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## **D42.5 M+E system for innovation and continuous monitoring of framework conditions and outcomes**

### **Approach and outline of indicator system**

**adelphi, January (2015)**



The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 619039

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## D42.5: M&amp;E SYSTEM FOR INNOVATION AND CONTINUOUS MONITORING OF FRAMEWORK CONDITIONS AND OUTCOMES

Approach and outline of indicator system

## SUMMARY

This document is part of DESSIN's work package 42, the route to market. The aim of task 42.6 is to set up an indicator system to keep track both on progress and impediments of conditions for marketization of the innovative products and services demonstrated within DESSIN. This system should document the respective framework conditions as well as outcomes. In order to achieve that, an effective indicator set as well as a monitoring and evaluation (M&E) system is developed that can be used by the SMEs developing and demonstrating innovative solutions within DESSIN. The M&E system supports the entrepreneurs in identifying application opportunities for their solutions during the course of the project and also after the project ends. As the first part of milestone MS18, this document outlines the initial approach and a potential set of indicators that could be used. The indicator system will be reviewed by month 25 and finalized by month 48.

## DELIVERABLE NUMBER

D42.5 (MS18, first version)

## WORK PACKAGE

WP 42

## LEAD BENEFICIARY

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## PLANNED DELIVERY DATE

31/12/2014

## ACTUAL DELIVERY DATE

12/12/2014 (for QA)  
19/01/2015 (final version)

## DISSEMINATION LEVEL

 PU = Public

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## List of acronyms and abbreviations

CBA	Cost Benefit Analysis
DESSIN	Demonstrate Ecosystem Services Enabling Innovation in the Water Sector
EC	European Commission
ESS	Ecosystem services
ETV	EU Environmental Technology Verification
EU	European Union
e.g.	For example
ICT	Information and Communication Technology
i.e.	That is
LCA	Life Cycle Assessment
M&E	Monitoring and evaluation
No.	Number
PE	Private equity
TBD	To be discussed
TRL	Technology Readiness Levels
VC	Venture capital

# 1. Approach and requirements of the M&E system

## 1.1 Introduction

This document is part of DESSIN's work package 42, the route to market and deliverable D42.5 of task 42.6 "Establish a monitoring & evaluation (M+E) system for innovation and continuous monitoring of framework conditions and outcomes". It is also the first version of milestone MS18 ("Indicator system developed").

The aim of Task 42.6 is to set up an indicator system to keep track both on progress and impediments of conditions for marketization of innovative products and services. This system documents the respective framework conditions as well as outcomes and in this way provides SMEs with a decision support system for approaching application opportunities at the right time and the right place. In order to achieve that, an effective indicator set is selected and a monitoring and evaluation (M&E) system developed which is tailored to the requirements of companies providing solutions for water related challenges in the context of ecosystem services. The final M&E system will be integrated into an easy to use online platform which the SMEs can apply on their own for their specific products and markets. The system aims to automatically update itself with only minimal external support thus making it usable also after the project ends. It will thus foster the uptake of ecosystem relevant technologies sustainably by providing long term services to the entrepreneurs.

As a first step, this document outlines the initial approach and a potential set of indicators that could be used – these will be updated in month 25 and finalized in month 48 of the DESSIN project.

## 1.2 Requirements for the M&E system

Marketization, i.e. opportunities for the application of innovative ecosystem service relevant technologies, is dependent on various **aspects**, which can be categorised into the following groups:

- A1. Product readiness
- A2. General market conditions for investments and demand
- A3. Regulatory environment and governance
- A4. Access to finance

Before monitoring information on the external framework conditions of a solution, in a first step, the **product readiness** of the solution itself should be evaluated. For this the maturity of the technology regarding the technical performance in relation to its applicability e.g. compliance with government regulations has to be assessed. In most cases the solution provider will have done this

prior to intending to market the product (the focus of this report is therefore rather put on the other three, external framework condition aspects).

If the product readiness has not been assessed this would need to be done prior to the evaluation of the external framework conditions. There are various approaches for evaluation of the product readiness that will be dealt with in Chapter 3.

The further three aspects are linked to the external framework conditions of a potential market region (e.g. as detailed in the outside-in reports).

For assessing the application opportunities of innovative environment technologies like ESS enabling solutions one of the most important external conditions is the **governance framework**. Rules and regulations make certain pollution abatement and nature conservation necessary which requires the application of ESS enabling solutions. These rules internalise external costs in commercial processes and thus create favouring market conditions.

Thirdly, **general market conditions** comprising of among others technical applicability and environmental circumstances demand for the product, favourable infrastructure and investment climate are important to be assessed.

Finally, the solution needs to be funded and thus the specific **access to financing options** plays a vital role. Specific financing services aiming at promoting environmental technologies and thus ESS solutions are an essential bottleneck for application opportunities.

The external conditions can be assessed on the basis of indicators which are specific to the market uptake of innovative ESS relevant technologies in the water sector. These indicators provide a basis for evaluating the current conditions for the marketization and can be applied to a specific product.

The M&E system has to be accessible to the solution provider who can then assess the market readiness for his product by making use of the monitoring information. Preferably, the M&E System is based on regularly updated third party indicators so that the M&E system can further be used after the project period. The indicator selection is dealt with in chapter 2 after defining the indicator requirements in chapter 1.3.

The overall M&E approach for assessing the current status of application opportunities for the DESSIN solution package or one of its components thus consists of the check of product readiness, then the assessment of the aspects of external framework conditions on the basis of certain indicators. Below graphic details the concept of the M&E system.

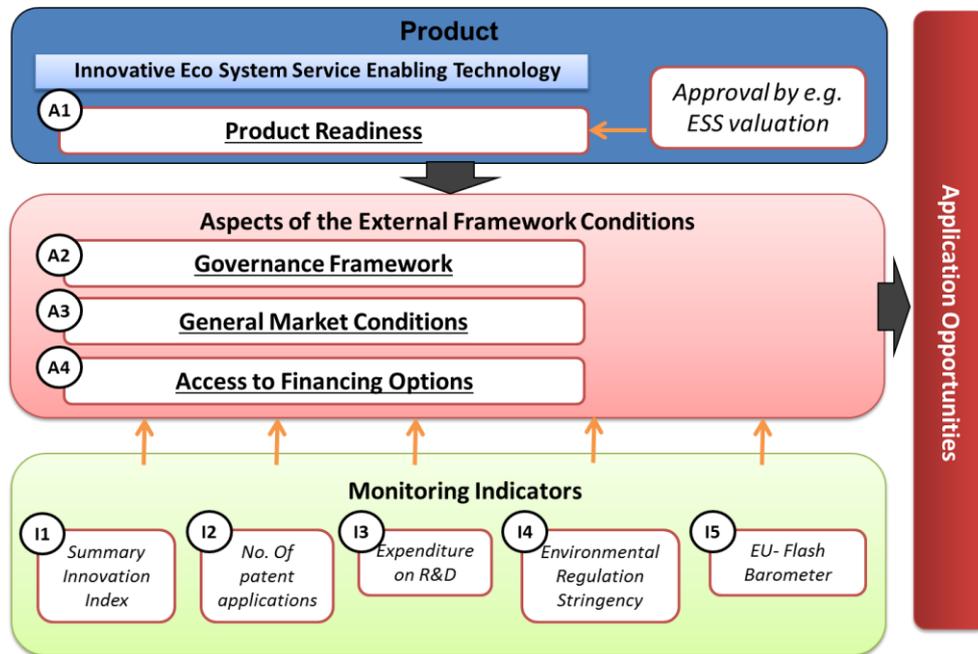


Figure 1: Initial suggestion for M&E approach; adelphi (2014)

### 1.3 Requirements for indicators

The identified M&E system requirements directly translate into the following necessary requirements/dimensions for the external framework condition indicators – i.e. apart from addressing the 3 aspect categories the indicators need to be:

1. a proxy for describing business and governance environment for innovation,
2. relevant for products and innovations in the water sector,
3. relevant for describing the valuation of ecosystem services (ESS),
4. updated on a regular basis,
5. available for all EU countries, preferably for other potential market regions,
6. connectable to a sub-website of the DESSIN project website,
7. aggregated to show a graphical result.

**1.** The indicator system mainly aims to measure the international innovation environment. Where possible, existing innovation indices should be used. Ideally, the indicator(s) should also take into account the characteristics of the different countries (i.e. which ones are particularly innovation friendly). Where possible, markets for innovations beyond the EU should also be taken into account.

**2.** As the DESSIN project focuses on innovative solutions for the water sector, indications for the demand and applicability of water quality control and solution increasing the available quantity are required

- 3.** DESSIN solution packages are promoted through enhancing ESS, thus an indication on the evaluation of the ecosystem and its services are required.
- 4.** In order to allow for benchmarking over time and for the indicator system to be self-sufficient after the project end of DESSIN, only those indicators should be used that are updated (automatically) on a regular basis.
- 5.** To allow for comparison, the indicators should preferably be available for at least all EU countries. In order to also assess possible export of products beyond the EU borders indicators should be chosen for which data is available in potential market regions.
- 6.** Regarding ICT requirements, the indicators need to be connected to a sub-website of the DESSIN project website. Preferably, the data base for the indicators is accessible online and can be read by an online assessment tool which in turn updates the website on a regular basis similar to the update frequency of the source data. This would need to be checked with the website developer.
- 7.** For ease of interpretation, the indicators should be aggregated in such a way that they provide a picture of the three or even four relevant aspects for the marketization of the solution. – i.e. a graphical method could be found (e.g. such a spider web, graph or bar chart) showing the development trend of each indicator.

## 2. Potential framework condition indicators

### Initial list of potential framework condition indicators

Following the criteria set out in section 1.3, a list of potential indicators describing the framework conditions has been compiled and evaluated.

Table 1: Initial list of potential framework condition indicators; adelphi (2014)

Name of indicator (source)	Description of the indicator	A. Market Conditions	B. Governance	C. Access to Finance	1. Innovation	2. Link water	3. Link ESS	4. Updated	5. EU wide or global	6. Website conn.	7. Graphical agg.
<b>Innovation Union Scoreboard – Summary Innovation Index</b> (EC (2014))	Aggregated data for all EU countries based on a set of sub-indicators (mainly from Eurostat); results for each EU country; updated yearly	X	X	X	X			X	E U	T B D	T B D
<b>EU Innobarometer</b> (EC (2014 b))	Annual opinion poll of businesses /general public on attitudes and activities related to innovation policy; part of the Eurobarometer series; different topics in different years (i.e. no single indicator)		X		X				E U		

Name of indicator (source)	Description of the indicator	A. Market Conditions	B. Governance	C. Access to Finance	1. Innovation	2. Link water	3. Link ESS	4. Updated	5. EU wide or global	6. Website conn.	7. Graphical agg.
<b>EU Enterprise by type of innovation</b> (Eurostat (2010))	EU enterprises in category: “water supply, sewerage, waste management and remediation activities”; only 2010 available from Eurostat	X			X				E U		
<b>Water information indices</b> (Eurostat –water statistics)	Water exploitation index contains i) the annual total fresh water abstraction, ii) the annual groundwater abstraction, and iii) the annual surface water abstraction; water use, water quality, sewerage connections and wastewater treatment. available for all EU countries; collected yearly	X				X		X	E U	T B D	T B D
<b>Patent applications to the EPO by priority year at the national level by IPC sections and classes</b> (Eurostat)	No. of patents applications in the IPC water supply and sewerage	X			X	X		X	E U	T B D	T B D

Name of indicator (source)	Description of the indicator	A. Market Conditions	B. Governance	C. Access to Finance	1. Innovation	2. Link water	3. Link ESS	4. Updated	5. EU wide or global	6. Website conn.	7. Graphical agg.
<b>Sustainable consumption and production headline indicator</b> (Eurostat)	Aggregated indicator that observes sustainable consumption and production patterns for all EU countries; does not include water (low priority)	X					(X)	X	E U	T B D	
<b>Headline Indicator on Gross domestic expenditure on R&amp;D</b> (OECD and Eurostat)	Percentage of country GPD spent on Research and Development	X		X	X			X	E U	T B D	T B D
<b>Environmental Regulatory Regime Index (ERRI)</b> (Esty 2002)	The ERRI is comprised of measures of various aspects of a country's environmental regulatory system including standards, implementation and enforcement mechanisms, and associated institutions. These variables capture regulatory	X									

Name of indicator (source)	Description of the indicator	A. Market Conditions	B. Governance	C. Access to Finance	1. Innovation	2. Link water	3. Link ESS	4. Updated	5. EU wide or global	6. Website conn.	7. Graphical agg.
	elements that directly affect pollution control and natural resource management (Esty 2002 page 80)										
<b>Environmental Regulatory Stringency Index / Dasgupta Index</b> (Brunel 2013)	The Environmental Regulatory Stringency index covering four media (air, water, land, and wildlife), five economic sectors and five different environmental dimensions: awareness, scope of policies, scope of legislation, control mechanisms, and implementation. This results in a ranking that can be compiled in aggregated form or separately for each media, industry, or environmental dimension. Dasgupta et al. showed that this measure is correlated with economic development (Brunel 2013).	X	X			X	X		G l o b a l		T B D
<b>ESS condition</b>	Maes et al. are working on EU indicators for ESS (not yet available)	X					X		E U		

Name of indicator (source)	Description of the indicator	A. Market Conditions	B. Governance	C. Access to Finance	1. Innovation	2. Link water	3. Link ESS	4. Updated	5. EU wide or global	6. Website conn.	7. Graphical agg.
(Maes et al. (2014))											
<b>River flow drought</b> (EEA (2012))	Water scarcity and drought events in Europe during the last decade and projected change in minimum river flow with return period of 20 years; shown in maps for EU; updates are scheduled every 4 years in October-December (latest data from 2012)	X				X			E U		
<b>Environmental Performance Index</b> (EPI (2014))	Has a worldwide ranking and includes ecosystem vitality, but is rather limited to describe the environmental situation	X	X				X		g l o b a l		
<b>Environmental Sustainability Index</b> (ESI 2005)	Comprehensive worldwide index for environmental situation, reports are published in 2 year turns, but since 2005 they do not seem to be online any more and communication seems only by post.	X					X	X	Gl o b a l		

Name of indicator (source)	Description of the indicator	A. Market Conditions	B. Governance	C. Access to Finance	1. Innovation	2. Link water	3. Link ESS	4. Updated	5. EU wide or global	6. Website conn.	7. Graphical agg.
Expenditure on R&D (OECD (2014))	Worldwide general index for expenditure (current and capital) on R&D by all resident companies, research institutes, university and government laboratories, etc. as a percentage of the GDP. R&D here is defined in three areas: basic research, applied research and experimental development. No specification on how much goes into each area. Yearly report stating figures of the penultimate year preceding publication.	X	X	X	X				G l o b a l	T B D	
EC Flash Eurobarometer (EC (2012))	Report on a survey carried out on attitudes of Europeans on water-related issues (e.g. level of information, seriousness of water-related issues, actions to be taken, role of different actors in water-efficiency topics); 2nd survey since 2009.		X			X	X	X	E U		

Name of indicator (source)	Description of the indicator	A. Market Conditions	B. Governance	C. Access to Finance	1. Innovation	2. Link water	3. Link ESS	4. Updated	5. EU wide or global	6. Website conn.	7. Graphical agg.
<b>Enterprises considering environmental objectives as very important</b> (Eurostat (2012))	Number of innovating enterprises considering reduction of environmental damage as very important objective, by size class and for EU countries. Might indicate useful links to existing markets or large enterprises interested in conducting environmental technology	X			X				E U		
<b>EVCA Barometer</b> (EVCA (2010))	Annual report by the European Private Equity & Venture Capital Association, 2010 Issue: <i>Cleantech private equity: state of the market</i> . Draws a picture of the grade of attractiveness for VC & PE-investors to engage in different sectors of cleantech (e.g. for environmental services). Includes figures with number of businesses, growth, growth forecast and countries of destination for venture cleantech investments.			X	X		X		E U		

## Pre-selection of indicators

From the list of potential indicators for the framework conditions only the most suitable indicators to meet our purpose are to be selected. In total we aim at limiting the number of indicators to a maximum of five in order to keep the monitoring and evaluation feasible with certain amount of resources available. The selection although limiting the overall comprehensiveness of the system makes it easier to be continued after the completion of the project as it is more effective and easier to maintain by the target group. The selection process suggested is the following: The indicators fulfilling the highest number of criteria are selected. This pre – selection provides a base for further evaluation of the opportunities for application.

The key indicator that can be used to measure innovation itself in the EU is the **Summary Innovation Index** of the Innovation Union Scoreboard. This indicator is collected regularly for all EU countries and is aggregated from a set of innovation indicators as detailed in below graphic.

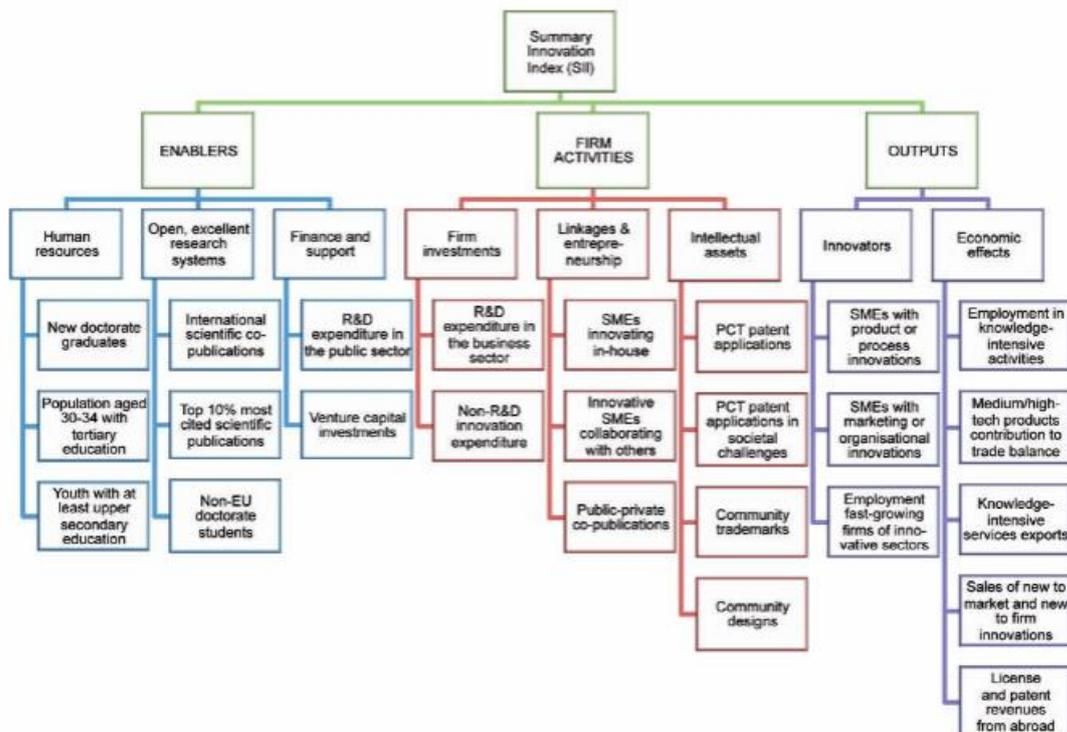


Figure 2: Measurement framework of the innovation union scoreboard; EC (2014), p.8

The next important index which should be looked into is the **No. of patent applications** in the field of water supply and sewerage. These give a good indication for the applied scientific activity in these specific sections.

The EU **Headline Indicator on Gross domestic expenditure on R&D** is a very important indicator for the access to finance, the OECD indicator on **Expenditure on R&D** further gives a scope outside

Europe. It could be thought of combining these two indicators in order to increase the reach out of the M&E System.

**Environmental Regulatory Stringency indication** is an important indication for the assessment of regulation framework which demands for ESS technologies.

**EC Flash Eurobarometer** provides a good indication on the awareness level of the general public on the solution demand for water related issues and is thus very relevant for assessing the demand for the specific ESS solution (TBD if topics are the same in every issue).

Other indices which e.g. describe the ESS status are very interesting, but rather limited to describe the environmental situation – a conclusion could also be taken in combination with the other indices e.g. environmental regulation stringency and finance assessment. A possible combination could then be: ecological status is low and regulation and financing is high, this could mean that there is a scope for the technology and the laws also provide a push for the solutions.

The current research did not reveal any index for “environmental regulation stringency”. However, such an index would be needed and then set in relation to the environmental situation and the availability of funds in order to identify the best market. This might not be so interesting for the EU as environmental laws are being streamlined but for markets beyond the EU.

From a practical point of view, the update of the indices as well as the publishing in the internet are prerequisites to make the index compatible with any kind of M&E system which should work automatically after the project end.

### 3. M&E for the product readiness

The M&E of the framework conditions provides information for the producer of an innovative product on the current market situation and the drivers for the demand for his/her product. On the other side, it is important to also assure that the product is innovative, performs according to its specifications, meets compliances and is economically feasible. The solution provider can check his market readiness with the following checklist. Ideally, the documentation for meeting the criteria should be approved by an accredited party or comply with a public accepted certification or verification process.

Table 2: Checklist with product readiness criteria; adelphi (2014)

Product Readiness criteria	Check (yes/no)
1. <b>Technical Performance:</b> The technical performance of the product has been assessed and is documented (> TRL 6)	
2. <b>Compliance with regulations:</b> The specifications relevant for assessing the compliance of the solution with rules and regulations are documented	
3. <b>Costs of the application:</b> The price of the product and its operation and maintenance have been assessed and documented	
4. <b>Innovation, benefit, value:</b> Advantages of the product in comparison to other standard solution with respect to socially, ecologically or economically perceived values are documented	

If any of the above criteria, especially the first three, have been answered with no then further product readiness evaluation has to be conducted.

Regarding the **technical performance**, the Technology Readiness Levels (TRL) mentioned in annex G of the Horizon 2020 Programme can be referred to. Generally, a framework condition can begin to be analysed for TRL3-5, a solution can initially be applied at TRL 6-7 and full application potential develops at TRL 8 (EC (2014d)).

Technical performance of certain products can be certified in accredited laboratories for any TRL. Some technologies, especially those interrelating with ecosystems can only be analysed in real case environments. As these full scale applications are resource intensive, care should be taken in advance to enable a setup which can have all necessary monitoring equipment and protocols in place to document the solution's performance.

When documenting the technical performance it would be necessary to include all the necessary parameters and specifications which are requested by government rules and regulations. E.g. a disinfection system would need to ensure that no E. coli and faecal coliform bacteria are present in the treated water. Only when these specifications are documented the external conditions for the rules and regulations can be compared with the solution in order to assess its potential demand.

An important aspect for the access to finance is the availability of data on the costs of the product and the expenses for operations and maintenance. These need to be assessed in order to identify suitable financing options and modes of funding for the solution.

Standard approaches which can include the above mentioned criteria in their scope of study are a Cost Benefit Analysis (CBA) or a Life Cycle Assessment (LCA).

The DESSIN project is also developing an ESS evaluation framework which can assess the environmental benefits regarding ecosystem service relevance of the solutions developed in the project. The results of the evaluation can provide a valuable information basis regarding the benefits within the CBA. For the ESS evaluation, the technological performance is assessed with regards to the impact on the ecosystem which covers specifications relevant for checking compliance with rules and regulations.

Another recently developed option for assuring the technical performance together with the environmental performance of the product is verifying this with the help of the EU Environmental Technology Verification (ETV). The ETV aims at supporting and promoting innovative technologies by providing a credible verification process. The verified performance is publicly accessible and thus a guarantee for the potential client of the product. (Figure 3)

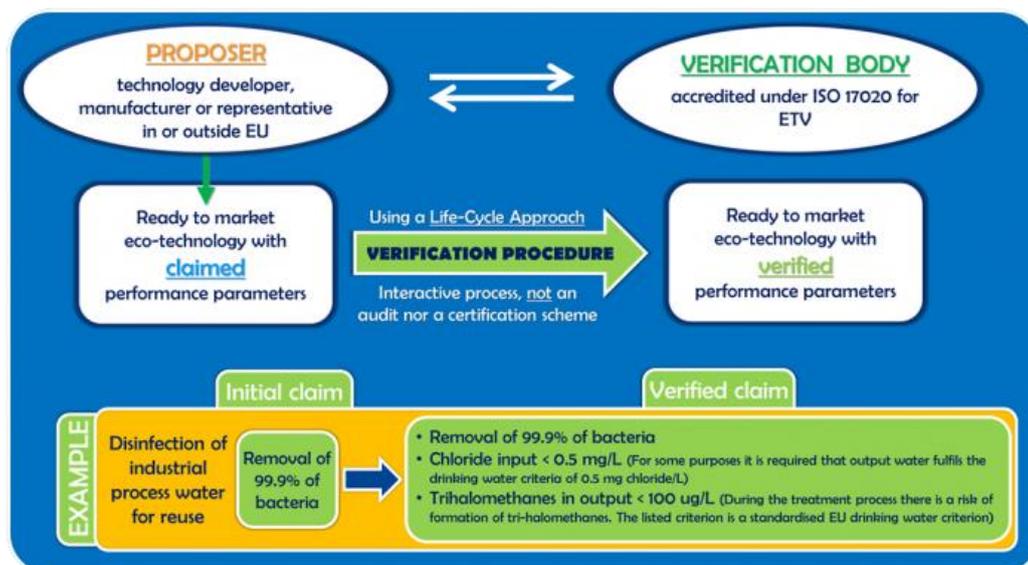


Figure 3: EU Environmental Technology Verification; EC (2014c)

The mode of documentation, valuation or certification varies according to the specifications of the solutions and a general suggestion is not possible. The above mentioned criteria and approaches should thus just support solution providers in the identification of options to assess their product readiness. Finally, the SME itself will decide on the product readiness and according to the circumstances and specific context further aspects might play important roles.

## 4. Conclusion and outlook

Conditions for application opportunities or marketization of ESS solutions have to be monitored from various aspects and there are a good number of indicators which provide a basis for the assessment of these aspects.

In order to provide a quick impression of the market situation an overall evaluation of the different aspects is to be concluded by an intelligent algorithm which takes into account the update intervals and the mode of publication of the indices as well as their regional scope.

On the other hand, the individual aspects will have varying importance for the individual solution provider - it is therefore necessary to also provide the individual information aspect and enable the solution provider to choose the aspect which is most relevant for his/her specific product. The individual relevance of each aspect will be worked out in the next phase of the DESSIN project in close communication with the SMEs who are providing ESS solutions.

The user frontend to the M&E system will be easy to use and integrated into the DESSIN online web platform. Where possible, indicators are aggregated and shown graphically. The technical details and feasibility need to be discussed further with the DESSIN website developer during the next development stages of this task.

We are looking forward to further discuss the suggested indicators, find ways of combining them in an intelligent way and then developing a M&E system which will benefit the solution providers so that the right time and the right place can be identified for the most optimal uptake of DESSIN solutions.

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The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 619039  
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