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ENVIRONMENTAL TECHNOLOGY VERIFICATION: A POSSIBILITY TO IMPROVE IMPLEMENTATION OF INNOVATIVE TECHNOLOGIES IN THE WATER SECTOR

Verifiering av miljöteknik: En möjlighet att förbättra implementeringen av innovativa vattenreningstekniker

by UWE FORTKAMP, CHRISTIAN JUNESTEDT
IVL Swedish Environmental Research Institute Ltd, Box 21060, 10031 Stockholm, Sweden
e-mail: uwe.fortkamp@ivl.se

Abstract

New technologies in the water sector can make treatment processes more efficient at lower total cost and with less environmental impact, but it is often difficult for new technologies to get from research to market. Therefore EU has proposed a number of measures to facilitate uptake of new technologies. One is the implementation of testing networks for independent third party verification of technologies. In order to design an EU verification system in the best way, experiences from existing systems were studied and a number of research projects performed. The EU project TESTNET and the Nordic project NOWATECH investigated how a verification system for water technologies should be implemented also including verification case studies for a number of technologies. The verification system will only be successful if it is designed to work efficiently. It has to be as simple as possible while at the same time guaranteeing high quality at reasonable cost. All possible measures should be taken to simplify the process without risking the quality of the output. An important aspect is to include all relevant parameters for verification, i.e. applying a life-cycle view and including customer needs. The European verification system is expected to be proposed during 2009.

Key words – Water treatment, innovative technologies, independent testing, verification, research to market, environmental technology verification, ETV

Sammanfattning

Nya tekniklösningar kan bidra till att effektivisera vattenreningsprocesserna till en lägre totalkostnad och med mindre negativ miljöpåverkan, men ofta är det svårt för dessa tekniker att etablera sig. Därför har EU tagit fram olika åtgärder för att underlätta implementering av ny miljöteknik. En av åtgärderna är att införa ett trovärdigt system för oberoende verifikation av en tekniks prestanda, vilket anses som viktigt för många intressenter. För att kunna göra systemet så optimalt som möjligt har man tagit del av internationella erfarenheter och startat ett antal forskningsprojekt. EU projektet TESTNET och det nordiska projektet NOWATECH har undersökt hur ett verifikationssystem kan implementeras för vattenrelaterade tekniker. För att göra ett verifikationssystem framgångsrikt krävs det att systemet är effektivt, för att okomplicerat genomföra en verifikation med hög kvalitet till en rimlig kostnad. I både TESTNET och NOWATECH har fallstudier med olika tekniker genomförts och förslag givits på hur systemet bör utformas för att åstadkomma detta. En viktig aspekt i verifikationen är att tillämpa helhetssyn för att kunna tillgodose alla behov kunderna har och samtidigt kunna visa på positiva sidoeffekter som nya tekniker ofta har vilka också kan leda till lägre totalkostnader. Det förväntas att EU kommer föreslå ett EU verifikationssystem under 2009.

Background

When analysing the market for environmental technologies in Europe and world-wide, it has been recognised that European environmental technologies have a much larger potential than their current implementation. This includes also a potential for new technologies in the water sector.

Based on an analyses of obstacles and opportunities, the European Commission adopted the Environmental Technologies Action Plan, also known as ETAP (COM(2004) 38 final). The plan was adopted by the Commission in 2004 to cover a wide range of activities promoting eco innovation. Its objective is to improve European competitiveness in this area, and enable the EU to become the recognised world leader. Eco-innovation means all forms of innovation activities resulting in or aimed at significantly improving environmental protection. Eco-innovation includes new production processes, new products or services, and new management and business methods, the use or implementation of which is likely to prevent or substantially reduce the risks to the environment, pollution and any other negative impact of the use of resources throughout the lifecycle of related activities.

One of the measures identified in ETAP is to improve the development from research to market by independent testing and verification of technologies. The idea is to provide independent and quality assured performance data for technologies in order to increase confidence in new technologies and allow purchasers to choose these new technologies based on reliable information.

At present a number of environmental technology verification (ETV) research projects are ongoing with the purpose to design a system that will be implemented within the EU to test and verify environmental technologies. One of these projects is the ongoing NOWATECH project (etvnord, 2009) where technologies within the water sectors are being tested and verified with partners from Denmark, Norway, Finland, and Sweden. A finalised EU research project, TESTNET (Est-testnet, 2009) also focused on water treatment and cleaner production. The research and development work performed in TESTNET and NOWATECH has resulted in relevant findings that are reported here.

Relevance for water industry

The water industry needs to meet future demands and future regulations. For the water industry a possible advantage by implementing new technologies is to combine a better environmental performance with a decreased production cost, which in most cases is created through savings or reuse of energy, water and/or chemicals.

A verification system, where the advantages and performance of new water technologies are tested by an independent body, can support the implementation of new technologies (Könnölä, 2007), which is in line with the ETAP. An important aspect is to provide interesting and reliable information for decision makers. It is one of a number of tools that has the potential to facilitate innovations in the water sector. Today the most common task is to improve the existing production and treatment facilities. A new technology has to fit into the existing systems and it has to be proved that it performs better than the current one.

The case studies from TESTNET and NOWATECH include water technologies. In the NOWATECH project a basis for the implementation of verification within the Nordic countries is developed. Within NOWATECH, a number of interesting Nordic water technologies have been collected (Arnold, 2008). The project supports the Nordic environmental water technology industry in both the home market and the global market by providing access to accepted and comparable verification data for their technologies. EU has pointed out water technologies as one of the important sectors for a verification system (Clark, 2008).

Description of a possible verification system

The verification system to be implemented in the EU is still under discussion. The experiences from similar systems running in the USA and Canada that have been investigated in a separate study (Merkourakis, 2007) will be used as well as findings from the EU research projects and studies. It is expected that a formal proposal for implementation will be presented this year.

A verification system will consist of different steps and involve different organizations. Figure 1 shows a possible outline as presented. A main task is to balance the output quality of the system with the costs and time for verification.

The information presented here is based on the results of the ongoing research projects as well as the information already provided by the commission. The final system might still be different to this outline. The system is likely to be vendor driven, i.e. a provider of a technology applies for verification at a national contact point or one of several thematic verification organisations.

On top of the organization acts the EC, initiating the ETV-system and controlling the program (van Naers-

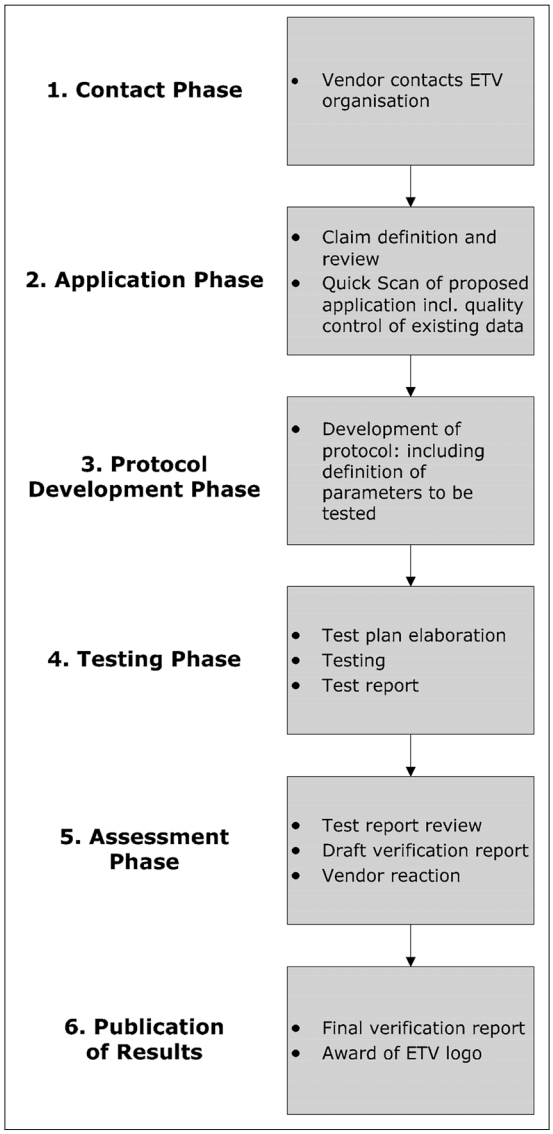

Figure 1. *Possible outline of a coming EU ETV (environmental technology verification) system.*

sen, 2007). The core process is covered by an EU-ETV team as part of the EC. This EU-ETV-team is supervising a public or private entity under their subcontract which is responsible for running the day-to-day process of the EU-ETV. A network of public/private institutes is performing the actual process of verification and testing. In order to safeguard independency, there must be a clear understanding of position, roles and responsibilities for each entity within the organization. The verification process is designed to be as simple as possible in order to reduce verification costs and verification time, but without compromising quality of verification in order to produce trustworthy results.

The verification, which also is described in Figure 1, starts with a vendor claim on the performance of the product in question (1). In the beginning the claim and the technology are reviewed, if they fit for verification (2). Additionally the quality of existing data is examined and checked if usable for verification. This step is done by a verification organisation.

During next step a verification protocol is produced (3). The protocol plays an important role, as it defines the parameters that have to be tested during verification. It is based on the claim, but includes also other parameters that are important for potential customers. Independent experts are involved in order to establish the set of parameters. The protocol also sets the framework for testing of the product.

Existing data are used as far as possible for verification, but if needed tests are performed to verify the performance of the parameters defined in the protocol. When testing is needed, a test plan is set up based on the protocol. Tests are performed and reported. Test plan, testing and reporting are done by a testing organisation, which very likely is different from the verification organisation (4).

The test results are checked against the performance parameters from the protocol. The results of this check are documented in a draft verification report provided by the verification organisation (5). A final version and verification logo are provided by the EU ETV team (6).

Experience from research projects and case studies

Within the different projects to investigate implementation of an EU ETV system a number of activities have been performed with relevance to the water sector. Both TESTNET and NOWATECH are projects that focus to a large extent on water technologies.

According to the investigations by VTT (VTT the Technical Research Centre of Finland) in the TESTNET project, there "will be new opportunities for the control and treatment of water processes that will lead to efficiency improvements in the management of resources, and the quality of outputs and better environmental quality. The improved understanding of chemical processes supports the development of new water quality monitoring and treatment technologies, which enable better modelling and simulation and will ultimately, lead to improvements in the planning, development and management of water resources." The report

stresses the role that ETV can play in the enhanced implementation of environmental technologies, especially by providing information about quality and performance of new technologies.

Within the NOWATECH project, VTT provided a market report for water technology, showing that "ETV will have increasing value as a marketing factor. ETV will also attain increasingly market brand value as it becomes used and known." An important factor is the increased importance of environmental performance of techniques especially in comparison with existing solutions.

Several case studies have been performed to test a possible ETV system and to provide input for an implementation. Table 1 shows an overview of the tested technologies in the water sector.

Within the case studies, verification has been performed according to a tentative schedule which includes all important steps from setting up parameters to testing and verification. There are a number of findings from the different case studies within TESTNET and NOWATECH.

All possible measures should be taken to simplify the process without risking the quality of the output. When protocols for a similar technology and application already exist, the verification will need fewer steps, as the protocol procedure can be simplified. Another measure to make the process more efficient is to develop protocol and test plan in parallel. The quality assurance procedures might be simplified if the quality of the involved organisations is guaranteed. A database with qualified organisations could be established.

The verification can be simplified when existing data can be used. Therefore early integration of the verification in the product development process is desirable. When performing tests during product development, they should be designed to fit for a possible future verification, e.g. assuring data quality by measurements done by an external organisation. This will reduce the need for additional testing during the verification. The initial screening of the technology is important, as it allows checking the suitability of the claim and the technology. It also allows checking the amount of available data and its quality.

For the customers it is important to get a comprehensive view of the technology. Therefore it has to be assured that all relevant parameters of a technology are tested. This includes parameters for the benefit of the

Table 1. *Water related technologies verified in case studies (product names in Italic style).*

Technology/*Product*	Application	Project
Bio- monitoring *(Toxcontrol)*	Water monitoring	TESTNET, NOWATECH
Optical monitoring *(S::can spectro::lyser)*	Water monitoring	TESTNET
Passiv sampler *(Sorbisense)*	Water monitoring	NOWATECH
Membrane technology Vilokan AB *(EnvoSep1000 and 1200)*	Degreasing bath /cutting oil treatment	NOWATECH
Evaporation Vilokan AB *EnvoVap 5500 and Prowadest 1000*	Degreasing bath/cutting oil treatment	NOWATECH
Membrane technology Mercatus Engineering desalination equipment	Condensate cleaning	TESTNET
Water filtering *(Fuzzy filter)*	Water cleaning	TESTNET
Biofilm reactor *(Krüger Kaldnes Moving Bed Biofilm Reactor)*	Municipal wastewater	NOWATECH
Membrane bioreactor *(BioWater CFAS)*	Municipal wastewater	NOWATECH
Oxidation (UV/H_2O_2)	Taste and odour removal	NOWATECH
Oxidation (UV/O_3)	Taste and odour removal	NOWATECH
Disinfection by: 1. addition of chlorine dioxide; 2. anodic oxidation; 3. elektrodiafragmalysis; 4. UV-technology; 5. ozonisation	Reuse of water in food industry	TESTNET

technology as well as resource use, which allows estimating the environmental burden and operational costs.

According to the TESTNET project investigations, running the verification system will require public funding for general system issues (including protocol development), while case specific costs like development of a test plan and testing have to be paid by the vendor. It is proposed that applicants pay a limited fixed fee for the initial screening of the technology and, apart from the testing costs, a percentage of the verification costs. The total costs of the verification should be roughly known after the initial screening. Other findings of TESTNET are:

- SMEs (innovation oriented) are the type of companies expected to benefit the most from an ETV system
- The ETV system has to be totally independent
- The cost is an issue of the utmost importance for the vendors – As many stakeholders as possible should contribute financially to the system. Financial help is a strong incentive to go through the verification process.
- The ETV system should remain voluntary but strategies have to be developed to motivate participation in it, without the system becoming mandatory.
- A clear system to handle confidential information is needed.
- The verification often also leads to improvements of the technology, as ideas for improvements often arise during verification.

There are also some general findings from the survey and the research projects.

- There is a need for third party verification; customers are more likely to choose a new technology with third party verified information.
- Cost is an important issue for vendors. SMEs are probably not capable to pay the total costs of verification, but there might be instruments to handle this. Besides the costs, also quality of the system and the results produced are important. Only if verification produces reliable results, it can have an impact on the market.
- The international market is important for vendors. An EU wide verification system that facilitates access to the EU market is seen as an advantage, as a single Nordic country usually does not provide enough market opportunities.
- In many industrial applications, best available technology (BAT) has to be applied according to the Integrated Pollution Prevention and Control directive. For a number of industries, documents describe what can be regarded as BAT. For new technologies it is often difficult to compete with the established technologies mentioned in these documents. Verification could be used as a shortcut to integration of these verified new technologies in order to be an alternative BAT technology.
- Clear advantages for customers are the access to reliable and comprehensive data, and, in the end access to better techniques than those that are standard today.

Discussion and conclusions

The research work and studies performed show that there is a clear need for third party verification of environmental technology in the water sector. A verification system will structure the verification process in order to guarantee high quality information at affordable costs.

A verification system is only one of several possible tools to facilitate implementation of innovative environmental technologies. A first pre-requisite is the incentive to invest in new technologies, which can be somewhat restricted in the at least partly mature market of water technologies. By verification of technologies in a holistic approach, the verification can show the total performance of technologies, not only single specific parameters, thus showing possible positive effects on the total economy and environmental impact, which often is an advantage of new technologies. A new technology might for example achieve the same or better treatment results, but also be more energy efficient, which can be an important reason to invest.

How successful the verification system will work in practice is dependent on how it is designed:

- The costs for verification will have to be limited, which can be achieved by several measures, e.g. by including existing data when the data quality is assured. Especially for SME there might be the need to support the financing of verification, which often is possible with already existing national funding programs. Part of the general costs, like administration of the EU system, should be covered by EU.
- The quality of the output has to be assured, i.e. verification has to produce reliable data in order to facilitate decision making processes for customers. By assuring the quality in the working procedures of the involved organizations, some time and cost intensive quality assurance steps might be avoided.
- The system is planned to be voluntary, which makes it free for vendors to decide if they want to participate. On the other hand, verified new technologies might get an advantage or at least equal pre-requisites compared to existing technologies as their performance is documented by independent organizations.

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