

H2020 Work Programme



D2.4 – REPORT AND PRESENTATION ON SO WHAT INTEGRATED TOOL FUNCTIONALITIES

Lead Contractor: IES R&D (IESRD)

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Executive summary

This document represents the Deliverable 2.4 Report and Presentation on SO WHAT integrated Tool functionalities. As such, it aims to summarise the key activities and results that have occurred in WP2 Specification of the Tool and common IT framework, in a way that all stakeholders can understand.

This report is seen as the conclusion of WP2 activities, and the specifications and functions explained within it will now feed into the SO WHAT Tool software development.

As part of this deliverable, a presentation has also been produced that will enable the content of this report to be explained to stakeholders. This presentation is show in the Annex and will be available and continually updated on the project website. This report and the presentation are complementary documents which complete each other, as the report can provide a further level of detail and should support an interested stakeholder in gaining a better understanding of the project, properly guided by a consortium member.

Acronyms and abbreviations

DH: District Heating
DHC: District Heating and Cooling operators
EA: Energy agencies
EC: European Commission
EU: European Union
GP: General Public
H&C: Heating & Cooling
iCD: Intelligent Community Design (IESRD software)
iCIM: IESRD Community resource
iVN: Intelligent Virtual Network (IESRD software)
M&V: Measurement and Verification
RES: Renewable Energy Sources
VE: Virtual Environment (IESRD software)
WH/R: Waste heat recovery technologies
WH/C: Waste Heat and Cold
WP: Work Package

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1 Introduction

This document represents the Deliverable 2.4 Report and Presentation on SO WHAT integrated Tool functionalities. As such, it aims to summarise the key activities and results that have occurred in WP2 Specification of the Tool and common IT framework, in a way that all stakeholders can understand.

The outcome of this deliverable report and associated presentation (see Annex), is to enable the project to engage with end users and other stakeholders in a more in depth way, so that they may understand what the software will do and to ensure all are of the same conclusion on how it will perform. When presenting to all stakeholders, this report will act as additional information for the interested parties. The report and presentation also offer a process by which testing and feedback for the software can occur.

The document is structured as follows:

- Chapter 2: Overview of the Tool and Functions
- Chapter 3: Online and Advanced Versions
- Chapter 4: Summary of Workflows and Use Cases
- Chapter 5: Demo Site and Stakeholder Feedback process
- Chapter 6: Conclusion
- Annex: SO WHAT Tool Summary Presentation

2 Overview of Tool and Functions

2.1 Software to be integrated and Data Exchange

The SO WHAT tool is made up from a number of different software, some of which were wholly or partially born from previously funded EU funded projects, and some which were already existing commercially and need to be enhanced for the purposes of SO WHAT. The challenge for the development phase of the project (performed in WP4) is to ensure the integration of these software so that the end user experiences SO WHAT as a single platform with a smooth and efficient workflow.

The main projects funded by the EU which feed into SO WHAT are as follows:

- REEMAIN (FP7) – IES - simulate energy in an industrial environment
- iURBAN (FP7) – IES - function to analyse community/city electricity networks
- ENTRUST (H2020) – IES - applied a user interface to the back-end network analysis form iURBAN
- PLANHEAT (H2020) – RINA C- mapping of local heat demand and availability of local RES

A brief explanation of the software that will be used and integrated in the project, the functions they will perform and who will develop them are as follows:

Table 1 Summary of Software and Function in SO WHAT

Software Name	Origination (EU Funded or Commercial)	Functions to be performed in SO WHAT
Online Portal (IES RD)	Bespoke new development for SO WHAT	Partial User Access & Management, 3D View, Partial data collection, Decision Support – baseline results, Scenario and KPI selection, Cost Calculation, KPI Panel & Dashboard, Value Choice, Business Model Guide
iCD (IES RD)	Existing Commercial software to be enhanced for SO WHAT	Partial User Access & Management, Project Setup, 3D View, Partial Data Collection (<i>to be investigated if these functions can be moved to other software</i>)
iSCAN (IES RD)	Manufacturing function - FP7 REMAIN – to be enhanced for SO WHAT	Data Collection – Manufacturing, Organisation of Data, Generation of Profiles
VE (IES RD)	Existing Commercial software	Energy Flow Analysis (<i>to be investigated how to move this to other software</i>), dynamic building simulation
iCIM (IES RD)	Existing Commercial software to be enhanced for SO WHAT	Storage of core data, storage of relational/referenced data and databases
iVN (IES RD)	H2020 ENTRUST & iURBAN - to be enhanced for SO WHAT	Community modelling of technologies and scenarios, modelling of District Heating/Cooling infrastructure.
PLANHEAT	PLANHEAT (H2020)	Mapping of local heat demand and availability of local RES

It should also be noted that all communication between software to occur via standard RESTful APIs, and the use of Python code will mean partner developments to be easily integrated (e.g. near to market technologies, cost calculations).

2.2 Stakeholders and Users of the SO WHAT Tool

The identified stakeholder with an interest SO WHAT and in waste heat/cooling recovery and reuse have been clustered in the following five types:

1. Industrial Facilities
2. Municipalities / Regional Energy Agencies /Public Authorities
3. Providers of equipment/services (Energy Audits Companies, RES equipment sellers, WH/C recovery equipment sellers, Engineering Consultancy firms)
4. Operators of the Waste Heat Networks
5. Academia, Associations and Research

The users of the SO WHAT Tool, and the context in which they will utilise its functions can be summarised as follows:

1. **Industry** - Operation/Energy Manager of Industrial Facilities will use the tool to understand the potential to:

- Recover waste heat/cooling and use within the factory
- How waste heat can be used to supplement renewable energy systems
- Recover waste heat/cooling and supply it local community
- Where waste heat/cooling could be purchased from in the local community

2. **Municipality / Regional Energy Agencies /Public Authorities** - will use the tool to understand:

- Supply areas with waste heat/cooling
- Where there is demand for waste heat/cooling
- Areas for integrating waste heat/cooling with Renewable Energy technologies.

3. **ESCOs / DH Operators** - will use the tool to:

- Recognize which solutions relating to waste heat/cooling in a community would best suit the business models they operate under.
- Assess the costs/risks of any investments required

2.3 Functions of the SO WHAT Tool

This section aims at giving an overview of the high-level functions so that what the tool will perform, as shown in the Figure below:

Integrated SO WHAT Tool - supported by online workflow		
Baseline Waste Heat/Cooling Industry/Community	Simulation of Technologies & Scenarios	Reporting & Decision Support
Minimal Data Collection via Energy Asset Audit Portal	Methodology for scenario & technology selection	KPIs to suit user focus (financial, energy, environment)
Industrial energy flow and waste h/c baseline	Modelling of technologies to recover and reuse waste h/c within factory	Compare scenarios to optimise solutions
Community heat & power supply baseline	Modelling of ways to reuse waste h/c at Community scale	Business Model & Energy Performance Contracting Guidance
Community heat & power demand baseline	Modelling of how to integrate waste h/c with RES	KPI Panel & Dashboard for Results Visualisation to suit different users
3D View of Individual site or Community	Balance local forecasted h/c demand with supply	Automated M&V software to allow ongoing reporting

Figure 1 Summary of the SO WHAT Tool Functions

The sections below offer a brief overview of each function in the Figure above, and where possible a visual of what a result may like in the software as the end user will see it. It should also be noted that the end user will be supported in utilising the SO WHAT Tool via an online workflow that will give step by step guidance to the user and where possible link into the software to allow a seamless experience.

2.3.1 Baseline Waste Heat/Cooling Industry/Community

- Energy Asset Audit Portal** – This will cover the data collection required in the Online (Free) version of the tool in both Manufacturing and Community environments. The aim is to allow users to enter only the information required to quickly give an estimate of the baseline for waste heat, and baseline for the community energy demand/supply. For the Advanced (Commercial Version) due to the detailed data collection required, these duties will be split by dedicated software. The below figure shows an example of some of the current software views for data collection and how it is organised:

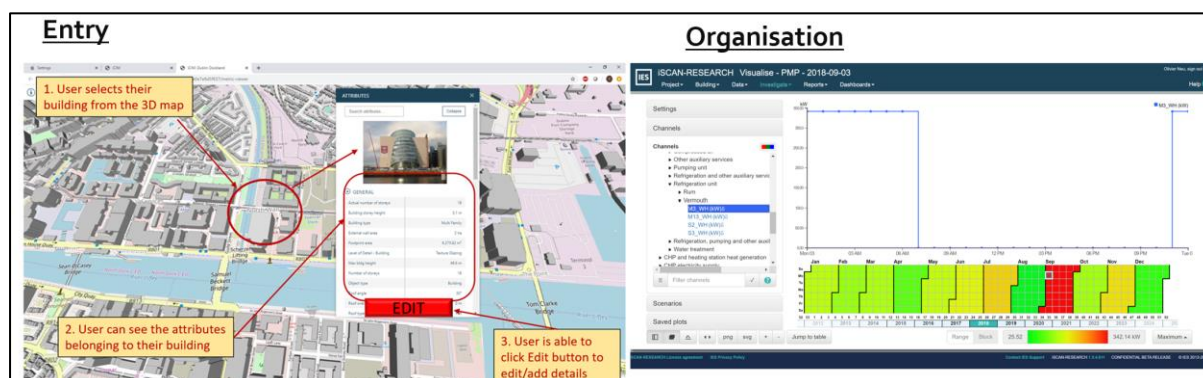


Figure 2 Example current software views for data entry and organisation

- *Industrial energy flow and waste heat/cooling baseline* – Where detailed energy data relating to the industrial facility can be obtained, then it will be [possible to divide map the data to specific processes, assign profiles and produce an energy flow analysis that shows the amount and quality of waste heat/cooling available and where the source is. Where the detailed energy data is not available, then it will be possible to use industry standard defaults values so that an estimate can be made. Below is an example of the current view produced following a detailed assessment in the software for the M&R Pessione demo site:

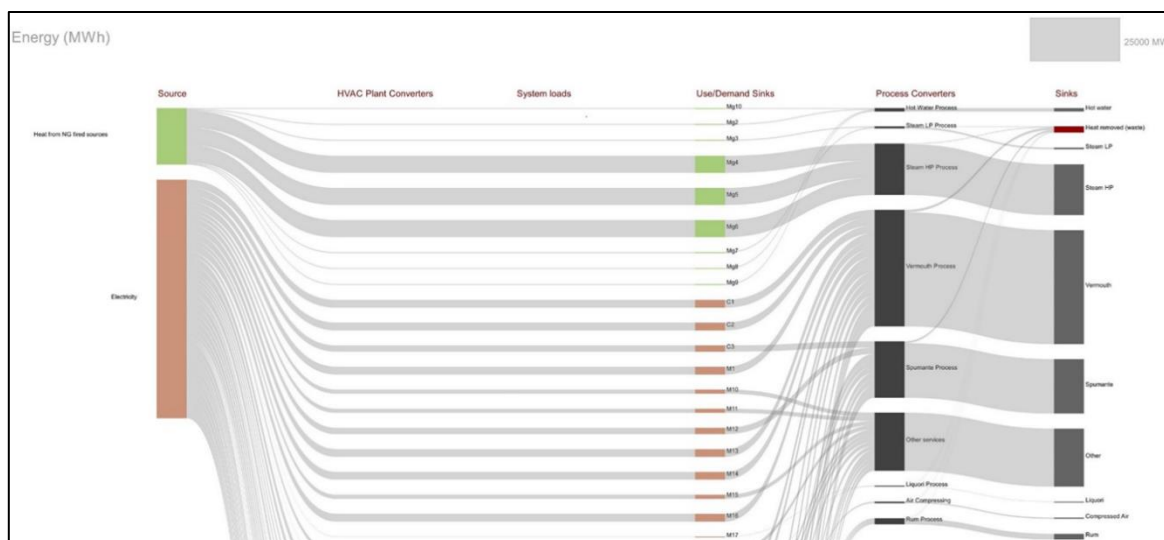


Figure 3 Example of Sankey diagram of energy flows and waste heat potential for the M&R Pessione demo site

- *Community heat and power supply baseline* – For the community perspective, it will be possible for the user to view a community heat and power supply baseline provided they have entered in the required details regarding the setup of their local energy grid. Where required details are not entered it will also be possible to use national default values to fill in the missing information.
- *Community heat and power demand baseline* – To obtain the heat and power baseline, there will be two approaches depending on the version of the software the user has. For the Online Version, the software will use ore-defined default values by building type in order to calculate heat and power demand for the community, whereas for the Advanced version, this will be done via the PLANHEAT software which does amore in depth analysis of population density of an area to gauge energy demand.
- *3D View of individual site or community* – Which ever version the user has, they will be able to view their facility or community in 3D.

2.3.2 Simulation of Technologies and Scenarios

- *Methodology for technology and scenario selection* – As explained below, there is a large number of technologies that can be combined to allow an interested party to understand how to recover and re-use waste heat/cooling. So that the user may be guided as to a methodology to follow in order to filter out scenarios that do not apply to them, the methodology has been produced and will be implemented within the software. A high-level view of the methodology is shown below:

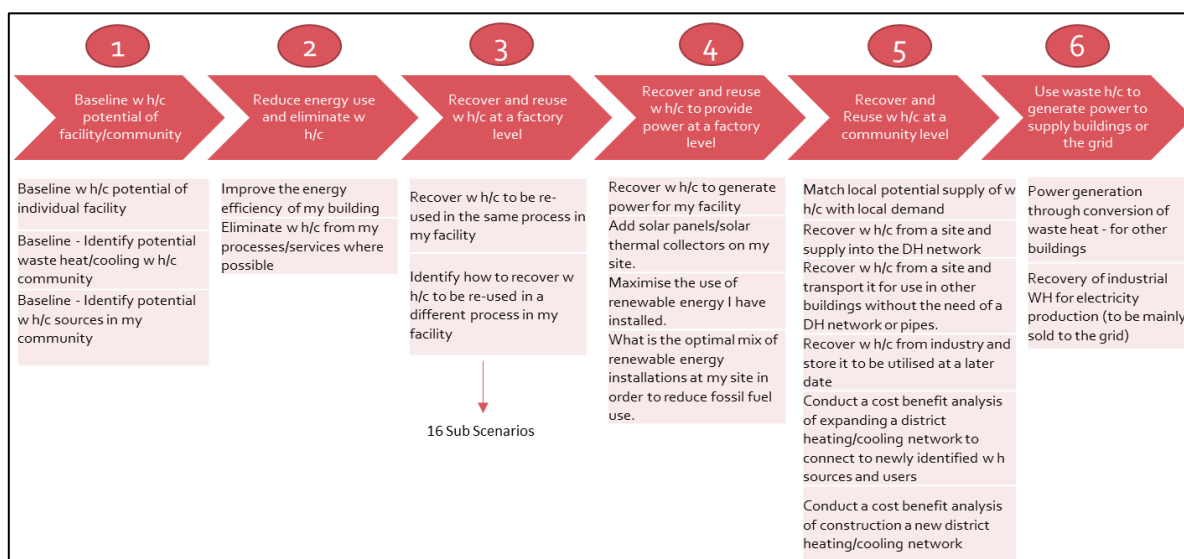


Figure 4 High level view of the scenario selection methodology

- *Modelling of technologies to recover and reuse waste heat/cooling within the factory* – In total, 27 technologies to recover and reuse waste heat within a factory have been researched (see D1.9) and will be modelled in the software.
- *Modelling of ways to reuse waste heat/cooling at a community scale* - Similar to above, there are a number of ways a user will be able to model how to recover and re-use waste heat/cooling a community scale.
- *Modelling of ways to integrate waste heat/cooling with RES* – At a community level, there will be functionality for the user to model both the potential for increase RES and also how any waste heat can be integrated with this, such as through solar thermal, heat pumps or storage.
- *Balancing local forecasted demand with supply* - From the community perspective, the functionality will also exist to view both demand and supply baselines together in order to understand where any surplus local waste heat/cooling could be used to supply demand that may be currently using heat from higher carbon/higher cost sources. The modelling of technologies will be able to show how to fill this gap.

2.3.3 Reporting and Decisions Support

- *KPIs to suit user focus* – Contained within the data for each technology there will be the parameters for environment, energy and finance. This will allow for KPIs on each of these to be produced so that the user can select what they wish to see based on their needs. At a community level, it will also be possible to add tariff information so that decisions on where to source heat from can be made more easily.
- *Compare scenarios to optimise solutions* – The user will be able to run multiple scenarios models and then view the results side by side. In this way, the KPIs they are focused on can be used to rank different solutions.
- *Business Model and Energy Performance Contracting Guidance* – Once the user has modelled the solutions they are interested in and viewed the KPIs to show them the best solution for them, there will also be a guide on how best to finance the solutions, and also how to conduct Energy Performance Contracting to an ESCO
- *KPI Panel & Dashboard for Results Visualisation to suit different users* – As explained above, there will be KPIs to suit different user needs, and so in order to view these, a KPI Panel will be produced as well as a dashboard that is pre-set for different user types, such as expert/non expert, technical or financial. In particular, the dashboard will offer a 3D view of the community, where the user can view an over lay of the KPIs. Although the detailed specification of the KPI Panel and Dashboard is not yet defined or developed, an example of some recent dashboards developed by IES for other projects are shown below in order to give a flavour of what the SO WHAT development may be like:

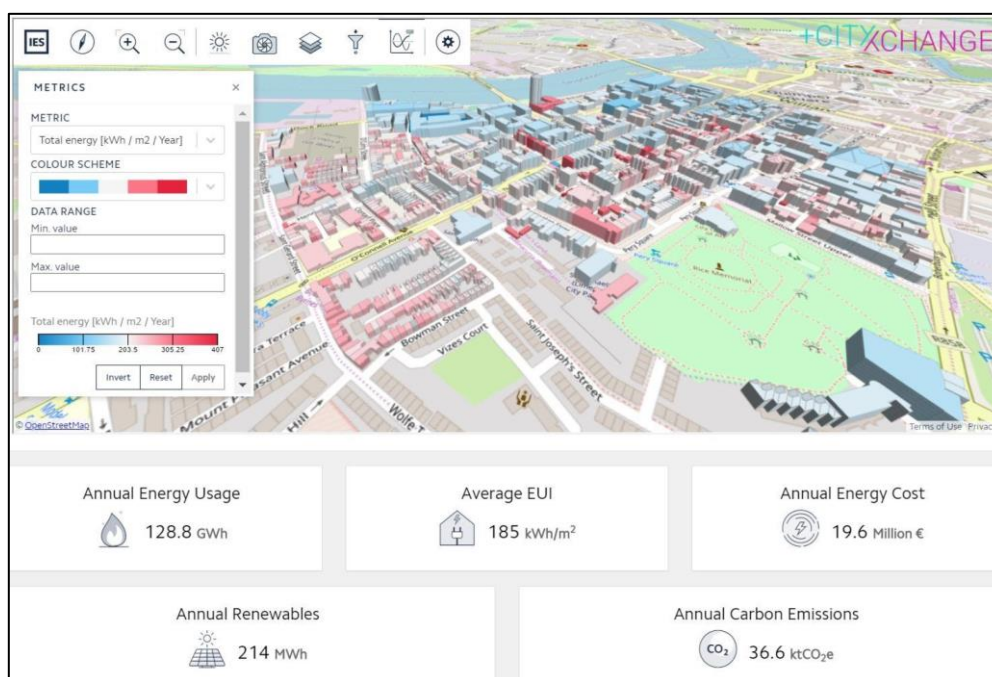


Figure 5 Dashboard for Limerick City Council in H2020 +CityxChange Project



Figure 6 Example of Dashboard Nottingham Trent Basin produced in UK funded SCENE project.

- *Automated M&V Software to allow ongoing reporting* – For an industrial user, the functionality will be available to install software at the user's site that can download real time, continuous energy data and send it back to the SO WHAT Tool. In this way, a user can view on going performance of the new waste heat recovery technology to check and ensure it is operating as planned.

3 Online and Advanced Versions

There will be two versions of the SO WHAT Tool: an online version and a desktop based one. The online version is intended to engage the users and present some initial results and should be free not only for the duration of the project but also after its end. On the other hand, the Advanced version, thus maintaining some online features, will be mainly based on a desktop and, as post-project exploitation route, is foreseen to be accessed via a commercial licence.

Table 2 Online vs Advanced Versions

Usability/Functionality	Online	Advanced
Form of Access to the SO WHAT Tool as post project exploitation	Free	Paid
Online or Desktop	Online	Desktop
Availability of expert consultant to support user	✗	✓
Online workflow to guide user through each step	✓	✓
3D Building / Community View	✓	✓
Industrial waste heat / cooling assessment based on industry profile or detailed assessment	Profile	Assessment
Results visualisation of waste heat/cooling potential	Basic	Detailed
Ability to select technologies/scenarios, & associated energy, environmental & finance	✓	✓
Simulation of potential waste heat recovery to be used in same factory	Basic	Detailed
Visualise local community energy consumption & supply sources	Basic	Detailed
View uses for waste heat/cooling in community & how to balance local waste heat supply with demand	Basic	Detailed
Ability to understand/view how this is integrated with RES	✗	✓
KPIs panel & dashboard suited to different users	Basic	Detailed
Business model guide	Basic	Detailed
Automated M&V software to allow ongoing reporting	✗	✓

4 Summary of Workflow and Use Cases

This section is intended to be complementary to the ppt to provide further information and summarise key aspects.

Use cases and workflows for the integrated SO WHAT Tool were developed in D2.2 Software modules functionality and in D2.3 Common IT Framework Specification. The concept of use case originates from software development and was born to describe a technique for capturing functional requirements. The sections which follow show the overall workflows produced, and also the key Use Cases which the User has to perform.

Please note: By each step in the workflow there is a unique identify which relates to the Use Cases table.

4.1 Summary of Workflow and Use Cases for the Online Tool

The workflow diagram has been split out between Manufacturing and Community uses in order to keep it as simple as possible. The workflow for the user interested in understanding how waste heat and cooling can be used in their own facility is shown in Figure 5 and for the user interested in the wider community in Figure 6 below:

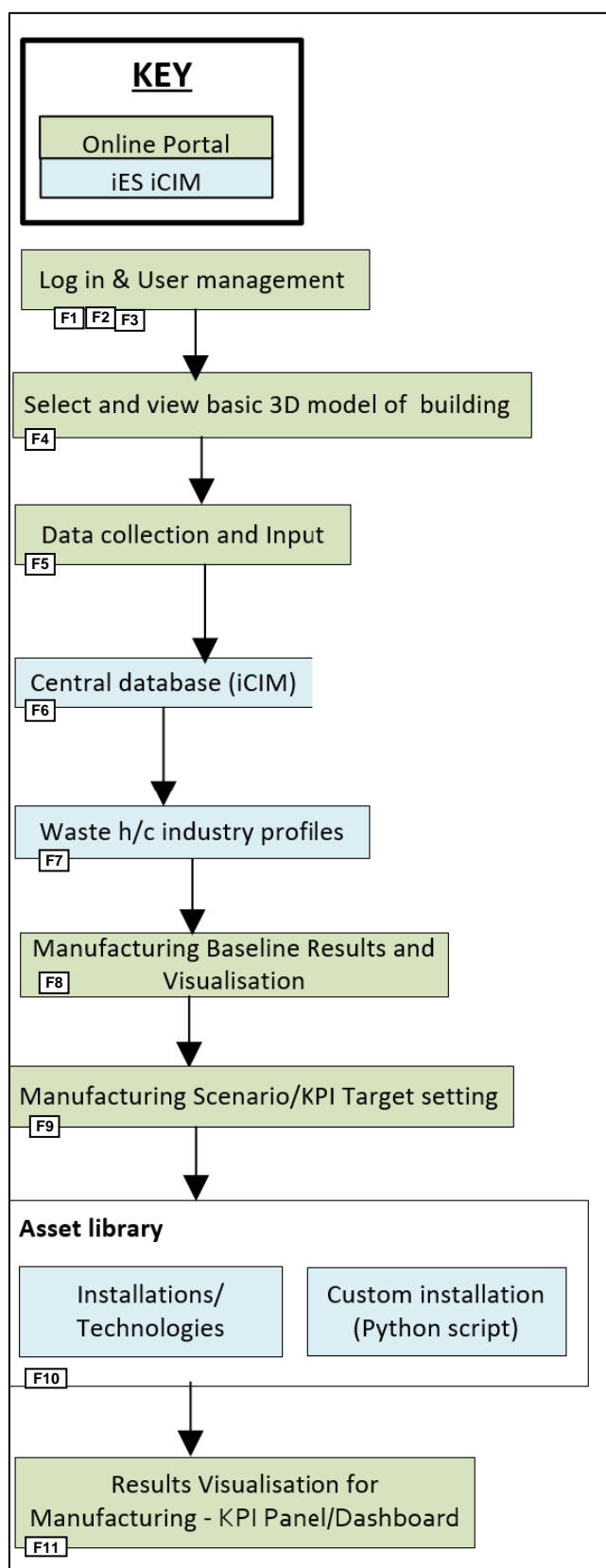


Figure 7 SO WHAT Online Tool Manufacturing workflow

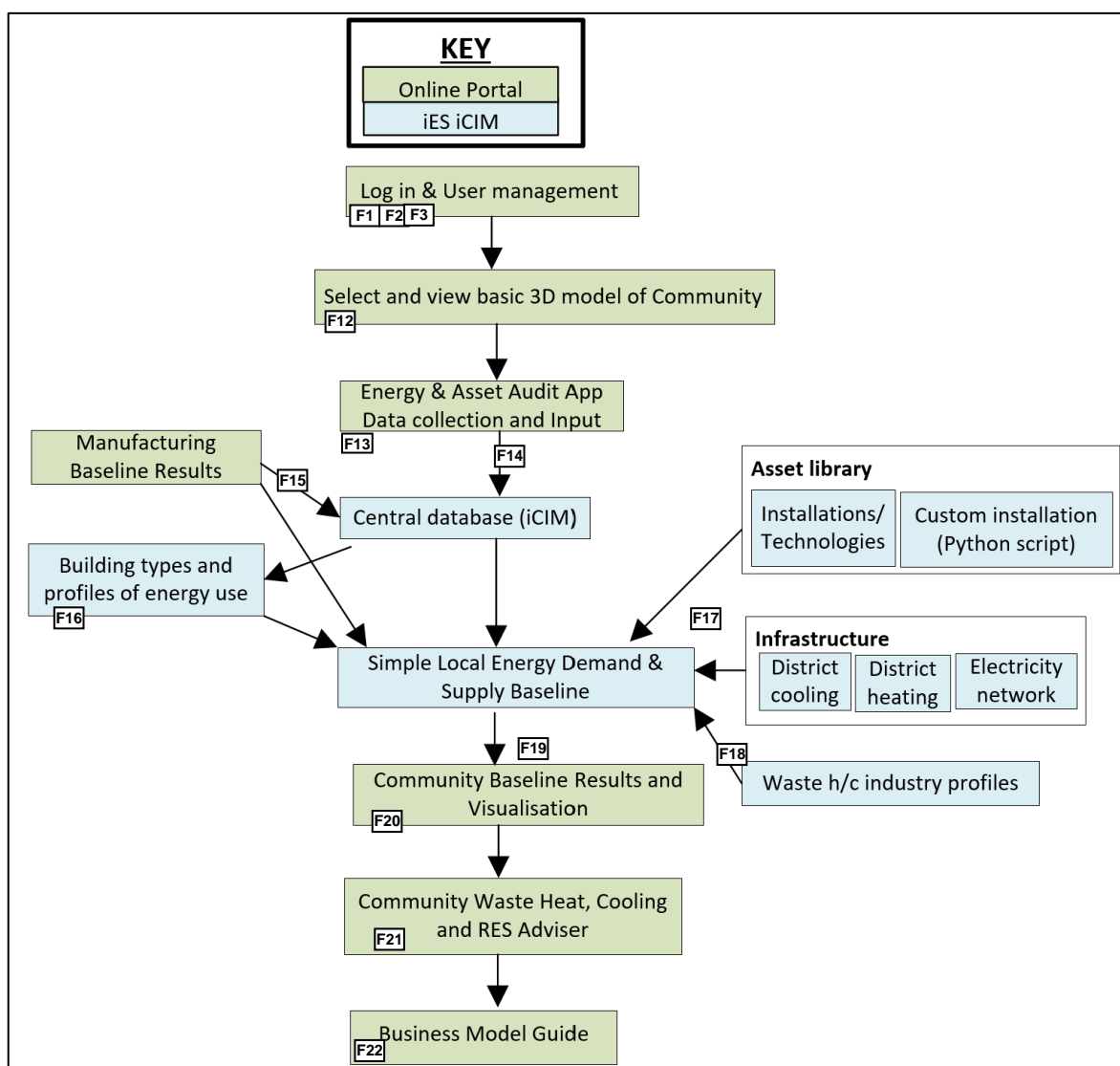


Figure 8 SO WHAT Online Tool Community workflow

The workflow is joined with the Use Case description for the key activities done by the User in the table below:

Table 3 Online tool Use Cases

Use Case	Module	User Type and Who	Task to perform	Software involved	Inputs	Outputs
F1-3	Decision Support	Industry/ Municipality/ ESCO - User	Log in to Decision Support Module (web portal), Create project, Manage Users	SO WHAT Free web portal	Personal log in details	User logged in, Project created, Users created and allocated roles
F4	Manufacturing	Industry- User	Locate/Select building of interest using Open Street Map	SO WHAT Online web portal - embedded Open Street Map/iCIM	User input of building location	Building located and selected
F5	Manufacturing	Industry – User	Collect and add required data into simple energy & asset audit questionnaire	SO WHAT Online web portal, embedded Open Street Map/Simple energy & asset audit questionnaire, iCIM	All required data added - including but not limited to: size, energy use, heat consumption, heat source manufacturing type, sector, and processes involved, existing interventions operating hours etc.	Ability to model waste heat/cooling baseline. If data requirements not met, this will be flagged.
F8	Decision Support	Industry- User	Choose how to recover and use the waste heat/cooling: (A) Internally, (B) Externally. If the Answer is (A), then user moves to the next Step. If the Answer is B, the user moves to the workflow described in F12 onwards	SO WHAT Online web portal- Baseline Results	User selection	User has selected whether they wish to recover and use the waste heat/cooling: (A) Internally, (B) Externally
F9	Decision Support	Industry- User	Set KPI targets and scenarios -user is presented with a list of appropriate 'Scenarios' (i.e. how they could potentially utilise the waste heat/cooling available in their facility), and also with a list of KPIs.	SO WHAT Online web portal- Scenario/KPI Target setting	List of potential KPIs and scenarios (see D2.6), and relevant local, regional, national benchmarks and targets.	KPIs selected, targets set.
F20	Decision Support	Industry/ Municipality/ESCO- Software/ User	The User is presented with a simple baseline which shows the local energy	SO WHAT online portal – Simple local	All results from F19 shown as table/graph/map views	Visual baseline for community energy

			consumptions and supply sources and constraints.	energy demand & supply baseline		demand and supply balance for the user
F21	Decision Support	Industry/ Municipality/ESCO-Software/ User	User can see the potential Waste Heat/cooling solutions and areas to supply heat to/demand heat from as well as areas for integrating waste heat/cooling with Renewable Energy technologies. It should be noted that the functionality in this step will not involve any detailed simulations or calculations, and will be limited to a filter on technologies and solutions appropriate to the user.	SO WHAT online portal – Community SO WHAT online portal- Waste Heat & Cooling & RES Adviser	Results from F19 with process to filter to applicable technologies	Community map view of potential waste h/c sources, information on potential ways to recover, store and supply heat, supply hear, as well as information on RES to integrate heat with.
F22	Decision Support	Industry/ Municipality/ESCO-Software/ User	Following, this, this user will also be able to view a Business Model Guide, which will be able to suggest different avenues to follow in order to finance solutions should they be viable.	SO WHAT online portal - Waste Heat & Cooling & RES Adviser SO WHAT online portal - Business Model Guide	List of potential ways to finance solutions with Business Model explanations	User is able to view and scroll through a variety of business models in order to understand how to best finance solutions.

4.2 Summary of Workflow and Use Cases for the Advanced Tool

The workflow diagram has been split out between Manufacturing and Community uses in order to keep it as simple as possible. The workflow for the user interested in understanding how waste heat and cooling can be used in their own facility is shown in Figure 7 and for the user interested in the wider community in Figure 8 below:

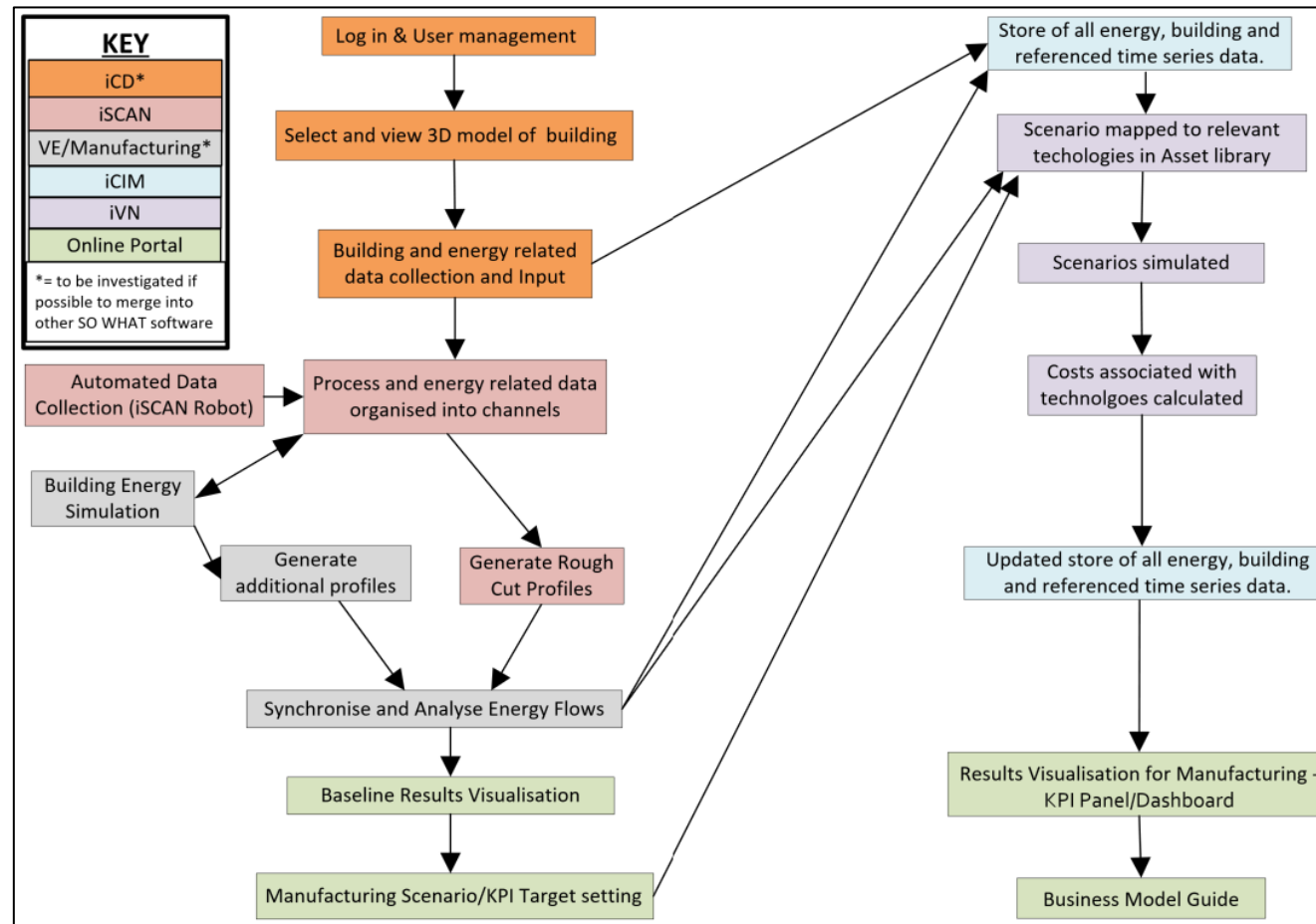


Figure 9 SO WHAT Commercial Tool Manufacturing Workflow

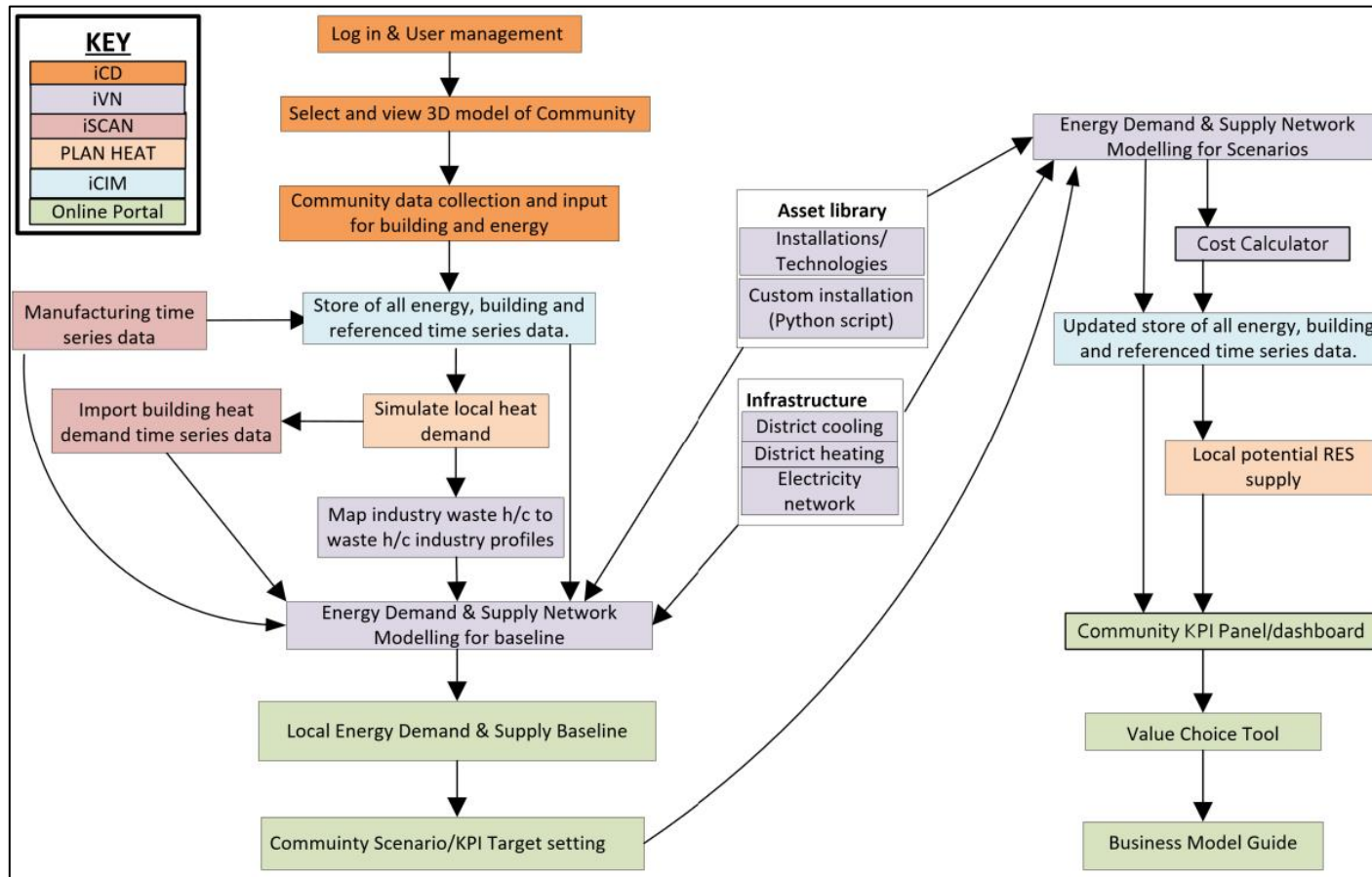


Figure 10 SO WHAT Commercial Tool Community Workflow

The Workflows are joined with the Use Case description in the table below:

Table 4 Commercial Tool Use Cases

Use Case	Module	User Type and Who	Task to perform	Software involved	Inputs	Outputs
C1-3	Project setup and management	Industry/ Municipality/ ESCO - User	Log in to iCD, Create project, Manage Users	iCD	Personal log in details	User logged in, Project created, Users created and allocated roles
C4	Manufacturing	Industry- User	Locate/Select building of interest using Open Street Map	iCD, Open Street Map	User location via address	User has found, selected and viewed building of interest
C5	Manufacturing	Industry – User	Collect and input all relevant data for industrial processes. NB: See separate Uses Cases below data input depending on data availability.	iCD	Description of processes & services, description of inputs & outputs, product flows / temperatures, production calendar, high-level information on daily profiles	To inform rough cut profiles and simulation inputs
C6	Manufacturing	Industry - Software	Send all process and energy related data to iSCAN	iCD, iSCAN	All from C5 via API	iSCAN has all relevant data collected in C5 relating to processes and services
C8	Manufacturing	Industry – User	Upload additional data as necessary and organise all data available and necessary to generate 'Rough Cut Profiles' for industrial processes energy flows. NB: See separate Uses Cases below regarding data input depending on data availability	iSCAN	All from C5, and which ever data is available from C8.1-8.5 use cases below	Generation of rough cut profiles to give time series profiles for all (relevant) energy flows within the industrial plant
C8.1	Manufacturing	Industry – User	Upload utility bills to iSCAN - e.g.: daily/weekly/monthly/ annual totals, depending on what data is available.	iSCAN	All from C5, Energy utility bills.	Generation of rough cut profiles to give time series profiles for all (relevant) energy flows within the industrial plant
C8.2	Manufacturing	Industry – User /Consultant	Upload partial sub metering time series energy data to iSCAN. Expressions may be required to derive time series data from available	iSCAN, VE	All from C5 partial sub metering time series energy data.	Generation of rough cut profiles to give time series profiles for all (relevant) energy flows within the industrial plant

			measurements, depending on data availability & relationships between processes. VE model may be required to generate additional profiles.			
C8.3	Manufacturing	Industry – User /Consultant	User has utility bills with partial sub metering. Expressions may be required to derive time series data from available measurements, depending on data availability & relationships between processes. VE model may be required to generate additional profiles.	iSCAN, VE	All from C5 plus partial sub metering time series energy data.	Generation of rough cut profiles to give time series profiles for all (relevant) energy flows within the industrial plant
C8.4	Manufacturing	Industry – User /Consultant	User has detailed time series sub metering. Metered data may be uploaded directly to iSCAN to generate profiles for energy flows	iSCAN, VE	All from C5 plus detailed metered energy data.	Generation of rough cut profiles to give time series profiles for all (relevant) energy flows within the industrial plant
C8.5	Manufacturing	Industry – User /Consultant	User has utility data & detailed sub-metering. Metered data may be uploaded directly to iSCAN to generate profiles for energy flows	iSCAN, VE	All from C5 plus utility data & detailed sub metered data.	Generation of rough cut profiles to give time series profiles for all (relevant) energy flows within the industrial plant
C8.6	Manufacturing	Industry – User /Consultant	User wants to setup live meter reading connection to automate data upload – use iSCAN Robot	iSCAN Robot	All from C5 plus metered data from iSCAN Robot	Continuous measurement and validation of process performance
C9	Manufacturing	Industry – Consultant	Conduct energy performance calibration and simulation of the building to assess potential energy efficiency improvements	iSCAN, VE	All from C5	Calibrated model of the dynamic thermal energy performance of the building
C10	Manufacturing	Industry – Consultant	Analyse energy flows.	iSCAN, VE Manufacturing NB: It is being investigated as to whether VE Manufacturing	All results from C5 plus C6.1-6.6	Clear view of energy flows and waste heat/cooling.

				g is required, and whether the function it performs can be moved to the Community Modelling software.		
C15	Decision Support	Industry-User	Set Scenario & KPIs and where available, benchmarks	SO WHAT portal – Scenario/KPI setting	Relevant technologies, scenarios, KPIs and benchmarks	User has selected which scenarios, technologies, KPIs and benchmarks they wish to simulate and view. scenarios have already been filtered based on the users facility and waste heat/cooling results, so the user only sees what is relevant and can select from these. The user will also be asked to select targets and potential benchmarks that are available.
C19	Community	Industry – User/ Consultant	Scenario simulation occurs (in the same process as in C39 only it is done for the single manufacturing facility.)	iVN	All data from C16-C18	Scenario simulation complete
C22	Decision Support	Industry – User/	The user is shown the results from the selected scenario in terms of how they can recover and re-use the waste heat/cooling with their own facility	SO WHAT portal KPI Panel/ dashboard, iCIM – asset database, iVN	All results from C20/21	User is able to view the results from the selected scenario in terms of how they can recover and re-use the waste heat/cooling with their own facility.
C23	Decision Support	Industry – user	The user is also able to view potential ways to finance the selected scenario and potential business models	KPI Panel/ dashboard, Business Model Guide	All cost related results from C20, relevant business models	User is also able to view potential ways to finance the selected scenario and potential business models
C24	Community	Industry/ Municipality/ ESCO - User	User locates their area of interest and selects the boundary of the local community to be the case study. The	iCD, Open Street Map	User data entry for location and boundary.	User has found, selected and viewed local area of interest

			user will also be able to view a 3D map of selected local community.			
C25	Community	Industry/ Municipality/ ESCO- User	User enters data as relating to the building in the local area, energy consumption, and energy supply.	iCD	User enters as much data as possible relating to the building in the local area, energy consumption, and energy supply.	User has entered all requested data.
C28	Community	Industry/ Municipality/ ESCO – User/ Consultant	Where there are gaps in the local energy demand from the users information, iCIM connects to PLANHEAT software to simulate local energy demand.	iCIM, PLANHEAT	Building data from iCIM	Local energy demand simulated to give time series energy demand per building
C29	Community	Industry/ Municipality/ ESCO- User/ Consultant	Local energy demand from PLANHEAT is passed to iSCAN	iSCAN, PLANHEAT	Time series energy demand results from PLANHEAT	Local energy demand results from PLANHEAT are passed to iSCAN
C33	Community	Industry/ Municipality/ ESCO – User/ Consultant	Results from PLANHEAT regarding waste h/c from industry are sent to waste heat/cooling profile database and mapped to relevant profile	PLANHEAT, Waste heat/cooling database, iVN	Results from PLANHEAT regarding waste heat and cooling	Results from PLANHEAT regarding waste heat and cooling from industry are sent to waste heat/cooling profile database and mapped to relevant profile
C34	Community	Industry/ Municipality/ ESCO - Software	Industry waste heat and cooling profile sent to iVN	iVN, Waste heat/cooling industry profiles database	All data relating to waste heat and cooling supply from industry in the local area	All manufacturing facilities identified in the local area have a waste heat/cooling profile in the iVN
C35	Community	Industry/ Municipality/ ESCO – User/ Consultant	Set up existing in iVN - Data entered in the iCD regarding energy supply which is already stored in iCIM is sent to iVN and mapped to the asset library and infrastructure databases for energy supply.	iCIM, iVN, Asset library, infrastructure database	Map data on energy supply from iCIM to installations and generation profiles from Asset library and Custom installations. Add existing network constraints from infrastructure database	Existing supply installations and constraints
C37	Decision Support	Industry/ Municipality/ ESCO- User	View community baseline which shows the dynamic local energy consumption and supply network,	iVN, iCIM, SO WHAT portal	All energy demand and supply baseline results data	The User is presented with a baseline which shows the dynamic local energy consumption and supply network, including where

			including where waste heat/cooling is generated.			waste heat/cooling could potentially be located.
C38	Decision Support	Industry/ Municipality/ ESCO- User	Select scenarios/ KPIs to simulate. See D2.6 for details of scenarios and the methodology for their selection.	SO WHAT portal, iVN	List of relevant scenarios, KPIs and available benchmarks.	User has selected the scenario to simulate , the KPIs they wish to see and the benchmarks available to compare the results to.
C45	Decision Support	Industry/ Municipality/ ESCO - User	Compare several scenario simulation results side by side	iCIM, Value Choice tool	All simulated scenarios, results, KPIs	User is able to view and Compare several scenario simulation results side by side to understand which will best suit the users requirements and preferences
C46	Decision Support	Industry/ Municipality/ ESCO - User	View the most viable business models to implement in order to finance the appropriate solutions.	Business Model Guide	All simulation results. Filter logic to show suitable business models.	User is able to view and select different business models to understand which is most appropriate for their needs.

5 Demo Site and Stakeholder feedback process

The SO WHAT Tool development will follow an 'Agile Software Development' methodology, whereby small chunks of software are specified and developed before being tested by the end users for feedback. It is collaborative and iterative, with internal testing first done by the developers to make sure the coding is correct, followed by testing by the SO WHAT demo sites to ensure the software performs as expected in the real world. Other stakeholders will be able to feedback on the software via conferences, webinars and training sessions as the project moves to the replication stage. The diagram below outlines this process:

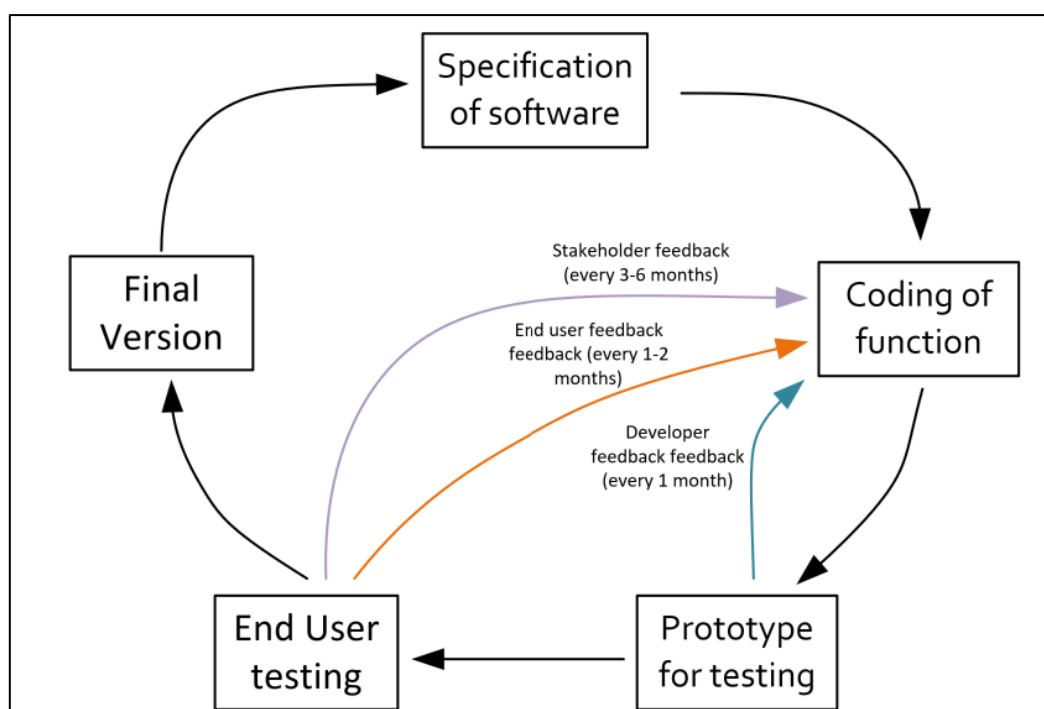


Figure 11 Agile Development Process

In terms of the demo site testing and feedback, as each function of the software is developed, specific demo sites of the project will be asked to test and feedback on that development. The table below demonstrates the breadth of different industrial sectors and countries that will be used to validate the Tool.

Table 5 Fit of Demo Sites to test and feedback on specific areas for software development

Name	Sector	Country	Module for development & feedback
LIPOR Maia Incineration Plant	Waste to Energy	Portugal	Community
UMICORE Rare material Centre	High tech manufacturing	Belgium	Manufacturing
GOTEBORG Multi Waste Heat District Heating Network	Refinery, Waste to Energy, District Heating Network	Sweden	Community

Pulp Mill District Heating Network VEAB	Pulp, District Heating Network	Sweden	Community
ISVAG Incineration	Waste to Energy	Belgium	Community
IMERYS Carbon black manuf.	Chemicals	Belgium	Manufacturing
M&R Pessione Distillery	Food & Beverage	Italy	Manufacturing
MPI steel pilot	Steel	UK	Manufacturing
Petromida refinery	Refinery	Romania	Manufacturing
Constanta District Heating Network	Various industrial sectors, District Heating Network	Romania	Community
ENCE Pulp mill	Pulp	Spain	Manufacturing

6 Conclusions and Next Steps

This report has summarised the SO WHAT tool functionalities as developed in WP2 so that they can be understood by stakeholders. An explanation of the origin of the software to be developed was first given, followed by a high-level overview of the key functions the software will perform. And which users are likely to perform them. An explanation was also given in the proposed split in the tool functions concerning the need for online and advanced versions of the tool. As WP2 activities also focussed on ensuring a workflow between the functions could be followed, and which software would perform each function, this has also been summarised. The demo sites and industrial sectors in the project have been highlighted and the process for end user and other stakeholders to feedback on the software has been explained.

This report is seen as the conclusion of WP2 activities, and the specifications and functions explained within it will now feed into WP SO WHAT Tool development, and will also annex the presentation.


As part of this deliverable, a presentation has also been produced that will enable the content of this report to be explained to stakeholders. It has already been used as part of a webinar and will be continuously updated through the rest of the project. This presentation is show in the Annex and will be available and continually updated and improved during the project lifetime and made available on the project website.

Annex – SO WHAT Tool Summary Presentation

Slide 1



Slide 2



Objectives of This Presentation

1. Users the tool and context
2. Overview of tool and functions
3. Online (Free) vs Advanced (Commercial) versions
4. Industrial Sectors Covered
5. Timeline
6. User Workflows
7. Current Progress



This Project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N. 847097

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Slide 3



About the Project

Objective is to develop and demonstrate a market ready integrated software which will:

- Support industries & energy utilities in simulating & comparing alternative Waste Heat and Waste Cold (WH/C) technologies
- Simulate how to balance the local forecasted H&C demand and supply
- Include RES integration.


Start: Jun 2019. End: May 2022

Consortium: 7 countries, 21 partners, 11 demo sites


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Slide 4



Integrated SO WHAT Tool - supported by online workflow

Baseline Waste Heat/Cooling Industry/Community	Simulation of Technologies & Scenarios	Reporting & Decision Support
Minimal Data Collection via Energy Asset Audit Portal	Methodology for scenario & technology selection	KPIs to suit user focus (financial, energy, environment)
Industrial energy flow and waste h/c baseline	Modelling of technologies to recover and reuse waste h/c within factory	Compare scenarios to optimise solutions
Community heat & power supply baseline	Modelling of ways to reuse waste h/c at Community scale	Business Model & Energy Performance Contracting Guidance
Community heat & power demand baseline	Modelling of how to integrate waste h/c with RES	KPI Panel & Dashboard for Results Visualisation to suit different users
3D View of Individual site or Community	Balance local forecasted h/c demand with supply	Automated M&V software to allow ongoing reporting


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Slide 5

soWHat

Who will use the Tool & in What Context?

1. **Industry** - Operation/Energy Manager of Industrial Facilities will use the tool to understand the potential to:
 - Recover waste heat/cooling and use within the factory
 - How waste heat can be used to supplement renewable energy systems
 - Recover waste heat/cooling and supply it local community
 - Where waste heat/cooling could be purchased from in the local community
2. **Municipality / Regional Energy Agencies / Public Authorities** - will use the tool to understand:
 - Supply areas with waste heat/cooling
 - Where there is demand for waste heat/cooling
 - Areas for integrating waste heat/cooling with Renewable Energy technologies.
3. **ESCOs / DH Operators** - will use the tool to:
 - Recognize which solutions relating to waste heat/cooling in a community would best suit the business models they operate under.
 - Assess the costs/risks of any investments required



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soWHat

Integrated SO WHAT Tool - supported by online workflow

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Slide 7

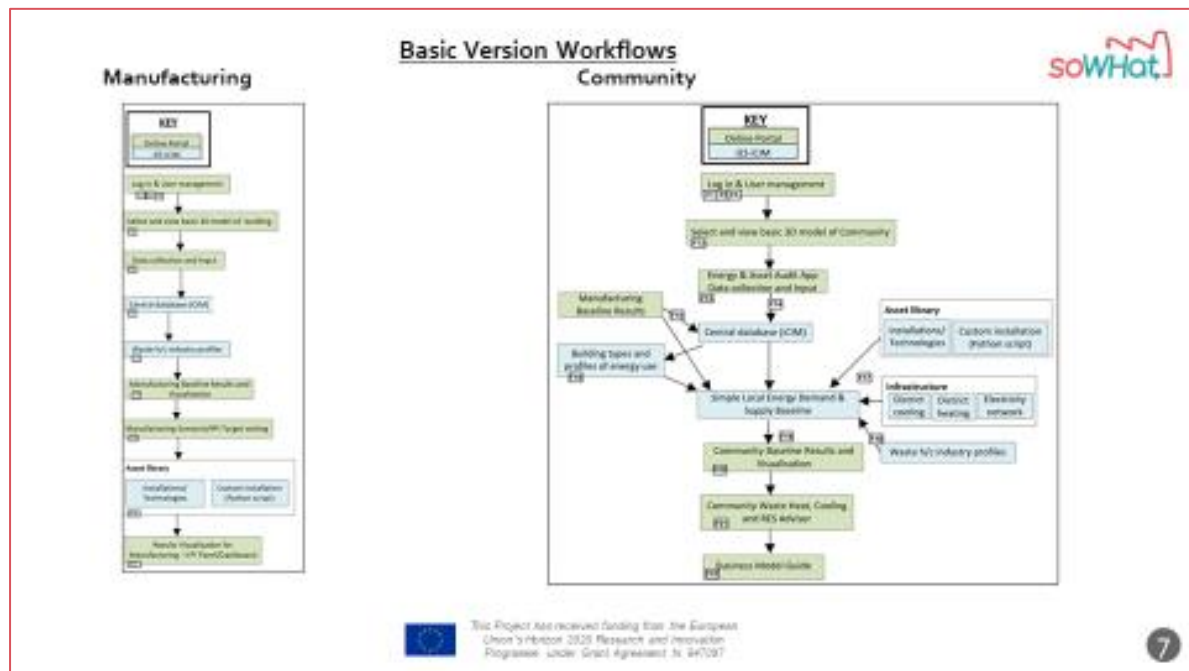
Online vs. Advanced Versions			soWHAT
Usability/Functionality	Basic	Advanced	
Form of Access to SO WHAT Tool	Free	Paid	7
Online or Desktop	Online	Desktop	
Availability of expert consultant to support user	✗	✓	
Online workflow to guide user through each step	✓	✓	
3D Building / Community View	✓	✓	
Industrial waste heat / cooling assessment based on industry profile or detailed assessment	Profile	Assessment	
Results visualisation of waste heat/cooling potential	Basic	Detailed	
Ability to select technologies/scenarios, & associated energy, environmental & financial KPIs to simulate	✓	✓	
Simulation of potential waste heat recovery to be used in same factory	Basic	Detailed	
Visualise local community energy consumption & supply sources	Basic	Detailed	
View uses for waste heat/cooling in community & how to balance local waste heat supply with demand	Basic	Detailed	
Ability to understand/view how this is integrated with RES	✗	✓	
KPIs panel & dashboard suited to different users	Basic	Detailed	
Business model guide	Basic	Detailed	
Automated M&V software to allow ongoing reporting	✗	✓	

Slide 8

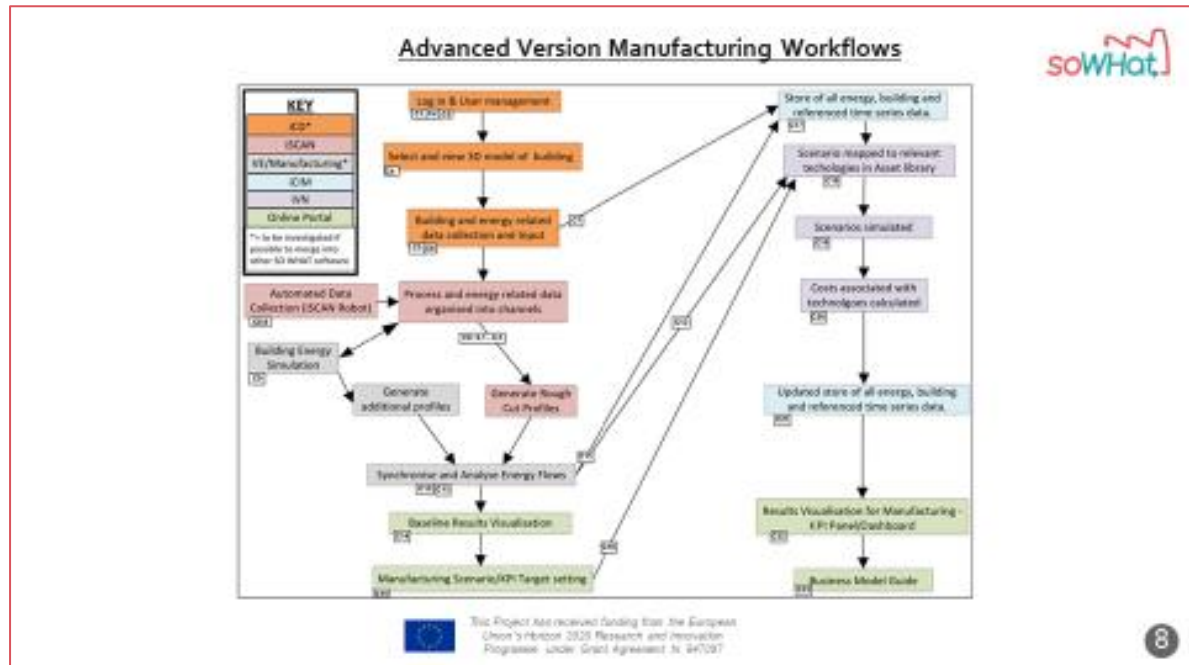
Demo Sites				soWHAT
Name	Sector	Country	Module for WP4 development & feedback	
LIPOR Maia Incineration Plant	WtE	Portugal	Community	8
UMICORE Rare material Centre	High tech manufacturing	Belgium	Manufacturing	
GOTEBORG Multi WH DHN	Refinery, WtE, DHN	Sweden	Community	
Pulp Mill DHN VEAB	Pulp, DHN	Sweden	Community	
ISVAG Incineration	WtE	Belgium	Community	
IMERYS Carbon black manuf.	Chemicals	Belgium	Manufacturing	
M&R Pessione Distillery	Food & Beverage	Italy	Manufacturing	
MPI steel pilot	Steel	UK	Manufacturing	
Petromida refinery	Refinery	Romania	Manufacturing	
Constanta DHN	Various industrial sectors, DHN	Romania	Community	
ENCE Pulp mill	Pulp	Spain	Manufacturing	



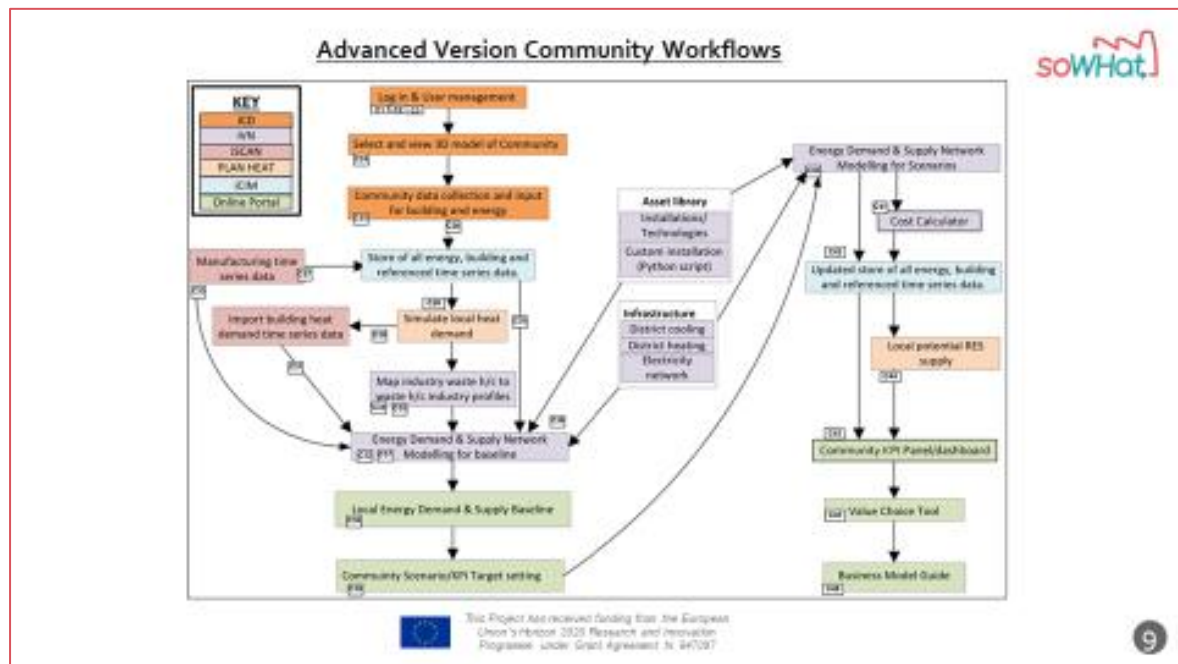
Slide 9



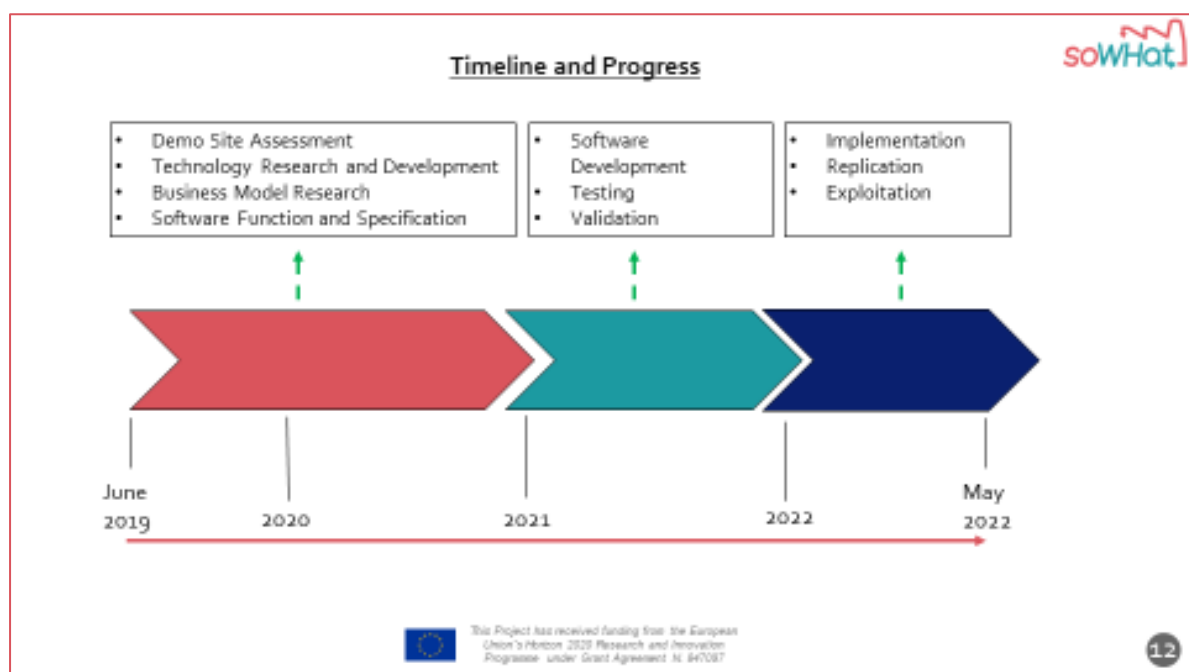
Slide 10



Slide 11



Slide 12



Slide 13

Data Collection, Entry & Organisation

Collection

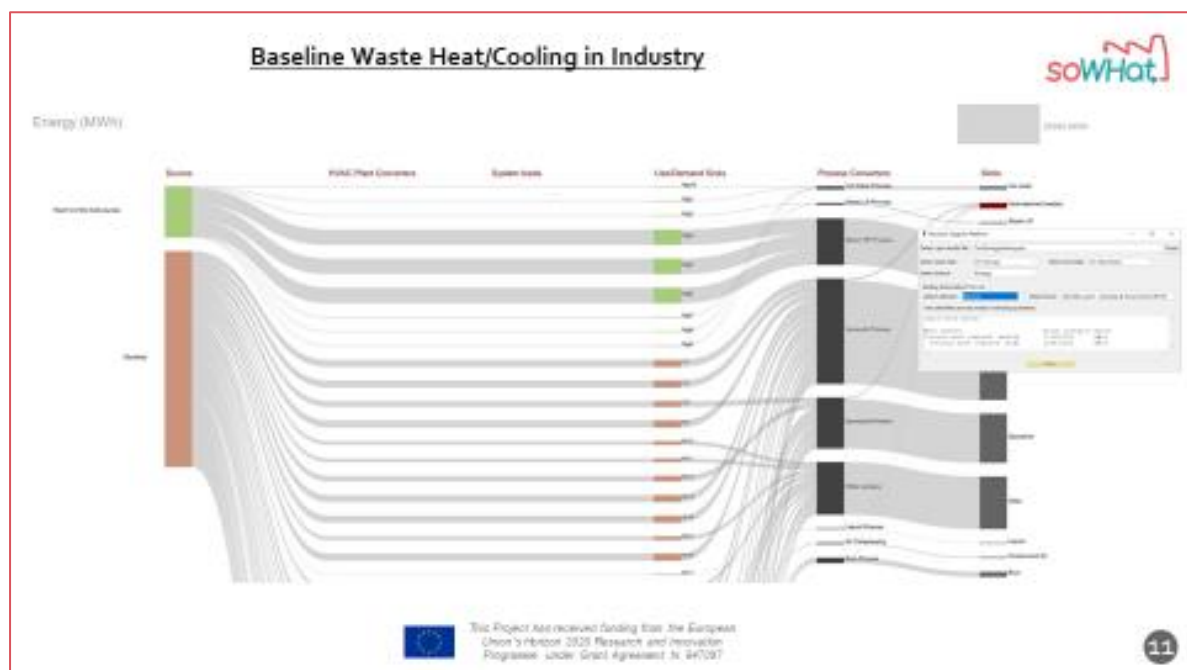
Data source	Data type
1. Demo site data checklist	List of sub-meter
2. Energy audit report	Sub-meter energy source type
3. Energy consumption sub-metering and production monitoring system file (Excel)	Rated power (kW) and monthly energy consumption (kWh)
	Operational schedule
	Process category and type
	Product category
	End-use category and type
4. Process technical datasheet	Process annual energy flows

Entry

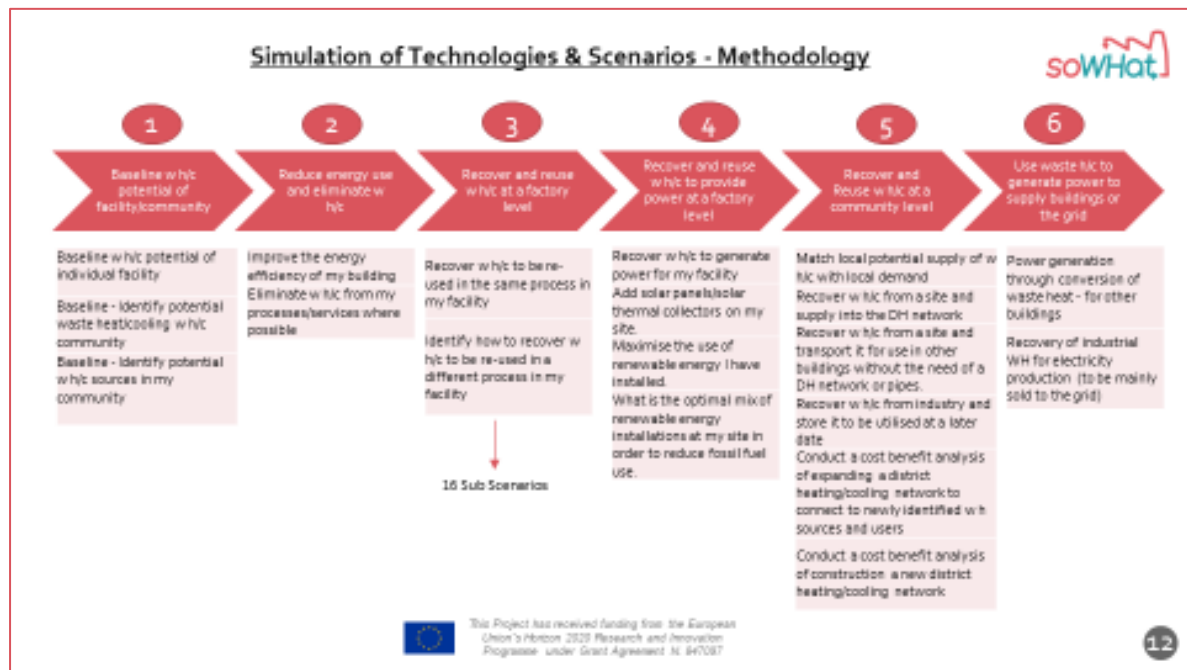
Organisation

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Slide 14



Slide 15



Slide 13



Slide 17

