



Boosting the secondary materials market levering on their circular performances.

How circular performances of secondary materials can be valorized from an economic point of view.

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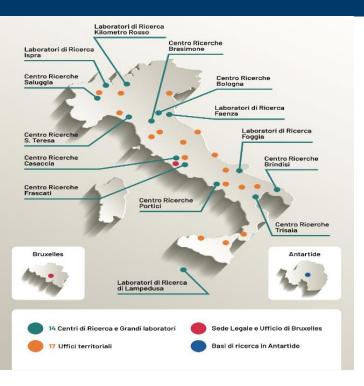


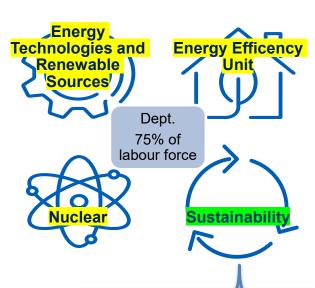






ENEA – National Agency for New Technologies, Energy and Sustainable Economic Development







60 anni di ricerca e innovazione



direzioni tecniche e amministrative



centri di ricerca



dipartimenti



ricercatori, tecnologi, tecnici e amministrativi













AREE URBANE

TERRITORIO E MARE

Pianificare e naturale, il territorio ed il mare in ottica di economia

SISTEMA **INDUSTRIALE**

Supportare le imprese nella transizione verso modelli di produzione e consumo più sostenibili e rigenerativi

CATENA DI VALORE

Promuovere e facilitare la chiusura dei cicli nelle filiere produttive e lungo il ciclo di vita di prodotti e materiali



TE3C project - ENEA-UTILITALIA 2021-2023

Main goal: to foster the use of secondary materials.

Its main objective is to develop and propose a scheme to support the valorization of potential energy savings or carbon footprint reduction associated with the replacement of primary materials with secondary ones.





Two different credit schemes are proposed and discussed





Circular Energy Efficiency Certificates (TEEC)



TEEC are defined based on potential energy savings associated with the use of secondary materials compared to primary ones





Circular Carbon Credits (3C)



3C are defined based on the potential reduction of CO₂ eq. emissions associated with the use of secondary materials compared to primary ones



The methodology – system boundaries



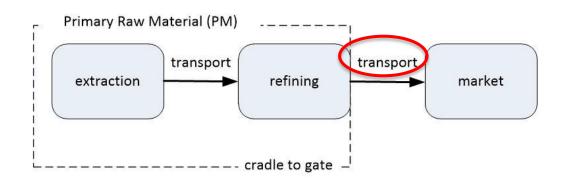
from CRADLE
to GATE

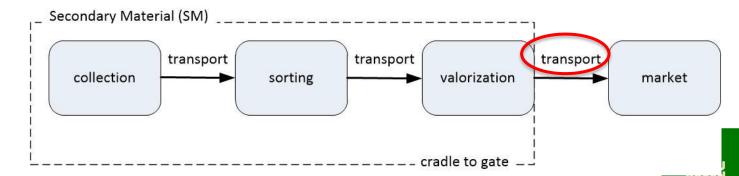
transport to the market

Primary (PM) and Secondary materials (SM) are evaluated along their life cycle in terms of:











The methodology



TEEC (Titoli Efficienza Energetica Circolare - TEP) (en: Circular Energy Efficiency Credits - TOE)

 Δ = Energy intensity PM - Energy intensity SM



If $\Delta > 0$ a credit (subsidy?) can be assigned to SM accordingly.

The number of TEECs obtainable by a company is directly correlated to the energy savings due to the use of secondary materials instead of primary ones with the same function. The energy saving at the base of the TEEC is, therefore, calculated as:

Number of TEECs = Q [ton] * (Energy PM - Energy SM) [toe/ton]

Where Q, expressed in tons, refers to the quantity of SM that substitutes the PM, Energy SM and Energy PM are the energy intensities of secondary and primary materials, respectively.

Consequently, the correspondence between TEEC and toe is one to one (1 toe = 1 TEEC).





The methodology



3Cs (Crediti di Carbonio Circolare – ton CO_{2eq}) (en: Circular Carbon Credits – tons CO_{2eq})

 Δ = Carbon footprint PM – Carbon footprint SM



If $\Delta > 0$ a credit (subsidy?) can be assigned to SM accordingly.

With a similar equation it is possible to calculate the number of 3Cs:

Number of 3Cs = Q [ton] *(CO_2 eq.PM – CO_2 eq. SM) [ton CO_2 eq. /ton]





TEEC - EXAMPLE CALCULATION (Aluminum)



Energy intensity $_{PM}$ = 4,078 toe/t Energy intensity transport $_{PM}$ = 0,042 toe/t

Energy intensity $_{SM}$ = 0,447 tep/t Energy intensity transport $_{SM}$ = 0,001 tep/t Primary material
Secondary material

TEEC = $((IE_{PM} + IE trasporto_{PM}) - (IE_{SM} + IE trasporto_{SM}))*Q$

1 ton of secondary aluminum (**Q = 1 t**):

TEEC = ((4,078 tep/t + 0,042 tep/t) - (0,447 tep/t + 0,001 tep/t))*1t = 4 tep

BENCHMARK

Ecoinvent Version 3 (market for aluminium, primary, ingot) val. min 2,34 kg oil eq./kg val. max 4,68 kg oil eq./kg

Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230.





3C - EXAMPLE CALCULATION (Aluminum)



Carbon footprint
$$_{PM}$$
 = 16 t CO_2 eq./t Carbon footprint transport $_{PM}$ = 0,054 t CO_2 eq./t

Carbon footprint $_{SM}$ = 0,786 t CO_2 eq./t Carbon footprint transport $_{SM}$ = 0,002 t CO_2 eq./t

Primary material

Secondary material

3C =
$$((IC_{MP} + IC trasporto_{MP}) - (IC_{MS} + IC trasporto_{MS}))*Q$$

1 ton of secondary aluminum($\mathbf{Q} = \mathbf{1} \mathbf{t}$):

$$3C = ((16t CO_2 eq./t + 0.054t CO_2 eq./t) - (0.786t CO_2 eq./t + 0.002t CO_2 eq./t))*1t = 15 t CO_2 eq.$$

BENCHMARK

Ecoinvent Version 3 (market for aluminium, primary, ingot) val. min 10 kg CO₂/kg val. max 21 kg CO₂/kg

Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., and Weidema, B., 2016. The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, [online] 21(9), pp.1218–1230.



The Database and the Tool TE3C



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Progetto

Contesto riferimento

degli

Homepage



Il progetto TEEC sviluppato da ENEA per conto di UTILITALIA intende favorire e incentivare l'uso di materiali secondari (MS) al posto dei materiali primari (MP) nei processi produttivi delle imprese italiane. Questo progetto è inserito nel quadro di riferimento inerente a favorire lo sviluppo dell'economia circolare al posto di una economia lineare e nel quadro di una maggiore resilienza del sistema Italia riguardo all'approvvigionamento dei MP.

L'incentivazione dei MS fa leva sul potenziale risparmio energetico associato rispetto al corrispettivo uso di MP. Questo delta energetico dovuto al minor consumo energetico sarà trasformato in titoli di energia circolare (TEEC) o in crediti di consumo circolare (3C) che potrebbero essere riconosciuti ai soggetti che usano MS. Il meccanismo dei TEEC e dei 3C avrà effetto anche su tutti i soggetti a monte della fiera del secondario, vale a dire imprese raccoglitrici, imprese selezionatrici e imprese di trasformazione e valorizzazione, poiché beneficeranno dell'effetto traino dovuto all'aumento dell'uso dei MS da parte degli utilizzatori finali. I titoli TEEC e i crediti 3C hanno finalità simili per quanto riguarda la sostituzione dei MS in luogo dei MP ma agiscono con differenti modalità: i TEEC hanno il focus sul risparmio di energia contenuta nei materiali, mentre i 3C avranno un ruolo di potenziale efficientamento nel sistema produttivo italiano

Questo sito da la possibilità ad una serie di soggetti: aziende, consorzi, università, enti di ricerca, di poter accedere a diverse funzionalità in base al ruolo che viene loro riconosciuto

• Utenti utilizzatori: consente alle aziende che operano sia nel settore secondario sia nel settore primario dei materiali di registrarsi ad una anagrafe interna in base alla loro tipologia di lavoro

Per riempiere la sezione anagrafica cliccare al seguente link: anagrafica

• Utenti alimentatori: consente a chi possiede informazioni (consumi energetici, quantità, etc.) relative al ciclo di vita dei materiali, sia primari sia secondari, di alimentare il database interno.

Per poter effettuare l'alimentazione cliccare al seguente link: alimentazione

• Utenti per la simulazione: consente di poter effettuare una simulazione, per calcolare i potenziali titoli TEEC e 3C in base al risparmio energetico conseguente l'uso dei materiali secondari al posto dei materiali primari.

The database (DB) for the calculation of TEEC and 3C, in short TE3C, has the aim of mapping and characterizing all those materials that may be of interest for the purposes of replacing primary materials (PM) with secondary materials (SM).

The DB is the basis of the web-based software. to be able to calculate, for users who request it, any TEEC and 3C accrued in the event of the use of an SM instead of the corresponding PM.





The cooperative DB



- Up to now, **Database with 34 materials** sub-divided into 8 macrocategories.
- The data relating to the materials present in the DB are both secondary data (coming from technical-scientific literature) and primary ones coming from Utilitalia associated companies. In both cases data, before being taken into consideration by the calculation algorithm, are validated on reference benchmarks.
- DB can be fed even only with data regarding "segments" of the supply chain since it has been foreseen that in this case the algorithm calculates the missing information by making weighted averages on the available data..

Category	Sub-category

1Plastica/gomma 1PET 2HDPE

3PO (PP/PE)

4PVC 5PET 6PE

7gomma generica

8LDPE

9Polimero generico

2Inerti 10calce

11sabbia 12ghiaia

3Metalli non ferrosi 13pi

13piombo 14platino 15cobalto 16argento 17piombo 18rame

19magnesio 20gallio 21alluminio 22palladio 23manganese 24zinco

4Metalli ferrosi 25acciaio/ferro 5Carta/Cartone 26carta grafica

27tissue

28carta/cartoncino 29granuli di vetro

7Tessili 30lana

6Vetro

31 cotone

32tessili generici

33nylon

8Legno 34Legno





The Database and the Tool TE3C



The TE3C web-based tool allows you to perform some main functions including:

- 1 → the calculation of TEEC and 3C and the related issuing of a certificate;
- 2 → the uploading of new data through the cooperative contribution of interested stakeholders.

Different types of stakeholders, such as companies, consortia, universities, research institutions, can access different functions of the site, based on the role that is recognized to them.

The first step is to register on the site, then you need to be enabled as a TE3C user (that "ask" the tool to calculate their TEEC or 3C according to a defined account of secondary materials) or as a user that provides data into TE3C DB.

Then, you are allowed to access the simulation procedure of TEEC and 3C credits.

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The Database and the Tool TE3C

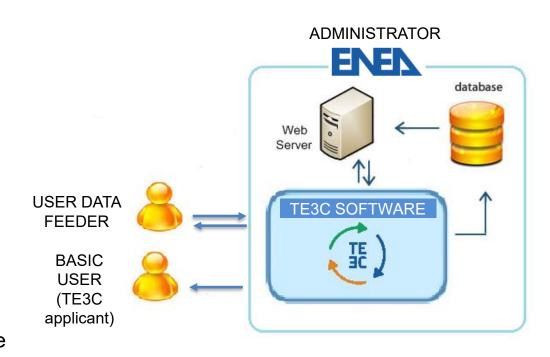


This software hosts a **cooperative database** containing benchmark data for energy and carbon intensities of both primary and secondary materials collected from scientific literature.

The database is also fed with primary data provided by companies operating in the collection, sorting, and recycling sector of waste.

Three kinds of users are foreseen:

- **1 feeder user** (company providing primary data both for PM or SM);
- 2 TE3C applicant (secondary material user and applicant for credits);
- **3 administrator** (a qualified user able to check entered data and validate the application procedure).







Conclusions



- Through the TE3C tool it is possible to rigorously evaluate energy savings and the reduction of GHG resulting from the replacement of PMs with corresponding SMs.
- The TE3C tool is cooperative; it allows the DB to be fed with primary and/or secondary data (relating to part of the supply chain or to the entire supply chain of the material being studied) by different kinds of stakeholders and their verification by administrators.
- The certificate relating to the TEECs and 3Cs accrued is issued not only based on a **technical verification** of the primary and secondary data used but also based on a **"documentary" verification** of the actual sale/purchase of the secondary material for which the credits are requested.
- Next steps are coming (average scenario vs SM scenario, comparison for same function, ...)



































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