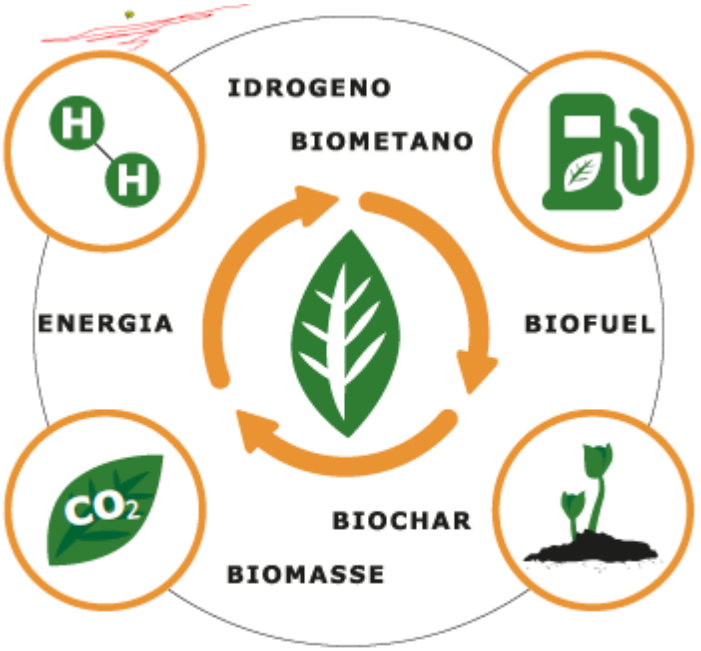
Termoref: chiusura dei cicli e abbattimento della CO2 nella valorizzazione delle biomasse di scarto

Francesco Basile

TERMOREF
scartizero



www.termoref.it

https://site.unibo.it/termoref/it

POR FESR EMILIA-ROMAGNA 2014/2020

UNIONE EUROPEA
Fondo europeo di sviluppo regionale

Regione Emilia-Romagna

Ravenna 11ª edizione 6-17-18 maggio 2018

TERMOREF
scartizero

Coordinatore Università di Bologna

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
CENTRO INTERDIPARTIMENTALE
DI RICERCA INDUSTRIALE ENERGIA E AMBIENTE

Termoref:

Integrazione di processi termochimici e reforming su biomasse di scarto e valorizzazione dei prodotti con un approccio a rifiuti zero

TERMOREF
scartizero

Francesco Basile:
CIRI EA, Dip. Chim Ind
f.basile@unibo.it

Partner di Progetto

CIDEA (UniParma)

CNR ISTEC (Faenza RA)

CRPA LAB (Reggio Emilia)

Azienda Tadini (Piacenza)

Aziende Associate

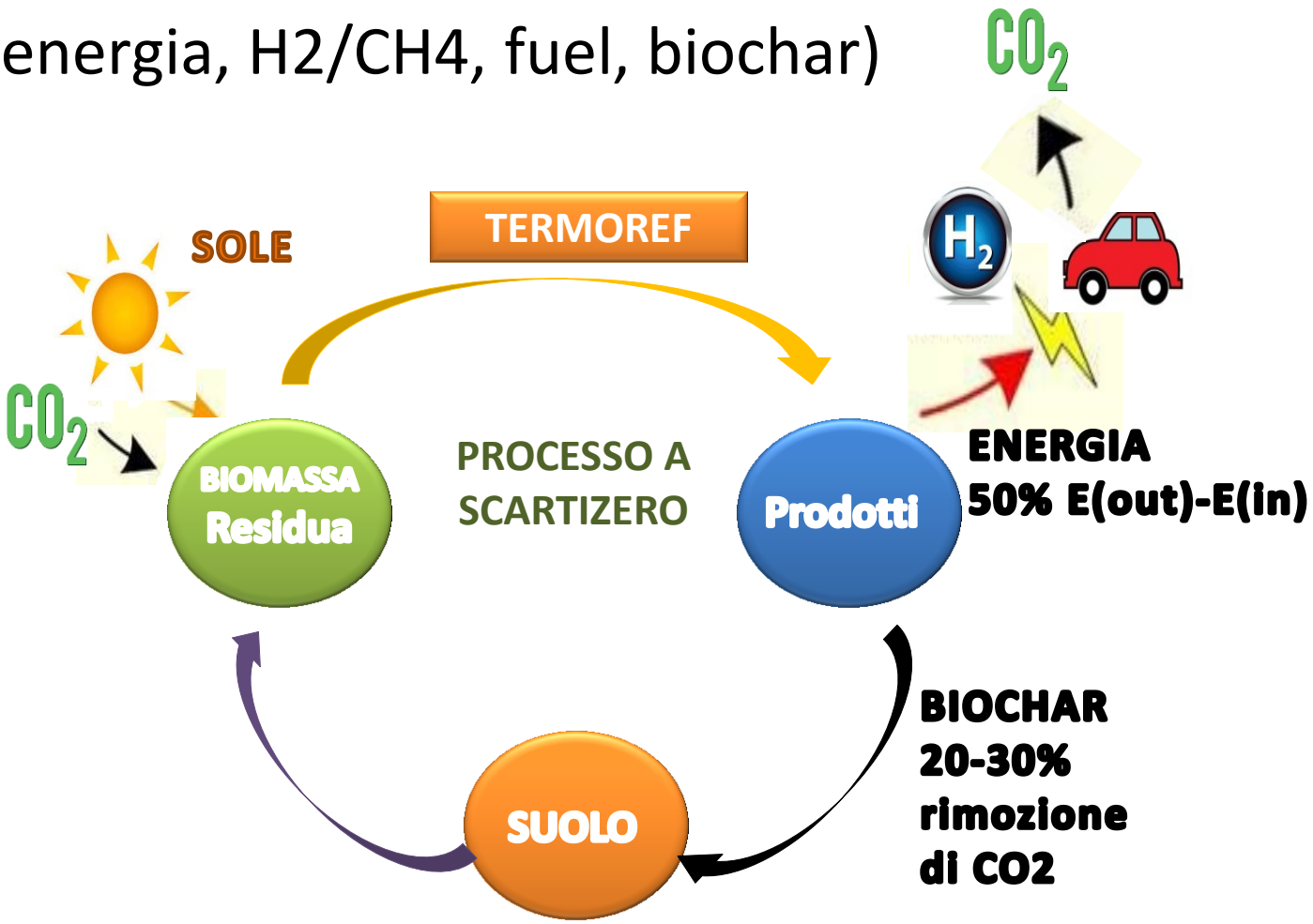
Super Taurus SRL

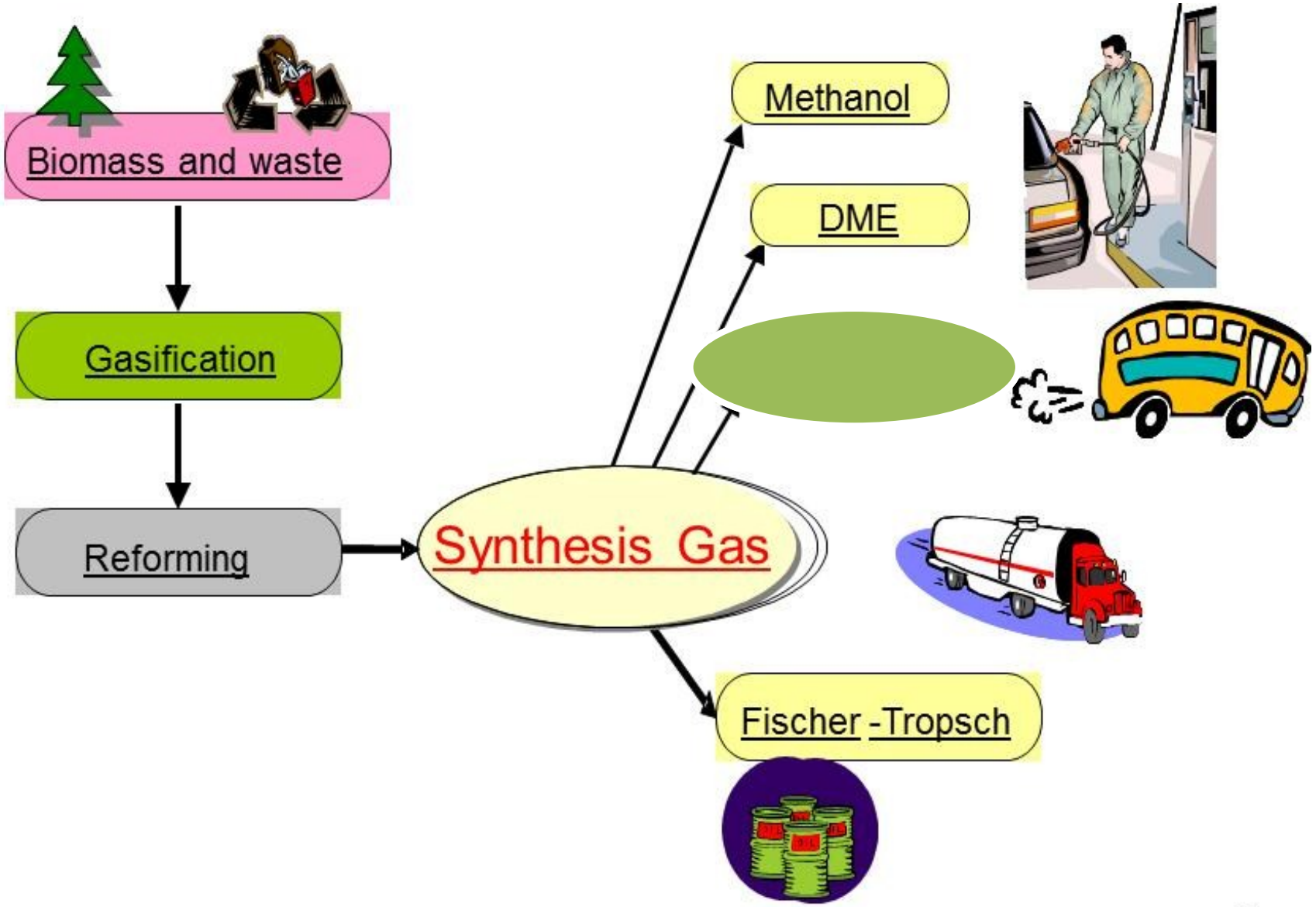
Sauber srl

OBIETTIVI

TERMOREF scartizero

- L'obiettivo del progetto è lo sviluppo di due processi termochimici integrati con processi di reforming e upgrading che aumentino la sostenibilità ambientale ed economicadei prodotti (energia, H2/CH4, fuel, biochar)




Biomass and waste
Gasification
Reforming
Synthesis Gas
Methanol
DME
Fischer -Tropsch

TERMOREF
scartizero



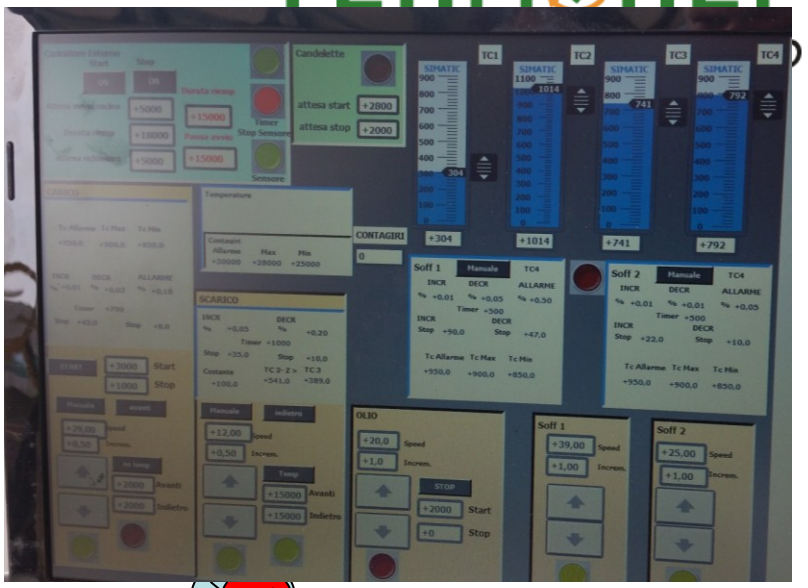


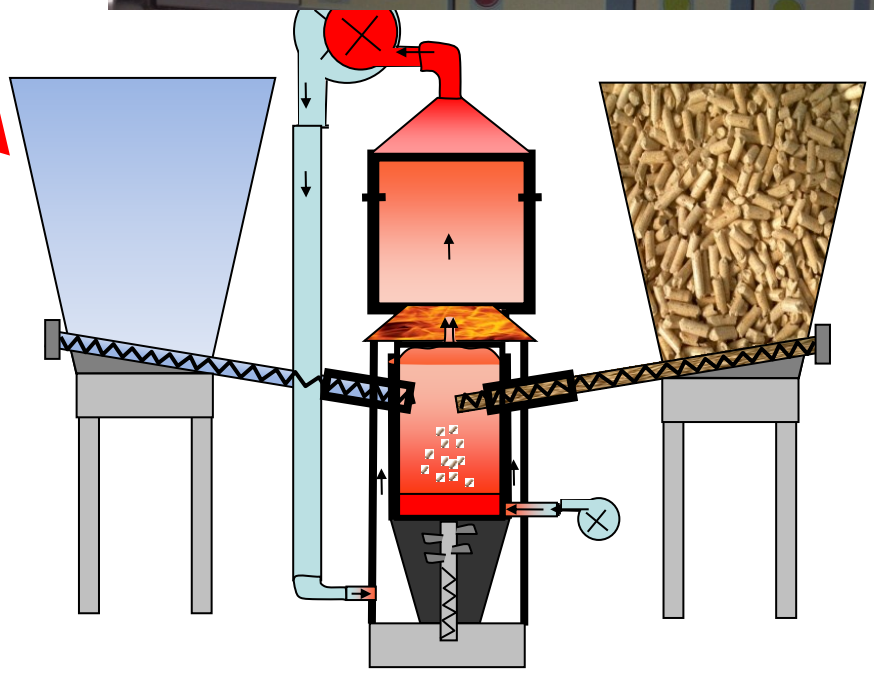



Biomassa di scarto e residuale

1) Pellet
2) Potature
3) Tutoli di mais
4) vinacce (presseate 55%)
5) RDF
6) Frazione Organica
7) Digestato
8) Pollina

Gasifier 20Kg/h



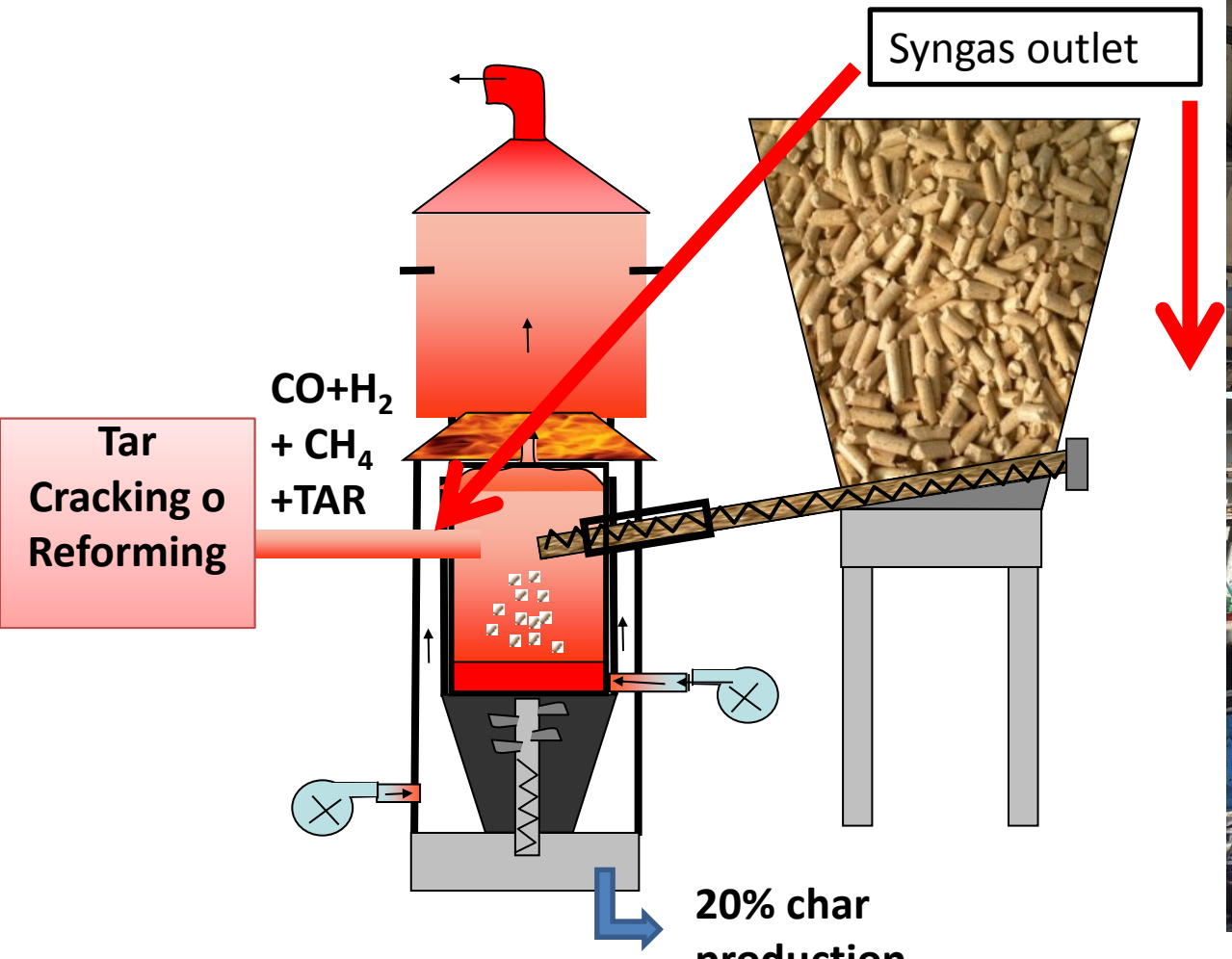


Feeding biomass with high water content (up to 60%)

N. Baraldi, M.

Cleaning the syngas by tar reforming for the production of hydrogen and biomethane

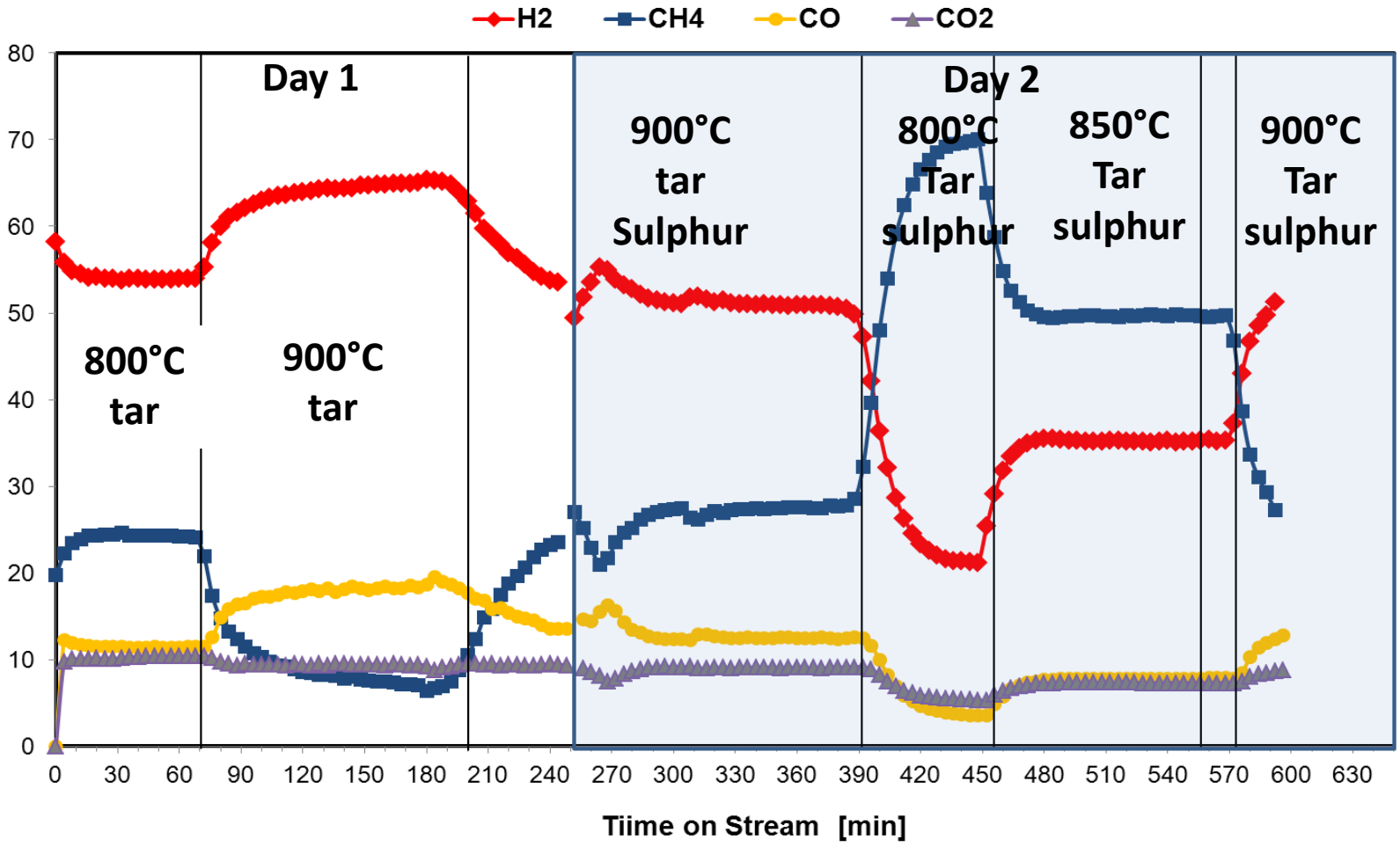
TERMOREF scartizero



Ni CH4 reforming

Componenti del gas reale

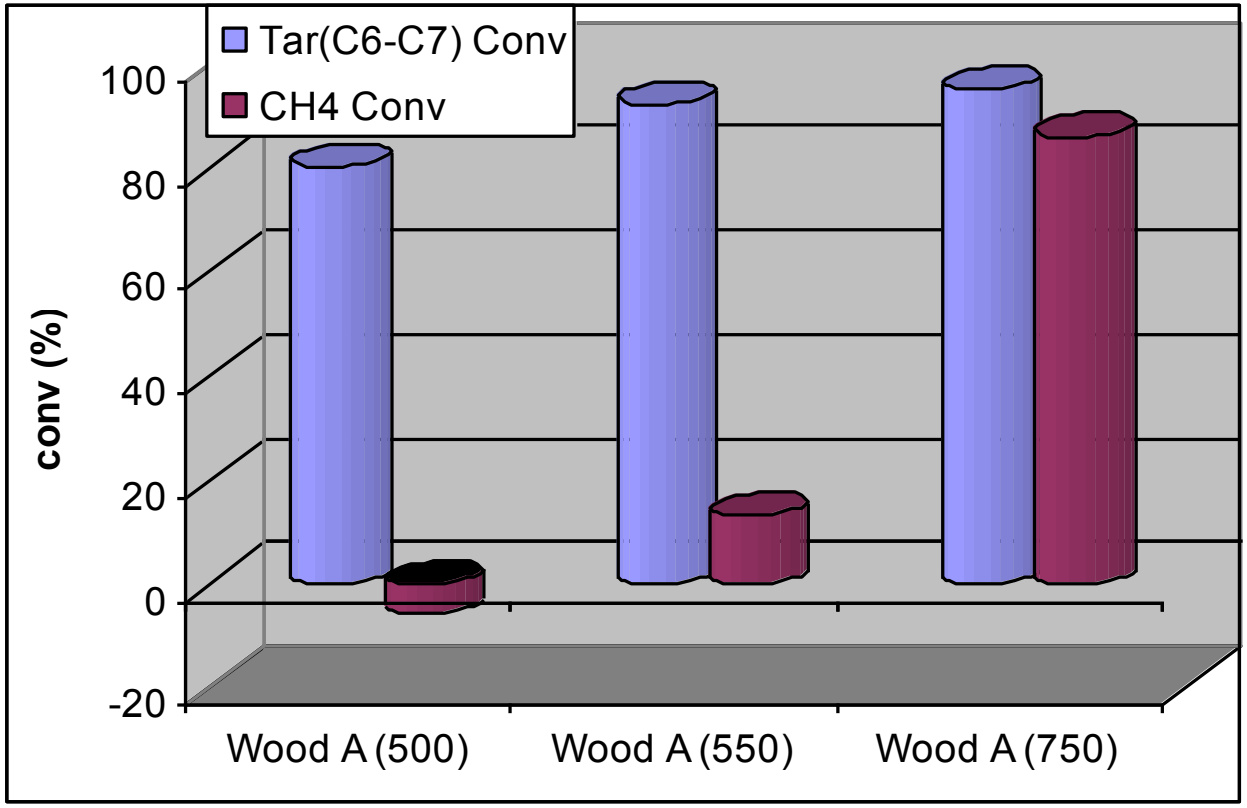
- CH_4 (90%), C_2H_6 (7%), C_3H_8 (3%)
- Phenol (0.057%), p-Cresol (0.05%),
- DMSO/sulphur (300ppm)
- Steam/Carbon = 3



F. Basile, A. T. Della Rosa, A. Inayat (CIRI EA)

Ni catalyst for tar reforming

80% of tar cracking at low temperature at 500°C increase methane
At higher T (550°C) starts CH_4 refoming and tar conversion is 90%
At 750°C tar cracking and tar reforming occurs



Prototipo 2 (TCR®)

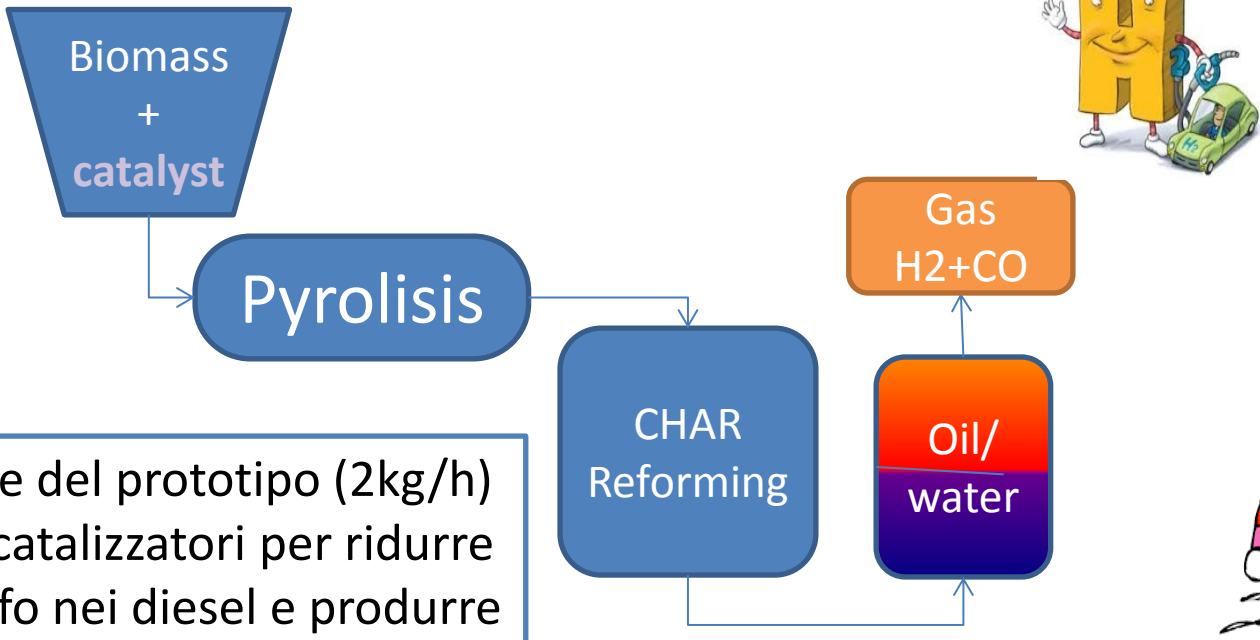
Reforming termocatalitico

Interessanti prodotti in fase gas

Fase acquosa e oli separati

Frazioni variabile in quantità e qualità

Olio che necessità di upgrading per eliminare N e S



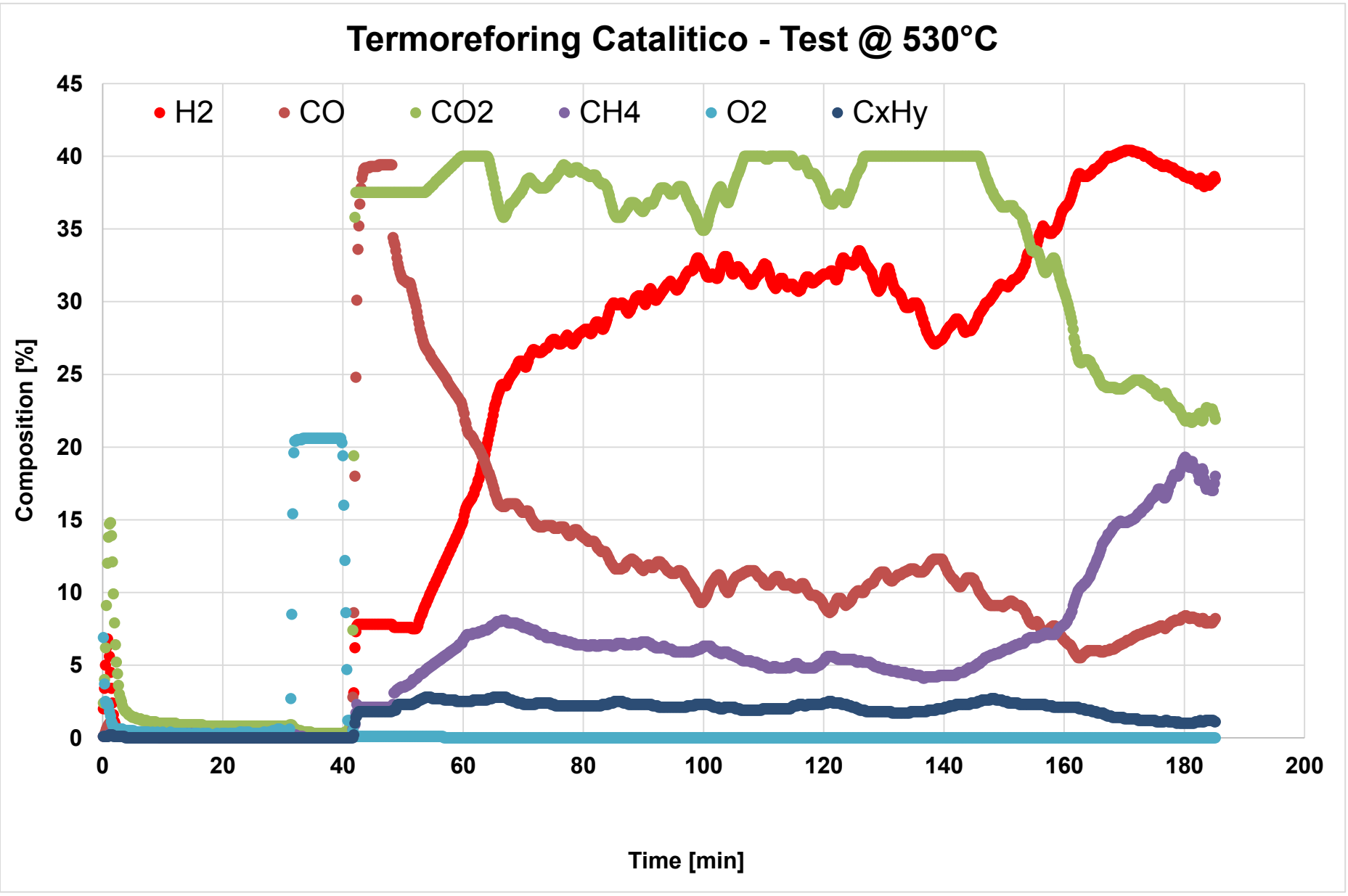
- Costruzione del prototipo (2kg/h)
- Utilizzo di catalizzatori per ridurre azoto e zolfo nei diesel e produrre
- Upgrading dei prodotti gassosi

Termo Reforming Catalitico

Peso 5000 g	530°C	730°C
	P/P %	P/P %
Alimentazione	100	100.0
Fase condensata	34.11	27.09
Fase Gassosa	27.42	31.61
Fase Solida	36.43	41.77
Perdita bilancio	3.68	0.60

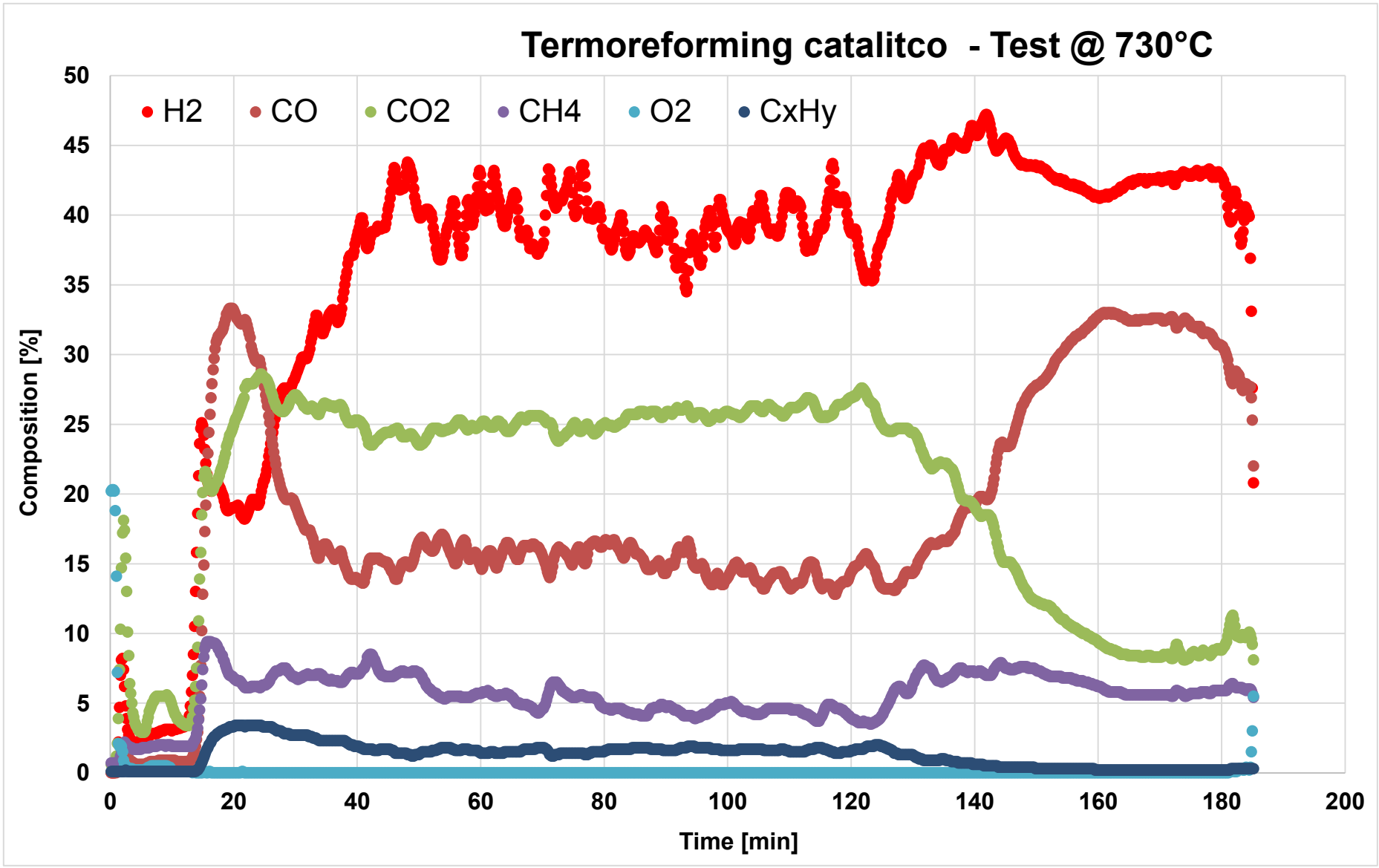
Fase Gas, testo del digestato 530°C

TERMOREF scartizero



Fase Gas, testo del digestato

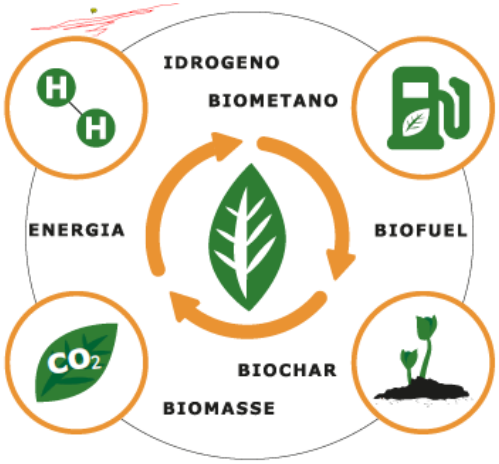
TERMOREF scartizero



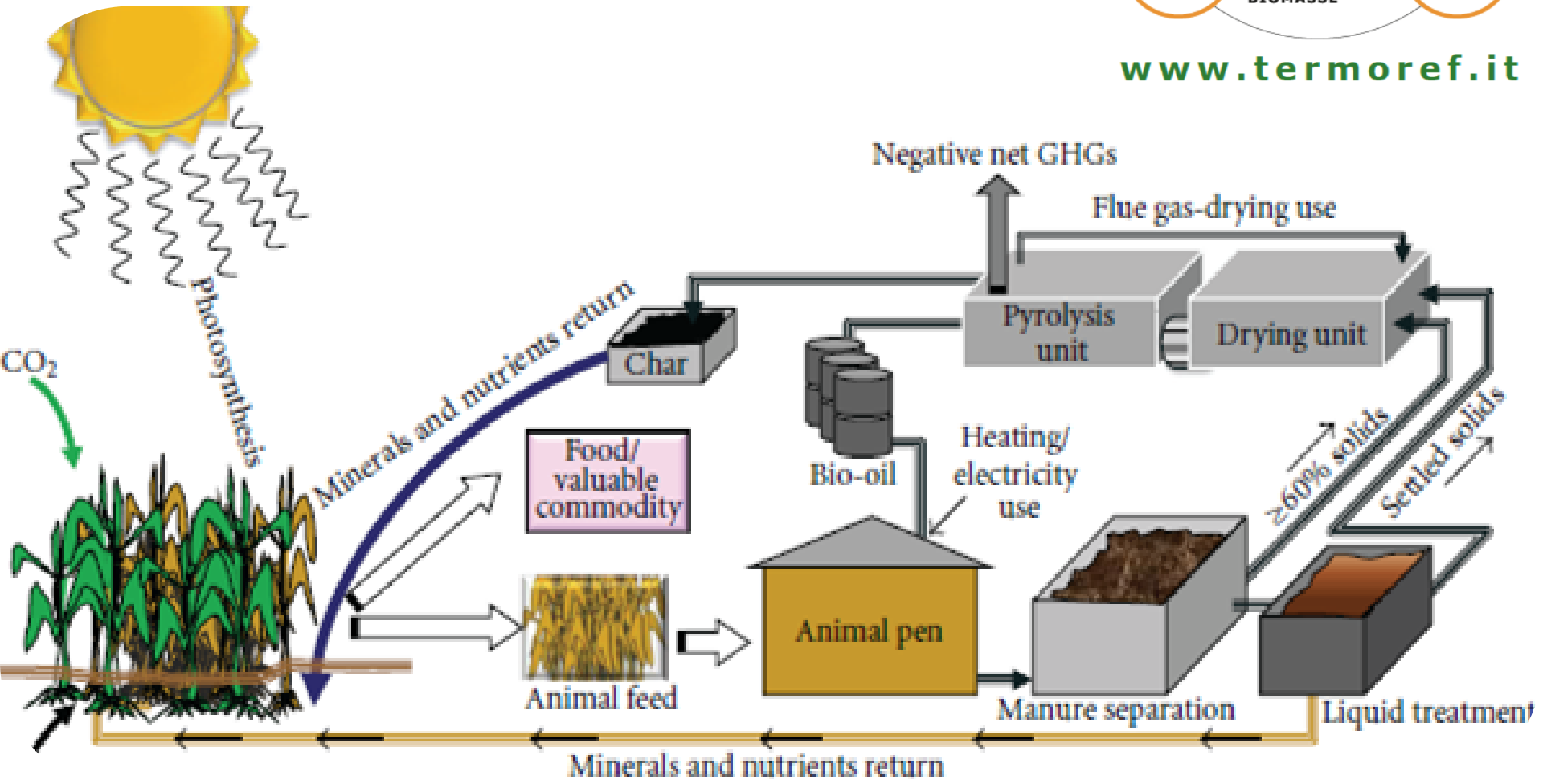
Termochemical conversion

Intengration with existing processes and agricolture with nutrient recycling

Negative CO2 emission by carbon sink



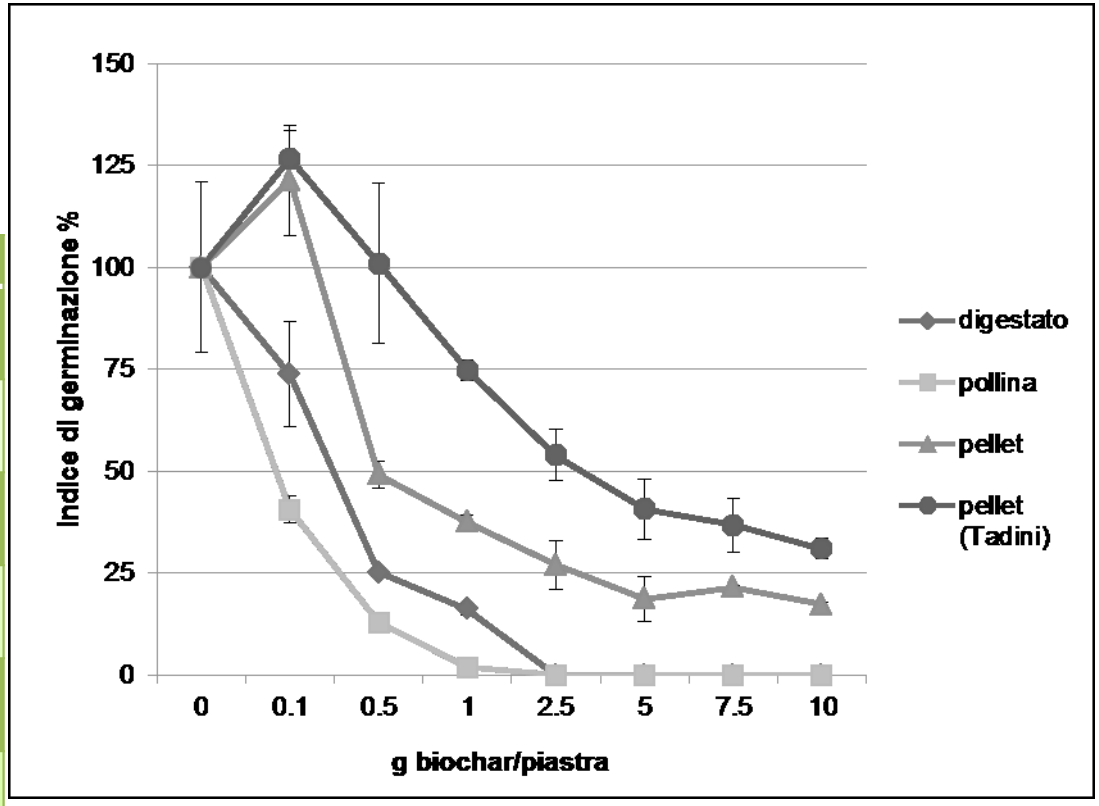
www.termoref.it

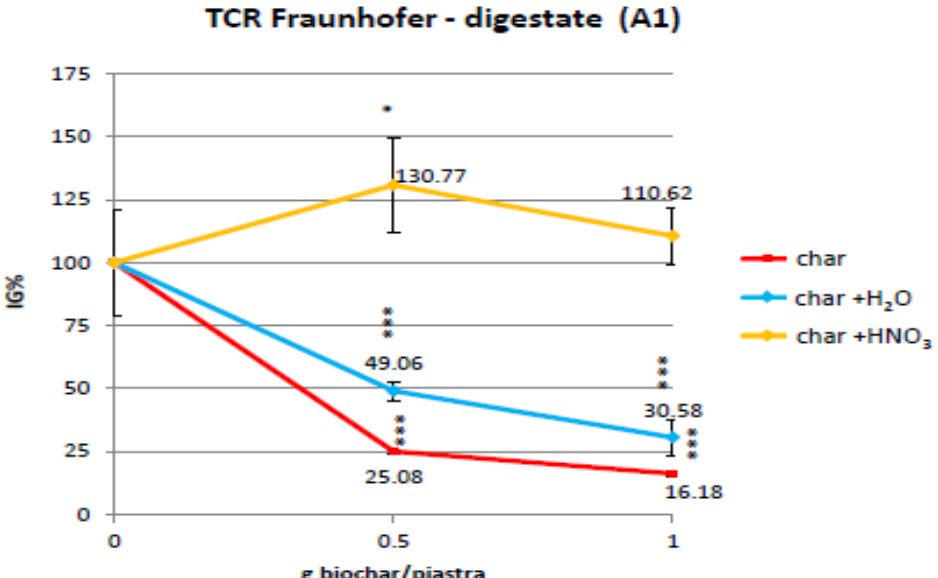


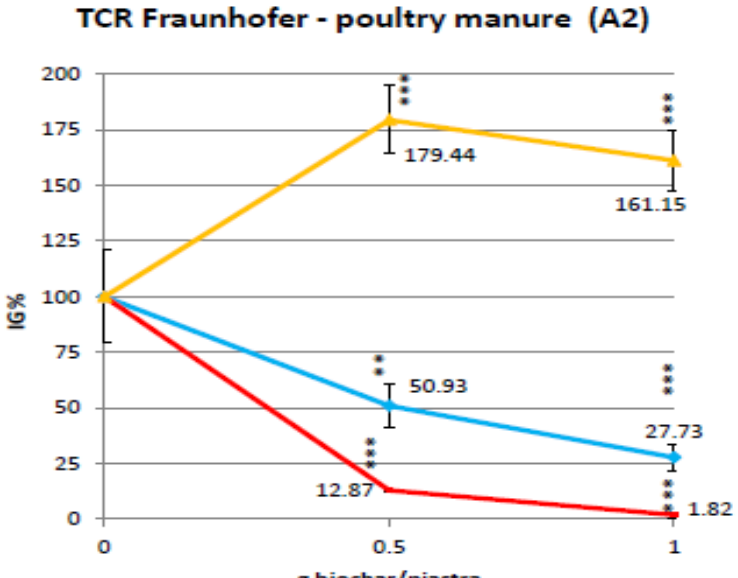
Test di germinazione

E.Maestri CIDEA), A Malcevschi (CIDEA), N.Marmiroli CIDEA);

substrati	fanghi	digestato	legno	legno
processo	TCR	TCR	TCR	PG
N	1.81	0.63	0.77	0.20
C	22.1	42.3	75.8	79.7
H	0.82	1.25	0.95	1.83
ceneri	73.9	47.0	10.0	5.3
umidità	1.3	1.7	1.2	3.1

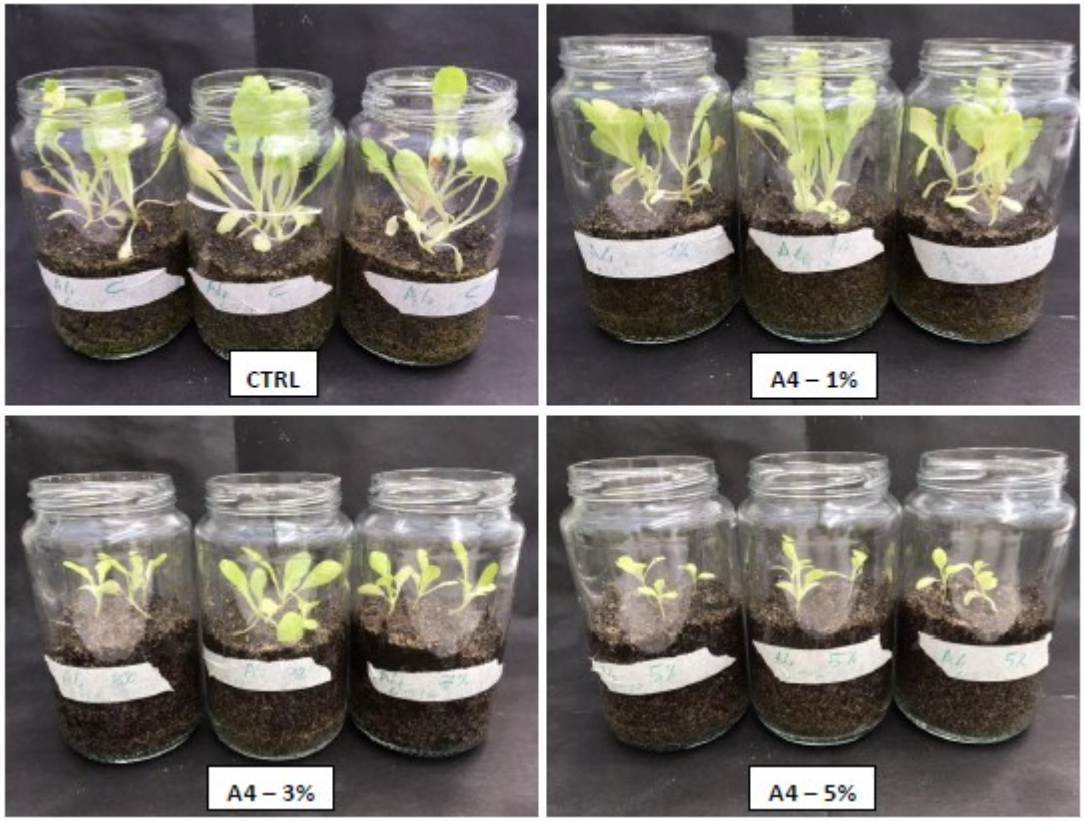




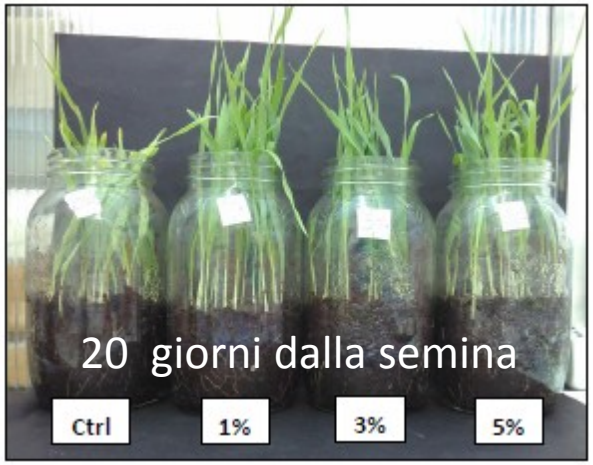


Analysis for Biochar

Lactuca Sativa L.

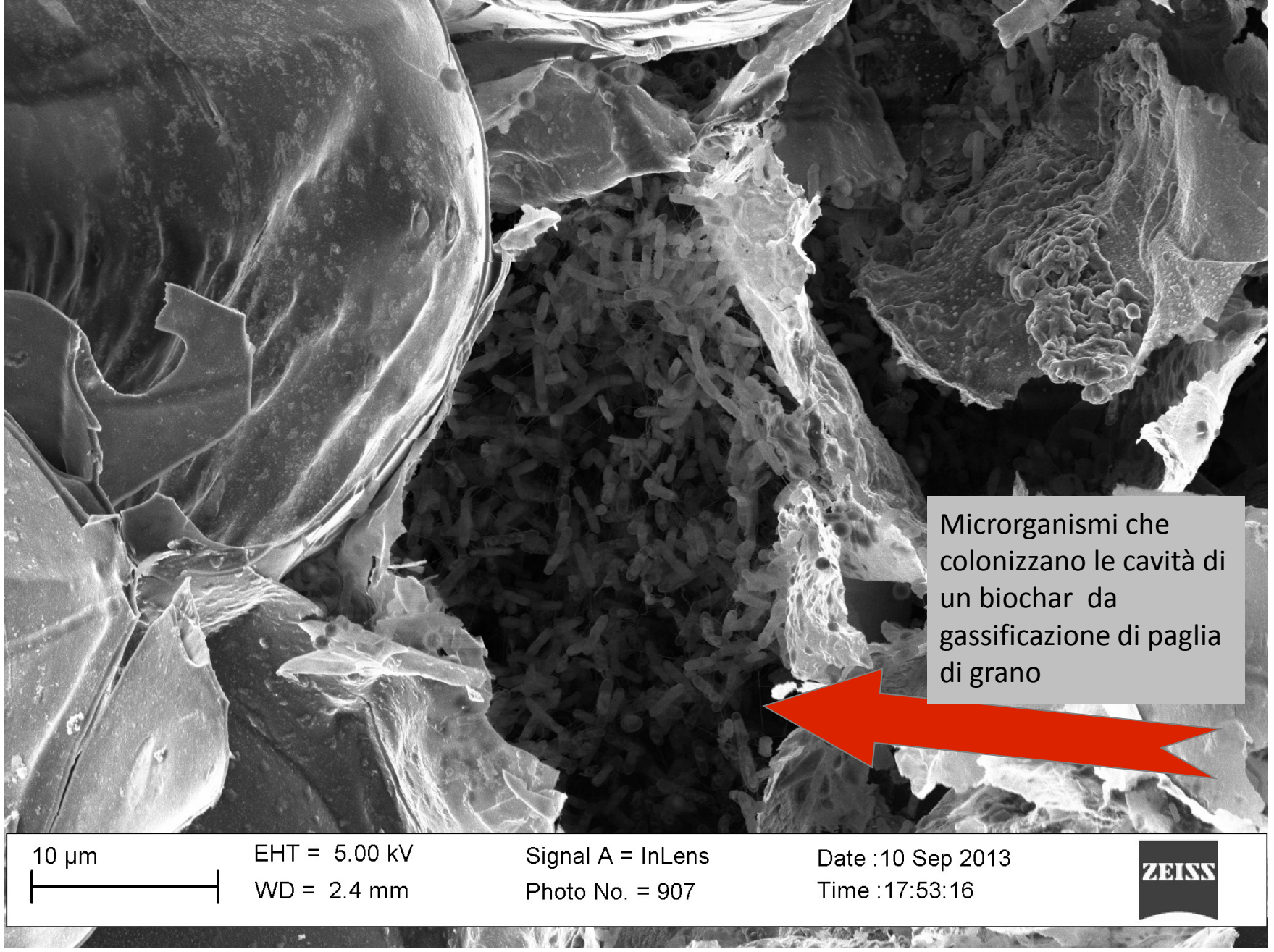


Hordeum vulgare L.



1% equivale circa a 226 ton ha

E.Maestri CIDEA), A Malcevschi (CIDEA), N.Marmiroli CIDEA); D Fabbri (UNIBO) I. Vassura

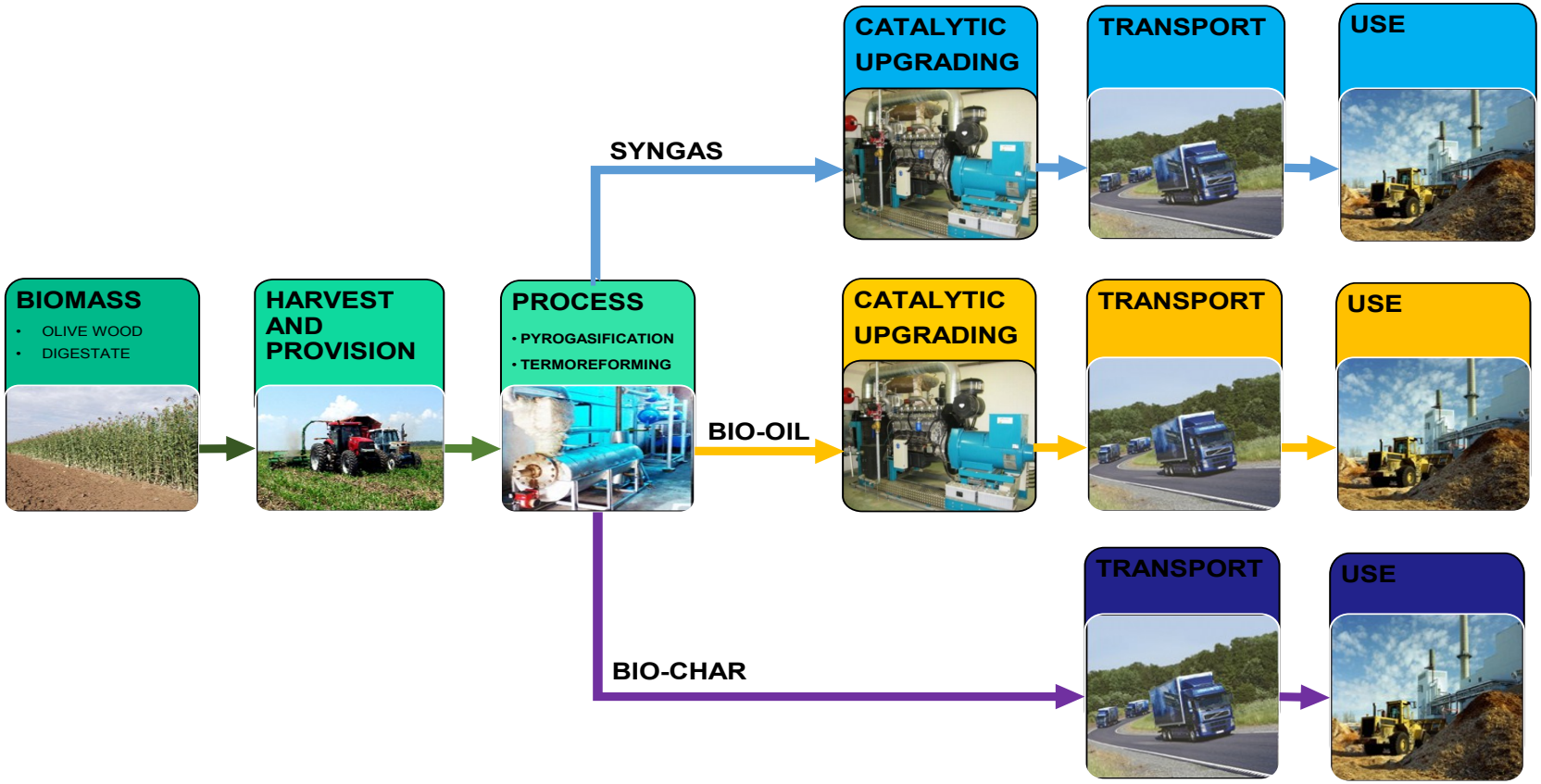


E.Maestri CIDEA), A Malcevschi (CIDEA), N.Marmiroli CIDEA);

Sustainable Analysis

TERMOREF scartizero

V. Cozzani, V Casson Moreno, A Tugnoli



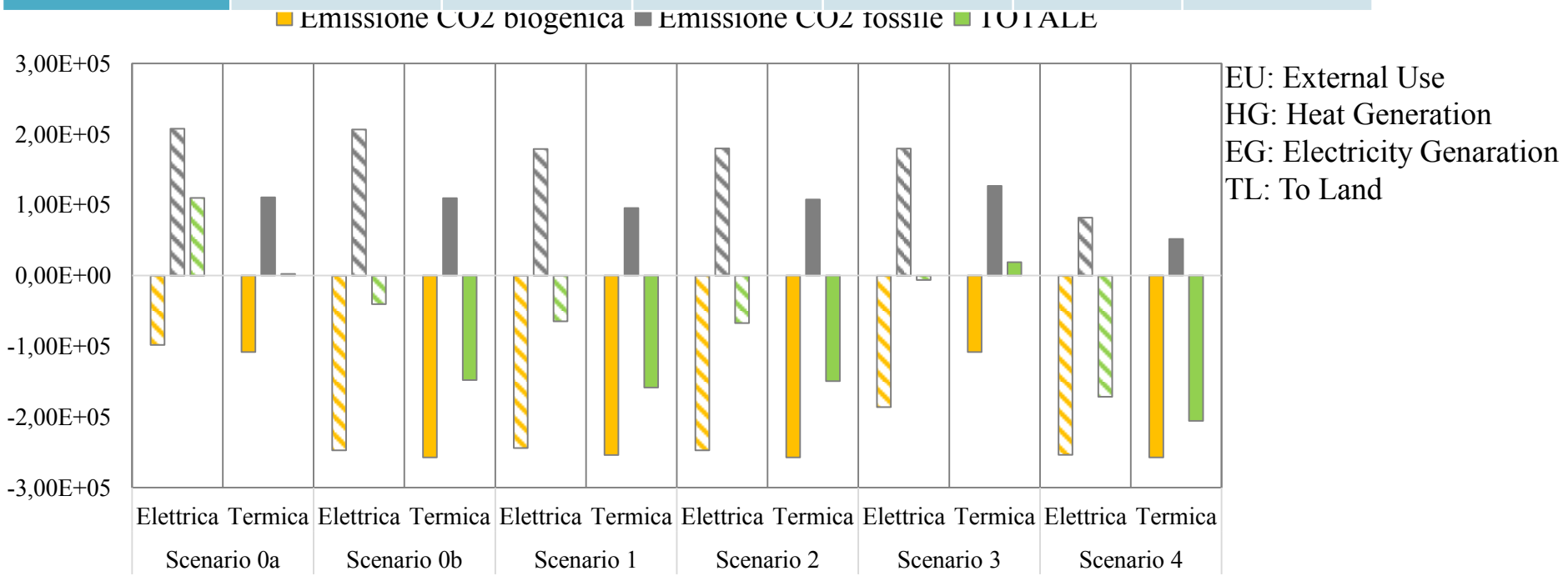
1. Definition of reference schemes
2. Definition of a set of KPIs
3. Normalizatione of KPIs
4. Aggregate KPIs ad Sustainalbe Index

Step metodology based on: KPIs: key performance indicator

Analisi di sostenibilità

TERMOREF scartizero

	Scenario 0_a	Scenario 0_b	Scenario 1	Scenario 2	Scenario 3	Scenario 4
SYNGAS	EU (100%)	EU (100%)	EU (100%)	HG(100%) EU (0%)	EU (100%)	HG(100%) EU (0%)
BIO-OIL	EU(100%)	EU (100%)	HG(100%) EU (0%)	EU (100%)	EU (100%)	EU (100%)
CHAR	EU (100%)	TL (100%)	EU (100%)	EU (100%)	HG(100%) EU (0%)	HG(100%) EU (0%)



TERMOREF

scartizero

Grazie per l'attenzione

e-mail: f.basile@unibo.it

sito web www.termoref.it

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
CENTRO INTERDIPARTIMENTALE
DI RICERCA INDUSTRIALE ENERGIA E AMBIENTE