	EUROPEAN COMMISSION Executive Agency for Small and Medium-sized Enterprises (EASME)

Project No: 630492

Project Acronym: Screencap

Project Full Name: Finescreen supported biological wastewater treat ment to enhance plant capacity

Final Report

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KWR WATER B.V.

Final Report

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1. Achievement of the action

1.1

General Progress

The Screencap project has successfully demonstrated at full scale the benefits of the finescreen tech nology to recover suspended solids from waste water on the basis of particle size. In the project finescreens have been designed, implemented and operated at the waste water treatment plant (WWTP) Aarle-Rixtel and the performance and impact have been monitored. The Aarle-Rixtel WWTP offered an excellent opportunity to establish the impact of finescreens as the plant has two identical treatment trains. The finescreen installation was incorporated into one of the trains, compar ison with the other train yielded data on the impact of the finescreens.

The implementation of a fine filtration step on the influent of the WWTP, after the removal of bulky waste, is a good basis for achieving a robust and efficient wastewater treatment process in which the sieved material (screenings) has great reuse potential. The screenings consist to a large extent of cel lulose. At the start of the project there was insufficient knowledge about the impact of the removal from the influent of this fibrous stream on the downstream treatment process. This was the focus of the Screencap research at the Aarle-Rixtel WWTP.

The most important results of the Screencap project are that the implementation of finescreen techno logy decreases aeration energy needs by 15%, reduces sludge production by 10%, and increases the WWTP's capacity by 10%.

At the start of the project, performance indicators were defined. Based on these indicators, the yearly greenhouse gas emission reduction is 77.5 million kg per year. Sludge reduction is 500 tons/year and the reduction in the usages of chemicals is 9.5 tons/year. The additional biomethane production is 2.3 million m3 per year. In financial terms, these indicators combined represent yearly savings of approx imately € 1.1 million. The expected payback time is about 9 years.

Design and construction of the finescreens
The project started in November 2014 with the design and construction of the building with the finescreens. This phase took a little bit more time than expected, but obviously, it is very important to have a solid and well balanced design, because it is the base of the further project and therefore has a huge effect on the execution and results. Nevertheless the project team managed to minimise the ef fect on the further project progress. The installation was completed in the summer of 2016. Water testing and commissioning took place in the end of the summer of 2016, while the official opening was on 13 October 2016.

Operation and impact monitoring
Starting from 13 October 2016 the performance of the finescreens and impact on the waste water treatment have been monitored intensively. Due to a toxic load of ammonium on 15 August 2017 there was a need to restart the whole WWTP Aarle-Rixtel. New sludge was obtained from another WWTP to reactivate the activated sludge system of WWTP Aarle-Rixtel. Therefore, the monitoring period was from 13 October 2016 to 15 August 2017, since the impact on the activated sludge could not be determined after the 15th of August 2017. By comparing the results of the finescreens-equipped and conventional waste water treatment lane, the effect of the finescreen pre-treatment could be determined.

During the finescreen operation, stubborn contamination was found on the sieve bands which could not be removed properly. This leads to additional maintenance and wear on the bands and loss of ca pacity. It seems a location-specific problem in which the composition of the influent plays a role. Re search on the cause and solutions is recommended to improve finescreen performance.
Other optimizations can be achieved with the performance of the dewatering press (increase dry sub stance (DM) content, reduce contamination load in dewatering water) and with various control strategies.

The screened material removed by the finescreen installation at the beginning of the treatment pro cess consists primarily of cellulose fibres from toilet paper. This incorporated treatment step in creases the processing capacity of the wastewater treatment plant and generates a cellulose-rich resid ual stream (screenings). These screenings can be used for the production of energy: they are easily di gested and produce 2 to 3 times more biogas than does the sludge generated by the downstream treat ment process. Screenings can also be used as a fibre source, for instance, for the optimisation of the dewatering installation, or as reprocessed clean cellulose for (road) construction or chemical industry applications.

The impact of the finescreen technology on the downstream treatment process applied at the Aarle-Rixtel WWTP can be summarised as follows:
• The finescreen technology has no negative or positive impact on the ultimate effluent quality: both treatment trains produced a comparable effluent quality.
• The finescreen technology has no impact on the sludge settling. The Sludge Volume Index (SVI) was comparable for both trains.
• The excess sludge production in the finescreen train decreased by about 10%.
• Besides the decreased amount of sludge, there was no noticeable impact on the sludge dewatering; the dry matter percentage of the dewatered material did not change nor did the chemical require ments.
• The train with the finescreen technology required about 15% less aeration energy.
• The capacity of the WWTP increased by about 10% through the implementation of the finescreen technology.
Finescreen performance
Based on analysis results and other measurement data, a balance sheet for suspended solids (SS) and chemical oxygen demand (COD) has been drawn up for the finescreens installation.

The net SS removal efficiency of the finescreen is 20-25%. This is lower than the 49% mentioned in the Technological Design (TD). Explanations for this are the use of a smaller pore size filter in the laboratory for the SS analysis, the indication that influent of WWTP Aarle-Rixtel contains relatively small particles (in comparison to influent of WWTP Beemster) and various operational issues that have occurred during the investigation, such as stubborn fouling of the finescreen bands. Further re search on these causes is recommended.

The net COD removal efficiency of the finescreen is 10-15%, which is also lower than the Technolo gical Design (30%). Net BOD removal efficiency is 15%, which is just above the value in TD (11%). The removal efficiency of both nitrogen (N) and phosphorus (P) is approximately 2%.

The reject flow of the finescreen installation consists of the water that is released during the dewater ing of screenings, and drainage and rinsing water that is released during the (soap) cleaning of the finescreens. Compared to the influent, the SS load in the reject flow is 8%. During the dewatering of screenings, 26% of the dry matter that was separated with the finescreens is returned to the reject flow via the dewatering water. This reject flow therefore contains a high waste load, which is re turned to the influent and thus has a negative effect on the net removal efficiency of the finescreen. It is recommended to investigate how to reduce the waste load of the reject stream or to investigate whether another destination for the reject water is possible, as this will lead to improved finescreen performance.

The production of screenings (1275 kg dm / d) is in practice about 40% of the design, which is ex plained by the lower SS removal efficiency. The screenings consists of about 67% of fibers, about 10% of proteins, 8% of fat and 9% of ash. The dry matter content (27%) of the screenings is almost the value mentioned in the TD (30%), but higher values could probably be obtained at stable opera tion. The screened material is well-digestable and produces 2-3 times more biogas compared to regu lar surplus sludge cake of WWTP Aarle-Rixtel.

WWTP performance
The performance of the waste water treatment lane that is equipped with finescreens is similar to the conventional WWTP lane. The effluent concentrations (COD, N, P) are similar, the sludge settling (SVI) is equal and no differences are observed during dewatering of the sludge mixture in comparis on to the past without finescreens in operation.

Microscopic analysis shows that the cellulose content in the sludge of the finescreen WWTP lane is halved in comparison with the conventional lane. In the WWTP lane, which is equipped with finescreens, 10% less waste sludge is produced, and the required aeration flow is about 15% lower than in the conventional lane.

Energy
The total energy consumption of the WWTP has increased by approximately 8% (1142 kWh/day) due to the operation of the finescreens on one of the two WWTP lanes. The finescreen installation consumes significantly more energy than the savings on aeration and sludge dewatering. A large part (40%) of energy consumption consists of the required pumping energy, which is location-specific. The second major item (21%) is the energy consumed by the blowers of the air knife of the finescreens. Without the pumping step, an energy-neutral or even energy positive installation could possibly be achieved if the efficiency of the finescreens improve and energy-saving measures prove to be effective.

Capacity increase WWTP Aarle-Rixtel
The influent pre-treatment with finescreens resulted in a 10% capacity increase on one WWTP lane of WWTP Aarle-Rixtel during Screencap research. The results of the determination of the net remov al efficiency, the production of screenings, the reduction of waste sludge production and the reduc tion of aeration flow are well matched and confirm the WWTP capacity increase.

Effect at higher finescreen efficiency
Research on optimization possibilities of the finescreen installation is recommended. At higher finescreen efficiencies, the effect on the WWTP process is expected to be in line with the current res ults. The aeration flow and the waste sludge production will decrease proportionally, and sludge set tling and dewatering will remain comparable. During the Screencap research, hardly any reduction of the BOD / N ratio was measured. Especially because this is in contradiction with the observed relat ively high BOD removal efficiency of the finescreens, this relationship remains an important para meter. At higher removal efficiency, it is expected that the BOD / N ratio will continue to decline, with potentially negative consequences for the denitrification process resulting in increased nitrate concentration in the effluent.

Comparison to WWTP Beemster
During the same period, finescreens were implemented at WWTP Beemster as well. The perform ance of the finescreens at WWTP Beemster is better than at WWTP Aarle-Rixtel. The removal effi ciency for SS and COD is at WWTP Beemster about 1.5 times higher and the production of screen ings at WWTP Beemster is higher. The problems with stubborn contamination and tearing finescreen bands do not occur at WWTP Beemster.

The main cause of these differences is the large amount of fine (sand?) particles in the influent of Aarle-Rixtel. The influent of the WWTP Beemster contains relatively more particles that are larger than the mesh size used in comparison to WWTP Aarle-Rixtel. In addition, the SS concentration in the influent of WWTP Beemster's is 50% higher, leading in general to higher efficiency.

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

Progress

Del. N.	Deliverable Name	Nature	WP N.	Delivered	Status	Delivery date from Annex I	Actual delivery date	Forecasted delivery date	Comments
1	Electronic project management tool for progress and resources monitoring and report preparation	Other	1	Yes	Final	2015-05-31	31/10/2015		
2	Progress report	Report	1	Yes	Final	2015-09-30	03/11/2015		
3	Interim report	Report	1	Yes	Final	2016-08-31	19/09/2017		
4	Final report	Report	1	No	Final	2017-10-31		02/01/2018	
1	Monitoring plan	Other	2	Yes	Final	2015-01-31	31/10/2015		
2	Pre-design	Report	2	Yes	Final	2015-02-28	12/10/2017		
3	Detailed engineering design	Report	2	Yes	Final	2015-04-30	12/10/2017		
4	Licenses and permits	Other	2	Yes	Final	2015-04-30	05/04/2016		
1	Operational and maintenance manuals	Report	3	Yes	Final	2015-10-31	12/10/2017		
2	Implemented fine screens	Other	3	Yes	Final	2016-01-31	21/03/2017		
3	Trained operators	Other	3	Yes	Final	2016-01-31	17/01/2017		
1	0-measurement	Report	4	Yes	Final	2016-01-31	10/01/2017		
2	Optimized finescreen operation	Report	4	Yes	Final	2016-06-30	14/11/2017		
3	Monitoring report	Report	4	Yes	Final	2017-04-30	05/12/2017		
4	Performance assessment (LCA)	Report	4	Yes	Final	2017-07-31	02/01/2018		
1	Market study	Report	5	Yes	Final	2016-04-30	26/10/2017		
2	Decision support model	Other	5	Yes	Draft	2016-04-30	31/10/2017		As agreed this deliverable is confidential.
3	Feasibility plans	Other	5	Yes	Final	2017-10-31	19/09/2017		
4	Business plan	Other	5	Yes	Final	2017-10-31	12/10/2017		

1	Project information updat es (pre-defined)	Other	6	Yes	Final	2017-10-31	31/10/2015		
2	Inputs to additional comm on information material r elated to eco-innovation actions (pre-defined)	Other	6	No	Draft	2017-10-31		02/01/2018	nothing to upload, no requests received
3	Project presentations (pre-defined)	Other	6	No	Draft	2017-10-31		02/01/2018	nothing to upload, no requests rece ived.
4	Layman's report (pre-defi ned)	Other	6	Yes	Final	2017-04-30	21/11/2017		
5	Evaluation report includi ng performance indicators (pre-defined)	Report	6	No	Draft	2017-10-31		02/01/2018	nothing to upload, 2 years after project.
6	Project website	Other	6	Yes	Final	2015-04-30	03/11/2015		
7	New media output	Other	6	Yes	Final	2017-10-31	20/11/2017		
8	Exhibitions/fairs	Other	6	Yes	Final	2017-10-31	16/11/2017		
9	press releases	Other	6	Yes	Final	2017-10-31	21/11/2017		
10	Notification panel	Other	6	Yes	Final	2015-02-28	08/03/2016		
11	Leaflets and brochures	Other	6	Yes	Final	2016-01-31	11/10/2016		
12	Open day	Report	6	Yes	Final	2016-01-31	16/11/2017		
13	Visitor programs	Report	6	Yes	Final	2017-10-31	31/10/2017		
14	Presentations at seminars, fairs and workshops	Other	6	Yes	Final	2017-10-31	16/11/2017		
15	Articles	Other	6	Yes	Final	2017-10-31	16/11/2017		

Detailed Progress per Work Package and/or other Specific Comments:

Work Package 1: Management
As part of Work Package 1 we established an electronic project management tool for progress and resource monitoring (D1.1) and organised meetings with the WP leaders to discuss progress and actions. We also prepared a Consortium Agreement and uploaded deliverables, including the progress report and this final report, to the ECAS-system (D1.2, D1.3 & D1.4).

Work Package 2: Design

In Work Package 2 designing of the finescreen technology for implementation in one of the two existing waste water treatment trains of WWTP Aarle-Rixtel in the Netherlands took place. This included preliminary design, detailed design and preparation of a tenderbook. Obligatory licenses and permits were taken into account. The new installation was realized in a way that the existing plant remained fully operational during the construction period, without adding risks to the performance.

The waste water treatment plant of Aarle-Rixtel consists of two identical parallel purification trains AT1 and AT2. Finescreens are taken into operation on one of these treatment trains, so the performance of the "finescreen train" could be compared with the conventional train. The purpose of the monitoring plan is to determine: (1) performance of the finescreen installation (e.g. efficiency, energy consumption) and (2) impact on the waste water treatment process (compare treatment train AT1 and AT2). We developed a monitoring plan, which describes parameter to be monitored, taking into account the specific points of attention at the various target markets for commercialization. The plan includes operational aspects such as energy, sludge growth, sludge quality, effluent quality, biogas production and running costs. The performance of the finescreen installation is determined by measuring, sampling and analysing all flows to and from the finescreen installation. Analysed parameters are for instance the concentration of suspended solids, COD, BOD, nitrogen components, phos phorous components… etc. From these results the removal efficiency for the different parameters is calculated. The plan was reviewed by the consortium partners and a summary is available on the Screencap project website (D2.1).

The pre-design (D2.2) is reported, including a short summary for the Screencap website. A detailed engineering design is available (D2.3) and a summary of this detailed engineering design is also available on the Screencap website. The finescreen installation has been newly installed. This installation is integrated between the sand trap and the aeration tanks. New connections have been made on the overflow of the sand trap for the supply of wastewater to the finescreens. To that end, the water flows by gravity. In this installation, the waste water is pumped and distributed over the finescreens. To this end, eight finescreens are installed with an option for extension to ten finescreens. The screened water (filtrate) is drained by gravity to one of the existing aeration tanks and the associated downstream process components. The captured debris is collected and centrally dewatered and stored in containers. The reject water of the dewatering is returned to the water line of the WWTP.

Licenses and permits (D2.4) have been obtained for the realization of the SCREENCAP installation at the WWTP Aarle-Rixtel, by modification/extension of the existing environmental permit. For the permit application, the project team carried out research to determine the expected emissions regarding odour and noise. Together with the final-/implementation design documents, these reports were the bases of the application. A revised permit has been provided to Wa terboard Aa en Maas by the Dutch Province of Brabant. The application submitted was approved in all aspects. A short notification about the obtained li censes and permits has been published on the Screencap website.

Work package 3: Construction

WP3 started after an intensive design period and the subsequent tender procedure. Through a tendering procedure, the main contractor for the project has been selected and awarded. Among other criteria, the contractor’s active contribution to dissemination of the projects results was one of the performance cri teria on which the contractor was selected (e.g. https://youtu.be/eJ5168GmvpU). The construction of the project at the WWTP Aarle-Rixtel was awarded to

GMB in Opheusden. Shortly after getting the project awarded, just before Christmas 2015, GMB has started the construction of the installations.

On December 15th, 2015 the acceptance test of the finescreens for the Screencap project has taken place. For this a delegation of Waterboard Aa en Maas and CirTec travelled to Salsnes in Norway. Prior to the visit an extensive protocol FAT (Factory Acceptance Test Protocol) was made, which allows the ma chines to be checked at various points. After an extensive tour through the production process, the machines were very carefully examined and checked by the project team. After an intensive day the FAT procedure could be closed with a satisfied team, both on the part of Waterboard Aa en Maas, as CirTec and Salsnes. The machines were ready and approved to be crated and sent to the Netherlands, where they were received. Operational and maintenance manuals haven been provided (D3.1).

In the summer of 2016 the highest point of the installation was reached and overall constructions finished at the end of the summer. Water testing and com missioning took place in the end of the summer of 2016, while the official opening was on 13 October 2016 (D3.2). The official opening was with a pop-up shop in the nearby city centre of Helmond and an open day at WWTP Aarle-Rixtel (Figure 2). Operators of Waterboard Aa en Maas were trained to work with the new innovative finescreen installation (D3.3).

Work Package 4: Building the reference
WP4 started with a so called 0-measurement to see if both treatment trains at WWTP Aarle-Rixtel were indeed similar in performance (D4.1). As expected both treatment trains performed very similar. In Figure 3 an aerial overview of WWTP Aarle-Rixtel with the two identical treatment trains (before installa tion of fine screens).

After the start-up the monitoring plan took effect. The performance of the finescreen installation was determined by measuring, sampling and analysing all flows to and from the finescreen installation. Parameters that have been analysed are for instance the concentration of suspended solids, COD, BOD, nitrogen components, phosphorous components, etc. From these results the removal efficiency for the different parameters have been calculated. The impact on the waste water treatment process is determined by comparing the performances of the two treatment trains at Aarle-Rixtel, with and without finescreen, AT1 and AT2. Attention points are effluent quality, energy consumption and sludge characteristics like dewaterability, settlleability, sludge composition and sludge production. Based on the operational experiences in the first months, the finescreen operation has been optimised and the optimisation reported (D4.2). A public report with the monitoring results has been prepared and is available (D4.3). A summary of the monitoring results has been given in this re port in paragraph 1.1 and table 1 gives an overview of the performance and impact of the finescreens at WWTP Aarle-Rixtel.

D4.4 (Performance Assessment) evaluates the environmental and economic performance of the project. Two Life Cycle Assessment (LCA) studies have been published in the Netherlands during the Screencap project on the effect of finescreen technology, cellulose recovery and valorisation. These LCAs show that the environmental benefit of finescreens compared to a standard WWTP is 34 to 46 kPt/year. One kPt represents the environmental impact or load (i.e. entire production/consumption activities in the economy) of 1 average person living in the western world. Valorisation routes like separate digestion of cellu losic screenings and the use of cellulosic screenings as substitute for residual wood both have a positive environmental impact. This project focused on the performance indicators at the wastewater treatment plant of Aarle-Rixtel. From the obtained results it can be concluded that there is 10% less sludge produc tion, a reduced use of chemicals of 9.5 tons/year and an increased biogas production of 2.3 million m3 per year. The total greenhouse gas emission reduction is 77,490 ton per year and the yearly savings can add up to about € 1.1 million.

Work Package 5: Exploitation and business development
As part of WP5 CirTec conducted a market study to determine what would be the most appealing business case for the development of the Screencap concept (D5.1). Market research has been conducted on the status of WWTP's in Europe and in more detail for the Netherlands, Germany and the United Kingdom. For successful marketing of Screencap the WWTP should at least have a size of 50,000 PE. This results in the following market potential:
• The Netherlands: ca. 60 % of the WWTP's (~210 WWTP's)
• The UK: ca. 5 % of the WWTP's (~540 WWTP's)
• Germany: ca. 23 % of the WWTP's (~1,000 WWTP's)

For successful marketing of Screencap the WWTP should have no pre-sedimentation. In the Netherlands roughly 55% of the WWTP's with more than 50,000 PE don't have a pre-sedimentation. For successful marketing of Screencap several operational challenges can positively influence the economy of a Screencap installation:
• The WWTP is preferably loaded to its maximum capacity and needs to be expanded. Introduction of Screencap will lower the load on the biological treat ment and free up capacity.
• Direct digestion of the screenings results in a higher total biogas yield.

A Decision Support Model is developed to give decision makers insight in the technical feasibility and operational and capital expenditures related to the in stallation of finescreens at a WWTP (D5.2). Input parameters such as input feed water, units of fouling (VE), total suspended solids are combined with effi ciency parameters and provide the effect of finescreens on energy consumption, maintenance, sludge production and consumption of chemicals. Furthermore, 21 specific feasibility studies have been conducted for waste water treatment plants in several countries like the Netherlands, Italy, Denmark and Norway (D5.3). feasibility studies are made with the objective to see if pre-treatment with finescreen for different WWTP's has benefits in comparison with conven tional waste water treatment with or without primary settling. The major technological aspects are the effects on volume of biological treatment, energy con sumption of aeration, biological phosphorous removal and sludge production. The overall energy consumption and sludge handling are important parameters to determine the financial outcome of such feasibility study. The extra publicity received by the technology, the extra attention at the water authorities and the additional insights the Screencap project has delivered, have resulted in a review of CirTec's business plan (D5.4).

Work Package 6: Dissemination
WP 6 included several activities, like the pre-defined tasks, e.g. Project Information Sheets, but also development of the website (www.screencap.eu), a project leaflet, and mobile presentation banners. With the start of building activities at the waste water treatment plant Aarle-Rixtel a notification panel (D6.10) was placed on site (Figure 4). The notification panel at the entrance of the WWTP informs the general public and visitors of the plant about the

Screencap project, with a cartoon that explains the basics of application of finescreen technology on waste water.

Project outcomes have been disseminated through the project website (http://www.screencap.eu/), communications to relevant target groups and presence at trade fairs. Several press releases have been issued during the Screencap project. Also contributions to dissemination events, both on a national and European level took place. During the project the Screencap partner CirTec attended several exhibitions/fairs and Screencap was visible during these exhibitions/fairs with e.g. roll banners. Besides fairs and exhibitions, presentations at several occasions have been given and some articles haven been written. A public lay man's report has been produced. Also an open day was organised on the 13th of October 2016. For this occasion a pop-up shop with information about Screencap and cellulose recovery and reuse was opened in the nearby city centre of Helmond. Guided tours were organised at wastewater treatment plant Aarle Rixtel, including visits to the new building with the commissioned finescreen installation.

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

Actions				
Name	Type	Reason	Impact	Measure

Comments:

There has been some delay in execution of WP2. This was mainly due to the delay in the (start of the) designing phase. Obviously, it is very important to have a solid and well balanced design, be cause it is the base of the further project and therefore has a huge effect on the execution and results. The delay in the beginning of the Screencap project has had an effect on the further project progress. Nevertheless, the overall project delay has been limited, since completion of the installations was in the summer of 2016. This meant limited delay and no problems in execution of the Screencap project. The official opening took take place in the beginning of October 2016. Since that time per formance of the finescreens and impact on the wastewater treatment have been monitored intens ively. Due to a toxic load of ammonium on 15 August 2017 there was a need to restart the whole WWTP Aarle-Rixtel. New sludge was obtained from another WWTP to reactivate the activated sludge system of WWTP Aarle-Rixtel. Therefore, the monitoring period was from 13 October 2016 to 15 August 2017, since the impact on the activated sludge could not be determined after the 15th of Augsut 2017. The end of the monitoring period came a little earlier than expected, but enough results have been obtained for the needed evaluation of the finescreen performance and the impact on the waste water treatment process.

1.4

Progress regarding performance indicators

At the start of the project, the indicators listed in table 3 were defined in relation to the expected per formance of the process at the end of the project. Table 3 also summarises the realised performance assessment indicators at the end of the Screencap project. In general, the realised impact has been lower than the expected impact, except for the additional biogas production potential, since the screened material proved to have a very high biogas potential. The screened material is well-di gestable and produces 2-3 times more biogas compared to regular surplus sludge cake of WWTP Aarle-Rixtel.

There is an approximate decrease of 15% in m3 aeration (= energy), which is equal to 400 kWh/day of energy savings. The finescreen installation, on the other hand, consumes energy while treating wastewater. The energy consumption of the finescreen installation is approximately 560 kWh/day. With some tweaks to the blowers the installation may be energy neutral, meaning the energy con sumed by the finescreen installation is equal to the energy saved in the aeration tank. This means that the net energy saving equals 0%.

As a result of the removal of suspended solids in the pre-treatment there is a 10% decrease in sludge production in the lane that has the finescreens compared to the lane without fine screens. The reduc tion in sludge production results in a 8% decrease in PE consumption, in kg/day. This was determ ined by comparing actual PE usage during the Screencap research period from October 2017 to Au gust 2017 to the PE usage in the period prior to the commissioning of the fine screens (January to Oc tober 2016). The trucking of sludge waste to the sludge incineration plant has been reduced by 10%, equal to the decrease in sludge production.

2. Evaluation of results

2.1

Results regarding market uptake and exploitation

Interest in the finescreen technology is growing. Several finescreen feasibility plans for waste water treatment plants in e.g. the Netherlands, Italy, Denmark and Norway have been developed. CirTec, the SME technology provider has won several prices in this reporting period, from the WssTP European Water Innovation Award 2015 to a top three place as most sustainable SME innovator in The Netherlands and the AquaTech Innovation Award at the Amsterdam International Water Week in the last week of the Screencap project.

2.2. Environmental benefits

Direct/quantitative environmental benefits

Two Life Cycle Assessment (LCA) studies have been published in the Netherlands during the Screencap project on the effect of finescreen technology, cellulose recovery and valorisation. These LCAs show that the environmental benefit of finescreens compared to a standard WWTP is 34 to 46 kPt/year. One kPt represents the environmental impact or load (i.e. entire production/consumption activities in the economy) of 1 average person living in the western world. Valorisation routes like separate digestion of cellulosic screenings and the use of cellulosic screenings as substitute for resid ual wood both have a positive environmental impact. This project focused on the performance indic ators at the wastewater treatment plant of Aarle-Rixtel. From the obtained results it can be concluded that there is 10% less sludge production, a reduced use of chemicals of 9.5 tons/year and an increased biogas production of 2.3 million m3 per year (Table 3). The total greenhouse gas emission reduction is 77,490 ton per year.

Relevance for environmentally significant issues or policy areas, consistency with important en vironmental principles, relevance to the EU legislative framework (directives, policy develop ment, etc.) and EU sector strategies

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2.3

Economic benefits

The WWTP Aarle-Rixtel was overloaded at the start of the project. The conventional response would have been to place an additional primary settling tank. The finescreens formed an economical altern ative. Finescreens require less surface area, enable material recovery and this solution turned out to be the most economical way to extend the capacity of the WWTP: it was almost 30% cheaper than the conventional solution.
The yearly financials savings related to indicators listed in Table 3 are shown in Table 4. The yearly savings can add up to about € 1.1 million.

2.4

Measures taken to ensure the autonomous economic viability of the business programme estab lished in the project, beyond project lifetime and therefore after the EASME financial support has ended. Residual threats and barriers should be explicitly addressed.

Regarding exploitation and business development, several activities are planned in the next period. With a running reference installation and performance assessment of the impact, a decision support model has been developed. This decision support model will be used in the feasibility plans for ap plication of influent finescreens at different WWTPs in Europe. With positive outcomes in feasibility plans, implementation, and therefore further market uptake of the new finescreen technology, will take place.

A market study has been performed by CirTec. This market study includes an inventory of waste wa ter characteristics by region/country and determination of opportunities, the major concerns and obstacles for the individual target markets. The market study determined what would be the most ap pealing business case for the development of the Screencap concept. Market research has been con ducted on the status of WWTP's in Europe and in more detail for the Netherlands, Germany and the United Kingdom. For successful marketing of Screencap the WWTP should at least have a size of 50,000 PE. This results in the following market potential:
• The Netherlands: ca. 60 % of the WWTP’s (~210 WWTP’s)
• The UK: ca. 5 % of the WWTP’s (~540 WWTP’s)
• Germany: ca. 23 % of the WWTP’s (~1,000 WWTP’s)

For successful marketing of Screencap the WWTP should have no pre-sedimentation. In the Nether lands roughly 55% of the WWTP’s with more than 50,000 PE don’t have a pre-sedimentation. For successful marketing of Screencap several operational challenges can positively influence the eco nomy of a Screencap installation:
• The WWTP is preferably loaded to its maximum capacity and needs to be expanded. Introduction of Screencap will lower the load on the biological treatment and free up capacity.
• Direct digestion of the screenings results in a higher total biogas yield.

The main Screencap objectives were 1) First full-scale validated application of the finescreen techno logy as a pre-treatment on a biological WWTP and 2) Overcoming market barriers for uptake of the concept and technology in Europe and beyond. This has been achieved in the Screencap project. With the knowledge acquired and the network of CirTec, the results of the Screencap project are be ing replicated and rolled out over Europe and beyond (see also Tables 3 and 4).

3. Other issues

KWR
The projected travel costs (€ 11.400) are lower than the reported travel costs (€ 3.474), due to less travels made than was foreseen.
The projected other specific costs (€ 30.000) are lower than the reported other specific costs (€ 7.418) due to less costs made
WSAM
The projected travel costs (€ 17.200) are lower than the reported travel costs (€ 7.131), due to less travels made than was foreseen.
The reported equipment and infrastructure for WSAM (€ 740.000) are lower than the projected equipment and infrastructure (€ 454.573). This is mainly due to lower deprecation of equipment as described in point 1.3
The reported other specific costs for WSAM (€ 87.000) are higher than the projected other specific costs (€ 141.230) This is mainly related to higher costs for analyses, unforeseen costs for permis sions and costs for printing of the container.
CirTec
The projected travel costs (€ 35.400) are lower than the reported travel costs (€ 15.403), due to less travels made than was foreseen.
The projected equipment and infrastructure (€ 363.413) are higher than the reported equipment and infrastructure (€ 535.821). This is mainly due to higher and more costs needed for pumps.
The projected other specific costs (€ 30.000) are lower than the reported other specific costs (€ 7.418) due to less costs made

4. Overview on hours spent

Template downloadable from our website ht
tp://ec.europa.eu/environment/eco-innovation/managing-projects/contract-finance/index_en.htm.

Please complete the xls-file per partner (optional, you may report the total hours) and per WP, comparing fore seen and actually spent working hours since the start of the project. In the table "Hours per partner" you should indicate:

• Under the column "Annex I", the hours foreseen on the respective work package. These numbers are given in Annex I (in the table "Role and contribution of each participant in this work package").

• Under the column "Spent", the hours that you and your partners have actually spent on the respective work package from the beginning of the project until the end of the reporting period.

The table " % Project Hours already spent" is completed automatically and indicates the overview on hours spent in %.

5. Financial report

The final report has to be submitted by the coordinator in one consolidated package with the financial report and with a cover letter in which the coordinator requests the payment of the balance. For details on the payment of the balance please consult your grant agreement Article I.5.3, together with Annex III. Up-to-date guidance on financial issues such as general financial guidelines, financial report or timesheets to report the time worked on the project, is available on our website ht
tp://ec.europa.eu/environment/eco-innovation/managing-projects/contract-finance/index_en.htm

Attachments	report overview on hours spent .xlsx
Grant Agreement number:	630492
Project acronym:	Screencap
Project title:	Finescreen supported biological wastewater treat ment to enhance plant capacity
Funding Scheme:	FP7-CIP-EIP-EI-PMRP
Project starting date:	01/11/2014
Project end date:	31/10/2017
Name of the scientific representative of the project's coordinator and organisation:	Mr. Kees Roest KWR WATER B.V.
Period covered - start date:	01/11/2014
Period covered - end date:	31/10/2017
Name	
Date	02/01/2018

This declaration was visaed electronically by Bianca VAN DER WOLF (ECAS user name nwolfbbi) on 02/01/2018