CIP Eco-innovation
First application and market replication projects
Call Identifier: CIP-EIP-Eco-Innovation-2013

Meeting Report

Project acronym: Less-Water Bev.Tech

Contract ECO/13/630314

Covering the Meeting of Dec. 3rd, 2014

Reporting Date

<03/12/2014>

Project coordinator: **A DUE DI SQUERI DONATO & C. S.p.A.**

Project website: **TBC (expected at month 6 – March 2015)**

European Commission | Executive Agency for Small and Medium-sized Enterprises

Meeting Participants:

Participants:

- Ing. Simone Squeri, A DUE S.p.A., CEO, connected in teleconference;
- Dott. Federico Cappa, A DUE S.p.A., in-house consultant;
- Craig Clayton, CVAR Ltd, Owner, connected in teleconference;
- Ing. Marco Bortolini, Università di Bologna, senior researcher;
- Ing. Alberto Dilda, A DUE S.p.A., COO and R&D director;
- Ing. Micaela Guerzoni, A DUE S.p.A., subcontractor;
- Prof. Mauro Gamberi, Università di Bologna, associate professor;
- Ing. Francesco Pilati, Università di Bologna, junior researcher, connected in teleconference;
- Ing. Marco Iasoni, A DUE S.p.A., project engineer;
- Ing. Guido Marossa, A DUE S.p.A., project engineer;
- Ing. Maurizio Violi, subcontractor.

1 Achievements of the action

1.1 General progress.

Report of partners' activities implemented from October 1st, 2014.

During the meeting on 3rd December in ADUE premises all participants agreed and proceed with the following activity:

- As due within 31st December as Deliverable 11 of WP 1, the participants set up an on-line web-platform for data sharing and communications among participants. The On line Project Management tool chosen is BASECAMP (you can find the detailed description of it in the Deliverable n.11 Report), that will make it easy, for all the project's participants who cover different roles with different responsibilities, to communicate, share data and ideas, and to work together.

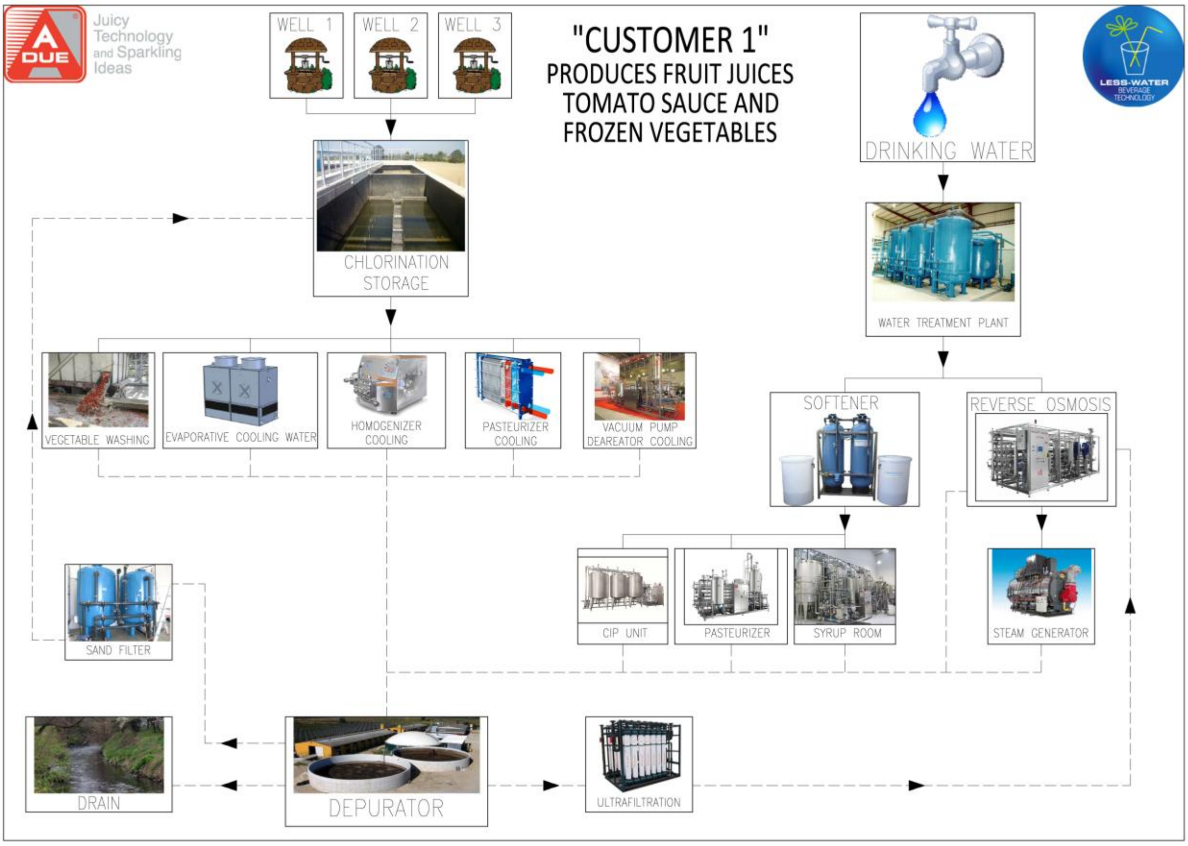
Moreover, during the meeting the participants discussed the activities for the scouting of clients potentially interested for the installation of the prototype. One basic characteristic of these clients was to preferably have **already the Osmosys System.** Another characteristic needed at this first stage of the project, was to be located near the A DUE headquarter, in order to ease the activities for the collection of data needed for the engineering phase.

At this first stage, the clients identified are the following (names are not cited because of privacy issues on the following data coming from analysis, etc.):

- CLIENT 1: It agreed with A DUE to be subject to the survey and the sample taking of water and waste-water of its plants. Its products are fruit juices, tomato sauce and frozen vegetables. Personnel from the project's participants went to the CLIENT 1 production plant and analyses the production plant in order to understand the right places where to collect water samples. Then, the same personnel collected the samples at different times. The samples taken have been sent to the analysis' laboratories.
- CLIENT 2: It agreed with A DUE to be subject to the survey and the sample taking of water and waste-water of its plants. Its products are tomato sauce, soups, tea and fruit juices. Personnel from the project's participants went to the CLIENT 2 production plant and analyses the production plant in order to understand the right places where to collect water samples. Then, the same personnel collected the samples at different times. The samples taken have been sent to the analysis' laboratories.
- CLIENT 3: currently ADUE is testing its interest in being subject to the survey and the sample taking of water and waste-water of its plants. Its products are Carbonated Soft Drinks.

On 12th November 2014, personnel from ADUE and UNIBO went to the CLIENT 1 production plant for a survey on water usage and waste-water management.

First, the project's participants identified the water cycle in the CLIENT 1 production plant.



The results of the Survey at CLIENT 1 are shown in the following charts.

The samples collected are described in the following table.

SAMPLING DESCRIPTION
SAMPLE 1
Collecting tank containing the cooled water drained from the 14 cooling towers.
SAMPLE 2
Spinach cooling water.
SAMPLE 3
Cooling water of homogeneizer rods.
SAMPLE 4
Pasteurizeur degaser: cooling water of the Liquid Ring of Vacuum Pump.
SAMPLE 5,6,7
Fruit juices Pasteurizeur: change over from apricot to apple/banana.
Pushing water/product at production end.
SAMPLE 8
Fruit juices Pasteurizeur: change over from apricot to apple/banana.
Pushing product/water at production start.
CIP WASHINGS (to be sampled)
Initial and final washings to be sampled near the CIP plant.

The project's participants verified an average consumption per year of **1.300.000 m3 H2O**.

CUSTOMER 1		ENVIRONMENTAL BALANCE - WATER SUPPLY							
YEAR	2013								
MONTH	WELL 1	WELL 3	WELL 6	WELL 7	WELL 8	RECOVERY POOL	Total well/month	AQUEDUCT WATER	INDUSTRIAL WATER
JANUARY	0,00	0,00	0,00	44.461,00	1,00	0,00	44.462,00	8.265,00	13.136,00
FEBRUARY	0,00	0,00	94,00	24.206,00	522,00	0,00	24.822,00	8.127,00	24.014,00
MARCH	0,00	0,00	30,00	37.511,00	16.488,00	0,00	54.029,00	10.625,00	26.478,00
APRIL	0,00	0,00	90,00	53.317,00	13.011,00	0,00	66.418,00	14.472,00	35.582,00
MAY	0,00	0,00	68,00	42.031,00	9.615,00	24.033,00	51.714,00	8.495,00	24.959,00
JUNE	0,00	0,00	102,00	22.770,00	24.275,00	17.449,00	47.147,00	18.543,00	45.984,00
JULY	0,00	0,00	212,00	27.516,00	60.718,00	22.870,00	88.446,00	19.158,00	52.020,00
AUGUST	0,00	0,00	868,00	36.001,00	55.065,00	43.775,00	91.934,00	17.320,00	39.502,00
SEPTEMBER	0,00	0,00	570,00	31.616,00	70.766,00	41.951,00	102.952,00	21.683,00	53.589,00
OCTOBER	0,00	0,00	278,00	23.356,00	39.776,00	19.872,00	63.410,00	16.317,00	45.686,00
NOVEMBER	0,00	0,00	507,00	7.867,00	47.893,00	14.893,00	56.267,00	15.978,00	42.431,00
DECEMBER	0,00	0,00	1.124,00	8.343,00	46.549,00	9.447,00	56.016,00	11.286,00	29.701,00
total m3 collected in 2013	**0,00**	**0,00**	**3.943,00**	**358.995,00**	**384.679,00**	**194.290,00**	**747.617,00**	**170.269,00**	**433.082,00**
well water Total (m3)	**747.617,00**								
drinking water Total (m3)	**603.351,00**								

The results from the samples are the following.

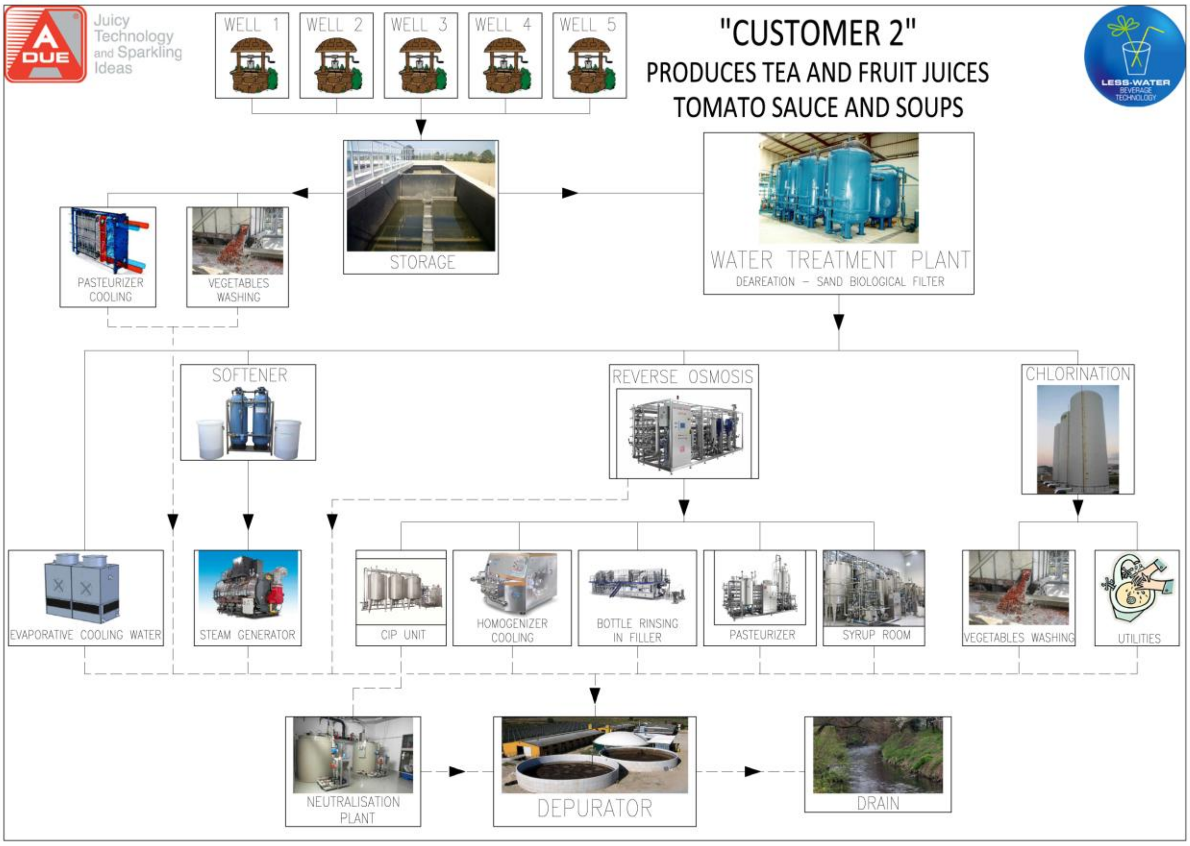
From CUSTOMER 1- 12/11/2014																	
Laboratory code						14SA24928	14SA24923	14SA24924	14SA24925	14SA24921	14SA24927	14SA24922	14SA24932	14SA24929	14SA24930	14SA24931	14SA24926
ADUE code						10	9	11	12	1	4	3	5	6	7	8	2
Sample description / analyzed parameter	DRINKING WATER *	CONCRETE TANK WATER *	WELL n° 7 **	WELL n° 8 *	DEMI WATER ***	Ultrafiltration input/ purification plant output	ULTRA FILTRATION (output)	Osmosis (INPUT)	RETENTATE Osmosis	TOWERS	DEGASER apricot production	HOMOGENEIZER tomato sauce production	PUSHING at production end (apricot)	PUSHING at production end (apricot)	WASHINGS from syrup room	Pushing at production start (apple/ banana)	SPINACH COOLING WATER
Conductivity (at 25°C) (µS/cm)	610	1850	1865	1890	440	1755	2060	556	1058	1707	1569	1584	969	815	560	1363	1259
pH (pH unit)	7,66	7,85	7,6	7,8	7,9	8,2	8,3	8,5	8,5	8,9	8,2	8,4	3,5	3,5	7,8	3,5	7,3
Flourine (Flourides) (mg/l)						0,43	1,14	0,23	< 0.15	1,36	1,01	1,17		6,9	0,35	8,1	0,16
Chlorine (Chloride) (mg/l)	23,82		333	348	35	189	386	40,5	< 2.00	87	158	151		77,3	44,6	66,5	75,7
nitric nitrogen (Nitrates) (mg/l)	<0,1	<0,1	<0,1	<0,1	4,3	< 3.0	3,1	3,5	< 3.0	40,8	< 3.0	5,2		6,5	3,3	13,7	< 3.0
Sulphates (SO4) (mg/l)					49	30,8	27,1	56,8	< 4.0	< 4.0	12,6	8,9		52,9	55,2	258	74,7
Sodium (Na) (mg/l)						230,7	315	29,1	68,7	314	251	260		27,8	31,1	25,2	51,7
Barium (Ba) (µg/l)						84,4	100,5	< 50.0	99,8	168,5	146,2	146,4		< 50.0	< 50.0	< 50.0	< 50.0
Calcium (Ca) (mg/l)						56,9	49,2	59	145,5	40,7	42,6	43,1		63,3	61,8	75,8	7,27
Iron (Fe) (µg/l)	<0,1		400	500		317	1189	< 20.0	21,3	453	352	407		355	< 20.0	434	99,2
Magnesium (Mg) (mg/l)						38,6	37,1	15,5	37,7	53,8	43,1	44,2		18,09	16,5	34,4	27,9
Manganese (Mn) (µg/l)						94,8	2122	< 5.00	< 5.00	7,4	41,6	42,7		31,6	< 5.00	260,9	214,3
Potassium (K) (mg/l)						84,3	54,7	6,14	14,69	11,64	10,71	11,08		97,2	6,67	405	180,2
Ammonia (NH4) (mg/l)	0,06	8,6	10,4	9,8		0,57	0,64	< 0.050	< 0.050	0,62	10,2	10,5		8,4	0,43	20	8,7
Silica (SiO2) (mg/l)					4,9	10,3	3,02	5,04	8,14	21,72	2,82	14,86		< 0.02	3,82	< 0.02	7,22
Sedimentable Solids (2 ore) (ml/l)						6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2		-	< 0.10	-	12
Total suspended solids (mg/l)					< 1	16	1,8	< 1.0	1,2	2,2	2,4	6		2900	4	40800	207
Turbidity (NTU)	assente					17	9	7	7	7	9	6		1550	11	11250	32
Alkalinity P (CaCO3) (mg/l)						48,5	60,4	33,7	61,4	122,8	46,5	49,5		< 5.0	< 5.0	< 5.0	< 5.0
Alkalinity T (CaCO3) (mg/l)	185	570			200?	609,8	439,6	193,1	345,5	780,1	616,8	616,8		< 5.0	185,1	< 5.0	390,1
Alkalinity (HCO3) (mg/l)						9	388,9	153,4	271,8	652,2	638	631,7		625,6	< 2.0	225,9	475,9
Alkalinity (CO3) (mg/l)						55,8	59,4	72,5	40,4	< 2.0	< 2.0	147,3		58,2	< 2.0	< 2.0	73,7
Alkalinity (OH) (mg/l)						< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0		< 2.0	< 2.0	< 2.0	< 2.0
total hardness (come CaCO3) (mg/l)	210	219	240	260	180	300,51	275,11	211,05	518,32	322,33	283,21	288,97		232,419	222,15	330,54	132,565
Oxidisability (Kubel's method) (mg/l O2)	<0,5				< 0,5	10,2	120	0,83	3,14	15,1	11,9	12,4		9790	1590	15200	110
BOD5 (O2) (mg/l)						14,3					12,9			5680	68,2	26128	73,6
COD (mg/l O2)						30,06					36,06			22596	3779	112453	134,16
Total Organic Carbon TOC (mg/l)						13,63					13,48			6709	1528	26130	38,74
redox potential (mV)																	
optical refractometric residue(°Brix)													4,6	2,4	0,6	10,1	
free chlorine ppm	<0,2																
Nitrites (NO2) (mg / l)	0,01	0,037	0,05	0,018													
Chlorine Dioxide		0,38															
Hourly flow rate (m3/h)								120	40		0,513	0,8	5	5	5	5	2
Total annual average amount (m3)	603.451	747.617	######	######	170.269	194.290	194.290	627.372	313.686	930	14.400	44910#	2808#		1170#	2808#	760

assumed consumptions starting from a production line and multiplying by 9 lines (considering 260 days a year)

potentially recoverable waste from a qualitative point of view	(green)
utilities consumption	(yellow)
not recovered watstes from customer plant	(light blue)

On 24th October 2014, personnel from ADUE and UNIBO went to the CLIENT 2 production plant for a survey on water usage and waste-water management

First, the project’s participants identified the water cycle in the CLIENT 2 production plant.



The results of the Survey at CLIENT 2 are shown in the following charts.

The samples collected are described in the following table.

SAMPLING DESCRIPTION
SAMPLE 4 - COOLING TOWER
Cooled water contained in the cooling tower collection tank.
SAMPLE 2 - DEGASER
Pasteurizeur degaser: cooling water of the Liquid Ring of Vacuum Pump.
SAMPLE 1 - HOMOGENEIZER
Cooling water of homogeneizer rods .
SAMPLES 9
Fruit juices/te pasteurizeur: begininnig of tea production.
(numbers from 500 to 800): volume (counted in l) of water/product for the production start.
SAMPLE 8 - CIP WASHINGS
CIP washings. Sample taken before the neutralization tank.
Collection tank containing all kind of washings (soda,acid and rinses).
SAMPLE 3
Osmotized water added with peracetic acid, acetic acid and Ozone, used to rinse the bottles before the bottling phase.

The project's participants verified an average consumption per year of **2.400.000 m3 H2O**, against a production of 1.200.000 kilos of tomato sauce, 100 million PET bottles, 60 million of products in pieces.

From CUSTOMER 2 - 05/11/2014															
Laboratory code	14SA24302	14SA24303	14SA24306	14SA24304	14SA24301	14SA24305	14SA24300	14SA24309	14SA24314	14SA24310	14SA24311	14SA24312	14SA24313	14SA24307	14SA24308
ADUE code	5	7	6	10	4	2	1	9	9	9	9	9	9	8	3
Sample description / analyzed parameter	FILTER (INPUT)	OSMOSIS PERMEATE	BIOLOGICAL FILTER (OUTPUT)	WELL WATER AFTER PLANT COOLING *	COOLING TOWER	DEGASER	HOMOGENEIZER	PUSHING (500)	PUSHING (600)	PUSHING (650)	PUSHING (700)	PUSHING (750)	PUSHING (800)	CIP WASHINGS **	BOTTLES RINSES
Conductivity (at 25°C) (µS/cm)	1060	28,7	1064	1056	841	1007	25,6	675	668					36900	53,6
pH (pH unit)	7,6	5,4	7,4	7,4	7,8	8,3	5,2	7,2	7,1					12,8	3,9
Flourine (Flourides) (mg/l)	0,38	< 0.15	0,38	0,38	0,28	0,32	< 0.15	0,22						3,53	< 0.15
Chlorine (Chloride) (mg/l)	150	4,7	159	143	134	130	5,2	124						116	4,4
nitric nitrogen (Nitrates) (mg/l)	< 3.0	< 3.0	< 3.0	< 3.0	128	5,4	< 3.0	6,7						338	< 3.0
Sulphates (SO4) (mg/l)	47,5	< 4.0	48,5	48,8	23,9	42,9	< 4.0	59,8						29,8	< 4.0
Sodium (Na) (mg/l)	75,2	4,7	77,4	71	116,6	131,8	3,8	59,1						4460	4,37
Barium (Ba) (µg/l)	218,9	< 50.0	166,9	209,2	57	74,9	< 50.0	130						135,2	< 50.0
Calcium (Ca) (mg/l)	121,3	0,2	120	117,1	39,9	62,5	0,399	34						86,8	0,478
Iron (Fe) (µg/l)	333	< 20.0	22,4	398	< 20.0	< 20.0	< 20.0	< 20.0						276	< 20.0
Magnesium (Mg) (mg/l)	41,4	0,2	42	39,9	11,61	30,9	0,2	38,1						27,7	0,2
Manganese (Mn) (µg/l)	372	< 5.00	< 5.00	382	< 5.00	< 5.00	< 5.00	< 5.00						33,6	< 5.00
Potassium (K) (mg/l)	3,06	< 0.200	3,1	2,91	4,71	4,45	< 0.200	2,87						20,1	< 0.200
Ammonia (NH4) (mg/l)	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050						0,95	< 0.050
Silica (SiO2) (mg/l)	22,38	0,94	25,45	21,3	15,81	24,26	0,3	19,28						< 0.02	0,6
Sedimentable Solids (2 ore) (ml/l)	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10						4	< 0.10
Total suspended solids (mg/l)	< 1.0	1	< 1.0	< 1.0	< 1.0	< 1.0	1,67	1						418	< 1.0
Turbidity (NTU)	2	1	< 0.40	1	1	1	2	1						314	< 0.40
Alkalinity P (CaCO3) (mg/l)	27,9	< 5.0	43,8	42,8	6	55,7	< 5.0	24,8						9035	15,8
Alkalinity T (CaCO3) (mg/l)	332,3	13,9	328,4	337,3	81,6	334,3	12,9	126,7						9393	63,4
Alkalinity (HCO3) (mg/l)	337,5	17	293,8	307,1	85	271,9	15,8	94,2						< 2.0	38,6
Alkalinity (CO3) (mg/l)	33,4	< 2.0	52,5	51,3	7,2	66,9	< 2.0	29,7						429,8	19
Alkalinity (OH) (mg/l)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0						2950	< 2.0
total hardness (come CaCO3) (mg/l)	472,99	1,32	472,2	456,34	147,351	282,94	1,8175	241,21						330,57	2,015
Oxidisability (Kubel's method) (mg/l O2)	< 0.50	< 0.50	< 0.50	0,51	< 0.50	< 0.50	< 0.50	< 0.50						49,6	48,6
BOD5 (O2) (mg/l)			< 5			< 5		< 5						164,5	
COD (mg/l O2)			< 25			< 25		< 25						359,45	
Total Organic Carbon TOC (mg/l)			1,57			5,98		< 1.0						124,4	
redox potential (mV)															298
optical refractometric residue(°Brix)								0	0,2	1,7	3,1	5,2	7,5		
Hourly flow rate (m3/h)		90		70	3	2,4	2								35
Total annual average amount (m3)		561.600													
potentially recoverable waste from a qualitative point of view															
* recoverable after checking the temperature															
** recoverable only by separating the washing steps															
utilities consumption															
not recovered wastess from customer plant															

CLIENT 2 is interested in recover the water from the bottles rinsing. It has one bottling line with a production range of 22.000 Bottles/h and a consumption of 15/20 m3 of water/h, plus another bottling line that consumes 15 m3/h; so, every 80/90 m3/h of water which are produced by osmosis, 35.000 m3/h are lost.

Such results were discussed during the meeting in order to understand their impact on the engineering activities.

Furthermore, during the meeting, Micaela Guerzoni, A DUE S.p.A. subcontractor, illustrated the sampling plan which has been used as a guideline for the qualitative and quantitative mapping of potential water points' recovery at the client's plant.

The sampling plan has identified and considered the following elements:

- Used water's typologies (well, drinkable, osmosized, demineralized) and their respective destinations (cooling, boiler, production, etc…);

- potential points of unloading: unload of the reverse osmosis concentrate; unload of filters' sand and coal washing; cooling of circuits (blowdown water waste from the evaporative towers), CIP's washings, water from the beginning and the end of the pasteurization cycle, pumps with double mechanical seals (previous identification of the pumps and the pumped fluid), cooling water of the homogenizer, water used for the PET bottles' rinsing before bottling, others potential points of unloading depending on the specific production processes of each customer.
- points of drainage where the unloading activities will take place: to be defined during the survey in the plant.
- the operative phase during which to collect the drainage, depending on the kind of drainage: continuous and stable for the reverse osmosis (so one sample taking); irregular for the filter washing (so, for duration of 15 mins approximately, 4 camps taking : 1 after the 1st min, 2 intermediate, 1 after 14 mins); irregular for the CIP (so, 3/4 camps taking: the beginner washing, then the intermediate ones with chemicals, and the final rinsing).
- Average quantity of the drainage both as total daily quantity both as flow rate (to be asked to the client).
- Current destination of the unloading (to be asked to the client): sewer, organic purifier.
- Entry water: from well, aqueduct, H20 Demi, H20 Osmosized – evaluated as qualitative stable in the course of time.
- Parameters needed to be searched on each samples, as follows:

Parameter	**Unit of Measure**	**Notes**
Alkalinity M	mg/l $CaCO_3$	
Ammonia	mg/l NH_4	
nitric nitrogen- Nitrates	mg/l NO_3	
Barium	mg/l	
Calcium	mg/l	
Chloride	mg/l	
Conductivity at 25°C	µS	
Iron	mg/l	
Flourine (Flourides)	mg/l	
Magnesium	mg/l	
Manganese	mg/l	
Total Suspended Solids	mg/l	
Sedimentable Solids	ml/l	
Oxidability	mg/l O_2	
pH	pH unit	
Potassium	mg/l	

Silica	mg/l SiO_2	
Sodium	mg/l	
Sulphates	mg/l	
Turbidity	NTU	
colony count at 22 at 22°C	n/ml	
colony count at 22 at 37°C	n/ml	
COD	mg/l	Only wastewater from productive cycle and from filters' washing
BOD 5	mg/l	Only wastewater from productive cycle and from filters' washing
TOC	mg/l	Only wastewater from productive cycle and from filters' washing

- Volume sample required:1,5 l;
- Operational limits of values: to be defined after obtaining the analysis results;
- Values limits after the treatment: drinkable limits – Law n. 31/2001 ;

All the collected samples have been delivered to the Laboratory in charge of the analysis: SAVI LABORATORI & SERVICE S.r.l http://www.savilab.it/ via Roma, 80 - 46037 Roncoferraro (Mantova).

During the meeting, were presented the following other activities implemented during the period from Oct. 1st to Dec. 3rd .

- ADUE attended the event H2O –ACCADUEO (www.accadueo.com) held in Bologna on 22-24 October 2014. During this event ADUE collected information materials and contacts with the following potential clients:

  1. Components Supplier (Valves)
     - SOCLA ITALIA: www.socla.com
  2. Suppliers of different kind of processes' tools for the meaurement of water parameters:
     - BD SENSOR: www.bdsensors.de – Pressure and level measurement
     - BM tecnologie industriali: www.bmtecnologie.it
     - BUERKERT: www.buerkert.it
     - SIEMENS
     - BC ELECTRONIC: www.bc-electronics.it
     - LANGE: www.hach-lange.it
     - PROMINENT (also for water treatment plants): www.prominent.it
     - CHEMITEC: www.chemitec.it
     - YOCOGAWA: www.yo cogawa.com/eu/
     - VALCOM www.valcom.it

3. Automation Suppliers:
   - YASKAWA: www.yakawa.eu.com
   - SISTEMAE: www.sistemae.it
4. Coal Supplier for water treatment
   - JACOBI: www.jacobi.net
5. Membrane suppliers
   - MEMBRANE TECHNOLOGY (Burkert group): www. Cut-membrane.com
6. Supplier of a “drum” system OPTIFIL for filtration as alternative of diatomaceous earth filter
   - HAWLE: www.hawle.com
7. Supplier of portable tool of measurement for the determination of water flow from external tube (approx. 2.000 €)
   - BM tecnologie industriali: www.bmtecnologie.it
8. Suppliers of tanks and vitrifies steal silos having building with assembled modules
   - GLSTANKS: www.glstanks.it
9. Supplier of a remote monitoring system of water and electricity consumption (approx. 1.000 €)
   - SBC SAIA BURGES CONTROLS: www.saia-pcd.com

- Between October and November ADUE held a Training course for its partner UNIBO regarding water treatment systems and beverages preparation systems.
- ADUE obtained the analysis’ results for the evaluation of qualitative recovery ability of unloaded materials.
- ADUE is working on the analysis of water volume for the evaluation of quantitative recovery ability of the unloaded materials.

- UNIBO has managed the following activities in the period between October and November 2014:

  - together with ADUE, UNIBO attended the event H2O –ACCADUEO (www.accadueo.com) held in Bologna on 22-24 October 2014.

  - It made a chronological review of articles about ultrafiltration system and reverse osmosis topics. All partners agreed on giving more attention to the ultrafiltration system in order to identify the best technologies to use during the project, considering the innovative aspect of this system in the last years.

  - It proceeded with a qualitative classification that describes each article following some important qualitative KPIs. Nowadays there are not quantitative markers to investigate as parameters. During this analysis and matching UNIBO will take care about the environmental aspects.

  The state of the art analysis is recapped in the following chart.

#Id	Year	Author(s)	Editorial Source	Manuscript Type: Industrial Application	Manuscript Type: Research Paper	Manuscript Type: Review/Survey	Industrial Sector: Beverage	Industrial Sector: Food	Industrial Sector: Multiple/Cross-sectorial	Industrial Sector: Other(s)	Purified Fluid: Water/Wastewater	Purified Fluid: Juices	Purified Fluid: Multiple/Cross-sectorial	Purified Fluid: Other(s)	Key Investigated Technology(ies): Microfiltration [0.1-0.5]µm	Key Investigated Technology(ies): Ultrafiltration [0.005-0.05]µm	Key Investigated Technology(ies): Nanofiltration [0.0005-0.005]µm	Key Investigated Technology(ies): Reverse Osmosis	Key Investigated Technology(ies): Other(s)	Topic(s)	Finding(s)/Relevance/Notes
1	1992	Capannelli et al.	Lebensm-Wiss	X			X					X				X				Ultrafiltration of fresh orange and lemon juices	Membrane comparison (polysulphone PSF polyvinylidene fluoride PVDF Ceramic)
2	1995	Al-Mazidi	Desalination		X				X		X									Water supply system management	Management of the closed-loop water supply chain
3	1996	A1-Malack & Anderson	J of Membrane Science		X				X				X		X					Dynamic membranes with crossflow microfiltration	Formation of a MnO2 dynamic membrane on top of a polyester primary membrane
4	1996	Jiraratananon & Chanachai	J of Membrane Science		X		X					X				X				Study of fouling in the ultrafiltration of fruit juice	Effects of operating variables on permeation flux and resistances for the ultrafiltration
5	1996	Snow et al.	Desalination		X				X		X					X	X	X		High temperature RO & nanofiltration	Study of high temperature water purification (SWOT analysis)
6	1997	Alvarez et al.	J of Membrane Science	X			X					X						X		Apple juice concentration by RO	AFC99 Tubular polyamide membranes - process modelling vs. field-evidences
7	1997	Jiraratananon et al.	J of Membrane Science		X		X					X				X				Self-forming dynamic membrane for ultrafiltration of fruit juice	Comparison between the filtration of the dynamic membrane and the traditional alumina one
8	1998	Grimm et al.	Desalination			X			X		X								Elettrochemistry	Electro-assisted methods for water purification	Analysis of contaminations + electrochemical reactor design
9	2000	El-Manharawy & Hafez	Desalination		X		X				X							X		Water purification for sea water	Application for Egyptian water purification current practices
10	2000	Mavrov & Bélières	Desalination	X				X			X						X	X		Wastewater treatment	Milk + meat + bottle washing case studies
11	2001	Al-Jayyousi & Mohsen	Desalination	X			X				X							X		Water purification	Home-use RO unit - field evidences
12	2001	El-Manharawy & Hafez	Desalination		X		X				X							X		Guidelined for RO system design	REFERENCE STUDY for drivers about water classification, membrane selection & guidelines
13	2002	Bruijn et al.	Desalination		X		X					X				X				Ultrafiltration and fruit juice quality	Influence of crossflow ultrafiltration on membrane fouling and fruit juice quality
14	2003	De Barros et al.	J of Membrane Science		X		X					X				X				Study of fouling mechanism in fruit juice clarification by ultrafiltration	The flux decay modeled using a differential equation used to describe the dead-end filtration process
15	2004	Galambos et al.	Desalination	X				X			X						X	X		Wastewater treatment	Dow-FilmTec std membranes (polyamide) - comparison among technologies > RO to be prefered
16	2004	Uche et al.	Desalination	X				X			X							X	Distillation	Energy & pure water requirements in dairy industry	Integrated appraoch to face energy and water needs
17	2005	Bohdziewicz & Sroka	Process Biochemistry	X				X			X							X		Hybrid system for wastewater treatment from meat industry	Application biological methods of activated sludge + RO
18	2005	Hinkebein & Price	Desalination			X			X		X					X	X	X		Roadmap for US about water desalination	Areas of interest - cost for RO
19	2005	Mehta & Zydney	J of Membrane Science	X					X				X			X				Ease the selection among the commercial ultrafiltration membranes	Trade-off between permeability and selectivity for different ultrafiltration membranes
20	2005	Yazdanshenas et al.	Separation & Purification Tech	X			X					X				X				Full scale juice ultrafiltration process	Equation and procedure to predict retentate solute concentration in the system
21	2006	Baruah et al.	J of Membrane Science		X				X				X		X					Scale-up from laboratory microfiltration to a ceramic pilot plant	Design and test of ceramic membrane, back-pulsing device, permeate re-circulation in co-flow and temperature control system
22	2006	Bruijn & Borquez	LWT	X			X					X				X				Fouling mechanism during ultrafiltration of apple juice	Study the fouling mechanisms of a Carbosep M8 membrane during the cross-flow ultrafiltration
23	2006	Cassano et al.	Desalination	X			X					X				X			Distillation	Design of integrate membrane process for kiwijuice	Prototipal plant - PVDF membrane 15kDa + Polypropylene membrane module
24	2007	Cassano et al.	Desalination		X		X					X				X				Operating parameters, juice quality and membrane fouling of ultrafiltration for ORANGE	Study of the effect of transmembrane pressure, axial flow-rate and temperature on permeation flux
25	2007	Cassano et al.	J of Food Engineering		X		X					X				X				Operating parameters, juice quality and membrane fouling of ultrafiltration for KIWI	Study of the effect of transmembrane pressure, axial flow-rate and temperature on permeation flux
26	2007	Rai et al.	J of Food Engineering		X		X					X				X				Pretreatment methods effect during ultrafiltration	Effect of various pretreatment methods on permeate flux and quality during ultrafiltration of mosambi juice
27	2007	Rektor et al.	Separation & Purification Tech	X			X					X						X		Concentration of grape juice	Validation of RO technology & prefiltration requirement
28	2008	Cassano et al.	Innovative Food Science and Emerging Tech		X		X					X				X				Recovery of bioactive compounds in kiwifruit juice by ultrafiltration	Influence of the ultrafiltration on the composition of bioactive compounds to develop a natural product to fortify foods and
29	2008	Frenkel	ASCE		X				X		X				X	X	X	X		Membrane analysis	REFERENCE STUDY for classifications of purification processes - current trends
30	2008	Mirza	Desalination		X				X				X				X	X		Energy assessment & savings	Energy concerns
31	2008	Mondal et al.	AIChe	X						Oil & Gas	X						X	X		Treatment of water from oil & gas explorations	Comparisons among commercial membranes
32	2008	Poulirot	Int Dairy J			X		X						Dairy fluids	X	X	X	X		Dairy technologies	Review of membrane applications in dairy industry - classification
33	2008	Vourch et al.	Desalination	X				X			X							X		Dairy technologies	Application to recover wastewater for heating, cleaning and cooling
34	2009	Di Giacomo & Taglieri	Food Bioprocess Tech	X			X					X						X		Carrot juice production process	Industrial process plant setup
35	2009	Eltawil et al.	Renewable & Sustainable Energy Reviews			X			X		X				X	X	X	X		Review of desalination system from a renewable energy perspective	Comparison of technolgies from a sustinability view-point - pro & cons of technolgies
36	2009	Gokmen et al.	J of Food Process Engineering		X		X					X				X				Modeling dead-end ultrafiltration of apple juice using artificial neural network	Molecular weight cutoff, transmembrane pressure, gelatin–bentonite concentration as input, filtrate flux and filtrate volume as
37	2009	Pradeep & Anshup	Thin Solid Films		X				X		X								Thermal	Metal nanoparticles for water purification	go beyond current standards
38	2009	Tarquin et al.	ASCE	X						Civil Uses	X						X	X		Water supply in rural area	Rural application
39	2009	Zularisam et al.	Separation & Purification Tech		X		X				X					X				Application of coagulation–ultrafiltration hybrid process for drinking water treatment	Optimization of operating conditions using experimental design for drinking water treatment
40	2010	Astudillo et al.	Separation & Purification Tech		X				X				X		X	X	X			A new parameter for membrane cleaning evaluation	Definition of a new parameter, membrane performance recovery. Ratio between the average membrane flux after and before
41	2010	El-Kamah et al.	Desalination	X			X				X								Thermal	Wastewater treatment from fruit juice	Comparison among three treatment processes
42	2010	Geise et al.	Wiley			X			X		X				X	X	X	X		Review of membrane technologies for purification	REFERENCE STUDY for comparisons in the water sector
43	2010	Girard & Fukumoto	Critical Review in Food Science & Nutrition			X	X					X			X	X		X		Review of membrane technologies	REFERENCE STUDY for comparisons in the juice sector
44	2010	Kanani et al.	J of Membrane Science	X					X				X			X				Permeability–selectivity analysis for ultrafiltration	Impact of pore geometry on the trade-off between the selectivity and permeability for membranes with pore size below 100 nm
45	2010	Onsekizoglu et al.	J of Membrane Science		X		X					X							Membrane distillation	Clarification and the concentration of apple juice	Evaluation of membrane processes for the clarification and the concentration of apple juice, considering the impact on the product quality
46	2010	Yazdanshenas et al.	Desalination	X			X					X				X				Ultrafiltration of raw apple juice at industrial scale	Model of the flux behavior during the industrial cross-flow ultrafiltration of apple juice in a batch process
47	2011	Echevarria et al.	Food Engineering Reviews			X	X					X			X	X		X		Review of membrane technologies	REFERENCE STUDY for comparisons in the juice sector
48	2011	Gao et al.	Desalination		X		X				X					X				Review of membrane fouling control for water production	Ultrafiltration technologies for drinking water production reviewed in terms of different effective pretreatments and operation
49	2011	Habibi et al.	J of Food Process Engineering		X		X					X			X					Influence of operating parameters on clarification of juice	Influence of transmembrane pressure, cross-flow velocity and temperature on permeate flux and some properties of clarified
50	2011	Razi et al.	Int J of Food Science and Technology		X			X					X		X					Clarification of tomato juice through microfiltration process	Influence of transmembrane pressure, cross-flow velocity and temperature on permeate flux and some properties of clarified
51	2012	Macedonio et al.	Chemical Engineering & Processing			X			X		X				X	X	X	X		Technolgies for clean water supply	REFERENCE STUDY for comparisons in the water sector
52	2013	Al Abdulgader et al.	Separation & Purification Tech			X			X		X				X	X	X	X		Review of membrane technologies for purification	REFERENCE STUDY for comparisons in the water sector
53	2013	Ghaffour et al.	Desalination			X			X		X				X	X	X	X		Economic perspectives of water desalination	Cost drivers and source of waste and potential revenues
54	2013	Kujawski et al.	J of Food Engineering	X			X					X						X		Concentration of grape juice	Polytetrafluoroethylene (PTFE) hydrophobic membranes at different pore diameter - feasibility study
55	2013	Sudhakaran et al.	Science of the Total Environment		X		X				X				X	X	X	X		Multicriteria analysis of water treatment processes	Rankings for drinkable water
56	2014	And et al.	Desalination			X			X		X				X	X	X	X		Review of membrane technologies for desalination	REFERENCE STUDY for comparisons in the water sector
57	2014	Mahmoud et al.	Desalination		X				X		X				X	X	X	X		Innovations in membranes for water desalination	New membranes based on graphene
58	2014	Sorlini et al.	Water Practice & Technology	X			X				X				X	X	X	X	Thermal	Arsenic removal treatments	Multiple treatment chains to be compared with the purpose of arsenic removal

- During the meeting on 3rd of December the participants agreed on the Project's Logo:

Next steps:

- Next meeting will be on **25th February 2015**.
- The agenda for the next meeting will be:
    - Definition of the main technical specification of the pilot plant (ADUE, UNIBO, Guerzoni Micaela and Ing. Violi Maurizio as subcontractors): due by end of February 2015.
    - Definition of main characteristics of water to be treated by the new water treatment plant (ADUE, UNIBO, Guerzoni Micaela and Ing. Violi Maurizio as subcontractors), due by end of January 2015.
    - Conclusion of the state of the art regarding the quantitative parameters come to light during ADUE analysis (UNIBO) due by end of January 2015.
    - Preparation of summary report and training in ADUE especially focused on the ultrafiltration technology (ADUE and UNIBO), due by end of February 2015.
    - Technical Group will meet once again on February 25th, 2015 at A DUE S.p.A. premises in Riccò di Fornovo (PR), Italy.

- Then, the **next meeting will be in July 2015**.

1.2 Results achieved as compared to what was planned in the project proposal

Results in line with the plan in the project proposal.

1.3 Deviations, problems and corrective actions taken in the whole project period

No deviations, problems or corrective actions have emerged so far.

2 Other issues (max 1 page)

No other issues have emerged so far.

3 Overview on hours spent

Will be regularly submitted with the Progress Report #1 on month 12 (September 2015).

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