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# 1 INTRODUCTION

Innovative Environmental Technologies are urgently needed in order to provide solutions to the current major environmental challenges: climate change, loss of biodiversity, etc.

But, the introduction of a new technology into the market is not an easy task, mainly due to a lack of sufficiently reliable performance data. End users, and above all, SMEs prefer to use more tested technologies rather than the new ones.

In this context, in 2004, the European Union adopted the “Environmental Technology Action Plan” (ETAP)<sup>1</sup> to improve the development and wider use of environmental technologies, which are defined as “all technologies whose use is less environmentally harmful than others”. One of the priority actions of ETAP is “Establishing European Networks of technology testing, performance verification and standardization”. An Environmental Technology Verification (ETV) System would be a tool to support this.

ETV means the assessment of individually defined performance claims of a certain product. The assessment of the performance claims is done by independent institutions using given verification protocols. Verification differs from “certification” as certification validates the compliance with standards and legal requirements.

However, to date, different definitions of Environmental Technology Verification exist:

- According to IWG lexicon ETV means the provision of independent, credible, relevant test data on the performance of an environmental technology that have been collected by a technically-qualified third-party operating under a documented quality management system and using documented verification procedures and processes .
- The EU defines it as the provision of objective evidence that the technical design of a given environmental technology ensures the fulfillment of a given performance claim, taking any measurement uncertainty and relevant assumptions into consideration.
- When it comes to conformity assessment, verification would be confirmation through examination of a given item and provision of objective evidence that it fulfils specified requirements.

In summary, the ETV System is a tool meant to:

- Reduce the gap between the development of a the technology and the introduction in the market
- Accelerate the market acceptance of Innovative Environmental Technologies.
- Verify technologies already developed and ready for the market.
- Provide reliable, transparent and independent information about the technology.
- Provide technologies end users with information about technology performance claims.
- Decrease the uncertainty in purchasing decisions.
- Facilitate the implementation of public policies
- Verification Statement recognized in all EU Member States

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<sup>1</sup> COM(2004) 38 final

## 2 ETV SYSTEMS BACKGROUND

### 2.1 Existing ETV systems

The development of ETV programmes is a recent phenomenon originating from North America. Just as eco-labelling provides guidance to consumers seeking to purchase “environmentally friendly” products, verification programmes have been designed as a means to accelerate market acceptance of innovative technologies.

The American ETV system and the Canadian ETV system are the pioneer systems in the verification of environmental technologies. Based on these two first systems, which have different characteristics, other ETV systems were developed in South Korea, Japan, Bangladesh, and elsewhere. The subsequent systems, which integrate the basic concepts of the first systems, have been adapted to meet specific local or regional requirements.

Since one of the primary objectives of Advance ETV is the integration and coordination of the European ETV system with existing and fully operating technology verification systems outside the EU, some of the existing ETV systems will be described briefly:

#### ***U.S. ETV***

The objective of the U.S. ETV programme is to provide credible performance data for commercially-ready environmental technologies to help vendors in selling innovative technologies, and regulators and purchasers in making their decisions. The verification is carried out by public-private partnerships conducted through competitive cooperative agreements with non-profit making research institutes. A broad based stakeholder process helps in choosing technologies, developing protocols and approving verification reports whereas the U.S. Environmental Protection Agency (EPA) has the overall responsibility of the programme. The programme is structured around a small number (five in 2005) of specialized verification organizations.

U.S. ETV follows a dynamic strategy where many different options are tested, modified and improved. In this way, a number of the verification organizations do not continue operation after the pilot phase and new organizations are created.

In U.S. ETV, technology performance is evaluated using generic test protocols developed with independent stakeholder advice. The technology is performed inside the system. The procedure of stakeholder involvement is time consuming but enhances the credibility of the system. All data and reports are publicly available.

The system provides no guarantee for “good” performance. It declares that the technologies have been tested under specific conditions and some of their characteristics have been measured. The buyer has to apply specialized knowledge to rank the technologies.

#### ***ETV CANADA***

ETV Canada has similar objectives to those of the U.S. ETV. The aim is to provide the market with evidence that a vendor's claim on technology performance is credible and supported by quality independent data. An independent private entity, OCETA, having received delegation from Environment Canada, is responsible for managing and running the programme. This system has developed two options for technology evaluation, namely verification and benchmarking. The verification scheme is technology specific whereas the benchmarking scheme is sector specific (like U.S. ETV).

The system does not directly verify the performance of the technology but verifies the vendor's claims on that performance. These claims are based on previously established data, and they must respect minimum standards and guidelines in force in Canada. After verification, ETV ascertains that the data have been examined and have been found sound. Accordingly, the claims provided by the vendor are supported by these data. The testing is done ex-ante by an independent, accredited laboratory. The claims are published but the test protocols and data are not.

## NORDIC ETV

In Europe, DANETV is an on-going initiative for Environmental Technology Verification, which is run according to the guidelines for technology verification that are being developed as part of the establishment of the coming EU ETV scheme

The Danish Centre for Verification of Climate and Environmental Technologies, DANETV, offers an independent test of technologies and products for the reduction of climate and environmental changes and of monitoring equipment detecting environmental changes. The focus is on technologies that are of great importance to the progress of climate and environmental strategy and also on the positioning of Danish suppliers of innovative technologies.

- Air emission
- Energy efficiency
- Alternative energy production
- Water treatment and water monitoring

## 2.2 EU ETV related projects

In the EU as whole, there is not a verification programme like those mentioned above. Nonetheless, partially resembling systems for certification, approval or eco-labelling exist. Some systems such as UK MCERTS, German UBA, French ACIME, Belgian PRODEM, EU Ecolabel, and German Blue Angel present organizational aspects that closely resemble ETV practice. The MCERTS certification and UBA type approval verify technology performance against minimum performance requirements. These systems are de facto mandatory (in the sense that a company cannot easily enter the related market before passing through these systems), pass or fail systems. The EU ETV System, on the contrary, would be a voluntary system.

As a preparation of the EU ETV system, some European projects have been carried out in order to evaluate the degree of already existing regulation, the available financial budget, the stakeholders involved, etc, to pursue the aforementioned ETAP goal to improve testing, performance verification and standardization related to environmental technologies.

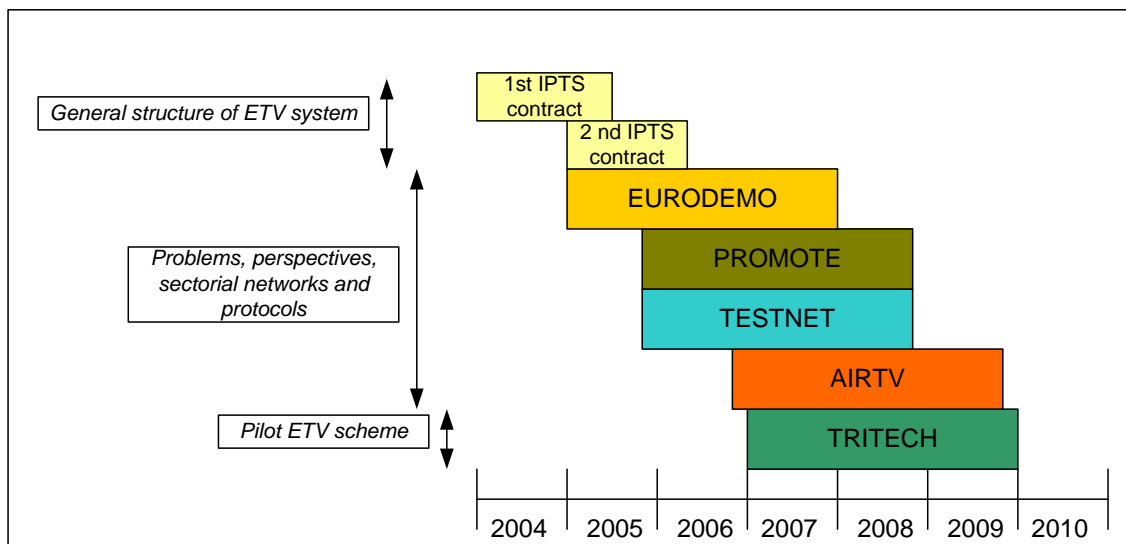


Figure 1. Overview of EU research on ETV

Table 1. Overview of EU ETV Projects

	EURODEMO	PROMOTE	TESTNET	AIRTV	TRITECH
Technology Areas	Soil and groundwater remediation technologies	Site characterization/ monitoring and remediation technologies for soil and groundwater	Water technologies and clean production technologies including monitoring technologies within these two areas	Air emission reduction technologies	Soil remediation, waste water and energy related technologies
Strategy	To collect and process information on technology demonstration	Elaboration of a generic verification concept including verification case studies	Developing organizational structures and testing systems including a business plan	To provide reliable and independent testing protocols for Air Emissions Abatement Technologies	To develop a working methodology for testing and verifying environmental technologies and to test 15-20 technologies under stakeholder involvement
Goal	To become the European contact point for co-ordination of technology demonstration	Developing verification processes for site characterization/ monitoring and remediation technologies for soil and groundwater	Developing verification processes for environmentally sound technologies	To develop a verification system of Environmentally sound technologies, propose an organizational framework for testing and verification for Europe	To establish a mechanism to validate objectively the performance of innovative environmental technology products
Period	2005-2007	2005-2008	2006-2009	2006-2009	2006-2009
Funding	FP6	FP6	FP6	FP6	LIFE

In the following paragraphs an overview of the main stakeholder consultations within each of the projects is provided.

### **EURODEMO**

EURODEMO gathered stakeholder input from a workshop in Katowice, Poland, in September 2005 and from ConSoil Special Session 2, in October 2005. The needs identified were wide-ranging in both scope and priority but may be grouped in the following categories:

- Information flow, for instance:
  - Linkages to the ETV initiatives and SedNET and NICOLE.
- End user dialogue
- Programmes & projects, for example:
  - Success reports are needed, as well as, reporting of failures.
  - A database/search engine should be developed. This DB should differentiate between projects that have been assessed and projects that have not.
- Decision processes:
  - It is essential to have simplified procedures and overall objectives and indicators.
- Efficiency
  - Efficiency objectives and indicators need to be defined. Therefore, efficiency outputs will be comparable.
- Technological reliability:
  - In order to guarantee technological reliability various needs were identified, such as, end-goal oriented reliability objectives, reliability indicators and a demonstration quality certification scheme.

## PROMOTE

In November 2007, the PROMOTE project gathered 150 experts from research, industry and administration, mainly in the field of site characterisation and monitoring and remediation technologies for soil and groundwater. The main points of discussion were the following [9]:

- The definition or review of performance claims should take care that the specifications of the claim should correspond to available test methods, and should include possible requirements of users and regulators; for remediation technologies, the claim should cover both the technology itself (hardware) and the engineering necessary for the technology operation; in any case, the boundary conditions for the validity of the claim should be clearly stated.
- The verification system should be as cost-efficient as possible, providing multiple entry points for applicants, ensuring the appropriate recognition and expertise for testing laboratories, using accreditation and certification structures where appropriate.
- Verifications in this technology area should make use of both reference site testing, to validate the technology principle in good conditions of comparability, and field testing for operational conditions and engineering. Verification of remediation technologies should be particularly challenging.

In the final conference in September 2008 [10], additional discussion points were raised:

- It has to be pointed out clearly, that ETV aims to verify specific products and not verification of a technology in terms of a class of products. Verification should also go further than legislation, because if technology acceptance and application procedures are regulated by national law, verification will not help. However, verification has to remain voluntary. In case it becomes mandatory, innovation may be hindered by discriminating non verified innovative technologies.
- The focus was also set on increasing technology sales. A faster entrance of verified products into new European and international markets would be a great benefit for technology providers. In this context, an international, mutual recognition would increase the attractiveness of a European ETV scheme. A well traceable ETV logo, with an easily understandable range of validity would be essential for acceptance.
- To overcome implementation barriers, languages other than English (at least, national languages of the major target markets of a product, which is prerequisite for acceptance by public administration) were found necessary, as well as National Contact points.
- Cost was once again identified as a hindering factor, that is why the benefit of verification has to exceed verification costs to attract vendors and to convince customers. Furthermore, additional funding would be of major benefit for ETV acceptance.
- A lean EU verification organization that contracts experts on a case specific basis is recommended instead of large technology sector specific verification centres.
- Another issue raised was that verification should be linked to the BREF Documents. A successful verification should ease the uptake of innovative technologies in the BREF chapter “Emerging Technologies”
- Standardisation of the ETV procedure as such is welcome to ensure a EU-wide comparable handling of the verification procedure. A standardised ETV procedure does not mean the compliance of a technology or technology provider with a standard, e.g. ISO 14000 et seq., but the execution and documentation of the verification according to a predefined procedure.
- The main requisites of the verification procedure were also identified:

- Identifying credible, verifiable claims is the most important task within the verification process. It must be possible to adjust claim according to the test results.
- Verification must allow multiple points of entry: initiation by vendors and regulators.
- A well balanced approach between the acceptance of existing data and the credibility of the verification system has to be ensured.
- Liability issues have to be clearly defined for a European verification scheme.
- Combination of verification with pilot installation or demonstration - within the client's application - would help to reduce efforts for verification.
- Qualification of laboratories should be based on accreditation or comparable record. Where outstanding qualification is required this has to be proven individually.
- Sampling, handling and transport during technology testing has to comply with related, generally accepted procedures and protocols. Keep shipping time at a minimum.
- Logistics is a crucial point for field scale verification, e.g. sample handling and transportation, on site infrastructure, testing schedule.
- The vendor should be integrated in the selection of test and analytical laboratories.
- Dissemination of verification results must guarantee protection of company internal know-how.

## **TESTNET**

The TESTNET project consortium organised a workshop for ETV end-users on 8 and 9 May 2006 in Stockholm, and an international seminar on ETV gathering 70 participants on 3 October 2006 in Espoo. The main conclusions of the two events are the following:

- ETV should focus on areas of interest for citizens like eco-construction and renewable energies. Attracting people who are not familiar with the ETV concept is very important. It can be achieved only with a well designed and "professional" awareness and explanation campaign.
- ETV should not replace standards or type-approval systems, since ETV verified technologies are expected to perform beyond any minimum performance requirements. The link between ETV and green public procurement should not be imposed by legislation but developed by an awareness raising process.
- Vendors seem ready to participate to ETV with the condition that EU wide recognition for the scheme is strived for. The importance of international recognition was mentioned and the formation of international working groups to co-verify or co-develop protocols was highlighted as a meant to achieve it.
- ETV can provide guidance on venture capital investors that finance innovative projects developed by SMEs (Small-Medium-Sized Enterprises) or start-ups, and socially responsible investors, concerned with sustainability issues without prejudice to return on investment. There is a need for reliable data to guide their choice of projects to be financed. ETV can provide means to the innovative companies to prove to the capital owners that they are on the right track.

## **AIRTV**

The AIRTV project organised a workshop with 29 participants on 5 June 2007. The main results of discussions were the following:

- The identity and organization of verification bodies appears essential to guarantee both the credibility of the system and its cost-efficiency, which could be improved by a level of competition between verification bodies, possibly through an accreditation system.



- The performance claims should be reviewed to ensure that important environmental impacts are not missed; it should include both the technology itself and the engineering; in the area of air pollution abatement, the verification of simple applications seems more appropriate than the verification of complex systems.
- The testing period should be limited to two months, and the detailed test report should remain confidential to preserve intellectual property rights, while a public part of the report should be published and registered by the ETV system.
- Links could be arranged with demonstration programmes, in particular to ensure that quality data is generated during demonstration projects, thus reducing the need to organise specific tests for the performance verification after demonstration.

In the final conference in October 2009 [11], international perspectives had also become a relevant discussion point:

- On international level ETV approaches distinguish between claim and application oriented verification strategies, this has to be considered in mutual recognition and harmonisation.
- Enhancing markets by international acceptance is highly appreciated, but has to cover the international target markets for vendors.
- Recognition by users is most important, as it is independent from the formal recognition of schemes. Harmonising the global stakeholder processes needs to be done as well as their integration is different from scheme to scheme.
- Additional costs induced by mutual recognition will only be accepted in case of an appropriate benefit on the market.

## **TRITECH**

Throughout the various stages of the TRITECH ETV project stakeholder consultations had been carried out and there were various issues and challenges experienced which have been extremely useful for drawing out lessons for a wider EU-ETV scheme, especially on the following areas:

- Developing the Verification Process
- Applying an ETV Scheme
- Economic Assessment
- Recommendations for technology vendors
- Recommendations for an end user

## 3 STAKEHOLDER ´S NEEDS & EXPECTATIONS

In this chapter the needs and expectations of the ETV stakeholders are analyzed, by taking into account the results obtained in the projects mentioned above (see figure 1).

In section 3.1 the results are presented in tables the needs and expectation regarding the stakeholders which a priori will take part in the European ETV system; applicants or vendor, technologies end users, verification bodies, test labs, public administrations of the State Member, the European ETV team and National Contact Points. Besides the needs and expectations, a brief description of each stakeholder is provided

In section 3.2 other ETV system related aspects are mentioned, which are considered important for the European ETV system but not associated with a specific stakeholder.

### 3.1 EUROPEAN ETV SYSTEM STAKEHOLDER ´S EXPECTATIONS

#### *APPLICANTS / VENDORS*

The entry point for the vendor has been placed at the level of the Thematic Verification Organization, but multiple entry points can be also envisaged.

The vendor contacts the ETV system by its own initiative or is asked to participate if the system follows a proactive approach. The input of the vendor can take either the form of a claim, accompanied by supporting data, or, the technology in question, accompanied by his advice on how to test it. The vendor has to collaborate actively with the other ETV actors, depending on the specific design of the system, including the test laboratories/verification centres, stakeholder groups and verification bodies (VB).

#### ***Entry at the level of the VB (or EU ETV team)***

The vendor contacts the VB who manages the entire process. The VB examines the application, develops the test protocol (if needed), executes the tests or subcontracts them to a qualified testing laboratory, (or identifies a suitable verification centre for claim verification) etc. In this case, the vendor only contributes when solicited by the VB (approval of test plan, training of testing staff, etc.).

The advantages are a better control of the process according to the established rules, thanks to an experience effect (e.g. dedicated staff who deal with all the ETs verified by the VB). Additionally, any technologies that do not fit inside the scope of ETV are screened out at an early stage.

### **Entry at the level of the Testing Laboratory/Verification Centre**

The vendor may enter the system by contacting directly an accredited testing laboratory, which informs the VB that verification is being started. The VB then checks that the technology is within the scope of the ETV system and that the testing laboratory complies with the requirements to conduct the test. The VB will have to verify that the testing laboratory is accredited, if relevant, that it is competent (in terms of staff, knowledge and test facilities) to test the technology, and that it is truly independent from the vendor's interests.

The main advantages of this solution is that the vendor independently chooses the test laboratory, hence competitiveness rules apply and the vendor can seek for the most convenient laboratory (taking into account the geographical proximity and language issues, the reputation or high technical level of the laboratory, the appropriateness of the test equipment) or for the less expensive one.

The main disadvantages of this option is that since it is only solicited for a verification once in a while, the test laboratory may lose a lot of time on the administrative procedures it is not very familiar with. However this burden can be born by the VO if the procedure is adequately well engineered. As a conclusion, both options have advantages and disadvantages. Having a system with multiple entry points seems to be the best solution.

<b>Advantages of ETV for applicants</b>	New business opportunities
	Access to European market (ETV system) speed up the acceptance of a new technology in the EU-27.
	Increase the credibility and recognition
	Speed up the acceptance of the technology in the market.
	Increase the technology sales (not totally proved)
	Increase competitiveness
	More benefits for SME.
	ETV system allow the to compare products more easily
<b>What do applicants need?</b>	Technology ready for the market
	Claims well defined and with clear checkable performance criteria.
	Distinct criteria that clearly define if a technology is eligible for getting into a verification system (The ETV system should define these criteria).
	Money for the verification process.
	Reliable data for the technology verification
	Claim definition has to tackle geographical boundary conditions
	Results of the technology obtained from a demonstration project.
	Vendors should be open to redefine the claims after verification tests in case the change would be necessary.
	The release of information from technology owners will increase the confidence of funders in the usefulness of innovative technologies.[6]
<b>What should ETV system provide to applicants?</b>	Combine the verification of technology and engineering
	The feasibility of verifying any type of technology.
	The feasibility of verifying a prototype on the basis of established protocols in order to compare and decide if the technology is ready for commercialization. A verification of a prototype should not, however, lead to awarding an ETV logo. [7]
	Simplicity. Vendors should be able to initiate a verification procedure
	Market International recognition
	Verification logo
	A system open to all companies. SMEs and large companies.
	Provide other services such as benchmarking, marketing, international cooperation, life cycle analysis, and insurance of innovation pilots.
	Simple, fast and accessible system
	The system has to allow that specific information that is crucial for the company has to be kept confidential.
	Motivation to verify their technology in a voluntary frame (legal or financial incentives, usefulness, etc)

<b>Barriers</b>	Verification cost
	Difficulties to substantiate their claims.
	In some cases, vendors do not associate the ETV system with an increment in sales neither in the introduction into European markets.
	Vendors are reluctant to attribute part of their sales on ETV process.
	Vendors foresee problems for ETV if it does not judge at the end
	How to adjust a technology to a particular site in a standardized way (PROMOTE)
	Administrative burden. Vendors will be typically short on staff resources.
	Most vendors are vague about these existing systems, and only few vendors were able to cite the names of the type approval systems they supposedly have to go through to be able to enter a certain country's market. [7]
	The long period of time needed to go through the administrative steps and the testing is an obstacle to sales.
	Some measures suggested that to help SME with the verification costs may not be compatible with EU competition rules. [7].
	About 90 % of the interviewees agreed that verification would not accelerate the entrance of the ET on the marketplace [7]
	No direct increase of sales has been observed by the interviewees [7], either because it is difficult to differentiate if the customer has been attracted mainly by the ETV logo or by the product characteristics, or because ETV truly had no impact.

## END USERS

The end users perceptions regarding an ETV System could be summarized as follows:

<b>Advantages of ETV for end users</b>	Way to evaluate the credibility of new technologies
	Decrease uncertainty in purchasing decisions
	More guarantees.
<b>What do end users need?</b>	Know the meaning of a verified technology
<b>What does ETV system provide to end users</b>	Bench marketing of the technologies they buy.
	Market International recognition
	Easy way for end users to identify verified technologies. LOGO.
	Help end users to base their decision on reliable information.
	Transparency of the process
	Targeted marketing; making the buyers aware of the benefits involved in purchasing a verified technology
<b>Barriers</b>	Above all SMEs prefer well-proven technologies not to take risks because they do not have the knowledge and the resources to compare all existing technologies.

## **VERIFICATIONS BODIES**

The VB implements the verification process, except for awarding the certificate and logo, and disseminating the results of the programme. It is in charge of developing test plans and protocols. The VB carries out directly the tests, appoints other test laboratories to perform the tests, or designates verification centers to verify the vendor claims when they are not qualified themselves or if this is required by the system's design. In that case, the VB is responsible for verifying the accreditation of these organizations or providing for an ETV specific accreditation system. The VB processes the vendor applications and the vendor is directly in contact with the VB who regulates the vendor participation in the process. The vendor is only in contact with the EU ETV Team at the end of the process, when awarding the certificate/logo.

The VB collaborates with thematic stakeholders groups, for scientific or technical support, for guidance on market needs or selection of qualified testing laboratories, or for promotion or review purposes. The stakeholders are selected among technology developers, technology buyers, consulting engineers, financial interest groups, industry associations, public interest groups etc. The VB can also call upon national or regional organizations/contact points, to locally act as an intermediary between the vendors (often small SMEs) and the ETV system.

The responsibilities of the VB can be enumerated as follows:

- Promotes the programme at EU level and identifies the technology vendors potentially interested in the programme
- Reviews the vendor applications
- Reviews the accreditations of the testing laboratories and verification centers
- For each technology to be evaluated the VB:
  - For systems that perform technology testing the VB:
    - Establishes the specific protocol and the test plan
    - Performs the testing or selects the appropriate testing laboratory
  - For systems that perform claim verification, the VB performs the verification or selects the appropriate verification centre to verify the claims and supporting data
  - Defines minimum performance requirements (if relevant)
- Reviews and approves the verification reports
- Designates and coordinates the stakeholder groups and their activities

### **Verification centre**

A verification centre is used when the system performs claim verification. It will examine the vendor data and verify if they support the accompanying claims. The verification centre proposes to the vendor to repeat the tests if it thinks that the quality of the data is not sufficient. The verification centre respects the quality management procedures of the system and writes the verification report. The verification centre should be accredited, but the accreditation procedure is to be defined (e.g. ISO, case by case ad-hoc accreditation). The Verification Centre:

- Examines the supporting data
- Verifies the vendor's claims
- Writes the verification report

In the U.S. ETV system the Verification Organizations (VOs) are the public and private sector organizations that hold cooperative agreements or contracts to assist EPA in implementing the ETV programme. They are responsible, together with stakeholder groups and the EPA's ETV team, for the selection of technology categories, which are under continuous review and frequently change to reflect the changes in the marketplace. They manage, supervise and conduct the verification activities, develop, carry out and oversee test and quality assurance plans in cooperation with technology vendors. They solicit vendor proposals; prepare verification reports and verification statements at the completion of each verification. Each verification organization is contractually required to fully implement EPA's quality assurance (QA) requirements.

In the case of ETV Canada these entities are private or public organizations in charge of conducting the third party verification and of comparing data to claims. In order to verify supporting data, they examine test relevance, test quality and test adequacy of data, together with test operating conditions. [7]

<b>Advantages of ETV for verification bodies</b>	Recognition
	Business
<b>Verification bodies requirements or obligations</b>	Credibility
	The role of the VB is crucial during the claim definition
	Develop the "Generics Verification Protocols" that is the testing guidance for a particular technology category..
	Development the testing plan with the testing labs and the with the feedback of vendors. The testing plan, based on the generic protocol, details the test conditions adapted to a specific test event.
	Scientific soundness
	Be capable of verifying vendors' claims. Good expertise in the technology area.
	Not be directly involved in the performance testing itself.
	Ensure minimum eco-efficiency parameters.
	Develop standardized test protocols
	Ensure the performance of the technology in any period of time (one month or one year)
	At least one Verification Body per country
Harmonize the verification procedures	
<b>Barriers</b>	There is a lack of methodological harmonization of hydro-geological and ground water technologies in Europe (PROMOTE)
	There is no guides or similar remediation best technologies in site characterization (PROMOTE)
	Verification body and Testing laboratories should not belong to the same structure. This would be ideally but it is not the most practical.

## TEST LABS

A testing laboratory is used when the testing is done by the ETV system. When the Thematic VB does not have the expertise or if this is the strategic choice of the system, it appoints a specialized testing laboratory to help in developing the specific protocols and test plans and to execute the tests.

The testing laboratory respects the protocols and the quality management procedures; implements the test plans when provided by the VB, and writes the verification report. The testing laboratory should be accredited, but the accreditation procedure is to be defined (e.g. ISO, case by case ad-hoc accreditation).

The Testing Laboratory:

- Participates in the drafting and updating of the test protocols
- Establishes the test plans
- Executes the tests
- Writes the verification report

<b>Advantages of ETV verification bodies</b>	Recognition and expertise
	Laboratory methods are the benchmark for monitoring technologies.
	Business opportunities
<b>Test lab requirements or obligations</b>	Test labs should be relevant and appropriate in terms of market recognition and technology expertise.
	Be accredited for the test performance
	Development the testing plan with the VO and the with the feedback of vendors. The testing plan, based on the generic protocol, details the test conditions adapted to a specific test event.
	Fund part of the verification process cost ( opinion of the 14% in the EBTP [9])
	Test plan for individual technologies, characterization of test site (PROMOTE)
	Recognition and expertise
	Accuracy is a very important point for monitoring devices to be verified. (PROMOTE)
<b>What does the ETV System require from Test Labs?</b>	Test procedure must be consistent and reliable (PROMOTE)
	How to accredit Test Labs so that they are part of the ETV System.
	Verification based on agreed standards or legal requirements.
	Ensure that test procedure are consistent and reliable (PROMOTE)
	More than one laboratory accredited per group of technology (to avoid monopoly and delay in producing test data).
	Test protocols established by independent experts.
<b>Barriers</b>	Accredited Test labs located in as many countries as possible as to reduce the distance and cost for the vendor.
	There is a lack of methodological harmonization of hydro-geological and ground water technologies in Europe (PROMOTE)
	If the laboratories are accredited the cost of the system would increase.
	Some test (e.G. microbiological test) are difficult at a reference site (PROMOTE)
	Heterogeneity is difficult to rebuild (PROMOTE)
	Claims have to be evaluated in terms of available tests methods.
	The cost of the audits the Test Labs will need to go through to validate their certification to be part of the ETV System.
	The tests are not always done in the right conditions or by sufficiently competent personnel.
The flexibility with the test results has to be improved	
Verification body and Testing laboratories should not belong to the same structure. This would be ideally but it is not the most practical.	

## ***PUBLIC ADMINISTRATIONS / MEMBERS STATES***

The European Commission, Governments of different Member States and local authorities may be considered public administrations.

The Member States are involved at various stages of the process: promoting the system and disseminating the list of awardees, soliciting the vendors and assisting them through the application procedure, establishing the network of ETV contact points etc. One of the most important added values that ETV could bring to the market, as was underlined during the market survey, is to become a doorway to the markets of the different Member States.

<b>Advantages of ETV for public administration</b>	Promote certain innovative environmental technologies
	Help them in the implementation of new rules and legislation. If, for instance, no ET has been able to achieve a satisfying performance level in a specific field, no regulation will be decided until some performing ETs are available on the market.
<b>Role of public administration</b>	Promote the use of new innovative environmental technologies
	Provide funds for the verification process.
	Create any kind of legal or financial incentive to boost Environmental Technologies
	Ensure an effective system within a time and cost frame acceptable. [6]
	Provide financial support to the vendors. Different funds, mainly depending on the size of the company and the type of technology to verify.
<b>Barriers</b>	Each country may request their own different set of data

## ***ETV TEAM / EUROPEAN COMMISSION***

The EU ETV Team's role is to coordinate and supervise the verification process. It is responsible for the compliance with the objectives and quality management procedures. It designates thematic verification bodies (VBs), the number of which depends on the priority technology areas addressed by the programme. The EU ETV Team is in charge of auditing the VBs and verifying that their procedures and outcome comply with the programme requirements.[7]

The responsibilities of the EU ETV team can be enumerated as follows. The team:

- Lays the foundations of the programme: definitions, objectives, eligibility criteria, funding considerations, organizational principles and general strategies
- Decides on the priority technology areas and appoints the thematic VBs in relation with the priority technology areas (if relevant)
- Establishes quality management procedures
- Establishes programme-level protocols
- Establishes the programme budget
- Communicates on programme activities, progress, outputs and recommendations
- Creates and maintains a means to communicate the programme opportunities and results (website, large scale publication, specific newsletters, etc.)
- Awards certificates and logos to successful vendors
- Audits the VBs, in terms of compliance with the objectives and quality management procedures
- Assesses the output of the VBs and redefines their objectives if necessary

In order to provide a comparison, EPA oversees the verification organization and has the ultimate responsibility of the US ETV system. The so called ETV team consists of EPA employees actively working on the ETV programme. Among their tasks are to coordinate the overall programme, including multi-year strategies, objectives, operating principles, protocols, implementation activities and annual budgets and to communicate the activities and outputs to EPA, the Congress, customers and the general public and give recommendations on future activities. The ETV staff works with several ETV Centers, one for each technology category (and to which a verification organization and a stakeholder group is linked) [7].



<b>Advantages of ETV for ETV team</b>	Achieve environmental targets
<b>Role of European ETV team</b>	Regulate liability question
	Develop the "System-level General Protocol" which includes the guidance and rules to ETV system in general such as quality assurance, testing, responsibilities, etc.
	Develop the "Quality management plan" which contains the specific policies and procedures for managing quality related activities in the ETV programme.
	Harmonization between European ETV systems and other international ETV systems, and also mutual agreements.
	Overcome all the stakeholders' barriers.
	Publication of the results (in case 100% public funding)
	Provide financial support to the vendors. Different funds, mainly depending on the size of the company and the type of technology to verify.
<b>Keys aspects of the system (</b>	Bureaucracy must be minimum
	The awarding of an ETV logo has to be done by an independent organization
	Impact assessment should be built into the EU-ETV scheme.
	Administrative tasks should be minimize
<b>Barriers</b>	National funding programmes depend on the European Union programmes.
	Harmonization of all National practices and regulation in Europe is a difficult process and even time consuming. [7]
	Member States markets have different degree of development regarding acceptance of innovative technologies
	The implementation of ETV will be different for each Member State, depending on existing national structures.
	The funding of European programmes such as CRAFT or LIFE is limited to 50% or 70% so it is necessary funds of other financial resources.

## **NATIONAL CONTACT POINTS (optional)**

The network's goal is to establish a relation of proximity between ETV and the vendors, diminishing any geographical distance, language or administrative barriers. It would also be active in communicating on ETV, explaining the ETV concept and the advantages that it can bring to its end users.

This contact points should be established in all Member States, their hosting establishment being variable: testing laboratories, certification organizations, innovation relay centers, national ministries of the environment etc.

<b>Advantages of ETV for NCP</b>	Small vendors will benefit for the approach that a NCP can offer.
	Allow the vendor to interact more directly with the EU ETV governing body.
<b>Role of NCP</b>	Support companies in the verification process, above all support SME.
	Avoid the language barriers between Member State
	Provide the cheapest and most efficient verification process.
	Absolutely needed at least for SME
<b>Who could play the role of NCP</b>	Innovation Relay centers
	Chambers of Commerce
<b>Barriers</b>	Not identified

### **3.2 STAKEHOLDER'S OVERALL NEEDS**

As explained before in this section other overall aspects are included.

#### ***Usefulness of ETV programme stakeholders opinion***

An ETV system is a guarantee for quality information on a technology and it allows to access to the market in each Member State with out having to go through additional local or national approval programmes. However an ETV system is a useful tool if the bureaucracy is kept to a minimum and high technical level is guaranteed. It should be simple, fast and affordable.

A European ETV system would replace the existing procedures for technology type-approval required in each country.

#### ***Report of successful and failure experiences***

A report summarizing practices cases of Environmental Verification carried out successfully would be very helpful to increase confidence in the stakeholders involved in the process.

According to EURODEMO report [6] it is no so clear if the failure experiences should be also included.

Regarding site remediation technologies, the main problem is that sites are normally heterogeneous and technology performance it is difficult to compare reliably from one case to another. The proposed costs, outcome and time scale of examples and test cases are almost always different from the information necessary to convince decision-makers to use any proposed innovative technique. The information that has been derived from test cases (examples) normally has too little similarity with the real case site.

#### ***Different level of knowledge between stakeholders***

A working group created in the frame of EURODEMO project identified that there is a difference in knowledge between the site owner/funder/decision-maker and the contractor or service provider. This is even more pronounced if R&D oriented bodies and site owners need to communicate. As a bottleneck, it has been identified that the two groups do not cooperate effectively, so that the R&D input for the service providers and contractors does not synchronize with the actual challenge that the site owner has to deal with.

### ***Independent system***

It was suggested that independent proof of the performance of technologies could be represented by indicators. Indicators would need to be elaborated by vendors and checked by expert third parties. [6]

### ***Should the verification process be funded by public or private?***

According to a survey questionnaire presented in [7], most stakeholders see the system as a public/private initiative, the public part helping for recognition and the private part providing the funds and assuring that the system is close to the market. The system should however start off as a public initiative in which the EU and Members States take part.

Central European Countries do not have abundant funding schemes (for remediation of contaminated sites), but they can also make use of the Structural Funds which are managed by the Ministry of finance [6].

According to an EURODEMO working group *“Priorities that are set by the EU are copied by National and local government organizations. This means that the soil and groundwater remediation lobby should advocate the financing of demonstration efforts through major programmes like Cohesion and Structural funds”*.

International funding is currently available in form of CRAFT and LIFE programmes, however these programmes funding is limited to 50% or 70% which makes necessary funds of other financial resources. The timing of projects is a risk of multiple financial funds.

Nonetheless, it is suggested [8] that costs related to Member States administrations (notifying and accreditation bodies, participation in ETV committee and technical groups) and the setting-up of contact points for SMEs would be born by Member States budgets.

The EU budget could cover the administrative cost related to ETV in the Commission, the costs associated with meetings of the technical groups and the Advisory Forum, it could support Verification Bodies and facilitate the access of SMEs to the system.

Based on the hypothesis that the number of verifications would increase progressively up to 200 over the first five years of implementation of the ETV scheme, the cost for the EU budget was estimated between 4 and 5 million Euros per year. Support to the Verification Bodies could be provided through multi-annual grants, covering the establishment of ETV procedures, participation in technical groups and the provision of support to SMEs for example through reduced fees or technical support.

### ***Results publications***

The publication of the results is closely related to the source of funding. ETV results could be public as far as Intellectual Property Rights is respected? This will be strongly depend on the ratio of public/private ETV funding. In case of Canadian ETV the claims are published but the test protocols and the data supplied by the applicant are not.

How to safeguard the Intellectual Property rights (IPR) gained during verification process. For instance in case the vendor is driving an ETV for his technology, is the test design, claim, etc, intellectual property of the vendor?

### ***Voluntary or mandatory?***

It has been stressed that any action by Member States that would give an advantage to verified ET would in a way make the process look mandatory and would justify some financial help.

Some vendors stressed that the EU ETV System should not reach that level of compulsoriness. They are afraid that the verification would then become banal and it would, in the end, make people pay for something that resembles a certification without being one. If the EU ETV System becomes mandatory, vendors think it should be fully subsidized, whereas type-approvals are not.

Countering this line of thinking one could argue that first of all the MCERTS scheme is a certification scheme and secondly, most certification schemes are strictly voluntary. If now an ETV scheme gains such success that it becomes necessary to the majority of the vendors of a specific market, then this could be interpreted as a sign meaning that the system is ready to move towards certification.

### ***ETV system official language***

If English is the only language of the system the results will spread easily, on the other hand multiple languages could extend the recognition within a country.

### ***Claim definition.***

Claim definition may vary depending on the stakeholders' perspective. Claim definition is crucial because it determines the cost and duration of the verification process.

Implementation of process protocols and the verification of remediation technologies based on specific standards will increase the funders' confidence in environmental technologies. [6]

The applicants have to submit technology performance claims, supported by previously established data, these claims must be specific, unambiguous, measurable and verifiable and moreover meet minimum standards [7].

### ***Which are the technologies to verify***

ETV would accept technologies ready for commercialization, ideally in the early stages of commercialization, in business-to-business relations (not consumer products): industrial products, equipments and processes. Technologies at design or development stage cannot be presented as their performance may not be representative of commercialized technologies. Nevertheless, according to stakeholders' prototypes and commercial products should both be accepted, but some distinction in the awarding process will need to be made (e.g. keep the ETV logo for commercial ETs).

The programme should be open to all technologies, but giving priority ETs with bigger environmental impact or because they are needed on the market. New and innovative technologies should also have priority. The need of an ETV programme is particularly strong for technologies that are not covered by standards of regulations. At this stage [8] the following areas are considered:

- Monitoring techniques
- Water and soils treatment technologies
- Renewable sources of energy and energy efficiency
- Air pollution abatement including GHG
- Clean technologies including waste and resource recycling

### ***Verification logo***

The awarding of an ETV logo has to be done by an independent organization. The awarding of national (or in this case a European) ETV logos based on well defined mechanisms linking to existing foreign verification seems to be preferable compared to "one international" ETV logo. "Verified once – verified everywhere" - based on clear and well defined international standards.

### ***Cost of the verification***

The cost of verification is the major factor of success and should be kept low. The cost may vary a lot depending on the technology area, the complexity of the technology itself and the availability or not of test results of good quality from the beginning. Based on other ETV systems, preliminary costs estimates are in the order of 50.000 to 90.000 € for verification. This price includes all fixed cost of the system but it does not include testing, done outside of the system and with highly variable cost.[8]

The European Commission Consultation Analysis Report [8], considered that “The funding provided by the applicants to the system (technology developers or vendors) would cover the cost of verifying their application (estimated €5000 to €20000) and the cost of additional tests if needed (estimated €10000 to €70000)”. However, according to the latest consultation paper [8] the cost of verifications may vary a lot depending on the technology area, the complexity of the technology itself and the availability or not of test results of good quality from the beginning. Based on non-EU ETV programmes and on similar (non-ETV) systems in the EU, preliminary costs estimates are in the order of €50 000 to €90 000 per verification. This includes all fixed costs of the system (costs of staff to run the system, cost of establishing protocols and quality systems) but it does not include testing, done outside of the system and with highly variable costs.

As aforementioned, the EU budget could cover the administrative cost related to ETV in the Commission, the costs associated with meetings of the technical groups and the Advisory Forum, it could support Verification Bodies and facilitate the access of SMEs to the system.

The remaining (variable) cost would be charged to applicants as the cost of the verification services. The objective is to limit this final cost to applicants in the order of €20 000.

When questioned about the adequacy of this cost, the majority of responding companies to both consultations (51%) thought it is 'Impossible to meet for small technology developers without external support'; for 27% of respondents, it is 'possible to meet if justified by the added-value of the scheme'; for 9% it is 'coherent with cost currently met for testing, verification or certification activities'; 12% of the respondents don't know.

This result clearly points at the need to provide support to SMEs to enable them to participate in an EU ETV scheme, if the first cost estimates are confirmed in the further development of the scheme.

The following actions were mentioned in different workshops in order to boost the technology verification:

- Legal or financial incentives to boost environmental technologies
- Invite vendors to verify their technologies for free at the beginning (ex: a couple of years). This measure was carried out by the US ETV programme.
- A system with several options of verification; type verification or verification compared to minimum requirements.
- Motivate vendor to verify their technologies without it becoming mandatory

### 3.3 RESULTS OF THE “EUROPEAN CONSULTATION ANALYSIS REPORT”

An important document regarding the ETV system stakeholders' expectation is the European Consultation Report carried out by the European Commission [9]. This document collects the results of the web-based stakeholder consultation for ETV in February 2008. Even though there is a more recent EC Consultation paper, these opinions still highlight the stakeholders' impressions regarding ETV.

The results of this report have been shown in the section 3.1 of the present document within each stakeholder tables. However, as in the previous section, there are other overall issues of the Consultation report, not referred to a specific stakeholder, considered important. See table below:

Table 2. Additional stakeholder input regarding EU ETV

First objective of a ETV system	Help technology purchasers to base their purchase decision on reliable information	Accelerate the market penetration of the environmental technologies					
	48%	41%					
For what of technologies should ETV be develop in priority	New technologies just entering into the market	All technologies should be accepted					
	36%	34%					
What should be main rationale of the ETV system?	Vendor's claim	legal requirements	standards protocols for verification	User's requirements			
	31%	29%	22%	17%			
Who should lead the organization of ETV?	EU institutions	organization by the private sector itself in a coordinated way	organization by one or a group of business services having the necessary capacity	organization by government at national levels			
	51%	19%	16%	15%			
Which types of technologies should be evaluated?	water and soil	waste	energy	bio/nano-technologies	air	monitoring	clean production processes
	23%	10%	24%	13%	6%	13%	11%
Reasonable cost (€)	< 20.000	20.000-50.000	50.000-100.000	>100,000	not apply	n/a	
	46%	10%	4%	1%	25%	15%	
Sources of funding	Public administrations	Public technology centers, laboratories and universities	Industry federations	Private sponsors	technology users	investors	chambers of commerce
	29%	14%	13%	12%	11%	11%	8%

## 4 CONCLUSIONS

The stakeholders' needs and expectations gathered in this document were established by stakeholders attending the workshops and conferences within the European ETV related projects and the first Advance ETV stakeholder workshop.

Stakeholders expect that the EU ETV System will create new business opportunities by speeding up the acceptance of new and innovative technologies in the EU-27. This would enable, on the one hand the promotion of innovative environmental technologies, and on the other hand decrease purchase uncertainties. This facilitation includes aspects of fast entrance to the market, lower costs for verification and demonstration and the ETV itself functioning as a kind of marketing tool.

In order to fulfill such a goal, all stakeholders agree that the system should be, above all, simple, fast and accessible. So that it does not become an obstacle to sales and does not turn into an administrative burden, because vendors will typically be short on staff resources. As aforementioned, the cost of it is one of their main concerns, since it is the major factor of success and thus, should be kept low. That is why stakeholders considered it might be necessary to provide financial support to the vendors, depending on the size of the company and the type of technology to be verified.

However, there is still on-going discussion on other topics such as result reporting and ETV System language. Even though not all stakeholders agree on whether unsuccessful verifications should be reported, as well as, successful ones, what is for sure is that certain data must be kept confidential to safeguard Intellectual Property Rights (IPR). Stakeholders also highlight that the ETV System language may become a burden in some Member States and hence it might be necessary to have national contact points or some other measure, in order to overcome this potential drawback.

The main barriers to be tackled under the mutual recognition efforts of ETV are related to a lack of confidence and acceptance. Furthermore, widespread skepticism against foreign suppliers or foreign technologies, foreign verification bodies etc. might hamper the internationalization of the market. Setting a profound political/legal basis in the participating states seems to be prerequisite for the success of an international ETV standard.

In addition to this, it should be noted that in some cases there is a lack of knowledge among stakeholders when it comes to what ETV could do for them and this could become a barrier to successfully implement the EU ETV System. For this reason, a clear need for Advance ETV is to further disseminate ETV activities and to involve more stakeholders. It was suggested that this could be achieved by means of a brochure format, such as a short laymen's report to inform purchasers and political level, and also an additional coffee-table book providing required information for the expert level.

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