedback mechanisms, and collaboration with industry associations or other relevant organizations. These efforts can help to build support and buy-in for the use of wood-based fillers and can help to identify opportunities for improvement or optimization throughout the project lifecycle.
	Solution transfer	**Knowledge sharing** include dissemination of research findings, best practices, and case studies related to the use of wood-based fillers in synthetic turf systems. This can be done through conferences, workshops, publications, and online resources, among other channels. **Technology transfer** can be facilitated through partnerships between manufacturers, suppliers, and sports facility owners or operators. Partnerships should be formed between organizations or individuals to collaborate on the development and implementation of wood-based artificial turf filler substitutes. These partnerships can involve sharing expertise, resources, and funding to accelerate the adoption and implementation of these substitutes in new locations and contexts. The success of **solution transfer** efforts for wood-based artificial turf filler substitutes will depend on a range of factors, including the availability of appropriate materials and equipment, the regulatory environment, and the willingness and ability of stakeholders to adopt and implement these substitutes.

Type KPI	KPI	Description / Numbers
Social	Jobs	Wood-based artificial turf filler substitutes can **create jobs** across the supply chain, from the production of the filler material to the installation and maintenance of the synthetic turf systems. The exact number of jobs created by wood-based artificial turf filler substitutes will depend on factors such as the size and scope of the sports facility and the level of adoption of these substitutes in the industry.
	Training & qualification	For sports facility owners and operators, **training and qualifications** will be required for the installation and maintenance of wood-based artificial turf systems. This may include training on proper site preparation, installation techniques, and ongoing maintenance and grooming practices to ensure optimal performance and longevity of the system. **Certification programs** and **training courses** focused on sustainable sports facility management and design may also be beneficial.
	Health & safety	Wood-based fillers **do not contain the harmful chemicals** found in rubber fillers, such as carcinogens and heavy metals, which can pose health risks to athletes and other users of sports fields. Furthermore, the use of wood-based fillers can contribute to **better air quality**, as they do not produce the same levels of fine particulate matter as rubber fillers. This can help reduce the risk of respiratory problems for athletes and other users of sports fields.

6. EVALUATION AND VALIDATION

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6.1. Validation and recommendations based on pilot 1 – PV implementation (Portugal)

Based on the SDG Striker pilot case #1, the installation and operation of a PV system on a football facility, the validation showed that conducting a feasibility study to evaluate the costs, returns, and social and economic impacts of installing photovoltaic (PV) solar panels in sports facilities is the most crucial action.

6.1.1. Costs and return

The first cost and returns should be estimated, which can be achieved through the following steps:

1. **Define the scope of the study:** Define the scope clearly, including the type and size of sports facilities to be assessed, and the goals and objectives.
2. **Conduct site assessment**: Conduct a site assessment of the sports facilities to determine their suitability for PV solar panels, with factors such as roof or ground space, orientation, shading, and access to the electrical grid.
3. **Estimate the costs:** Cost of installing PV solar panels, including the costs of equipment, installation, maintenance, and ongoing energy.
4. **Evaluate the financial return**: Investment in PV solar panels, including energy bill savings and any savings incentives or tax credits that may be available.
5. **Consider social and economic impacts:** Impacts of installing PV solar panels, including job creation, increased site investment, and potential for community involvement in renewable energy initiatives.
6. **Analyse data and report preparation:** A comprehensive report that includes a detailed summary of the data, findings, recommendations, and conclusions.
7. **Review and conclusion:** The findings were refined, including any additional data or feedback received during the review process.

A detailed **cost analysis** should be conducted to determine the costs associated with installing a PV solar panel system in a sports facility. This analysis should be performed to gather information about the costs of PV panels, inverters, electrical work, and other costs. This analysis should consider the savings realized through reduced energy costs and the cost of financing any applicable tax credits or incentives.

This study should provide a clear and comprehensive evaluation of the costs, returns, and other social and economic impacts of installing PV solar panels in sports facilities, allowing decision-makers to make informed decisions about their energy and sustainability goals.

6.1.2. Technology assessment

A suitable sports facility for PV solar panels meets several key criteria.

- **Roof Orientation and Tilt:** The orientation roof of the sports facility should be towards the south, or have a southerly aspect, to maximize the amount of solar radiation that can be captured by the panels. The roof tilt should be between 20-45 degrees.
- **Structural Capacity:** The roof of a sports facility should be appropriate for the weight of the PV solar panel system. PV include panels, mounting hardware, and other equipment.
- **Shading:** It would be most efficient if the roof of the sports facility had minimal shading. The efficiency of the PV solar panel system is significantly reduced by shading. Shading

analysis was performed to determine the shading level of the roof.

- **Electrical system:** The electrical system of a sports facility can support a PV solar panel system. This includes an electrical panel with an adequate capacity and a grounding system.
- **Energy demand:** The energy demand of a sports facility must be considered when sizing the PV solar system. The power consumption patterns of the facility, including peak usage times and seasonal fluctuations, should be evaluated to determine the size and capacity of the facility to meet its energy needs.
- **Site accessibility:** The roof and sports facility system must be accessible for purposes and repair, as well as for the connection and monitoring of the PV solar panel system.
- **Environmental considerations:** The environmental impact of installing a PV solar system in a sports facility should be assessed to ensure that it meets sustainability objectives and does not negatively impact wildlife or habitats.

Sports facilities that meet these criteria are well suited for the installation of PV solar panel systems and can benefit from the reduced energy costs, durability, and greater energy independence of PV solar panel systems.

It is recommendeded to cooperate with a professional solar energy consultant or installer to analyse the costs and benefits of installing a PV solar panel system in a sports facility. All relevant factors to determine the potential overinvestment of the project should be considered. This will provide a clearer and more realistic estimate of expected returns and help make informed decisions regarding project feasibility.

6.1.3. Potential challenges

The implementation of PV installations in grassroots sports organizations can present several **surprises and challenges**, including:

- **Cost:** It can be expensive to install a PV solar panel system, and funding may be a challenge for grassroots sports organizations with limited budgets.
- **Technical expertise:** Technical expertise is required when installing a PV system, which may not be available in grassroots sports organizations.
- **Site suitability:** Sports facilities suitable for PV installation may be limited by factors such as orientation, shading, and available space.
- **Maintenance and durability:** Long-term performance and durability of the PV system may require ongoing maintenance and upkeep, which can be challenging for grassroots sports organizations when they have limited resources.
- **Resistance to change:** Stakeholders such as players, coaches, and volunteers must be introduced to a new technology and may be resistant to change, particularly if it involves changes to the playing surface or other facilities.
- **Technical standards:** A challenge can be to ensure that the PV system meets technical standards and requirements such as electrical safety and grid connection.
- **Integration with other systems:** Integrating a PV system with other systems, such as lighting, heating, and cooling, may be complex and require additional expertise.

In summary, the **challenges and benefits** of installing a PV system in a grassroots sports organization include r**educing energy costs, increasing energy independence, and contributing to a more sustainable future**. Careful planning, collaboration with experts, and ongoing monitoring and evaluation can help mitigate these challenges and ensure successful PV installation.

6.1.4. Social and economic impacts

Social and economic impact analyses assess the social and economic potential of the community, such as increased access to renewable energy, reduced greenhouse gas emissions, and any potential negative impacts.

The installation of a PV solar panel system can have several **positive social and economic impacts:**

- **Cost savings:** A sports facility with a PV solar panel system can reduce its energy costs and potentially save a significant amount of money over time by generating electricity. This can bring resources to other important initiatives and programs in the organization.
- **Increased sustainability:** By generating clean and renewable energy, PV solar panel systems can help reduce the carbon footprint of installation and contribute to a more sustainable future. It can also demonstrate the organization's commitment to and responsible use of energy.
- **Energy independence:** With a PV solar panel system, a sports facility can reduce its dependence on the grid and is less vulnerable to fluctuations in energy prices, which can lead to long-term cost savings.
- **Job creation:** The installation of a PV solar panel system can create local jobs in the installation, maintenance, and repair of the system, which can impact the local economy.
- **Improved community relations:** By demonstrating commitment to sustainability and environmental responsibility, a sports facility with a PV solar panel system can improve its reputation and community relations, which can have a positive impact on its long-term viability and success.
- **Education and awareness:** A PV solar panel system can be useful as an educational tool for the community, providing an opportunity for people to gain knowledge of renewable energy and its potential benefits.
- **Recommendation:** After evaluating the results of the feasibility study, it is important to make a recommendation on whether or not to proceed with the installation of PV solar panels at sports facilities. This recommendation should consider the costs, returns, and impacts on the social and economic aspects of the project.

In summary, installing a PV solar panel system at a sports facility can lead to significant social and economic impacts, including cost savings, increased sustainability, energy independence, job creation, and increased awareness and education regarding renewable energy. A **feasibility study** is essential for assessing the costs, returns, and other social and economic impacts of installing PV solar panels in sports facilities. This study provides valuable information regarding the viability and sustainability of this investment. This would help ensure that the installation of PV solar panels conforms to the goals and values of the sports facility and the broader community.

6.2. Validation and recommendations based on pilot 2 – Energy efficiency and energy poverty (Scotland)

6.2.1. Design elements for success

Designing a campaign to increase the efficiency of sports facilities and raise awareness of poverty in energy, including actions to reduce energy bills, is recommended through the following **actions**:

1. **Define the audience:** Identify the target audience, such as sports facilities managers, coaches, athletes, and the local community.
2. **Develop a clear message:** Develop a concise message that highlights the relevance of energy efficiency, reduces energy bills, and outlines the issue of energy poverty.
3. **Choose channels:** Examine the best channels to address the target audience, such as social media, websites, local newspapers, and billboards.
4. **Create engaging content:** Develop informative content, such as infographics, videos, and posters that visualize the benefits of energy efficiency and show how it helps to reduce energy bills and avoid energy poverty.
5. **Organize training sessions:** Sports facility managers and coaches should learn how to reduce energy bills, apply energy-saving measures, and become more energy efficient.
6. **Partner with organizations:** Partner with local businesses that specialize in energy efficiency and sustainability to help deliver resources and support for the campaign.
7. **Launch the campaign:** Through a launch event or press conference, use the selected channels to disseminate the message to the target audience.
8. **Monitoring and evaluation:** Continuously monitor and evaluate the effectiveness of the campaign and make adjustments, as needed. Use of metrics such as engagement rates, energy bill reductions, and increased awareness of energy poverty.

The success of the SDGs of grassroots sports organizations related to the aspects of increased energy efficiency and reduced energy poverty can be achieved through a combination of data collection, monitoring indicators, stakeholder feedback, self-assessment, and external evaluation. This **continuous monitoring process** would gain valuable insights that would promote the effectiveness of grassroots sports organizations of SDGs and would inform efforts to promote their implementation of effective practices and positive social impact.

6.2.2. Potential challenges

Some potential **challenges and surprises** in implementing a campaign to increase efficiency and raise awareness of energy poverty in sports facilities may include the following.

- **Resistance to change:** Some stakeholders may adopt new technologies or practices that change their current operations and habits.
- **Funding and cost:** Obtaining the necessary funding for upgrades and training actions can be a challenge, and identifying cost-effective solutions provides measurable results.
- **Raising awareness and education:** Raising awareness and educating parties about the importance of energy efficiency and reducing energy bills may require effort and resources.
- **Technical expertise:** Implementing energy efficient practice technologies may require specialized technical expertise and expertise that may not be readily available within the organization.
- **Long-term commitment:** Sustaining energy efficiency improvements over time may require ongoing monitoring, which can be challenging given competing priorities and limited resources.

On the other hand, some **surprises and potential benefits** may include:

- **Cost savings:** Implementing energy efficient practices can result in significant cost savings, which can be reinvested in other programmes or to improve operations.
- **Improved operations:** Improved energy efficiency can lead to better operations, including better interior quality and better control of temperature, thus improving the reliability of the equipment and systems.
- **Increased community engagement:** Engaging with the community regarding energy poverty and energy efficiency can lead to increased public support and engagement, as well as greater community involvement in the organization.
- **Improved environmental impact:** Reducing consumption can positively impact the environment by reducing greenhouse gas emissions and resources.
- **Positive reputation:** Demonstrating a commitment to sustainability energy efficiency can improve an organization's reputation and visibility in the community.

6.3. Validation and recommendations based on pilot 3 – Artificial turf filler (Norway)

The **problem of microplastics** in football pitches with artificial playing areas is a growing issue because of their significant environmental impacts. Microplastics are small plastic particles present in many consumer products, such as artificial turfs. When these particles disassemble over time, they enter the environment and harm wildlife and human health.

Additionally, high maintenance costs and large amounts of energy are required to produce, transport, and install are necessary to keep artificial football pitches. Furthermore, the synthetic materials used in these pitches emit heat when exposed to sunlight, which can cause health issues to players and spectators.

Owing to these concerns, there is a growing need for more **sustainable alternatives** to artificial football pitches that minimize plastic use and other synthetic materials and promote sustainable practices. By changing these alternatives, we can reduce the environmental impact of football and promote a more sustainable future for the sports sector.

6.3.1 Material and technology assessment

A document on greener alternatives (Norway) to microplastics as infill materials for artificial football pitches, including a Life Cycle Assessment (LCA) and a comparative environmental impact analysis of new technologies, was created through the following steps:

1. **Define the problem:** The state of the problem of microplastics in artificial football pitches and the need for more sustainable alternatives.
2. **Alternative infill materials** that are more environmentally friendly include recycled materials, materials of natural origin, and biodegradable materials. Different alternative infill materials are more sustainable than traditional microplastics used in artificial football pitches.
    - **Recycled materials:** Recycled rubber and rubber from old tires are already being used as alternative infill materials in artificial football pitches. They divert waste from landfills and reduce rubber production, which could have a significant environmental impact.

    - **Natural materials:** Some artificial football pitches use natural materials, such as cork, sand, and coconut fibres. These materials are biodegradable, nontoxic, and renewable, making them a more sustainable option.
    - **Biodegradable materials:** Some companies are developing materials that are designed to break down over time, helping to reduce the long-term environmental impact of artificial football pitches. These materials are a combination of natural and synthetic materials. They can be produced to mimic the performance of traditional infill materials.

There is a **growing amount of research** on the use of these alternative infill materials, including their environmental impacts, performance characteristics, and costs. Although these alternatives are still relatively new, they show promising results and provide a more sustainable solution for the future of artificial football pitches.

6.3.2. Methodologies

Ongoing research methodologies and the development of alternative sustainable infill materials consider the specific conditions and requirements of each football pitch, including player safety, performance, and cost, in addition to the general environmental impact:

- **Conducting Life Cycle Assessment:** Conducting a Life Cycle Assessment (LCA) of the alternative infill materials, including the impacts of production, use, and end-of-life in the environment.
- **Comparative environmental impact analysis:** A comparative environmental impact analysis should be conducted to gather data on alternative infill materials, including the impacts on air, groundwater, and soil quality, as well as on human health and biodiversity.

6.3.3. Environmental impact analysis

To conduct a comparative environmental impact analysis of alternative infill materials, an evaluation of the sustainability of these materials is required. To find the best option for a particular football pitch, the **following steps** were used to conduct this analysis:

- **Gather data:** Collection of information on the environmental impact of each alternative infill material. Sources of raw materials, production processes, transportation, and disposal were included.
- **Assessment of air quality:** Assessment of the impact of each infill material on air quality. This includes air pollutant and greenhouse gas emissions.
- **Assess water quality:** Analyse the impact of each infill material on water quality, including the contamination potential, for example, by leaching harmful substances into water sources.
- **Assess soil quality:** Gathering information on the impact of each infill material on soil quality, including the potential for contamination and soil structural degradation.
- **Assess human health:** This assessment includes exposure to toxic chemicals and potential health risks.
- **Assess biodiversity:** Evaluation of the impact of each infill material on biodiversity, including the potential to harm wildlife and ecosystems.
- **Compare results:** Comparing the results of the analysis for each infill material, including the material that has the lowest overall environmental impact.
- **Results and recommendations:** Presenting the LCA results and comparative environmental impact analysis, outlining the most promising alternatives, and summarizing recommendations for their use in artificial football pitches.
- **Consider technical requirements:** Analyse the technical requirements of the alternative infill materials, including duration, performance, and maintenance, to achieve the needs of the football pitch.

In conclusion, it is important to use a comprehensive methodology when conducting this analysis to ensure accurate results and facilitate comparison between infill materials. Continuous monitoring and evaluation of the environmental impact of these materials are also important to achieve their continued sustainability over time.

6.3.4. Evaluating the infill material and production technology

When evaluating alternative infill materials for a football pitch, it is **necessary to consider** the following aspects:

- **Durability:** The material is suitable to withstand the demands of use, including impact, abrasion, and weathering.
- **Performance:** Prove the ability of the material to provide a stable, level-playing surface that supports play and reduces the risk of injury.

- **Maintenance:** Assess the amount of maintenance needed to maintain the material in good condition. This includes cleaning and replacing the infill.
- **Drainage:** Prove material conditions and ensure that the material provides good drainage to prevent standing water and provide a safe playing surface.
- **Playability:** Assess the impact of the infill material on the ball's bounce, roll, and speed to ensure that it meets the wishes of the players and the standards for several levels of play.
- **Environmental conditions:** Assess the performance of the material under different weather conditions including extreme heat, cold, and precipitation.
- **Sustainability:** Prove that the material is sustainable, including its life cycle and impact on the environment.

It is important to test alternative infill materials in a comprehensive way **to determine their suitability** for a particular football pitch and to ensure that they cover the needs of players, facility managers, and have environmentally friendly effects. Continuously monitoring and evaluating the material performance and ensuring its continued suitability over a long period.

6.3.5. Potential challenges

There can be different **challenges** in choosing artificial turf options for grassroots sports organizations, including:

- **Cost:** The cost can increase and present a significant challenge for grassroots sports organizations with limited budgets.
- **Maintenance:** Regular maintenance is important for turf, such as cleaning and grooming, which can be time-consuming and costly.
- **Durability:** An artificial turf can wear out over time and must be replaced. This can be an unexpected cost for grassroots sports organizations expecting the turf to last for several years.
- **Environmental impact:** Some types of artificial turf can release microplastics and other harmful substances into the environment. The air, water, and soil quality can also be affected.
- **Health and safety:** Artificial turf can contain chemicals that are harmful to human health and the environment. Some types of artificial turf can also present a slipping hazard, particularly under wet conditions.
- **Performance:** The performance of an artificial turf can vary over a wide range depending on the quality of the turf and the conditions in which it is used. Some types of artificial turf may not perform well under extreme weather conditions such as high heat or heavy rain.
- **User acceptance:** Some users may prefer natural grass to artificial turf because of their appearance, feel, and performance.

These challenges need to be taken into consideration when choosing an artificial turf option for a grassroots sport's organization, and a proven decision should be made after clear consideration of the costs, benefits, and risks associated with each option.

6.3.6. Examples

Following examples, are sports facilities that have **already implemented greener alternatives to microplastics**:

- **La Escuela Maracaná in Brazil:** This school uses a combination of coconut fibres, sand, and rubber made from recycled tires. This has replaced traditional crumb rubber infill. This improved infill provides better drainage and a natural feeling to the playing surface while reducing the amount of waste sent to landfills.
- **Westerpark in Amsterdam:** They have invested in an artificial football pitch made with a cork and rubber infill, which provides

improved cushioning and a more natural feel on the playing surface. This infill also has a lower environmental impact than traditional crumb rubber. It is a renewable and biodegradable material.

- **Cal State Monterey Bay:** They replaced traditional crumb rubber infill with a recycled rubber alternative. This new infill has the advantage of improved performance and is a more sustainable solution. It reduces the amount of waste sent to landfills and helps conserve valuable natural resources.

Challenges include an **increase in upfront costs**, difficulty in sourcing alternative materials, and maintenance of the material in good condition over time. It is important to carefully evaluate trade-offs and select a solution that considers the specific needs of a particular facility.

6.4. Incorporation of the SDGs in grassroots sports organisations

To assess and validate the incorporation of the SDGs as a corporate social responsibility framework to improve grassroots sports organizations, an approach following the steps characterized in this section has been followed in the SDG Striker evaluation and is also recommended as a general guideline.

6.4.1 Review of the literature

A review of the literature on the integration of SDGs into CSR and good governance in grassroots sports organizations revealed a growing recognition of the role of sports organizations in promoting sustainable development and promoting positive impact. There is growing evidence to suggest that CSR and good governance practices can contribute to the achievement of SDGs, especially in poverty, gender equality, labour and economic growth.

Studies also show that despite the **potential for sports organizations** to contribute to the SDGs, the integration of the SDGs into their operations and strategies is still in its early stages. Many organizations can struggle to effectively align their activities with the SDGs. Additionally, grassroots sports organizations face **additional challenges** in terms of resources and capacity to effectively integrate the SDGs into their operations and the need for support from larger sports organizations' governments to help them realize their potential.

In summary, the literature review suggests that the integration of the SDGs into CSR and good governance practices organizations of grassroots sports is an essential area of practical testing and research as performed within the SDG Striker project. However, many aspects still need to be considered to fully achieve their potential for sustainable development and positive social impact.

6.4.2. Research question and hypothesis

An example of a research question: Does incorporating SDGs as a CSR framework improve good governance in grassroots sports organizations?

Hypothesis: The integration of the SDGs as a CSR framework in grassroots sports organisations will result in significant improvements in good governance practices, such as transparency, accountability, and commitment of stakeholders.

6.4.3. Study of research – Methodologies

The design of a research study is needed to test this hypothesis by carefully considering the research question, target population, and appropriate research methodologies.

One possible approach, tested in SDG Striker and documented in intellectual output 1 (practical guideline), is to report a method study using a combination of surveys and case studies for data acquisition. Surveys and interviews were administered to a sample of grassroots organizations. They have been used to assess their current level of commitment to SDGs, CSR practices, and good governance practices. The case studies are used to provide deeper insight into the experiences of specific organizations and explore how the integration of the SDGs as a CSR framework has influenced their governance practices.

Steps to implement a **comprehensive study**:

1. **Determine the target population:** It can be one of the local sports organizations in a specific region or country or a multiple of it, as in SDG Striker. The sample size depended on the resources and availability of the study.
2. **Develop the survey instrument:** The survey includes questions about the organizations' integration of the SDGs, their CSR practices and good governance practices. The survey should also involve the demographic information of organizations. (See SDG Striker intellectual output 1)[12].
3. **Administer the survey:** The survey can be administered via an online platform or mail. A follow-up email or phone call may be sent to organizations that have not responded within a specified time. The SDG Striker issued a comprehensive and professional online survey.
4. **Conduct the case studies:** A small number were selected from the survey sample to participate in the case studies. These organizations could be chosen based on their commitment to the SDGs and their good governance practices. Case studies can be conducted using interviews with key stakeholders and a review of the relevant literature.
5. **Test the hypothesis:** Survey and case study data are combined to test the hypothesis and whether integrating the SDGs as a framework has resulted in improvements in good governance practices of grassroots sports organizations.

   This study design provides a framework for collecting data and testing the hypothesis but may need to be modified depending on the specific needs of the resource availability study.
6. **Analysing data:** The survey data were used to describe descriptive statistics, such as percentage frequencies, to explain the sample and compare the engagement of the SDGs, their CSR practices, and their good governance. Data from case studies can be analysed using qualitative methods, such as thematic analysis, for patterns and themes related to the influence of SDGs on governance practices (see SDG Striker Intellectual Output 1)[13].

   Analyse data using statistical techniques such as regression analysis or other appropriate between the integration of the SDGs as a CSR framework and good governance in grassroots sports organizations.
7. **Descriptive statistics:** In addition, descriptive statistics, such as means, standard deviations, and frequencies, could be used to summarize data collected from surveys and to describe local sports organizations. This information provides a basic understanding of the SDGs, CSR practices, and governance practices in the sample.

Another statistical technique that may be appropriate for data collected from case studies is **multilevel.** This method would allow us to examine the relationship between CSR and SDG practices and good practices both at the organizational and individual levels, taking into account the influence of contextual factors, such as the policies and practices of major sports organizations and the context and policy in which sports organizations operate in which grassroots sports organizations operate.

In summary, **appropriate statistical techniques**, such as regression analysis and multilevel analysis, can be used to analyse data from surveys and case studies to determine the relationship between SDGs as a CSR framework and good governance in grassroots sports organizations. The results of the analysis provide valuable insights into the potential of the SDGs to influence the governance practices of grassroots sports organizations and could inform futures aimed at promoting sustainable development and positive impact in the sports sector.

[12,13] https://www.ecoserveis.net/wp-content/uploads/2022/11/MUESTRA-Maqueta-SDG-STRIKER-IO-km-8.pdf

6.4.4. Study of research – Conclusions

Conclusions and further recommendations drawn from the study findings highlight the impact of integrating development goals as a framework for corporate social responsibility good governance in sports organizations at the base. The results would provide insight into the potential of integrating the SDGs into CSR practices in grassroots sports organizations and would inform efforts to promote sustainable development and positive social influence in the sports sector.

Following steps are possible to conclude the analysis of the results of the studies:

- **The extent of commitment to the SDGs by grassroots organizations:** This information provides insight into the level of awareness of the SDGs and the extent to which they are integrated into CSR practices.
- **The impact of the SDGs on good governance practices:** The output of the regression or multi-level analysis provides evidence on the connection between incorporating the SDGs as a CSR framework and good governance practices in grassroots sports organizations.
- **Challenges in incorporating SDGs into CSR practices:** The results of the case studies could provide information on the challenges faced by grassroots sports organizations in implementing the SDGs in their CSR and governance practices.

6.4.5. Promoting the incorporation of SDGs

Promoting the incorporation of the SDGs in sports organizations' policies and communication can be achieved through the **following steps**:

1. **Raising Awareness:** Among sports organizations, the importance of SDGs and their role in contributing to sustainable development. This can be achieved through workshops, webinars, and other educational initiatives.
2. **Develop Guidelines:** Develop guidelines and practices for sport organizations to help them involve the SDGs in their policies and communication. Practical advice and recommendations on how sports organizations can align their operations and initiatives with the SDGs.
3. **Provide support:** Provide support to sports organizations such as training, technical assistance, and other resources. This would help them incorporate the SDGs into their policies and communications. It includes assistance in developing and implementing policies and advice on communication strategies.
4. **Encourage Collaboration:** Good collaboration between sports organizations and other participants, such as government agencies, non-profit organizations, and the private sector, to support the consolidation of the SDGs into sports organizations' policies and communication.
5. **Reward Efforts:** Recognize sports organizations that involve the SDGs in their policies and communication. This can be awards, certifications, and other forms of recognition that appreciate efforts to promote sustainability.
6. **Monitor and Evaluate Progress:** Monitor and evaluate the progress of sports organizations in incorporating the SDGs into their policies and communication and use this information to adjust and improve the approach as needed.

It is possible to drive positive change and contribute to the achievement of the United Nations 2030 Agenda for Sustainable Development by promoting the incorporation of the SDGs into sports organizations' policies.

6.5. Toolkit and Examples – Incorporation of SDGs

In 2018, at the international level, the SDG fund released a compelling Toolkit for Action for "The incorporation of Sports to the achievement of the SDG," which has several examples of how to integrate different SDGs in sports. Surprisingly, no examples were provided on environment-related issues, despite the fact that Football Associations have both the interest and the potential to implement them. In addition, other institutions have developed guidelines on sustainability and sports, such as the toolkit for actions to achieve sustainable development goals. The Sustainable Sports Events Toolkit mainly focuses on sports events, while other aspects of the daily running of sports organizations are not addressed.

In addition, after realizing that the proliferation of reference standards was leading European consumers to a state of confusion and mistrust, the European Commission decided to elaborate recommendation 179/2013 on Product Environmental Footprint (PEF) and organizational Environmental Footprint (OEF). This recommendation has become the official method for calculating the environmental footprint and has an LCA approach.

These examples underline that an increasing number of steps are being taken to support good governance and sustainability at international and national levels. Nevertheless, the majority of efforts focus on specific actions towards major sport events rather than the inclusion of SDGs as permanent elements at the organizational level. Therefore, it is crucial to prove that **sports communities contribute to mitigating climate change by including long-term changes** in their routine activities, and not only through punctual events. Through its implementation on a pilot scale and validation of energy management and material choice, SDG Striker has addressed a substantial portion of this problem.

Here are examples of **good practices** for incorporating SDGs into sports organizations' policies and communication:

Goal 3: Good Health and Well-being: A sports organization could provide a health program for its employees and members, with a focus on physical activity, healthy eating habits, and stress management. This program could be integrated into the organization's policies and communication materials and used to demonstrate the organization's commitment to Goal 3.

Goal 5: Gender Equality: A sport organization could develop policies to promote gender equality in all areas, including hiring, promotion, and leadership. The organization could also incorporate in its annual report or sustainability report to demonstrate its commitment to the goal.

Goal 7: Affordable and Clean Energy:

A sports organization could install PV solar panels or other renewable energy sources and incorporate information about these actions into its policies and communication materials. Engagement of employees, members, and other stakeholders to reduce energy consumption and energy efficiency.

Goal 13: Climate Action:

A sports organization could develop and implement a plan, with specific goals for reducing greenhouse gas emissions and promoting sustainability. Including information about climate-action efforts into policies and communication materials is also possible. Furthermore, the engagement of employees, members, and other stakeholders is helpful in these efforts.

Goal 17: Partnerships for the Goals:

A sport organization could connect with other organizations in sport, government agencies, and non-profit organizations to promote the SDGs, and incorporate information about these partnerships into its policies and communication materials. The organization could also engage its employees, members, and other stakeholders in efforts to promote the SDGs and contribute to sustainable development.

These are a few examples from many examples of the possibilities of how sports organizations can incorporate the SDGs into their policies and communication. By following these practices, sports organizations can demonstrate their commitment to the United Nations 2030 Agenda for Sustainable Development and contribute to the achievement of the SDGs.

6.6. Progress monitoring

Here are some indicators that could be part of a **self-assessment tool to monitor progress** towards the SDGs of grassroots sports organizations:

SDG 3: Good Health and Well-being

- Number of participants in sport programs
- Percentage of participants who report improvements in physical health
- Percentage of participants who report improvements in mental health
- Number of programs promoting healthy lifestyles

SDG 4: Quality Education

- Number of education and training programs offered in sport
- Number of participants in education and training programs
- Percentage of participants who report improvements in their knowledge and skills
- Number of programs who are responsible for gender equality in sport

SDG 11: Sustainable Cities and Communities

- Number of community sport events organized
- Number of volunteers involved in community sport events
- Percentage of participants who report increased social connections and sense of community
- Number of programs promoting environmental sustainability in sport

SDG 13: Climate Action

- Percentage of programs that reduce the carbon footprint of the organisation
- Percentage of participants who report increased awareness of climate change and its impacts
- Number of programs promoting climate-friendly practices
- Number of partnerships with organisations promoting climate action

There are a few examples of indicators that can be included in a self-assessment tool. The specific indicators included in the tool will depend on the activities and impact of the organization and should be selected to best reflect their progress towards the SDGs.

6.7. Positive impacts of SDGs

The following steps could be a self-assessment tool to monitor positive impacts of SDGs of grassroots sports organizations:

- **Identify relevant SDGs:** The first step would be to identify the SDGs most relevant to grassroots sports activities and organizations. This could involve reviewing the important sectors of 17 SDGs: SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), and SDG 11 (Sustainable Cities and Communities).
- **Develop indicators:** For each of the selected SDGs, indicators relevant to the activities could be identified, which have an impact on grassroots sports organizations. These indicators could include measures such as the number of participants, number of programs offered, number of volunteers, and the extent to which the organization promotes healthy lifestyles.
- **Create a Self-Assessment Tool:** This tool could be developed to enable grassroots sports organizations to prove their own progress towards the SDGs. This could include a questionnaire or another assessment tool that includes questions related to the indicators identified in the previous step.
- **Data collection:** The self-assessment tool could be used to collect data from grassroots sports organizations on their progress towards the SDGs. These data could inform ongoing efforts to support the implementation of effective social practices.
- **Analysis and reporting:** Data collected through self-assessment could be analysed to determine grassroots athletes' progress towards the SDGs and to identify areas for improvement. A report summarizing the results of the self-assessment can be shared with stakeholders, including partners and communities.

In summary, a self-assessment tool is an effective method for monitoring the positive impact generated by the implementation of SDGs by grassroots sports organizations. This tool would enable organizations to observe their own progress and to identify improvement and would provide valuable insights into the impact of grassroots sports organizations on the SDGs and their progress.

6.7.1 Recommendations

As a basis on the conclusions, following **recommendations** could be concluded:

- **Increased awareness and commitment to the SDGs:** Recommendations can be made to support the dissemination of information about the SDGs and their relevance to the sports sector. This could include the development of resource training programs for grassroots sports organizations.
- **Improve governance practices:** Recommendations could be made to support the improvement of governance practices in grassroots sports organizations, taking into account the challenges of the obstacles identified in the study. This could include the development of practice guidelines, as well as aid and support.
- **Promote the integration of the SDGs into CSR practices:** Recommendations could be made to encourage the integration of the SDGs into CSR practices in grassroots sports organizations to recognize the potential for sustainable development and positive social impact.
- **Publish the results:** Disseminate the findings to relevant stakeholders, including grassroots sports organizations, policymakers, and academic communities.
- **Monitoring and evaluating the implementation impact:** Monitoring and evaluating continuously and incorporating the SDGs as a CSR framework for good governance in grassroots sports organizations through further research and evaluation.
- **Further monitoring and evaluation of the implementation and impact** of incorporating the SDGs as a CSR framework for good governance in grassroots sports organizations can be performed through continuous research and evaluation.
- **Stakeholder engagement:** Stakeholder feedback should be sought regularly to ensure that the monitoring and evaluation processes are inclusive and responsive to the needs and perspectives of key stakeholders.

Recommendations can be drawn with **continuous monitoring and evaluation** of the implementation and impact of incorporating the SDGs as a CSR framework for good governance in grassroots sports organizations. The evaluation can be achieved through surveys, case studies, evaluations, progress monitoring, and stakeholder engagement.

In general, this research and evaluation process provides important insights into the effectiveness of SDGs in promoting good governance and positive social impact in sports and informs more efforts to promote the implementation of effective CSR and governance practices in grassroots sports organizations.

7. CONCLUSIONS

Co-funded by the Erasmus+ Programme of the European Union

This report focuses on the evaluation of the impact of pilot implementation on the sustainability practices of partner federations in football and aims to validate the process of improving sustainability practices in these organizations. The process involves an effort to identify and define KPIs within relevant categories (technological, economic, environmental, and social). For each of these categories, the KPIs vary between highly specific (the technological ones) and a set of common ones for the whole set of solutions (social ones).

This approach allows us to consider the differences between solutions and pilot cases but maintains a global reference. Following this objective, a global KPI matrix was prepared, which provides an overview of the KPI's defined for the SDG Striker project and a further section to investigate the specific baseline before and a performance evaluation after each one of the solutions. The following paragraphs summarize individual pilot activities.

7.1. Pilot 1 – PV implementation

The installation of photovoltaic panels at the SL Benfica Training Center on the Benfica Campus serves as a pilot implementation project in Portugal. This activity involves the specification of solar panels on both the roof of a sports club training facility and car park areas, with a specific production of approximately 150,000 kWh/a, based on the latest status measurements. SL Benfica completed the installation on November 21. As expected, the strongest production months occurred during the summer, while energy consumption remained relatively constant throughout the year.

This led to the conclusion that the most effective savings were achieved in April, May, and June, resulting in savings in electricity costs of 37,240 € for the year 2022. The installation of PV panels also resulted in a significant reduction in CO2 emissions, which exceeded the initial expectations. However, this activity faced challenges such as designing the best business model and addressing risks related to changes in energy prices.

7.2. Pilot 2 – Energy efficiency and energy poverty

This activity achieved successful outputs, including an energy-efficiency workshop for grassroots and club members in rural Scotland, a community workshop, and Scottish FA staff training. Staff members of the clubs were also trained as environmental champions, and a no-cost energy-saving guide was created.

However, ongoing work is planned, such as delivering a workshop to Scottish FA staff to raise awareness of issues and highlight key challenges and updating digital resources to provide clubs with contacts for sustainability specialists, funders, and partners. There are potential risks and challenges such as the cost of a living crisis, governmental priorities, reduced capacity of stakeholders, and delivery delays. Deviations in the timelines for workshops have already been pushed back from their original dates. The next steps included club workshops with Scottish FA staff in attendance, Scottish FA staff training, and Green Champion training.

7.3. Pilot 3 – Artificial turf filler

This activity involved a Life Cycle Assessment study, KPI evaluation, field test, player feedback, leakage test, and development concept with a wooden infill manufacturer. Discussions have been held in the REACH committee about the ban on placing granular infill with microplastics, which could affect artificial turfs and football activities that are crucial for local communities in Norway and elsewhere in Europe. Although the construction of new pitches has decreased in the last three years, many pitches still need to be rehabilitated.

Despite the lack of research on alternative infills, a draft LCA has been received through the scientific project partner (EI-JKU). Presentations were made for teams, fairs, webinars, and meetings with politicians and municipalities. A second version of the infill will be installed in Kristiansand and 10 pitches in different climate zones in Norway.

The development of practical guidelines for clubs and municipalities is an ongoing process. Improvements have been made in the rounding edges and inhomogeneous sizes of the infills. Challenges such as obtaining more user feedback from players and addressing maintenance and user feedback on versions 1 and 2 of the infill material, as well as the lack of time tested on durability and different systems for comparison, still need to be addressed. Further testing of fields and players may also be required. The next steps include finalizing the LCA on the performance material, producing a second version of the infill, performing a test in Kristiansand, and testing the second version in different climate zones in Norway.

In addition to these partly specific results from the pilot activities, significant implications regarding the SDGs could be identified.

7.4. Accelerate the Integration of the SDGs

Plan development to **integrate the SDGs** into grassroots sports organizations may involve the following steps:

- **Awareness raising:** The importance of the SDGs and the role of grassroots sports organizations should be outlined to achieve them. This could involve organizing training sessions and workshops and promoting the SDGs through communication and marketing campaigns.
- **Assessment:** Self-assessment of the current status of the grassroots sports' organization should be assessed in terms of its alignment with the SDGs. This will help identify improvements in decisions and inform the development of action plans.
- **Planning:** Develop an action plan that outlines the steps and activities needed to integrate the SDGs into the operations and activities of the grassroots sports' organization. The plan should be SMART (specific, measurable, achievable, relevant, and time bound).
- **Implementation:** Action should be activated by implementing the activities and initiatives outlined in the plan. This may involve working with partners and stakeholders and securing necessary resources and support.
- **Monitoring and Evaluation:** Regularly monitor and evaluate the progress of the action plan using metrics and KPIs to track progress and identify areas for improvement.
- **Review and revision:** Regularly review and revise the action plan. This should be done to meet the evolving needs of grassroots sports organizations and the SDGs.

In the future, further efforts are required based on the project results of the SDG Striker.

7.5. Improve existing guidelines on SDGs

To improve the guidelines, it is important to ensure that they are relevant, practical, and accessible for grassroots sports organizations. This may involve:

- Providing **clear and concise information** about the SDGs and how they can be integrated into the operations and activities of grassroots sports organizations.
- Offering **practical tools**, such as self-assessment tools[14], to help organizations measure their progress towards the SDGs and provide areas for improvement.
- **Involving stakeholders and building partnerships** to show the importance of the SDGs and promote the implementation of sustainable actions in grassroots sports organizations.
- **Reviewing and regularly updating** the guidelines to ensure that they are up-to-date and relevant, considering changing circumstances and new developments.
- Encouraging **good practices** by recognizing organizations that have successfully incorporated the SDGs into their operations and activities, and sharing their experiences and lessons learned.

By taking these steps, it is possible to implement the guidelines and support SDGs in grassroots sports organizations.

[14] https://www.ecoserveis.net/en/donation/sdg-striker/

7.6. Avoiding the pitfalls

There can be several pitfalls related to implementing the SDGs in grassroots sport organisations:

- **Lack of awareness:** Many grassroots sports organizations may not understand the SDGs and their role in promoting sustainable development. This lack of understanding is the reason for the lack of understanding in organizations to effectively incorporate the SDGs into their routine operations and activities.
- **Limited resources:** Grassroots sports organizations may have limited financial, human, and technological resources, which makes the implementation of the SDGs effective. This may include a lack of funds for programs, limited staff capacity, and limited access to technology and digital tools.
- **Resistance to change:** Some stakeholders in grassroots organizations may resist change and oppose SDGs in their operations and activities. This resistance can stem from a lack of understanding of sustainability, perceived benefits, or simply a lack of motivation.
- **Difficulty in measurement and reporting:** Measuring and reporting progress towards the SDGs can be a challenge, especially when it comes to grassroots sports organizations with limited resources. This can lead to difficulties in tracking, documenting, and obtaining reliable data. In addition, effective communication of results to stakeholders is difficult.
- **Competition for funding:** Grassroots sports organizations face competition for funding from others and initiatives, making it difficult to secure resources to effectively implement the SDGs.

It is important that grassroots sports organizations pay attention to these potential pitfalls and strive to overcome them, effectively integrate the SDGs into their operations and activities, and promote sustainable development through sports.

Finally, until now, the majority of actions aimed at SDGs in sports have focused on events, mainly on major sporting events. **SDG Striker has generated new knowledge on the feasibility of how far grassroots sports organizations can achieve some of the SDGs through day-to-day facility management.**

7.7. Recommendations

Based on these conclusions, recommendations could be made **to increase awareness and engagement** with the SDGs:

- This could include the development of **training programs and resources** for grassroots sports organizations, such as practical guidelines or multilingual webinars.
- Improving governance practices: Recommendations including the development of the **practitioner's guide** and the provision of **technical assistance and support** during the implementation and evaluation of specific pilots.
- The **results of the evaluation of pilots** and the conclusions and recommendations drawn from the data provide **valuable insights into the potential impact** of incorporating the SDGs as a CSR framework on good governance in grassroots sports organizations and can be **replicated as best practice solutions**.
- The **results will be published** in academic journals and the findings will be disseminated to relevant stakeholders, including grassroots sports organizations, policymakers, and academic communities.
- The following strategies could be implemented in grassroots sports organizations for ongoing **research and evaluation**.
    - **Surveys:** Regular surveys can be conducted to analyse SDGs engagement and the impact of their incorporation into CSR practices.
    - **Case studies:** Ongoing case studies can be conducted to identify any challenges or best practices.
    - **Evaluation of governance practices:** Regular evaluations can be conducted to assess the impact of the SDGs.
    - **Monitoring progress:** Progress towards the SDGs could be monitored through regular reporting and tracking of indicators relevant to the sports sector, such as access to sports, physical activity, and participation in sports.
    - **Stakeholder engagement:** Stakeholder engagement and feedback should be sought regularly.

This ongoing research and evaluation process would provide insights into the effectiveness of the SDGs and would inform ongoing efforts to support the implementation of effective CSR and governance practices in grassroots sports organizations.

PILOTS' EVALUATION REPORT

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SUSTAINABLE DEVELOPMENT GOALS

SDG Striker
Scoring Goals for Sustainability

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