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PVC CABLES RECYCLING

A Cost-Benefit Analysis

February 2020

Disclaimer

The aim of this document is to show the findings of a Cost-Benefit Analysis of PVC cables recycling done by Althesys on behalf of ECVM.

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Thanks to Vincent Stone, Marco Piana and Carlo Ciotti for their cooperation and to all the companies and associations interviewed for their technical contribution and information given for the study.

Milan, February 2020

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1. PVC Recycling

The European PVC industry has embraced its social responsibility and has been working since the late 90s to ensure that the challenge of sustainable development is taken seriously. In the past decade, the industry has made great progress in waste management, innovative recycling technologies, stakeholder engagement and responsible use of additives. So, PVC cables are recyclable.

With the “VinylPlus”[®] sustainability programme, the European PVC industry is well positioned for moving towards a model of circular economy.

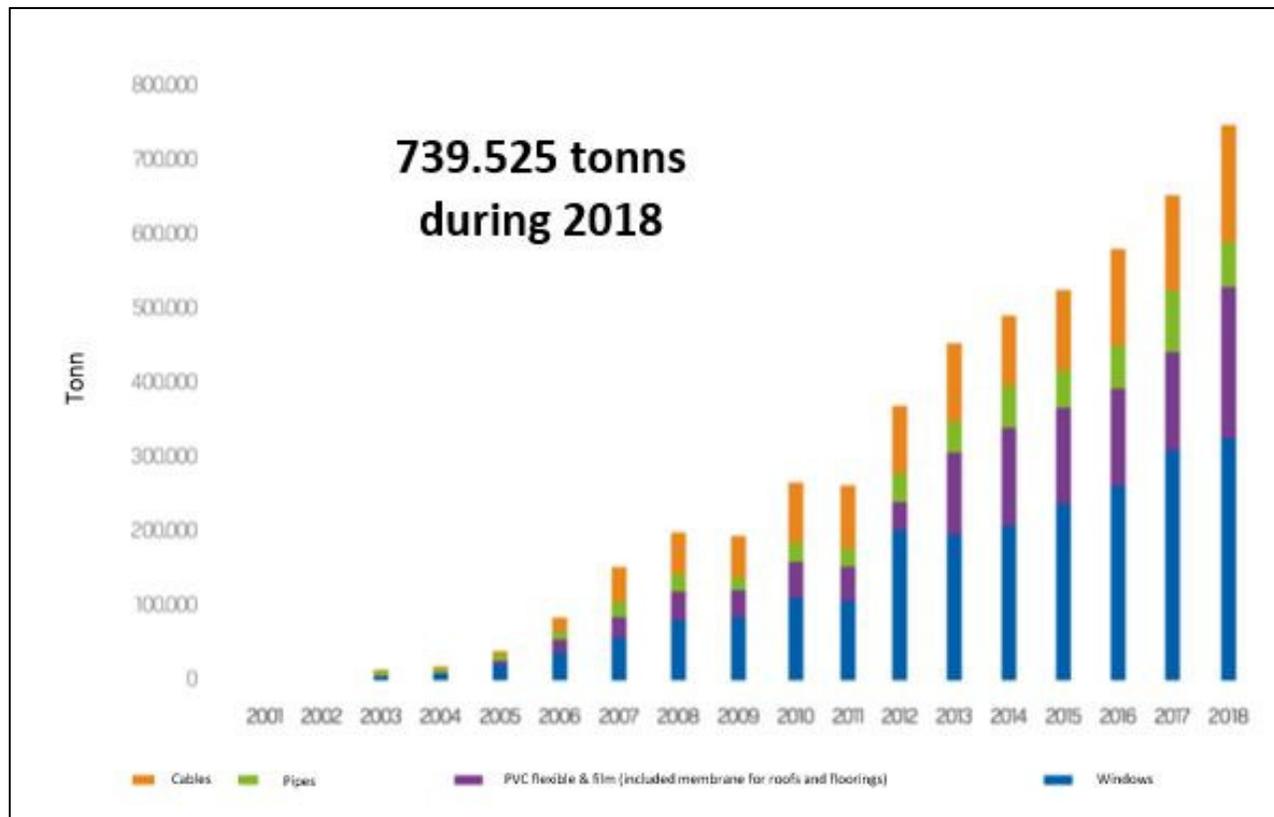
Launched in 2011, VinylPlus is the renewed 10-year Voluntary Commitment to sustainable development by the European PVC industry. The VinylPlus programme was developed through open dialogue with stakeholders, including industry, NGOs, regulators, civil society representatives and PVC users. The regional scope is the EU-28 plus Norway and Switzerland.

Recycling is a critically important aspect for the VinylPlus Programme, especially given the increasing political importance of the Circular Economy Package adopted by the European Commission and its EU Plastics Strategy.

The aim of this report is to provide a Cost-Benefit Analysis (CBA) of PVC cables recycling

PVC recycled under VINYL 2010 e VINYL PLUS

In 2018, the amount of recycled cables was 150,000 tons.



Source: Recovinyl

1.1 The main PVC recycling phases



The most critical phase is collection, sorting and cleaning of PVC. This activity is complex and expensive because:

- the quantity of PVC are diluted on a large numbers of applications (different products and use), with difficulty in organizing appropriate and competitive collection chains;
- in many products PVC is coupled with other materials, this involves the need of appropriate and specific technologies for its separation

PVC recycling generally is mechanical with crushing and grinding or micronizing process to reduce PVC in homogenous powder. After PVC is extruded (also with addiction of other materials) to obtain the final product with injection or moulding.

1.2 The PVC cables recycling

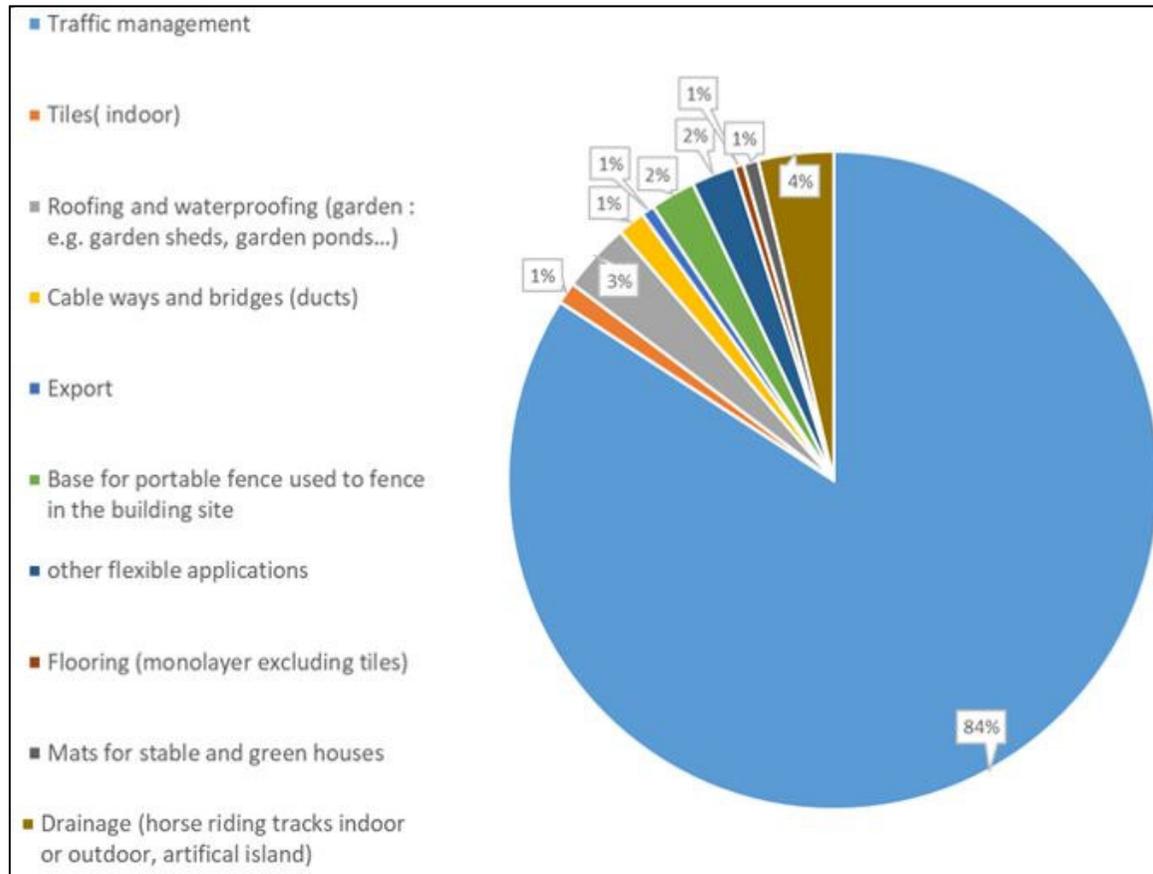
PVC cables at the end of their life are collected for recycling. The first step concerns the copper separation (copper separation could also be done after grinding of PVC). After this phase there are two main processes for PVC recycling:

- with rubber separation
- without rubber separation.

The kind of process is related to the final application of the required product . The recycling with rubber separation could provide a more «pure» PVC recycled product. However the presence of other components in the compound like rubber or also metals can improve the technical features of the product for some special applications. For example the presence of rubber mixed with PVC provides to the product more flexibility and elasticity (for example for artificial speed bumps on the roads).

1.3 End applications using PVC cable recycled

PVC recycled from cables is used for a wide range of applications



Source: Recovinyl

2. The Cost-Benefit Analysis methodology

The methodology used is the Cost-Benefit Analysis (CBA). This approach allows to examine the direct and indirect effects of a project, (or an investment, a system, a technology, a plant, etc.) for the community (or a Country) as a whole. The CBA aims to verify that the costs incurred by a project are lower than the corresponding benefits. The analysis is based on the comparison of different scenarios of carrying on (or not) of a project. The CBA has been developed according to the major literature principles and the OECD guidelines.

For the purposes of this study, the CBA examines the direct and indirect effects of PVC cables recycling. The effects regard economic as well as environmental features.

Economic features

- Costs (or missed benefits)
- Benefits (or avoided costs)

of the PVC product recycling

Environmental features

- Monetary evaluation of environmental costs (or missed benefits)
- Benefits (or avoided costs)

of the PVC product recycling

3. PVC CABLES RECYCLING IN ITALY



3.1 Main assumptions of the study (Italy)

- The CBA considers both electric and data cables, assuming as a reference respectively the cable type FS 18 OR 18 and UPT 5 E PVC
- For the purpose of the study a 100 meters long cable is assumed as functional unit, the same adopted in the TCO report. The items expressed in different unit of measure have been parametrized accordingly to the functional unit.
- Both for electric and data cables are considered two different scenarios:
 - a) recycling compared to landfill disposal;
 - b) recycling compared to incineration.
- Cost for disposal:
 - a) landfill 200 €/ton;
 - b) incineration 220 €/ton.
- Costs of separate collection and sorting:
 - a) 220 €/ton of additional costs (vs. landfill/incineration) for collection and sorting of PVC cables;
 - b) 30 €/ton pre-treatments for recycling of wasted PVC cables.
- Incremental cost for transportation to recycling site (compared to landfill disposal and compared to incineration) + indirect environmental impacts.
- Assumption regarding distance of recycling site: 100 Km from collecting center.

Main assumptions of the study (Italy)

- Recycling costs: 45 €/ton PVC + 15 €/ton PVC for other treatments.
- Revenues from recovered material: 500 €/ton for cables FS18OR18 (only PVC), 400 €/ton for data cables containing also thermoplastics (lower quality of recovered materials).
- Energy consumption of recovered PVC: -50% vs. primary PVC production.
- Environmental benefits of recycling compared to residual disposal are calculated on the base of Emissions Trading Scheme. CO₂ current price (EUAs) 30 €/ton.
- Energy monetization from incineration: electricity valued to Italian wholesale electricity market price (PUN); heat linked to gas price.
- Sensitivity analysis: with or without copper recovery monetization. As a matter of fact, copper is often recovered both in case of landfill disposal and incineration of PVC scraps.

Sources of data

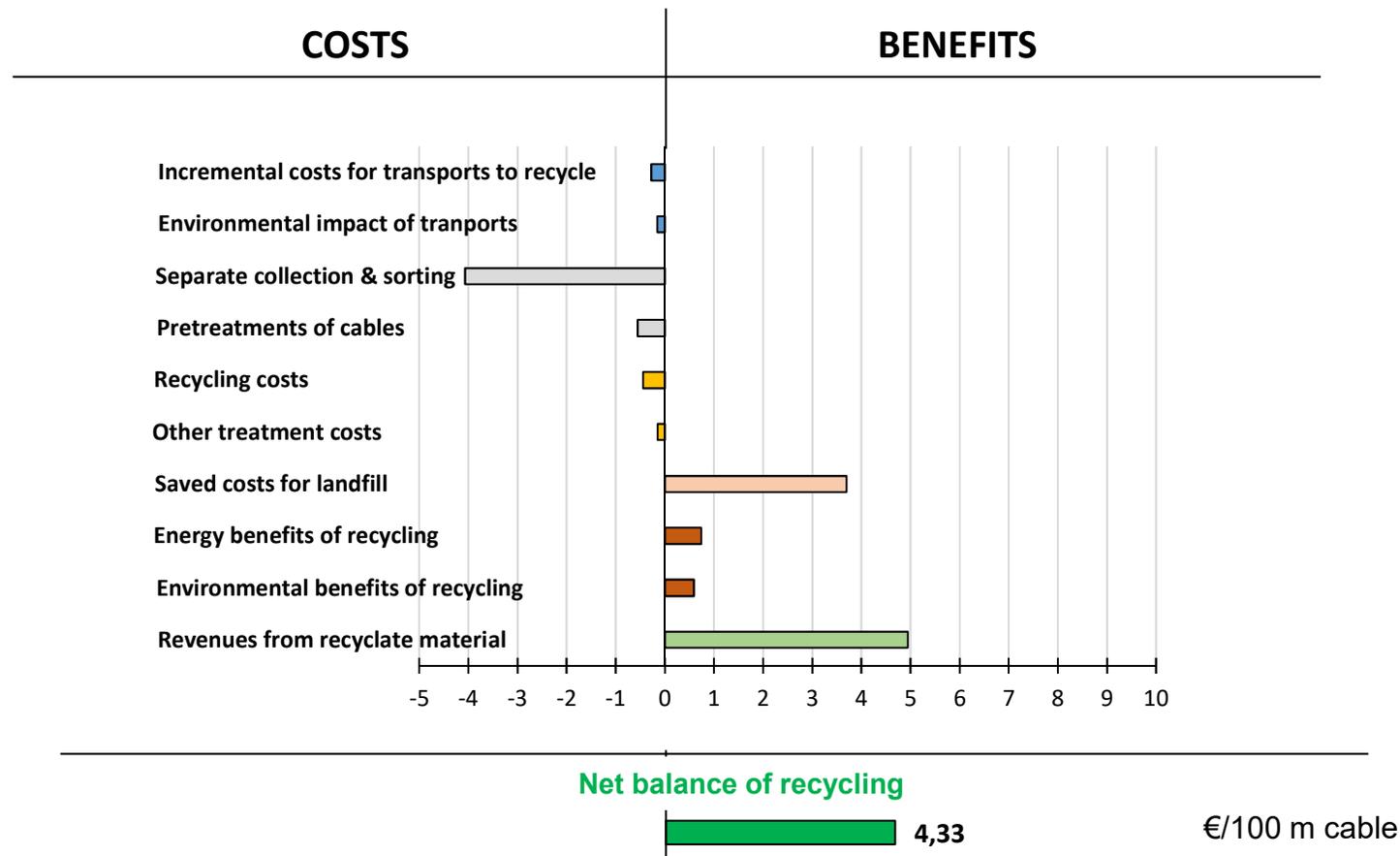
- Information about disposal (landfill and incineration) and collection and sorting costs come from price lists, tenders and national experts' judgment
- Recycling costs' sources are technical literature and PVC associations
- The price of PVC recycled for Revenues from recovered material is very volatile and depends on quantity and place of delivery. We assumed medium price for 2019. The source of price are on line PVC markets and national experts' judgment

3.2 Main results of the Cost-Benefit Analysis

Electricity cable FS 18 OR 18

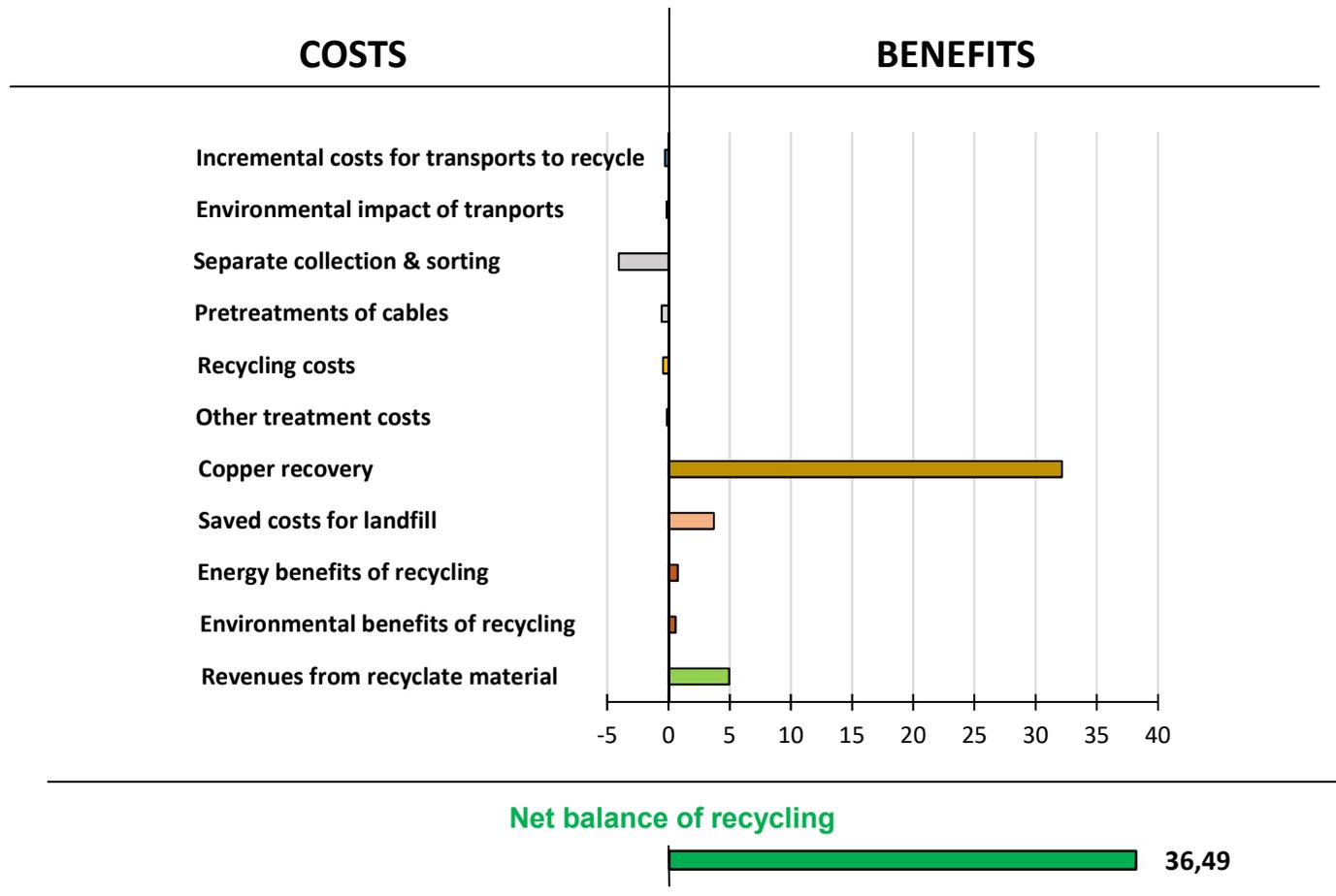


Recycling vs. Landfill without copper recovery monetization



Main results: Electricity cable FS 18 OR 18

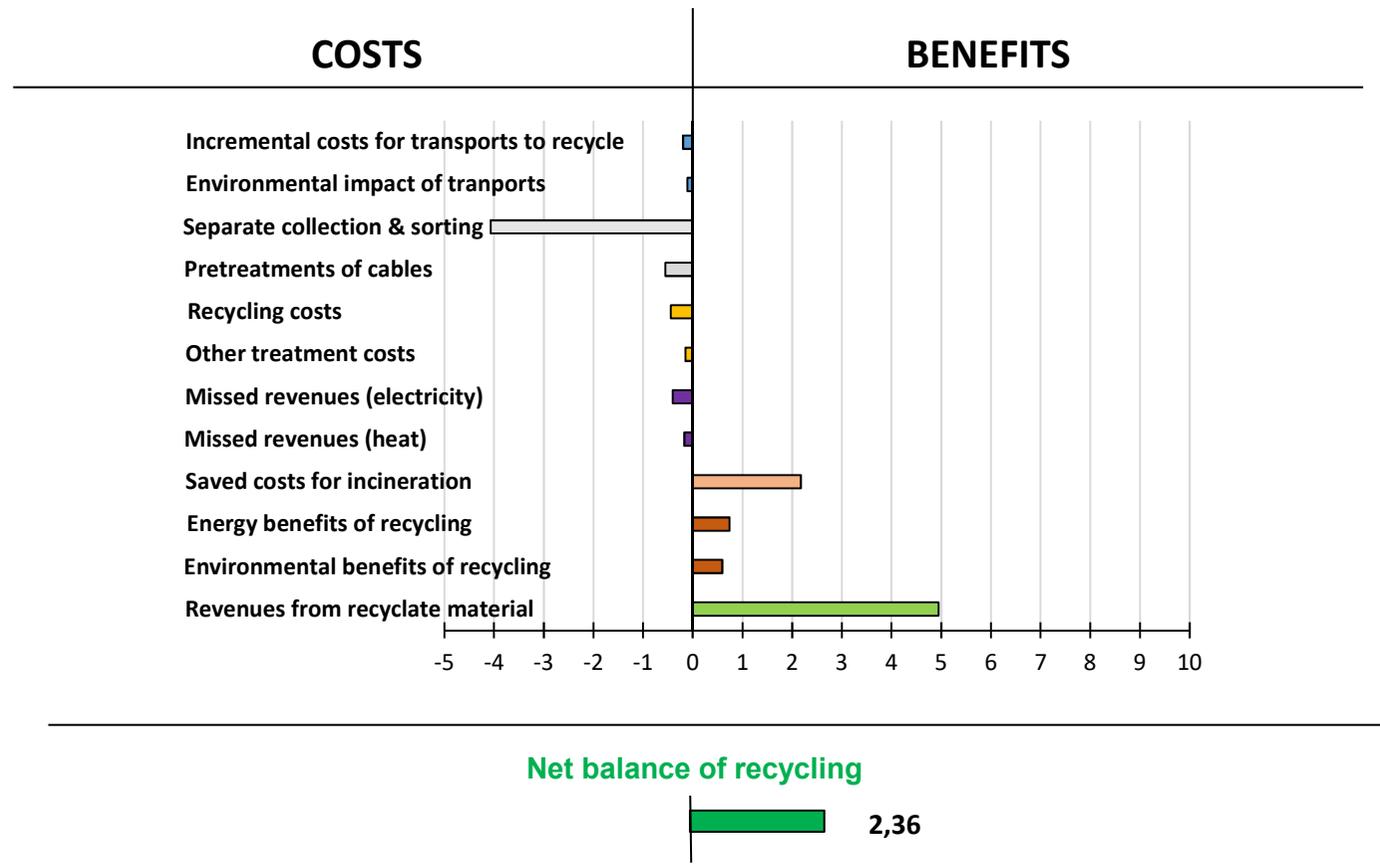
Recycling vs. Landfill with copper recovery monetization



Main results: Electricity cable FS 18 OR 18

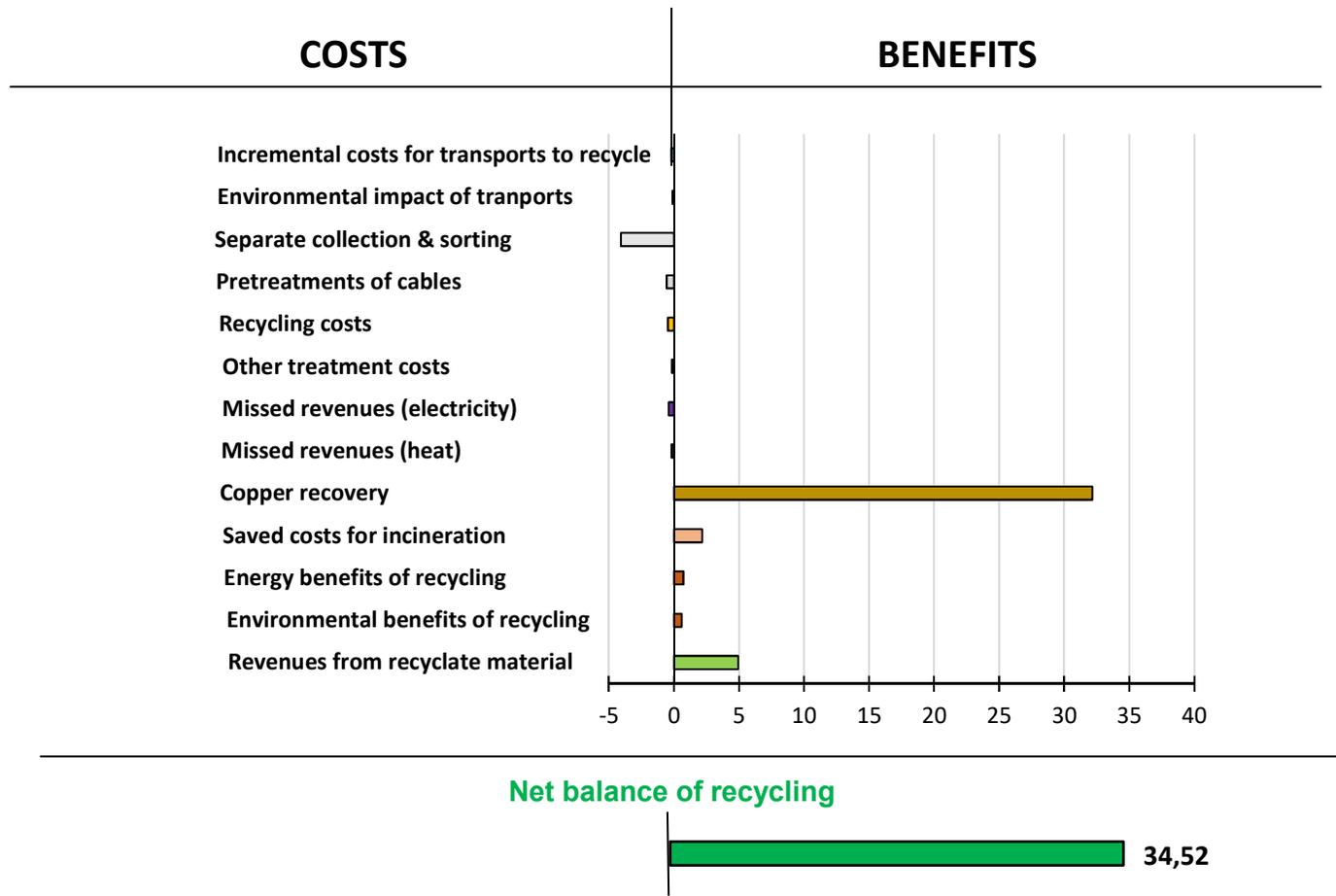


Recycling vs. Incineration without copper recovery monetization



Main results: Electricity cable FS 18 OR 18

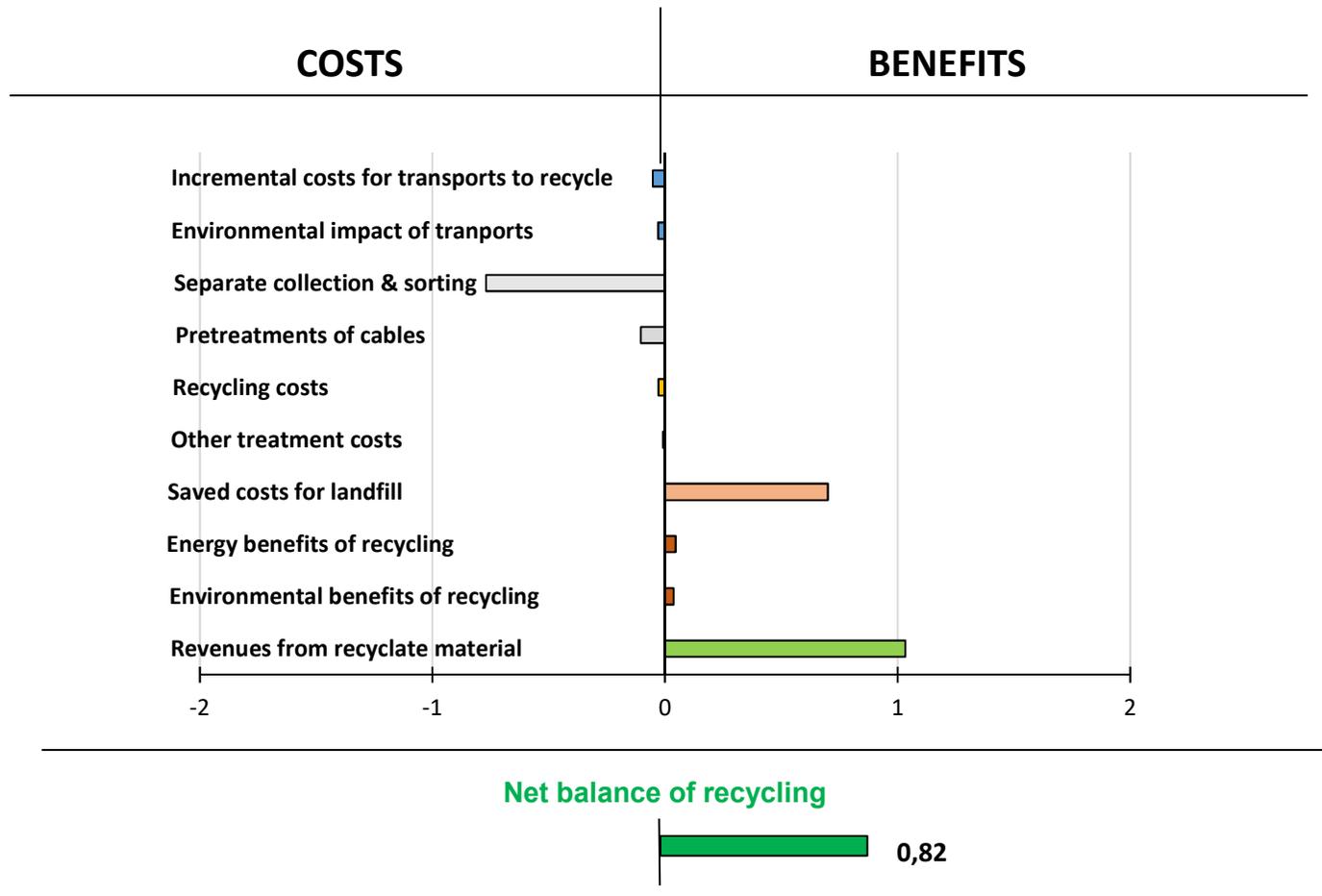
Recycling vs. Incineration with copper recovery monetization



€/100 m cable

Main results: Data cable UPT 5 E PVC

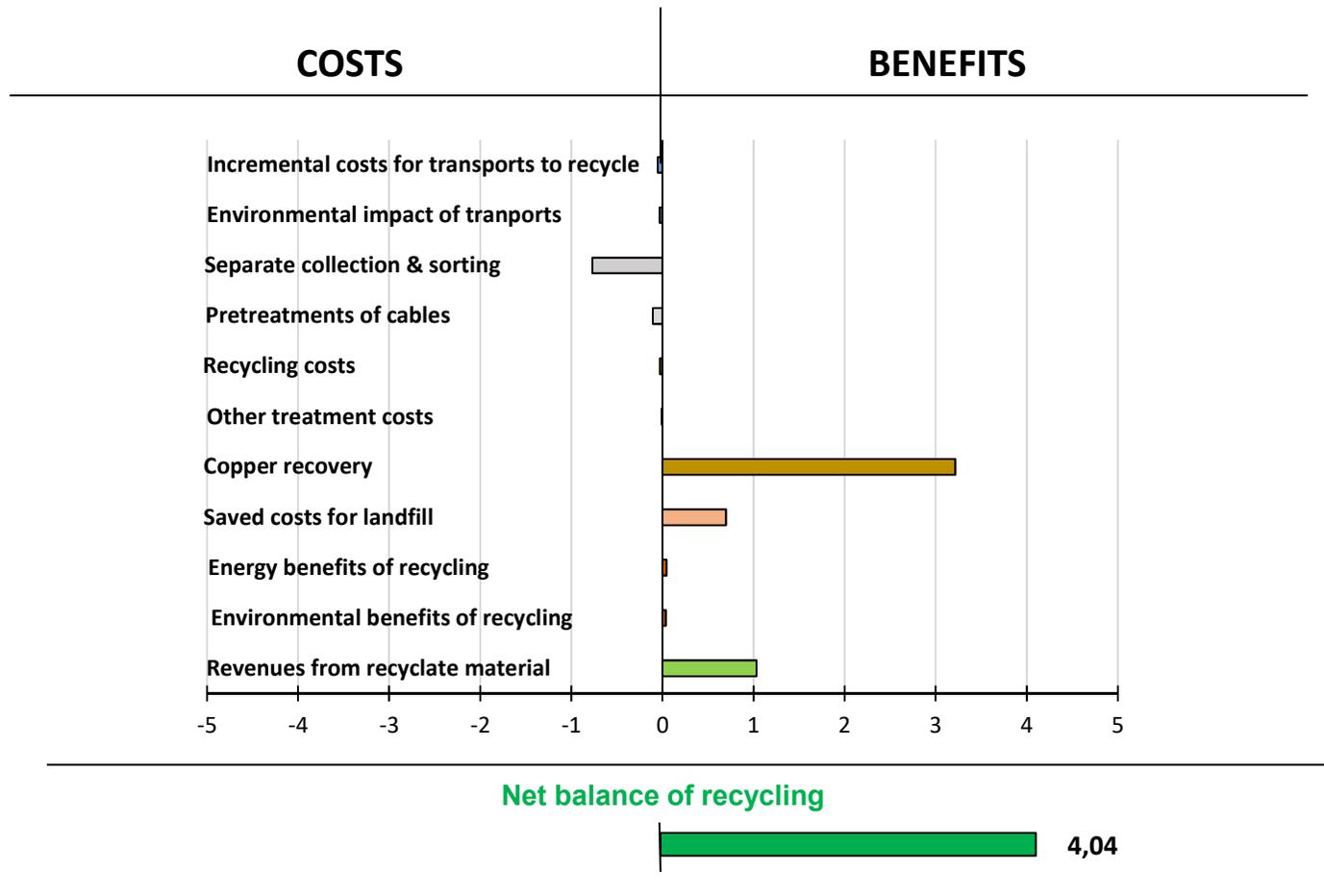
Recycling vs. Landfill without copper recovery monetization



€/100 m cable

Main results: Data cable UPT 5 E PVC

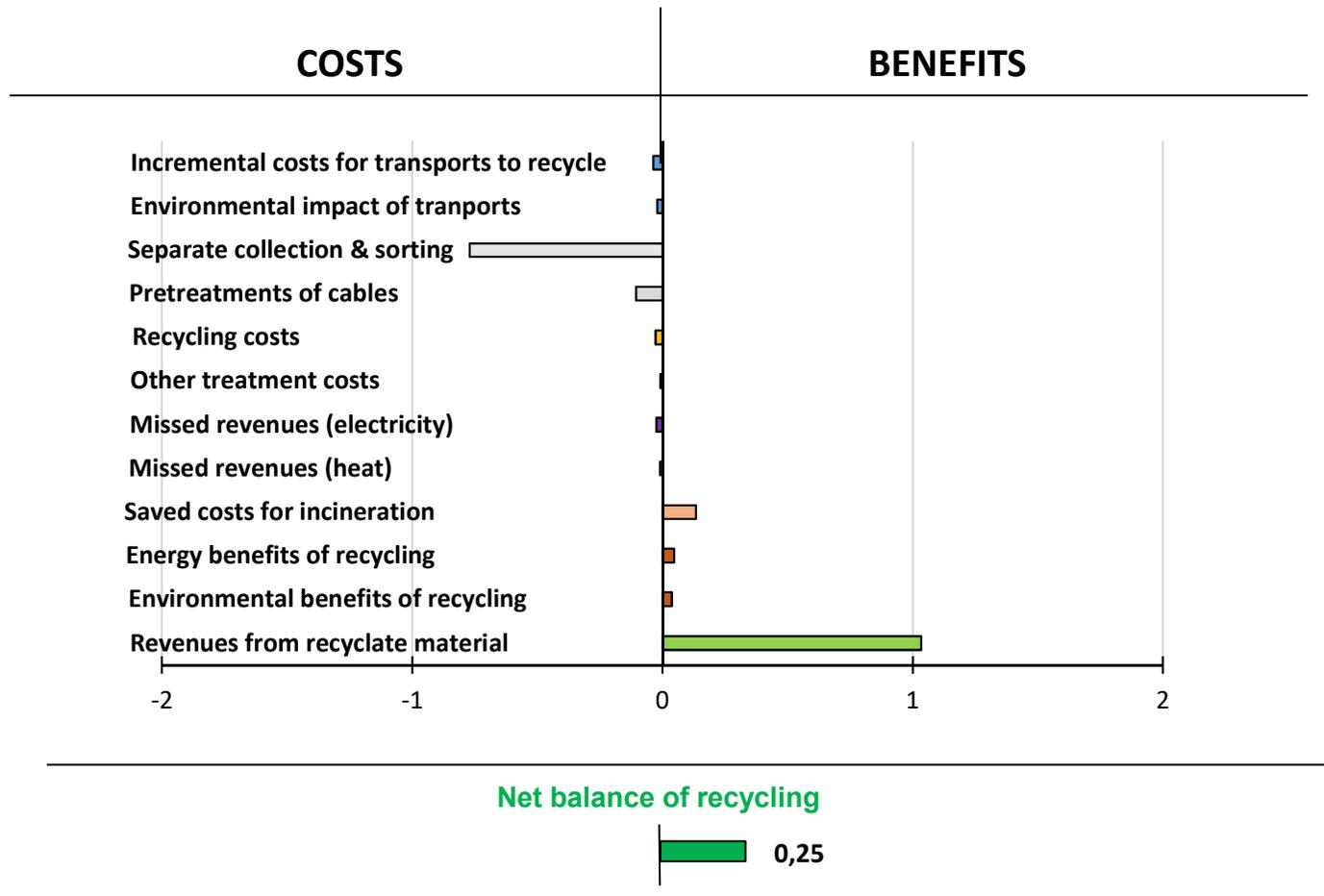
Recycling vs. Landfill with copper recovery monetization



€/100 m cable

Main results: Data cable UPT 5 E PVC

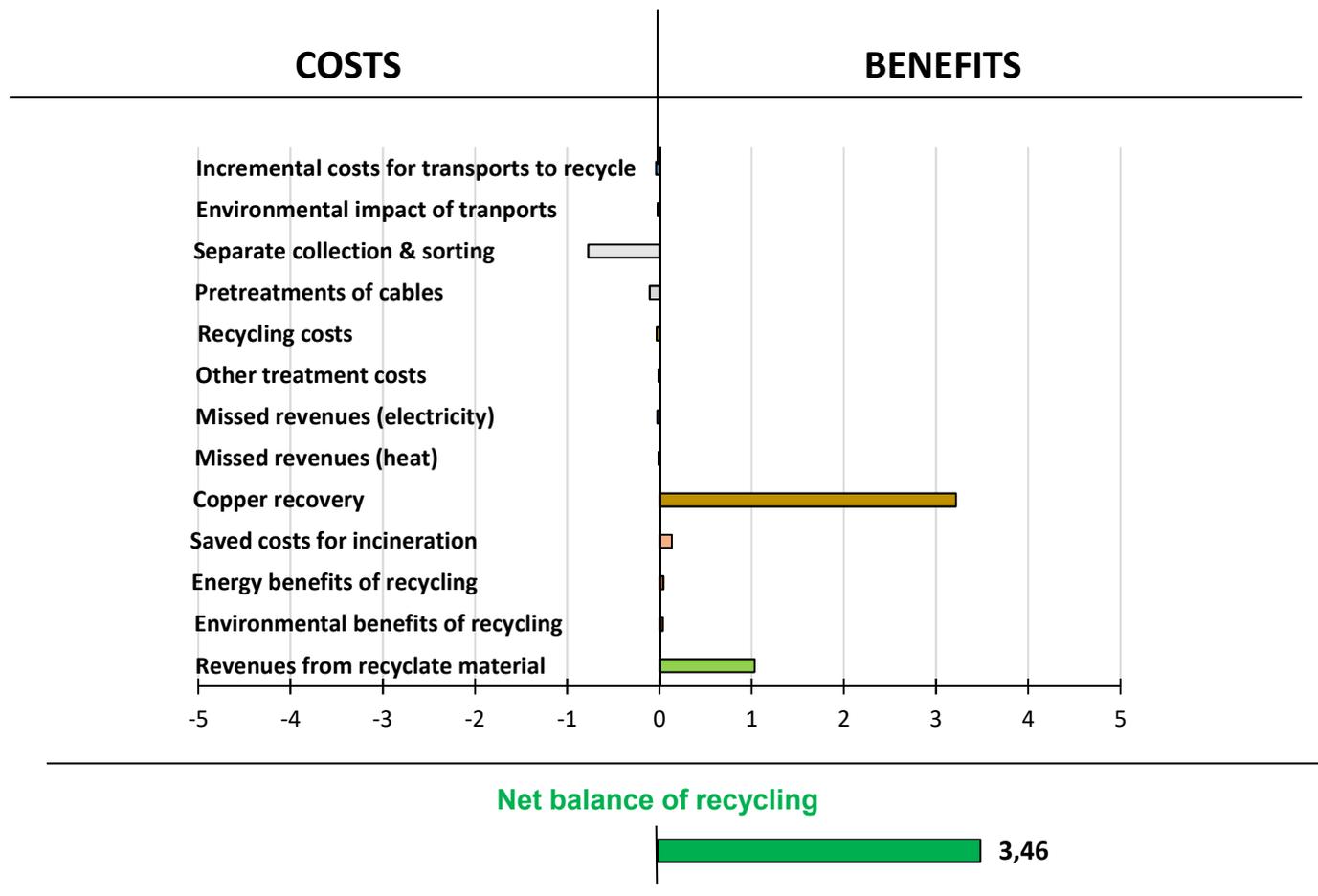
Recycling vs. Incineration without copper recovery monetization



€/100 m cable

Main results: Data cable UPT 5 E PVC

Recycling vs. Incineration with copper recovery monetization



€/100 m cable

4. PVC CABLES RECYCLING IN GERMANY



4.1 Main assumptions of the study (Germany)

- The CBA considers both electric and data cables, assuming as a reference respectively the cable type FS 18 OR 18 and UPT 5 E PVC
- For the purpose of the study a 100 meters long cable is assumed as functional unit, the same adopted in the TCO report. The items expressed in different unit of measure have been parametrized accordingly to the functional unit.
- For Germany only one scenario is considered: recycling compared to incineration. The reason is the ban in the Country of the disposal in landfill of such cables' wastes because of materials with high caloric value have to be pre-treated, recycled or incinerated with energy recovery.
- Cost for disposal:
 - b) incineration 200 €/ton
- Costs of separate collection and sorting:
 - a) 235 €/ton of additional costs (vs. incineration) for collection and sorting of standard PVC cables;
 - b) 35 €/ton pre-treatments for recycling of wasted PVC cables;
- Incremental cost for transportation to recycling site (compared to landfill and compared to incineration disposal) + indirect environmental impacts.
- Assumption regarding distance of recycling site: 100 Km from collecting center.

4.1 Main assumptions of the study (Germany)

- Recycling costs: 50 €/ton PVC + 17 €/ton PVC for other treatments.
- Revenues from recovered material: 500 €/ton for cables FS18OR18 (only PVC), 400 €/ton for data cables containing also thermoplastics (lower quality of recovered materials).
- Energy consumption of recovered PVC: -50% vs. primary PVC production.
- Environmental benefits of recycling compared to residual disposal are calculated on the base of Emissions Trading Scheme. CO₂ current price (EUAs) 30 €/ton.
- Energy monetization from incineration: electricity valued to German wholesale electricity market price; heat linked to gas price.
- Sensitivity analysis: with or without copper recovery monetization. As a matter of fact, copper is often recovered both in case of landfill disposal and incineration of PVC scraps.

Sources of data

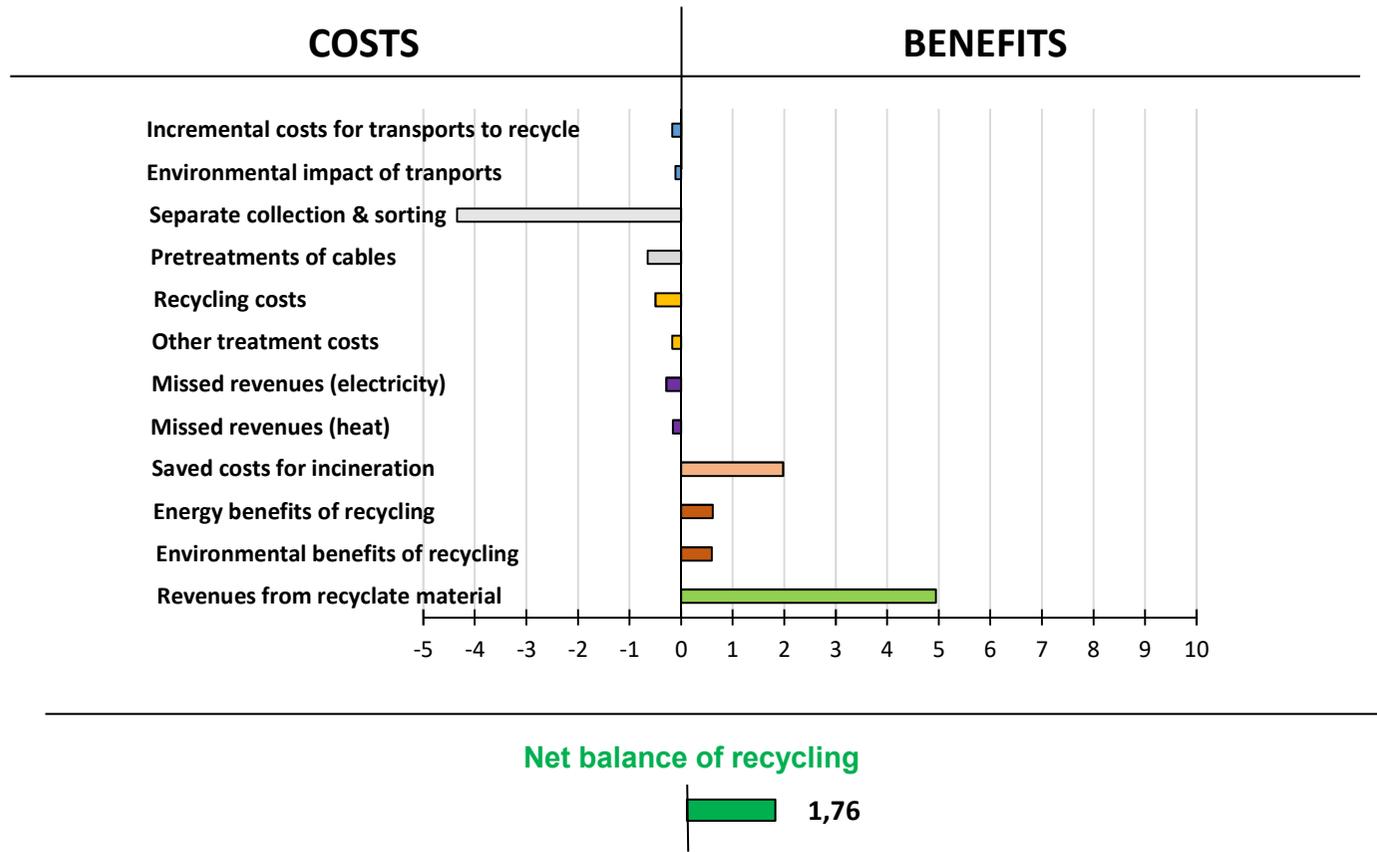
- Information about for disposal (incineration) and collection and sorting costs come from national experts' judgment, technical literature and presentations at International forum
- Recycling costs' sources are technical literature and PVC associations
- The price of PVC recycled for Revenues from recovered material is very volatile and depends on quantity and place of delivery. We assumed medium price for 2019. The source of price are on line PVC markets and national experts' judgment

4.2 Main results of the Cost-Benefit Analysis

Electricity cable FS 18 OR 18



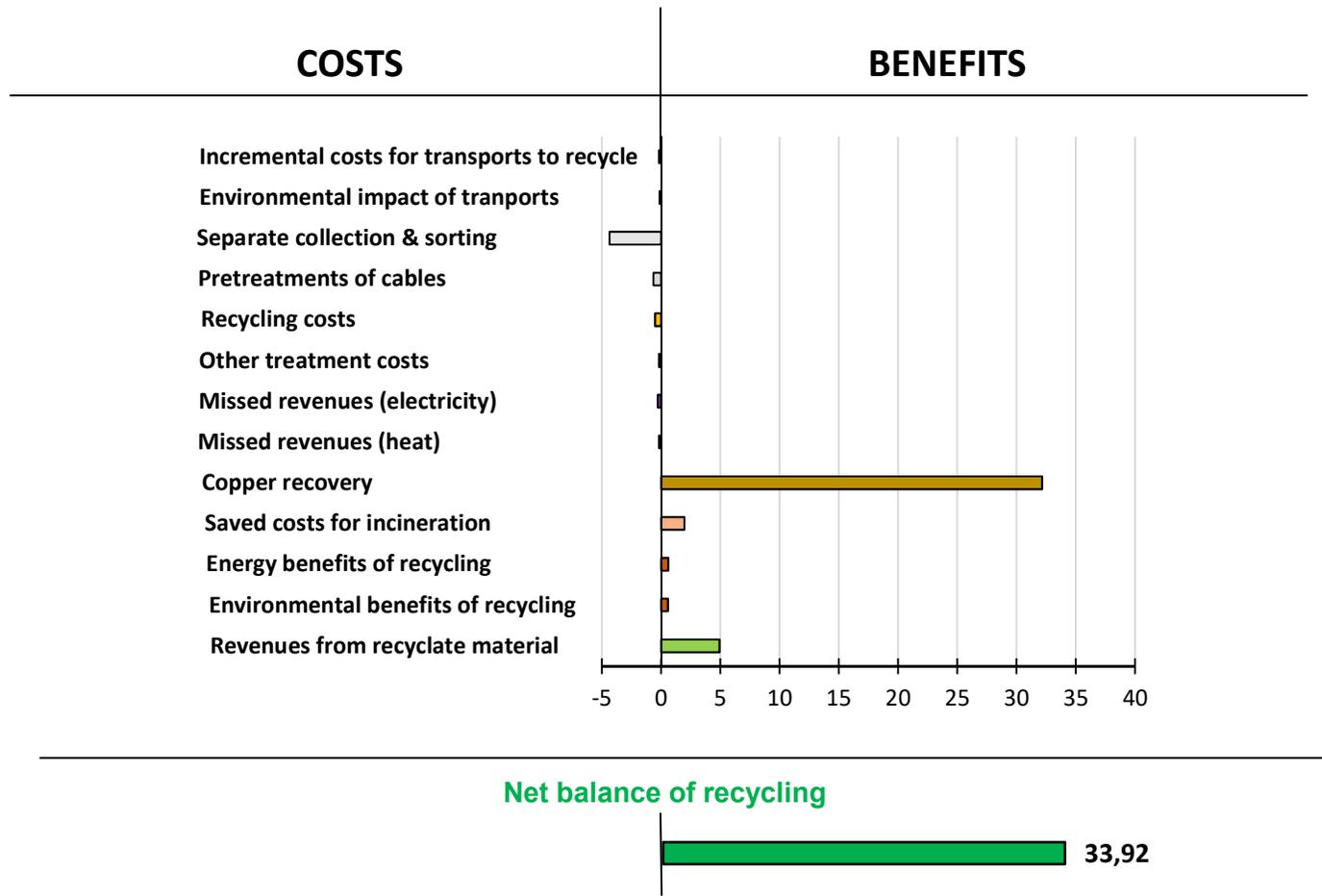
Recycling vs. Incineration without copper recovery monetization



Electricity cable FS 18 OR 18

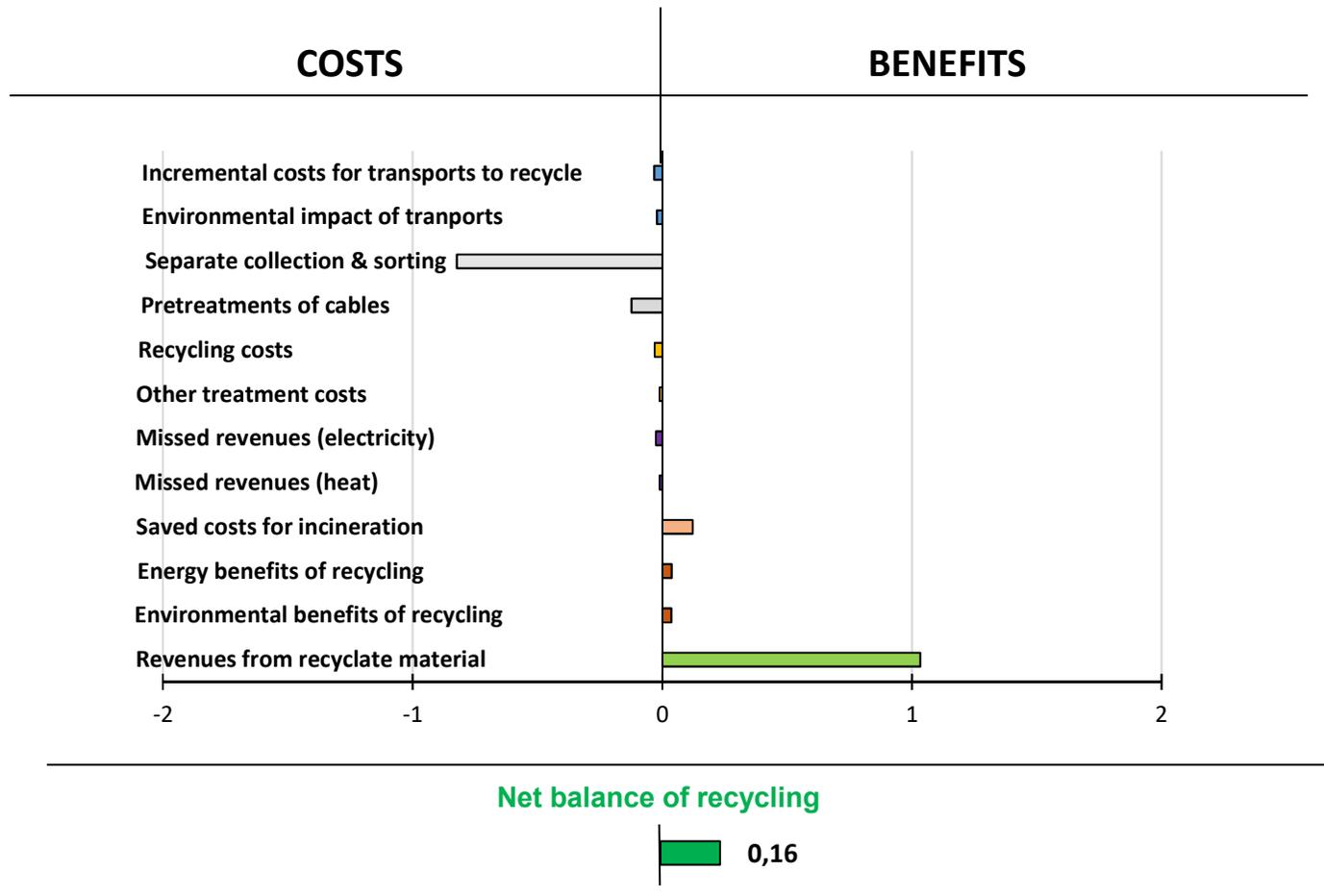


Recycling vs. Incineration with copper recovery monetization



Data cable UPT 5 E PVC

Recycling vs. Incineration without copper recovery monetization

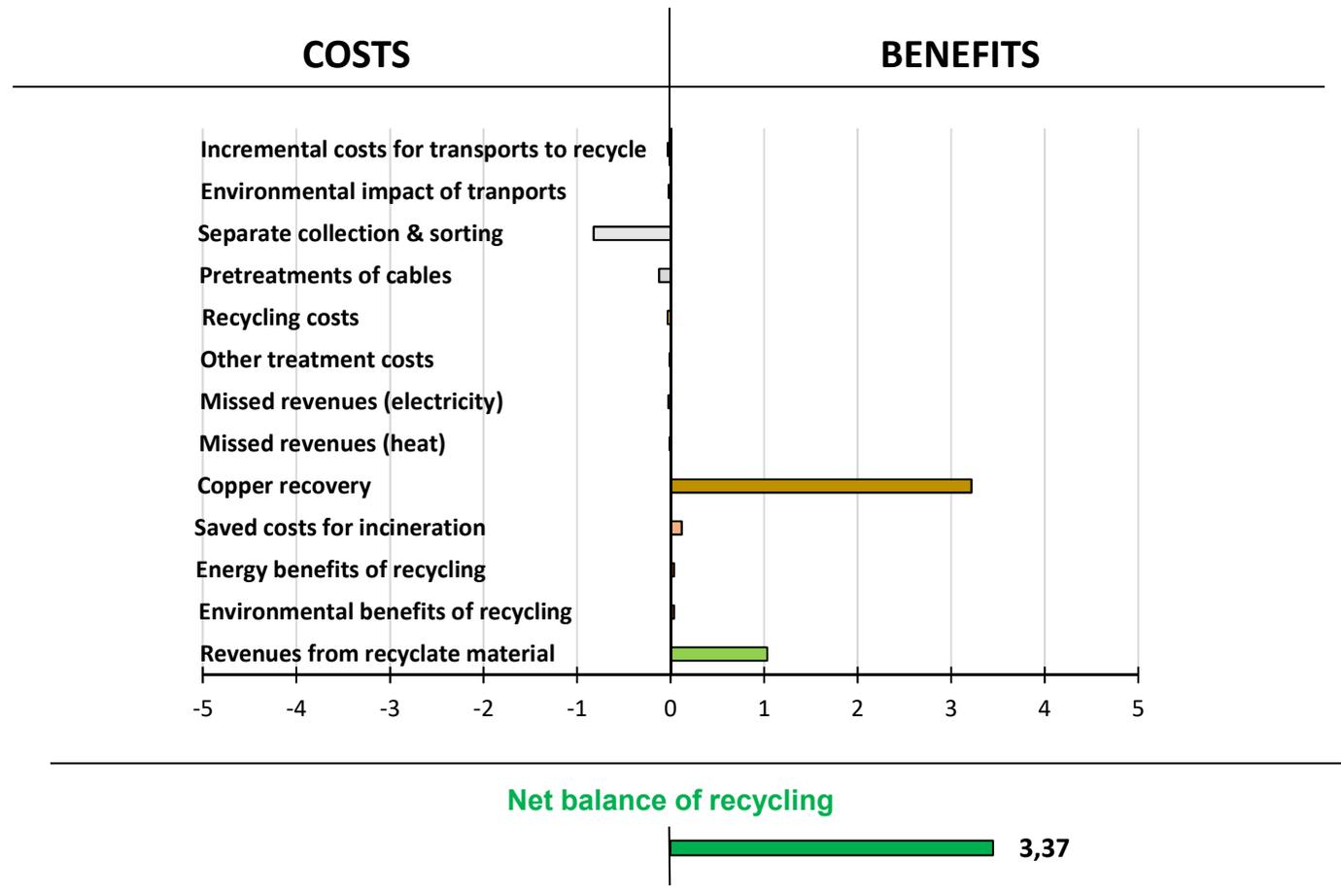


€/100 m cable

Data cable UPT 5 E PVC



Recycling vs. Incineration with copper recovery monetization



€/100 m cable

5. Conclusions

- CBA results show a net benefits balance of recycling for all cases considered (for Italy vs. incineration or vs. landfill and for Germany vs. incineration).
- In Italy the net benefits of recycling vs. landfill are greater than recycling vs. incineration due to energy recovery (electricity and heat) during incineration.
- Higher is the quantity of PVC in the cable and higher is the net benefits of recycling:
 - cable FS18OR18 (with sheath and insulation in PVC) shows greater net benefits
 - than data cable (containing also thermoplastic) due to higher quantity and quality of PVC recycled.
- All CBA results consider a adequate territorial coverage of PVC cables collection and recycling sites. Increase in the distance could reduce the net benefit of recycling, anyway positive.
- In all cases considered the revenues from recycled material are the main benefit and collection and sorting is the main cost. Fluctuations in raw materials' prices could so affect the Costs-Benefits balance.

Conclusions

- Net benefits of recycling vs. incineration are higher in Italy than in Germany (+34,2% for cable FS18OR18 and +57,1% for data cable UPT 5 E PVC both without copper recovery) mainly due to lower collection & sorting cost and upper energy price and incineration cost.
- The monetization of copper recovery increases a lot net benefits, but also without taking into account the value of recovered copper the CBA net balance is positive.

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