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SPEEDIER

SME Program for Energy Efficiency through Delivery and Implementation of EneRgy Audits

D4.8 - FINAL E-LEARNING MATERIALS, MOBILE APP, CASE STUDIES, VIDEOS, ON-LINE RESOURCES FOR (WP5, WP6) AND DISSEMINATION PHASES (WP8)

Lead Contractor: SIE

Author(s): SIE

Date: 28 July 2021

This document corresponds to D4.8 (M26) led by Sustainable Innovations (SIE). This document contains all relevant information regarding the content definition and the development of the different e-learning materials.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847034.

Project details			
Project acronym	SPEEDIER	**Start / Duration**	June 2019/ 30 Months
Topic	LC-SC3-EE-8-2018-2019 Capacity Building programmes to support implementation of energy audits	**Call identifier**	H2020-LC-SC3-EE-2018
Type of Action	CSA	**Coordinator**	Padraig Lyons (IERC)
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Deliverable details			
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Title	Final e-learning materials, mobile app, case studies, videos, on-line resources for (WP5, WP6) and dissemination phases (WP8)		
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Document History

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Abbreviations

AEEPM	Asociatia agentia pentru eficienta energetica si proteclia mediului
CTA	Corporación Tecnológica de Andalucía
ECM	Energy Conservation Measure
ECTS	European Credit Transfer System
EE	Energy Efficiency
EED	Energy Efficiency Directive
EQF	European Qualifications Framework
IERC	International Energy Research Centre
LIT	Limerick Institute of Technology
LU	Learning Unit
LMS	Learning Management System
Polimi	Politecnico di Milano
SIE	Sustainable Innovations
SME	Small and Medium-sized Enterprise
WP	Work Package
WP2	Literature review and needs analysis
WP3	Needs and Opportunities for SMEs
WP4	Development of content for SPEEDIER training materials
WP5	Implementation of SPEEDIER Service in SMEs and large enterprises in 4 pilot regions
WP6	Training of SPEEDIER Experts and future Trainers on SPEEDIER guidelines
WP9	Quality Assurance

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1 Executive Summary

The SPEEDIER project is a highly innovative one-stop-shop solution that applies an integrated approach to energy management, energy auditing, financing, implementation of energy efficiency solutions and monitoring of impacts.

It also aims to provide information, advice, and capacity building to SMEs, experts, and trainers. To do this, the SPEEDIER partners will develop a suite of e-Learning materials in WP4, targeting staff at the operational level and senior management level. The materials will include content for workshops, a mobile app for awareness and capacity building, case studies, presentations, evaluation surveys and simple gamification techniques.

This document describes the process followed for the definition and development of the e-learning materials by addressing the needs and barriers in Energy Auditing identified in WP2 and WP3 to provide a comprehensive compendium of SPEEDIER Service programmes. These materials that include videos, presentations, and story maps, among others, aim to transfer knowledge about how to better manage energy in a business.

1.1 Context of WP4

The objectives of WP4 are to:

- Build up a service of energy management for SMEs.
- Structure the content of the capacity building to be addressed to SMEs and experts (auditors, energy managers, etc.)
- Identify the appropriate financing structure and contract with the specific cluster or SME.

1.2 Objective of Task 4.6

This task will develop a suite of e-Learning training tools and resources that will be freely available for download via the SPEEDIER website and will complement the training materials developed for SMEs, Experts and Trainers.

1.3 Objective of Deliverable 4.8

Deliverable 4.8, this document, corresponds to the development of the different e-learning materials available on the project website.

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2 Content definition and development

One of the core principles on which the SPEEDIER Service is founded is the initial implementation of ECMs to generate energy savings, which can be ring-fenced and reinvested in actions that require some capital outlay. It is therefore critical for the success of the project that individual staff members employed by the participating SMEs develop an increased awareness of energy in the workplace, an understanding of the actions that they can personally take to reduce energy consumption and feel empowered and incentivised to take those actions in practice.

To do this, it was necessary to define the content that will target staff at the operational and senior management levels, considering the existing differences in climate, culture, energy policy and government incentives in the pilot countries of the project (i.e., Ireland, Italy, Romania, and Spain).

In this sense, SPEEDIER delivers two types of training and capacity building activities:

1. **Training for staff at SMEs**, that will increase their understanding of how their organisation uses energy, why it is important to consider energy usage as part of their role, as well as actions that they can take to reduce energy consumption. The training content will reach employees at all levels of the organisation from management to operational staff.
2. **Training for delivery partners** (SPEEDIER Experts & SPEEDIER Trainers) on how to implement the SPEEDIER Service. For this training, the content will include the results from the SPEEDIER pilots and advice on how to engage with SMEs and landlords, how to operate the self-financing mechanism, contractual considerations, and management of the relationship between SMEs and energy managers.

A first pilot activity was carried out so it could work with an initial cohort of SMEs to test the service and materials developed in WP4. Following an extensive evaluation exercise, the feedback received was used to refine the service and materials, obtaining the updated and improved SPEEDIER Service and materials that will be used in the second pilot activity with a second cohort of SMEs.

In addition, all the content developed as part of WP4 will engage with actors from all parts of the organisation (from decision makers to employees), and will increase background knowledge of energy efficiency, and will impact on business operational costs, health and comfort of employees in compliance with national and European regulations (e.g., the EED, and Clean Energy for all Europeans).

2.1 Content development for general staff and decision makers

LIT coordinated the development of the content for the capacity building training for general staff & decision makers. They also defined the learning topics, written the training content, and reviewed additional contents provided by other partners.

LIT, in collaboration with the project partners in each of the pilot countries, defined the learning topics and structure for the training, including descriptors, an indicative syllabus and core

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resources as required. The content will be translated into Italian, Romanian and Spanish by CTA, AEEPM and Polimi for use in their respective countries.

In order to engage staff at all levels in the organisation, the training content is available for the following groups covering specific topics:

1. **Training and capacity building for all staff:** it includes a general overview of why organisations need to manage energy efficiency (EE); the impact of an efficient building on health, comfort and productivity of building users, the potential economic benefits of action, as well as guidance on efficient use of workplace systems e.g., production lines, heating/cooling systems, ventilation, etc.
2. **Training and capacity building for senior managers and decision makers:** it includes the techno-economic assessment of EE measures and evaluation of their impact in terms of profit margin to give decision makers enough information and confidence to act.

The quality of the training modules has been assured by following the Quality Assurance Plan developed in WP9.

As stated in Deliverable 4.4 “Final training and capacity building materials for general staff and decision makers”, this content was developed for supporting SMEs through four key stages in the Energy Efficiency (EE) process:

- Understanding the benefits in committing the organisation to Energy Efficiency.
- Developing an Energy Culture within the SME.
- Supporting the process of behavioural change.
- Ensuring Energy Conservation Measures yield real savings.

The content has been lumped together in six different modules that will be online available via the project website and will also be delivered as on-site trainings in the pilot regions:

1. SPEEDIER Service & Energy Management.
2. Ring Fencing Mechanism, Behavioural Change & SPEEDIER App.
3. Energy Efficiency in Transport.
4. The Energy Pyramid (Energy Conservation, Energy Efficiency and Renewable Energy).
5. National Funding Options, Risk Management, Register of Opportunities and Verifications.
6. SMEngineering: Energy Conversation Measures

2.2 Content development for SPEEDIER Experts and Trainers

Polimi coordinated and developed the training content for the SPEEDIER Experts & Trainers. They have also defined the Learning Unit topics and structure for the training, including a description for each LU, an indicative syllabus, core resources required and information regarding the level of accreditation to the EQF (it was later decided not to use it).

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The training content for the experts is focused on how to successfully implement the SPEEDIER Service, it is provided in English and it includes several learning units that will cover the following:

- Introduction to Energy Efficiency
- Energy efficiency technologies
- Regulatory framework
- Energy efficiency value chain
- Energy Service Companies (ESCO)
- Sustainability

The content will be translated into Italian, Romanian and Spanish by AEEPM, CTA, and Polimi for use in their respective countries.

Apart from this content, other modules will be developed and delivered at the second training event:

- SPEEDIER Energy Expert support tool
- SPEEDIER Mobile App
- SPEEDIER Impact analysis

On the opposite, the content for SPEEDIER trainers is focused on how to deliver the SPEEDIER Expert Training using pedagogical methods and techniques. Monitoring and evaluation techniques and resources will also be provided so the Trainers can follow up and assess the Experts work and SPEEDIER service roll-out. In this sense, Polimi has developed an Education Kit focused on providing teaching notes about how to effectively deliver training content to the SPEEDIER Experts.

More information regarding the different modules and their specific learning outcomes, structure, content, and assessment can be found in Deliverable 4.6 “Revised training content for SPEEDIER Experts and Trainers”.

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3 E-learning materials

After the content definition, SIE is in charge of coordinating the development of the suite of e-Learning tools, managing their inclusion on the project website. These materials are based on the principles of distance learning, with a particular focus on the Blended Learning approach using advanced technologies suitable for future online, classroom and on-site deliveries.

Moreover, the development of a free download mobile app by IERC is expected, aimed at raising awareness through simple gamification techniques that will serve to embed these behavioural change practices into the organisational culture of each participating organisation. It will also help to strengthen the awareness of the one-stop-shop solution, its capabilities, and the derived benefits for the SMEs.

3.1 Steps taken

Several meetings were held for discussing the content development for SPEEDIER training materials. SIE presented some of the points that needed to be considered for making decisions about the creation of the e-learning materials and their online availability: platform to be used, structure of the materials, evaluation methodology, and the certification requirements.

The first point discussed was about the materials inclusion on the website, on Polimi's platform or on a specialised online platform. It was intended that Polimi preliminary tested this e-Learning suite by leveraging its existing online platform for training, but after some discussions and for facilitating access to the different training content, it was decided not to use Polimi's platform as trainees needed to be students of Polimi.

As an alternative, it was mentioned the possibility to use an existing Learning Management System (LMS) for uploading all the content and for conducting the evaluation needed for issuing a certification. SIE proposed to use the CANVAS platform, and to include on the website a google form to collect the personal data and send an invitation to the platform.

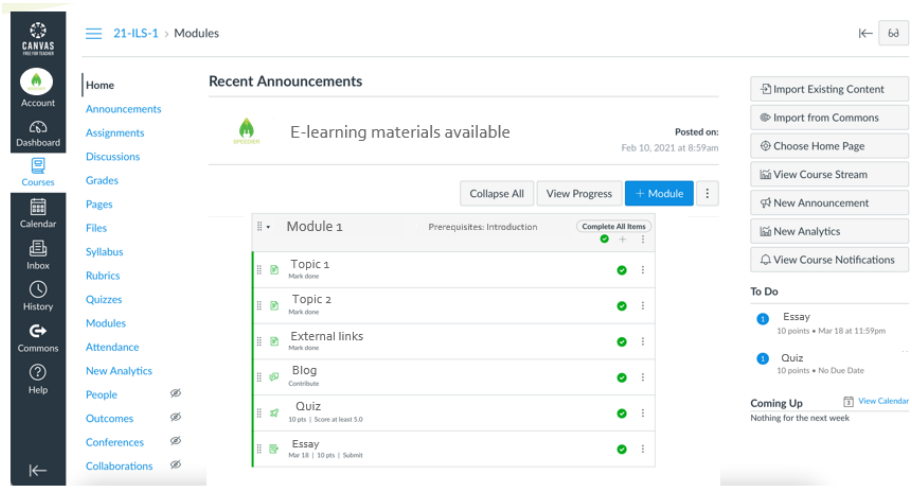

Figure 1. Example of e-learning materials in an LMS

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Despite the advantages of a LMS (better structure and organisation, user's track, one-stop solution, automatically graded assignments), it was agreed not to use it as it was better to centralise all the contents on the SPEEDIER website, since users are already familiar with the platform, and it also allows the centralisation of statistics and the alignment with the rest of the content.

The last option was to include all the materials on the website; therefore, it was necessary to define how to structure it. In that sense, SIE proposed different options:

- Per target group (SMEs vs Experts & Trainers)
- Content blocks (Modules based on a syllabus – task 4.4)
- Per materials included (case studies, workshops & webinars, videos & tutorials, download section)

An example of how it could look like for some of the options is found in **Error! Reference source not found.**.

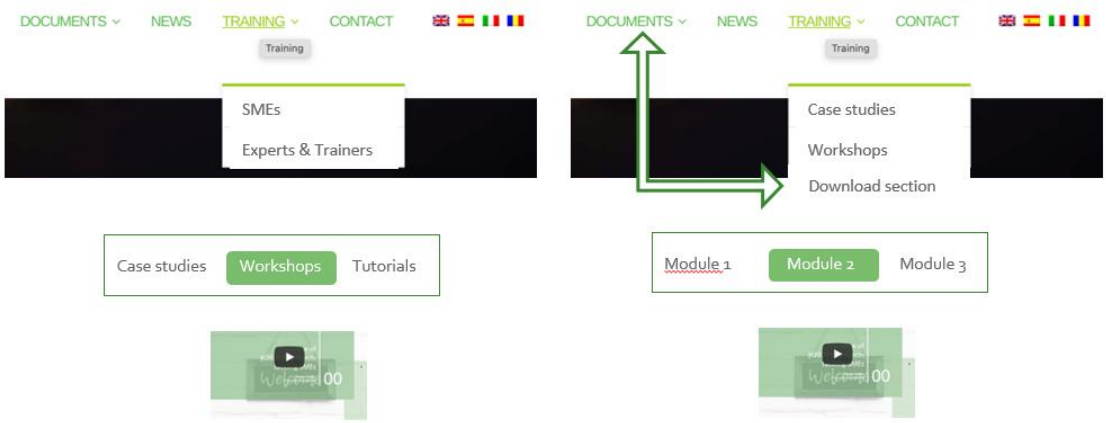

Figure 2. Example of the e-learning materials inclusion on the website

As mentioned before, Polimi needed to establish the minimum requirements to obtain the certification, including the evaluation methodology, total devoted hours, and the administrative process to follow. After the discussions, the outcome was that SPEEDIER will not try to develop training that will be certified to EQF or the ECTS system, as these systems are outside the scope of what can be achieved in SPEEDIER.

To better understand this, accreditation to the EQF does not apply to the training content that is under development by Polimi. SPEEDIER training for experts is developed based on the needs of the SPEEDIER Service and certification of this training to any national standard is outside the scope of the SPEEDIER project, and so the application of the EQF does not apply.

For the certifications' requirements, training module headings needed to be decided and they had been agreed upon by the SPEEDIER project team. For these modules, Polimi has defined in Deliverable 4.6 "Revised training content for SPEEDIER Experts and SPEEDIER Trainers", the learning outcomes, structure, content, and assessments. Taking part in the virtual training event in September 29 and 30, 2021 and successful completion of the assessment are the requirements for achieving certification as a SPEEDIER expert. This means that once Experts

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have completed the training, the project will issue a certificate of completion, and this would allow them to be included on a list of SPEEDIER Experts.

3.2 E-learning suite

A suite of e-Learning training tools and resources are freely available for download via the SPEEDIER website and will be complemented with the training materials developed for SMEs, Experts and Trainers.

The e-Learning tools should include the following:

- An interactive mobile app (still under development) to be used as a virtual tool for creating awareness and capacity building for employees of organisations using the SPEEDIER Service. Content for the mobile app has been developed by LIT, IERC and ITEC drawing from the training developed for participating organisations, key facts from the research in WP2 and estimates of savings that were developed in WP3.
- Interactive training videos created to support remote learning and capacity building for the SPEEDIER Service.
- Case studies of SMEs, large enterprises and experts that have benefitted from the SPEEDIER Service.
- "SPEEDIER Service guide for trainers" document.
- PowerPoint presentations relating to the scheduled workshops.
- Evaluation surveys to allow users to give feedback on the materials provided.

305 staff at all levels are expected to be trained using the training and capacity building materials from the e-Learning suite which will be website available during and after the project. For the moment, 24 staff have been already trained and it is expected to raise this number after the launch of all the available materials and their inclusion on the project website. The content for general and management staff will be also uploaded to the YouTube channel.

Most of the materials are not accessible yet on the website, as SIE is still receiving input regarding the training content and it was also decided to wait until the first training in pilot regions to be developed, tested and modified if necessary. Likewise, it is expected for SPEEDIER to continue updating and completing its e learning materials throughout the project life. For the time being, the available materials can be found under a training section and the audience can choose between Workshops and Webinars, Tools or e-Learning.

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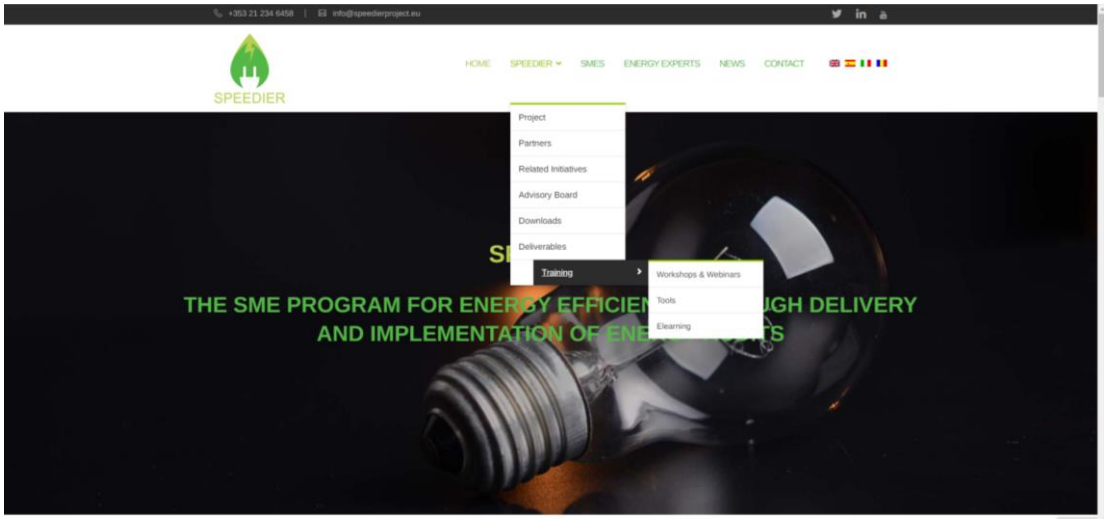

Figure 3. Materials inclusion on the website

The workshops and webinar section include the presentations and videos of two events held between October and December 2020. The first one consisted of a workshop about the "Energy Efficiency Solutions for Small and Medium-Sized Enterprises" and the second one was a two-day train the trainer event under the title "A new approach to selling energy audits and energy efficiency advice to SMEs".

Energy Efficiency Solution for Small and Medium-Sized Enterprises Workshop

Presentation

Figure 4. E-learning materials - workshop

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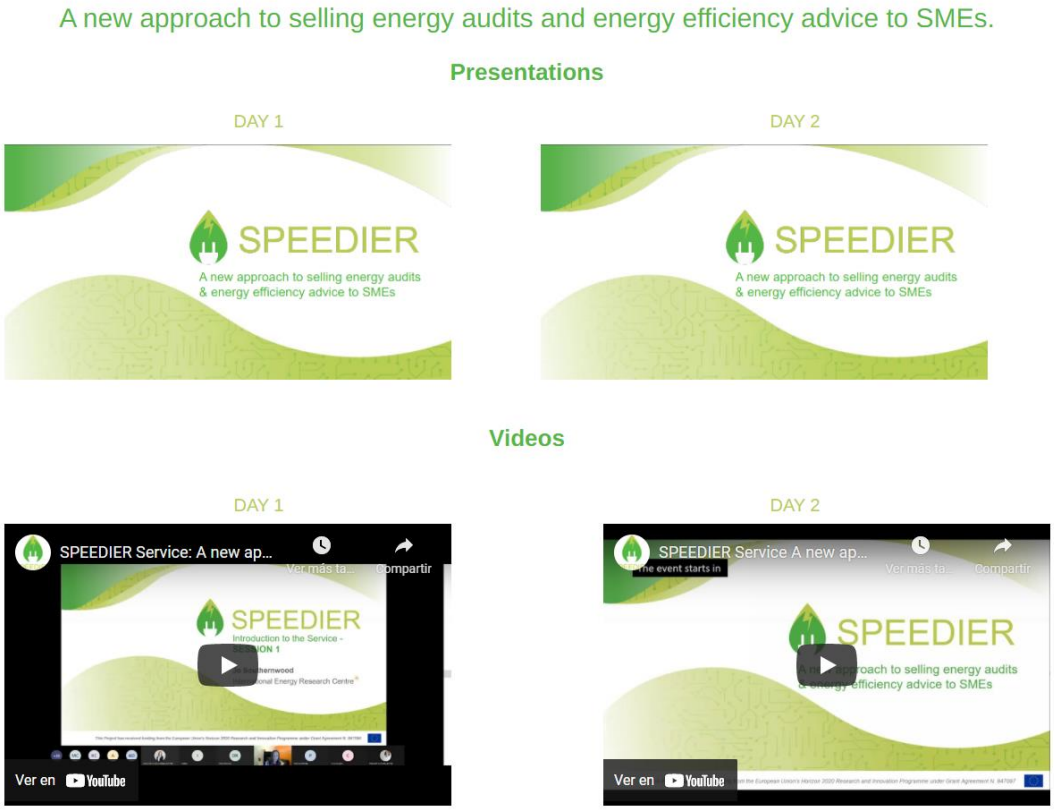

Figure 5. E-learning materials - train the trainer event

The second section includes video tutorials for the training and the energy experts support tool. For the training tool, two videos are included targeting different audiences, the first one is focused on an admin account, and it includes information about login, feedback, suggestions, notifications, user management, energy management, etc.

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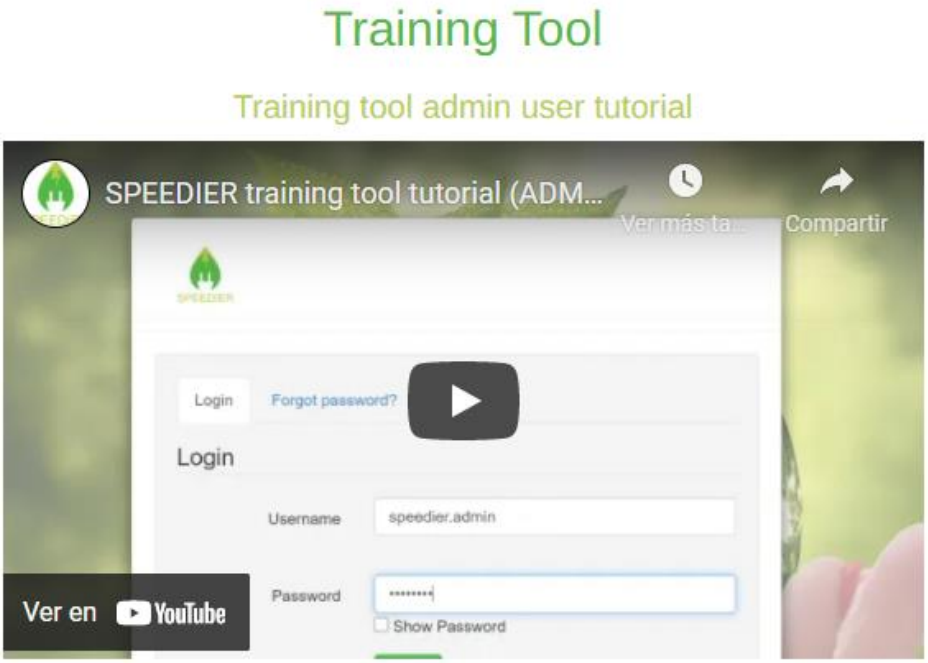

Figure 6. Admin user tutorial

The second video targets standard user accounts, so the information included covers profile edition, feedback panel use and management, energy management, notification section, rewards panel use, etc.

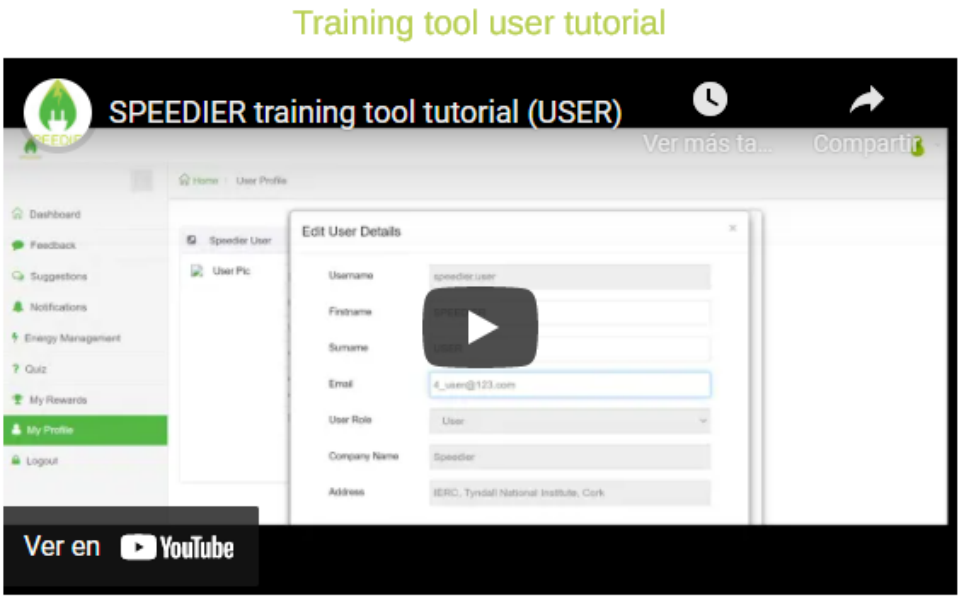

Figure 7. Standard user tutorial

The last video included corresponds to the energy experts support tool tutorial, which shows how to introduce the required information per project as use details, economic data, energy contribution or building information.

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Figure 8. Energy expert support tool tutorial

The last section “e-learning” contains part of the training targeting SMEs providing useful information for each pilot region covering important topics as climate action plans, tools for PV and wind, and funding opportunities. All the materials were received separately as draft versions that needed to be harmonised and gathered in only one document with all the information.

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Figure 9. Document for download about funding options & regional inputs

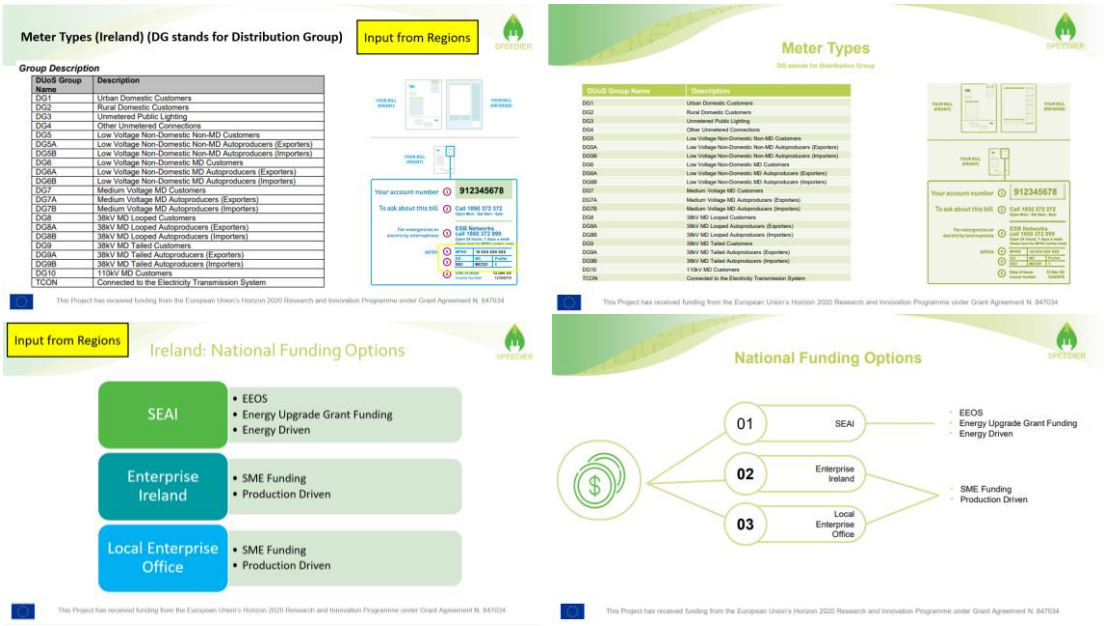

Figure 10. Example of materials transformation & harmonisation for the Ireland region

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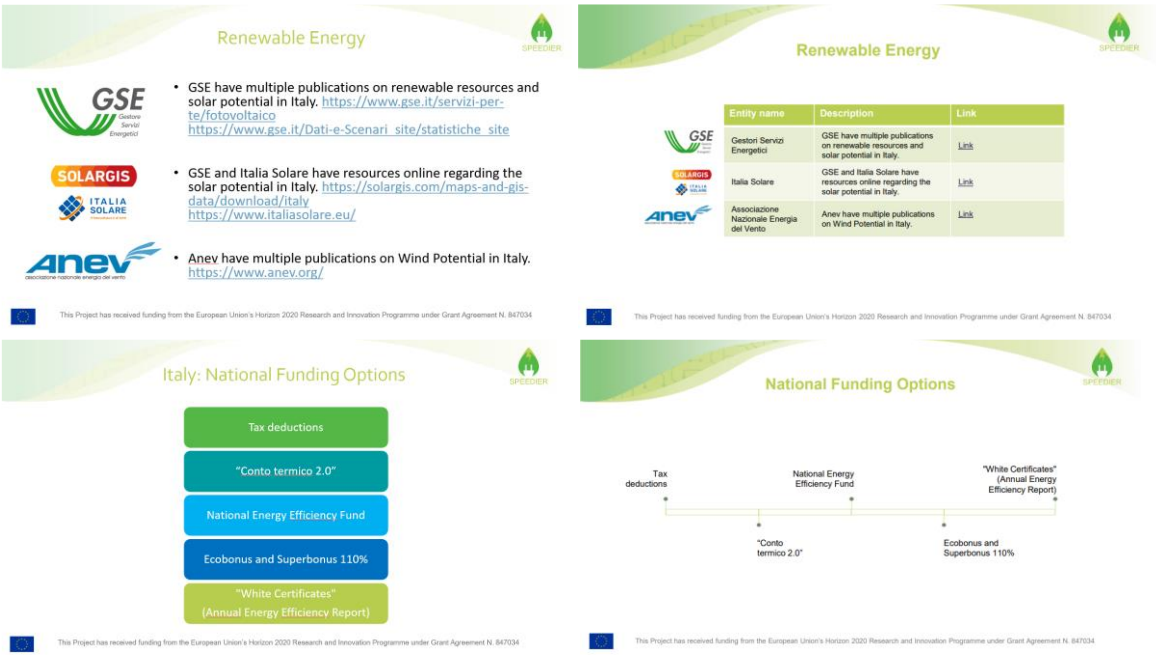

Figure 11. Example of materials transformation & harmonisation for the Italy region

Figure 12. Example of materials transformation & harmonisation for the Romania region

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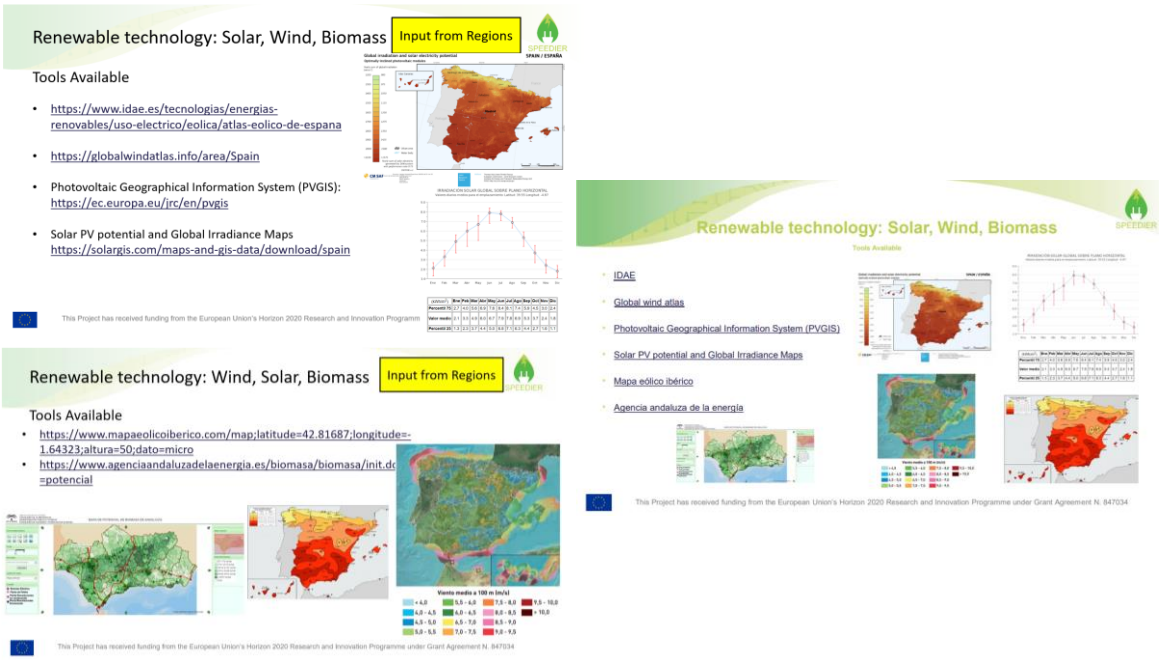

Figure 13. Example of materials transformation & harmonisation for the Spain region

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4 Planned actions

The e-learning materials for the SME training will not be visible on the website until the on-site training events take place. As explained in previous sections, inside this training, the content will address both general staff and senior managers, as well as decision-makers for each of the pilot regions.

It is still needed to harmonise and gather all the individual presentations to upload them to the website in a way that is adapted to distance learning and easily accessible. For this, SIE will use 'pdf' documents, videos, and story maps to convert the 24 PowerPoint presentations into e-learning materials.

LIT has already shared with SIE, 3 pre-recorded videos that are aligned with Modules 1, 2 & 3 from the SME training module (all staff) for Ireland. SIE has transformed the ppts available for these modules into more appealing presentations and will edit the pre-recorded videos for including this updated version. An example of how the final version of the presentations will look like can be found in Annex I – SME modules (Ireland). As not all the materials will be finally transformed into presentations, for the creation of the story maps, an external software called ARCGIS will be used. A draft version of how the information will be used to create this type of material can be found in the following link.

Figure 14. Story map - draft version 1

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Figure 15. Story map - draft version 2

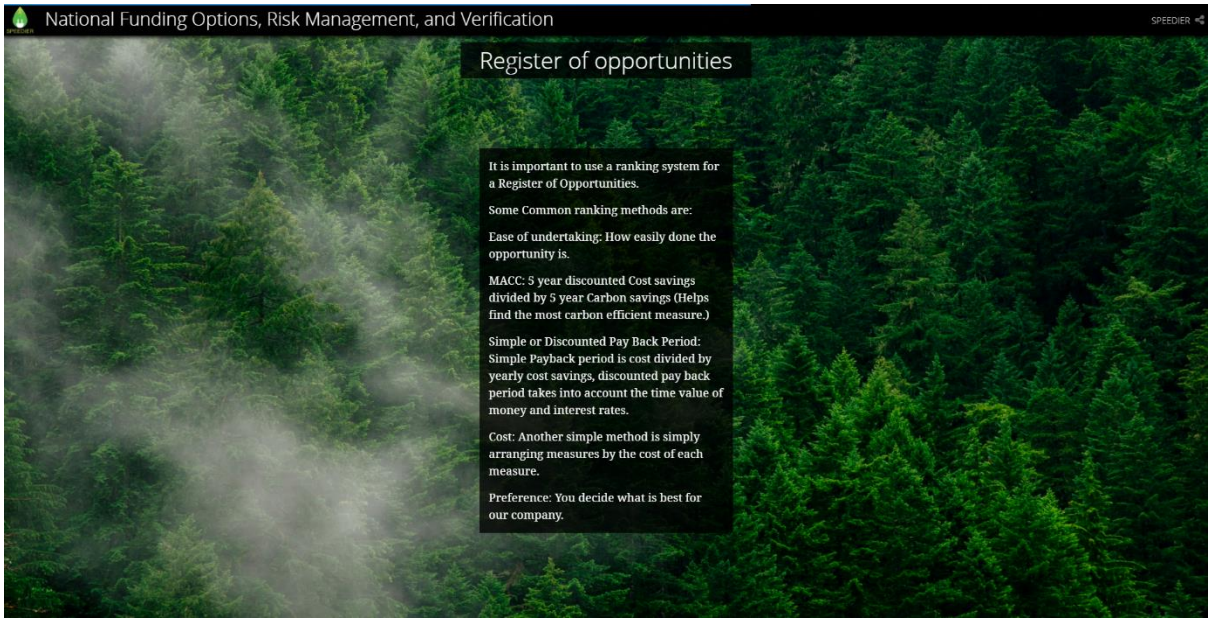

Figure 16. Story map - draft version 3

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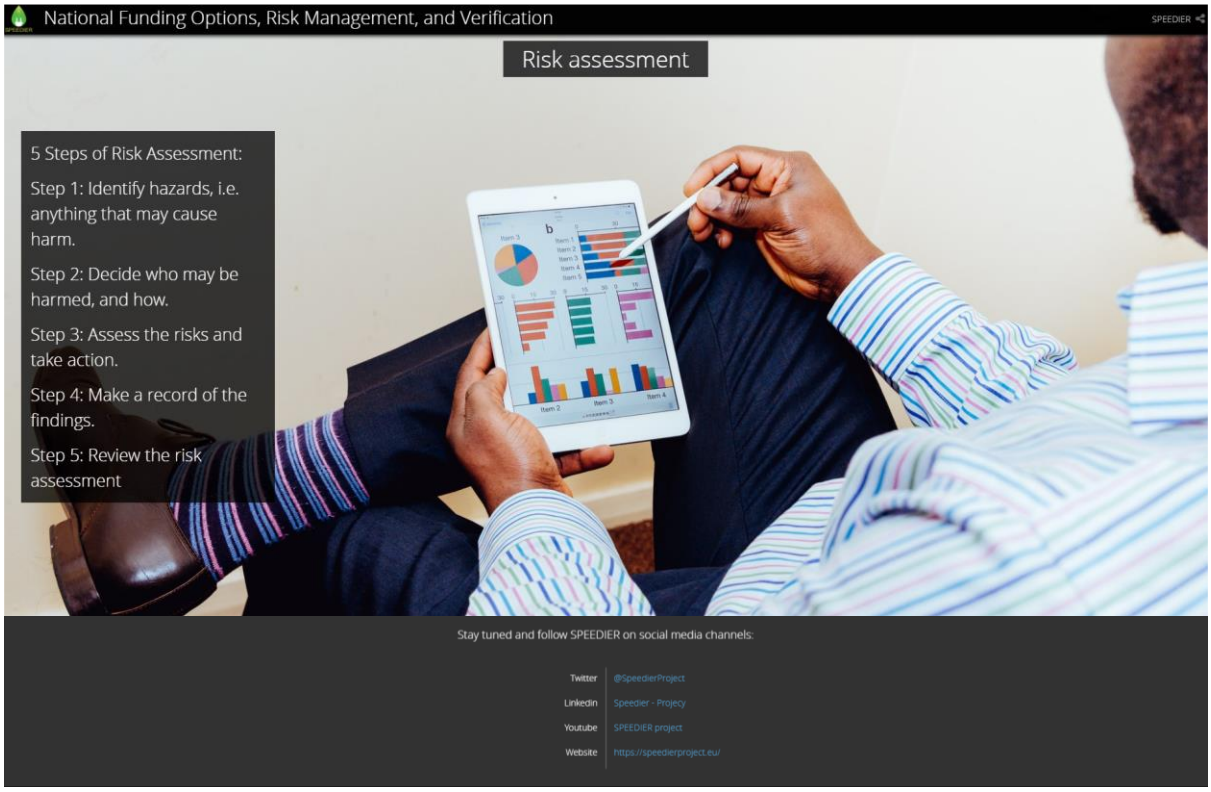

Figure 17. Story map - draft version 4

The e-learning materials section on the website will be 'live' and updated progressively with new content, extracted from all the training programmes. They will be available at this link https://speedierproject.eu/training/ and they will continue to be promoted and disseminated during the two years following the project completion.

All the content will be later translated into Italian, Romanian & Spanish, by AEEPM, CTA, and Polimi for use in their respective countries.

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5 Links & Interconnections

As mentioned before, it is important for the project success that individual staff members employed by the participating SMEs develop an increased awareness of energy in the workplace, an understanding of the actions that they can personally take to reduce energy consumption and feel empowered and incentivised to take those actions in practice.

The development of e-learning materials directly contributes towards this end and to one of the main objectives of SPEEDIER: to enhance the energy culture of SMEs through a series of engagement awareness and capacity building activities leading to SMEs that are fully aware of the multiple benefits of energy auditing.

This task is highly dependent on the content definition and development carried out by Polimi and LIT. Thus, there is an interconnection with different deliverables:

- D4.3: Draft training and capacity building materials for general staff & decision makers.
- D4.4: Revised training and capacity building materials for general staff & decision makers.
- D4.5: Draft training content for SPEEDIER Experts and SPEEDIER Trainers.
- D4.6: Revised training content for SPEEDIER Experts and SPEEDIER Trainers.

Even if the content creation of these materials corresponds to WP4, there is an interconnection with WP5 and WP6 to ensure a user-centred approach, accessibility, and pedagogical fit as 305 staff at all levels will be trained using the training and capacity building materials developed in WP4 and the materials developed for the e-Learning suite.

In addition, the e-learning materials contribute to the dissemination strategy and the results exploitation as the main goal is to raise awareness and to boost knowledge transfer regarding the importance of energy audits and implementation of energy conservations measures among SMEs, large enterprises, industries, and public bodies. It will also help to increase the visibility of the project and help to build capacity as part of exploitation activities.

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6 Conclusions

The SPEEDIER project aims to facilitate the uptake of energy audits and the subsequent implementation of energy efficiency measures by outsourcing all time-consuming energy management activities that require technical expertise (i.e. carrying out an energy audit, training staff in good energy practices) to a SPEEDIER Expert.

As one of the main barriers is the lack of time and expertise, this project is enhancing the energy culture of SMEs through a series of engagement awareness and capacity building activities targeting staff at the operational level and senior management level. For the successful rollout of this service, it is also required to train individuals with the ability to deliver the SPEEDIER Service (SPEEDIER Experts) and/or train others to deliver the service (SPEEDIER Trainers).

In this sense, two main capacity building programmes have been created including insights from other WPs, LIT and Polimi have been the ones in charge of developing the whole content and evaluation methodology, while SIE is transforming all the input received (ppts and videos) into more appealing website available content.

The e-learning materials section on the website will be live and updated with the final versions of the modules that are transformed with the main goal to make them attractive, accessible, and with an easy-to-use multi-media format.

As has been mentioned before, these materials act as facilitators for the dissemination, exploitation, and replication strategies, thus helping to raise awareness and understanding regarding energy management principles and the implementation of ECMs. After making them all available on the project website, they will be promoted through the official social media channels of the project.

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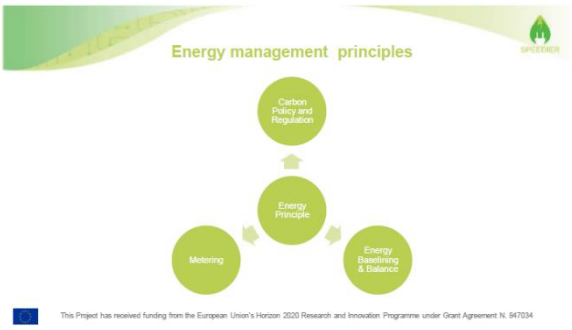
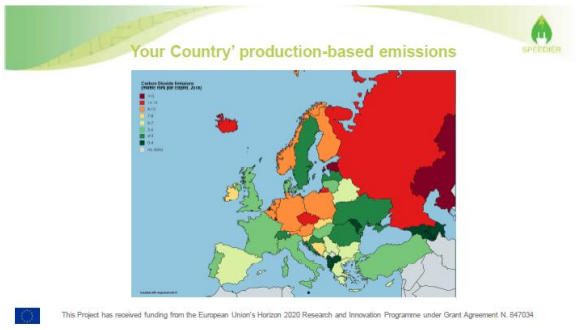
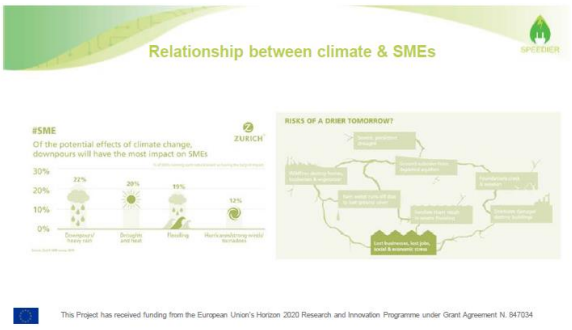
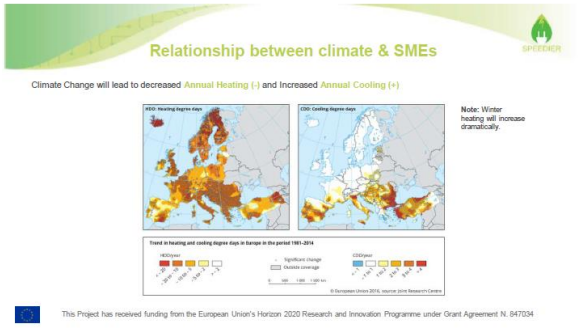
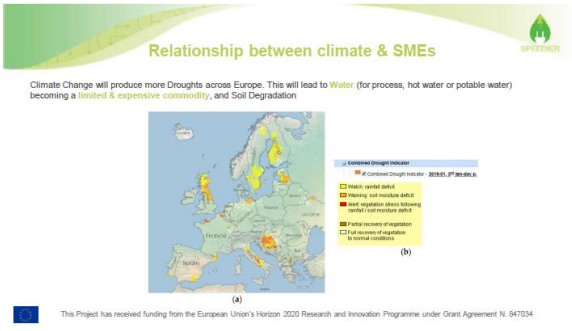
7 Annex I – SME modules (Ireland)











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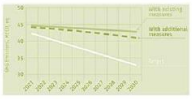
Ireland Climate Action Plan 2021 - 2030



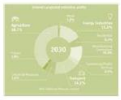


Table 8.1 Enterprise GHG Emissions, 2017

ETS/Non-ETS	Enterprise Emissions CO2eq	Share of Total GHG Emissions	Enterprise Emissions CO2eq./head
ETS/Non-ETS	5.0 Mt	9.1%	1.1t
Non-ETS	2.9 Mt	4.3%	0.6t
Total	8.1 Mt	13.4%	1.7 t

Table 8.3 Enterprise GHG Emissions International Comparisons, 2016

	Ireland	Denmark	Austria	Finland	EU 28
Share of total GHG	13.0%	12.0%	34.4%	22.8%	19.8%
Enterprise Emissions, CO2eq./head	1.7 t	1.1 t	5.1 t	2.4 t	1.7 t
Change Since 2005	-17.4%	-29.0%	-0.7%	-27.1%	-23.1%

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Relationship between climate & SMEs

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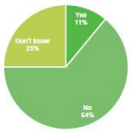
The Baseline

- We carried out an online survey of 84 SMEs in 4 countries
- Only 11% of SMEs confirmed they have had an energy audit in the last 5 years
- 64% of SMEs have not had an energy audit
- This shows there is a great need for programmes to assist SMEs manage their energy consumption

Has your business had an energy audit in the last 5 years?



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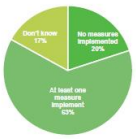
The Baseline

- 63% of SMEs have taken at least one energy efficiency measure
- LED lighting and upgrades to lighting controls is the most common action taken
- But 37% of SMEs have taken no action on energy efficiency or don't know of any actions
- There is still huge opportunity for energy saving among SMEs

What proportion of SMEs have implemented energy efficiency measures?



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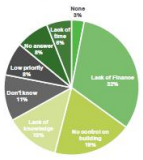
The Baseline

- 32% of SMEs state lack of finance is the main barrier to implementing energy efficiency
- Only 3% stated that there are no barriers
- Many SMEs rent the building they occupy and have no control over the building services equipment
- Some SMEs lack the knowledge to know which measures to implement

What is the MAIN challenge preventing installation of energy efficiency measures?



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Relationship between climate & SMEs

- Article 8 of the Energy Efficiency Directive (EED) requires Member States to set up national incentives to assist SMEs to undertake energy audits.
- SMEs account for 99.98% of European enterprises.
- Are responsible for approximately 13% of total energy demand.
- SMEs have enormous potential to save energy and contribute towards the ability of the EU 28 to achieve their collective targets under the EED of a 32.5% improvement in energy efficiency by 2030.
- Studies estimate that only 25% of SMEs in Europe have undertaken an energy audit.
- Studies citing barriers that include lack of time, resource, in-house expertise, finance and the low priority nature of energy efficiency compared to other business needs.

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Know your Emissions (IE)

Fuel	Grams of Carbon Dioxide
Peat Briquettes	355.9
Electricity	324.5*
Kerosene Oil	257.0
LPG	229.3
Natural Gas	204.7

*Average Annual Fuel Mix in 2019

Source: SEAI 2019 Carbon Conversions

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Energy Management Standards

How ISO 50001 works

ISO 50001 is based on the management system model of continual improvement. The standard provides a framework of requirements for organizations to:

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet the policy
- Use data to better understand and make decisions about energy use
- Measure the results
- Review how well the energy policy is working

The Plan-Do-Check-Act (PDCA) cycle is the operating principle of ISO management standards. By following this cycle, you can effectively manage – and continuously improve – your organization's effectiveness

- Enterprises do not have to get their energy management certified.
- Expensive & Time Consuming to Implement & Certify.
- Recommended for Larger Enterprises.
- Energy Management can be done in any Enterprise from Micro - Large

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Energy Management Standards

Steps can still be learned from ISO50001

Principle is the same: certified or not

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Measurements of Energy Performance

Building Energy Rating (BER): Indicates your buildings energy performance (Energy per unit Area, kWh/m2) Scale of A to G, A being the most energy efficient and G being least energy efficient.

Energy Performance Indicator (EnPI): Energy performance can use other parameters other than area of your building, any site related parameter can be used.

Energy Conservation Measure (ECM): Any activity taken to reduce energy usage and become more energy efficient. [Module 5]

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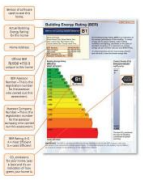
Measurements of Energy Performance

Building Energy Rating (BER)



Energy Performance Indicator (EnPI)

Energy Conservation Measure (ECM)

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Energy Baseline

- An Energy Baseline is energy consumption data for a comparable period.
- 12 Month Billing from Fossil fuels and electricity is the most basic and widely used.
- You can't save what you can't measure. Makes Verification of Savings easier.
- Comparing Consumption after and before changes to indicate savings.

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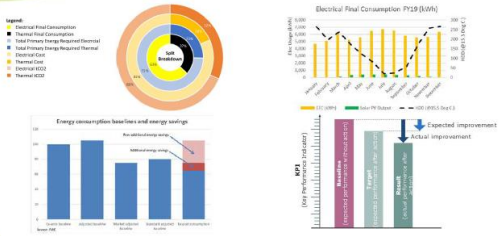
Examples of Energy Baseline



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Energy Performance Indicators (EnPI)

A type of performance measurement that helps you understand how your organisation or department is performing. To be effective a EnPI must be:

- Well-defined and quantifiable.
- Communicated throughout your organisation or department.
- Crucial to achieving your goal.
- Applicable to your line of business.

Common KPIs for Energy are Energy per unit Area, Number of staff, or production.

NFA Energy Use Intensity	TUA Energy Use Intensity	tCO2 / Staff / Week	kWh / Staff / Week	tCO2 / Goat / Week	kWh / Goat / Week	tCO2 / Unit Produced	Energy Per Unit Produced
34 kWh/m2	1 kWh/m2	0.02 tCO2/ Staff / Week	79 kWh/m2	0.7 tCO2/Goat	1.6 kWh/Goat/Week	0.0003 tCO2 / kg Produced	1.2 kWh / kg Produced
58 kWh/m2	3 kWh/m2	0.06 tCO2/ Staff / Week	138 kWh/m2	1.1 tCO2/Goat	3.1 kWh/Goat/Week	0.0005 tCO2 / kg Produced	2.0 kWh / kg Produced
92 kWh/m2	20 kWh/m2	0.08 tCO2/ Staff / Week	213 kWh/m2	2.1 tCO2/Goat	7.1 kWh/Goat/Week	0.0009 tCO2 / kg Produced	3.1 kWh / kg Produced

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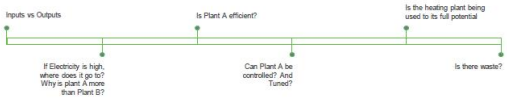
Energy Balance



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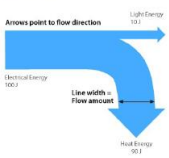
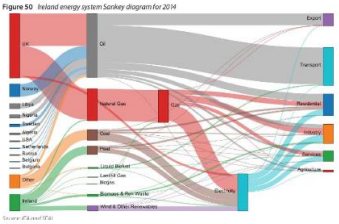
Examples of Energy Balance





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Metering
Report
appraisal of the current energy situation
Install
install energy monitoring and metering equipment
Analyse
gather the energy data, analyse and set reduction and energy saving targets
Implement
apply energy saving initiatives and consumption targets
Verification
access and verify the energy savings implemented
thermodial
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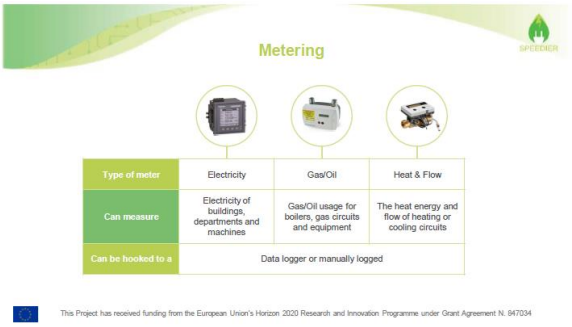
Metering
Type of meter
Electricity
Gas/Oil
Heat & Flow
Can measure
Electricity of buildings, departments and machines
Gas/Oil usage for boilers, gas circuits and equipment
The heat energy and flow of heating or cooling circuits
Can be hooked to a
Data logger or manually logged
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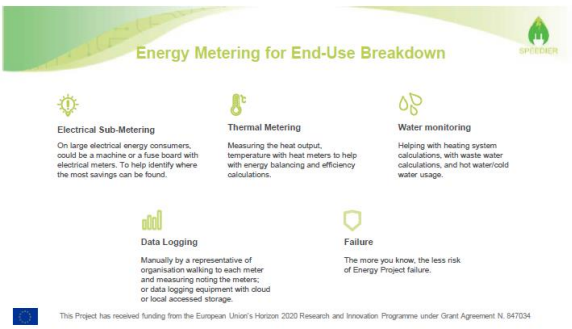
Energy Metering for End-Use Breakdown
Electrical Sub-Metering
On large electrical energy consumers, could be a machine or a fuse board with electrical meters. To help identify where the most savings can be found.
Thermal Metering
Measuring the heat output, temperature with heat meters to help with energy balancing and efficiency calculations.
Water monitoring
Helping with heating system calculations, with waste water calculations, and hot water/cold water usage.
Data Logging
Manually by a representative of organisation walking to each meter and measuring noting the meters; or data logging equipment with cloud or local accessed storage.
Failure
The more you know, the less risk of Energy Project failure.
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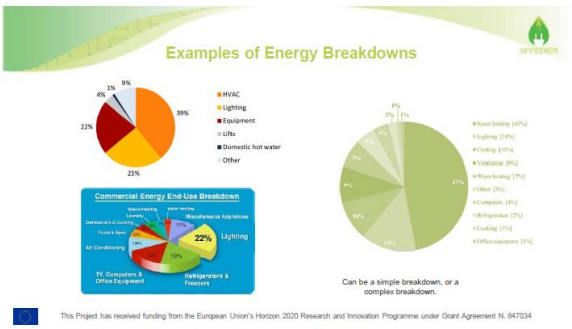
Examples of Energy Breakdowns
HVAC
Lighting
Equipment
Lifts
Domestic hot water
Other
Commercial Energy End-Use Breakdown
Lighting
Refrigerators & Freezers
TV, Computers & Office Equipment
Can be a simple breakdown, or a complex breakdown.
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Behavioural Change

SPEEDIER Energy Champion

The Energy Champion in your company must:

1. Have the ability to promote internal awareness campaigns.
2. Demonstrate a willingness to change behaviour.
3. Is knowledgeable and up to date with environmental policies, grants and regulations.
4. Lead by example
5. Have a passion for Energy efficiency and environment.

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Behavioural Change

Steps to take to nurture a Sustainable Goal!

01 Monitoring and Targeting

In order to become as energy efficient as possible, it helps to know where you are inefficient with energy. Installing metering on site can help identify where the biggest savings can be found and what is responsible for inefficiency.

02 Communication

All staff members are important in saving energy, staff must be made aware of how they contribute to overall carbon emissions. Staff must be trained to operate equipment and controls in an energy conscious manner. Weekly Emails or Newsletters with relatable insights can help boost knowledge of energy efficiency.

03 Status Report

Get staff involved with energy efficiency. Using staff learning days on Energy is an effective measure to undertake. Making a competition out of Energy efficiency is another measure that can yield both interest from staff and energy savings.

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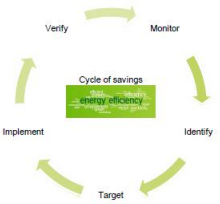
Behavioural Change

Steps to take to nurture a Sustainable Goal!



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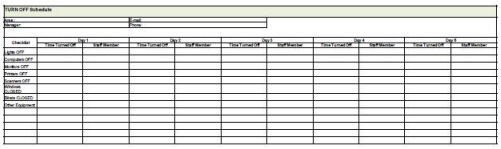
Behavioural Change

Simple Housekeeping and Energy Savings

1. Switch – OFF Schedule:

The simplest measure to kick-start energy savings is to start a Switch-OFF Schedule. This requires 1 staff or more committing to switching off all equipment and lights at the end of each day. (Can save 5% of Energy Costs).



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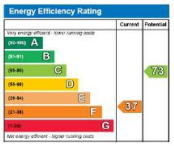
Behavioural Change

Simple Housekeeping and Energy Savings

2. Stick to the Code:

Another Simple measure is to incorporate a colour code system that notifies staff what should be:
Never Turn Off, Turn Off after Use, and Turn Off at end of Day. This simple gesture removes any confusion amongst staff.



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Behavioural Change

Simple Housekeeping and Energy Savings

2. Stick to the Code:

Most of the time Staff are just unsure if they should turn off equipment. Use a simple colour code on the plugs of machines to identify what equipment can be:

a) Turned off After Use

b) Turned off at end of day and

c) Never Turned Off.

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Behavioural Change

Simple Housekeeping and Energy Savings

3. Hot and Cold:

Ask staff about their comfort levels (Light, Heating). You might find that some staff are too cold in one section and staff are too hot in another section. A staff relocation based on their personnel preference can reduce heating bills and reduce bad habits (Electric Heaters, Opening Windows, Lights ON during the day).

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Behavioural Change

Simple Housekeeping and Energy Savings

4. Communication:

To keep your staff in the loop is the key to an energy awareness culture in your company:

1. **Newsletters**: Keep your staff in the loop with updates on measures and the savings from your behavioural change campaign.
2. **Weekly Reminders**: A simple email to remind staff to switch off their equipment and lights.
3. **Posters**: Remind staff around your site that energy awareness is at the core of your company.
4. **Events**: an event once a month or once a quarter. Used to encourage Energy efficient culture in your company.
5. **SPEEDIER App** provides a platform to keep communications open between decision makers and staff.

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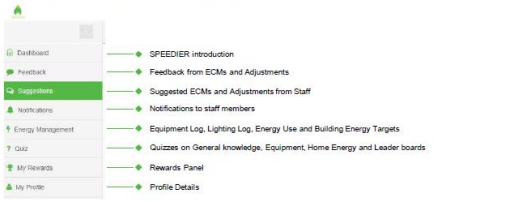
Behavioural Change

SPEEDIER App

Helping to nurture an Energy Efficient Culture & Capacity Building



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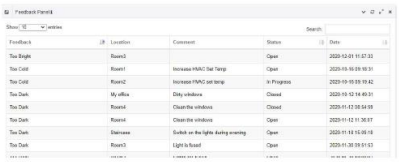
Behavioural Change

SPEEDIER App

Feedback Panel: Reporting Staff feedback of ECMs or adjustments made



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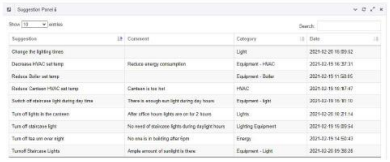
Behavioural Change

SPEEDIER App

Suggestion Panel: Reporting Staff Suggestions for ECMs or Adjustments



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Behavioural Change

SPEEDIER App

Notifications Panel: Staff Notifications

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Behavioural Change

SPEEDIER App

Energy Management Panel: Reporting Equipment & Energy Use

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Behavioural Change

SPEEDIER App

Rewards Panel: Rewarding staff for participation

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Module 3: Transport - Energy Efficiency through Transport

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EU target By 2030

- at least 30 million zero-emission cars will be in operation on European roads
- 100 European cities will be climate neutral
- high-speed rail traffic will double across Europe
- scheduled collective travel for journeys under 500 km should be carbon neutral
- automated mobility will be deployed at large scale
- zero-emission marine vessels will be market-ready

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Transport in the EU

Facts and figures (2018)

3.6 billion tonnes of freight were handled at sea ports;

1/5 of road freight journeys were performed by empty vehicles;

75.3% of the total inland freight transport was attributed to road transport

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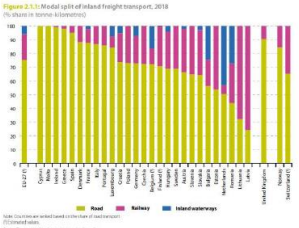
Inland Freight Transport (2018)



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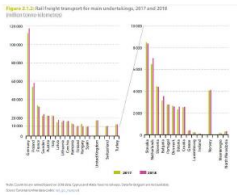
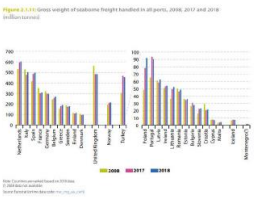
Freight Transport (2017 & 2018)





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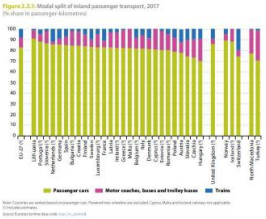
Modal Split of Inland Passengers



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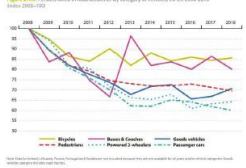
Persons Killed in Road Accidents



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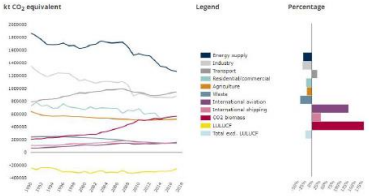
Energy in Transport

CO_2 emissions

Transport is the second highest Carbon Emitter in Europe!



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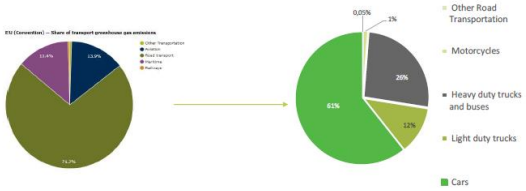
CO_2 emissions

Cars are the top Transport Carbon Emitter in Europe!



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Transport Modes

Private cars are the highest emitter of carbon (43.7%) of total carbon emissions from transport. This due to the low amount of passenger capacity and longer distance journeys.

Heavy Goods Vehicles and road freight is the second largest (27%) of total carbon emissions from transport. According to the Department of Transport, 75% of all goods are moved by road, with 20% transported by rail, 5% by water.

Aviation is the 3rd largest carbon emitter (14%) in total carbon emissions from transport. The Higher a country's GDP the higher the Aviation GHG emissions. It takes 3 to 4 litres of jet fuel per passenger per 100 kilometres.

Railway transport is the most efficient form of transporting people and freight, with total carbon emissions from rail being below 1% of total Carbon emissions from Transport.

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Modes of Transport: Private Car (43.7%)

Private Cars is one of the many reasons why public transport is slow and inefficient.

Relevant data:

1. Only has capacity for 1-5 or 1-7 passengers
2. Carbon Emissions:
   - **Diesel**: A typical 2L Diesel VW Golf, 117 gCO2/km (Excluding toxic NOX emissions)
   - **Petrol**: A typical 1.5L Petrol VW Golf, 113 gCO2/km
   - **Hybrid**: VW Golf GTE 1.4 Hybrid, 39 gCO2/km

Source: https://www.cso.ie/en/releasesandpublications/ep/p-tiri/tiri9/economy/tpi/

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Modes of Transport: Rail (>1%)

Transport via rail has been around for 200 Years! In 1804 the first rail journey took pace.

Relevant data:

1. Irish Rail intercity rail has capacity for 190 – 304 passengers
2. The LUAS has a capacity for 291 - 319 passengers
3. Carbon Emissions:
   - **Irish Rail**: average emissions for trains 44 gCO2/km
   - Vehicle km: 15.01 million
   - Passenger km: 45.5 million
   - **LUAS**: average emissions for tram 54 gCO2/km
   - Vehicle Km: 3.9 million
   - Passenger Km: 183.5 million (2016)

Source: https://www.cso.ie/en/releasesandpublications/ep/p-tiri/tiri9/economy/tpi/

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Modes of Transport: Bus (27%)

Relevant data:

1. Double Decker City Bus has capacity for 86-125 passengers
2. Long Range Coach has a capacity for 52 passengers
3. Carbon Emissions:
   - **Average Bus:** 822 gCO2/km
   - **Hybrid Bus:** 493.2 gCO2/km

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Modes of Transport: Cycle

Good for YOU and Good for the Planet

Relevant data:

1. There are no carbon emissions associated with Cycling, there is however Energy Required by YOU.
2. Bike to Work Scheme can help you obtain a brand new bike and safety equipment worth up to €1,250 for a regular bike, and up to €1,500 for an electric bike!
3. Bike to Work Scheme means that employees save up to half of the retail price of bike and equipment, and your company also makes a saving of 10.75% on Employers' PRSI contributions.
4. If you cycle 5km to work instead of driving a private car for an entire working year (253 Days)
   - You can save 296 kg of Carbon!
   - You can Save €614 a year!
   - Reduce your Risk of Heart Disease.
   - Reduce your Risk of Diabetes.

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Transporting People vs Goods

Transporting Goods is very different to Transporting People

Transport of	People	Goods
Metrics	Passengers	Tonnes of Product
Performance Indicators	Passenger-km	Tonne-km
Carbon Indicators	tCO2 / Passenger-km	tCo2 / Tonne-km
Carbon Efficient Mode	Cycling / Walking	Rail / Water-bourne
Ireland Statistics	48.6 billion Car Vehicle km (2016)	11.6 billion tonnes-km (2016)

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Calculating Energy Required for a Journey

$$E = PE + KE - Fr$$

$PE = Potential\ Energy = mgh$

$KE = Kinetic\ Energy = \frac{1}{2}mv^2$

$Fr = Rolling\ resistance = cmg$

E = Energy Required
m = mass of vehicle
g = acceleration due to gravity
h = Altitude (+/-)
V = Speed (Average)
C = Rolling Friction Coefficient

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Carbon Emissions for Each Mode

for 10,000km/Year

Mode	Carbon Emission (tCO2)	Passenger-km	gCO2 / Pass-km
Private Car (1-Pass) Diesel	1.17	10,000	117
Private Car (1 Pass) Petrol	1.13	10,000	113
Private Car (2 Pass) Diesel	1.17	20,000	58.5
Diesel Bus (20 Pass)	8.22	200,000	41.1
Private Car (1 Pass) Hybrid	0.39	10,000	39
Hybrid Bus (20 Pass)	4.93	200,000	24.7
Train (80 Pass)	0.44	800,000	0.55
LUAS (100 Pass)	0.54	1,000,000	0.54
Private Car (1-Pass) Diesel	1.17	10,000	117

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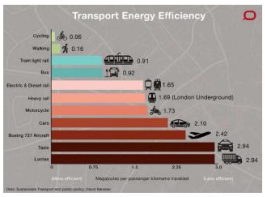
Cycling and Walking

The most efficient modes of Transport



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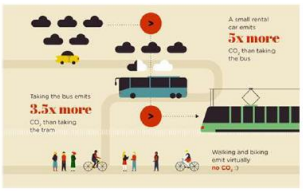
Rail

The most efficient mode of Public Transport



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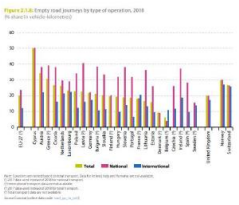
Fleet management

Can reduce the number of Empty Freight road journeys



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Energy Metering for End-Use Breakdown

Vehicle Tracking

Real time vehicle tracking data, mileage and fuel consumption data

Fleet Optimisation

Analysis of gathered data through KPIs and round trip optimisation

Workforce Management

Keeping your drivers and your clients happy, providing accurate ETA Delivery times.

Green and SAFE Driving

Eco-friendly driving and safe driving training courses for drivers

Professional Navigation and traffic avoidance

High Quality satellite navigation systems can help reduce loss of momentum and ensure fuel savings.

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Electric Vehicles

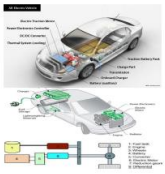
Electric Vehicles

Types of Electric Vehicles

01 Completely electric driven, charged at a charge point. → Battery Electric Vehicle

02 Can be charged via charge point or by onboard petrol fuelled generator → Plug-in Hybrid Electric Vehicle

03 Mainly Petrol driven, petrol charges battery, and battery is only used in traffic for stop start situations, very inefficient for long distance driving → Hybrid Electric Vehicle



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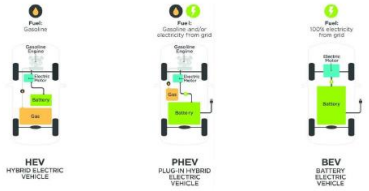
Electric Vehicles

If you're looking to purchase an electric vehicle, use this cheat sheet to help determine the various options. Drivers can choose between three types of electric vehicles (Evs). Evs are classed by the amount of electricity that is used as their energy source.



Source: Electric Power Research Institute

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Electric Vehicles

	Battery Electric Vehicle (BEV)	Plug-in Hybrid Vehicle (PHEV)	Hybrid Electric Vehicle (HEV)	Conventional Vehicle
Key mechanism	Powered by an electric motor and a battery that can be recharged by plugging into an electric outlet.	Powered by a conventional engine (petrol/diesel), along with an electric motor and a battery that can be plugged into an electrical outlet for recharging	Along with a conventional (petrol/diesel) engine, HEVs are powered by an electric motor and a battery that is recharged by regenerative braking	Powered by an internal combustion engine (petrol/diesel)
Propulsion	Electric motor drive	Electric motor drive, Internal Combustion Engine (ICE)	Electric motor drive, Internal Combustion Engine (ICE)	Internal Combustion Engine (ICE)
Energy source and infrastructure	Charging stations drawing power from electric grids	Charging stations drawing power from electric grids plus Petrol/diesel stations	Petrol/diesel stations	Petrol/diesel stations
Advantages	• Higher efficiency • Home/workplace charging • Low engine noise • Few autoparts	• Higher efficiency • Home/work place charging • Many refuelling stations	• Higher efficiency • Many refuelling stations	• Wide variety of models • Many refuelling stations
Disadvantages	• Range anxiety • Long time to recharge • Fewer recharging stations • Battery management in indian context where temperatures go up to 45-50 degree centigrades	• Technologically complex • Fewer recharging stations	• Tail pipe emissions • Oil dependency • Engine noise • Technologically complex	• Low efficiency • Tail pipe emissions • Oil dependency • Engine noise

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Electric Vehicles

Type	Range	Cost	Carbon Emissions	Advantages	Disadvantages
Battery EV (BEV)	250 km - 450 km	€27,000 - €95,000 Ford Kuna – Test drive Dublin to Galway for €4 (overnight charging)	Direct emissions: 0 g/km Indirect emissions: 23 g/km - 29 g/km	• Most efficient use of energy means cheaper on fuel. • Less moving parts means less wear and tear. • Less emissions and reduced use of fossil fuels. • No need for petrol or diesel.	• Home charger is slow. • Charging infrastructure is poor in Ireland. • Range Anxiety
Plug-in Hybrid EV (PHEV)	43 km - 87 km	€25,000 - €99,000	28 g/km - 74g/km	• Uses conventional fossil fuels, so infrastructure is in place • More efficient city driving than conventional car • Charging makes PHEV more efficient	• Limited electric driving range. • Must be plugged in more often to recharge battery. • Less efficient than BEV due to weight of dual drive systems.
Hybrid EV (HEV)	4.7 Litres / 100 km (Petrol) City Driving	€24,000 - €85,000	112 g/km	• Uses conventional fossil fuels, so infrastructure is in place • Transitional technology	• Limited electric driving range. • Heavier than conventional car • Less Efficient long distance driving

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