Study for the review of the Commission Regulation 2019/424 Ecodesign of Servers and Data Storage Products

3rd Stakeholder consultation meeting

9 July 2024

Agenda

- Introductions & Housekeeping
  - Meeting slides will be published on the study website
- Scene setting from DG GROW
- Study overview – scope & deliverables
- Draft Reports:
  - Tasks 1–4
  - Task 5
  - Task 6
  - Task 7
- Comments & Feedback
- AOB

Housekeeping rules of the meeting

- During each sub-session of presentation, virtual participants will be able to pose written questions or to ask for the floor (type [name organization] + ‘floor please’ [+topic]). Please write them in the chat when invited to do so by the Chair, starting with the name of your organisation (questions without the organisation name will not be considered).
- The questions will be answered at the end of each sub-session. In case of time constraints, priority in replying to the questions will be given, based on the order in the chat. Everyone remains muted (unless speaking when invited by the Chair)
- **Concise** intervention or question

NB: The chats will not be kept/copied. Please do **not** make comments in the chat area unless invited by the Chair.

Scene setting from DG GROW

Study overview – Scope & Deliverables

Phase 1 – Technical analysis
This involves a detailed assessment of all items raised in the review section of Commission Regulation (EU) 2019/424 plus the other items raised by DG GROW, as well as an update to the Ecodesign frequently asked questions (FAQ).

Phase 2- Update of the preparatory study for the server and data storage Regulation
This phase will update the existing preparatory study of Commission Regulation (EU) 2019/424, informed by Phase 1, and further by additional market research, consultation and experience in the EU.

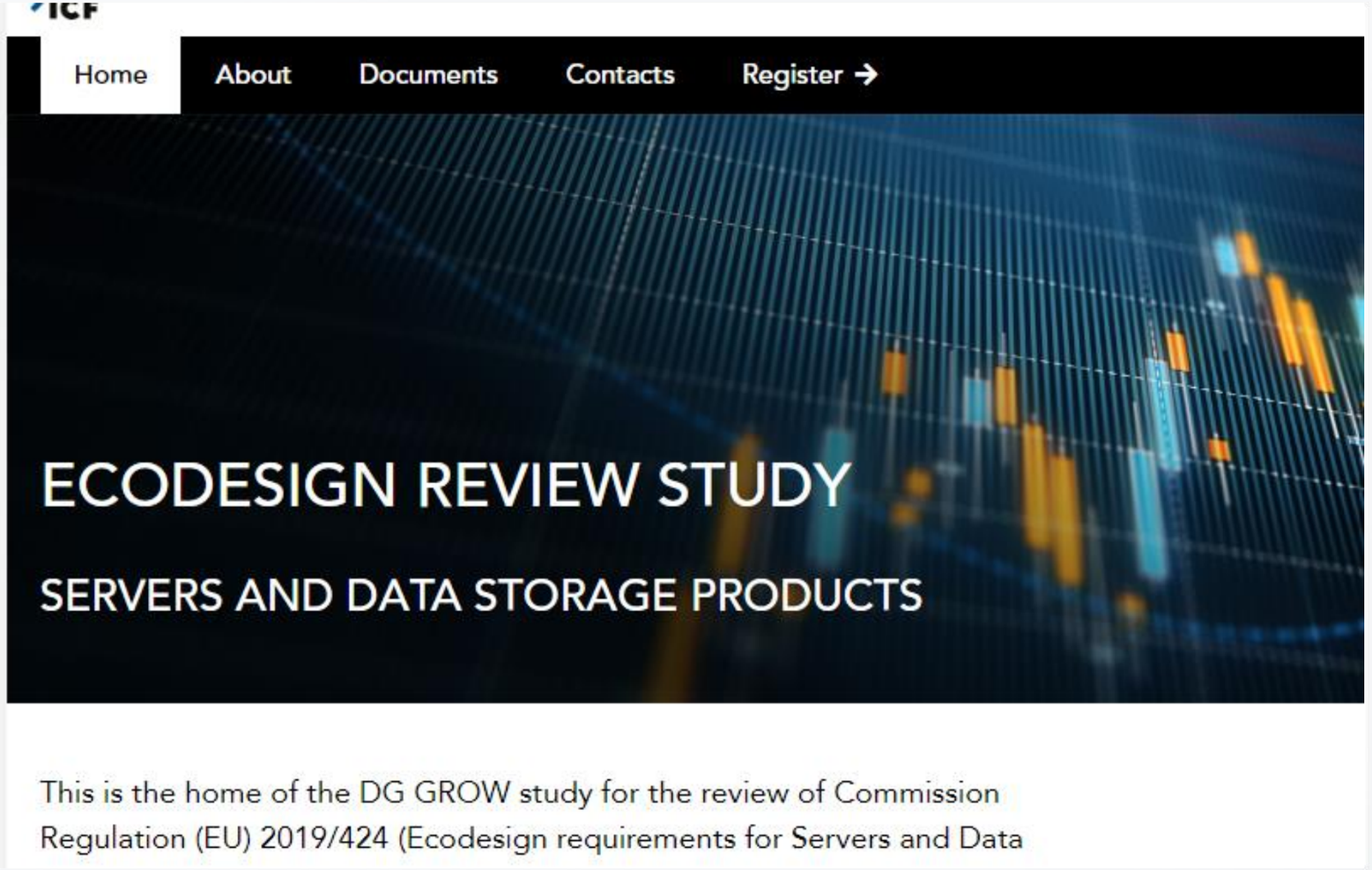
Deliverables

1. Report on Phase 1 and updated preparatory study (Phase 2).
2. Working documents on the revised Ecodesign Regulation for servers and data storage products (draft revised Ecodesign Regulation and explanatory memorandum)
3. Update of the 'Commission guidelines: Ecodesign frequently asked questions (FAQ) on servers and data storage products'.

https://eco-servers-review.eu/

Draft Task Reports 5, 6 & 7 are published under the documents section of the study website

Stakeholder comments due by:
6th August



Task Reports 1–4

Task Reports: 1–4

- Thank you for feedback relating to content and updates to draft Task Reports 1–4
- These have now been made and revised versions uploaded to the study website

Batteries in Servers – Batteries Regulation (Article 11)

Portable batteries must be removable and replaceable by end-users

- Portable batteries are defined in the Batteries Regulation as a battery that is sealed, weighs 5 kg or less, is not designed specifically for industrial use and is neither an electric vehicle battery, an LMT battery, nor an SLI battery.

Exception (article 11.3):

- Where continuity of power supply is necessary and a permanent connection between the product and the respective portable battery is required to ensure the safety of the user and the appliance or, for products that collect and supply data as their main function, for data integrity reasons
  - Such as CMOS battery* in servers (i.e. it seems they would fall under this exception clause)
  - (what about) Batteries for power continuity? Are there examples of these batteries physically incorporated in server? Or are they always part of the external UPS systems?
- THANKS FOR FEEDBACK ON THIS

* It powers the firmware/chip on the motherboard, that stores important system settings and configurations such as the date and time, boot order, hardware settings, and password information.

Task 5 Environment & Economics

Task 5: Overview of Base Cases

- BC-1 and BC-2 in the table opposite are developed using the average technical characteristics of the most popular configurations in the SERT dataset
  - Rack servers represent 75% of the SERT dataset
  - Blade servers represent 16% of the SERT dataset
  - 2 socket servers represent >50% of the SERT dataset

- BC-3 was constructed using Online 3 systems where multiple drive type configurations are commonly deployed.
  - Block I/O products constitute a substantial 73% of the dataset.
  - Transaction products account for 47%, with Streaming products at 28% and Composite products at 25%.
  - Models identified were representative of commonly installed configurations.

Technical specifications of BC-1, BC-2, and BC-3

Base Case	Description
BC-1 2 socket Rack Server	• Silver level Intel processor • 2021 model • 2U volume • 16 memory DIIMMs • 2 storage devices • 800-Watt nameplate power • 136 idle watt measurement • 27.1 efficiency score
BC-2 2 socket Blade Server	• 2 storage devices • 3000-Watt nameplate power • Memory capacity: 3TB • Number of blade slots: 8 • SERT Score (typical config): 31.2 • Idle measurement (typical config): 166 watts
BC-3 Storage (virtual product, hybrid system)	• Taxonomy: Online 3 • Workload optimization: Transaction • Storage model connectivity: Block I/O • Storage controller config: Scale-up • 1100-Watt nameplate power • 22 storage devices in optimal configuration (6 SSD + 16 HDDs)

Task 5: Input Assumptions for Servers (BC1 & BC2)

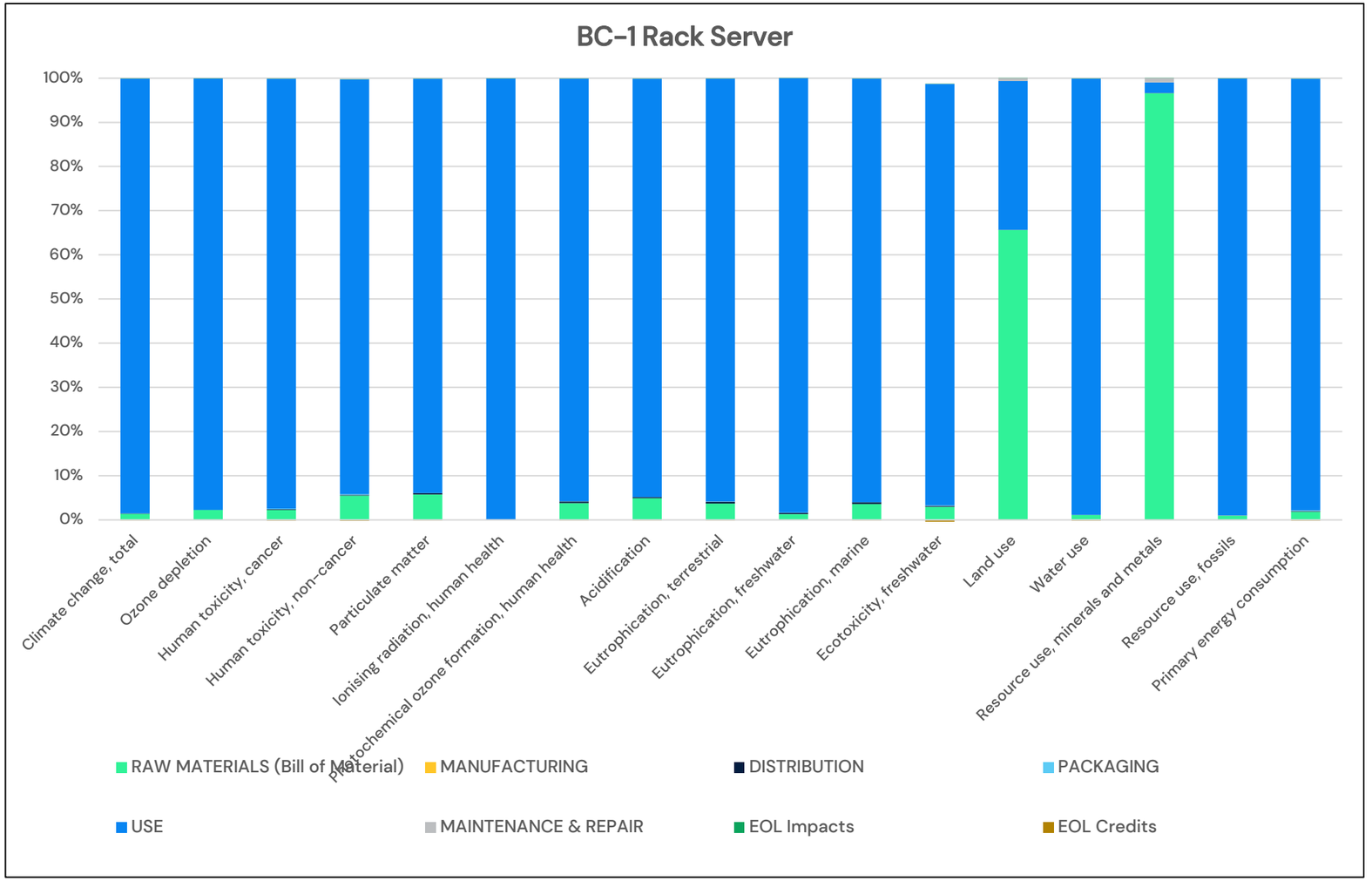
Bill of materials	Packaging	Distribution	Direct and in-direct use phase values	Maintenance & repair values	Inputs for EU totals & economic life cycle
• BC1 – total weight amounts to 15.80 kg • BC2– total weight amounts to 116.4 kg BC1 cover a range of CRMs, plastic, and hazardous materials. BC2 BoM considers the materials found in: • Chassis • Fans • PSUs • CPU heat sinks • Memory • HDDs • Mainboards	• BC1 – HDPE and GPPS/ Styrofoam • BC2 – HDPE, GPPS/ Styrofoam and cartons Source: CEDaCI data	• Transport mean 1 (Ship) 16,000 km Average distance from Hong Kong to Rotterdam and San Francisco to Rotterdam • Transport mean 2 (lorry) 450 km Distance from Rotterdam to Frankfurt	• Product lifetime: 4 years • Electricity consumption over lifetime: BC1: 7.95 MWh BC2: 58.30 MWh • Heat power output is 0 MWh	• BC1: spare parts materials calculated as: 158.096 g • BC2 spare parts materials calculated as: 1164 g	Calculated inputs: • Annual sales, EU stock. Inputs from Task 2 report: • Lifetime, product price, installation/ acquisition costs, repair/ maintenance costs Inputs from MEErP: • Electricity, water, discount, escalation, present worth factor, ratio efficiency stock rates.

Task 5: Input Assumptions for Data Storage (BC3)

Bill of materials	Packaging	Distribution	Direct and in-direct use phase values	Maintenance & repair values	Inputs for EU totals & economic life cycle
• BC3 – total weight amounts to 34.1 kg BC3 BoM considers the materials found in: • 3,5 HDD (9) • SSDs (6) • 2,5 HDD (7) • Disc Array enclosures (2) • Chassis • Fans in PSU (4) • Controller cards (2) • Mid plane boards (1) • Controller (1/2) • Controller • PSU controller • PSU fans	• BC3 – HDPE, GPPS/ Styrofoam and cartons Source: CEDaCI data	• Transport mean 1 (Ship) 16,000 km Average distance from Hong Kong to Rotterdam and San Francisco to Rotterdam • Transport mean 2 (lorry) 450 km Distance from Rotterdam to Frankfurt	• Product lifetime: 6 years • Electricity consumption over lifetime: BC3: 14.611 MWh • Heat power output is 0 MWh	• BC1: spare parts materials calculated as: 340.616 g	Calculated inputs: • Annual sales, EU stock. Inputs from Task 2 report: • Lifetime, product price, installation/ acquisition costs, repair/ maintenance costs Inputs from MEErP: • Electricity, water, discount, escalation, present worth factor, ratio efficiency stock rates.

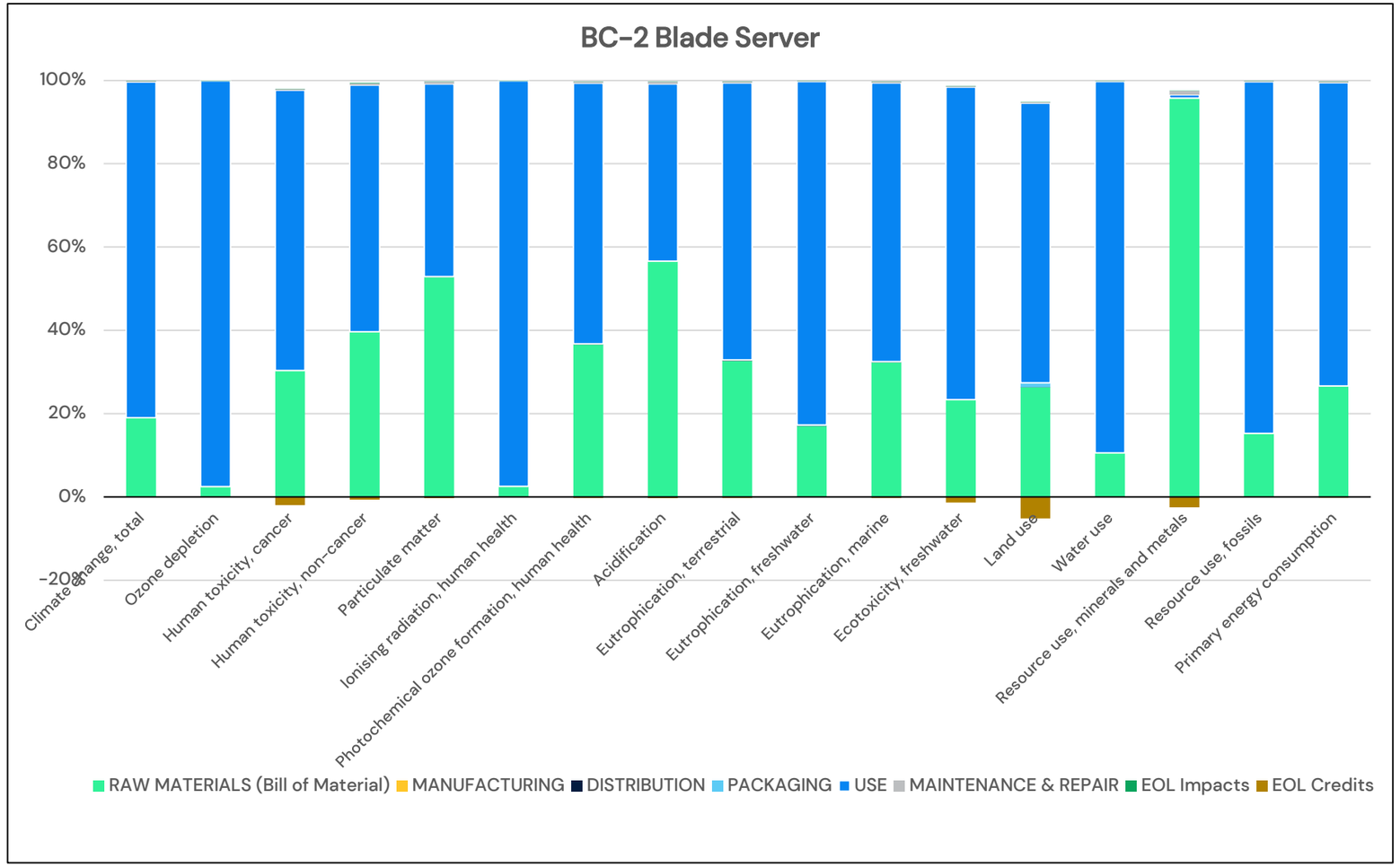
Task 5: Environmental Impact Assessment

- **Distribution of BC-1 environmental impacts by life cycle phase**



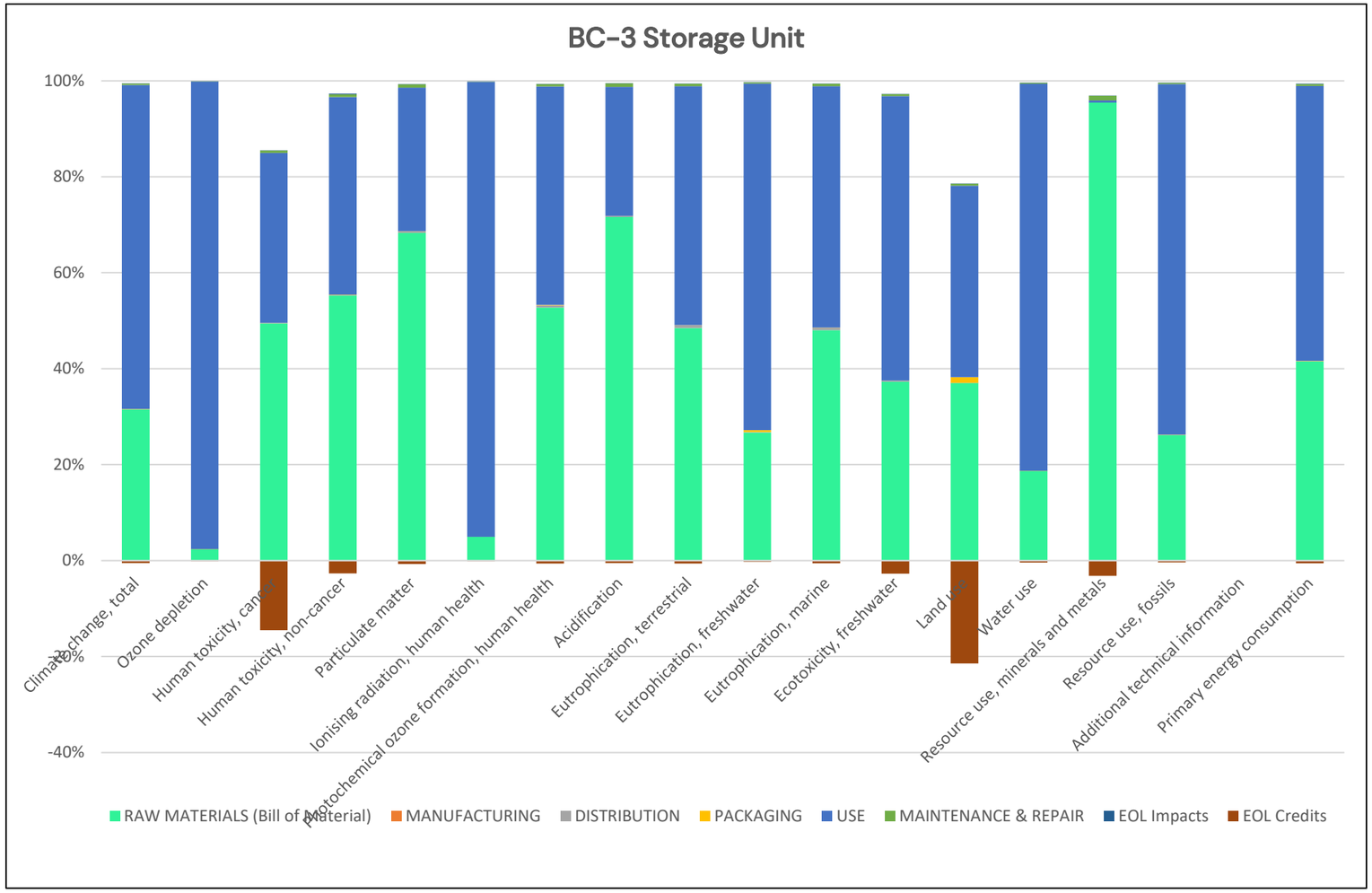
Task 5: Environmental Impact Assessment

- **Distribution of BC-2 environmental impacts by life cycle phase**



Task 5: Environmental Impact Assessment

- **Distribution of BC-3 environmental impacts by life cycle phase**

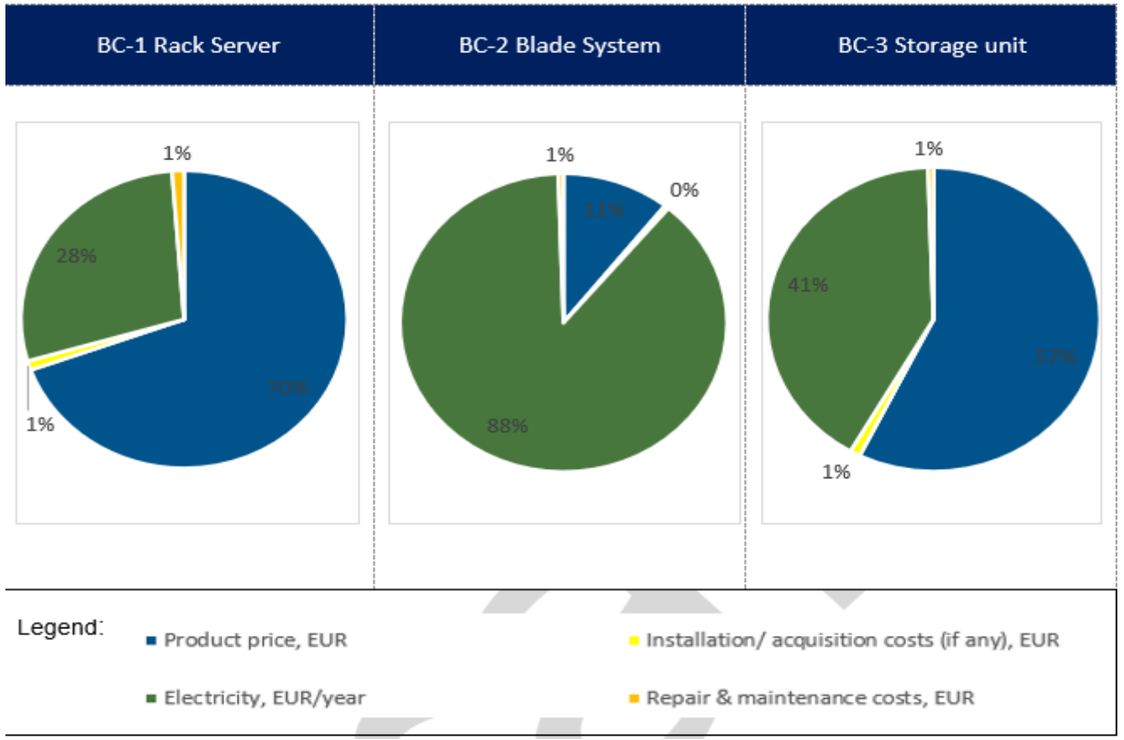


Task 5: Life Cycle Cost for Consumers

Life cycle costs for all base cases per product per year

	BC-1 Rack Server	BC-2 Blade System	BC-3 Storage Unit
Product price, EUR	23,420	8,435	24,400
Installation/ acquisition costs (if any), EUR	340	340	425
Electricity, EUR/year	9,551	69,956	17,534
Repair & maintenance costs, EUR	400	400	220
Total, EUR/year	**15,591**	**72,249**	**21,708**

Life cycle costs for all base cases



Task 5: Life Cycle Cost for Society

Total societal life-cycle costs per product per year

	BC-1 Rack Server	BC-2 Blade System	BC-3 Storage Unit
PP damages, EUR	33	2,748	1,376
N*OE damages, EUR	893	6,540	1,639
EoL damages, EUR	-1	-17	-24
Total External Damages, EUR	925	9,272	2,992
LCC (excl. ext. damages), EUR)	15,591	72,249	21,708
Total Societal LCC, EUR/year	**1,5823**	**74,567**	**22,207**
Total External damages as % of Total Societal LCC	**5.8%**	**12.4%**	**13.4%**

Total annual social life-cycle costs in the EU-27

	BC-1 Rack Server	BC-2 Blade System	BC-3 Storage Unit
PP damages (m €)	45.86	961.97	44,176.35
N*OE damages (m €)	1233.20	2,290.74	52,634.45
EoL damages (m €)	-1.29	-5.78	-763.28
Total External Damages (m €)	1277.78	3,246.93	96,047.52
LCC (excl. ext. damages) (m €)	86,102	101,217	4,181,783
Total Societal LCC (m €)	**87,380**	**104,464**	**4,277,830**

Comments & Feedback

Task 6 Design Options

Task 6: Design Options: Background

SERT Dataset

- SERT stands for Server Efficiency Rating Tool and it was developed by SPEC in collaboration with the U.S. Environmental Protection Agency.
- It collects measurements and uses an accompanying efficiency metric to assess computer server energy efficiency
- SERT is organised around eleven worklets which broadly fall under three categories: CPU based, memory based, and storage based.
- The tested results from the worklets are aggregated into a single score with a weighting of 65% for CPU, 30% for memory, and 5% for storage worklets.
- SERT measures the power demand of these different worklet groupings at idle as well as several designated utilization levels to capture variations in workflow.
- SERT serves as the foundation for ISO IEC 21836: 2020
- SERT active efficiency is the primary metric for server energy efficiency
- Thanks to a collaboration with The Green Grid, the study team has access to a server SERT dataset ranging from model years 2019-2021 which is being used for the development of outputs under Phase 2 of this study

Task 6: Design Options 1, 2 & 3

DO 1: Removes 17% server families in TGG dataset (Green Public Procurement)

Number of sockets	Product type	Minimum Active efficiency
1	Rack	13.0
2	Rack	18.0
2	Blade or multi-node servers	20.0
4	Rack	16.0
4	Blade or multi-node	9.6

DO2: Removes 18% server families in TGG dataset

Number of sockets	Product type	Minimum Active efficiency
1	Rack	15.0
2	Rack	20.0
2	Blade or multi-node servers	20.0
4	Rack	16.0
4	Blade or multi-node	12.0

DO 3: 75% of the models from the SERT threshold tool meet the requirement.

Number of sockets	Product type	Minimum Active efficiency
1	Rack	15.33
2	Rack	23.36
2	Blade or multi-node servers	21.09
4	Rack	20.32
4	Blade or multi-node	22.44

DO1, DO2 and DO3 effects on base cases

Product modelled	Active efficiency modelled	Idle consumption modelled (W)	Server weighted performance
Base Case 1	27.1	136	7945
Base Case 1 after DO1: EU GPP requirements	30.2	142	9196
Base Case 1 after DO2: high-rate active efficiency requirements	30.4	141	9269
Base Case 1 after DO3: Stricter active efficiency requirements	31.6	142.5	9784.8
Base Case 2	31.2	166	17934
Base Case 2 after DO1: EU GPP requirements	33.2	172	20015
Base Case 2 after DO2: high-rate active efficiency requirements	33.2	172	20015
Base Case 2 after DO3: Stricter active efficiency requirements	34.2	182.8	21716.8

Task 6: Design Options: Background

Idle Energy Consumption

- Existing idle approach in the current regulation contains outdated base allowances as well as functional adders, the latter of which are challenging to keep up to date with quickly evolving technologies
  - The current idle requirement has a 100% pass rate in the TGG data set.
- The proposed idle consumption to workload ratio for servers considers a scenario where a new idle efficiency metric is proposed to ensure that idle consumption is being optimised for use in the market
- The SSJ worklet chosen represents a worklet with both CPU processing and memory activities that has had broad adoption in comparing server products for well over a decade
- This new metric serves as a method to remove products which are operating inefficiently in idle versus their maximum typical energy consumption

Task 6: Design Option 4

DO 4: Idle consumption to workload ratio

- $Idle\ to\ workload\ ratio = \frac{idle\ power\ (in\ Watts)}{100\%\ SSJ\ workload\ power\ (in\ Watts)}$
- Idle to workload ratio < 0.38, 75% pass rate for BC1
- Idle to workload ratio < 0.16, 75% pass rate for BC2

Modelling changes for DO4

DO	Base Case	Change made	Percentage difference
4	1	Cost increase	0%
4	1	Active consumption figures reduced by:	10%
4	1	Idle consumption reduced by:	7%
4	1	Performance figures increased by:	14%
4	2	Cost increase	0%
4	2	Active consumption figures reduced by:	1.3%
4	2	Idle consumption reduced by:	11%
4	2	Performance figures increased by:	2%

DO5: Processor management functions to be mandated and shipped enabled.

- Reducing voltage and/or frequency through Dynamic Voltage and Frequency Scaling (DVFS)
- DVFS is also required by ENERGY STAR
- Overall expected energy consumption reduction by 5%
- No changes to cost, materials or life expectancy

Task 6: Design Options: Background

SNIA and Emerald Testing

- SNIA stands for the Storage Networking Industry Association
- SNIA created the Emerald Power Efficiency Measurement Specification.
- SNIA Emerald serves as the foundation for ISO IEC 24091: 2019
- The purpose of the ISO IEC 24091: 2019 is to provide public access to storage system power usage and efficiency and provides a recognised method to assess the energy efficiency of data storage products
- The resulting power efficiency metrics are defined as ratios of idle capacity or active operations during selected stable measurement intervals to the average measurement power

Task 6: Design Option 6

DO 6: Energy efficiency requirements on data storage products

- Set SNIA performance level on storage systems
- For streaming workloads: meet either the sequential read or the sequential write requirement.

Active state requirements for Block I/O Storage products

Workload Type Specific	Specific Workload Test	Minimum Performance /Watt Ratio	Applicable Units of Ratio
Transaction	Hot Band	28.0	IOPS/Watt
Streaming	Sequential Read	2.3	MiBS/Watt
Streaming	Sequential Write	1.5	MiBS/Watt

- Power management functions: Capacity optimisation methods
  - Thin Provisioning
  - Data Deduplication
  - Compression
  - Delta Snapshots

- Impacts on Base Case 3 modelling
  - No additional costs for including these measures
  - 2014 ENERGY STAR survey indicates:
    - 60% data centre admins use data compression
    - 55% use deduplication
    - 62% use snapshot technology
  - 75% data centres already have data storage capacity optimization methods
  - Overall, 10% savings to the average purchaser

Task 6: Design Options 7 & 8

DO 7 and DO 8: Improved disassembly, repairability and recycling on servers and data storage products

- Disassemblability requirements by class B generalist, workshop environment class A, using tools from A, B or C nomenclature.
- Provide information on disassemble and repair
- Availability of spare parts:
  - Memory cards, CPU, motherboard, graphic cards, PSU, chassis, batteries, fans, integrated switch, RAID controllers and network interface cards.
- Preventing Parts Pairing
- Provision of hardware component level performance and material content compatibility in information sheet.

- Effects of DO7 and DO8 on the base cases
  - 5% increased cost to manufacturers to facilitate new design which is disassemblable
  - 5% additional cost for spare parts availability
  - 0.5% increased use for PSU and motherboards
  - Replacement rate of 0.5% per year for HDDs and 0.4% per year for SSDs
  - Average product life expectancy of server to improve by 5%
  - Collection rates are increased from 40% to 50%, which increases the R2 recycling output rates in the Ecoreport tool

Task 6: Design Options 9 & 10

DO 9: Combined measures servers, BC1 and BC2

- For servers, BC1 and BC2, the following DOs have been combined:
  - DO3 stricter-active efficiency server
  - DO4 idle consumption to workload ratio
  - DO5 processor management function
  - DO7 material efficiency

Modelling changes for DO9

DO	Base Case	Change made	Percentage difference
9	1	Cost increase	10%
9	1	Active consumption figures reduced by:	19%
9	1	Idle consumption reduced by:	2%
9	1	Performance figures increased by:	27%
9	2	Cost increase	10%
9	2	Active consumption figures reduced by:	8.1%
9	2	Idle consumption reduced by:	7%
9	2	Performance figures increased by:	15%

DO 10: Combined measures data storage products, BC3

- The data storage product combined DO should consider the measures of DO6 on energy efficiency, and DO8 on material efficiency.
  - BC3 provides overall 10% saving to the average purchaser hence there are no additional costs.
  - 5% increased cost to manufacturers to facilitate new design which is disassemblable
  - 5% additional cost for spare parts availability
  - 0.5% increased use for PSU and motherboards
  - Replacement rate: 0.5% per year for HDDs and 0.4% per year for SSDs
  - Average product life expectancy of improves by 5%
  - Collection rates are increased from 40% to 50%, which increases the R2 recycling output rates in the Ecoreport tool

Task 6: Product Scope

Products under scope of the existing regulation

Products included under proposed expanded scope but not including energy efficiency requirements:

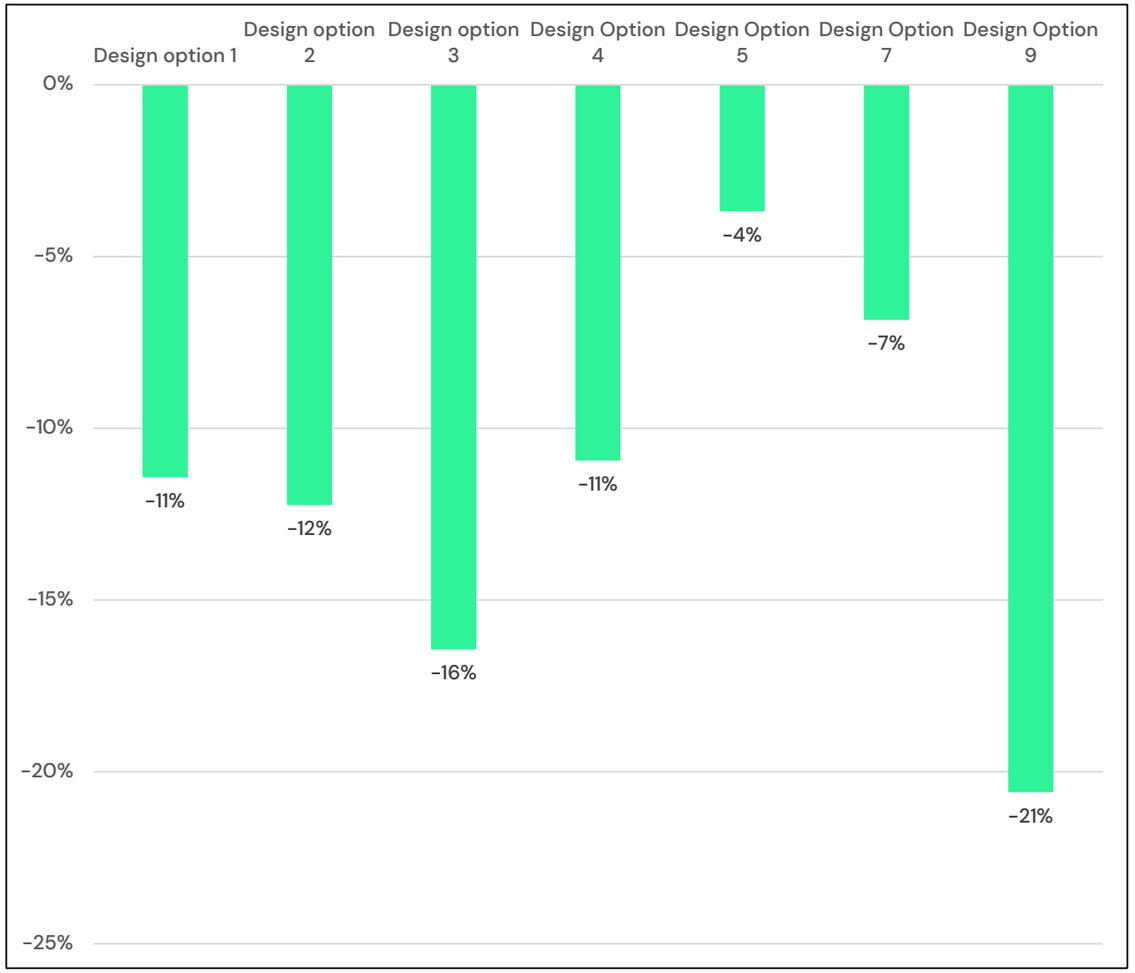
- Server Appliances
- Fully Fault Tolerant Servers
- Hyperconverged Servers
- Large Servers

Measures considered but not taken forward

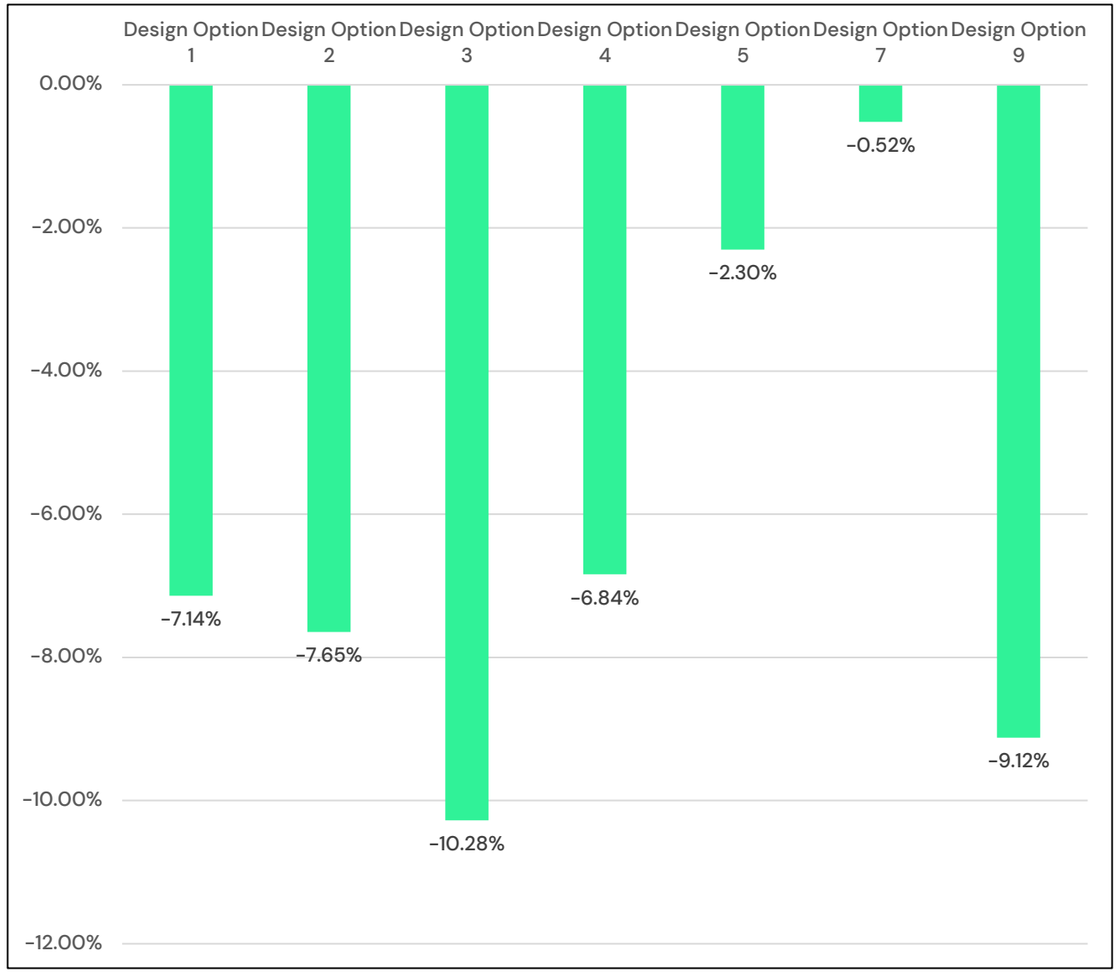
- PSU Energy Efficiency Metrics
- Standby Readiness
- DC Power Supply
- High Performance Computing and Servers with Integrated APA exclusions
- Ban of Particular Polymer Combinations
- Liquid Cooling Servers
- Waste heat recuperation
- Firmware Provision
- Custom Servers
- Resilient Servers
- Setting Minimum Operation Range Requirement to be ASHRAE A2 (or ban A1)

Task 6: BC1 – Assessment Enviro Impacts, Life Cycle Costs and Price

Primary energy consumption for Design Options compared to BC1 (%)

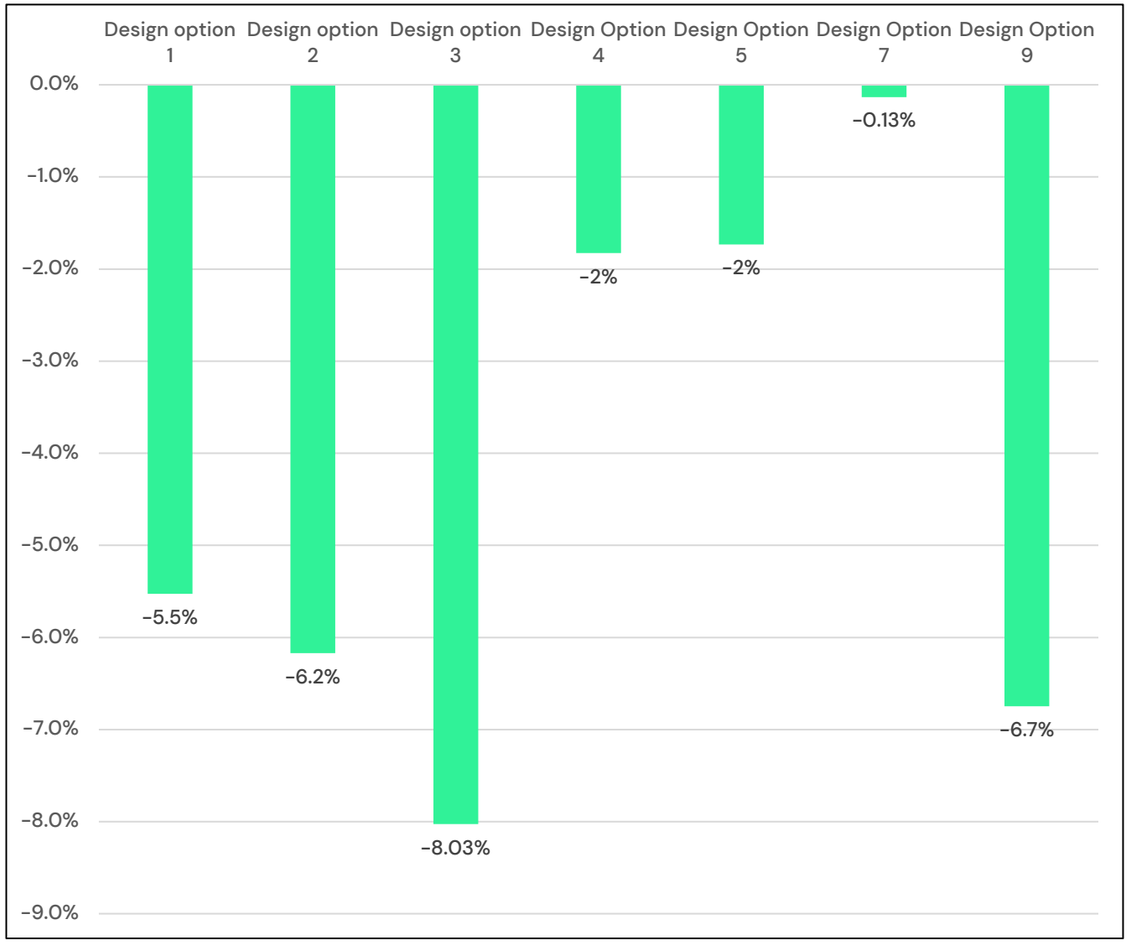


Life cycle costs as compared with BC1 (%)

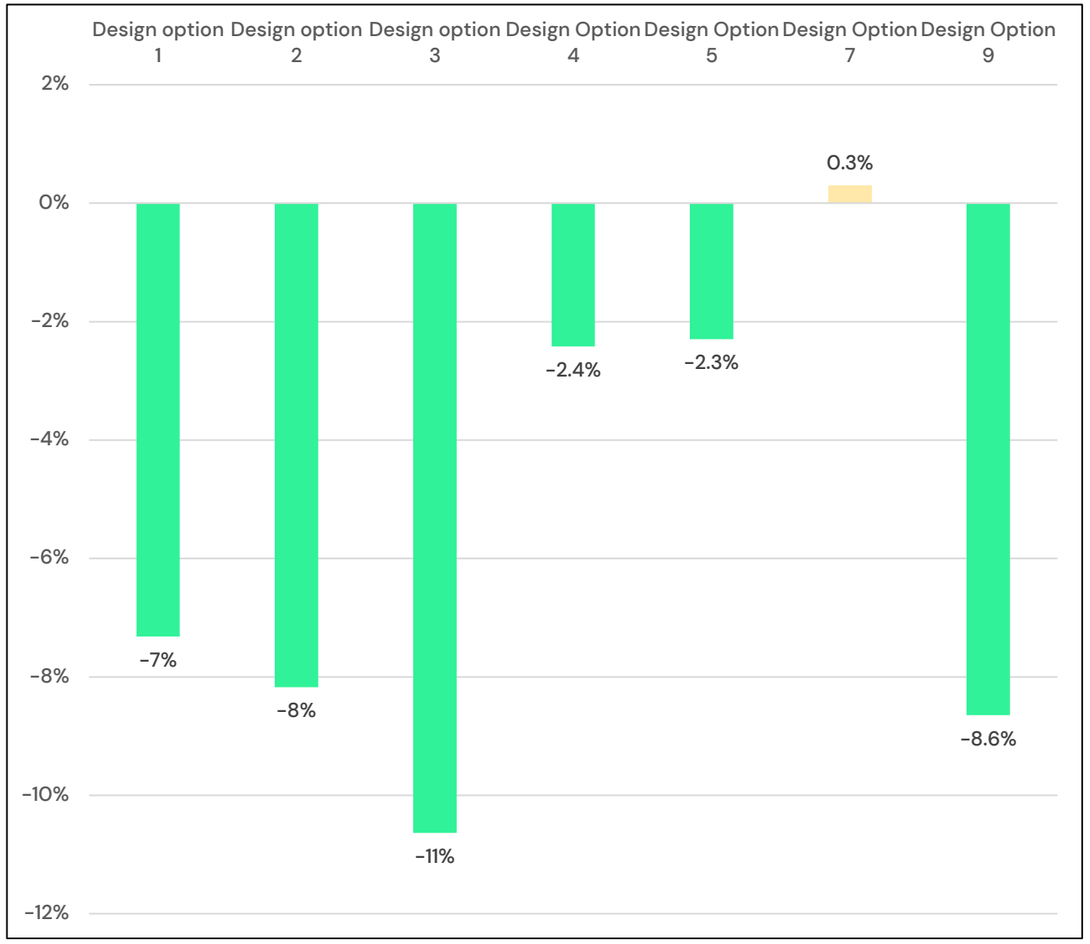


Task 6: BC2 – Assessment Enviro Impacts, Life Cycle Costs and Price

Primary energy consumption for Design Options compared to BC2 (%)

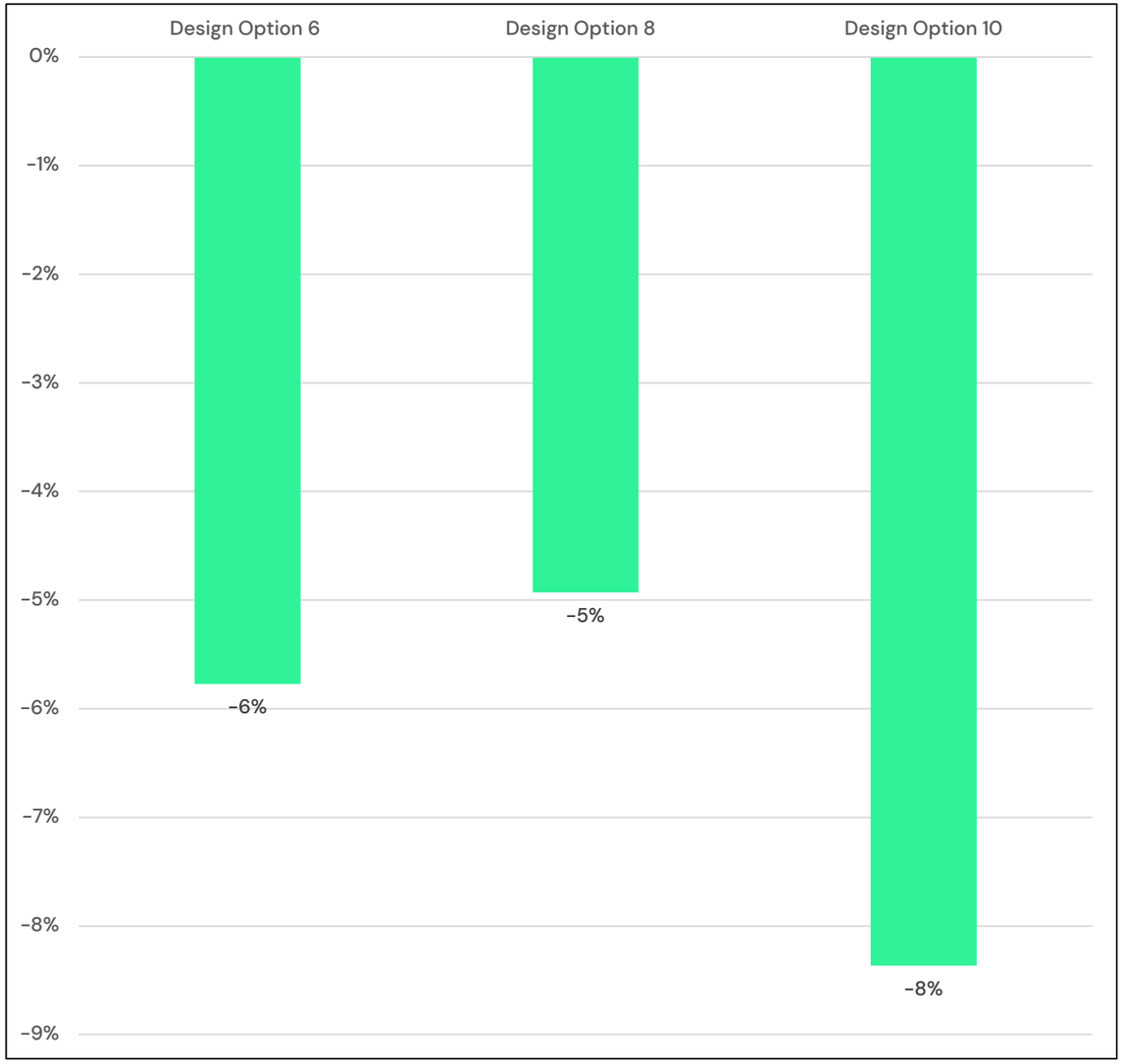


Life cycle costs as compared with BC2 (%)

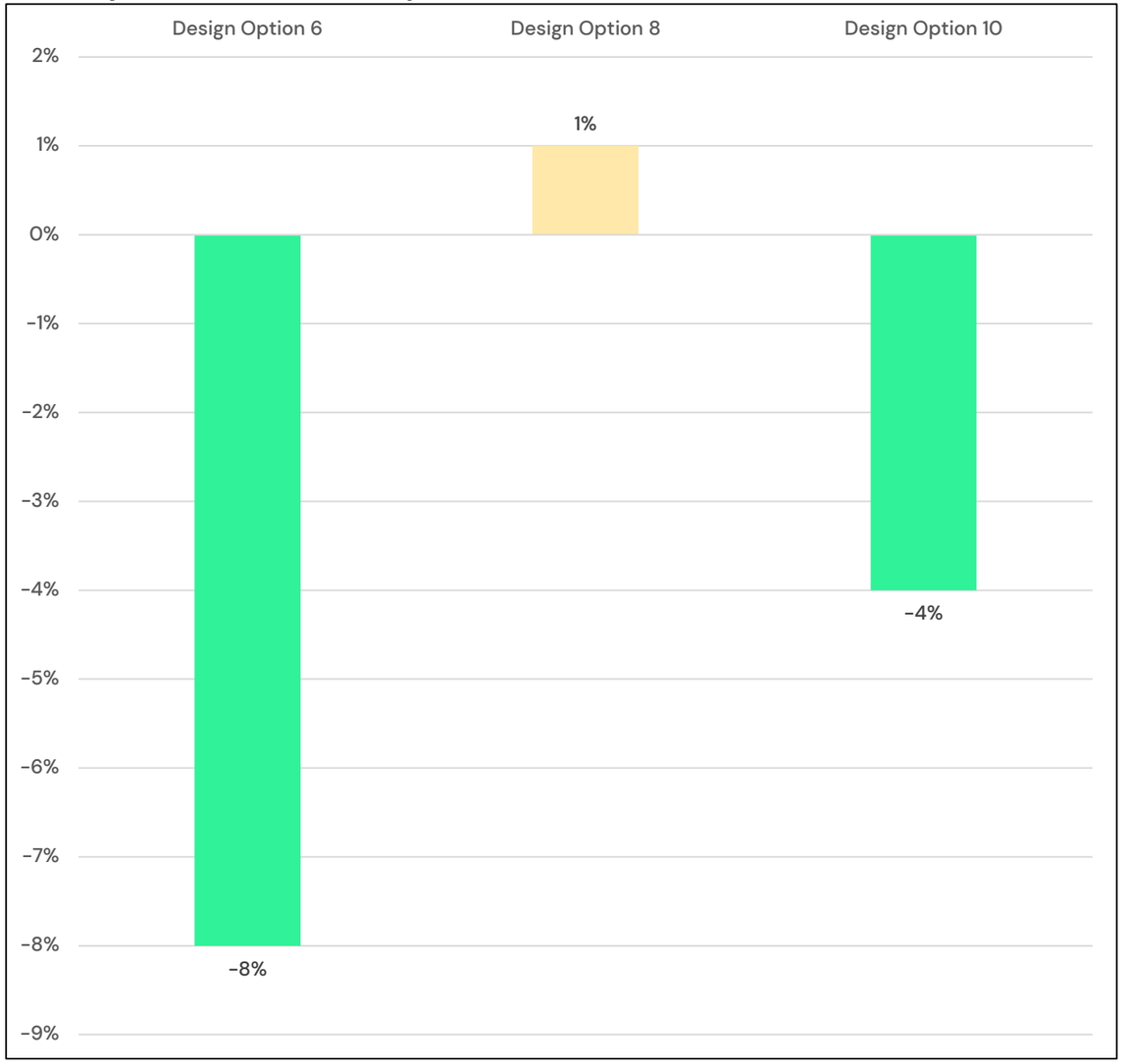


Task 6: BC3 – Assessment Enviro Impacts, Life Cycle Costs and Price

Primary energy consumption for Design Options compared to BC3 (%)

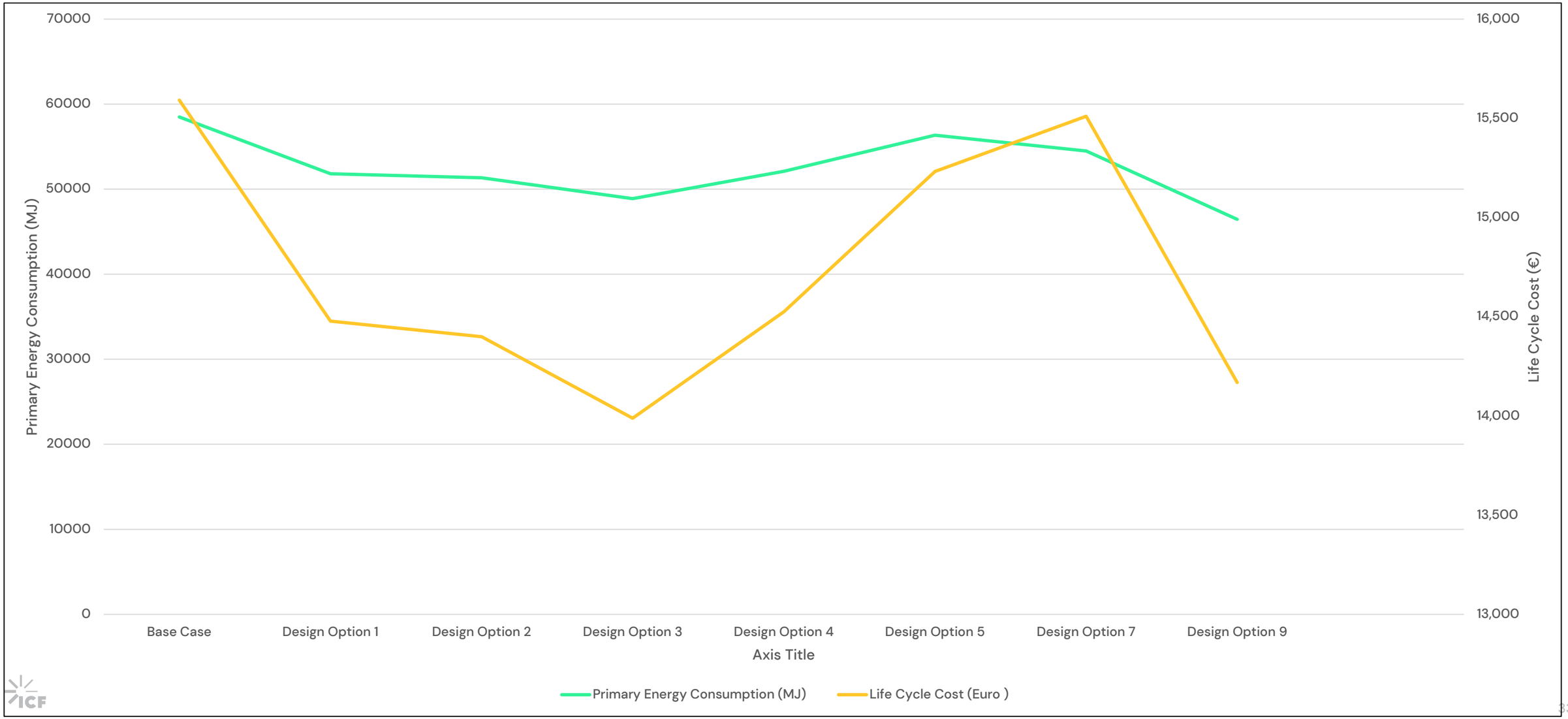


Life cycle costs as compared with BC3 (%)



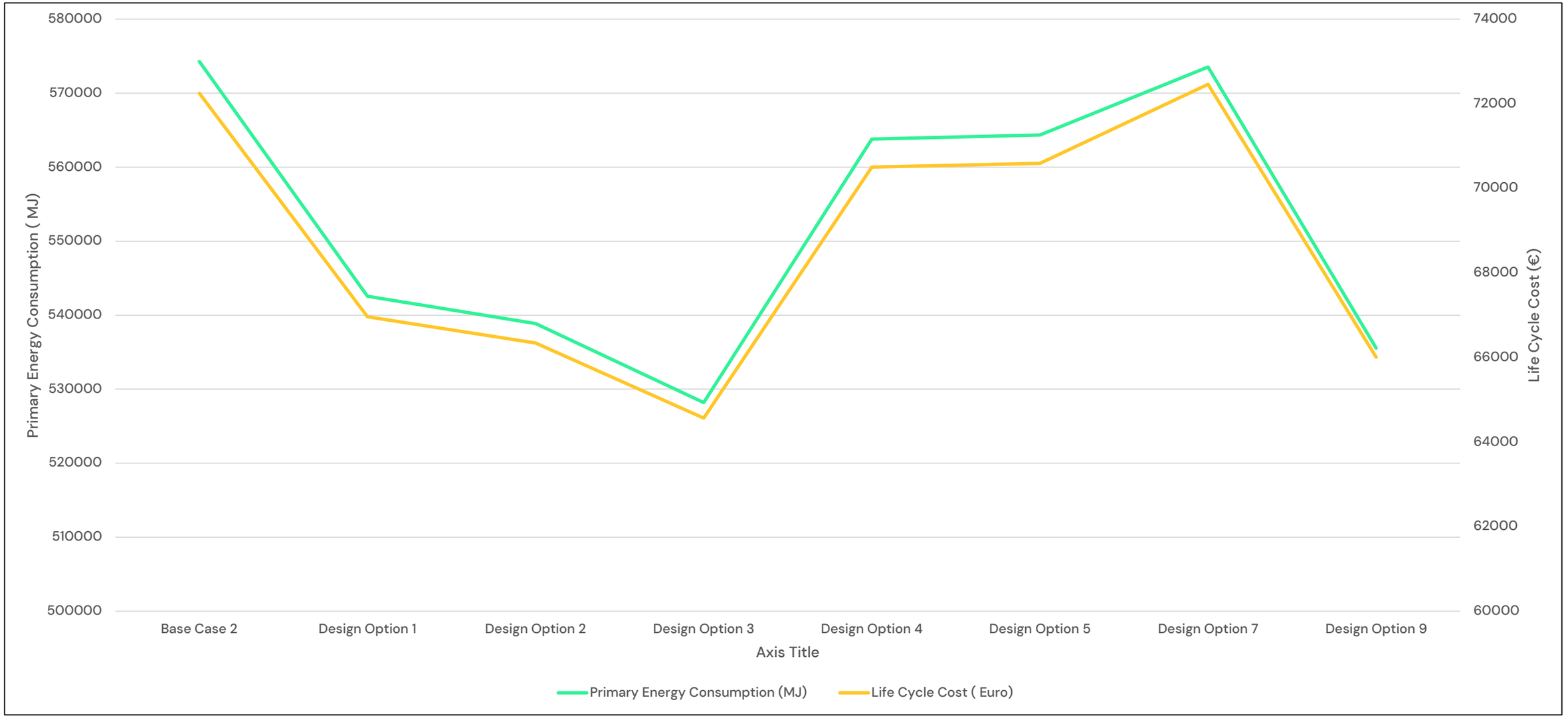
Task 6: BC1 – Design Option Least Life Cycle Costs

LLCC curve for BC1



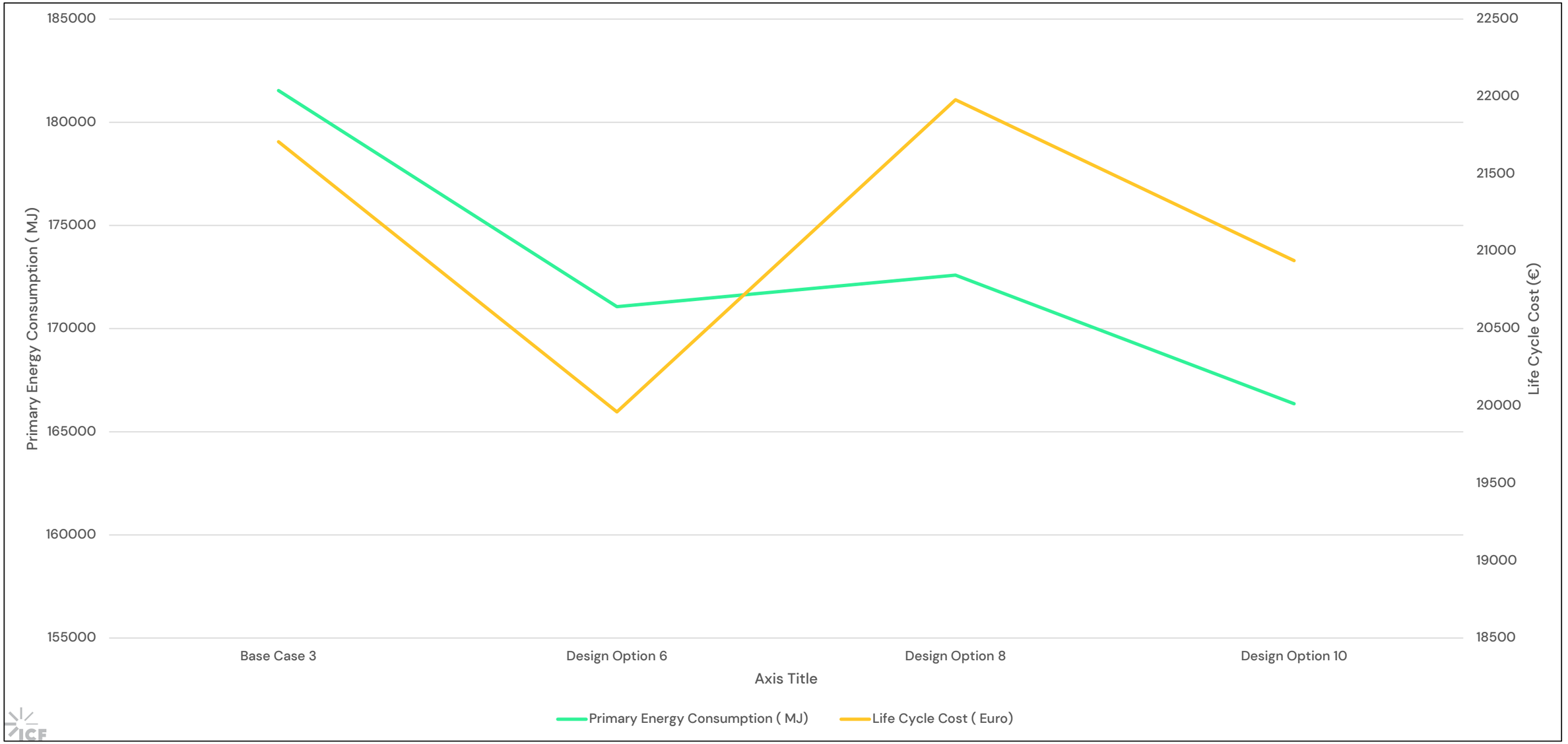
Task 6: BC2 – Design Option Least Life Cycle Costs

LLCC curve for BC2



Task 6: BC3 – Design Option Least Life Cycle Costs

LLCC curve for BC3



Comments & Feedback

Task 7 Scenarios

Task 7: Proposed Measures (1/3)

The proposed measures for the servers are presented and discussed below:

- Stricter Active Efficiency
  - Design Option 3 considers a scenario with 75% pass rate

- Idle Consumption to Workload Ratio
  - $Idle\ to\ workload\ ratio = \frac{idle\ power\ (in\ Watts)}{100\%\ SSJ\ workload\ power\ (in\ Watts)}$
  - Idle to workload ratio < 0.38, 75% pass rate for BC1
  - Idle to workload ratio < 0.16, 75% pass rate for BC2

- Processor Power Management Function
  - Dynamic Voltage and Frequency Scaling (DVFS)

- Improved disassembly, repairability and recycling for servers

Proposed server stricter-active efficiency thresholds

Number of sockets	Product type	Minimum Active efficiency
1	Rack	15.33
2	Rack	23.36
2	Blade or multi-node servers	21.09
4	Rack	20.32
4	Blade or multi-node	22.44

SERT 2019 dataset pass rate under stricter-active efficiency thresholds

Number of sockets	Product type	Pass rate (%)	Total sample size
1	Rack	75%	76
2	Rack	75%	152
2	Blade or multi-node servers	75%	60
4	Rack	75%	24
4	Blade or multi-node	75%	10

Task 7: Proposed Measures (2/3)

The proposed measures for the data storage product groups are presented and discussed below:

- Energy efficiency requirements
  - Setting SNIA performance level
    - Aligns with ENERGY STAR
  - Setting Capacity Optimisation Methods (COMs) availability requirements

- Improved disassembly, repairability and recycling for data storage products
  - Disassemblability requirements by a class B generalist, workshop environment class A, using tools from A, B or C nomenclature
  - Provide information on disassemble and repair
  - Availability of spare parts
  - Provide non-discriminatory access for professional repairers to any software tools, firmware or similar auxiliary means

Active state requirements for Block I/O Storage products

Workload Type Specific	Specific Workload Test	Minimum Performance /Watt Ratio	Applicable Units of Ratio
Transaction	Hot Band	28.0	IOPS/Watt
Streaming	Sequential Read	2.3	MiBS/Watt
Streaming	Sequential Write	1.5	MiBS/Watt

Recognised COM features

Feature	Verification Requirement
COM: Thin Provision	SNIA Verification test, following ISO/IEC 24091:2019 standard
COM: Data Deduplication	SNIA Verification test, following ISO/IEC 24091:2019 standard
COM: Compression	SNIA Verification test, following ISO/IEC 24091:2019 standard
COM: Delta Snapshots	SNIA Verification test, following ISO/IEC 24091:2019 standard

COM requirements for Disk Set & NVSS Disk Set Access Online 2, 3 & 4 Systems

Storage Product Category	Minimum number of COMs required to be made available
Online 2	1
Online 3	2
Online 4	3

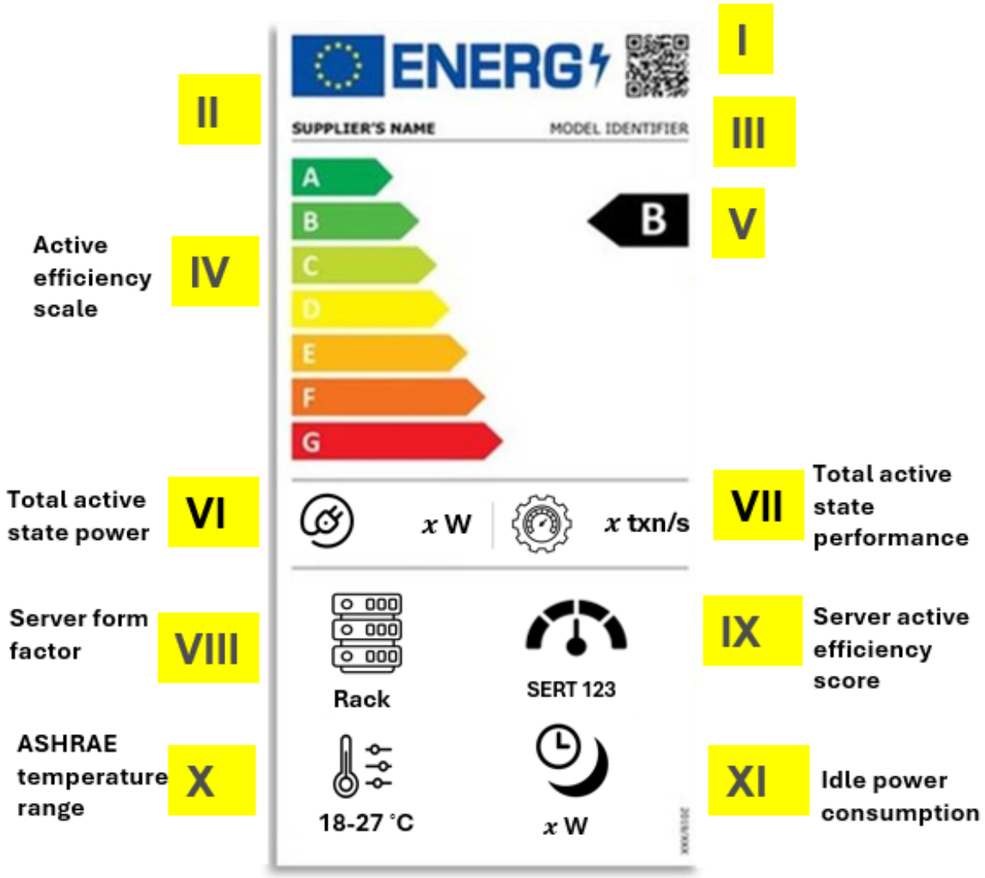
Task 7: Proposed Measures (3/3)

Information Sharing

The following measures encourage better product utilisation, datacentre facilities management and improved purchasing practices:

- Server real time utilisation and power consumption reporting
  - Processor Utilisation
  - Input Power
- Server thermal management and monitoring
  - Inlet Air temperature
- Data storage products performance reporting
  - Input Power, in Watts
  - Inlet Air Temperature

Task 7: Labelling (Servers)



Servers shall be sold with an energy label which includes the following information:

A–G Scale:

- Server active efficiency
  - Determined directly on the different levels of the SERT score.

Pictograms:

- Total active state power (Watts)
- Total active state performance (transactions per second)
- Server form factor
- Server active efficiency score
- ASHRAE temperature range
  - The temperature values presented represent the recommended ASHRAE temperature for servers.
- Idle power consumption (Watts)

For servers which are part of a server configuration family, the "typical server configuration" data should be reported.

Task 7: Labelling (Servers) Calculation Methods

Active state efficiency calculation:

$$Eff_{server} = \exp\left[W_{cpu} \times \ln\left(Eff_{cpu}\right) + W_{Memory} \times \ln\left(Eff_{Memory}\right) + W_{Storage} \times \ln\left(Eff_{Storage}\right)\right]$$

where: W_{CPU}, W_{Memory} and $W_{Storage}$ are the weightings applied to the CPU, Memory and Storage worklets respectively, as follows:

— W_{CPU} is the weighting assigned to the CPU worklets = 0,65

— W_{Memory} is the weighting assigned to the Memory worklets = 0,30

— $W_{Storage}$ is the weighting assigned to the Storage worklets = 0,05

and

$$Eff_{CPU} = \left(\prod_{i=1}^{n} Eff_i\right)^{1/7}$$

where:

— i = 1 for worklet*Compress*;

— i = 2 for worklet*LU*;

— i = 3 for worklet*SOR*;

— i = 4 for worklet*Crypto*;

— i = 5 for worklet*Sort*;

— i = 6 for worklet*SHA256*;

— i = 7 for worklet*Hybrid SSJ*;

$$Eff_{Memory} = \left(\prod_{i=1}^{n} Eff_i\right)^{1/2}$$

where:

— i = 1 for workletFlood3;

— i = 2 for workletCapacity3;

$$Eff_{Storage} = \left(\prod_{i=1}^{n} Eff_i\right)^{1/2}$$

where:

— i = 1 for workletSequential;

$$Eff_i = 1\,000\frac{Perf_i}{Pwr_i}$$

where

— $Perf_i$: Geometric mean of the normalized interval performance measurements;

— Pwr_i: Geometric mean of the measured interval power values;

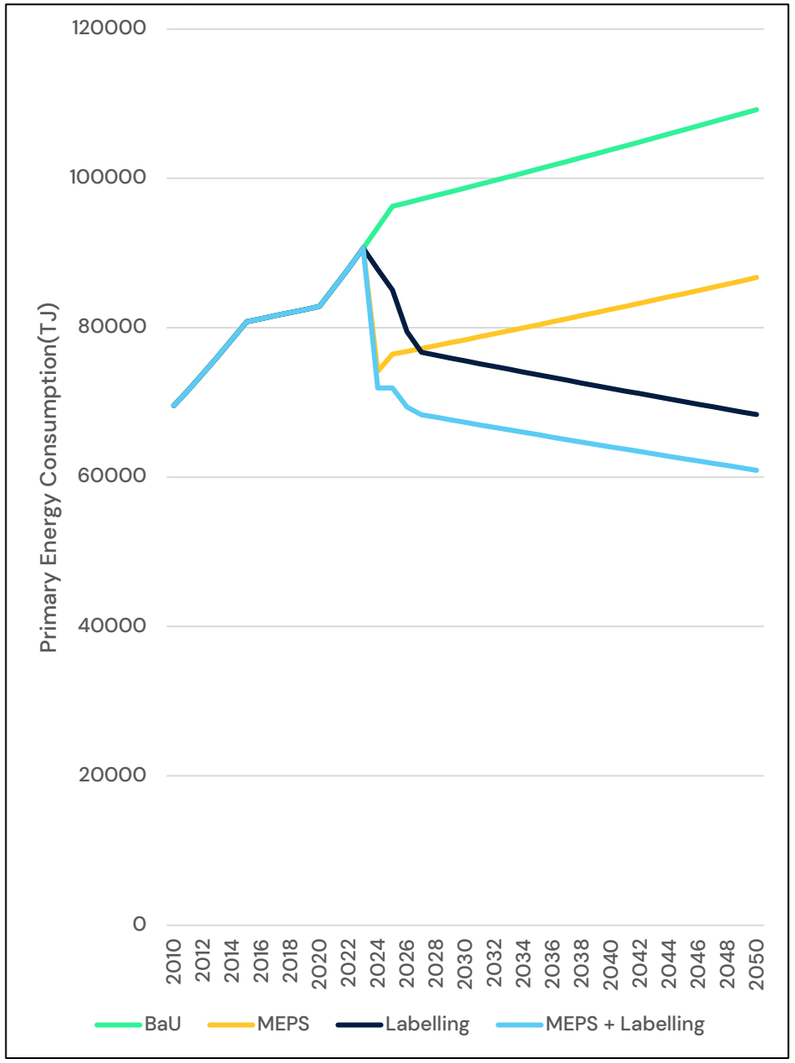
Idle power consumption is measured within the SERT methodology

Task 7: Scenario Analysis – Inputs & Assumptions

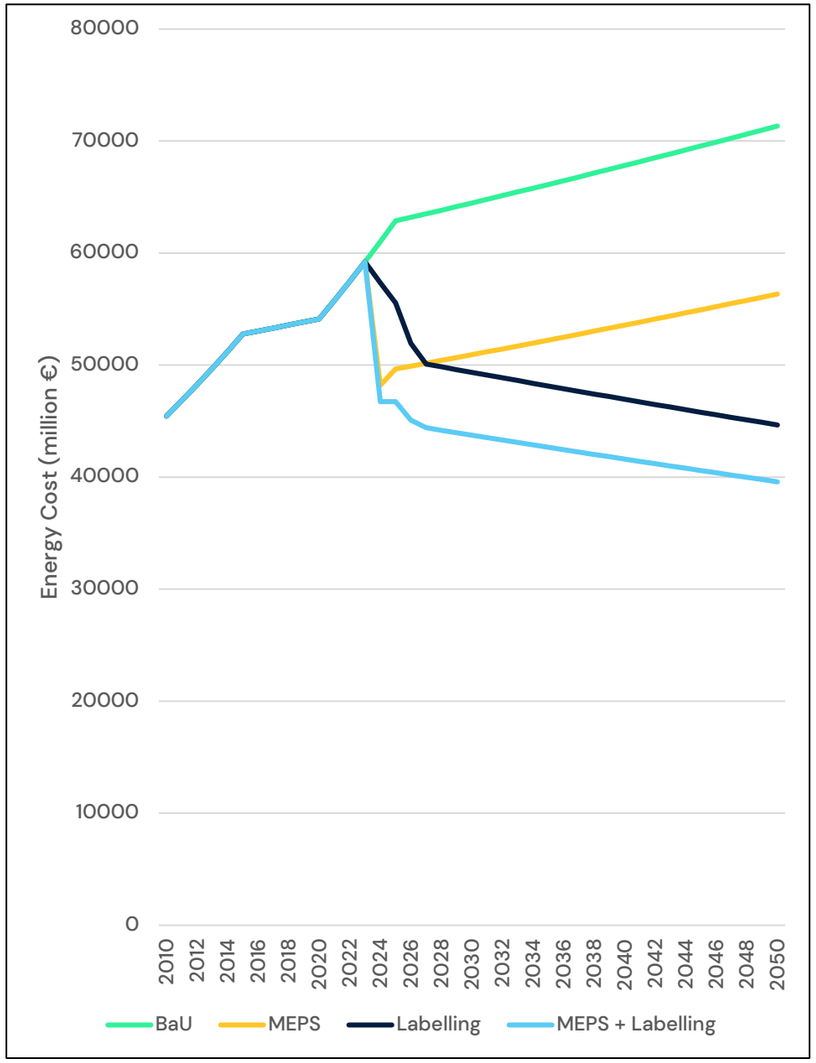
Scenarios	BC1	BC2	BC3	
BaU	No new policy measure	No new policy measure	No new policy measure	
MEPS	Implementing DO9 from 2024	Implementing DO9 from 2024	Implementing DO10 from 2024	
Labelling	2024 – 6% 2025- 6% 2026 – 7% 2027 – 4% 2028-2050- 1%			
MEPS + Labelling	2024 – MEPS + 3% 2025- MEPS + 3% 2026 –MEPS + 4% 2027 – MEPS + 2% 2028-2050- MEPS + 1%			

Task 7: Scenario Analysis – BC1 Resource Use / Enviro Impact Results

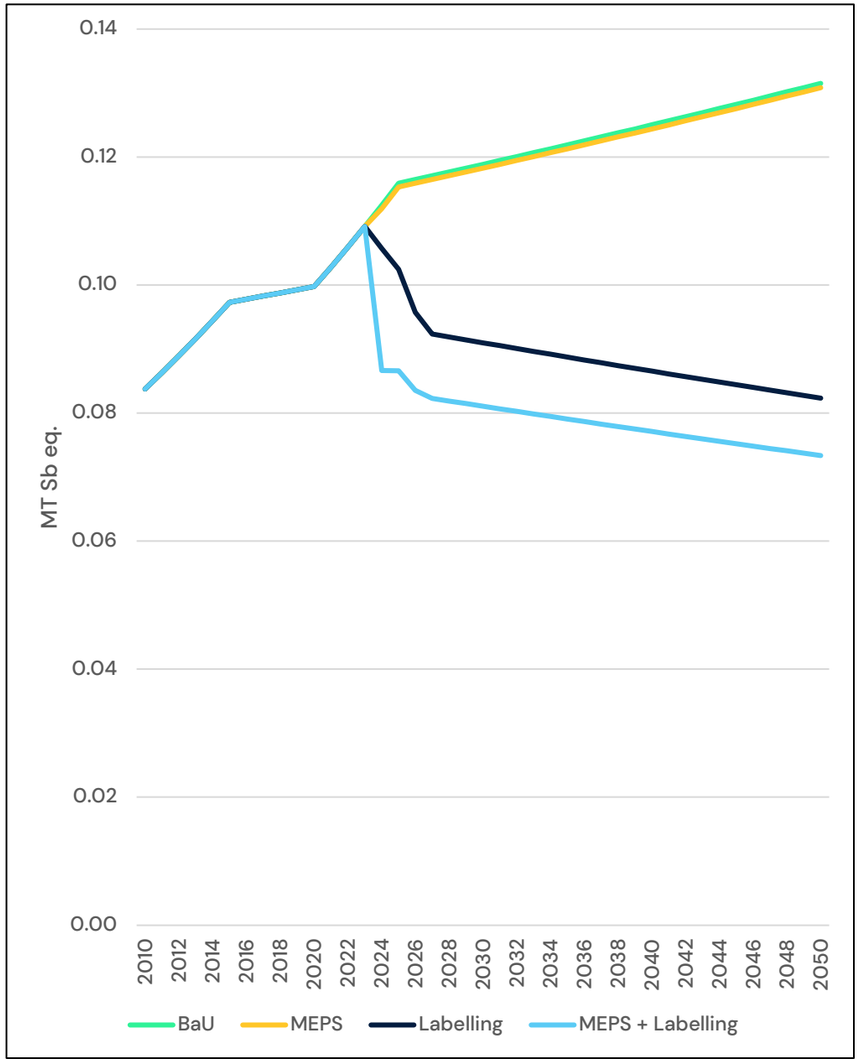
BC1 Primary energy consumption, four scenarios, 2010-2050 (EU-27)



BC1 Energy cost, four scenarios, 2010-2050 (EU-27)

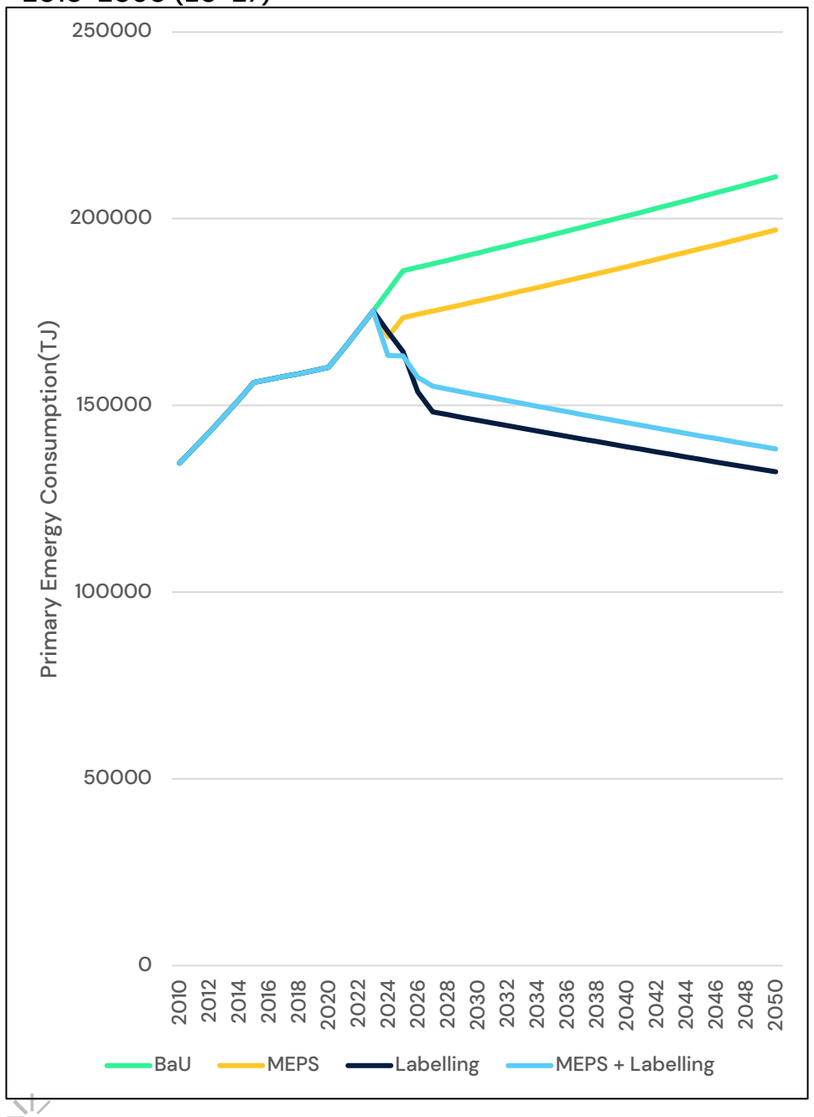


BC1 Resource use, four scenarios, 2010-2050 (EU-27)

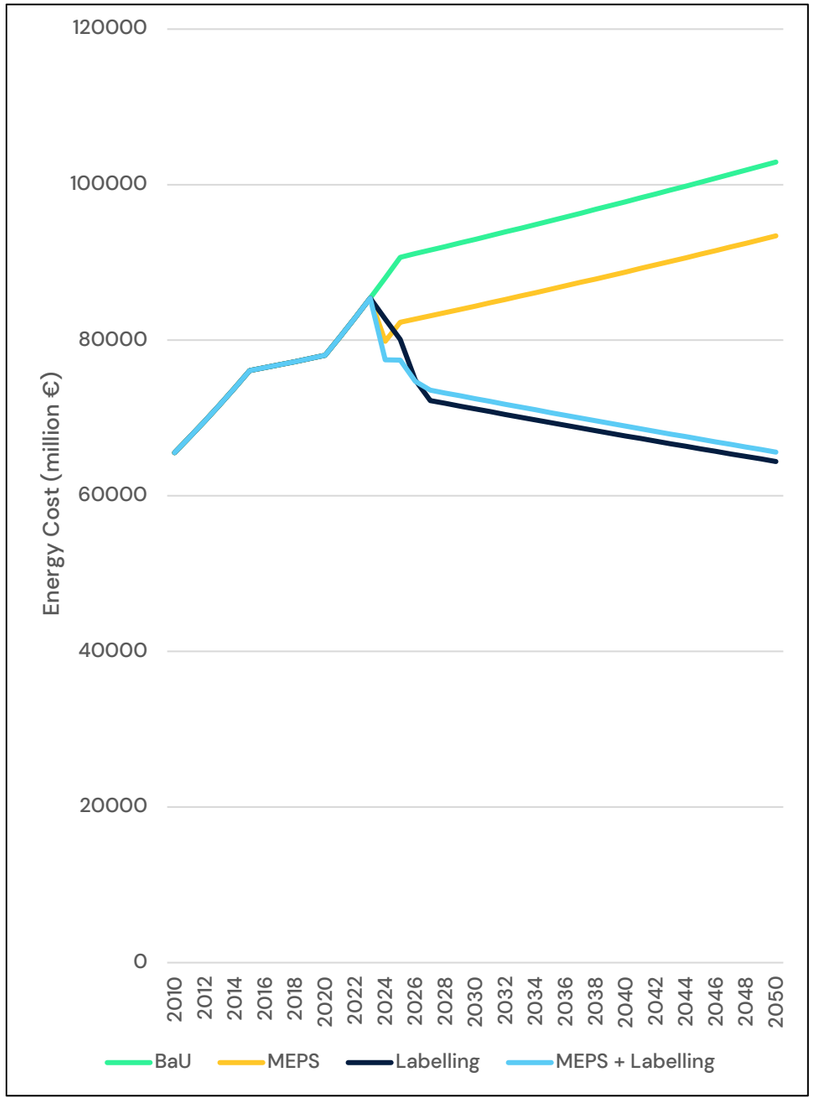


Task 7: Scenario Analysis – BC2 Resource Use / Enviro Impact Results

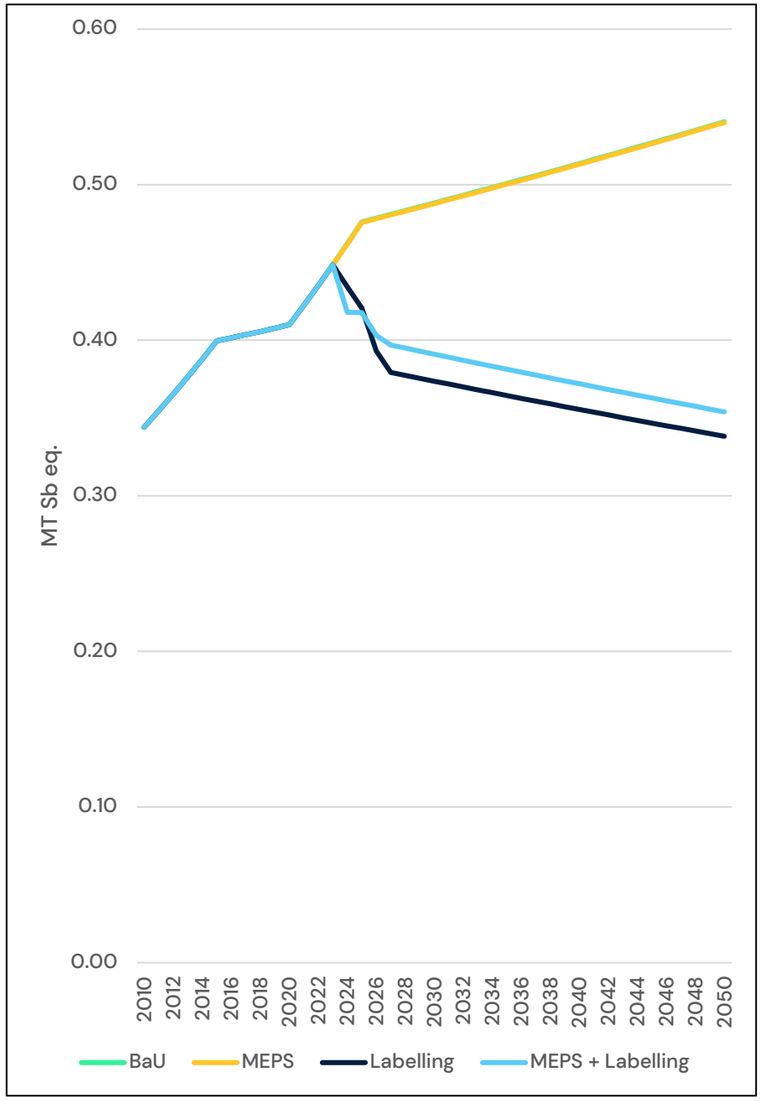
BC2 Primary energy consumption, four scenarios, 2010-2050 (EU-27)



BC2 Energy cost, four scenarios, 2010-2050 (EU-27)

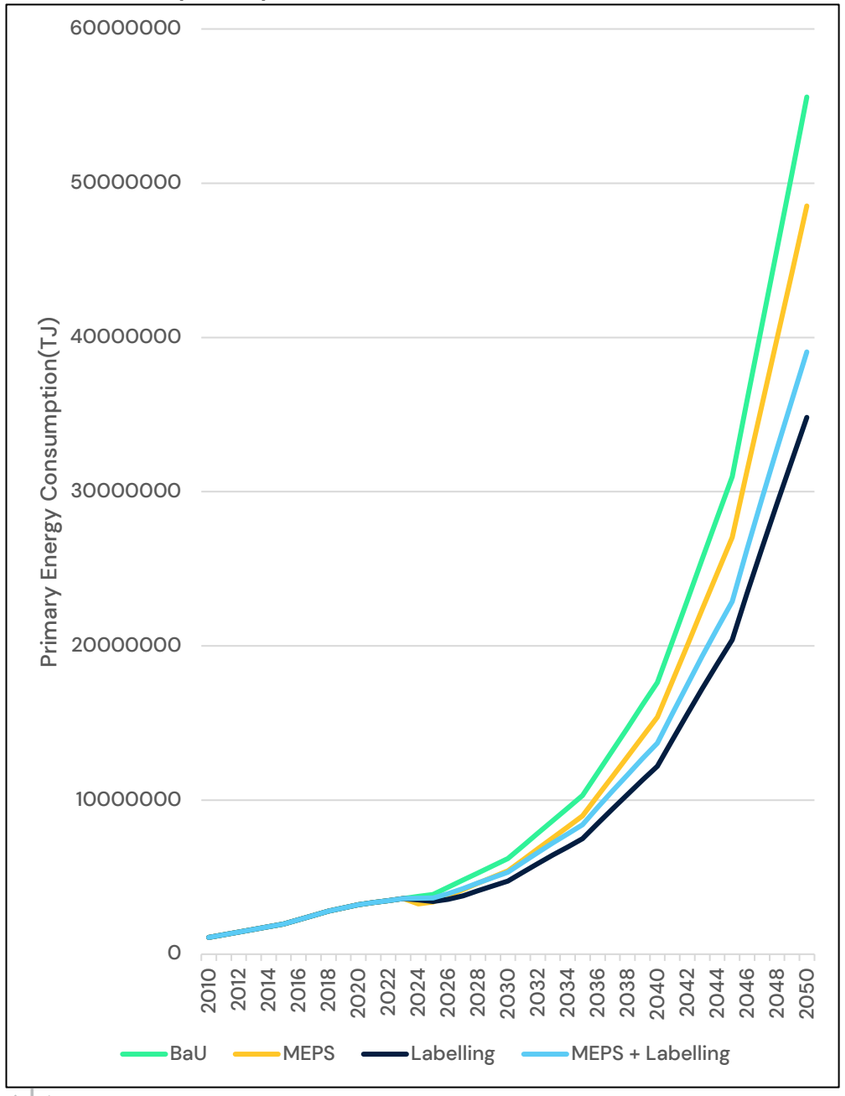


BC2 Resource use, four scenarios, 2010-2050 (EU-27)

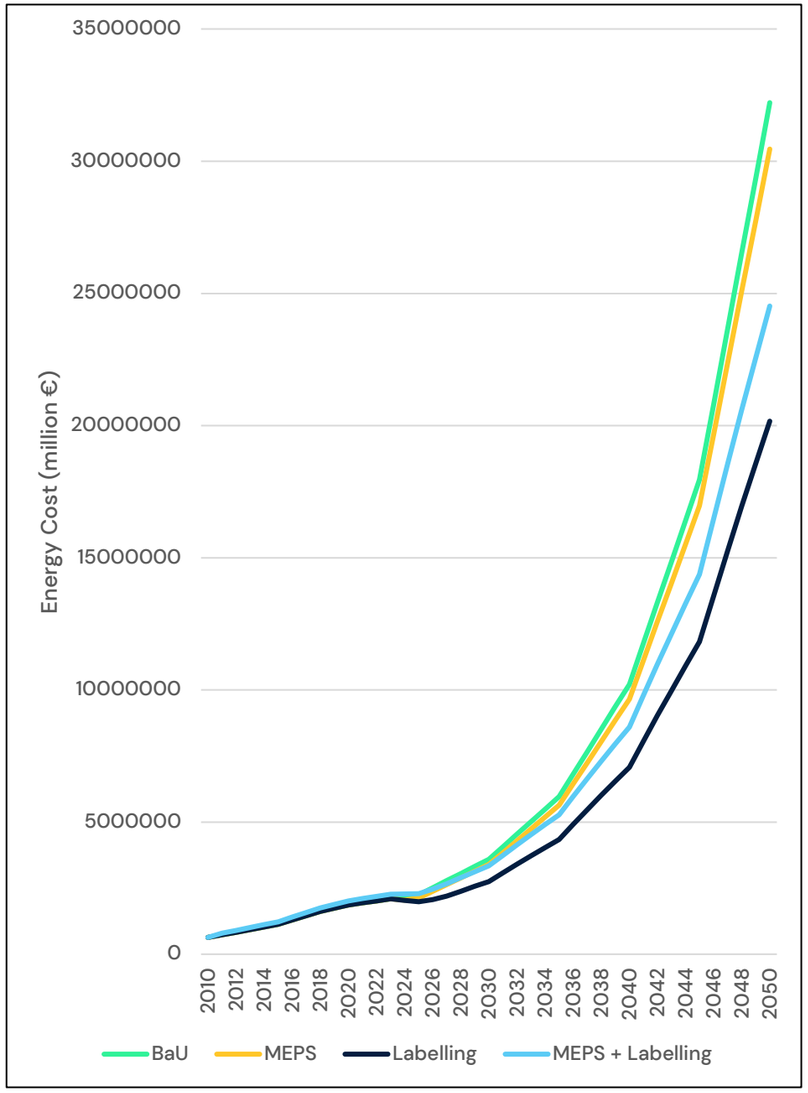


Task 7: Scenario Analysis – BC3 Resource Use / Enviro Impact Results

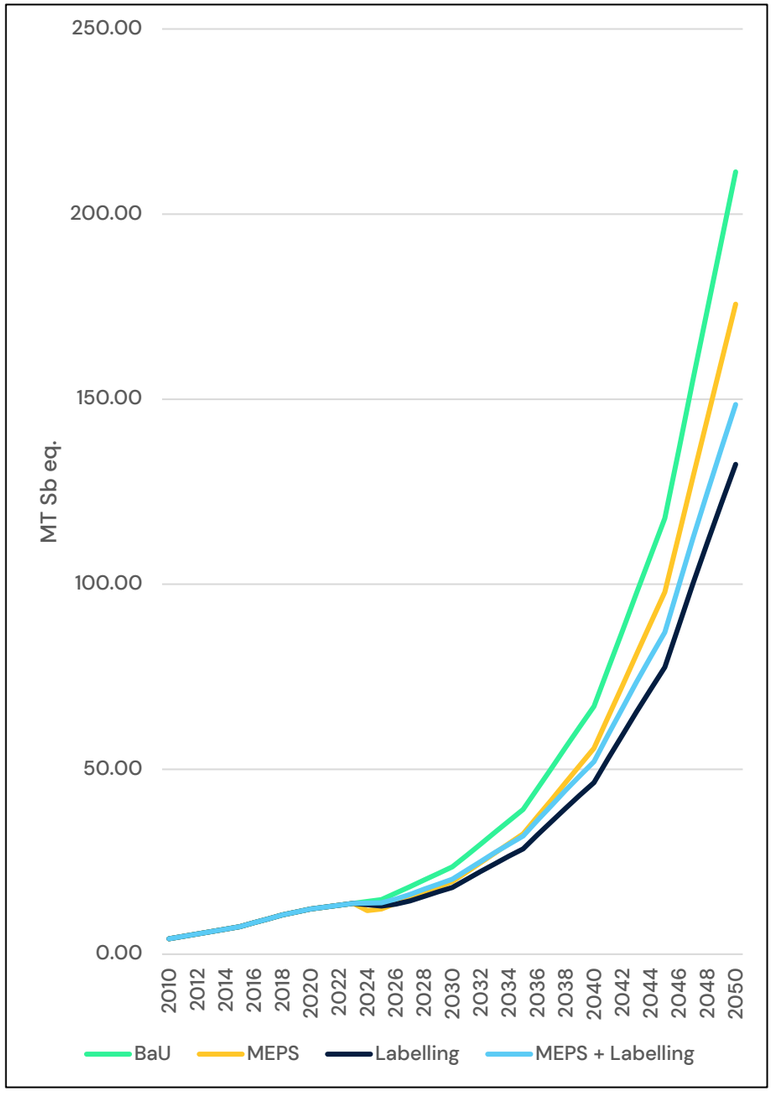
BC3 Primary energy consumption, four scenarios, 2010-2050 (EU-27)



BC3 Energy cost, four scenarios, 2010-2050 (EU-27)

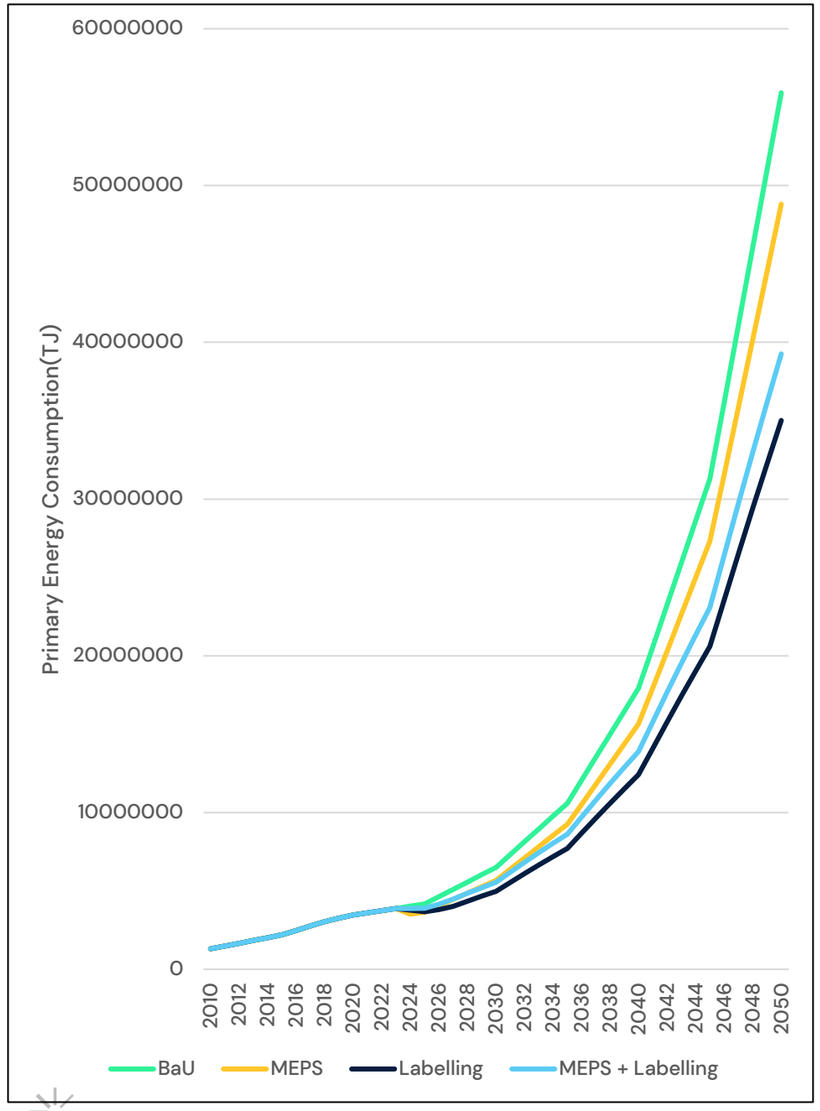


BC3 Resource use, four scenarios, 2010-2050 (EU-27)

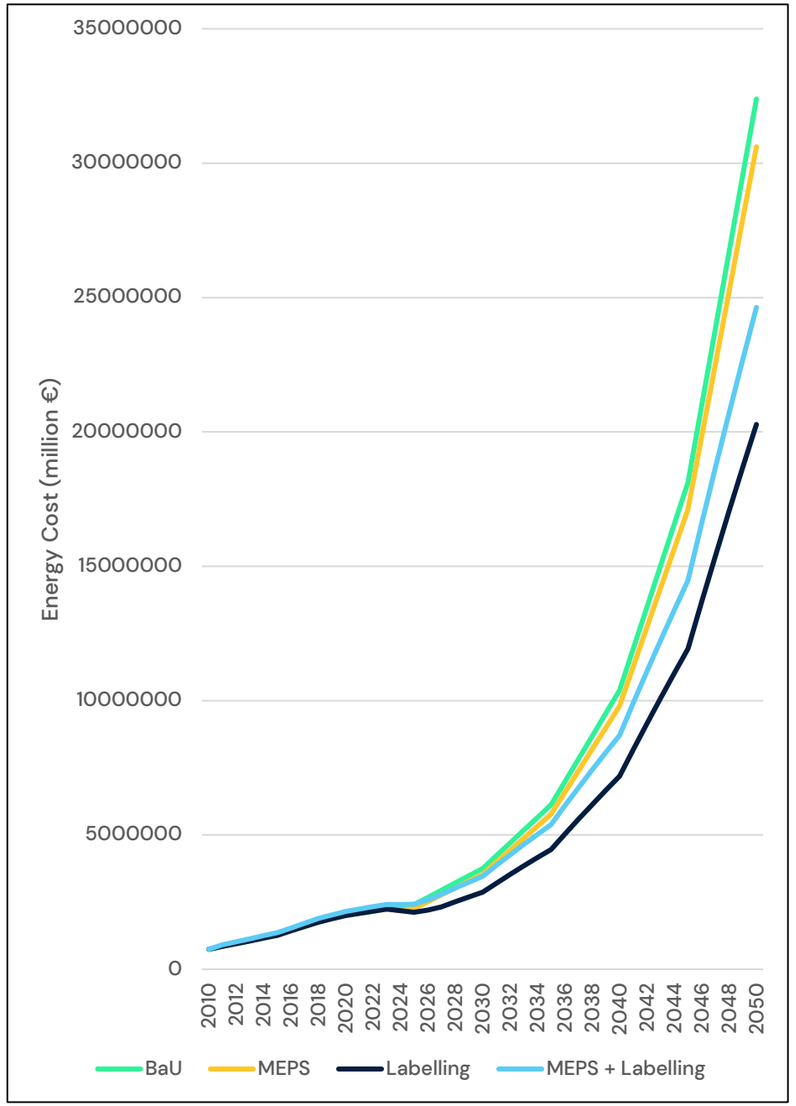


Task 7: Scenario Analysis – All Base Case Results

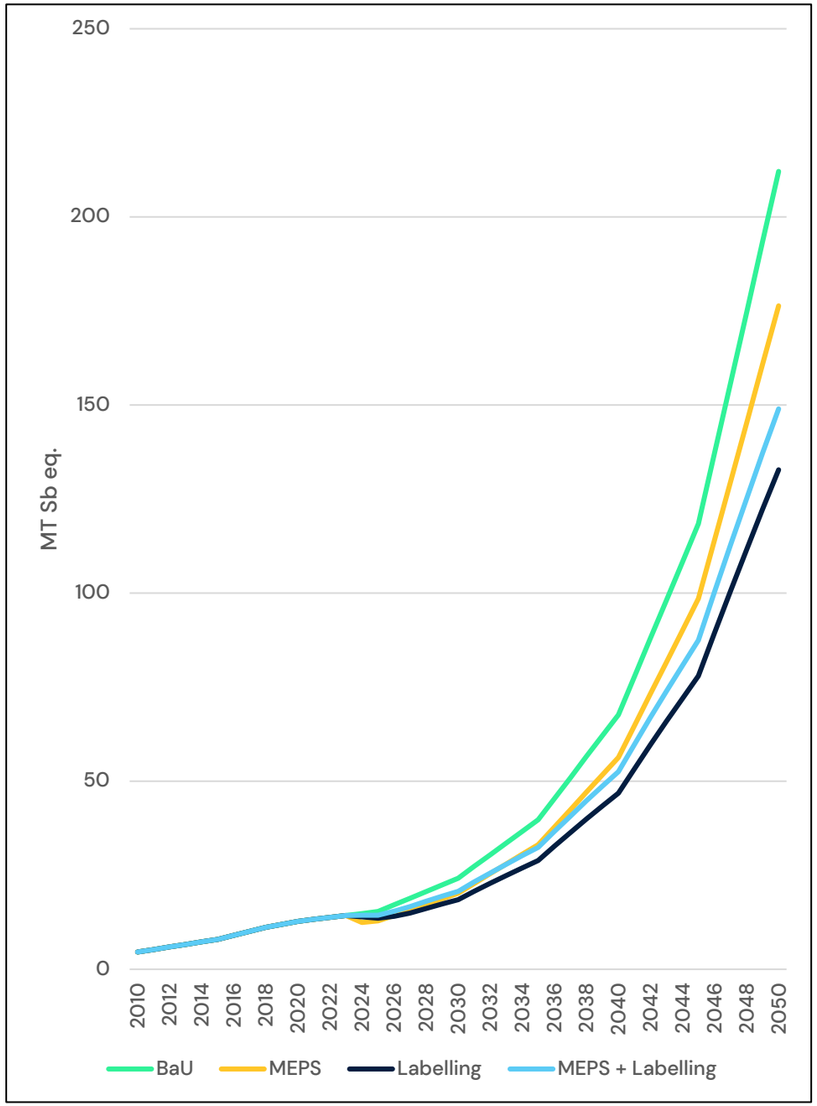
All BCs primary energy consumption, four scenarios, 2010-2050 (EU-27)



All BCs energy costs, four scenarios, 2010-2050 (EU-27)



All BCs Resource use, four scenarios, 2010-2050 (EU-27)



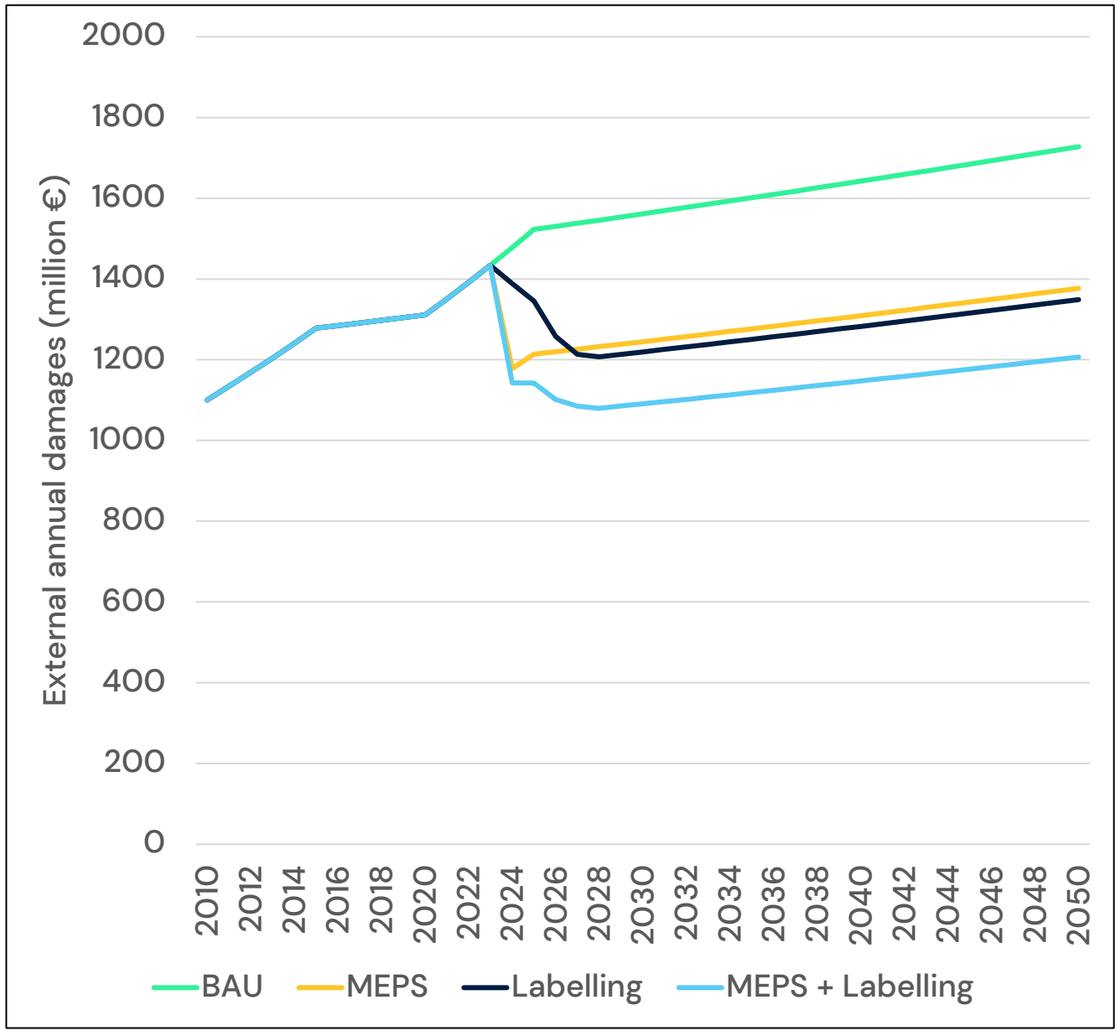
Task 7: Scenario Analysis – Inputs & Assumptions

Purchase price of units used in the four scenarios

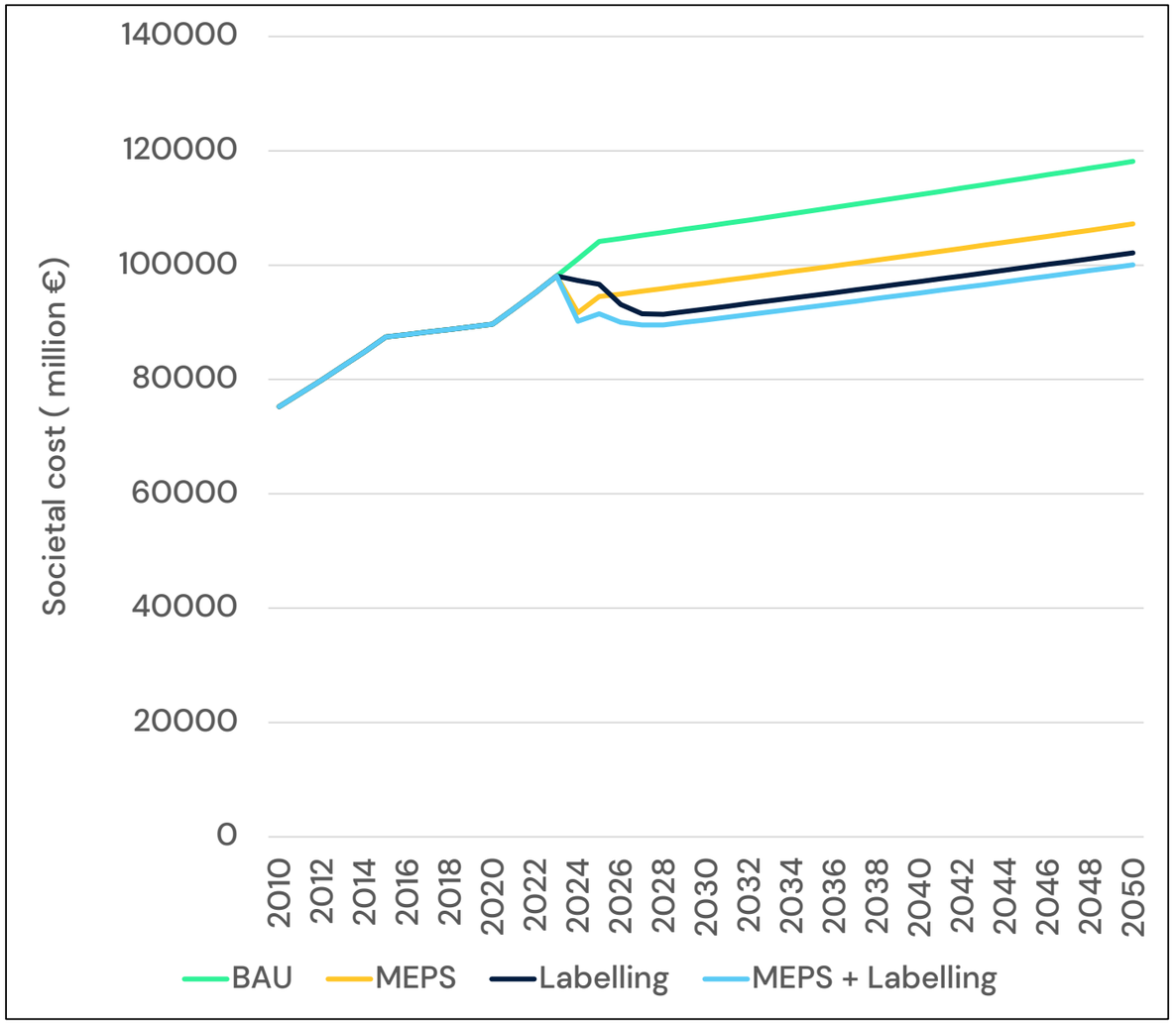
Base Case	BaU and Labelling purchase price (€)	MEPS and MEPS + Labelling purchase price (€)	All 4 scenarios installation cost (€)	All 4 scenarios repair and maintenance cost (€)
BC1	23,420	25,762	340	400
BC2	8,435	9,279	340	400
BC3	24,400	26,840	425	220

Task 7: Scenario Analysis – BC1 Socio Economic Results

BC1 External annual damages, EU-27

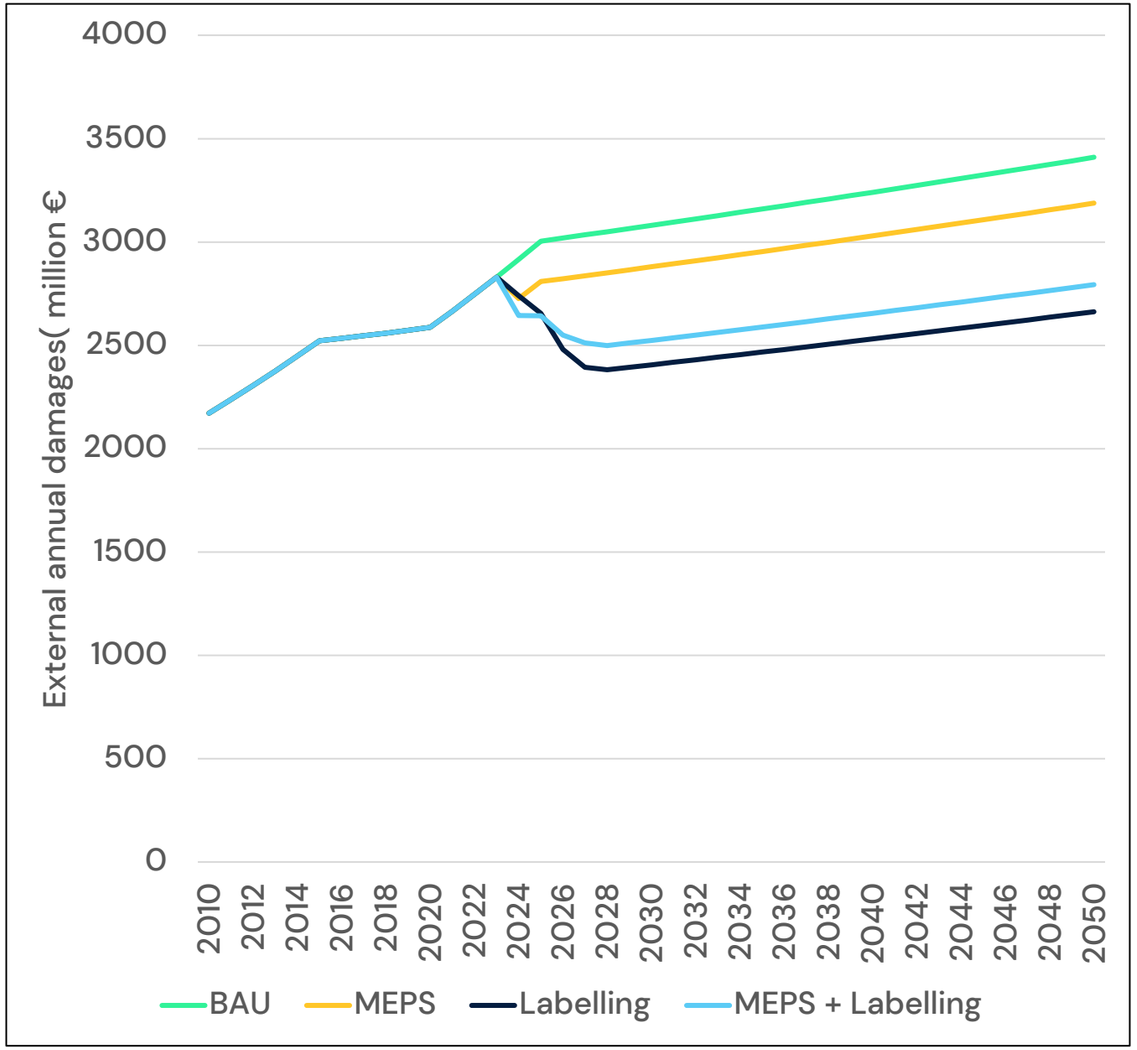


BC1 Total societal cost, EU-27

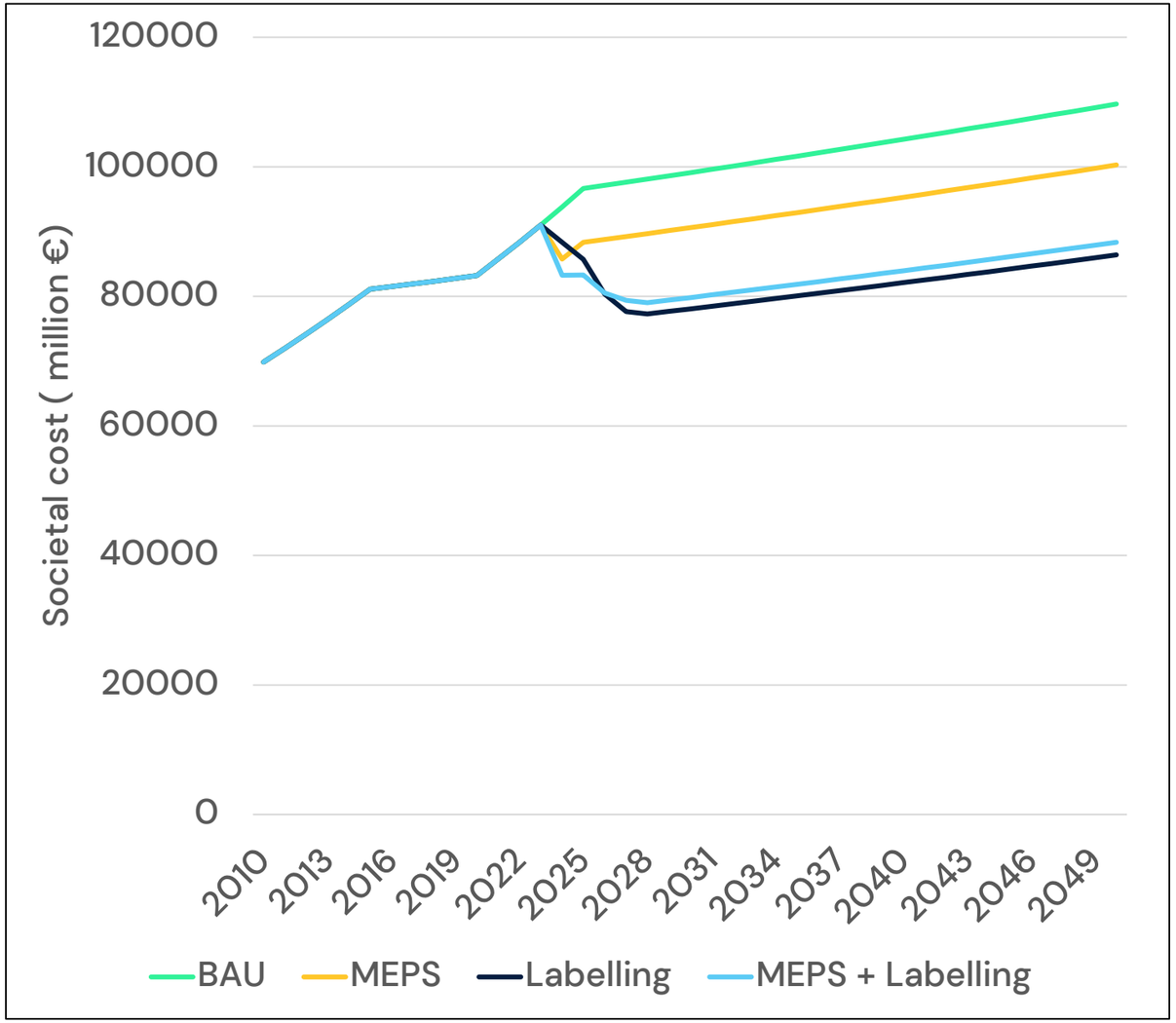


Task 7: Scenario Analysis – BC2 Socio Economic Results

BC2 External annual damages, EU-27

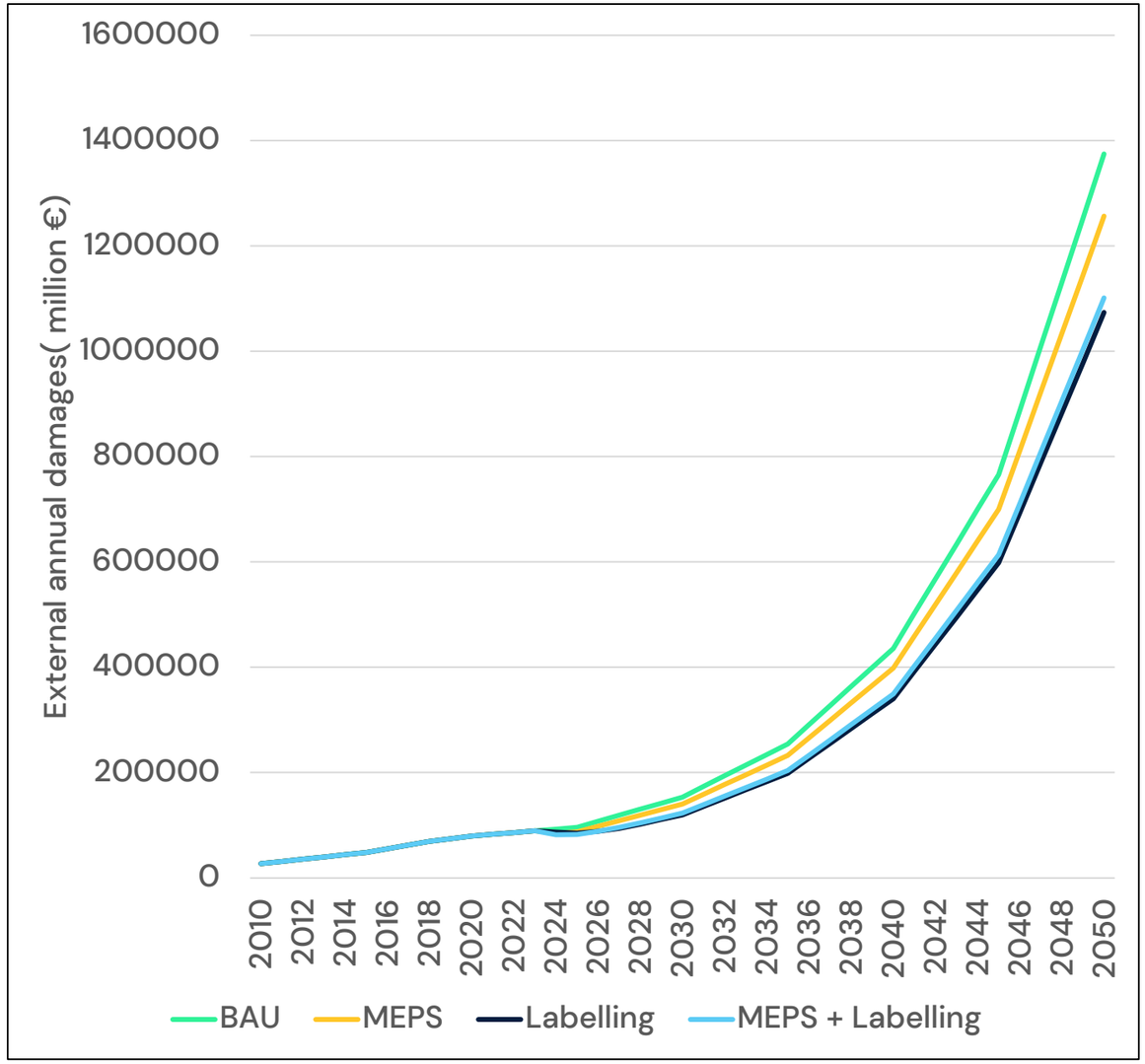


BC2 Total societal cost, EU-27

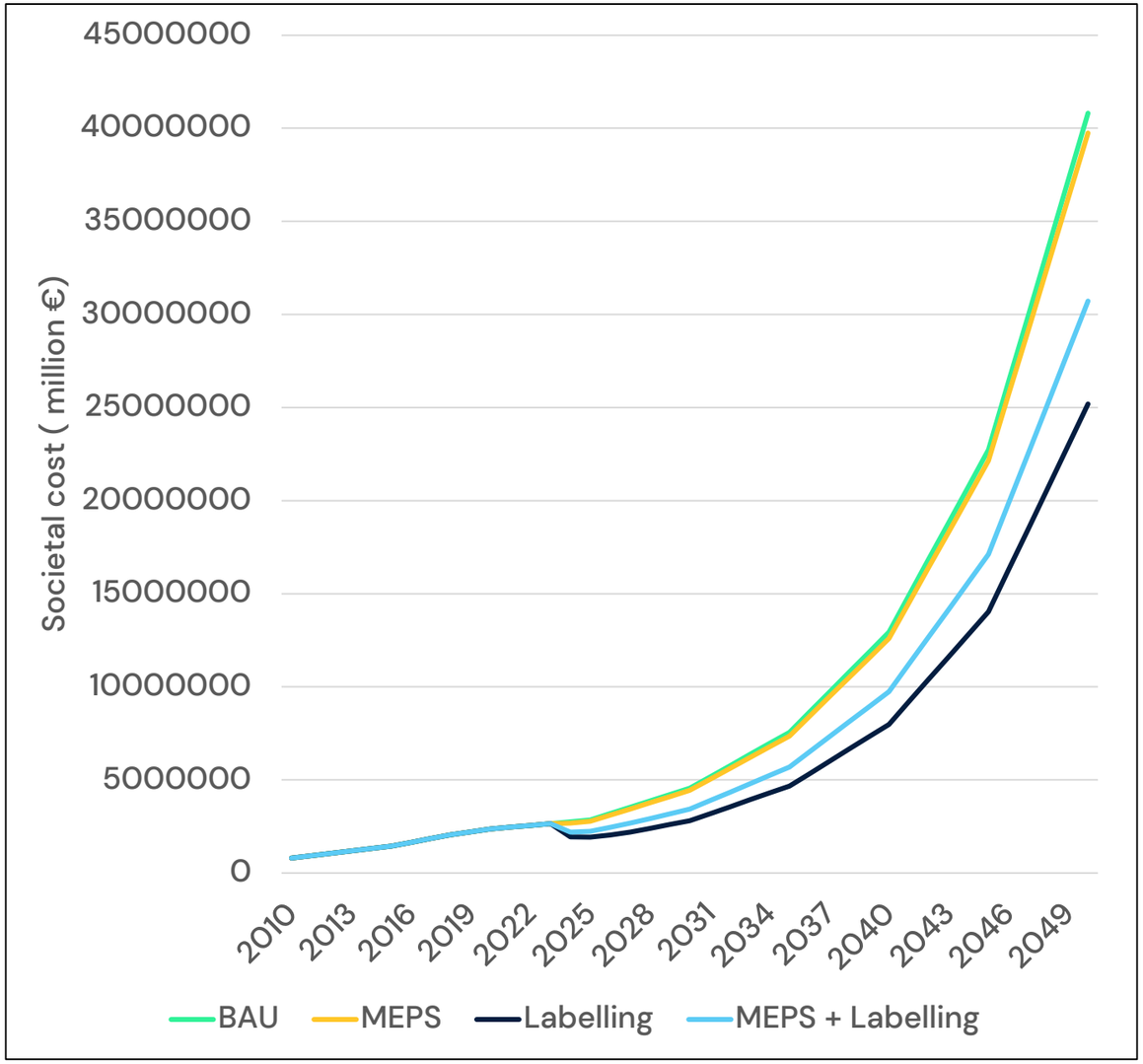


Task 7: Scenario Analysis – BC3 Socio Economic Results

BC3 External annual damages, EU-27

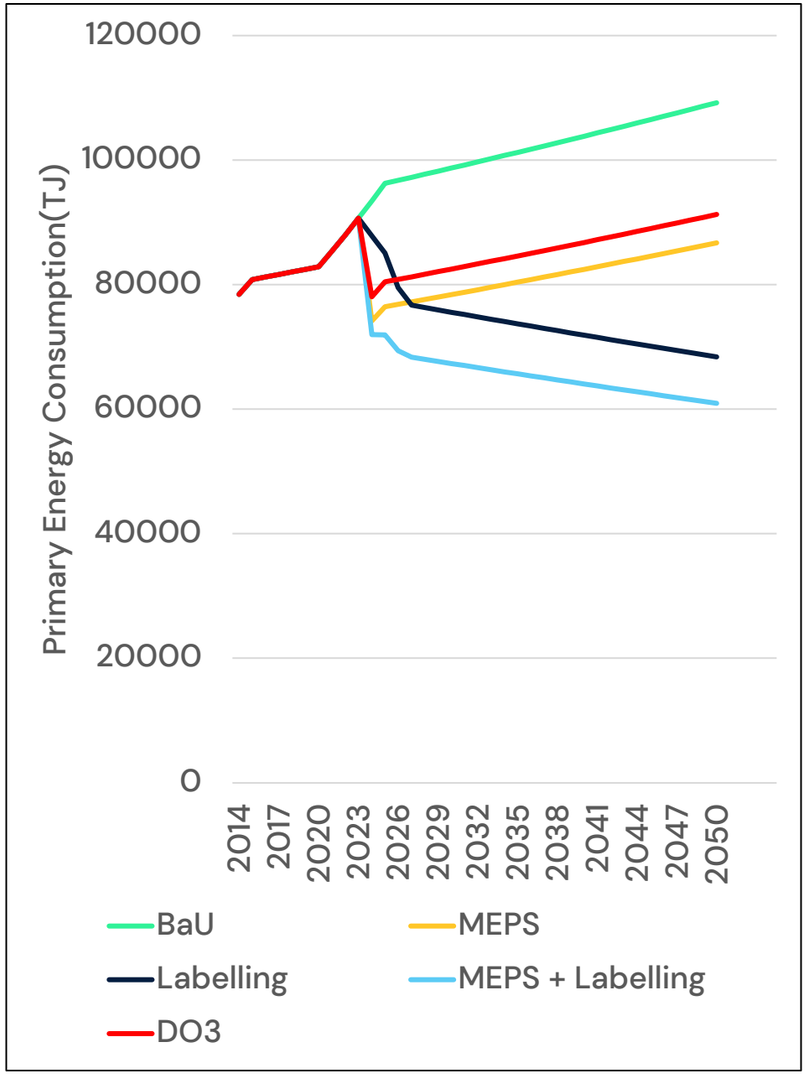


BC3 Total societal cost, EU-27

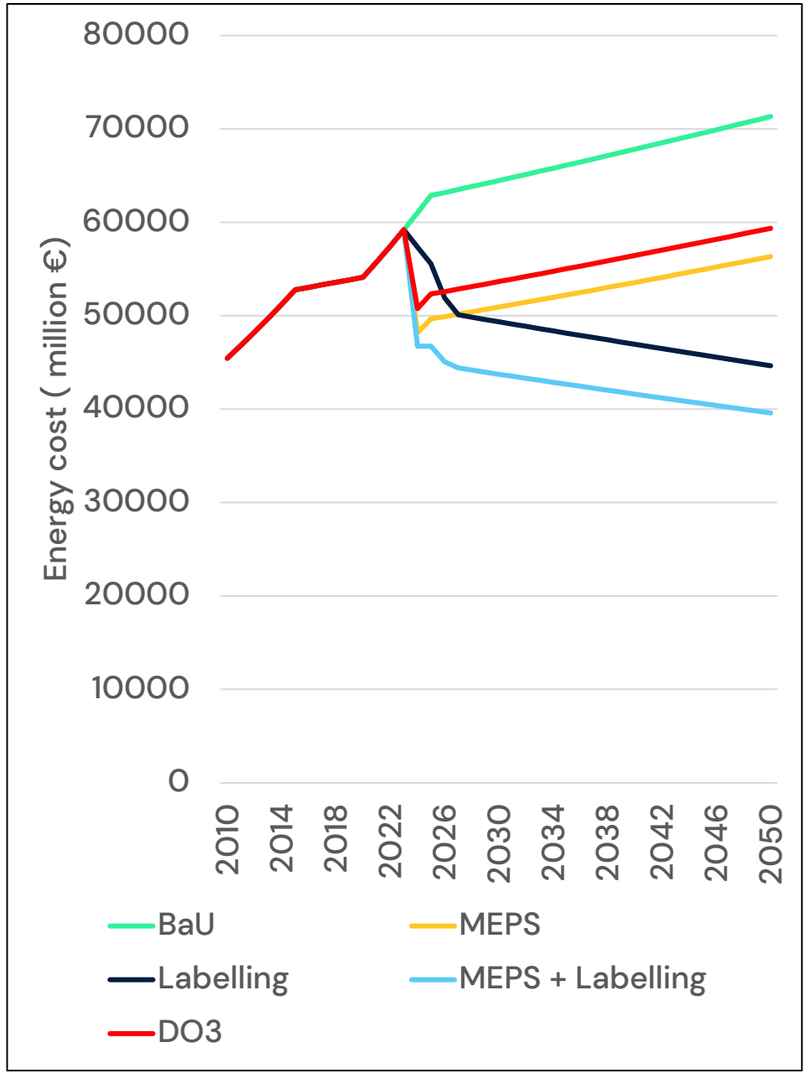


Task 7: Sensitivity Analysis – BC1

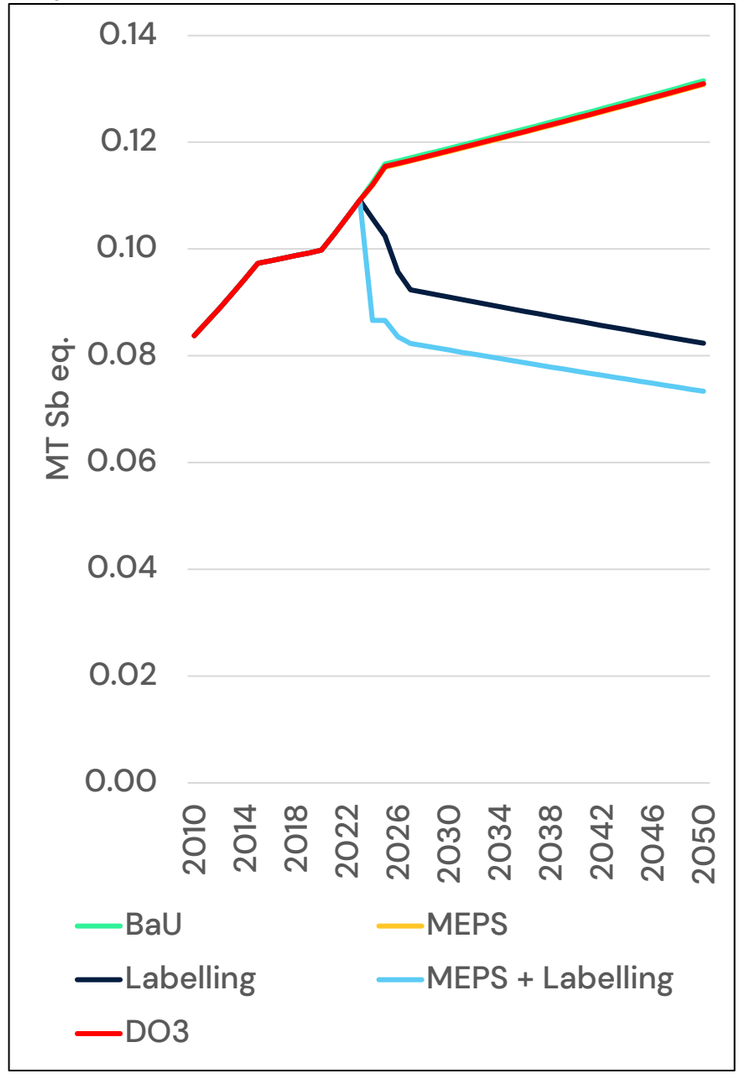
BC1 Primary energy consumption, four scenarios vs DO3, 2010-2050 (EU-27)



BC1 Energy cost, four scenarios vs DO3, 2010-2050 (EU-27)

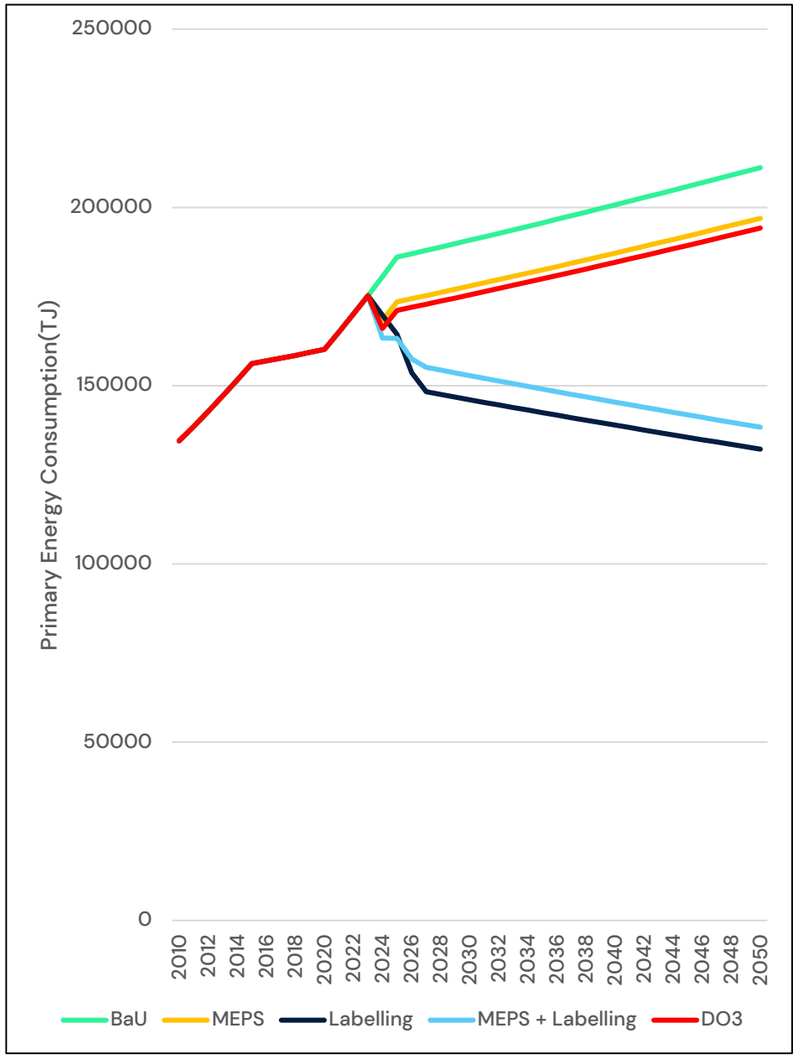


BC1 Resource use, four scenarios vs DO3, 2010-2050 (EU-27)

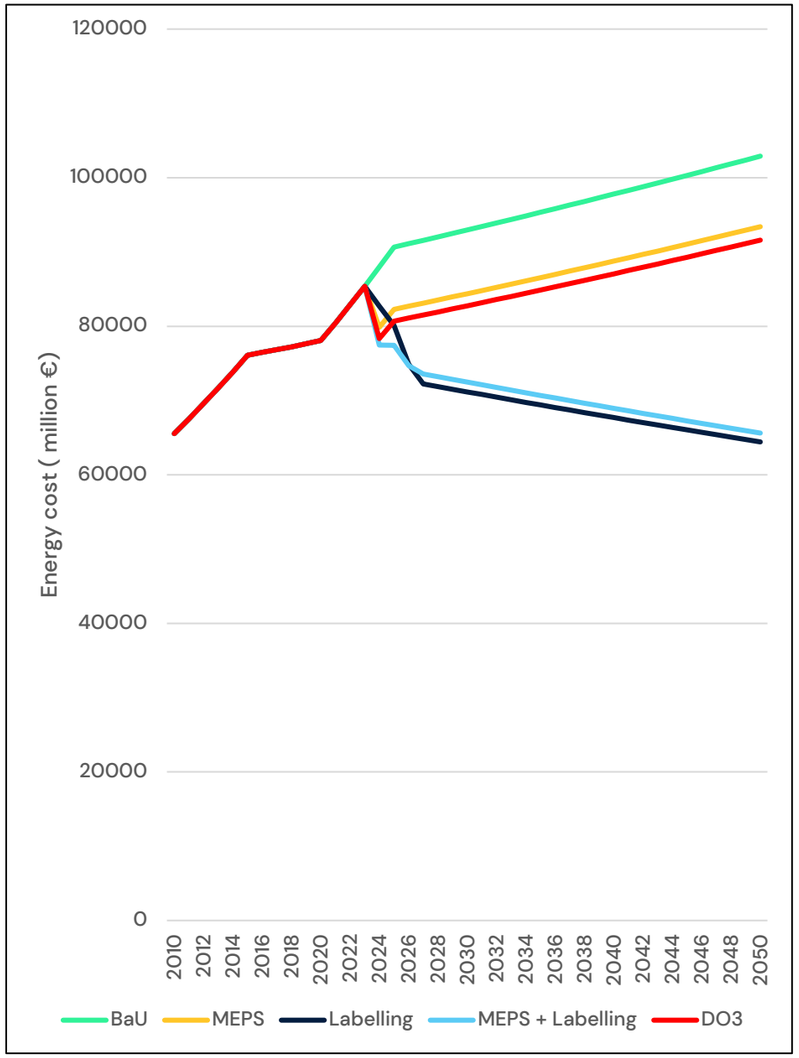


Task 7: Sensitivity Analysis – BC2

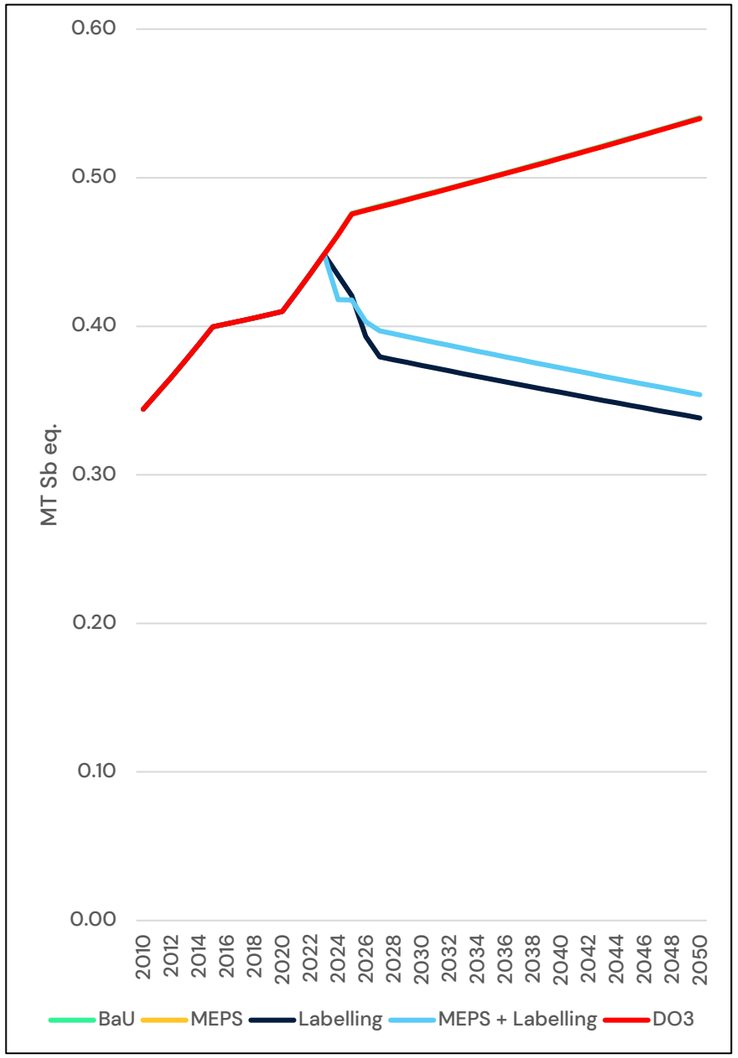
BC2 Primary energy consumption, four scenarios vs DO3, 2010-2050 (EU-27)



BC2 Energy cost, four scenarios vs DO3, 2010-2050 (EU-27)

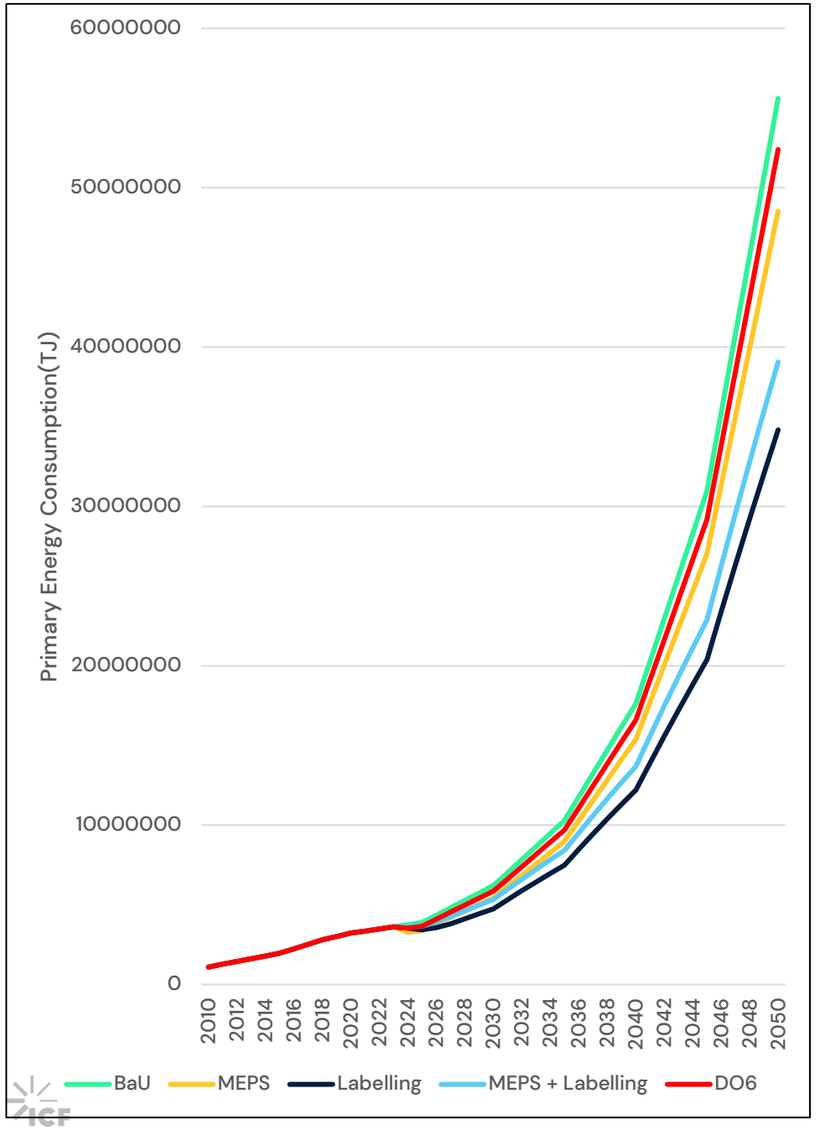


BC2 Resource use, four scenarios vs DO3, 2010-2050 (EU-27)

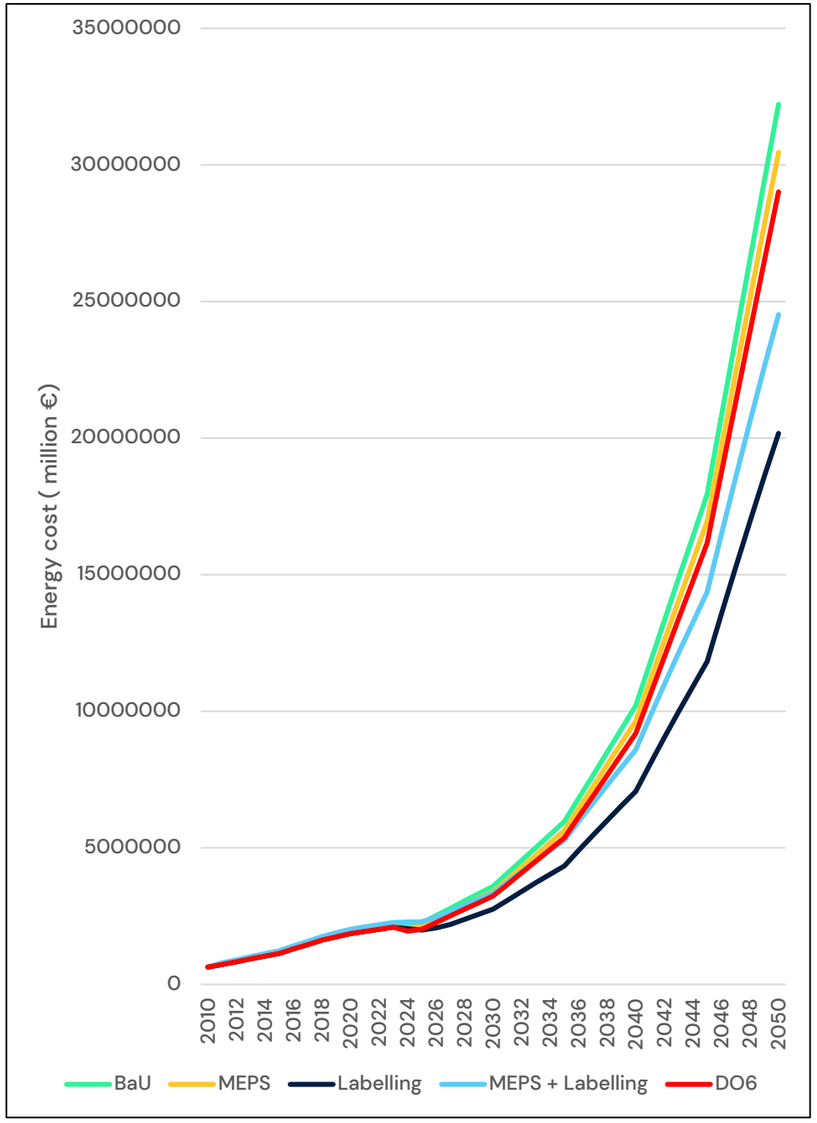


Task 7: Sensitivity Analysis – BC3

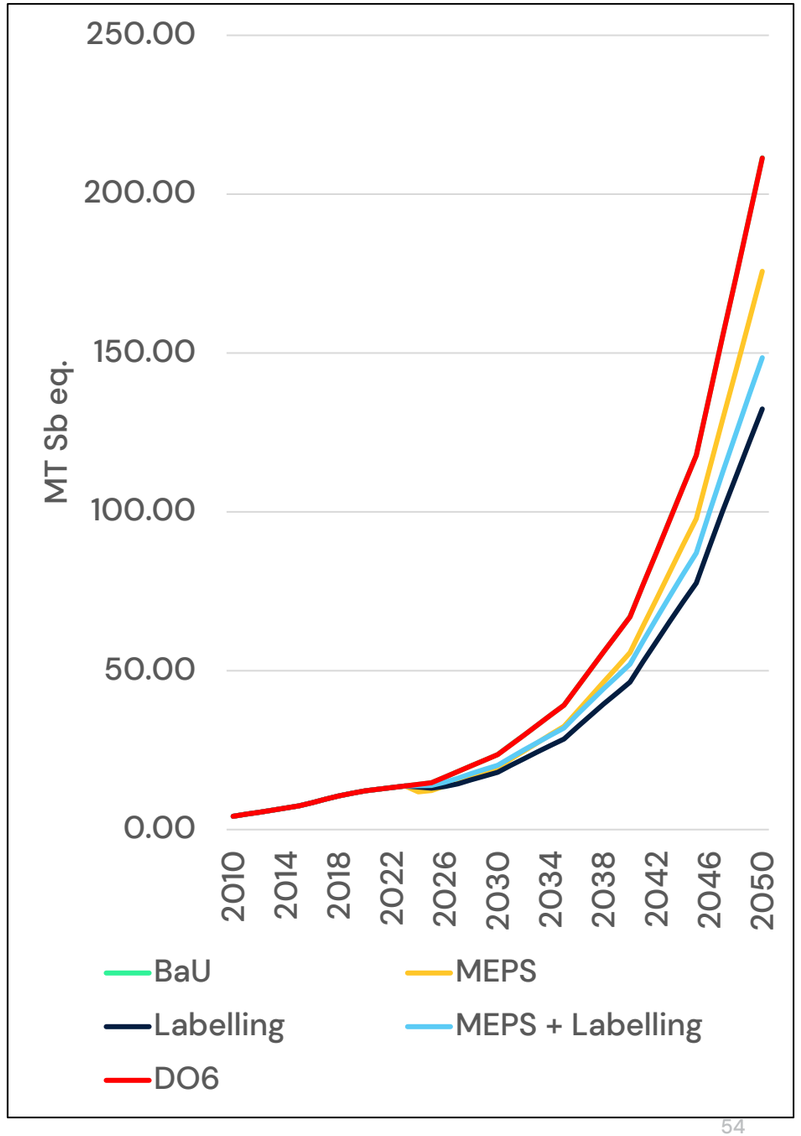
BC3 Primary energy consumption, four scenarios vs DO3, 2010-2050 (EU-27)



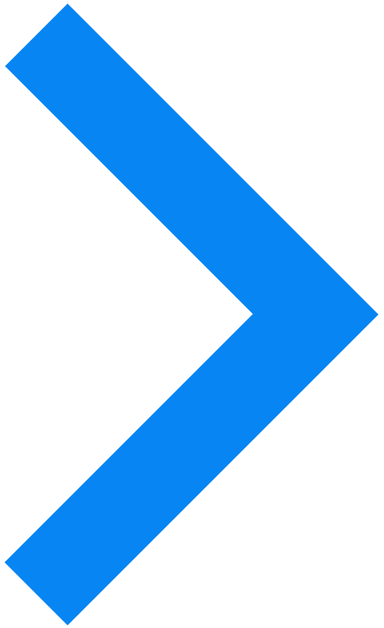
BC3 Energy cost, four scenarios vs DO3, 2010-2050 (EU-27)



BC3 Resource use, four scenarios vs DO3, 2010-2050 (EU-27)



Comments & Feedback



Responses are due by:

Tuesday 6th August to:
serversreview@icf.com

Thank you

for your participation

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