





WEBINAR NOTICES



This session is being recorded





This is an interactive session, please, participate



Please, make sure your microphone is muted



Use the chat function to enter your questions



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

WEBINAR AGENDA

14.00-14.05 Welcome and introduction to the session. Mariana Fernández Sustainable Innovations

14.05-15.00 SO WHAT tool. Approach, functionalities and tutorial. Nick Purshouse. IESVE

15.00-15.45 Feasibility tool. Live demonstration. Bob de Maijer. Kelvin Solutions

15.45-16:15 Panel discussion with stakeholders. Feedback and Q&A.

16.15-16:20 Wrap up and end of session.







ABOUT

The project

SO WHAT is developing and validating, through different sector and countries real industrial test cases, an integrated software for auditing industrial process, planning and simulation of waste heat and cold (WH/C) valorisation systems towards the identification of economically viable scenarios where WH/C and renewable energy sources (RES) cooperate to match local demand.

CONSORTIUM













































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SO-WHAT-PROJECT



SOWHAT_PROJECT

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About the SO WHAT Tools



Key Objective:

 Develop & demonstrate market ready integrated software which will simulate Waste Heat and Cooling (WH/C) technologies at single site and community scale.

Online Tool

- Free, easy to use, user to collect & enter as little data as possible
- A starter/guide to allow the user to understand the rough potential before conducting detailed analysis

Advanced Tool

- Desktop based, requires expertise to set up models
- Can simulate waste heat/cooling technologies, district heating/cooling networks
- Technical and economic analysis/ decision support







Who Will Use The Tool & In What Context?



- Industry Operation/Energy Manager of Industrial Facility wants to know how 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. <u>Municipality / Regional Energy</u>
 <u>Agencies / Public Authorities</u> wants 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. <u>ESCOs / DH Operators</u> – wants 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.

DEMO SITES



Name	Sector	Country	User perspective
LIPOR Maia Incineration Plant	Waste to Energy	Portugal	Community
UMICORE Rare material Centre	High tech manufacturing	Belgium	Manufacturing
GOTEBORG Multi WH DHN	Refinery, Waste to Energy, District Heating Network	Sweden	Community
Pulp Mill DHN 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 DHN	Various industrial sectors, District Heating Network	Romania	Community
ENCE Pulp mill	Pulp	Spain	Manufacturing











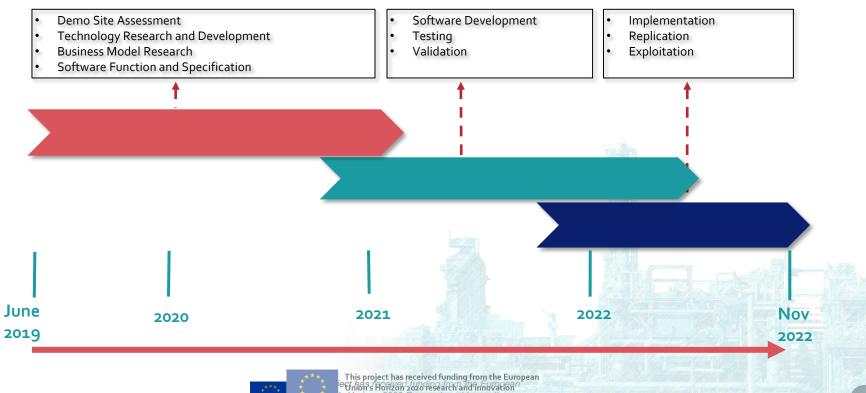








TIMELINE AND PROGRESS



's programme under Grant Agreement N. 847097
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SO WHAT Online Tool

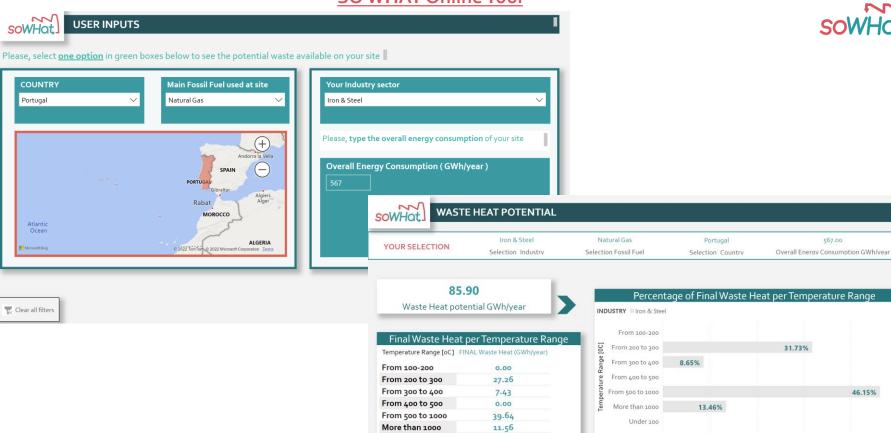


Status:

- Ready for testing and validation for sites
- Economic analysis to be completed
- Community module to be completed
- Fully functional and live by start of July



SO WHAT Online Tool





Clear all filters

Under 100

Click here for detail on how this was calculated

0.00

Now that you know the potential waste heat,

30%

40%



20%

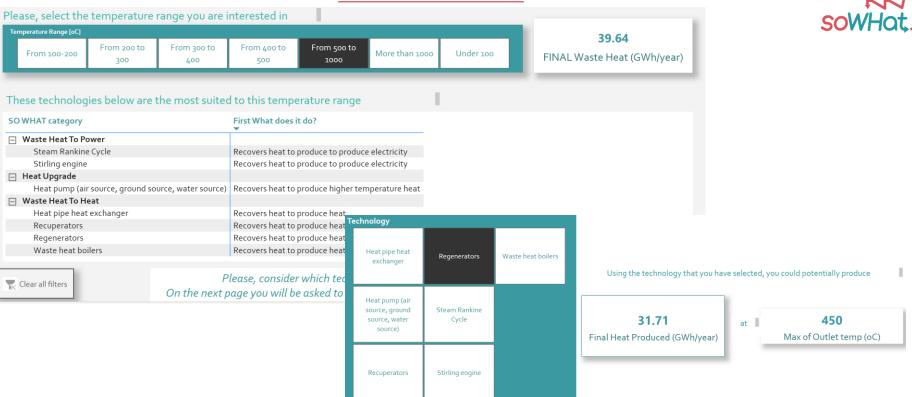
10%

do you want to do with it?



50%

SO WHAT Online Tool





SO WHAT Advanced Tool



INTEGRATED SO WHAT TOOL – SUPPORTED BY ONLINE WORKFLOW

Baselin	e Waste Heat/Cooling
Industr	y/Community

Simulation of Technologies & Scenarios

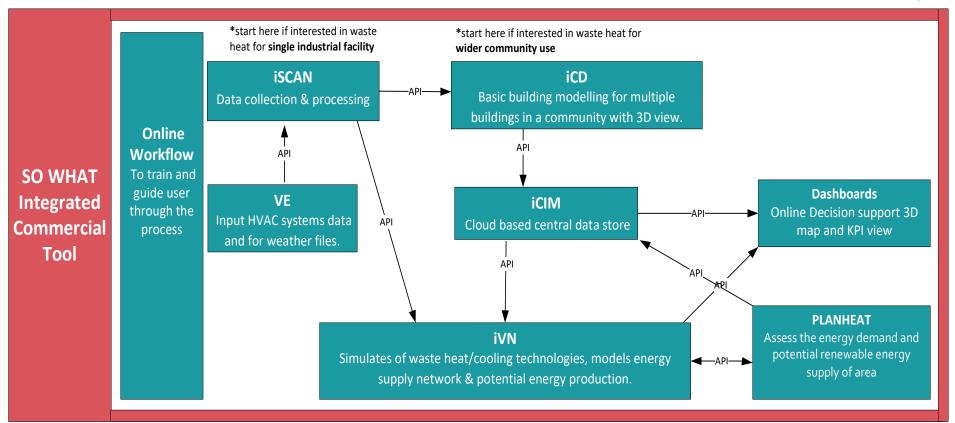
Reporting & Decision Support

KPI Dashboard for Results Visualisation to suit Modelling of waste h/c technologies Minimal Data Collection different users Waste h/c baseline Modelling of ways to reuse waste h/c at Compare scenarios to optimise solutions Community scale Modelling of how to integrate waste h/c with Community heat & power supply baseline Business Model & Energy Performance RES **Contracting Guidance** Community heat & power demand baseline Balance local forecasted h/c demand with Automated M&V software to allow ongoing reporting supply

3D View of Individual site or Community

SO WHAT Advanced Tool – Integrated software

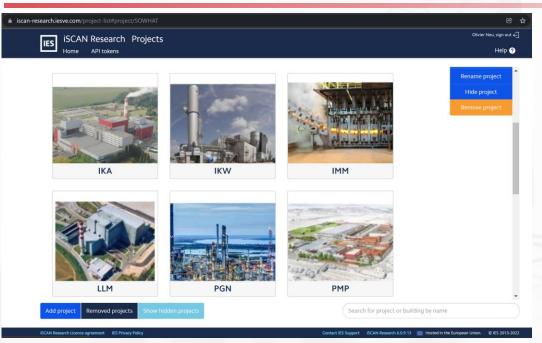






SO WHAT advanced tool - iSCAN (intelligent Control & Analysis)

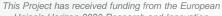




Use Case	Data Available	Minimum additional information required
1	Utility bill data only	Description of processes & services via diagrams or otherwise Description of inputs & outputs, product flows / temperatures, production calendar High-level information on daily profiles to inform rough-cut profiles
2	Partial sub-metering only	Description of processes & services via diagrams or otherwise Description of inputs & outputs, product flows / temperatures, production calendar High-level information on daily profiles to inform rough-cut profiles, where required Information on what inputs/outputs the sub-metering relates to
3	Utility bill & partial sub-metering	Description of processes & services via diagrams or otherwise Description of inputs & outputs, product flows / temperatures, production calendar High-level information on daily profiles to inform rough-cut profiles Information on what inputs/outputs the sub-metering relates to
4	Detailed sub-metering time series	Description of processes & services via diagrams or otherwise Description of inputs & outputs Information on what inputs/outputs the sub-metering relates to
5	Utility bill & detailed sub-metering time series	Description of processes & services via diagrams or otherwise Description of inputs & outputs Information on what inputs/outputs the sub-metering relates to

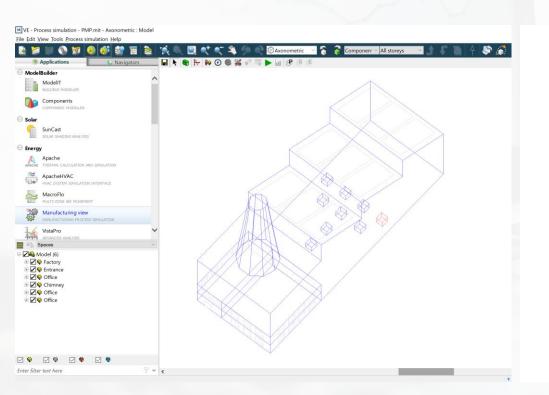


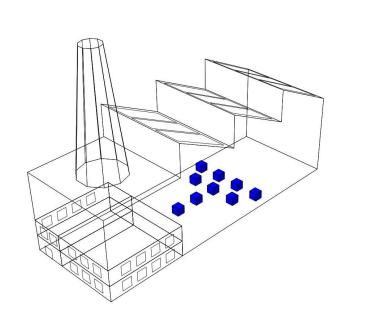




SO WHAT advanced tool – VE (Virtual Environment)



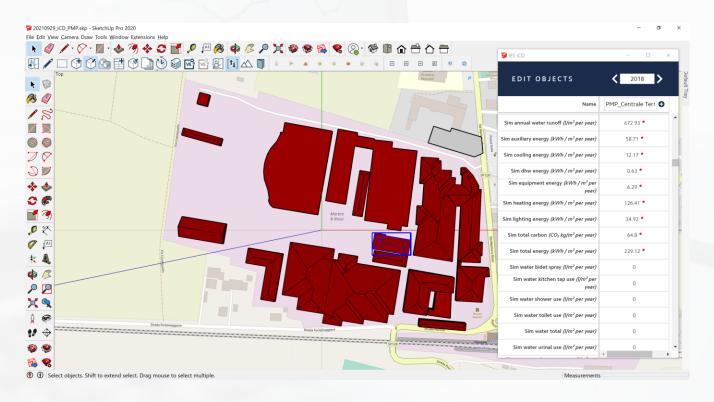






SO WHAT advanced tool – iCD (intelligent Community Design)

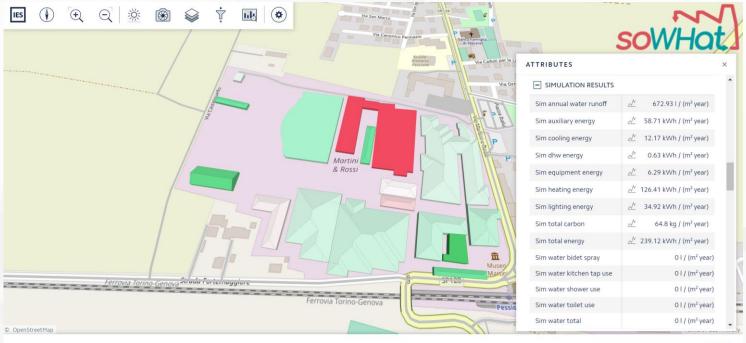






SO WHAT advanced tool – iCIM (intelligent Community Information Model)





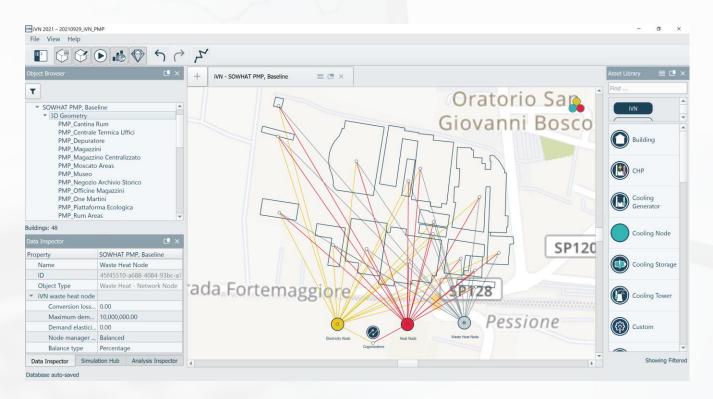
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SO WHAT advanced tool – iVN (intelligent Virtual Networks)

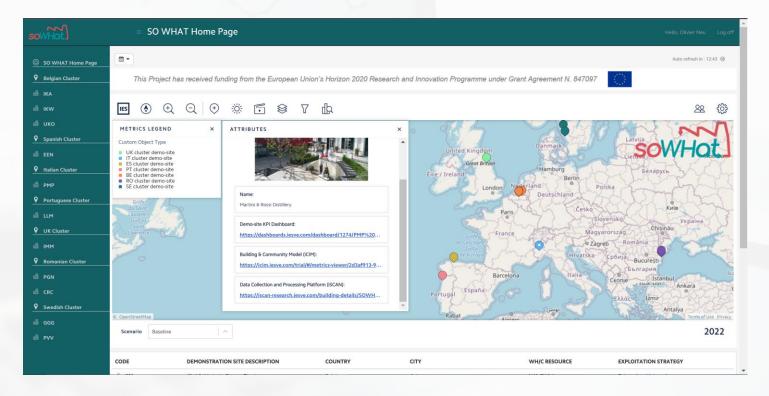






SO WHAT advanced tool – iDashboards (Decision Support) – **Project Homepage**

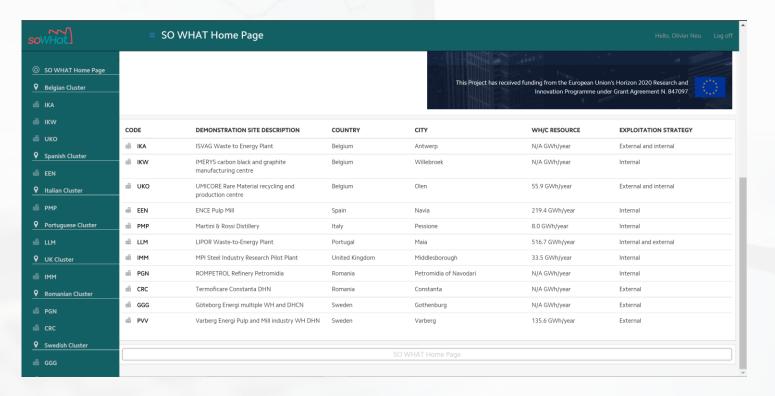






Get to see the SO WHAT advanced tool – iDashboards (Decision Support Tool) – Project Homepage

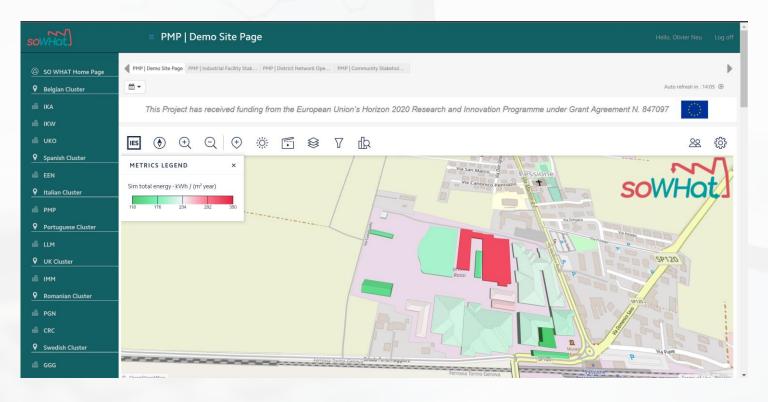






SO WHAT advanced tool – iDashboards (Decision Support) – Demo-site Homepage

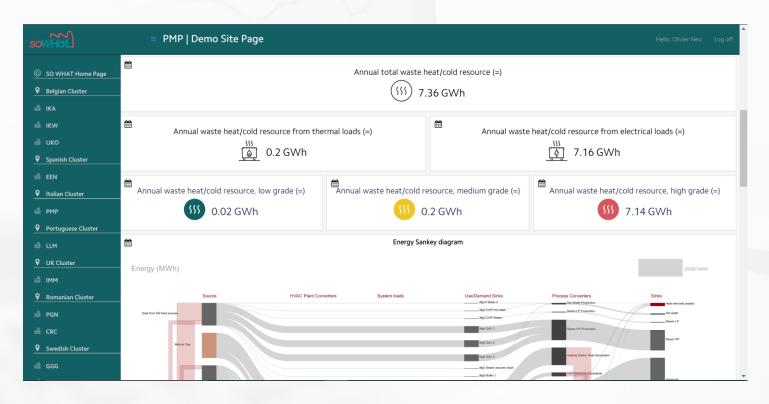






SO WHAT advanced tool – iDashboards (Decision Support) – Demo-site Homepage WH/C resource breakdown

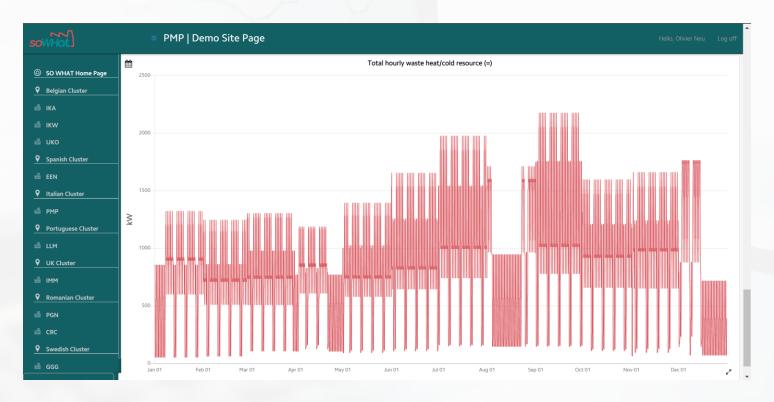






SO WHAT advanced tool – iDashboards (Decision Support Tool) - Demo-site Homepage WH/C resource time-series







SO WHAT advanced tool – coming soon.....



- Economic analysis and business model functionality
- Completion of Dashboards for Financial and Community users
- Full feasibility studies of most appropriate technologies from the demo sites
- Replication studies on further potential sites
- Launch of the SO WHAT Advanced Tool as Commercial Software



METHODOLOGY FOR SIMULATION OF TECHNOLOGIES

HU

Heat Upgrade

Baseline w h/c potential of

Reduce energy use and eliminate w h/c

Recover and reuse w h/c at a factory level

Recover and reuse w h/c to provide power at a factory level

Recover and Reuse w h/c at a community level

Use waste h/c to generate power to supply buildings or the grid

1. Waste h/c supply individual facility

- 2. Waste h/c supply community
- 3. Waste h/c demand community
- 1. Improve the energy efficiency of building 2. Eliminate w h/c from

processes

- 1. Recover w h/c and re-use in the same process
- 2. Recover w h/c to be re-used in a different process
- 1. Recover w h/c to generate power for facility 2. Add solar PV/solar thermal collectors on site 3. Maximise use of renewable energy installed
- 4. Calculate optimal mix of renewable energy installations at site
- 1. Match supply with demand 2. Recover w h/c from site and supply into the DH network
- 3. Recover w h/c and transport it to another building without using DH network or pipes.
- 3. Recover w h/c and store it
- 5. Cost benefit analysis of expanding DH network to new waste h sources

WHTC

Waste Heat to Cold

4. Cost benefit analysis of constructing new district network

- 1. Power generation through conversion of waste heat - for other buildings
- 2. Power generation through conversion of waste heat - for the grid

This project has received funding from the European Union's Horizon 2020 research and innovation

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WHTH Waste Heat to Heat - District Heating heat exchagners; Condensation recovery: - Economizers; Waste Heat Boilers: - Recuperators; - Regenerators: - Heat pipe exchangers Available

Progra

Thermal Energy Storage - On site sensible; - On site latent. Available - Off site latent: - Off site thermochemical. Near to market

TES

- Sorption chillers. Availabl

- Steam Rankine Cycle; - Heat Pumps - Organic Rankine Cycle. Available Available - Kalina Cvde:

- Piezoelectric Power Generation: - Thermo Photovoltaic Generator: -LAES;

- Thermoelectric materials

WHP

Waste to Power

- Stirling Engine;

- Daerman Engine/LAES

Near to Market



TARGETS

- 1. SO WHAT will ensure a maximum prediction error in energy recovery estimate and CBA results between 5% and 10%.
- 2. SO WHAT will reduce the cost and time related to Energy Audits, and thus WH/C recovery projects, up to 0.4 €/m2 and 3-5 day/audit (number of visits reduction)
- 3. SO WHAT will progressively increase the number of new project on industrial WH/C recovery, resulting in 27,705 accumulated projects by 2030.
- 4. SO WHAT will reach at least 36 industrial sites, including 24 SPIRE industries, 4 industrial parks, 12 public authorities, including 16 energy agencies, 12 DHC operators (energy companies), 24 associations and 4 RTO by 2021.
- 5. SO WHAT is expected to trigger the creation of around 2,815 new jobs between 2023 and 2030.









Objectives

- Objective is to develop full feasibility studies for the demo sites.
- These should not only focus on technical issues but also on commercial and economical/financial issues.
- Also the evaluation of CAPEX, OPEX, revenues, return of investment as well as primary energy savings and avoided GHG
 emissions are taken into account
- We developed a standardized way (facilitated by template) to perform feasibility studies of demo cases. Standardized inputs will guarantee a maximum of reliable output(s).

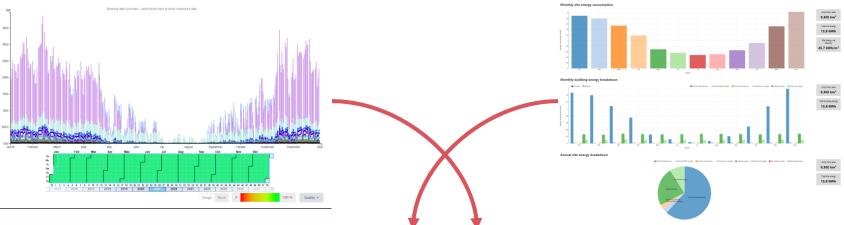


Methodology Feasibility studies

- Develop a standardized way (facilitated by template) to perform feasibility studies of demo cases
- Standardized inputs → maximum of reliable output(s)
- Inputs:
 - Output So what tool: Using primary energy saving vectors as input
 - Take in account of production loss of other energy vectors (e.g. CHP)
 - Quantifying cost of Energy Vectors (for both savings as production loss), big variations between countries
 - (Local) Financial parameters (tax, runtime, interest rate, emission rights, WH gains)
 - Phasing of energy savings
 - Investments to attain energy savings by implementing WH or RES
 - Operational income and expenses by implementing WH or RES



Methodology Feasibility studies: inputs

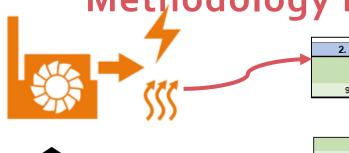


		<u> </u>			
1. Energy reduction /Energy replaced by Waste Heat (WH) or Renewable Energy Source (RES)					
	Energy content		Potential energy	Vector to heat	
vector	(GJ primairy/unit)	(kg CO ₂ / GJ_primair)	reduction per year	efficiency	
1 Natural gas (MWh-LF	1V) 4	56	38.044	85%	
2	#N/E	₽ #N/B			
3	#N/E	#N/B			
4	#N/E	#N/B			
5	#N/E	#N/B			
6	#N/E	#N/B			
7	#N/E	#N/B			
8	#N/E	#N/B			





Methodology Feasibility studies: inputs



2. Decrease in electricity production because of energy-output reduction (Energy replaced by WH/RES)				
	energie-inhoud Potential energy			
vector	(GJ primair/eenheid) (kg CO ₂ /	GJ_primair) loss per year		
9 Electricity (MWh)	9	44 -10.350		



Financial				
Corporate taks	25%			
Runtime model	30	years		
Interest rate	4%			
CO ₂ -emission rights	58	€/ton_CO2		
Cost for WH/RES	0	€/MWh_heat		



	Parameters		
	Energy cost		
Energy reduction /Energy replaced	by Waste Heat (WH) or Renewable Energy	Source (RES)	
Energy vector 1 Natural gas	commodity cost [€/MWh]	27,23	
Energy vector 1 Natural gas	non-commodity cost [€/MWh]	0,88	





	Overview of benefits from avoided CO2-emissions						
1	Estimation per year						
		Unit	0	1	2	3	4
	Natural gas reduction	MWh-HHV		21.222,00	48.870,00	108.274,00	108.274,00
	#WAARDE!	#WAARDE!					
	#WAARDE!	#WAARDE!					

Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N. 847097



Methodology Feasibility studies: inputs

BUDGET	7.249.550,00€
Omschrijving budgetpost	
	Bedrag (€)
Direct Cost	6.277.550,00
Energy station ISVAG	1.364.950,00
Equipment	280.000
Valves and measurements	40.000
Piping	240.000
Electric wiring and automation	580.000
Acceptance and documantation	20.350
Civil works	204.600

Pipes district heating network	3.722.600,00
Piping	3.600.000
Glassfibre communication	75.000
Acceptance and documantation	22.000
Soil investigation	25.600

Connection Atlas Copco	1.190.000,00
Pipes	760.000,00
Substations	430.000,00

Indirecte kosten	972.000,00
Engineering	210.000,00
Construction supervision	300.000,00
Project management	402.000,00
HSE	60.000,00

TOTAL COSTS	7 249 550 00 €

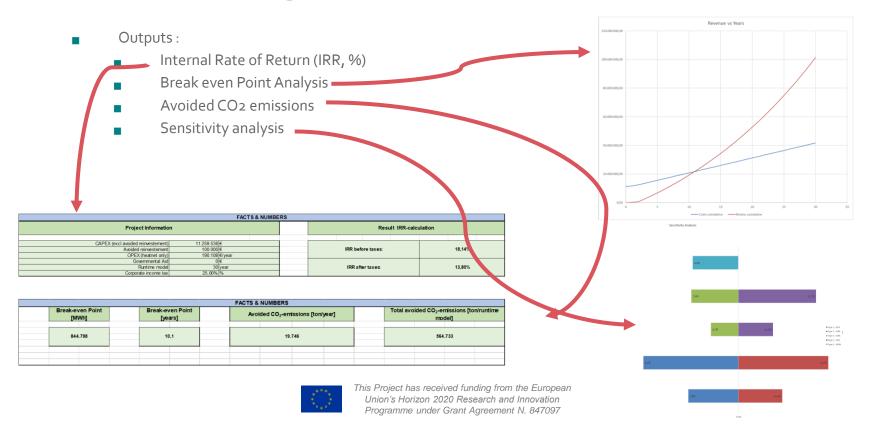
Total budget	7.249.550,00 €
Subsidy (%)	30,00%
Subsidy (€)	2.174.865,00 €
Total Cash (€)	5.074.685.00 €

	Subprojects		Phasing of the investement /project [over x years]	Cost Estimate Se [€] vit	nsiti Cost incl. y margin [€]
A	Waste heat recovery equipment e.g. heat exchangers, pumps, internal piping, valves, elektricity, buffer	10			0%
В	Distribution network / heat transportation netwerk e.g. piping, demin water, ground/soil disposal/removal, surface restoration	0			0%
С	Conversion and connection of heat network users e.g. internal piping, substation/heat exchanger @ user,	10			0%
D	Local support through subsidy or other means	1			0%
E	Additional back-up equipment				0%
			Installation year of current installation [year]	Cost Estimate new installati Se on [€] vit	nsiti Cost incl. y margin [€]
lir a fr	om Avoided costs - Equipment	20			(





Methodology Feasibility studies: Outputs



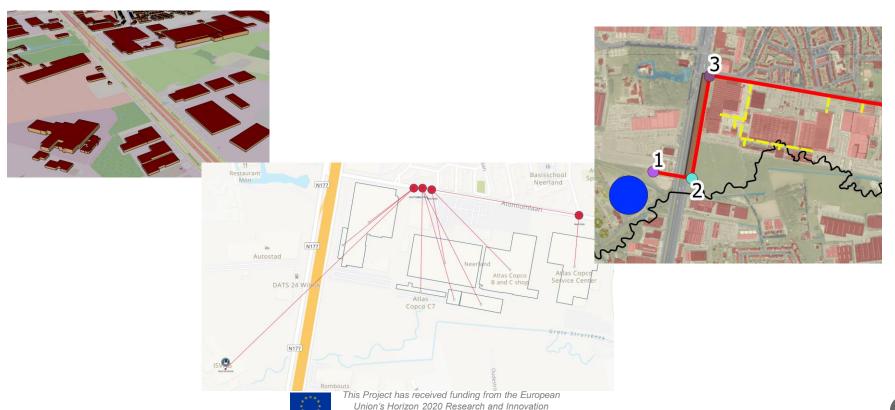


Methodology Feasibility studies: live demo

CASE:

- Source: Waste incinerator ISVAG CHP
- Demand: buildings Atlas Copco Airpower

Methodology Feasibility studies: live demo



Programme under Grant Agreement N. 847097



Methodology Feasibility studies: live demo

Live Demo and questions



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