A CIRCULAR APPROACH TO BIOECONOMY: THE ITALIAN BIOPLASTICS AND BIOCHEMICALS VALUE CHAIN

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Concentrations of carbon dioxide in the atmosphere surged at a record-breaking speed in 2016 to the highest level in 800,000 years.

Globally averaged concentrations of CO₂ reached 403.3 parts per million in 2016, up from 400.00 ppm in 2015 because of a combination of human activities and a strong El Niño event.

Concentrations of CO₂ are now 145% of pre-industrial (before 1750) levels.

World Meteorological Organization's Greenhouse Gas Bulletin, 30th October 2017
24% of global soils are degraded at various levels, including 50% of agricultural soils [source: Bai et al., 2013]

1,500 billion tonnes of carbon are stocked in soil organic matter, which is twice more carbon than atmospheric CO₂ [source: IPCC, 2013]

1,2 billion tonnes of carbon could be stocked every year in agricultural soils which represents an annual rate of 4% compared to the surface soil horizon [source: IPCC, 2014]

Every years crop production in Africa, Asia and South America could increase by millions, by increasing soil organic matter by 1 tonne/ha [Lal, 2006]

24/40

1,2 billion USD is the economic loss in crop production due to soil degradation [FAO, 2006]

BUDIMAN MINASNY ET AL. (2017)
Global greenhouse gas emissions and adaptation to climate change could prevent the worst impacts on hunger globally and help make people less vulnerable to food insecurity.

Failure to adapt, along with increases in greenhouse gas emissions, could push millions of people deeper into hunger and malnutrition.

*Met Office and the UN World Food Programme (WFP), January 2016*
BIOWASTE AS AN ECONOMIC GROWTH DRIVER
ECN (EUROPEAN COMPOST NETWORK) FACTSHEET

BIOWASTE IN EUROPE

TOTAL WASTE

- 60%
- 40%

TOTAL BIOWASTE

- 33.3%
- 66.6%

potential biowaste in MSW EU28 96 Mt pa
regular waste
utilized potential biowaste
non-utilized potential biowaste

POTENTIAL DIRECT JOBS IN THE BIOWASTE SECTOR

RURAL AREAS
1 JOB / 1380t biowaste

URBAN AREAS
1 JOB / 4500t biowaste
GLOBAL FLOWS OF PLASTIC PACKAGING MATERIALS

ELLEN MACARTHUR FOUNDATION 2016 (2013 DATA)

8% CASCADED RECYCLING

4% PROCESS LOSSES

14% COLLECTED FOR RECYCLING

2% CLOSED-LOOP RECYCLING

98% VIRGIN FEEDSTOCK

78 MILLION TONNES
(ANNUAL PRODUCTION)

14% INCINERATION AND/OR ENERGY RECOVERY

40% LANDFILLED

32% LEAKAGE

1. Closed-loop recycling: Recycling of plastics into the same or similar-quality application

2. Cascaded recycling: Recycling of plastics into other, lower-value applications

Source: Project Mainstream analysis – for details please refer to the extended version of the report available on the website of the Ellen MacArthur Foundation: www.ellenmacarthurfoundation.org
NOVAMONT: BIOECONOMY AS TERRITORIAL REGENERATION
THE PILLARS OF NOVAMONT’S STRATEGY AIMED AT RECONNECTING ECONOMY, ENVIRONMENT AND SOCIETY

- Transforming world-first technologies into flagships
- Biorefineries intended as bioeconomy infrastructures, interconnected among them and connected with the local areas
- Through the valorisation of marginal land and not in competition with food production
- Integrated in the local areas and connected with the bioeconomy infrastructures
- Designed to tackle real societal challenges
- Elements of a system which provide concrete solutions to problems going far beyond the product itself
TURNING A PROBLEM INTO AN OPPORTUNITY

ORGANIC WASTE IN LANDFILL

TOTAL WASTE

- 60%
- 40%

TOTAL BIOWASTE

- 33,3%
- 66,6%

potential biowaste in MSW EU28: 96 Mt pa

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utilized potential biowaste

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SOURCES: EUROPEAN COMPOST NETWORK, BUDIMAN MINASNY ET AL. (2017)

ORGANIC WASTE SEPARATE COLLECTION INFRASTRUCTURES AND BIODEGRADABLE BIOPLASTICS IN LIMITED AND SPECIFIC APPLICATIONS

COMPOST AS DRIVER FOR SOILS FERTILITY
NOVAMONT’S PROPRIETARY TECHNOLOGIES
UPSTREAM INTEGRATION 1989-2017: INTEGRATED VALUE CHAIN OF MATER-BI BIOPLASTICS AND BIOCHEMICALS

1ST GENERATION MATER-BI
C14 > 25%

2ND GENERATION MATER-BI
C14 > 40%

3RD GENERATION MATER-BI
C14 > 50%

4TH GENERATION MATER-BI
C14 > 70%

SPECIALISED SEEDS

DEDICATED CROPS AND Biomass TREATMENT

SEEDS CRUSHING

CHEMICAL PROCESSES - 2015 -

BIOTECH PROCESSES - 2016 -

POLYESTERS FROM RRM - 2004 -

COMPLEXED STARCH - 1990 -

2017 MATER-BI CAPACITY INCREASE

2017 FIRST CARDOON HYBRID

2017 FIRST BIO-THF PRODUCTION

AZELAIC ACID
PELARGONIC ACID
OTHER CHEMICAL INTERMEDIATES
NOVAMONT’S BIOECONOMY INFRASTRUCTURES

NOVAMONT’S NETWORK FOR THE BIOPLASTICS AND BIOCHEMICALS VALUE CHAIN

FROM A RESEARCH CENTER IN 1996 UP TO…

- Pioneer and world leader in the development of bioplastics and bioproducts
- Consolidated turnover (2016): 170M€
- > 600 people
- 3 R&D centers
- 20% of people in R&D activities
- >7% of turnover in R&D activities
- About 1,000 patent cases filed
- 4 production sites
- 4 new technologies up and running
NEW PRODUCTS FOR THE QUALITY OF THE ENVIRONMENT
AND RELATED BUSINESS OPPORTUNITIES ALL ALONG THE VALUE CHAIN

INTEGRATED AGRICULTURAL VALUE CHAIN
(LOW IMPACT OLÉAGINOUS CROPS)

FRACTIONS
- SEEDS
- LIGNOCELLULOSIC BIOMASS
- ROOTS

OUTPUTS
- OIL
- ACTIVE MOLECULES
- CAKE
- ENERGY
- 2ND GENERATION SUGARS
- OTHER CHEMICALS
- FOOD INGREDIENTS

MAIN MARKETS
- BUILDING BLOCKS FOR BIOPLASTICS
- BASES FOR BIOLUBRICANTS
- COSMETICS INGREDIENTS
- BIOHERBICIDES
- PLASTICIZERS
- NUTRACEUTICS PRODUCTS
- ANIMAL FEED
- ENERGY FOR FARMERS;
- BUILDING BLOCKS FOR BIOPLASTICS

OPPORTUNITIES FOR
- R&D CENTRES
- START-UPS AND SMES
- SUPPLY CHAIN COMPANIES
THE PIONEERING ACTIVITIES ON BIODEGRADABLE CARRIER AND WASTE BAGS AND THEIR VALUE-CHAIN IN ITALY ARE BECOMING A POWERFUL DEMONSTRATIVE CASE OF RELEVANT DIMENSIONS FOR SUSTAINABLE DEVELOPMENT AND CULTURAL GROWTH

- Redesigning entire application sectors
- Affecting the way raw materials are produced through integration of entire agro-industrial chains
- Modifying use and disposal of products
- Extending the experimental activity of research labs to local areas
- Defining reliable standards
ORGANIC WASTE SEPARATELY COLLECTED IN ITALY 2016

CIC (Italian Composting Association) DATA 2016 AND THE CASE STUDY OF MILAN

- **6 MIO TONS (FOOD AND GARDEN WASTE)**
- **100 KG/INHAB./Y NATIONAL AVERAGE**
- **4,8% IMPURITIES**
- **261 COMPOSTING PLANTS**
- **47 ANAEROBIC DIGESTION PLANTS**
- **550 MW BIOGAS = 3,5 MIO TONS CO2eq**
- **1,761 MIO TONS COMPOST**
- **280.000 TONS ORGANIC C PER YEAR BACK TO SOIL**
- **1.700 MIO € AND 9.000 GREEN JOBS**

**Graph:**

- **Vienna:** 45 KG/INHAB./Y
- **Munich:** 31 KG/INHAB./Y
- **London:** 39 KG/INHAB./Y
- **Hamburg:** 30 KG/INHAB./Y
- **Berlin:** 18 KG/INHAB./Y
- **Milan:** 30 KG/INHAB./Y

- **2012 (door-to-door biowaste collection)**
- **Milano 2013**
- **Milano 2014**

**Statistical Data:**

- **2006:** 2.6 MIO TONS – ORGANIC & GREEN WASTE
- **2015:** 5.7 MIO TONS – ORGANIC & GREEN WASTE
- **6 MIO TONS (FOOD AND GARDEN WASTE)**
- **100 KG/INHAB./Y NATIONAL AVERAGE**
- **4,8% IMPURITIES**
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CAMPAIGN FOR A PROPER AND INTEGRATED MANAGEMENT OF PLASTICS AND BIOPLASTICS

80% OF MARINE LITTER COMES FROM LAND-BASED SOURCES

1. Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
   ResOLVE levers: regenerate, virtualise, exchange

2. Optimize resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
   ResOLVE levers: regenerate, share, optimise, loop

3. Foster system effectiveness by revealing and designing out negative externalities
   All ResOLVE levers
Ogli imballaggi in plastica e bioplastica sono diversi e vanno smaltiti separatamente. Riconoscerli è facile. Basta guardare i simboli.

Fai una cometa raccolta differenziata! Separali nei contenitori della plastica e dell’umido: la plastica si trasformerà in nuova materia prima per utili prodotti, la bioplastica biodegradabile e compostabile in compost per la terra.

Scopri di più su dichieplasticait.it
Italy towards zero organic waste in landfill

EU strategies, funds for infrastructure and increasing spending efficiency in municipal solid waste management (OFMSW): a 5-year programme for Italy to achieve levels of excellence and zero organic waste in landfill.
AN EFFECTIVE CONTRIBUTION TO DECARBONISATION (1/2)

GHG EMISSION BALANCE IN CASE OF ZERO ORGANIC WASTE IN LANDFILL IN ITALY WITH 100 KT/Y OF MATER-BI IV BAGS

Life cycle phases

- Raw material production
- B&C carrier bag production
- B&C carrier bag distribution
- B&C carrier bags RE-USE
- Organic waste collection
- End of life
- Compost use
- Total

GHG EMISSION BALANCE IN CASE OF ZERO ORGANIC WASTE IN LANDFILL IN ITALY WITH 100 KT/Y OF MATER-BI IV BAGS

-5.082.000 t/y

-4.870.839 t/y

Monomers
Biogenic CO2 uptake
B&C bin liners for organic waste collection
C-sink (compost used in agriculture)
Others raw material
By-products recovery
Composting
Chemical fertilizer replacement
Origo-Bi (polyester) production
Electricity
Biogenic CO2 (Mater-Bi)
Mater-Bi production
Trasports
Fossil CO2 (Mater-Bi)
AN EFFECTIVE CONTRIBUTION TO DECARBONISATION (2/2)

GHG EMISSION BALANCE FOR 320 KT/Y OF B&C CARRIER BAGS AND 39 Mt OF ORGANIC WASTE (ONLY FOOD WASTE)

- +39 million tonnes of organic waste (only food waste*) per year
- 320.000 t/y biodegradable bags
- Project objective: «zero organic waste»

- 46.093.508,68 ton/y

*estimation based on CIC annual report (2015) where food waste represents about 65%
** of organic waste collected in Italy
1.000 tons of bioplastics = creation of 60 new jobs which means 100.000 potential jobs in the European Union.
A CIRCULAR APPROACH TO BIOECONOMY
AN OPPORTUNITY TO DECARBONISE THE ECONOMY
AND RECONNECT IT WITH SOCIETY

There is a much more at stake than industry and agriculture in this reconnection: there is the antidote against the increasing poverty that fuels populisms jeopardizing our democracies. The social fabric is not something separate from the industrial world: industry, agriculture and the environment, academy and school institutions, the world of consumption and labor must work together for a common project of development where virtuous cooperation – at a time so highly critical on many fronts – could take the place of sterile position battles.