EPAH working group session 2 - SCBA tool

03/12/2025

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Why do we need cost-benefit analysis?

1 **Optimising resource allocation** | CBA helps to assess the economic viability of different projects before they are implemented. By systematically comparing the costs and benefits of energy efficiency solutions against other energy investments, it helps policymakers and planners to prioritise measures that offer the greatest net benefits.

2 **Assessing wider impacts and sustainability** | In regional energy planning, it is important to consider the long-term impacts of energy decisions. CBA enables planners to assess the sustainability of energy efficiency investments by quantifying not only direct financial savings, but also wider costs and benefits.

3 **Ensuring compliance with legal and policy requirements** | There are now strict legal requirements that mandate the use of CBA when dealing with the energy efficiency first principle. Meeting these requirements is key to successfully integrating energy efficiency into regional energy strategies and securing funding and support.

Some examples of CBA in EU legislation

Regulation (EU) 2018/1999, Art. 2(18)

'energy efficiency first' means taking utmost account in energy planning, and in policy and investment decisions, of alternative cost-efficient energy efficiency measures to make energy demand and energy supply more efficient, in particular by means of cost-effective end-use energy savings, demand response initiatives and more efficient conversion, transmission and distribution of energy, whilst still achieving the objectives of those decisions

Directive (EU) 2023/1791

Article 3(1) In accordance with the energy efficiency first principle, Member States shall ensure that energy efficiency solutions [...] are assessed in planning, policy and major investment decisions

Article 3(5) In applying the energy efficiency first principle, Member States shall (a) promote and, where cost-benefit analyses are required, ensure the application of, and make publicly available, cost-benefit methodologies that allow proper assessment of the wider benefits of energy efficiency solutions [...]

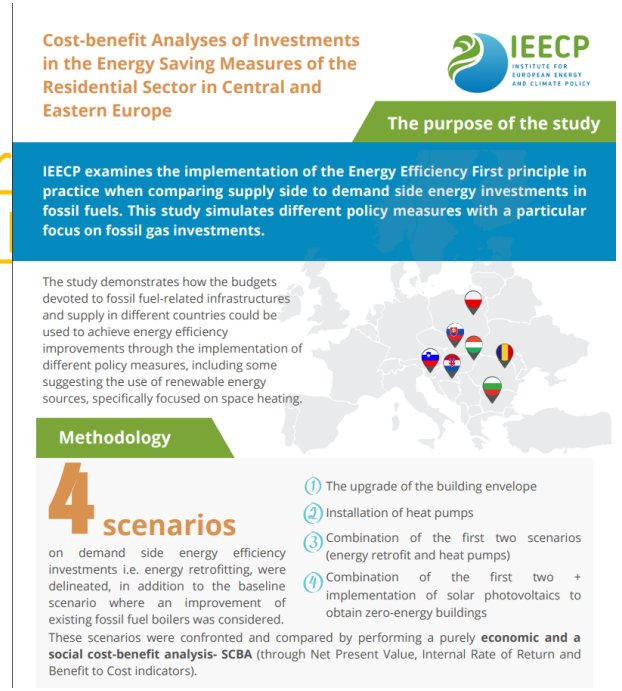
Article 25(3) For the purpose of the comprehensive assessment [...], Member States shall carry out a cost-benefit analysis covering their territory, [...] capable of facilitating the identification of the most resource- and cost-efficient solutions to meeting heating and cooling needs, taking into account the energy efficiency first principle.

...

Theoretical background of the tool

- Two types of CBA: (Original) CBA and Social CBA
- Original CBA: The **economic** impacts are identified, and the evaluation is performed taking into consideration the impacts of **national economy**. The analysis is based on changes in **market prices**.
- Social CBA: Includes **environmental** and **social** impacts.

Used for the study Cost-benefit Analyses of Investments in the Ener
Measures of the Residential Sector in Central and Eastern Europe - I

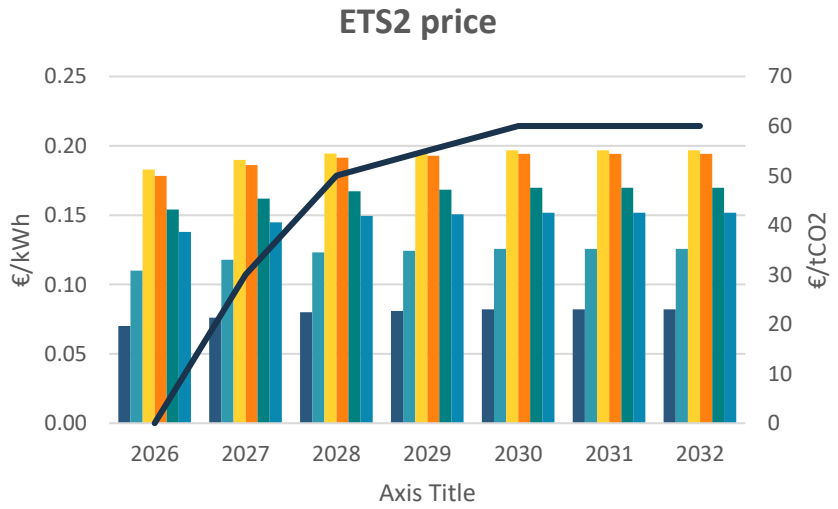


Externalities

Data	external cost €/MWh
Oil boiler-existing	51.0
Oil boiler-new	43.4
NG boiler-existing	36.0
NG boiler-new	32.2
HP-existing	36.0
HP-new	21.8
Electricity-current	48.5
PV-new	24.0
Solar-new	9.6
Coal boiler-existing	57.0
Biomass boiler-new	174.0

Capitalization rate		3.0%
Total cost savings		1,149,375
	Energy savings	1,149,375
	O&M savings	0
Building value increase-total		38,312,488

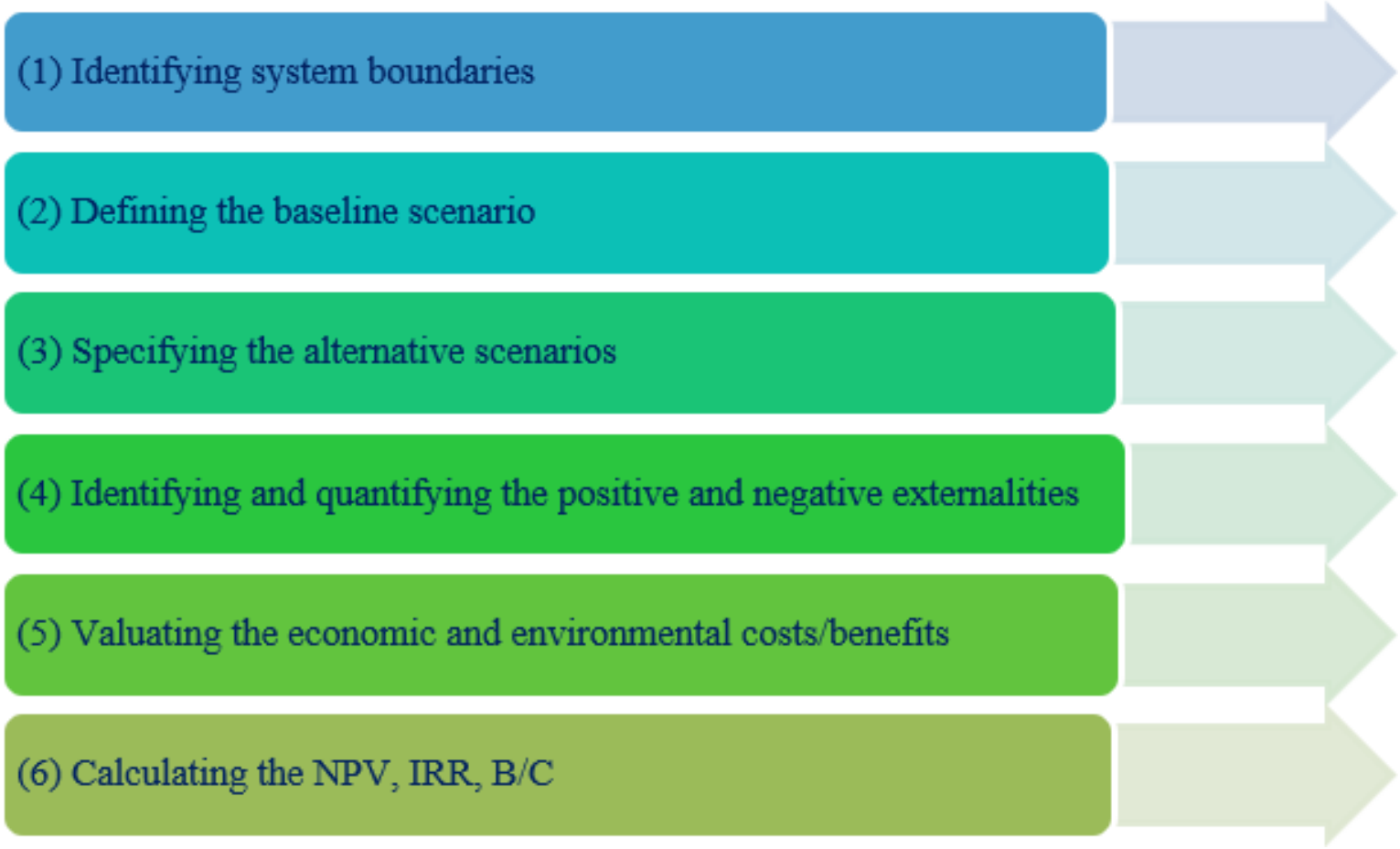
multiple benefits	external cost
Insulation + Windows + HVAC + Lighting	5
Insulation + Windows	4
Windows and/or HVAC and/or Lighting	3
Insulation and/or HVAC and/or Lighting	2
HVAC and/or Lighting	1



Theoretical background of the tool

Potential result of calculations	Financial NPV	Social NPV	Conclusions	Next steps
1st	≥ 0	≥ 0	Economically and socially beneficial to invest/implement projects/interventions.	Promoting these types of investments/interventions
2nd	≤ 0	≥ 0	Economically is not beneficial. However, socially is important to invest/implement the project/intervention.	Providing financial supports, e.g., subsidies, increasing municipality's equity share in the investment
3rd	≥ 0	≤ 0	Economically is beneficial to invest on a project and not socially beneficial.	Penalty for the investors and imposing the incentives that distribute the economic benefits among different groups, such as tax.
4rth	≤ 0	≤ 0	Economically and socially is not beneficial.	Stop the investments/interventions

Six steps


(1) Identifying system boundaries
(2) Defining the baseline scenario
(3) Specifying the alternative scenarios
(4) Identifying and quantifying the positive and negative externalities
(5) Valuating the economic and environmental costs/benefits
(6) Calculating the NPV, IRR, B/C

Scenarios

Scenario code	Assumptions
Sc0	Changing from existing energy mix to Natural gas (efficient gas boilers)
Sc1 Deep	Deep renovation (no changes in energy mix)
Sc1 Medium	Medium renovation (no changes in energy mix)
Sc2	Heat pump implementation
Sc3 Deep	Deep renovation + heat pump + PV
Sc3 Medium	Medium renovation + heat pump + PV

How to use the Excel tools in the REGIO1st framework?

Cover


REGIO1ST

IEECP INSTITUTE FOR EUROPEAN ENERGY AND CLIMATE POLICY

Social Cost-Benefit Analysis Tool (Regio1st SCBA tool)

REGIO1st Planning Framework
Stage 5 - Performing a Cost-Benefit Analysis
https://ieecp.org/projects/regio1st/

Date of last update 12/05/2025
Version number 1

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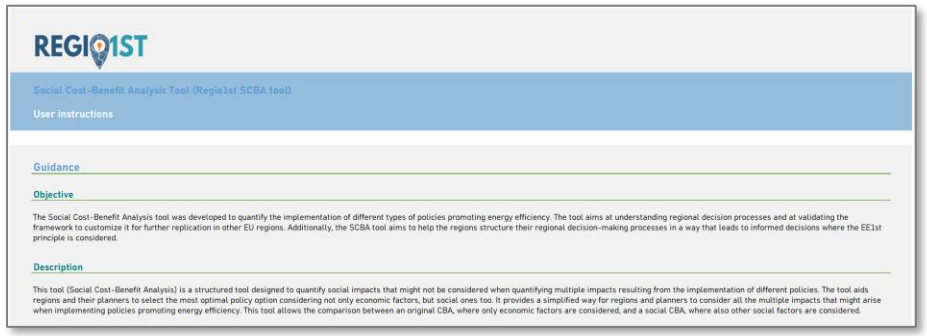
Instructions


REGIO1ST

Social Cost-Benefit Analysis Tool (Regio1st SCBA tool)

User instructions

Guidance

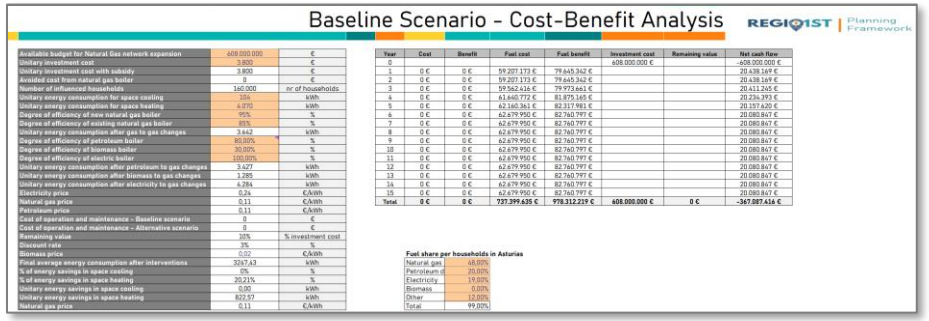
Objective

The Social Cost-Benefit Analysis tool was developed to quantify the implementation of different types of policies promoting energy efficiency. The tool aims at understanding regional decision processes and at validating the framework to customize it for further replication in other EU regions. Additionally, the SCBA tool aims to help the regions structure their regional decision-making processes in a way that leads to informed decisions where the EE1st principle is considered.

Description

This tool (Social Cost-Benefit Analysis) is a structured tool designed to quantify social impacts that might not be considered when quantifying multiple impacts resulting from the implementation of different policies. The tool aids regions and their planners to select the most optimal policy option considering not only economic factors, but social ones too. It provides a simplified way for regions and planners to consider all the multiple impacts that might arise when implementing policies promoting energy efficiency. This tool allows the comparison between an original CBA, where only economic factors are considered, and a social CBA, where also other social factors are considered.

User inputs


Baseline Scenario - Cost-Benefit Analysis

REGIO1ST | Planning Framework

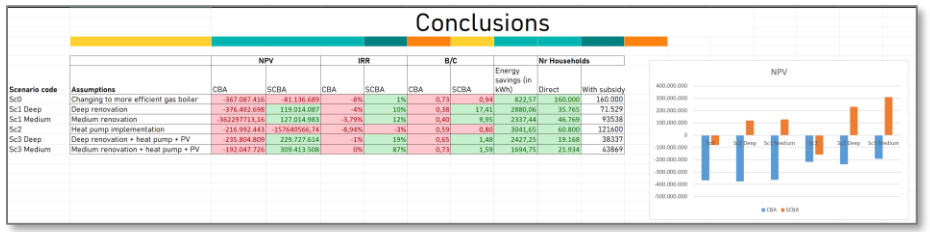
Available budget for Natural Gas network expansion	608.000.000	€
Unitary investment cost	3.800	€
Unitary investment cost with subsidy	3.800	€
Avoided cost from natural gas boiler	0	€
Number of influenced households	160.000	nr of households
Unitary energy consumption for space cooling	594	kWh
Unitary energy consumption for space heating	4.070	kWh
Degree of efficiency of new natural gas boiler	95%	%
Degree of efficiency of existing natural gas boiler	85%	%
Unitary energy consumption after gas to gas changes	3.642	kWh
Degree of efficiency of petroleum boiler	80,00%	%
Degree of efficiency of biomass boiler	30,00%	%
Degree of efficiency of electric boiler	100,00%	%
Unitary energy consumption after petroleum to gas changes	3.427	kWh
Unitary energy consumption after biomass to gas changes	1.285	kWh
Unitary energy consumption after electricity to gas changes	4.284	kWh
Electricity price	0,24	€/kWh
Natural gas price	0,11	€/kWh
Petroleum price	0,11	€/kWh
Cost of operation and maintenance - Baseline scenario	0	€
Cost of operation and maintenance - Alternative scenario	0	€
Remaining value	10%	% investment cost
Discount rate	3%	%
Biomass price	0,02	€/kWh
Final average energy consumption after interventions	3267,43	kWh
% of energy savings in space cooling	0%	%
% of energy savings in space heating	20,21%	%
Unitary energy savings in space cooling	0,00	kWh
Unitary energy savings in space heating	822,57	kWh
Natural gas price	0,11	€/kWh

Year	Cost	Benefit	Fuel cost	Fuel benefit	Investment cost	Remaining value	Net cash flow
0					608.000.000 €		-608.000.000 €
1	0 €	0 €	59.207.173 €	79.645.342 €			20.438.169 €
2	0 €	0 €	59.207.173 €	79.645.342 €			20.438.169 €
3	0 €	0 €	59.562.416 €	79.973.661 €			20.411.245 €
4	0 €	0 €	61.640.772 €	81.875.165 €			20.234.393 €
5	0 €	0 €	62.160.361 €	82.317.981 €			20.157.620 €
6	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
7	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
8	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
9	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
10	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
11	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
12	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
13	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
14	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
15	0 €	0 €	62.679.950 €	82.760.797 €			20.080.847 €
Total	0 €	0 €	737.399.635 €	978.312.219 €	608.000.000 €	0 €	-367.087.416 €

Fuel share per households in Asturias

Natural gas	48,00%
Petroleum d	20,00%
Electricity	19,00%
Biomass	0,00%
Other	12,00%
Total	99,00%

Final outputs for decision-support


Conclusions

Scenario code	Assumptions	NPV CBA	NPV SCBA	IRR CBA	IRR SCBA	B/C CBA	B/C SCBA	Energy savings (in kWh)	Nr Households Direct	Nr Households With subsidy
Sc0	Changing to more efficient gas boiler	-367.087.416	-81.136.689	-8%	1%	0,73	0,94	822,57	160.000	160.000
Sc1 Deep	Deep renovation	-376.492.698	119.014.087	-4%	10%	0,38	17,41	2880,06	35.765	71.529
Sc1 Medium	Medium renovation	-362297713,16	127.014.983	-3,79%	12%	0,40	9,95	2337,44	46.769	92538
Sc2	Heat pump implementation	-216.992.443	-157640566,74	-8,94%	-3%	0,59	0,80	3041,65	60.800	121600
Sc3 Deep	Deep renovation + heat pump + PV	-235.804.809	229.727.614	-1%	19%	0,65	1,48	2427,25	19.168	38337
Sc3 Medium	Medium renovation + heat pump + PV	-192.047.726	309.413.508	0%	87%	0,73	1,59	1694,75	21.934	43869

Baseline Scenario

REGIO1ST | Planning Framework

Baseline Scenario - Cost-Benefit Analysis

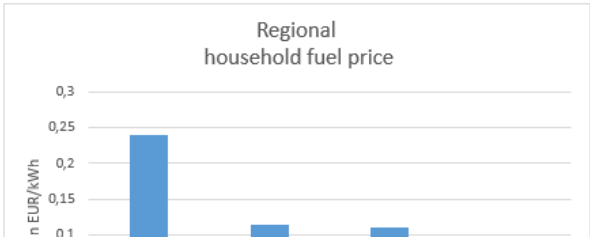
Instructions: all cells indicated in orange need to be filled in.

Available budget for Natural Gas network expansion	680.000.000	€
Unitary investment cost	2.000	€
Unitary investment cost with subsidy	2.000	€
Avoided cost from natural gas boiler	0	€
Number of influenced households	340.000	nr of households
Unitary energy consumption for space cooling	104	kWh
Unitary energy consumption for space heating	4.070	kWh
Degree of efficiency of new natural gas boiler	95%	%
Degree of efficiency of existing natural gas boiler	85%	%
Unitary energy consumption after gas to gas changes	3.642	kWh
Degree of efficiency of petroleum boiler	80,00%	%
Degree of efficiency of biomass boiler	30,00%	%
Degree of efficiency of electric boiler	100,00%	%
Unitary energy consumption after petroleum to gas changes	3.427	kWh
Unitary energy consumption after biomass to gas changes	1.285	kWh
Unitary energy consumption after electricity to gas changes	4.284	kWh
Electricity price	0,24	€/kWh
Natural gas price	0,11	€/kWh
Petroleum price	0,11	€/kWh
Cost of operation and maintenance - Baseline scenario	0	€
Cost of operation and maintenance - Alternative scenario	0	€
Remaining value	10%	% investment cost
Discount rate	3%	%
Biomass price	0,02	€/kWh
Final average energy consumption after interventions	3247,43	kWh
% of energy savings in space cooling	0%	%
% of energy savings in space heating	20,21%	%
Unitary energy savings in space cooling	0,00	kWh
Unitary energy savings in space heating	822,57	kWh
Natural gas price	0,11	€/kWh

Year	Cost	Benefit	Fuel cost	Fuel benefit	Investment cost	Remaining value	Net cash flow
0					680.000.000 €		-680.000.000 €
1	0 €	0 €	125.870.448 €	169.266.416 €			43.395.968 €
2	0 €	0 €	125.870.448 €	169.266.416 €			43.395.968 €
3	0 €	0 €	126.625.671 €	169.964.294 €			43.338.623 €
4	0 €	0 €	131.042.178 €	174.004.990 €			42.962.812 €
5	0 €	0 €	132.146.304 €	174.945.974 €			42.799.670 €
6	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
7	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
8	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
9	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
10	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
11	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
12	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
13	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
14	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
15	0 €	0 €	133.250.431 €	175.886.958 €			42.636.527 €
Total	**0 €**	**0 €**	**1.567.636.595 €**	**2.079.154.999 €**	**680.000.000 €**	**0 €**	**-168.481.595 €**

Fuel share per households in the region

Natural gas	48,00%
Petroleum de	20,00%
Electricity	19,00%
Biomass	0,00%
Other	12,00%
Total	99,00%



Scenario 1 Deep renovation

REGIO1ST | Planning Framework

Scenario 1 – Deep Renovation Cost-Benefit Analysis

Instructions: all cells indicated in orange need to be filled in.

Available budget for Natural Gas network expansion	680.000.000	€
Unitary investment cost	17.000	€
Unitary investment cost with subsidy	17.000	€
Avoided cost from natural gas boiler	0	€
Number of influenced households	40.000	number of households
Unitary energy consumption for space cooling	104	kWh
Unitary energy consumption for space heating	4.070	kWh
% of energy savings in space cooling	69%	%
% of energy savings in space heating	69%	%
Energy savings in space cooling	72	kWh
Energy savings in space heating	2.808	kWh
Electricity price	0,24	€/kWh
Natural gas price	0,11	€/kWh
Petroleum price	0,11	€/kWh
Biomass price	0,02	€/kWh
Cost of operation and maintenance - Baseline scenario	0	€
Cost of operation and maintenance - Alternative scenario	0	€
Remaining value	10%	% of investment cost
Discount rate	3%	%

NPV	-421.051.245
IRR	-4%
B/C	0,38

Fuel share per households in the region	
Natural gas	48,00%
Petroleum derivatives	20,00%
Electricity	19,00%
Biomass	0,00%
Other	12,00%
Total	99,00%

Subsidy	0%	%

Year	Cost	Benefit	Fuel cost	Fuel benefit	Investment cost	Remaining value	Net cash flow
0					680.000.000 €		-680.000.000 €
1	0 €	0 €	0 €	14.429.346 €			14.429.346 €
2	0 €	0 €	0 €	14.429.346 €			14.429.346 €
3	0 €	0 €	0 €	14.485.998 €			14.485.998 €
4	0 €	0 €	0 €	14.814.007 €			14.814.007 €
5	0 €	0 €	0 €	14.890.393 €			14.890.393 €
6	0 €	0 €	0 €	14.966.778 €			14.966.778 €
7	0 €	0 €	0 €	14.966.778 €			14.966.778 €
8	0 €	0 €	0 €	14.966.778 €			14.966.778 €
9	0 €	0 €	0 €	14.966.778 €			14.966.778 €
10	0 €	0 €	0 €	14.966.778 €			14.966.778 €
11	0 €	0 €	0 €	14.966.778 €			14.966.778 €
12	0 €	0 €	0 €	14.966.778 €			14.966.778 €
13	0 €	0 €	0 €	14.966.778 €			14.966.778 €
14	0 €	0 €	0 €	14.966.778 €			14.966.778 €
15	0 €	0 €	0 €	14.966.778 €			14.966.778 €
16	0 €	0 €	0 €	14.966.778 €			14.966.778 €
17	0 €	0 €	0 €	14.966.778 €			14.966.778 €
18	0 €	0 €	0 €	14.966.778 €			14.966.778 €
19	0 €	0 €	0 €	14.966.778 €			14.966.778 €
20	0 €	0 €	0 €	14.966.778 €			14.966.778 €
21	0 €	0 €	0 €	14.966.778 €			14.966.778 €
22	0 €	0 €	0 €	14.966.778 €			14.966.778 €
23	0 €	0 €	0 €	14.966.778 €			14.966.778 €
24	0 €	0 €	0 €	14.966.778 €			14.966.778 €
25	0 €	0 €	0 €	14.966.778 €			14.966.778 €
Total	**0 €**	**0 €**	**0 €**	**258.948.755 €**	**680.000.000 €**	**0 €**	**-421.051.245 €**

Scenario 1 Medium renovation

REGIO1ST | Planning Framework

Scenario 1 – Medium Renovation Cost-Benefit Analysis

Instructions: all cells indicated in orange need to be filled in.

Available budget for Natural Gas network expansion	680.000.000	€
Unitary investment cost	13.000	€
Unitary investment cost with subsidy	13.000	€
Avoided cost from natural gas boiler	0	€
Number of influenced households	52.308	number of households
Unitary energy consumption for space cooling	104	kWh
Unitary energy consumption for space heating	4.070	kWh
% of energy savings in space cooling	56%	%
% of energy savings in space heating	56%	%
Energy savings in space cooling	58	kWh
Energy savings in space heating	2.279	kWh
Electricity price	0,24	€/kWh
Natural gas price	0,11	€/kWh
Petroleum price	0,11	€/kWh
Biomass price	0,02	€/kWh
Cost of operation and maintenance - Baseline scenario	0	€
Cost of operation and maintenance - Alternative scenario	0	€
Remaining value	10%	% of investment cost
Discount rate	3%	%

NPV	-405.173.674
IRR	-4%
B/C	0,40

Fuel share per households in the region	
Natural gas	48,00%
Petroleum derivatives	20,00%
Electricity	19,00%
Biomass	0,00%
Other	12,00%
Total	99,00%

Subsidy	0%	%

Year	Cost	Benefit	Fuel cost	Fuel benefit	Investment cost	Remaining value	Net cash flow
0					680.000.000 €		-680.000.000 €
1	0 €	0 €	0 €	15.314.089 €			15.314.089 €
2	0 €	0 €	0 €	15.314.089 €			15.314.089 €
3	0 €	0 €	0 €	15.374.214 €			15.374.214 €
4	0 €	0 €	0 €	15.722.335 €			15.722.335 €
5	0 €	0 €	0 €	15.803.405 €			15.803.405 €
6	0 €	0 €	0 €	15.884.474 €			15.884.474 €
7	0 €	0 €	0 €	15.884.474 €			15.884.474 €
8	0 €	0 €	0 €	15.884.474 €			15.884.474 €
9	0 €	0 €	0 €	15.884.474 €			15.884.474 €
10	0 €	0 €	0 €	15.884.474 €			15.884.474 €
11	0 €	0 €	0 €	15.884.474 €			15.884.474 €
12	0 €	0 €	0 €	15.884.474 €			15.884.474 €
13	0 €	0 €	0 €	15.884.474 €			15.884.474 €
14	0 €	0 €	0 €	15.884.474 €			15.884.474 €
15	0 €	0 €	0 €	15.884.474 €			15.884.474 €
16	0 €	0 €	0 €	15.884.474 €			15.884.474 €
17	0 €	0 €	0 €	15.884.474 €			15.884.474 €
18	0 €	0 €	0 €	15.884.474 €			15.884.474 €
19	0 €	0 €	0 €	15.884.474 €			15.884.474 €
20	0 €	0 €	0 €	15.884.474 €			15.884.474 €
21	0 €	0 €	0 €	15.884.474 €			15.884.474 €
22	0 €	0 €	0 €	15.884.474 €			15.884.474 €
23	0 €	0 €	0 €	15.884.474 €			15.884.474 €
24	0 €	0 €	0 €	15.884.474 €			15.884.474 €
25	0 €	0 €	0 €	15.884.474 €			15.884.474 €
Total	**0 €**	**0 €**	**0 €**	**274.826.326 €**	**680.000.000 €**	**0 €**	**-405.173.674 €**

Scenario 2 Heat Pump Implementation

REGIO1ST | Planning Framework

Scenario 2 – Heat pump implementation – Cost-Benefit Analysis

Instructions: all cells indicated in orange need to be filled in.

Available budget for Natural Gas network expansion	680.000.000	€
Unitary investment cost	10.000	€
Unitary investment cost with subsidy	10.000	€
Avoided cost from natural gas boiler	2.000	€
Number of affected households	68.000	number of households
Unitary energy consumption for space cooling	104	kWh
Unitary energy consumption for space heating	4.070	kWh
Degree of efficiency of petroleum boiler	80%	%
Degree of efficiency of existing natural gas boiler	85%	%
Degree of efficiency of biomass boiler	30,00%	%
Degree of efficiency of new natural gas boiler	95,00%	%
Degree of efficiency of electric boiler	100,00%	%
Degree of efficiency of heat pump	3,0	
Average efficiency after interventions	25%	%
Unitary energy consumption for space heating after interventions	1028,35	kWh
% of energy savings in space cooling	0,00%	%
% of energy savings in space heating	74,73%	%
Energy savings in space cooling	0	kWh
Energy savings in space heating	3.042	kWh
Electricity price	0,24	€/kWh
Natural gas price	0,11	€/kWh
Petroleum price	0,11	€/kWh
Biomass price	0,02	€/kWh
Cost of operation and maintenance - Baseline scenario	0	€
Cost of operation and maintenance - Alternative scenario	0	€
Remaining value	0%	% of investment costs
Discount rate	3%	%

NPV	-365.013.847
IRR	-12%
B/C	0,49

Subsidy	0%	%

Year	Cost	Benefit	Fuel cost	Fuel benefit	Investment cost	Remaining value	Net cash flow
0					544.000.000 €		-544.000.000 €
1	0 €	0 €	16.782.726 €	33.853.283 €			17.070.557 €
2	0 €	0 €	16.782.726 €	33.853.283 €			17.070.557 €
3	0 €	0 €	16.782.726 €	33.992.859 €			17.210.132 €
4	0 €	0 €	16.782.726 €	34.800.998 €			18.018.272 €
5	0 €	0 €	16.782.726 €	34.989.195 €			18.206.468 €
6	0 €	0 €	16.782.726 €	35.177.392 €			18.394.665 €
7	0 €	0 €	16.782.726 €	35.177.392 €			18.394.665 €
8	0 €	0 €	16.782.726 €	35.177.392 €			18.394.665 €
9	0 €	0 €	16.782.726 €	35.177.392 €			18.394.665 €
10	0 €	0 €	16.782.726 €	35.177.392 €			18.394.665 €
11	0 €	0 €	16.782.726 €	35.177.392 €			18.394.665 €
12	0 €	0 €	16.782.726 €	35.177.392 €		0 €	18.394.665 €
Total	0 €	0 €	167.055.326 €	346.041.479 €	544.000.000 €	0 €	-365.013.847 €

Fuel share per households in the region

Natural gas	48,00%
Petroleum d	20,00%
Electricity	19,00%
Biomass	0,00%
Other	12,00%
Total	99,00%

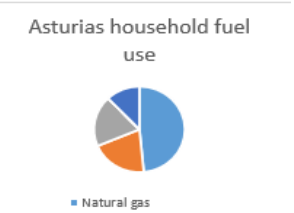
Scenario 3 Deep renovation

Available budget for Natural Gas network expansion	680.000.000	€
Avoided cost from fossil fuel boiler	2.000	€
Unitary investment cost-building envelope	17.000	€
Unitary investment cost-Heat pump	10.000	€
Unitary investment cost for PV	5.469	€
Unitary investment cost with subsidy	31.719	€
Installed capacity - PV	3	kW
Cost of installation - PV without VAT	1.300	€/kW
Cost of installation - PV	1.573	€/kW
Cost of grid update/connection	250	
Number of affected households	21.438	number of households
Energy consumption for space cooling	104	kWh
Energy consumption for space heating	4.070	kWh
Degree of efficiency of existing natural gas boiler	85,00%	%
COP heat pump	3	
% of energy savings in space cooling	69,00%	%
% of energy savings in space heating	69,00%	%
Energy savings in space cooling	72	kWh
Energy savings in space heating	2.808	kWh
Electricity consumption	3.930	kWh
Electricity consumption after interventions	4.382	kWh
Electricity price	0,24	€/kWh
Cost reduction due to net metering	50,00%	%
Electricity price - net metering	0,12	€/kWh
Natural gas price	0,11	€/kWh
Cost of operation and maintenance - Baseline scenario	0	€
Cost of operation and maintenance - Alternative scenario	100	€
Remaining value	10%	% investment cost
Discount rate	3%	%
Total energy savings	2427,25	kWh
Degree of efficiency of new gas boiler	95,00%	%
Degree of efficiency of petroleum boiler	80,00%	%
Degree of efficiency of biomass boiler	30,00%	%
Degree of efficiency of electric boiler	100,00%	%
Petroleum price	0,11	€/kWh
Biomass price	0,02	€/kWh
Natural gas price	0,11	€/kWh

Year	O&M Cost	O&M Benefit	Fuel cost	Fuel benefit	Investment cost	Remaining value	Net cash flow
0					637.123.491 €		-637.123.491 €
1	2.143.825 €	0 €	1.640.230 €	20.802.682 €			17.018.626 €
2	2.143.825 €	0 €	1.640.230 €	20.802.682 €			17.018.626 €
3	2.143.825 €	0 €	1.640.230 €	20.846.685 €			17.062.630 €
4	2.143.825 €	0 €	1.640.230 €	21.101.466 €			17.317.411 €
5	2.143.825 €	0 €	1.640.230 €	21.160.799 €			17.376.743 €
6	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
7	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
8	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
9	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
10	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
11	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
12	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
13	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
14	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
15	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
16	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
17	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
18	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
19	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
20	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
21	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
22	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
23	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
24	2.143.825 €	0 €	1.640.230 €	21.220.131 €			17.436.076 €
25	2.143.825 €	0 €	1.640.230 €	21.220.131 €		68.000.000 €	85.436.076 €
Total	**37.330.749 €**	**0 €**	**28.561.565 €**	**368.212.133 €**	**637.123.491 €**	**66.019.417 €**	**-302.326.494 €**

Fuel share per households in the region

Natural gas	48,00%
Petroleum der	20,00%
Electricity	19,00%
Biomass	0,00%
Other	13,00%



Scenario 3 Medium renovation

Available budget for Natural Gas network expansion	680.000.000	€
Avoided cost from fossil fuel boiler	2.000	€
Unitary investment cost-building envelope	13.000	€
Unitary investment cost-Heat pump	10.000	€
Unitary investment cost for PV	5.469	€
Unitary investment cost with subsidy	27.719	€
Installed capacity - PV	3	kW
Cost of installation - PV without VAT	1.300	€/kW
Cost of installation - PV	1.573	€/kW
Cost of grid update/connection	250	
Number of affected households	24.532	number of households
Energy consumption for space cooling	104	kWh
Energy consumption for space heating	4.070	kWh
Degree of efficiency of existing natural gas boiler	85,00%	%
COP heat pump	3	
% of energy savings in space cooling	56,00%	%
% of energy savings in space heating	56,00%	%
Energy savings in space cooling	58	kWh
Energy savings in space heating	2.279	kWh
Electricity consumption	3.930	kWh
Electricity consumption after interventions	4.572	kWh
Electricity price	0,24	€/kWh
Cost reduction due to net metering	50,00%	%
Electricity price - net metering	0,12	€/kWh
Natural gas price	0,11	€/kWh
Cost of operation and maintenance - Baseline scenario	0	€
Cost of operation and maintenance - Alternative scenario	100	€
Remaining value	10%	% investment cost
Discount rate	3%	%
Total energy savings	1694,75	kWh
Degree of efficiency of new gas boiler	95,00%	%
Degree of efficiency of petroleum boiler	80,00%	%
Degree of efficiency of biomass boiler	30,00%	%
Degree of efficiency of electric boiler	100,00%	
Petroleum price	0,11	kWh
Biomass price	0,02	kWh

Year	O&M Cost	O&M Benefit	Fuel cost	Fuel benefit	Investment cost	Remaining value	Net cash flow
0					630.936.181 €		-630.936.181 €
1	2.453.191 €	0 €	2.664.021 €	24.221.692 €			19.104.480 €
2	2.453.191 €	0 €	2.664.021 €	24.221.692 €			19.104.480 €
3	2.453.191 €	0 €	2.664.021 €	24.272.045 €			19.154.833 €
4	2.453.191 €	0 €	2.664.021 €	24.563.592 €			19.446.380 €
5	2.453.191 €	0 €	2.664.021 €	24.631.487 €			19.514.275 €
6	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
7	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
8	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
9	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
10	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
11	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
12	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
13	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
14	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
15	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
16	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
17	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
18	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
19	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
20	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
21	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
22	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
23	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
24	2.453.191 €	0 €	2.664.021 €	24.699.381 €			19.582.169 €
25	2.453.191 €	0 €	2.664.021 €	24.699.381 €		68.000.000 €	87.582.169 €
Total	**42.717.776 €**	**0 €**	**46.388.990 €**	**428.609.644 €**	**630.936.181 €**	**66.019.417 €**	**-258.956.124 €**

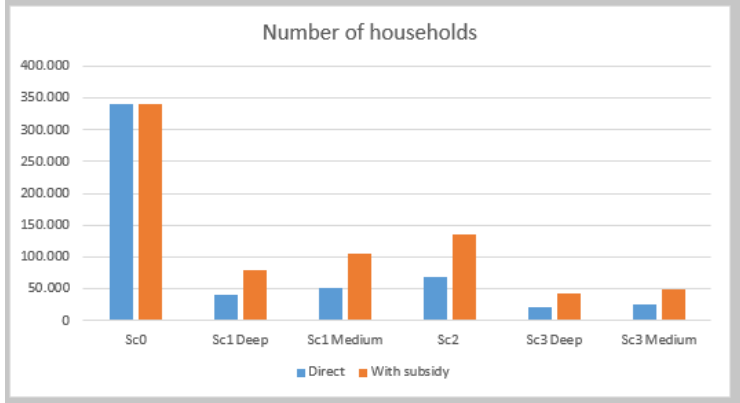
Fuel share per households in the region

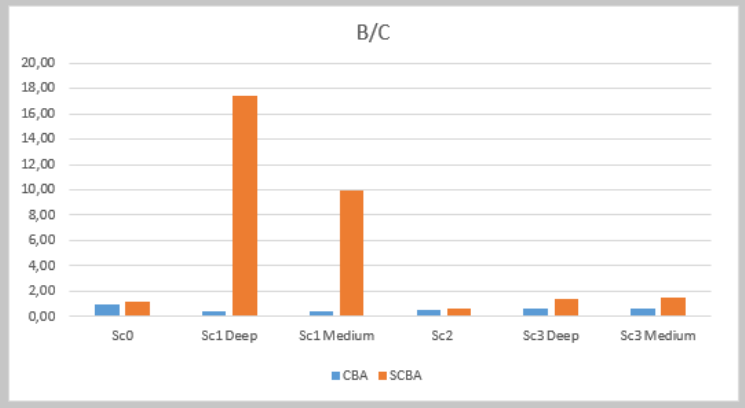
Natural gas	48,00%
Petroleum der	20,00%
Electricity	19,00%

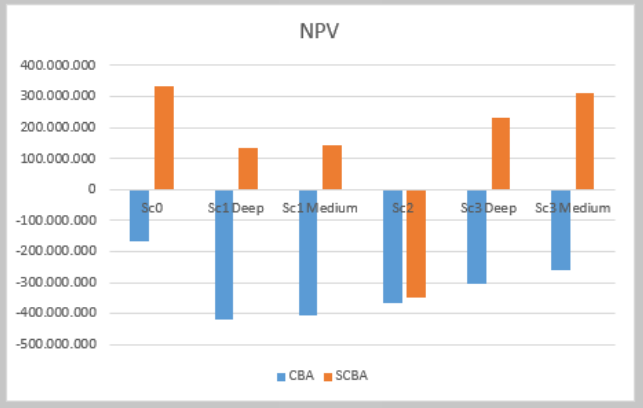
Conclusions

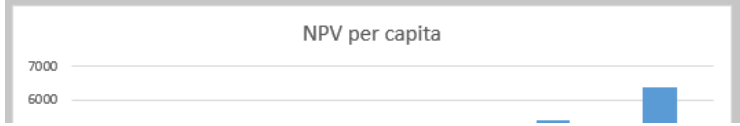
Conclusions

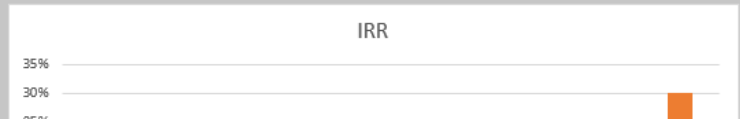
		NPV		IRR		B/C			Nr Households		
Scenario code	Assumptions	CBA	SCBA	CBA	SCBA	CBA	SCBA	Energy savings	Direct	With subsidy	NPV per capita
Sc0	Changing to more efficient gas boiler	-168.481.595	335.427.591	-1%	10%	0,93	1,15	822,57	340.000	340.000	986,551738
Sc1 Deep	Deep renovation (still on DH)	-421.051.245	133.059.084	-4%	10%	0,38	17,41	2880,06	40.000	80000	
Sc1 Medium	Medium renovation (still on DH)	-405173674,14	142.004.465	-3,79%	12%	0,40	9,95	2337,44	52.308	104615	1357,39562
Sc2	Heat pump implementation	-365.013.847	-346848932,46	-11,85%	-6%	0,49	0,67	3041,65	68.000	136000	-2550,3598
Sc3 Deep	Deep renovation + heat pump + PV	-302.326.494	230.263.587	-2%	14%	0,62	1,42	2427,25	21.438	42877	5370,39022
Sc3 Medium	Medium renovation + heat pump + PV	-258.956.124	313.058.976	-1%	30%	0,69	1,52	1694,75	24.532	49064	6380,64836











To summarise

- The SCBA tool allows to consider not only economic factors, but also social ones
- It is a simplified way to understand how different policy measures promoting energy efficiency would work out
- It is intended to spur an initial discussion
- Easy to use tool and highly customisable

Thank you!

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