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Part A

Workplan Tables

A1:
Project summary

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per project

General information			
Project title [3]	Quod Erat Demonstrandum: Large scale demonstration for the bio-based bulk chemicals BDO and IA aiming at cost reduction and improved sustainability		
Starting date [4]	01/01/2014		
Duration in months [5]	48		
Call (part) identifier [6]	FP7-KBBE-2013-7-single-stage		
Activity code(s) most relevant to your topic [7]	KBBE.2013.3.3-01: Support for demonstrating the potential of biotechnological applications		

Abstract [9]

Europe is preparing for a transition from a fossil- to a bio-based economy and this European Bioeconomy offers, as described in the EC Strategy Paper and Action plan “Innovating for Sustainable Growth: A Bioeconomy for Europe”, a comprehensive answer to key societal challenges, like creating and maintaining jobs, maintaining the competitiveness of the European Process Industries, adaptation to climate change, reducing the dependency on non-renewable feedstocks and “more with less” strategy on renewable biomass used for food, added value chemicals and energy.

Due to its extensive scope and complex character such a transition is expected to take at least 1 to 2 decades. The current starting position for Europe on the biotechnological production of added value chemicals from renewable biomass is still very good, with its leading scientific position on industrial White Biotechnology, the global top positions of the European chemical and agro-food industries and the sophisticated logistic infrastructure, but there is a urgent need to go to commercial exploitation to prevent that Europe loses its strong position to faster acting competing economies.

In this framework, an entrepreneurial consortium was built with the joint ambition to generate hard evidence and collect all technical/economic key design parameters needed for investment decisions for the first industrial production plants for the bio-based building blocks 1,4 butanediol, itaconic acid and 2,5-furandicarboxylic acid, which would definitely contribute to guiding these 3 important bio-based chemical building blocks through the notorious “Innovation Valley of Death” to industrial deployment. The consortium is based on strong industrial leadership on both of the selected products, and covers the full supply chains for bio-based BDO, IA and FDCA. The planned demonstrations are solidly based on preceding research results originating from the KBBE Flagship Project BioConSepT and the internal research programs of the industrial partners.

A2:
List of Beneficiaries

Project Number [1]	613941	Project Acronym [2]	BIO-QED

List of Beneficiaries

No	Name	Short name	Country	Project entry month[10]	Project exit month
1	NOVAMONT SPA	NOVAMONT	Italy	1	48
2	LUBRIZOL ADVANCED MATERIALS MANUFACTURING SPAIN SL	LUBRIZOL	Spain	1	48
4	MATER-BIOTECH SPA	MATERBIO	Italy	1	48
5	CARGILL HAUBOURDIN SAS	CARGILL	France	1	22
6	MI-PLAST DOO ZA PROIZVODNJU TRGOVINU I PRUZANJE USLUGA - MI-PLAST LLC MANUFACTURING, TRADING AND SERVICES MIPLAST	MIPLAST	Croatia	1	48
7	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK - TNO	TNO	Netherlands	1	48
8	FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V	FHG	Germany	1	48
9	PATENTOPOLIS BV	Patentopolis	Netherlands	1	48
10	RINA SERVICES SPA	RINA	Italy	1	48
11	NOVA-INSTITUT FUR POLITISCHE UND OKOLOGISCHE INNOVATION GMBH	NOVAINST	Germany	1	48
12	VAN LOON CHEMICAL INNOVATIONS BV	VLCI	Netherlands	17	48
13	ITACONIX CORPORATION	ITACONIX	United States	19	48
14	SOLIQZ BV	SOLIQZ	Netherlands	25	48
15	CARGILL R&D CENTRE EUROPE BVBA	CARGILL R&D	Belgium	23	48

A3:
Budget Breakdown

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One Form per Project

Participant number in this project [11]	Participant short name	Fund. % [12]	Ind. costs [13]	Estimated eligible costs (whole duration of the project)					Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D	
1	NOVAMONT	50.0	A	0.00	3,911,231.00	494,800.00	354,200.00	4,760,231.00	2,804,615.50
2	LUBRIZOL	50.0	F	0.00	495,544.00	9,799.20	16,399.08	521,742.28	273,970.00
4	MATERBIO	50.0	A	0.00	767,200.00	47,300.00	67,600.00	882,100.00	498,500.00
5	CARGILL	50.0	S	0.00	223,814.43	9,162.38	7,127.79	240,104.60	128,197.39
6	MIPLAST	75.0	T	0.00	271,580.00	800.00	7,200.00	279,580.00	143,790.00
7	TNO	75.0	A	0.00	1,183,813.00	69,500.00	30,344.00	1,283,657.00	691,750.50
8	FHG	75.0	A	0.00	940,000.00	40,000.00	50,000.00	1,030,000.00	560,000.00
9	Patentopolis	75.0	T	0.00	0.00	0.00	237,005.00	237,005.00	237,005.00
10	RINA	50.0	A	0.00	149,668.00	6,930.00	126,710.00	283,308.00	208,474.00
11	NOVAINST	75.0	T	0.00	175,104.00	16,128.00	221,360.00	412,592.00	325,040.00
12	VLCI	75.0	T	0.00	422,080.00	7,920.00	7,920.00	437,920.00	226,880.00
13	ITACONIX	75.0	T	0.00	67,200.00	8,800.00	4,000.00	80,000.00	0.00
14	SOLIQZ	50.0		0.00	100,268.00	0.00	0.00	100,268.00	50,134.00
15	CARGILL R&D	50.0		0.00	347,683.97	5,850.00	37,610.63	391,144.60	217,302.62
Total				0.00	9,055,186.40	716,989.58	1,167,476.50	10,939,652.48	6,365,659.00

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and linked Third Parties.

*** The following funding schemes are distinguished**

Collaborative Project (if a distinction is made in the call please state which type of Collaborative project is referred to: (i) Small of medium-scale focused research project, (ii) Large-scale integrating project, (iii) Project targeted to special groups such as SMEs and other smaller actors), Network of Excellence, Coordination Action, Support Action.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project, and it cannot be changed. The project number **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

2. Project acronym

Use the project acronym as indicated in the submitted proposal. It cannot be changed, unless agreed during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry info force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a detailed justification on a separate note.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Activity code

Select the activity code from the drop-down menu.

8. Free keywords

Use the free keywords from your original proposal; changes and additions are possible.

9. Abstract

10. The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

11. The number allocated by the Consortium to the participant for this project.

12. Include the funding % for RTD/Innovation either 50% or 75%

13. Indirect cost model

A: Actual Costs
S: Actual Costs Simplified Method
T: Transitional Flat rate
F :Flat Rate

Workplan Tables

Project number

613941

Project title

BIO-QED—Quod Erat Demonstrandum: Large scale demonstration for the bio-based bulk chemicals BDO and IA aiming at cost reduction and improved sustainability

Call (part) identifier

FP7-KBBE-2013-7-single-stage

Funding scheme

Collaborative project

WT1
List of work packages

Project Number [1]	613941	Project Acronym [2]	BIO-QED

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Type of activity [54]	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Evaluation of 1st and 2nd generation feedstock	DEM	5	46.10	1	12
WP 2	Upstream process – fermentation development	DEM	8	88.30	4	30
WP 3	Downstream process (separation and purification) (up to 50 l)	DEM	7	116.70	1	30
WP 4	Scale-up: integration of fermentation and downstream processing	DEM	4	183.20	1	48
WP 5	Application development and end of use	DEM	2	202,10	7	48
WP 6	Sustainability assessment	DEM	1	105.90	1	48
WP 7	Dissemination and exploitation	OTHER	11	103.30	1	48
WP 8	Project coordination and management	MGT	1	65.00	1	48
			Total	910.30		

WT2:
List of Deliverables

Project Number [1]	613941	Project Acronym [2]	BIO-QED

List of Deliverables - to be submitted for review to EC

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	Report on selection and analysis of by-products from 1st and 2nd generation sugars	1	5	10.40	R	CO	4
D1.2	Deliverables of 1st and 2nd generation sugars for toxicity tests	1	8	17.00	R	CO	6
D1.3	Influence of side-products within 1st and 2nd generation sugars to E.coli and Aspergillus sp. and the production of BDO and IA, respectively	1	8	18.70	R	CO	12
D2.1	Fermentation broth of BDO fermentation for separation and purification process in WP3	2	4	19.00	P	RE	14
D2.2	Fermentation broth of IA fermentation for separation and purification process in WP3	2	8	15.80	R	RE	14
D2.3	Protocols of fermentation development for of BDO production with 1st & 2nd generation feedstocks	2	4	31.00	R	RE	30
D2.4	Protocols of fermentation development for of IA production	2	8	22.50	R	RE	30

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	with 1st & 2nd generation feedstocks						
D3.1	Process protocols and key design parameters for scale up in WP4 for the recovery of BDO from fermentation broth	3	7	15.00	R	RE	30
D3.2	Process protocols and key design parameters for scale up in WP4 for recovery of IA from fermentation broth	3	7	10.00	R	RE	30
D3.3	Samples (kg scale) of IA after recovery steps for application research in WP 5	3	7	16.00	P	PP	30
D3.4	Process protocols and key design parameters for scale up of the purification of BDO in WP 4	3	4	18.00	R	RE	30
D3.5	Samples (kg scale) of BDO after purification for application research in WP 5	3	4	18.00	P	RE	30
D3.6	Process protocols and key design parameters for scale up of the purification of IA in WP 4	3	7	11.20	R	RE	30
D3.7	Samples (kg scale) of IA after	3	7	16.00	P	RE	30

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	purification steps for application research in WP 5						
D3.8	Pre-validation of the purification and separation methodology for the subsequent polymerization at small scale (up to 50 Lt) and suggestion for tuning the previous process steps based on the achieved	3	2	12.50	P	RE	30
D4.1	Protocol and mass balance of feasible process up to 1m3	4	4	24.00	R	RE	42
D4.2	Protocol and mass balance of feasible process up to 10 m3	4	4	25.00	R	RE	42
D4.3	Protocol and mass balance of feasible process up to 240 m3	4	4	31.70	R	RE	42
D4.4	Protocol of by-products valorization	4	4	56.50	R	RE	48
D4.6	Protocols of HMF production process starting from 2nd generation sugars	4	1	23.00	R	RE	45
D4.7	Report on biobased FDCA production: comparison between the chemical and biotechnological routes	4	1	23.00	R	CO	48

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	and biotechnological routes						
D5.1	Technical report on the synthesis of polyurethane from BDO, recommended path forward, commercial recommendations	5	2	24.00	R	CO	40
D5.2	Technical report on the preparation of acrylic copolymers from IA, recommended path forward, commercial recommendations	5	2	25.00	R	CO	40
D5.3	Report on the pilot scale latex production from IA	5	13	10.00	R	CO	48
D5.4	Report on the development of polymeric binder synthesis from IA	5	7	15.00	R	CO	48
D5.5	Report on the polymerization by polycondensation to synthesize polyesters and co-polyesters	5	1	26.10	P	CO	48
D5.6	Report on film applications development	5	6	60.00	P	CO	48
D5.7	Report on guide formulations for biobased itaconic acid applications and results from performance tests	5	12	22.00	R	CO	48

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.8	Report on injection molding applications development	5	1	20.00	R	CO	48
D6.1	Report describing consumer needs and market trends, including a comprehensive section on the conditions for product marketability within the CEE region	6	11	9.00	R	PU	6
D6.2	Comprehensiv e database with technical, economical aspects on value chain/network and unit operation level	6	11	22.50	R	CO	45
D6.3	Report describing environmental impact analysis of the process and products obtained	6	1	31.50	R	CO	45
D6.4	Life-cycle analysis assessment following ISO 14040 and 14044	6	1	32.40	R	CO	45
D6.5	First steps undertaken towards products certification	6	10	10.50	R	CO	48
D7.1	Dissemination and exploitation plan	7	11	10.50	R	RE	6
D7.2	Website up and running	7	11	5.00	O	PU	3

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.3	Leaflet on the project	7	11	5.00	O	PU	12
D7.4	Halfway stakeholder workshop done, report and participants list of first workshop	7	11	8.00	O	PU	18
D7.5	Final stakeholder demo event for dissemination of the projects' results	7	11	13.80	O	PU	48
D7.6	Final dissemination and exploitation report	7	11	14.00	R	RE	48
D7.7	Report on Strategy and proposal for measures to be undertaken towards Standardization	7	10	16.00	R	RE	48
D7.8	IA Strategy Toolkit for Consortium Partners	7	9	2.50	R	RE	12
D7.9	IP Strategy Set up	7	9	2.50	R	RE	18
D7.10	IP Mapping studies on 3 domains (a) itaconic acid, (b) butanediol and (c) separation/ purification technologies	7	9	4.00	R	RE	12
D7.11	IA Management Agreement	7	9	4.50	R	RE	24
D7.12	Update of IA Strategic Plan and IP Mapping studies for developments by competitors and emerging technologies outside the Consortium	7	9	4.00	R	RE	24

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.13	Update of IA Strategic Plan and IP Mapping studies for developments by competitors and emerging technologies outside the Consortium	7	9	4.00	R	RE	36
D7.14	Update of IA Strategic Plan and IP Mapping studies(includin g FDCA) for developments by competitors and emerging technologies outside the Consortium	7	9	9.50	R	RE	48
D8.1	Draft Plan for the Use and Dissemination of Foreground and periodic updates	8	9	12.00	R	RE	18
D8.2	Final Plan for the Use and Dissemination of Foreground and periodic updates	8	9	12.00	R	RE	42
			Total	869.50			

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP1	Type of activity [54]	DEM
Work package title	Evaluation of 1st and 2nd generation feedstock		
Start month	1		
End month	12		
Lead beneficiary number [55]	5		

Objectives

The challenges to overcome and the technological advances that this project intends to realise are aimed at the identification of innovative solutions to:

- use and valorise all the by-products from 1st generation sugars available without competition with the food supply chain as well as supply 2nd generation feedstock
- develop toxicity test and select sugars from lignocellulosic feedstock for fermentation processes of BDO and IA to be developed in WP2

Description of work and role of partners

Task 1.1: Valorisation of by-products from 1st generation sugars [M1-M6]
In this task, Cargill addresses screening and identification of different by-products from 1st generation sugars, evaluates their sugar types and content and optimizes the necessary treatments for their use in fermentation processes for the production of BDO and IA in task 1.3.The screening and identification of waste biomasses from agroindustrial processes (e.g. lignocellulosic residues, agro-industrial wastes, meadow mowing, fats and oils) available within European territory are aiming to map the enterprises and manufacturing areas that could provide useful by-products and to evaluate the rate of production of them. A great attention will be focused on the update of these maps according to the data that will be recorded. According to all biomasses that will be analyzed, a partial and non-comprehensive list will be done and the main issues that will be considered for the evaluation of the biomasses will be the availability within the European territory, the advantage to be ready-to-supply, the cost, the lack of competition with the food chain, the positive rate between cellulose/hemicellulose and lignin (for lignocellulosic biomasses), the amount and percentage composition in fatty acid (for oil and fats biomasses). The biomasses that will be analyzed and positively evaluated will be characterized by standard protocols (e.g. NREL) or other analytical methods such as LC, LC-MS, GC, GC-MS. These activities will be performed according to the data recorded in previous activities.
Partners: Cargill, Novamont; Milestone M1; Deliverables: D 1.1.

Task 1.2: Preparation of 2nd generation sugars from lignocellulose feedstock [M1-M12]
FhG has a facility for pretreatment of lignocellulose (400-L-scale percolator) by the use of organosolv treatment. The pretreated lignocellulose is afterwards enzymatically converted into sugar (glucose and xylose) with (hemi)cellulosic enzymes. 40 kg of glucose per batch can be produced. This will be provided as sirup (~50%) to task 1.3 and WP2-4. Furthermore, the pre-treatment technologies will be evaluated with the main target to fine tuning a one step process that can efficiently purify the three main biomass lignocellulosic components: cellulose, hemicellulose, lignins.
The improvement of the purification steps, the yield of the process and the reduction of the cost approach will be considered in order to identify the most efficient technique or combination of techniques that will be able to produce the streams of products to be used in the processes developed in WP2-4 The step by step streams of production will be comprehensively characterized.
Partners: FhG, Cargill, Novamont; Milestone M1; Deliverables: D 1.2

Task 1.3: Toxicity tests and selection of selected 1st and 2nd generation feedstock [M1-M12]
Sugars from as by-product and lignocellulose often include side products caused by the hydrothermal pretreatment of lignocellulose. These side products may be sugar-degradation products (e.g. HMF, furfural,

levulinic acid), soluble aromates from lignin and acetic acid. All these side products can influence growth of microorganism negatively. FhG will investigate the dose response curves, inhibition and toxic concentration on E.coli and Aspergillus sp. strains used for fermentation of BDO and IA. First the curves will be done by commercial available model compounds; afterwards sugar from different by-products lignocellulose feedstock will be tested.
Partners: FhG, Novamont; Milestone M2; Deliverables: D 1.3

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	19.00
5	CARGILL	6.40
8	FHG	20.70
	Total	46.10

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	Report on selection and analysis of by-products from 1st and 2nd generation sugars	5	10.40	R	CO	4
D1.2	Deliverables of 1st and 2nd generation sugars for toxicity tests	8	17.00	R	CO	6
D1.3	Influence of side-products within 1st and 2nd generation sugars to E.coli and Aspergillus sp. and the production of BDO and IA, respectively	8	18.70	R	CO	12
		Total	46.10			

Description of deliverables

D1.1) Report on selection and analysis of by-products from 1st and 2nd generation sugars: [month 4]
D1.2) Deliverables of 1st and 2nd generation sugars for toxicity tests: [month 6]
D1.3) Influence of side-products within 1st and 2nd generation sugars to E.coli and Aspergillus sp. and the production of BDO and IA, respectively: [month 12]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS1	Selection of 1st and 2nd generation sugars	5	6	List of feedstock
MS2	Evaluation of 1st and 2nd sugars on the production of BDO and IA	5	12	Availability of protocols

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP2	Type of activity [54]	DEM
Work package title	Upstream process – fermentation development		
Start month	4		
End month	30		
Lead beneficiary number [55]	8		

Objectives

- To develop and optimise different robust microbial fermentation processes with 1st and 2nd generation feedstock from WP1 in 50 L scale equipment.
- To enhance time space yield and productivities for the production of the platform chemicals BDO and IA by batch, fed-batch, (semi)continuous or novel fermentation processes at 50 L scale
- Evaluate fermentation processes towards scale-up in WP4
- To deliver broths with platform chemicals to further downstream process development (WP3).

Description of work and role of partners

In this WP, cost-effective and sustainable processes will be established that convert the 1st and cheap 2nd generation biomass fractions from WP1 into a broth containing the desired platform chemical. For this purpose, processes and protocols will be developed that fully utilize the potential of the production strains. Various processing strategies, e.g. batch, fed-batch and continuous processes, and control systems will be addressed.

Task 2.1: Fermentation with recombinant E.coli for the production of BDO [M4-M30]

Sub-Task 2.1.1: Batch and fed-batch processes

This task is to set batch combined with fed batch BDO fermentation process up to 50L by achieving the optimization of the basal medium and microelements, feed medium, process parameters and by establishing a cost and time-efficient approach. Furthermore, because different types of fed-batch mode can be used, the following will be evaluated: fixed volume fed-batch (the limiting substrate is fed without diluting the culture), extended fed-batch (periodic withdrawal of a portion of the culture and use of the residual culture as the starting point for a further fed-batch process), variable volume fed-batch (volume changes with the fermentation time due to the substrate feed). They will be implemented also taking into account the possibility to reach a stage of fermentation after which a quantity of culture is removed from the vessel and replaced by fresh nutrient medium and/or supplementary growth medium is added during the fermentation, but no culture is removed until the end of the batch.

The fermenters will be fed by 1st or 2nd generation sugars, or a combination of both; first generation feedstock will constitute the benchmark for the development of the batch/fed-batch as well as continuous process toward the implementation of both with second generation sugars. With this perspective, strains tolerant to 2nd generation sugars (alone or as a mixture with 1st generation) will be evaluated in fermentations, comparing results (BDO concentration, yield, productivity) with those obtained using 1st generation sugars. The best feed composition and process parameter will be set as basis for WP4.

Partners: Novamont, Mater-Biotech, FhG; Milestone M3, M4; Deliverables: D2.1; D2.3

Sub-Task 2.1.2: Novel process technology (semi- and continuous fermentation)

The purpose of this activity is to perform a feasibility study regarding the application of continuous or semi-continuous fermentation mode for BDO production. The main requirements for the new process will be:

- the strain should produce BDO as well as in the batch/fed-batch mode
- no product inhibition and toxicity should be prevented due to BDO concentration

FhG will support Novamont for working on these novel continuous fermentation in order to evaluate whether the process if feasible and economically sustainable. An hypothetical fermentation will be investigated with and without continuous cell recovery. The use of fermentation cascades will be considered to get higher production in continuous mode. All the fermentation will be calculated towards large scale fermentation in WP3. If the study

will show both technical and economic advantages over batch/fed-batch, Novamont will verify the new process at laboratory scale (≤50L).
Partners: Novamont, Mater-Biotech, FhG; Milestone M3, M4; Deliverables: D2.1; D2.3

Task 2.2: Fermentation of Aspergillus sp. for the production of IA [M4-M30]

Sub-Task 2.2.1: Fed-batch and semi-continuous processes

FhG with the technical support of TNO, will work on fed-batch fermentation up to 40-L-scale. IA fungal fermentation will be done in two steps: growing phase and afterwards IA production phase. The growing phase will be done in sterile conditions and FhG will optimize nutrients (preferable mineral salt media without yeast extract or other peptide source) and develops a fed-batch with exponential or constant feeding rate for higher biomass concentration (high cell density). In the second phase, the fungi pellets will harvested from the first fermenter will be transferred to the production reactor where the fungi growth is stopped by limiting nitrogen.
While transfer is done it is possible to concentrate the fungal biomass in order to get once again a higher conversion rate and time space yield.
On the other hand, the production phase could be in the same fermenter if nitrogen source is completely consumed by the fungi during the first phase. As the second phase is running at low pH and is limited in nutrient the production phase could run in non-sterile conditions and could be more economically in industrial scale. So it should also be proven if the whole fermentation could be run under non-sterile or just pasteurized conditions. The advantage is to save sterilization costs in industrial scale. The robustness of the non-sterile processing will be evaluated. The production phase will be run for several hours to achieve high conversion rate. Moreover, this second phase will run with 1st generation sugars and also sugars from lignocellulose feedstock to adapt the fermentation organism to renewable feedstock. The whole process will be done in sterile and non-sterile conditions to evaluate the feasibility of the techniques chosen. All the fermentations will be calculated towards large scale fermentation in WP4. A new partner that will be identified for demonstration of IA production process will support this work concerning feasibility for industrial scale. Itaconix will provide guidance in fermentation processes and conditions.
Partners: Itaconix, TNO, FhG; Milestones M3, M4; Deliverables: D2.2; D2.4

Sub-Task 2.2.2: Novel process technology (fermentation with immobilized cells)

FhG with the technical support of TNO, will work on continuous fermentation in order to run a long term fermentation and make the fermentation more economically feasible. The process described in the task 2.2.1 will be applied as well but with the following differences: After growth phase of Aspergillus sp. the strain will be immobilized on submerged synthetic particles. This enables the re-used on the fungi towards the application of continuous production. Afterwards the production phase will be run with immobilized fungi in continuous mode (above 300 hours). All processes will be tested with 1st and 2nd generation sugar, under sterile, non-sterile conditions up to 40-L-scale and will be evaluated concerning robustness, time-space yield and productivity. All the fermentation will be calculated towards large scale fermentation in WP4.
Partners: TNO, FhG; Milestones M3, M4; Deliverables: D2.2; D2.4

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	51.00
4	MATERBIO	8.00
5	CARGILL	10.00
7	TNO	3.00
8	FHG	15.00
13	ITACONIX	0.50
15	CARGILL R&D	0.80
	Total	88.30

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.1	Fermentation broth of BDO fermentation for separation and purification process in WP3	4	19.00	P	RE	14
D2.2	Fermentation broth of IA fermentation for separation and purification process in WP3	8	15.80	R	RE	14
D2.3	Protocols of fermentation development for of BDO production with 1st & 2nd generation feedstocks	4	31.00	R	RE	30
D2.4	Protocols of fermentation development for of IA production with 1st & 2nd generation feedstocks	8	22.50	R	RE	30
		Total	88.30			

Description of deliverables

D2.1) Fermentation broth of BDO fermentation for separation and purification process in WP3: [month 14]
D2.2) Fermentation broth of IA fermentation for separation and purification process in WP3: [month 14]
D2.3) Protocols of fermentation development for of BDO production with 1st & 2nd generation feedstocks: [month 30]
D2.4) Protocols of fermentation development for of IA production with 1st & 2nd generation feedstocks: [month 30]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS3	Successful BDO and IA production with 1st generation feedstock	8	14	Availability of protocols
MS4	Successful BDO and IA production with 2nd generation feedstock	8	30	Availability of protocols

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP3	Type of activity [54]	DEM
Work package title	Downstream process (separation and purification) (up to 50 l)		
Start month	1		
End month	30		
Lead beneficiary number [55]	7		

Objectives

- To test and implement pre-selected separation techniques to recover butanediol (BDO) and itaconic acid (IA) from fermentation broth at a scale up to 50 L.
- To apply BDO and IA recovery technique as ISPR to improve productivities and feedstock impurities inhibition
- To test and implement techniques to purify BDO and IA from the stream coming out of the separation step at a scale up to 50 L.
- To deliver purified samples of IA and BDO for application research in WP5 (kg scale).

Description of work and role of partners

In this WP, cost-effective and sustainable separation and purification crystallization processes will be tested at a scale up to 50 L to prove the full recovery and purification of BDO and IA from fermentation broths.
Different separation and purification techniques have been selected for Bio-QED. The running EU project BioConSepT has identified Eutectic Freeze Crystallization (EFC) as recovery technique for IA (and water) from fermentation broths. Internal research at TNO, identified extraction with trioctylphosphine oxide (TOPO) followed by the novel Eutectic Freeze Crystallization as best candidate for BDO recovery. For the purification of BDO and IA, melt crystallization by the use of Hydraulic Wash Column technology will be applied. WP2-3 focuses at proving previously generic high-selectivity and energy-friendly technologies for recovery and purification of fermentation products at a scale up to 50 L. Key data will be collected for the integration and scale up to large demonstration scale in WP4.

Task 3.1: Separation [M1-M30]
Sub-Task 3.1.1: Separation of BDO from fermentation broth
Biomass will be removed from fermentation broth with a centrifuge or microfiltration. To separate BDO from fermentation supernatant, the separation technology chosen is solvent extraction with tri-octyl-phosphine oxide (TOPO) or similar solvents, coupled with eutectic melt crystallization. In case of TOPO, in the extraction step BDO will be extracted from fermentation supernatant by the solvent. The resulting BDO-TOPO mixture will be treated by eutectic melt crystallization at the eutectic point of the BDO-TOPO (16°C). Under these conditions TOPO and BDO will crystallize simultaneously. The TOPO and BDO crystals, which differ in density, will be separated by settling or centrifugation. The TOPO crystals will be molten and recycled to the extraction step.
The separated BDO crystals will be further purified in Sub-Task 3.2.1. When the technology is validated at 50 L scale, it will be tested as ISPR technique by integrating it with BDO production by fermentation.
Partners: TNO, NOVAMONT, MATERBIO, Lubrizol; Deliverable: D3.1
Sub-Task 3.1.2: Separation of IA from fermentation broth
Eutectic Freeze Crystallization is chosen as technology to recover relatively pure IA and water from fermentation broth. Here, after biomass removal with centrifugation or microfiltration, the remaining supernatant will be cooled to the eutectic point, which is slightly below 0oC. Ice and IA crystals are then formed simultaneously. IA and ice crystals are separated from each other using the large difference in density by settling or centrifugation. The
IA crystals will be separated from the mother liquor and used for the purification tests in WP 3.2.2. Sufficient quantities of IA crystals will be prepared and sent to Lubrizol for the research in Task 5.2. The ice will also be separated from the mother liquor in order to create water with a high purity (for recycling or disposal). When the technology is validated at 50 L scale, it will be tested as ISPR technique by integrating it with IA production by fermentation.

As reference a new partner that will be identified for demonstration of IA production process will obtain dissolved IA from fermentation broth at large scale.
Partners: TNO, FhG, Deliverable: D3.2, D3.3

Task 3.2 Purification [M1-M30]
Sub-Task 3.2.1: Purification of BDO
To further purify BDO to polymer grade quality the BDO product stream will be further purified by a Melt Crystallization (MC) Hydraulic Wash Column (HWC®) process. HWC combines continuous solid-liquid separation with efficient counter-current washing with an extremely low wash liquid consumption. It uses hydraulic forces to transport the bed of melted BDO to the out stream. The MC-HWC process is capable of producing BDO at the high purity level required for polymerization. Mater-Biotech and Novamont will test hydrogenation coupled with distillation as conventional reference technology as well.
Partners: TNO, Novamont, Mater-biotech, Lubrizol; Deliverables: D3.4, D3.5
Sub-Task 3.2.2: Purification of IA
The MC-HWC process used for the purification of BDO is also the preferred process for the purification of IA to polymer grade quality. HWC combines continuous solid-liquid separation with efficient counter-current washing with an extremely low wash liquid consumption. It uses hydraulic forces to transport the bed of melted IA to the out stream. The MC-HWC process is capable of producing IA at the high purity level required for polymerization. As reference and comparison a new partner that will be identified for demonstration of IA production process will polish/purify the product stream from WP3.1.2 using a suitable industrial technology Also the purified IA material from WP 3.2.2 will be collected and sent to Lubrizol as feed for the preparation of acrylic copolymers in WP 5.
Partners: TNO, FhG, Itaconix ; Deliverables: D3.6, D3.7

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	54.00
2	LUBRIZOL	12.00
4	MATERBIO	19.00
5	CARGILL	0.10
7	TNO	26.00
8	FHG	5.00
13	ITACONIX	0.50
15	CARGILL R&D	0.10
	Total	116.70

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D3.1	Process protocols and key design parameters for scale up in WP4 for the recovery of BDO from fermentation broth	7	15.00	R	RE	30
D3.2	Process protocols and key design parameters for scale up in WP4 for recovery of IA from fermentation broth	7	10.00	R	RE	30

WT3:
Work package description

List of deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
D3.3	Samples (kg scale) of IA after recovery steps for application research in WP 5	7	16.00	P	PP	30
D3.4	Process protocols and key design parameters for scale up of the purification of BDO in WP 4	4	18.00	R	RE	30
D3.5	Samples (kg scale) of BDO after purification for application research in WP 5	4	18.00	P	RE	30
D3.6	Process protocols and key design parameters for scale up of the purification of IA in WP 4	7	11.20	R	RE	30
D3.7	Samples (kg scale) of IA after purification steps for application research in WP 5	7	16.00	P	RE	30
D3.8	Pre-validation of the purification and separation methodology for the subsequent polymerization at small scale (up to 50 Lt) and suggestions for tuning the previous process steps based on the achieved	2	12.50	P	RE	30
		Total	116.70			

Description of deliverables

D3.1) Process protocols and key design parameters for scale up in WP4 for the recovery of BDO from fermentation broth: [month 30]

D3.2) Process protocols and key design parameters for scale up in WP4 for recovery of IA from fermentation broth: [month 30]

D3.3) Samples (kg scale) of IA after recovery steps for application research in WP 5: [month 30]

D3.4) Process protocols and key design parameters for scale up of the purification of BDO in WP 4: [month 30]

D3.5) Samples (kg scale) of BDO after purification for application research in WP 5: [month 30]

D3.6) Process protocols and key design parameters for scale up of the purification of IA in WP 4: [month 30]

D3.7) Samples (kg scale) of IA after purification steps for application research in WP 5: [month 30]

D3.8) Pre-validation of the purification and separation methodology for the subsequent polymerization at small scale (up to 50 Lt) and suggestions for tuning the previous process steps based on the achieved: [month 30]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS5	BDO crystals with desired purity for applications in WP5	4	30	Availability of protocols
MS6	IA crystals with desired purity for applications in WP5	7	30	Availability of protocols

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP4	Type of activity [54]	DEM
Work package title	Scale-up: integration of fermentation and downstream processing		
Start month	1		
End month	48		
Lead beneficiary number [55]	4		

Objectives

- To provide information for integration of fermentation and downstream sections to produce BDO, IA and FDCA;
- To test engineering concepts from WP2 and WP3 via pilot-scale to industrial scale;
- To demonstrate the technical feasibility of the production of platform chemicals on pilot-scale by efficient processes with optimized continuous fermentation and novel integrated production and separation techniques.

Description of work and role of partners

In this workpackage the proved and most promising fermentation and purification processes from WP2 and WP3, as well as FDCA production and purification, will be scaled-up and optimized within larger scale. Here BDO, IA and FDCA will be produced out of 1st generation feedstock as well as 2nd generation feedstock. Following tasks will be done

• Scale up and optimize fermentation processes for BDO and IA production up to 1 m3-scale
• Scale up and optimize fermentation processes for BDO and IA production up to 10 m3-scale
• Scale up and optimize fermentation processes for BDO production up to 240 m3-scale
• Scale up and optimize fermentation processes for FDCA production up to 1m3-scale

Task 4.1: Scale-up of BDO and IA production up to 1 m3 [M4-M48]

The optimized fermentation from WP2 will be scaled up to 1 m3 with 1st and 2nd generation feedstock. Here the most promising process strategies from WP2 will be scaled-up (Fermentation for production of BDO with recombinant E.coli and IA with Aspergillus species). This will be done within a fermentation cascade 10-L 100-L 1 m3. The prior fermenters are used as a seed fermenter to produce biomass; the final fermenter will be used for biomass and also production of BDO or IA, respectively.

E.coli produces BDO constitutively within the growing phase and stationary phase (batch and fed batch) while Aspergillus sp. starts production of IA in the stationary phase after nutrient limitation. For IA production by fermentation with Aspergillus sp. the following two configurations will be tested: (i) growth and production in the same vessel (ii) concentration of biomass after growth phase and transfer into a nutrient limiting media. As Aspergillus sp. fermentation is done at low pH the production process could run in non-sterile conditions as optimized in WP2.

Fermentation broth will be combined with downstream processing after biomass removal (separator, microfiltration). The BDO or IA present in the fermentation super-natant will be recovered via eutectic crystallization as it was optimized in WP3. In the case of BDO, solid-liquid separation couple with ion exchange will be tested as well and be used as a reference case.

With the support of SoliQz, further purification of BDO and IA will be done by using the hydraulic wash column technique developed by TNO (HWC®). The purified BDO and IA will be used in the application development described in WP5.

The data collected and technical evaluation will be used to scale up the process in task 4.2.

Partners: FhG, Novamont, Mater-Biotech, TNO, Cargill, Lubrizol, SoliQz, Cargill R&D; Milestone M7; Deliverables: D 4.1

Task 4.2: Scale-up of BDO and IA production up to 10 m3 [M4-M48]

The most promising BDO process investigated in task 4.1 will be scaled up to 10 m3 with 1st generation feedstock as well as 2nd generation sugar at the facility of Novamont and Mater-Biotech. The best IA process from task 4.1 will be scaled up to 10 m3 for 1st and 2nd generation feedstock at the facility of FhG. Where

fermentation will run within the fermentation cascade 10-L 100-L 1 m3 10 m3. The robustness of fermentation process will be proven concerning the different feedstock for IA and BDO production. Furthermore, stability production of IA under non-sterile conditions with Aspergillus sp. will be evaluated at 10 m3. For IA downstream processing, TNO, Fraunhofer and SoliQz will jointly implement the proven technologies from Task 4.1 for the recovery and purification of IA at 10 m3. The following process steps will be tested: eutectic freeze crystallization of IA, separation of ice and IA crystals in a settler, cooling crystallization of IA, separation and washing of IA crystals in a solvent switch HWC after the two crystallization processes and the washing of ice with a HWC® after the eutectic freeze crystallization step. SoliQz, with the help of TNO, will design and construct an upgrade of a pilot plant for testing the so-called solvent switch process with the Hydraulic Wash Column®. This solvent switch HWC® pilot plant will be tested in both the recovery of IA from fermentation broth and the purification step of IA to polymer grade. A HWC® will be tested for the washing of ice to increase the yield of the process as well as to improve the recyclability of water. The purified IA from the pilot plant will be used in the application development described in WP5.

For BDO, downstream processes will involve separation of biomass through centrifugation and microfiltration and through solid-liquid separation couple with ion exchange. Purification will be performed by Mater-Biotech and Novamont via hydrogenation coupled with distillation. The data collected and technical evaluation will be used to scale up the process in task 4.3.
Partners: FhG, Novamont, Mater-Biotech, SoliQz, Lubrizol, TNO, Cargill, Cargill R&D; Milestone M8; Deliverables: D 4.2

Task 4.3: Scale-up of BDO production up to 240 m3 [M4-M48]
The most promising process from task 4.2 of BDO will be further scaled up by using 1st and 2nd generation feedstock as raw materials. Production of BDO will be adapted and run at Novamont and Mater-Biotech facilities. Stability and robustness of the different fermentation processes will be proven.
Downstream processes for BDO developed in the previous task will be scaled-up in this task.
Partners: Novamont, Mater-Biotech, Cargill, Cargill R&D; Milestone M9; Deliverables: D 4.3

Task 4.4: By-products valorization (water treatment, anaerobic digestion, energy) [M7-M48]
This activity aims to evaluate the recovery of the by-products of processes (microbial biomass, nutrient solution) developed and studied in previous tests. Particular focus will be on treatment technologies for the residual biomass produced within the fermentation process to get energy recirculation in the tested processes.
To develop an efficient use of biomass as an energy source, different techniques to remove water from biomass will be tested (centrifuge, drying system with vacuum pump). The best technique for removing water content in fungi and bacteria biomass will be validated and implemented in IA and BDO processes respectively.
Partners: Mater-Biotech; Deliverables: D 4.4

Task 4.5: Production of HMF and its conversion into FDCA (chemical and biotechnological route) [M25-M48]
This activity aims to produce FDCA from HMF, comparing a biotechnological and a chemical route.
First, chemical conversion of second generation sugars into HMF will be performed through a Novamont proprietary process (WO 2014/180979), leveraging Novamont's facilities in Novara. After an initial step of parameters' optimization (temperature of the process, pressure, catalyst type and concentration, solvent type and quantity), the process will be scaled up to pilot scale. Different products separation and purification methods will be evaluated (solvent extraction/evaporation, etc.) in order to obtain HMF concentrated solution/crystals. After that, starting from the promising results obtained within the framework of the BioConSepT project, the HMF, which is chemically produced from 2nd generation feedstock by Novamont, will be used to produce via a fermentation process with a modified *P. putida* strain FDCA. Fraunhofer IGB will optimized the fermentation protocol, to establish a good fermentation which can be scaled–up. The optimized fermentation and downstream processes' (extraction, crystallization/precipitation) protocols will be set-up by FhG (fermentation) and TNO (DSP), respectively at pilot scale. Then the process will be scaled up to demo scale (up to $1m^3$), leveraging Novamont's facility at Piana di Monte Verna together with Fraunhofer.
Purification of FDCA from the fermentation broth at demo scale will be performed by TNO, based on a two-step process: i) FDCA is recovered from fermentation broth by acidification with sulfuric; ii) the obtained impure crystals will be subsequently purified by re-crystallization using super heat water (about 180 °C).
Results obtained through the biotechnological conversion will be compared to a chemical production route, where HMF will be oxidized into FDCA through a Novamont proprietary process (US 2013/0137882 A1) which will be scaled up at 100 kg/h scale. Different products separation and purification methods will be investigated for this route as well. Yield and cost of the chemical and biotechnological processes will be investigated as a function of the feedstock, the process conditions and the quality of the product. The purified biochemicals will be used in the application development described in WP5.
Partners: Novamont, TNO, FhG; Deliverables D 4.6, D4.7; Milestone MS11

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	51.70
2	LUBRIZOL	7.00
4	MATERBIO	18.00
5	CARGILL	0.10
7	TNO	37.00
8	FHG	52.50
14	SOLIQZ	6.20
15	CARGILL R&D	10.70
	Total	183.20

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.1	Protocol and mass balances of feasible process up to 1 m3	4	24.00	R	RE	42
D4.2	Protocol and mass balances of feasible process up to 10 m3	4	25.00	R	RE	42
D4.3	Protocol and mass balances of feasible process up to 240 m3	4	31.70	R	RE	42
D4.4	Protocol of by-products valorization	4	56.50	R	RE	48
D4.6	Protocols of HMF production process starting from 2nd generation sugars	1	23.00	R	RE	45
D4.7	Report on biobased FDCA production: comparison between the chemical and biotechnological routes	1	23.00	R	CO	48
		Total	183.20			

WT3:
Work package description

Description of deliverables

D4.1) Protocol and mass balances of feasible process up to 1 m3: [month 42]
D4.2) Protocol and mass balances of feasible process up to 10 m3: [month 42]
D4.3) Protocol and mass balances of feasible process up to 240 m3: [month 42]
D4.4) Protocol of by-products valorization: [month 48]
D4.6) Protocols of HMF production process starting from 2nd generation sugars: [month 45]
D4.7) Report on biobased FDCA production: comparison between the chemical and biotechnological routes: [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS7	Proof of concept: production up to 1 m3	4	42	Availability of protocols and demo
MS8	Process validation: production up to 10 m3	4	42	Availability of protocols and demo
MS9	Process demonstration: production up to 240 m3	4	42	Availability of protocols and demo
MS11	HMF and FDCA samples	7	42	Availability of protocols and demo

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP5	Type of activity [54]	DEM
Work package title	Application development and end of use		
Start month	7		
End month	48		
Lead beneficiary number [55]	2		

Objectives

- To transform BDO, IA and FDCA into intermediary derivatives;
- To further process intermediates into end-user / value added applications;
- To characterize properties and evaluate the performance of these applications;
- To provide feedback/guidance for the developments in other WPs;
- To produce prototypes of piloted end-user products.

Description of work and role of partners

Task 5.1: Synthesis of polyurethane from BDO [M16-M48]
Synthesis of TPU from 1,4-butanediol will be evaluated through the preparation and testing of intermediate polymers and their further processing into end-user applications. Activities will be initiated upon receiving >10 kg quantities of biomass derived BDO. This will be initially subject to chemical characterization, including assay, major impurities, metallic contaminants (particularly sodium, iron and other metallic species significant to use in polyurethane polymerization). Subsequent activities will consist in the preparation and testing of standard 1,4-butanediol adipate polyester polyol, for which characterization of key polymer aspects – conversion, molecular weight and molecular weight distribution, colour – will take place. Preparation and testing of the above polyester polyols as polyols in the synthesis of TPU will follow. Also in this case, characterization of key polymer aspects – conversion, molecular weight and molecular weight distribution, color, mechanical properties, rheological properties – will subsequently take place, along with end use performance testing. This work will establish influence on performance aspects that might not be readily apparent from the chemical characterization work.
Partners: Lubrizol, Cargill R&D; Milestone M10; Deliverables: D 5.1

Task 5.2: Preparation of acrylic copolymers from IA [M16-M48]
Preparation of acrylic copolymers will be evaluated through the preparation and testing of intermediate polymers and their further processing into end-user applications. Activities will be initiated upon receiving >10 kg quantities of biomass derived IA. This will be initially subject to chemical characterization, including assay, major impurities, metallic contaminants (particularly sodium, iron and other metallic species significant to use in free radical polymerization). Subsequent activities will consist in the preparation and testing of the homopolymer in an aqueous control recipe. Characterization of key polymer aspects – conversion, molecular weight and molecular weight distribution, solution colour – will take place. Preparation and testing of acrylic copolymers – aqueous solution and emulsion polymers – will subsequently take place, along with end use performance testing. This work will establish influence on performance aspects that might not be readily apparent from the chemical characterization work. As a contingency upon the economic case, the partial replacement of acrylic and methacrylic monomers in existing products with itaconic acid and/or itaconic esters will be evaluated.
VLCI will collaborate for providing guidance for optimizing formulations of the final applications as described in task 5.3.
Partners: Lubrizol, VLCI; Milestone M10; Deliverables: D 5.2-D5.7

Task 5.3: Latex production from IA (through esterification and emulsion polymerization of alkyl itaconates) [M16-M48]
This task seeks to scale-up the production of performance bio-based latex. The goal being to yield a core-shell type geometries with solid contents greater than 45 wt.%, and shelf stability that exceed a year.
Successful commercialization of bio-based latex can be met by leveraging the lower production cost of IA with recently developed large-scale fermentation methods and achieving equivalent cost structure and performance

for the esterification and emulsion polymerization of alkylitaconates versus petroleum based acrylic latex. Moreover, this new product being at the end of a high value-added chain can enhance biorefinery economics. Sub-tasks in this activity will be:
• Produce di-alkyl itaconate from itaconic acid and a combination of alcohols at the 100L scale.
• Purify these monomers to provide a month-long shelf stability.
• Quantify the agitation and heat exchange requirements during the various stages of polymerization.
• Validate a 100L reactor with multi-feed capabilities to carry out emulsion polymerization reactions.
• Test stability, and quantify morphology and performance of the latex for architectural coatings applications.
• (co)polymerize itaconic acid anhydride and modify this polymer to enable it to crosslink thermo-reversible. to modify poly itaconic acid to produce a thermo-reversible coating.
• All produced (co)polymers will be characterized for relevant properties. Demonstration will be given on the applicability of the materials produced in this project and by the partners within the field of coating applications.
• To show the potential of using the bio-based building block itaconic acid (IA) for a polymeric binder system
Within this task, the role of VLCI will be to develop and evaluate new modifications/synthesis of itaconic acid in various formulations by using HT screening and manual testing (or via HT later on).
VLCI will perform the synthesis (polymers and modifications) via HT with Itaconic acid which can lead to existing and novel raw materials like surfactants/dispersants, humectants, coalescents and binders for coatings, adhesives, etc…With these raw materials, the formulations can be prepared as well via HT, which then can be tested on performance (manual or via HT later on). Specific modifications and formulations will be made for fulfilling partners' requirements and increase their potential business. These guide formulations can also be used as a quality check during the various up scale steps in WP 1 to 4. The performance testing results, like on rheology, barrier, etc. can then be used to adjust the processing, modify itaconic acid synthesis or the formulations.
Guide formulations will be also proposed to Lubrizol for the applications of interest within task 5.2.
Partners: TNO, Itaconix, VLCI.; Milestone M10, Deliverables: D5.3, D5.4, D5.7.

Task 5.4: Polymerization by polycondensation to synthesize polyesters and co-polyesters [M25-M48]
Di-carboxylic acids from RRM whose production will be achieved in WP2-4, will be used in polycondensation reaction to synthesize polyesters and co-polyesters; in particular the reactions will be carried out also using other dicarboxylic acids (aliphatic as well as aromatic) and / or hydroxyacids with BDO. Polymerisation with smaller amounts of IA will be also tested. Several type of polyesters from renewable resources could be synthesized and characterized in terms of their chemical- physical properties, mechanical as well as rheological properties, performances in aging, permeability, biodegradability and their environmental impact (in cooperation with WP6). The new biopolymers need to have enough molecular weight to be processed using standard converting machines that were developed for traditional thermoplastic materials (i.e. film blowing), good mechanical and thermal properties, better barrier properties that traditional biopolymers, biodegradability and compostability according to the EN 13432. Taking into account this target, polymerization conditions will be optimised (temperature, catalyst, molecular weight regulator, etc). In the same way, the purified FDCA provided by task4.5 will be polymerized to obtain PEF and PBF suitable for injection applications. The initial screening of the physical conditions of the polymerization process and the chemical-physical, rheological and mechanical aspects of the reaction products will be performed at lab scale and subsequently at pilot scale (capacity up to 10 L/batch). The characteristics of the biopolymer obtained will be optimized and compared to the benchmark, i.e. a petrochemical based polymer. The possibility to use other dicarboxylic acids and diols (in the polymerisation stage - e.g. bio-BDO, etc.) to obtain co-polymers will be evaluated.
The compatibility of the innovative polymers with other biopolymers (i.e. PLA, PHA, etc.) will be evaluated as well. Products will be fully characterized and tested in cooperation with task 5.5 and task 5.6.
Partners: Novamont; Milestone M10; Deliverables: D5.5.

Task 5.5: Film applications development [M7-M48]
This activity aims at the definition of the process parameters in film production to obtain films for packaging / mulch film applications, using the innovative materials that are developed in previous tasks (T5.4). Samples of film will be fully characterised and tested in food packaging and other applications; their performance will tested on packaging machines (i.e. FFS) and printing (rotogravure and flexographic printing). The tests will be developed in cooperation with Novamont and samples will be fully characterised. Activity will focus on testing materials and products developed within the project towards both biodegradability and ecotoxicity. This includes biodegradation testing in different environments, compostability testing and environmental fate studies. Anaerobic digestion could proceed the composting test. In this case it is really important to measure the biogas production in anaerobic digestion in order to determine energy recoverability. All the tests will be performed in laboratory scale following standard test methods.
Partners: MIPLAST, Novamont; Milestone M10; Deliverables: D5.6.

Task 5.6: Development of materials suitable for injection molding [M37-M48]
This activity aims at defining the optimal process parameters of the injection molding production process to obtain products for packaging, using the innovative materials developed in task 5.4. Different analytical and technological approaches will be tested, also compounding with the Novamont-property materials, to produce valuable biobased polymers and FDCA-based materials. In order to develop products suitable for packaging applications, the new biopolymers need to have enough molecular weight to be processed using standard converting machines that were developed for traditional thermoplastic materials, good mechanical and thermal properties, better barrier properties than traditional biopolymers, (in case biodegradability and compostability according to the EN 13432). Taking into account this target, polymerization conditions will be optimised (temperature, catalyst, molecular weight regulator, etc). The obtained products will be fully characterized.
Partners: Novamont; Milestone M10; Deliverables: D5.8.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	58.60
2	LUBRIZOL	44.00
6	MIPLAST	60.00
7	TNO	10.00
12	VLCI	23.00
13	ITACONIX	5.00
15	CARGILL R&D	1.50
	Total	202.10

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.1	Technical report on the synthesis of polyurethane from BDO, recommended path forward, commercial recommendations	2	24.00	R	CO	40
D5.2	Technical report on the preparation of acrylic copolymers from IA, recommended path forward, commercial recommendations	2	25.00	R	CO	40
D5.3	Report on the pilot scale latex production from IA	13	10.00	R	CO	48
D5.4	Report on the development of polymeric binder system from IA	7	15.00	R	CO	48
D5.5	Report on the polymerization by polycondensation to synthesize polyesters and co-polyesters	1	26.10	P	CO	48

WT3:
Work package description

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.6	Report on film applications development	6	60.00	P	CO	48
D5.7	Report on guide formulations for biobased itaconic acid applications and results from performance tests	12	22.00	R	CO	48
D5.8	Report on injection molding applications development	1	20.00	R	CO	48
		Total	202.10			

Description of deliverables

D5.1) Technical report on the synthesis of polyurethane from BDO, recommended path forward, commercial recommendations: [month 40]

D5.2) Technical report on the preparation of acrylic copolymers from IA, recommended path forward, commercial recommendations: [month 40]

D5.3) Report on the pilot scale latex production from IA: [month 48]

D5.4) Report on the development of polymeric binder system from IA: [month 48]

D5.5) Report on the polymerization by polycondensation to synthesize polyesters and co-polyesters: [month 48]

D5.6) Report on film applications development: [month 48]

D5.7) Report on guide formulations for biobased itaconic acid applications and results from performance tests: [month 48]

D5.8) Report on injection molding applications development: [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS10	Availability of 3 end-product demonstrators produced via the developed processes	1	48	Availability of prototypes (film, latex, polymeric binder system)

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP6	Type of activity [54]	DEM
Work package title	Sustainability assessment		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

- To evaluate the technical and economic feasibility and sustainability of the developed production processes and final products
- To evaluate the environmental impact of the developed production processes and final products

Description of work and role of partners

Technological aspects will be evaluated based on (pilot) work carried out in WP2, 3 and 4. Economic aspects will cover analyses of cost competitiveness, CAPEX and OPEX reduction of the new processes compared to current technologies, as well as the market potential for new products. Environmental aspects will be analysed using well established LCA approaches. These different aspects will be integrated and updated with results of the other WPs to provide an inbuilt sustainability, market and reality checks for the whole project.

Task 6.1: Market studies [M1-M6]
The market analysis focuses on the products' market's volume, structure, trends and the products' economic sustainability, mainly for butanediol and itaconic acid as well as for their main applications developed in WP5. It also has to take into account all valuable by-products to assess the highest value from the whole process. Furthermore, it evaluates the potential market size of all products and how to capture it.
Partners: Nova Institute, Novamont, Mater-Biotech, TNO, FhG, Lubrizol; Deliverables: D6.1.

Task 6.2: Techno-economical assessment [M4-M45]
Technological aspects will be evaluated based on (pilot) work carried out in WP2, 3, 4 and 5. Economic aspects will cover analyses of cost competitiveness, CAPEX (capital expenditure) and OPEX (operating expense) reduction of the new processes compared to current technologies, as well as the market potential for new products. In Task 6.2, process data on BDO and IA value chains is collected from project partners and the developed products are analysed in terms of techno-economic aspects. This task is strongly interconnected to WP4 where basic engineering data is obtained. The analysis also include an evaluation of raw material costs, including price forecasts for principal biomass/sugar fractions. In addition, the selected value chains are assessed from the techno-economic point of view. The analysis will contribute to increased understanding of technical feasibility which can be used in further technological development closely linked to commercialisation.
Based on a thorough feedstock and market analysis- including competing products- the identified market position and achievable prices evaluation of raw material costs, will be identified in collaboration with the partners from the technical work packages (from WP1 to WP5).
The target cost analysis will focus on the products resulting from the processes based on the given prices of the end products or substitutes and additional process costs as well as on potential bonuses for selling by-products and Green Premium in the whole value. In order to also obtain holistically meaningful results, the target cost analysis will be combined with sensitivity analyses of the costs and a competition analysis with respect to petroleum-based alternatives on the market. The target cost of the new products will be compared with the current cost based on the process technology in order to identify needs and potentials for cost reduction.
Partners: Nova Institute, Novamont, Mater-Biotech, TNO, FhG, Lubrizol, VLCI, ITACONIX, Cargill R&D ; Deliverables: D6.2.

Task 6.3: Environmental sustainability assessment/evaluation [M4-M45]
This task will address environmental benefits and constraints of the BIO-QED Products pathways and portfolio in order to quantify and balance the impacts of the developed products using Life Cycle Analysis (LCA).

Partners of all technical work packages will contribute by delivering quantitative data specific to their expertise and necessary for the assessment. Novamont will perform a life-cycle analysis (LCA) for the aimed and selected processes following ISO 14040 and ISO 14044. The whole life cycle starting from the feedstock and preparation of suitable sugars for the aimed industrial processes, logistics as well as end-of-life options compared to conventional processes based on petroleum and first generation sugars for the same applications will be included in the analysis from cradle to grave, as will the utilization and recycling of energy and carbon dioxide from technical processes. For the ecological sustainability assessment energy consumption, greenhouse gas emissions and material flow analysis will be in the focus. The social impacts will be addressed in a SWOT analysis based on a qualitative analysis according to a framework of parameters following the UNEP "Guidelines for social life assessments of products" and other approaches from literature data.
Partners: Novamont, Mater-Biotech, TNO, FhG, Lubrizol, VLCI, Itaconix , Nova-Institute, Cargill R&D; Deliverables: D6.3 & D6.4.

Task 6.4: Products certifications [M37-M48]
As a complementary activity to the previous sustainability assessments, it is also proposed to pave the way towards product certifications, investigating the possibility of the release of a certificate of conformity and relative concession of the Licence of use of the Mark of Quality. Obtaining of such a certification is highlighted by means of the apposition on the product itself (or on his primary containers/packages), of the MQ RINA allowed in use to the Organisation. The use of the latter mark on the product is allowed in accordance with how much expected at the Rule of the Organism of Certification. The Certificate is issued to good result of the proofs carried out on samples of the product itself based on the normative reference documents and to the verification that the Organisation makes according to a System of Management for the Quality in production fit recognised (SGQ) of RINA. The validity on the time of the Certificate of Conformity and then of the relative Licence of use of the MQ RINA is subordinated to satisfactory results of following controls of the production carried out by RINA with formalities established in the normative detailed bill of reference (for example: Technical rules / Particular Schemes of Certification / Technical rules) of the product in examination and to the maintenance of the fitness of the company SGQ. The aspects that must be taken in consideration in the technical document that will have to be created will be: verification of the productive cycle for the production of the polymer to be certified, Evaluation of the used raw materials and all the products and generated byproducts, energy, comparison with the product generated for traditional; there will also attention to potential risks relative to the utilization of OGM and to the regulation of cultivation of the raw material/feedstock. As far as the obtained polymeric product is regarded the points of the rule they must comply Italian National Standard EN 13432:2002, which has as a reason the verification of the requirements and the progresses to determine the possibilities of composting and of treatment anaerobic packages for the next characteristics: 1. Biodegradability 2. Disintegration during biological treatment 3. Effect on the process of biological treatment 4. Effect on the quality of the resulting compost. It is necessary to verify also the intrinsic characteristics from the material as the content from metals the quantity of organic carbon and the quantity of ashes.
Rina will also focus its activity on the sustainability aspects of 2,5-furandicarboxylic acid (FDCA), verifying the productive cycle for the production of the new polymers to be certified, evaluation of the used raw materials and all the products and generated byproducts and energy, in comparison with the product generated for traditional.
Partners: RINA; Deliverables: D6.5

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	42.30
2	LUBRIZOL	7.00
4	MATERBIO	6.00
6	MIPLAST	16.00
7	TNO	2.00
10	RINA	9.50
11	NOVAINST	18.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
12	VLCI	1.00
13	ITACONIX	1.00
15	CARGILL R&D	3.00
	Total	105.90

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.1	Report describing consumer needs and market trends, including a comprehensive section on the conditions for product marketability within the CEE region	11	9.00	R	PU	6
D6.2	Comprehensive database with technical, economical aspects on value chain/network and unit operation level	11	22.50	R	CO	45
D6.3	Report describing environmental impact analysis of the process and products obtained	1	31.50	R	CO	45
D6.4	Life-cycle analysis assessment following ISO 14040 and 14044	1	32.40	R	CO	45
D6.5	First steps undertaken towards products certification	10	10.50	R	CO	48
		Total	105.90			

Description of deliverables

D6.1) Report describing consumer needs and market trends, including a comprehensive section on the conditions for product marketability within the CEE region: [month 6]
D6.2) Comprehensive database with technical, economical aspects on value chain/network and unit operation level: [month 45]
D6.3) Report describing environmental impact analysis of the process and products obtained: [month 45]
D6.4) Life-cycle analysis assessment following ISO 14040 and 14044: [month 45]
D6.5) First steps undertaken towards products certification: [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP7	Type of activity [54]	OTHER
Work package title	Dissemination and exploitation		
Start month	1		
End month	48		
Lead beneficiary number [55]	11		

Objectives

- To promote Bio-QED and its results as widely and as effectively as possible to all relevant stakeholders
- To ensure widespread dissemination of the results to the stakeholders, the broad public and the scientific community;
- To ensure proper and effective handling of Intellectual Property
- To implement a toolbox-supported IP Strategy in order to maximize the exploitation of project results for individual and combined partners inside and outside the consortium
- Development of a Technology Implementation Plan (TIP);
- To prepare documentation of new products and processes for standardization

Description of work and role of partners

This project will employ a broad set of dissemination activities, which will both include the usual state-of-the-art activities like a website, online and printed brochures, flyers, posters, and social media such as LinkedIn as well as novel tools like a professional video, a documentary on EURONEWS and open days for stakeholders at the demonstration sites in Adria and Leuna. An advanced IP Strategy and toolbox-supported monitoring system will be implemented by a specialized SME. With this the value of the IP will be assessed, monitored and maximized. For new products and processes it will be investigated whether existing standards can be applied. If not, proper documentation will be prepared for the European Committee for Standardization.

Task 7.1: Dissemination (Nova-Institute and all partners) [M1-M48]
A dissemination and exploitation plan (D&E Plan) will be developed and continuously updated throughout the duration of the project. The D&E plan will include all planned dissemination and exploitation activities, such as publications (scientific and promotional) and activities engaging with the public (workshops, press communication, website etc.). The D&E plan will be a living document with regular reviews and updates.
A comprehensive set of dissemination tools will be developed and implemented. The toolbox will at least consist of the following elements: (1) A website with an internal area for secure and effective communication within the consortium, as well as an external platform for displaying all relevant information to interested parties and stakeholders; (2) Press releases that will communicate intermediate results and important milestones to key media actors; (3) Publishable information material (leaflets, brochures, posters etc.) that will be updated as the project progresses; (4) Publications in scientific journals and other appropriate media; (5) Participation in trade fairs and conferences. Several events in the domain of bio-based economy will be selected for targeted PR around Bio-QED. This will at least include some events that nova-Institute organises annually. On top of these 5 “standard” activities Bio-QED will also undertake the following special dissemination activities to draw the attention of targeted stakeholder groups:
• EuronewsFuturis: the project will use the existing contacts with EURONEWS Futuris to prepare a documentary dedicated to biorefineries and the large scale demonstration in the facilities in Leuna, Adria, Piana di Monte Verna and Novara. During 1 week, the documentary will be broadcasted on Futuris several times. The documentary will be broadcasted in > 130 countries in 10 languages (English, German, French, Spanish, Russian, Italian, Portuguese, Turkish, Arabic and Persian). Furthermore, it will be also uploaded on the EuronewsFuturis website, along with an article describing the documentary’s contents
• Open Demo days will be organized in each of the 2 demo locations (Adria for BDO and Leuna for IA). In these events, the highlights of the project results and the impact achieved will be transferred to the following specific stakeholder groups: (a) politicians and (b) scientists and students. The activities related to the FDCA value chain will be disseminated within the context of other planned initiatives

Task 7.2: Standardization (RINA) [M7-M42]
The development of appropriate standards will have a direct impact on the application of the bio-based chemical building blocks BDO, IA and FDCA as well as the markets for bio-based products derived from them. The timely development and implementation of standardizations diminishes trade barriers, promotes safety, increases compatibility of products, systems and services and promotes common technical understanding. Existing gaps will be identified and new standards and labeling options will be developed for unmet needs related to the bio-based BDO, IA and FDCA value chains. An initial review will firstly assess the current state with respect to the existence and appropriateness of current standards for the production and subsequent application of the three building blocks by the processes and methods addressed within the project. The review will also identify possible gaps in norms and standards for unmet needs related to the bio-based BDO, IA and FDCA value chains. It is anticipated that gaps may exist on the following domains: use of 2nd generation feedstocks, residue management and process safety, etc. The gaps identified in the review will be analyzed and opportunities for new standardization areas will discussed and elaborated with the Consortium and particularly the industrial stakeholders. After completion of the intra-project preparations, proposals for new standards may be brought under the attention of the European Committee for Standardization. A report on the strategy and proposal for measures to be undertaken towards Standardization will be issued by Month 48. RINA will also focus its activity on the environmental performance within all the value chains, evaluating the existing standards for measuring the renewability and biodegradability/compostability of monomers, polymers and plastic materials.

Task 7.3: IPR management and exploitation (PATENTOPOLIS, ALL industrial players) [M1-M48]
Patentopolis BV will provide the Partners with an IA toolkit customized to the bio-based economy. This toolbox will help Partners to align IA with the business; to bridge research/innovation and market; to optimize (IA) commercialization; and to explore new, untapped options. After that an IA management agreement among the Consortium Partners will be established which will cover aspects like IA ownership, access rights, commercialization, Background IA, IP portfolio management, publication…. . An IA supervision committee responsible to monitor the implementation of the agreement will be erected. In close consultation with the IA supervision committee, Patentopolis will facilitate the elaboration of IA strategic plans on the following 4 domains: (a) itaconic acid, (b) butanediol (c) FDCA (d) separation/purification technologies (extraction/(melt/eutectic freeze crystallization). The IA strategic plans, which amongst others will include new or updated “IP mapping studies” for the mentioned domains, will be monitored and updated during the project execution phase. This activity will include: (a) regular updates of the information on the competition and external technology development (including but not limited to updates of the IP mapping studies); (b) Measuring the impact of the plans by means of IA indicators and (c) Carrying out IA assessment of new inventions generated during project execution.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	31.90
2	LUBRIZOL	1.00
4	MATERBIO	8.00
5	CARGILL	0.30
6	MIPLAST	2.00
7	TNO	2.00
8	FHG	3.50
9	Patentopolis	13.90
10	RINA	11.00
11	NOVAINST	26.30
12	VLCI	1.00
13	ITACONIX	0.50
15	CARGILL R&D	1.90
	Total	103.30

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.1	Dissemination and exploitation plan	11	10.50	R	RE	6
D7.2	Website up and running	11	5.00	O	PU	3
D7.3	Leaflet on the project	11	5.00	O	PU	12
D7.4	Halfway stakeholder workshop done, report and participants list of first workshop	11	8.00	O	PU	18
D7.5	Final stakeholder demo event for dissemination of the projects' results	11	13.80	O	PU	48
D7.6	Final dissemination and exploitation report	11	14.00	R	RE	48
D7.7	Report on Strategy and proposal for measures to be undertaken towards Standardization	10	16.00	R	RE	48
D7.8	IA Strategy Toolkit for Consortium Partners	9	2.50	R	RE	12
D7.9	IP Strategy Set up	9	2.50	R	RE	18
D7.10	IP Mapping studies on 3 domains (a) itaconic acid, (b) butanediol, and (c) separation/purification technologies	9	4.00	R	RE	12
D7.11	IA Management Agreement	9	4.50	R	RE	24
D7.12	Update of IA Strategic Plan and IP Mapping studies for developments by competitors and emerging technologies outside the Consortium	9	4.00	R	RE	24
D7.13	Update of IA Strategic Plan and IP Mapping studiesfor developments by competitors and emerging technologies outside the Consortium	9	4.00	R	RE	36
D7.14	Update of IA Strategic Plan and IP Mapping studies (including FDCA) for developments by competitors and emerging technologies outside the Consortium	9	9.50	R	RE	48
		Total	103.30			

Description of deliverables

D7.1) Dissemination and exploitation plan: [month 6]
D7.2) Website up and running: [month 3]
D7.3) Leaflet on the project: [month 12]
D7.4) Halfway stakeholder workshop done, report and participants list of first workshop: [month 18]
D7.5) Final stakeholder demo event for dissemination of the projects' results: [month 48]
D7.6) Final dissemination and exploitation report: [month 48]

D7.7) Report on Strategy and proposal for measures to be undertaken towards Standardization: [month 48]
D7.8) IA Strategy Toolkit for Consortium Partners: [month 12]
D7.9) IP Strategy Set up: [month 18]
D7.10) IP Mapping studies on 3 domains (a) itaconic acid, (b) butanediol and (c) separation/purification technologies: [month 12]
D7.11) IA Management Agreement: [month 24]
D7.12) Update of IA Strategic Plan and IP Mapping studies for developments by competitors and emerging technologies outside the Consortium: [month 24]
D7.13) Update of IA Strategic Plan and IP Mapping studies for developments by competitors and emerging technologies outside the Consortium: [month 36]
D7.14) Update of IA Strategic Plan and IP Mapping studies (including FDCA) for developments by competitors and emerging technologies outside the Consortium: [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT3:
Work package description

Project Number [1]	613941	Project Acronym [2]	BIO-QED

One form per Work Package

Work package number [53]	WP8	Type of activity [54]	MGT
Work package title	Project coordination and management		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

- To ensure efficient coordination of the project
- To ensure efficient management of common consortium activities
- To ensure efficient administrative, financial and contractual management

Description of work and role of partners

Task 8.1: Project Coordination (Novamont) [M1-M48]

Project Coordination activities will be undertaken by Novamont, which, being supported by a Steering Committee, will be responsible for the overall project strategy implementation including project planning, performance and financial control, quality assurance, risk management and contingency planning, and administration of the Community financial contribution. Particularly, in compliancy with the Model Grant Agreement (Article II.2), the Coordinator shall:

• Represent the beneficiaries towards the European Commission, being the intermediary for any communication between the Commission and any beneficiary;
• Receive the Community financial contribution to the project on behalf of the beneficiaries;
• Administer the Community financial contribution regarding its allocation between beneficiaries and activities, in accordance with the Grant Agreement and the decisions taken by the consortium. The coordinator shall ensure that all the appropriate payments are made to the other beneficiaries without unjustified delay;
• Keep the records and financial accounts making it possible to determine at any time what portion of the Community financial contribution has been paid to each beneficiary for the purposes of the project;
• Inform the Commission of the distribution of the Community financial contribution and the date of transfers to the beneficiaries, when required by the Grant Agreement or by the Commission;
• Review the reports to verify consistency with the project tasks before transmitting them to the Commission;
• Monitor the compliance by beneficiaries with their obligations under the Grant Agreement.

Task 8.2: Consortium Management (Novamont) [M1-M48]

Consortium Management activities will be undertaken by Novamont including:

• Maintenance of the Consortium Agreement;
• Implementation of competitive calls by the consortium for the participation of new beneficiaries, where required;
• Organisation of official project meetings such as periodic Progress Meetings, General Assemblies of Partners, Management Board meetings, and Reviews of the European Commission;
• Distribution of deliverables and reports to the consortium, and maintenance of a project archive in the form of a document repository to be hosted by the project website (private area with exclusive accession by the participants only).

Furthermore, Novamont will also be responsible for internal communication management, ensuring that an adequate level of communication exists among the consortium, including through the preparation of minutes of meetings, and circulars to the consortium where appropriate.

Novamont will also act be responsible for what concerns the control over the timely implementation of the project's duties by the beneficiaries, including the collection of inputs for Periodic Reports and for the Final Report, and the preparation of Deliverables by the lead beneficiaries, ensuring that the project implementation is undertaken by all beneficiaries in full compliancy with the general conditions set forth by the Grant Agreement and the FP7 guidelines.

Task 8.3: Administrative, Financial and Contractual Management (Novamont) [M1-M48]

Administrative, Financial and Contractual Management activities concern the fulfilment of all administrative, financial and contractual obligations within the project in compliancy with the general conditions and provisions set forth within the Grant Agreement and the FP7 guidelines for the implementation of projects.

Administrative, Financial and Contractual Management activities will be undertaken by Novamont that as Coordinator will be responsible for the following activities:

- Overall financial and administrative management including, for each of the beneficiaries, the obtaining of financial statements whenever required;
- Overall contractual management including the management of requests for amendments to the Grant Agreement such as, e.g. for the accession of new beneficiaries, the management of the related contractual duties and the obtaining of Forms A, or e.g. for the requests of modifications to Annex I, the management of the related contractual duties and the update of the Description of Work (Annex I).

Within the course of BIO-QED, the project coordinator will benefit of the collaboration with a Steering Committee that will support the coordinator for the responsibilities of the overall monitoring of the project progresses,

results and management of eventual risks and decision for contingent actions. Then SC's members will have man-months dedicated to this activity, while all partner will have minor efforts (0.5 MM) for fulfilling specific administrative, financial and contractual issues and participating to General Assemblies of partners.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	NOVAMONT	51.00
2	LUBRIZOL	1.00
4	MATERBIO	4.00
5	CARGILL	0.30
6	MIPLAST	0.50
7	TNO	3.00
8	FHG	2.00
10	RINA	0.50
11	NOVAINST	1.00
12	VLCI	1.00
13	ITACONIX	0.50
15	CARGILL R&D	0.20
	Total	65.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.1	Draft Plan for the Use and Dissemination of Foreground and periodic updates	9	12.00	R	RE	18
D8.2	Final Plan for the Use and Dissemination of Foreground and periodic updates	9	12.00	R	RE	42
		Total	24.00			

WT3:
Work package description

Description of deliverables
D8.1) Draft Plan for the Use and Dissemination of Foreground and periodic updates: [month 18] D8.2) Final Plan for the Use and Dissemination of Foreground and periodic updates: [month 42]

Schedule of relevant Milestones				
Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT4:
List of Milestones

Project Number [1]	613941	Project Acronym [2]	BIO-QED

List and Schedule of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS1	Selection of 1st and 2nd generation sugars	WP1	5	6	List of feedstock
MS2	Evaluation of 1st and 2nd sugars on the production of BDO and IA	WP1	5	12	Availability of protocols
MS3	Successful BDO and IA production with 1st generation feedstock	WP2	8	14	Availability of protocols
MS4	Successful BDO and IA production with 2nd generation feedstock	WP2	8	30	Availability of protocols
MS5	BDO crystals with desired purity for applications in WP5	WP3	4	30	Availability of protocols
MS6	IA crystals with desired purity for applications in WP5	WP3	7	30	Availability of protocols
MS7	Proof of concept: production up to 1 m3	WP4	4	42	Availability of protocols and demo
MS8	Process validation: production up to 10 m3	WP4	4	42	Availability of protocols and demo
MS9	Process demonstration: production up to 240 m3	WP4	4	42	Availability of protocols and demo
MS10	Availability of 3 end-product demonstrators produced via the developed processes	WP5	1	48	Availability of prototypes (film, latex, polymeric binder system)
MS11	HMF and FDCA samples	WP4	7	42	Availability of protocols and demo

WT5:
Tentative schedule of Project Reviews

Project Number [1]	613941	Project Acronym [2]	BIO-QED

Tentative schedule of Project Reviews

Review number [65]	Tentative timing	Planned venue of review	Comments, if any
RV 1	19	Novara	
RV 2	37	Novara	
RV 3	48	Novara	

WT6:
Project Effort by Beneficiary and Work Package

Project Number [1]	613941	Project Acronym [2]	BIO-QED

Indicative efforts (man-months) per Beneficiary per Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	Total per Beneficiary
1 - NOVAMONT	19.0	51.0	54.0	51.7	58.6	42.3	31.9	51.0	**359.5**
2 - LUBRIZOL	0.0	0.0	12.0	7.0	44.0	7.0	1.0	1.0	**72.0**
4 - MATERBIO	0.0	8.0	19.0	18.0	0.0	6.0	8.0	4.0	**63.0**
5 - CARGILL	6.4	10.0	0.1	0.1	0.0	0.0	0.3	0.3	**17.2**
6 - MIPLAST	0.0	0.0	0.0	0.0	60.0	16.0	2.0	0.5	**78.5**
7 - TNO	0.0	3.0	26.0	37.0	10.0	2.0	2.0	3.0	**83.0**
8 - FHG	20.7	15.0	5.0	52.5	0.0	0.0	3.5	2.0	**98.7**
9 - Patentopolis	0.0	0.0	0.0	0.0	0.0	0.0	13.9	0.0	**13.9**
10 - RINA	0.0	0.0	0.0	0.0	0.0	9.5	11.0	0.5	**21.0**
11 - NOVAINST	0.0	0.0	0.0	0.0	0.0	18.0	26.3	1.0	**45.3**
12 - VLCI	0.0	0.0	0.0	0.0	23.0	1.0	1.0	1.0	**26.0**
13 - ITACONIX	0.0	0.5	0.5	0.0	5.0	1.0	0.5	0.5	**8.0**
14 - SOLIQZ	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	**6.2**
15- CARGILL R&D	0.0	0.8	0.1	10.7	1.5	3.0	1.9	0.2	**18.2**
Total	46.1	88.3	116.7.	183.2	202.1	105.9	103.3	65.0	910.3

WT7:
Project Effort by Activity type per Beneficiary

Project Number [1]	613941	Project Acronym [2]	BIO-QED

Indicative efforts per Activity Type per Beneficiary

Activity type	Part. 1 NOVAMONT	Part. 2 LUBRIZOL	Part. 4 MATERBI	Part. 5 CARGILL	Part. 6 MIPLAST	Part. 7 TNO	Part.8 FHG	Part. 9 Patento	Part. 10 RINA	Part. 11 NOVAINS	Part. 12 VLCI	Part. 13 ITACONIX	Part 14 SOLIQZ	Part 15 Cargill R&D	Total
1. RTD/Innovation activities															
Total Research	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2. Demonstration activities															
WP 1	19.0	0.0	0.0	6.4	0.0	0.0	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.1
WP 2	51.0	0.0	8.0	10.0	0.0	3.0	15.0	0.0	0.0	0.0	0.0	0.5	0.0	0.8	88.3
WP 3	54.0	12.0	19.0	0.1	0.0	26.0	5.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1	116.7
WP 4	51.7	7.0	18.0	0.1	0.0	37.0	52,5	0.0	0.0	0.0	0.0	0.0	6.2	10.7	183.2
WP 5	58.6	44.0	0.0	0.0	60.0	10.0	0.0	0.0	0.0	0.0	23.0	5.0	0.0	1.5	202.1
WP 6	42.3	7.0	6.0	0.0	16.0	2.0	0.0	0.0	9.5	18.0	1.0	1.0	0.0	3.0	105.9
Total Demo	276.6	70.0	51.0	16.6	76.0	78.0	93.2	0.0	9.5	18.0	24.0	7.0	6.2	16.1	742,2
3. Consortium Management activities															
WP 8	51.0	1.0	4.0	0.3	0.5	3.0	2.0	0.0	0.5	1.0	1.0	0.5	0.0	0.2	65.0
Total Management	51.0	1.0	4.0	0.3	0.5	3.0	2.0	0.0	0.5	1.0	1.0	0.5	0.0	0.2	65.0
4. Other activities															
WP 7	31.9	1.0	8.0	0.3	2.0	2.0	3.5	13.9	11.0	26.3	1.0	0.5	0.0	1.9	103.3
Total other	31.9	1.0	8.0	0.3	2.0	2.0	3.5	13.9	11.0	26.3	1.0	0.5	0.0	1.9	103.3
Total	359.5	72.0	63.0	17.2	78.5	83.0	98.7	13.9	21.0	45.3	26.0	8.0	6.2	18.2	910.3

WT8:
Project Effort and costs

Project Number [1]	613941	Project Acronym [2]	BIO-QED

Project efforts and costs

Beneficiary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs	
1	NOVAMONT	359.5	1,876,877.60	44,000.00	1,713,226.84	1,126,126.56	4,760,231.00	2,804,615.50
2	LUBRIZOL	72.0	335,951.90	10,000.00	90,500.00	85,290.38	521,742.28	273,970.00
4	MATERBIO	63.0	283,500.00	33,500.00	395,000.00	170,100.00	882,100.00	498,500.00
5	CARGILL	17.2	119,163.70	0.00	3,155.57	117,785.33	240,104.60	128,197.39
6	MIPLAST	78.5	78,500.00	0.00	96,237.50	104,842.50	279,580.00	143,790.00
7	TNO	83.0	502,806.00	108,500.00	148,000.00	524,351.00	1,283,657.00	691,750.50
8	FHG	98.7	441,891.00	3,500.00	107,856.0	476,753.00	1,030,000.0	560,000.00
9	Patentopolis	13.9	104,328.13	0.00	43,800.00	88,876.88	237,005.00	237,005.00
10	RINA	21.0	153,300.00	0.00	23,000.00	107,008.00	283,308.00	208,474.00
11	NOVAINST	45.3	229,870.00	0.00	28,000.00	154,722.00	412,592.00	325,040.00
12	VLCI	26.0	128,700.00	0.00	145,000.00	164,220.00	437,920.00	226,880.00
13	ITACONIX	8.0	40,000.00	0.00	10,000.00	30,000.00	80,000.00	0.00
14	SOLIQZ	6.2	45,167.50	0.00	17,500.00	37,600.50	100,268.00	50,134.00
15	CARGILL R&D	18.0	180,157.99	3,000.00	45,844.43	162,142.18	391,144.60	217,302.62
Total		910.3	4,520,213.82	202,500.00	2,867,120.34	3,349,818.33	10,939,652.48	6,365,659.00

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It cannot be changed unless agreed so during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

53. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

54. Type of activity

For all FP7 projects each work package must relate to one (and only one) of the following possible types of activity (only if applicable for the chosen funding scheme – must correspond to the GPF Form Ax.v):

• **RTD/INNO =** Research and technological development including scientific coordination - applicable for Collaborative Projects and Networks of Excellence

• **DEM =** Demonstration - applicable for collaborative projects and Research for the Benefit of Specific Groups

• **MGT =** Management of the consortium - applicable for all funding schemes

• **OTHER =** Other specific activities, applicable for all funding schemes

• **COORD =** Coordination activities – applicable only for CAs

• **SUPP =** Support activities – applicable only for SAs

55. Lead beneficiary number

Number of the beneficiary leading the work in this work package.

56. Person-months per work package

The total number of person-months allocated to each work package.

57. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

58. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

59. Milestone number

Milestone number:MS1, MS2, …, MSn

60. Delivery date for Milestone

Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

61. Deliverable number

Deliverable numbers in order of delivery dates: D1 – Dn

62. Nature

Please indicate the nature of the deliverable using one of the following codes

R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

63. Dissemination level

Please indicate the dissemination level using one of the following codes:

• **PU =** Public

• **PP =** Restricted to other programme participants (including the Commission Services)

• **RE =** Restricted to a group specified by the consortium (including the Commission Services)

• **CO =** Confidential, only for members of the consortium (including the Commission Services)

• **Restreint UE =** Classified with the classification level "Restreint UE" according to Commission Decision 2001/844 and amendments

• **Confidentiel UE =** Classified with the mention of the classification level "Confidentiel UE" according to Commission Decision 2001/844 and amendments

• **Secret UE =** Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

64. Delivery date for Deliverable

Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date

65. Review number

Review number: RV1, RV2, ..., RVn

66. Tentative timing of reviews

Month after which the review will take place. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

67. Person-months per Deliverable

The total number of person-month allocated to each deliverable