Project no.: 226824

AdvanceETV

"Coordination action on Environmental Technology Verification ETV - Building a framework for international cooperation"

Coordination action

Area 6.3.3.3
Environmental technologies verification and testing

D 1.1: Report on results and knowledge of previous ETV activities

15.02.2010

Organisation name of lead contractor for this deliverable:
IVL Swedish Environmental Research Institute Ltd.

Revision: [final]

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including Commission Services)	
RE	Restricted to a group specified by the consortium (including Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Table of Contents

1 Summary

1.1 General

The EU project AdvanceETV aims to demonstrate that the proposed schemes and protocols for Environmental Technology Verification (ETV) systems have the potential to be recognised internationally. Verification provides independent third party assessment of a technology and its performance. It has been identified in the EU Environmental Technology Action Plan[1] as one possible solution to improve implementation of environmental technology in the market. As part of the AdvanceETV work, the main findings and recommendations from previous and ongoing projects and activities are collected, namely the projects AIRTV, EURODEMO, PROMOTE, TESTNET, TRITECH, and NOWATECH and DANETV. Also the IPTS (Institute for Prospective Technological Studies, Sevilla, Spain) work on ETV is recognised as well as experiences from the existing ETV systems in USA and Canada. More information about ETV in general is provided at www.eu-etv-strategy.eu.

This report on findings consists of this summary and of dedicated chapters for the different projects and activities. This summary extracts the main findings and recommendations from the different chapters under specific topics of ETV, but can only give an overview. More detailed information on different aspects of verification can be found in the different chapters. The report is short collection of the different findings, but not a deep analysis of these. The IPTS results are incorporated into the different chapters; especially has IPTS contributed with the chapter about the Canadian system. The other chapters were to a large extent produced by AdvanceETV project partners that also have been involved in the project or activity in question. Experiences from USA and Canada are based on actual work with their ETV systems in place for several years. The European experiences are except for DANETV based on a number of projects performed to develop and test a possible ETV system. The EU projects targeted different areas like water, soil, air emissions, cleaner production etc. The proposed systems from these projects have many similarities, but there are also different findings that are described more in the different chapters.

1.2 System

Environmental Technology Verification is performed within a verification system. The system sets the framework and the mode of operation. Procedures and responsibilities for achieving a verification statement are described. There are differences in the procedures used in USA, Canada and the different EU projects, but the basic steps are common. Figure 1 illustrates a possible division in different steps.

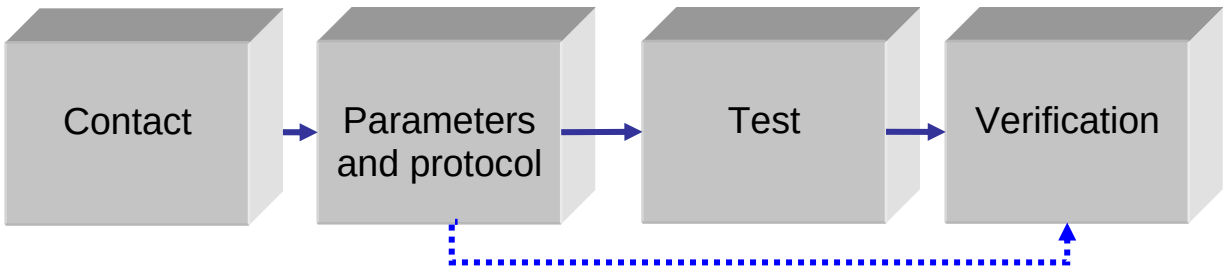


Figure 1 Basic steps in verification

[1] ETAP, EU COM(2004)38 final

First, there is a **contact** step that can be initiated by a technology vendor taking contact with the verification system. It is also possible that verification is initiated by the government for a specific technology area, as it has been done in the USA. In the second step, the **parameters** to be verified for the technology and the framework for the specific application and technology are worked out. In general this is done by producing a specific protocol document. The procedure for definition of parameters often includes independent experts. There might also be cases, where an existing protocol can be used or has to be modified only slightly.

Testing of the technology is necessary in order to provide data that can be checked against the parameters and values that have been defined. In some systems it is possible to use existing data, i.e. results from testing before starting verification, e.g. during the product development, can be used if the data quality is sufficient. Otherwise testing is necessary, which comprises a test plan, testing of the technology as prescribed by the protocol and test plan, and a test report. The final step is the **verification** of the product by check of results in comparison with the protocol. If specific target values have to be achieved, there is a pass or fail. Another option is only to provide the test results for all necessary parameters and leave it to the reader to assess the results. The results at leas of successfull verifications are published.

The aim of verification is to provide confidence in perfomance by a sufficient verification quality at reasonable time and costs. As priorities have to be made for one or another of these factors, the proposed verification systems are different in complexity, e.g. as it regards quality assurance procedures and complexity of the parameter definition process. It is common though to involve independent external experts in the definition of parameters.

The number and kind of organisations involved vary in the different verification systems. The number of available verification organisations that manage individual verifications varies between the different proposed and active systems. For example, it can be organised according to thematic areas like water, monitoring, air etc. Also the number of testing organisations can vary, from a very restricted number with specific organisations pointed out, to a larger number by setting only specific criteria for being eligible.

1.3 Financing

Financing aspects have been part of the investigations in the different European projects. Also, there are experiences from USA and Canada where verifications have been performed within their existing frameworks for more than ten years. Verification costs range from US$50.000 to 250.000 in the US, including testing. Earlier, the US system was financed to a larger extend by the US EPA, but nowadays, about 90 per cent of the funding is received by vendors and others.

According to the findings from the EU projects, which are based on case studies and investigations, the cost of producing one verificate (verification statement) is typically between €10,000 and €100,000, but the expected costs vary and are often below €50.000. Verification costs can include the production of a new protocol where it is not available as well as costs for testing that might be necessary in order to produce verifiable data.

Some general conclusions from the projects and active systems are:

- Vendors expect some characteristics from the ETV system to be us useful for their technology, but this implies some costs.
- Effort in terms of working hours could vary, e.g. for air abatement verification according to the case studies from 140 to 412 hours.

- Variable costs will strongly depend on the technology complexity and type of verification, but also on the country where it is performed.
- Where there are relatively few (and large) vendors and many (and smaller) purchasers, the vendor will often pay for the entire verifications to get a verificate which will differentiate them from other competitors. Examples for this situation are large international companies selling new sensor technologies to e.g. waste water treatment plants.
- In markets with many (smaller) vendors and few (larger) technology purchasers, the purchaser may have an interest in buying verification protocols to use in e.g. tender materials. Examples are large international water utilities buying treatment technologies from small innovative technology development companies.

Verification includes different tasks and organisations like a central body, verification centres, development of protocols and test plans etc. In order to minimise costs, it is proposed to rely as much as possible on existing structures and organisations. Different potential financing models have been proposed, but a central and generic part like the ETV body is often supposed to be financed officially. Also, additional funding has been proposed to facilitate participation of SME (Small and medium-sized enterprises). For EU, already existing funding structures might also be applicable to support verification.

Especially for EU, where no system is in place, internal financial resources are expected to support the development of ETV. Vendors might also have to pay for re-newal for every three year period, as it is the case e.g. for ETV Canada.

1.4 Quality aspects

The quality of verification and its results have been identified as crucial to provide increased confidence in a technology. Therefore quality assurance (QA) and quality control (QC) have been taken into account carefully in the different activities.

The verification system addresses technologies, not companies as a whole or their engineering systems in general. In this way, the verification system is a complement to existing systems for quality and environmental management, such as EMAS, ISO 9000 and ISO 14000. Requirements are set up for organisations to qualify for a role in verification, which include existing requirements for e.g. ISO 9000, but have also specific requirements for the tasks performed by the body during verification.

The overall process is often proposed to be controlled by a central (EU) ETV body, which also has the general responsibility for the quality assurance of the system itself. For the remaining parts, different approaches have been chosen to assure the quality and credibility of verifications by the projects and ongoing ETV activities.There is either more focus on quality by assuring in procedures or by requirements to organisations. Usually the proposed and active systems use a mixture of both. In procedures the production, handling and control of plans, documents, audits etc. is managed. Organisations have to fulfill quality requirements with regards to ISO standards, staff management, etc. Credibility and quality control are important for the success of verification, but unnecessary bureaucracy has to be avoided.

1.5 Market aspects

1.5.1 Markets

The market for a technology is to depending on the kind of technology, e.g. its complexity, its application. In general, solutions different to today´s solutions solving problems better than

today or solutions providing additional benefits that can be verified are often potential candidates of a verification system. For some technology markets, a broadly available and applicable independently developed test system is probably helpful.

Within the ETAP (Environmental Technology Action Plan, COM (2004) 38 final) the need for verification has been identified. Verification facilitates to show the additional value of new solutions (that might have a higher investment costs, but lower total costs). Both national and international markets can be important, therefore international harmonisation is important. For EU one main advantage mentioned by stakeholders is the access to the whole EU by verification accepted by all EU countries. With an international harmonisation, the advantages would be even larger. This is also valid for US and Canada.

1.5.2 Drivers

Investments in new and innovative technologies involve risks and perhaps resistance. The risks can be reduced when the buyer have independent documentation on the efficiency of the products. Through verification, producers can prove the efficiency of their products and increase the share of the market. The independent documentation on efficiency, which the verification gives, is considerably useful for innovative companies that market new products and try to be established on new markets.

Increased confidence in new innovative technologies is one of the important drivers, which only can be achieved by a credible verification system.

To make verification of technologies successful, it is important to show the added value of the products, e.g. by taking reduced cross-media effects into account. This can be included into verificaton. A well-established system will also allow reducing advertisement costs.

Legislation can be a driver, not for making verification mandatory, but leading to requirements that can be satisfied with new technologies with verification proofed performance. Only a voluntary system is regarded as acceptable especially by technology providers.

1.5.3 Barriers

Verification as instrument targets improved and new solutions, and has also SME as target group. Especially for SME costs for verification are important, but also for larger companies, the costs have to be balanced by a clear benefit, e.g. by the expected increased sales. It is possible that additional funding might be necessary for SME to participate in verification. In general, it is expected, that those parts of the verification that are of generic nature are covered centrally, e.g. a central body, possibly generic protocols.

When targeting foreign markets, there can be a language barrier, as both vendors and possible customers might not be able to take full advantage of verification documents in a language different to their mother tongue. National contact points could partly solve this issue.

The lack of a normative framework for ETV operation in Europe until the EU ETV scheme has been implemented, probably some time during 2011, is indeed a barrier for recognition of verificates obtained in the Nordic countries and in Europe.

2 AIRTV

2.1 Organisation of the ETV system

2.1.1 Type of organisations involved in the system

There is a need for different organisations within a verification system. Except for the EU ETV Team, the organisations involved in verification are existing organisations, i.e. the ETV system uses existing structures like laboratories, institutes and certification organisations. For example, this means that an existing laboratory or institute takes the role of the testing laboratory in the verification. The organisations and their main roles could be:

Table 1: List of ETV organisations according to AIRTV

Organisation		**Role in ETV system**	**How to choose**
Contact point	CoP	First contact with vendors, provides information, guides to appropriate Verification managers	Countries choose the most appropriate
Vendor	V	Has technology to be tested, knowledge about technology	(might be EU initiative) open access
EU ETV Team	ETV	Representing EU, system management, overall quality control, management of databases on VM and experts, information about ETV	For EU?
Verification managers	VM	Project manager, project quality control, expertise for criteria, contact and advice for vendors	Free to choose by vendor, from a list or by criteria
Testing laboratories	L	Expertise for data acquisition and testing	Chosen by vendor from list or by criteria (with necessary experience)
Independent experts	Ex	Expertise for setting criteria for individual verification	Chosen by VM from database
Stakeholders	S	Additional expertise for criteria	Public inquiry and specifically addressed by VM and vendor

Besides these organisations, there is the task of a national contact point to be appointed by each country. For example, business development authorities can be an alternative. In order to inform vendors about the EU ETV system, also other organisations are important players. This includes branch organisations, verification managers, and test laboratories, which have information and access to relevant material. The EU ETV Team appoints Verification managers and experts, and sets criteria for test laboratories.

VM, Ex and L get paid for their efforts. The stakeholders are involved by the VM through public inquiry.

2.1.2 Financing of the system

Within the AIRTV project, the costs for performing the case studies were estimated as well as the potential costs when an ETV system is running. Also, the willingness to pay was investigated.

Some main conclusions are:

- Vendors expect some characteristics from the ETV system to be us useful for their products, but this implies some costs
- For verification of air emissions abatement technologies, effort in terms of working hours could vary from 140 to 412 hours, based on the case studies.
- Variable costs in terms of money will strongly depend on the technology complexity and type of verification, but also on the country where it is developed.

The costs for verification are dependent on the number of man hours needed as well as costs per hour. When using existing data, the estimated need for verification based on the experiences from case studies in AIRTV varies between 112 and 220 hours, with an average of 150 hours. This would translate to an average cost of 4450 EUR, as shown in the table below.

Table 2: Costs for verification based on existing data, in EUR (derived from case studies)

	Highest	***Lowest***	**Average**
EU 27 average	5660	3025	4450
Example higher wages	8140	4500	6610
Example lower wages	1755	935	1380

When new data is derived from testing the number of hours needed increased and has been estimated to 185 to 338, with an average of 258 hours. The average cost would be about 7300 EUR.

Table 3: Costs for verification including testing, in EUR (derived from case studies)

	Highest	*Lowest*	**Average**
EU 27 average	8900	6025	7280
Example higher wages	13225	8955	10820
Example lower wages	2760	1865	2255

It has been mentioned during the first AIRTV workshop in Brussels that financial support for the first installation as demonstration is important for establishing new technology on the market. Such financial support is available. One European example is the LIFE+ programme for demonstration of environmental technology.

It would be valuable to integrate verification into such programmes, i.e. to combine verification and demonstration. It could be a model to increase financial support when including verification. At the same time verification would allow to assess the results of the demonstration project in a defined way.

2.1.3 Quality aspects of the system

The system proposed within AIRTV is based on the idea to have a lean and efficient system, with a quality guarantee through the involvement of stakeholders and experts as well as through quality criteria for the involved organisations rather than intensive quality assurance steps in the procedure.

The overall process is controlled by the EU ETV body, which also has the general responsibility for the quality assurance of the system itself. The verification system addresses technologies, not companies as a whole or their engineering systems in general. In this way,

the verification system is a complement to existing systems for quality and environmental management, such as EMAS, ISO 9000 and ISO 14000.
In order to guarantee the quality of the verification, quality management and environmental management are part of the requirements to the organisations involved in verification. Requirements are set up for organisations to qualify for a role in verification, e.g. as verification manager. The requirements include existing requirements for e.g. ISO 9000, but have also specific requirements for the tasks performed by the body during verification.

2.1.4 Market aspects

AIRTV investigated ways to identify the most promising technologies for verification. As part of the investigation, sectors with air emissions in Europe and possible need for air emission abatement technologies were identified. The main sectors are: transport, industrial processes, power generation, agriculture, domestic emissions. The characteristic of emissions vary with the sectors.

The investigation within AIRTV also looked into factors that make a technology interesting for ETV. These factors could partly also be drivers for ETV within air emission abatement. The main identified factors were:

- Legislation
- Resource consumption of the technology
- Avoided/additional costs by implementation
- Cross-media effects
- Impact of ETV on diffusion rate (e.g dependent on awareness about ETV, technological knowledge of buyers)
- Diffusion rate (e.g. longer or shorter investment cycles in different industries)

Other market aspects, e.g. a potential international market, were not part of the investigation.

2.2 Technologies

AIRTV focuses on Air emission abatement technologies. The eligibility criteria for such technologies should correspond to market needs. For this reason, the technology suitable for going through the ETV Programme is either the commercially available technology or technology fully developed in technological terms and ready for full-scale commercial application.

The technology eligible to apply for the AIR-ETV Programme, apart from the development stage limitation, shall also meet the following prerequisites:

- it must be an environmental technology according to definition of EST given below
- it must be related to air emission prevention or abatement;
- claimed environmental benefits of the technology shall be well documented;
- full access to the plant for technology testing is warranted.

2.2.1 Environmentally Sound Technology (EST)

EST is an individual technology or total system which includes know-how, procedures, goods and services, and equipment, as well as organisational and managerial procedures that protect the environment. EST is less polluting than the technology for which it is substitute, for example by using resources in a more sustainable manner, recycling more of its wastes and products, and handling residual wastes in a more acceptable manner.

Note: The technologies should also meet the following criteria:

- additional investments and operational costs compared to the average practice at moderate payback time of investments; Costs are reasonable in order to achieve the wanted benefit
- environmental incentives to make investments

2.2.2 Technologies verified within AIRTV

Some of the technologies verified within AIRTV have already been proposed during the application. The choice of technologies was finalised within the project, also with respect to the criteria for verification. Besides, the choice was influenced by the goal to represent a number of different technologies and applications.

The following technologies have been used for case studies during the AIRTV project within different areas of air emissions:

Particles

- Multifunction ion technology
- Wet scrubber
- Electrostatic precipitator

VOC (Volatile Organic Compounds)

- Regeneration of activated carbon
- Regenerative combustion

Ammonia

- Combi-scrubber system

NOx

- Low emission natural gas burning

Multi-pollutant

- Turbosorp

Odour

- Applied plasma physics

2.3 The system

2.3.1 Outline of the system

The following scheme illustrates the proposed ETV procedure and the main involved organisations in each step. The scheme is based on the experiences from the IPTS study, the existing systems and the systems of the EU projects PROMOTE and TESTNET. It is based on a vendor driven system, but would look similar for an ETV driven system, as that still has to be based on technology from a vendor.

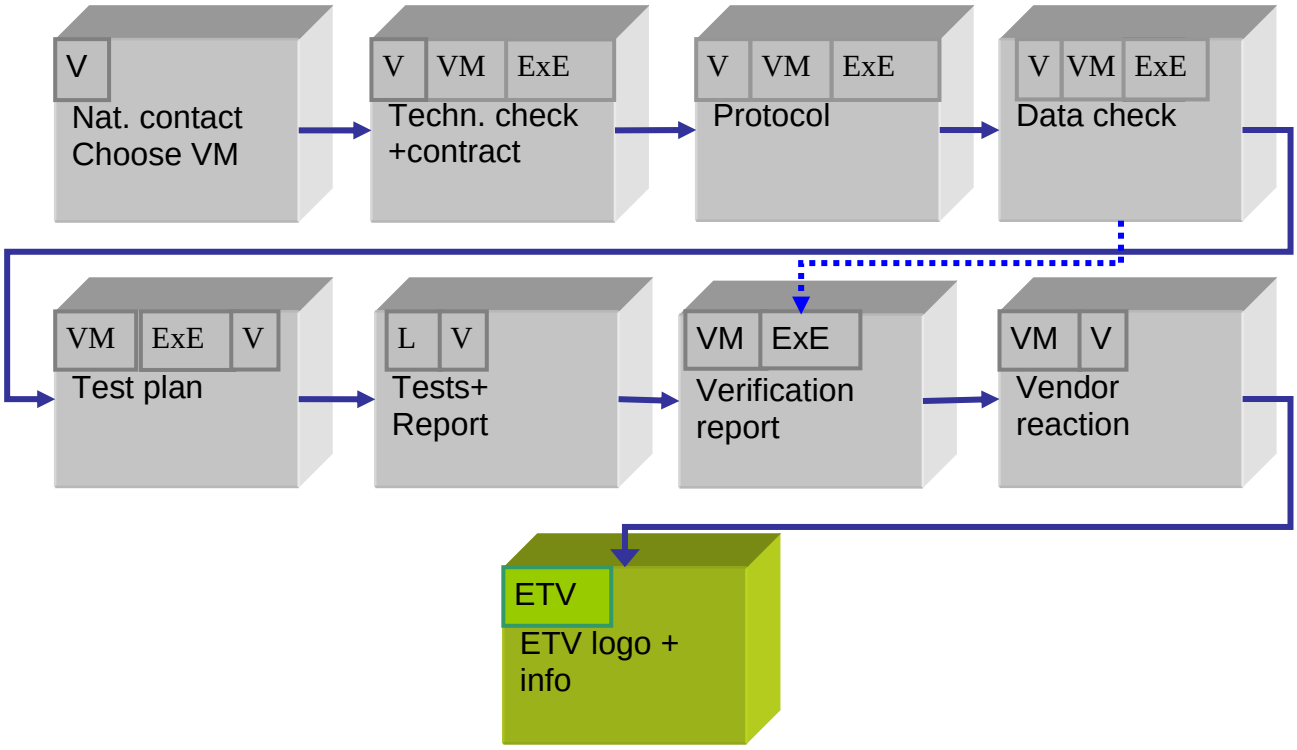


Figure 2: The proposed scheme for verification (V=Vendor, VM= Verification manager/organisation, L= Laboratory, ExE= External Expert, ETV= European ETV body), Dotted line: alternative path when no additional testing is needed

In the first stage, the vendor who wants a technology to be tested, contacts either a Verification body or a national contact point. At this stage a "quick-check" is done in order to check if the product is suitable for verification and what kind of data is available and might be used for the verification.

If the product is suitable and the vendor decides to go for verification, a contract is set up. In the next step a specific protocol is developed, where the parameters to be tested are defined in order to give sufficient information for customers. If there is an existing protocol for comparable products, this will be used and adapted.

If the existing data are sufficient, they will be used together with the protocol to produce the verification report

If the available data are not sufficient, a test plan is developed with expertise from technology and measurement experts. At this point the test location is chosen in agreement between the verification manager, the experts and the vendor as the test location is needed to write an appropriate test plan. With the test plan and test location the vendor asks different (ETV recognised) test labs for offers. The verification manager and/or experts assess the quality of the offers. The vendor can choose a test lab from the labs with complying offers. In the next stage, the product is tested in order to generate the missing data for verification, i.e. the amount of testing depends on the availability of suitable data that have been produced earlier.

During the verification, a number of functions held by different organisations are needed. All functions can be covered by existing organisations, which might be different types of organisations in different countries. In order to facilitate the entry, national contact points

exist that can guide vendors in verification questions in a local language. The verification manager is an organisation that manages the verification process from the quick-check to the final verification report. This organisation is responsible for performing the verification. During verification, external experts are needed in order to set up a relevant set of parameters for the technology to be verified. Also, they assure the claim to be realistic and verifiable, i.e. both technology and measurement experts are needed. When testing is needed, a test laboratory performs the tests according to the test plan and reports the test results. In the final stage of the verification, the EU ETV body approves the verification report and provides the logo. The body is also responsible for the overall management and quality assurance of the verification in Europe and for co-ordination internationally.

Discussions within AIRTV suggest that the proposed system should be applicable to different technology areas; it is not limited to air abatement technologies, although developed within a project restricted to this area.

The possibility to interrupt the verification process has been discussed. It has to be possible to stop verification from the vendor side, but no decision is made if information about the verification should be publically available in this case. As the verification management organisations and laboratories have to be qualified by expertise, each one might also be restricted to certain technology areas, but there will be institutes and laboratories for all areas.

2.3.2 Protocols and reports

2.3.2.1 Documents produced during verification

There is one **Generic Verification Protocol** as basis for the verification. It provides the structure for a case specific verification protocol as well as guidance for establishment of the Specific Verification Protocol. The generic protocol is provided as public document by the ETV system.

From the Generic Verification Protocol, a **Specific Verification Protocol** is developed during each verification process. The Specific Verification Protocol follows the same structure as the generic one, but describes the procedures, the actors and materials involved as complete and detailed as necessary, also with respect to the tests to be performed. It provides also information about which parameters are to be verified and which have to be tested, i.e. some parameters might not have to be tested for example due to already existing data. If the tested technology is comparable with BAT technology and relevant parameters are available, the BAT parameters have to be included in the test.

Based on the Verification Protocol a **Test Plan** is established. The Test Plan contains a detailed (complementary) description that defines how to perform the necessary tests for the verification. The test plan will apply what is written in the protocol to a specific test event. It will give details on specific equipment that is to be tested, specimens, names, dates, people involved etc. It is clear that some information has to be repeated in both documents, the test plan being more specific.

The test results are presented in a **Test Report** that also includes recommendations for the Verification Report.

At the end of each verification, a **Verification Report** is produced which normally follows the structure of the Specific Verification Protocol. The Verification Report uses information from the Test Report and the Specific Verification Protocol.

It is also proposed to provide a ETV logo for a passed verification. The idea is to limit the period of validity, as technologies are often developed further, i.e. they might perform different, and as requirements might change as well.

It is proposed not to provide liability, i.e. ETV is not responsible for the technology, especially not for the technology working well in a specific application.

Thus, the main documents used during verification are:

- Generic Verification Protocol (for guidance on establishing the Specific Verification Protocol)
- Specific Verification Protocol (one for each verification including guidelines for the testing laboratory)
- Test Plan (Applies the Specific Verification Protocol to a given test event, methodology and procedure of the tests, instructions for the testing laboratory)
- Test Report (reporting results from testing and draft parts for Verification Report)
- Verification Report (describing the technology and its application and giving the results of the verification in a clear and understandable format)

The following table shows the different documents and their availability:

Table 4: Verification documents

Type of document	Specific/Generic	Public?
Generic Verification Protocol = Verification Guidance Document	Generic	Public (homepage)
Specific Verification Protocol (one for each verification)	Specific for each verification	Public (homepage + send list)
Test Plan (instructions for the testing laboratory)	Specific for each verification	Non public
Test Report (reporting results from testing and draft parts for Verification Report)	Specific for each verification	Non public (but partly used for verification report)
Verification Report (describing the technology and its application and giving the results of the verification in a clear and understandable format)	Specific for each verification	Partly public, not too many technology details (homepage and vendor), but not those that fail

2.3.2.2 Performance criteria and their definition

The performance criteria are defined in the protocol development phase. It is always based on the vendor claim, but a task group including external independent experts will decide on which parameters have to be tested. If there is an existing protocol to be adapted, this will also be included.

All necessary parameters for verification of the technology have to be defined in the different categories mentioned below. Claim values are defined for specific target markets that have been identified with the vendor.

Each parameter is also classified as one that has to be verified with high confidence or one that will be verified with limited confidence (e.g. those that can not be tested within a reasonable time period of ca. 2 months, like man-power needed)

- Parameters that verify the achievement of the stated benefit, including operational conditions to be verified (temperature, volume flow etc).
- Additional parameters to verify the technology, especially
    - Environmental impact: including emissions and resource use (e.g. Environmental Product Declaration, EPD)
    - If a comparable technology is available in the BAT-BREF documents, all relevant parameters shall be included (for each kind of technology/application the minimum relevant parameters have to be known)
        - Emissions to air, water
        - Waste generation
        - Resource use
        - Use of hazardous substances
    - Cost related parameters:
        - use of energy,
        - consumption of chemicals and other raw materials, cooling water,
        - waste generation,
        - man power needed (quantity and quality),
        - space
        - Longevity (e.g. by information on longer test period in existing installation, possibly ageing tests)
        - maintenance
    - Parameters related to legal standards in an/several identified target markets

2.3.2.3 Acceptance of existing data

The AIRTV procedure allows the use of existing data, as long as the data quality is assured. No specific method for quality assurance of this data has been proposed.

2.3.2.4 Reference methods

The issue of reference methods has not been a main point of discussions in the design of the verification system.

3 DANETV and NOWATECH

The Nordic Water Technology Verification Centers, NOWATECH, supported by Nordic Innovation Centre (NICe) started as a project in 2006. The objectives of this project are:

- To support the Nordic environmental technology industry in both the home market and the global market by giving access to accepted and comparable technology verification data.

The sub objectives are:

- To establish ETV test centers within the water technology sector
- To establish a cooperation with networks of technology providers and users
- To establish a web site with access to technology verification data
- To initiate extension of the test center net

During the project, three ETV test centers were established within the following areas:

- Biological water treatment technologies (Aquateam)
- Cleaner water treatment technologies (IVL)
- Water technologies (DHI DANETV)

The Danish Centre for Verification of Climate and Environmental Technologies, DANETV, was established in 2007 and offers independent tests 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. DANETV offers verifications within the following technology areas:

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

3.1 Organisation of the ETV system

3.1.1 Type of organisations involved in the system

3.1.2 NOWATECH

NOWATECH is a collaboration between four Nordic institutes/companies.

- VTT - Technical Research Centre of Finland, a research and technology organisation, responsible for ao. market and technology analyses, dissemination
- Aquateam - Norwegian Water Technology Centre AS, an independent consulting company, responsible for one test centre
- IVL - The Swedish Environmental Research Institute, a research and technology organisation, responsible for one test centre
- DHI from Denmark, a research and technology organisation, responsible for one test centre

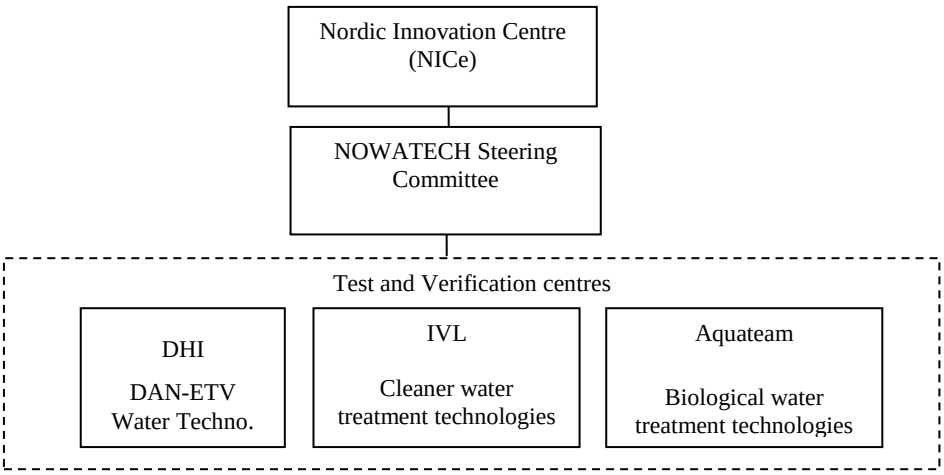


Figure 3: Organization of the NOWATECH

3.1.3 DANETV

DANETV is established as a joint ETV centre without walls between four member institutes in the Danish GTS – Advanced Technology Group. GTS is a grouping of independent Danish research and technology organisations. The institutes develop and offer state-of-the-art technological services within respective specialist fields. Customers are private businesses as well as public authorities on national and international levels. The four collaborating institutes in the DANETV centre, initially supported financially by the Danish Ministry of Science, Technology and Innovation, is

- DHI (lead partner)
- Danish Technological Institute
- Force Technology
- Agrotech

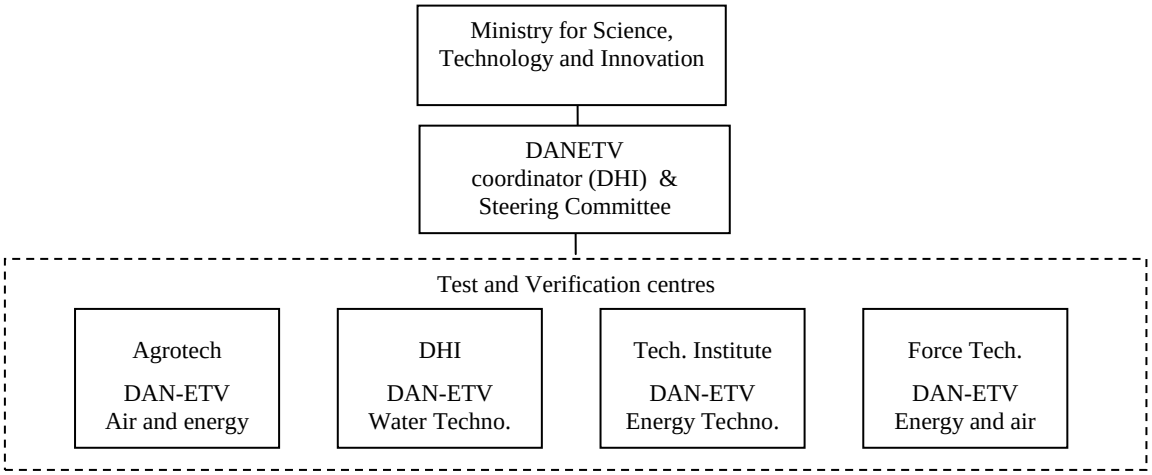


Figure 4: Organization of the DANETV

3.1.4 Internal Organization of the Test and Verification Centres

Under each test and verification centre, an organisation is established. The following shows an example from the DHI DANETV Water Centre. A similar organisation is established for the other test centres. One test centre may refer to more than one steering committees.

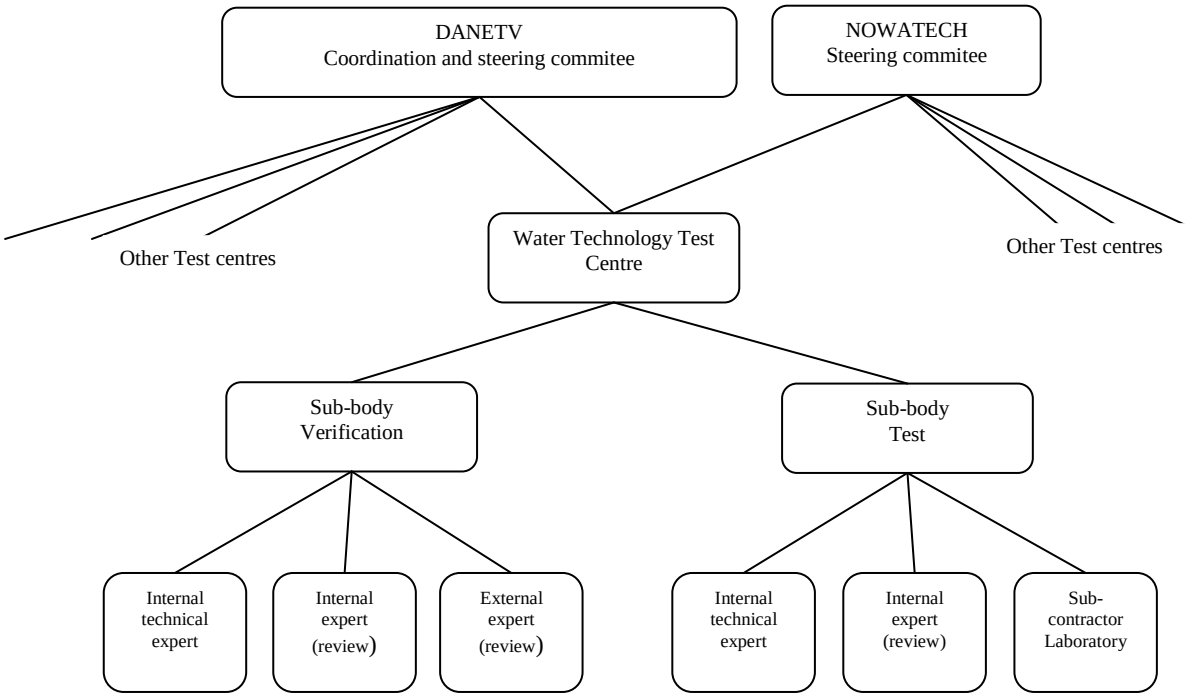


Figure 5: Organization of the Water Technology Test and Verification Centre under NOWATECH and DANETV

The roles and functions in the organization are briefly described in the following table.

Table 5: Roles and functions of organisations in ETV system

Organisation	**Role in ETV system**	**How to choose**
Contact point	The test centre provides information on the verification operation and reports on the web sites www.etvnord.org (for NOWATECH) and www.etv-danmark.dk and www.etv-denmark.com (for DANETV). All protocols and plans (on-going verifications) and reports and verification statements (completed verifications) are published on the web sites.	Maintained by coordinator and test centre managers
Vendor	Has the technology to be tested	Vendors apply for verifications and are selected if eligible and within focus technology areas
NOWATECH steering committee	The steering committee with representatives from the 4 project participants has the overall responsibility for the NOWATEC project.	The steering committee is appointed by each participant. The chair of the steering

Organisation	Role in ETV system	How to choose
		committee is the NOWATECH coordinator.
DANETV steering committee	The DANETV steering committee with representatives from the 4 project participants has the overall responsibility for the centres, until an EU ETV body has been established. The steering committee has the overall responsibility for the centre operation, and shall handle complaints that have not been settled in the test centres.	The steering committee is appointed by each participant. The chair of the steering committee is the DANETV coordinator.
Organization management	Each participating institute is hosting each own test centre. For instance DHI is hosting the test centre for water technology, and the head of the hosting department has the overall responsibility for the operation of the test centre according to this manual. The organization management has the overall responsibility for providing the resources (staff and facilities) required to follow the manual and for handling any complaints over the test centre, including an organization quality system compliant with ISO 9001 /19/ for at the least the verification and test activities.	Each participating institute organizes internally the test centre.
Test centre management	The test centre management of each test centre is responsible for practical operation of the test centre according to a quality manual established for each test centre. The test centre management has the responsibility according to procedures in the general quality manual of the institute for: • Maintaining the quality manual of the test centre • Keeping records of staff training and experience. • Keeping record of facilities and their maintenance. • Keeping records of complaints from vendors.	Each participating institute appoints a test centre manager
Verification sub-body	The test centre verification sub-body has the overall responsibility for: •Preliminary evaluation of applicant technology products. •Recruitment of qualified and independent technical experts for the verifications. •Identification of suitable verification methods and test design. •Elaboration of verification protocol in cooperation with the technical experts. •Elaboration of verification report. •Revision of verification report after quality assurance by the technical ex-pert. •Elaboration of verification statement with logo.	Appointed by test centre manager

Organisation	Role in ETV system	How to choose
	The staff performing verification shall not be the same as those responsible for the test of the test centre test sub-body and they should not be dependent upon these.	
Test sub-body	The test centre test sub-body has the overall responsibility for: •Identification of and subcontracting with one or more independent analytical laboratories for analyses of test samples, if required. •Elaboration of test plan within the requirements set in the verification protocol with test design requirements. •Performance of the test according to the test plan. •Elaboration of the test report. The staff performing the test shall not be the same as those responsible for the evaluation of the test results of the test centre verification sub-body and they shall not be dependent upon these.	Appointed by test centre manager
Technical expert	The technical expert shall have the overall responsibility for: •Providing input on relevant applications and performance parameters of the technology to be verified. •Elaboration of review report after quality assurance of the plan document and report document. The technical expert shall be independent, qualified and without any undue interests in the technologies verified. The experts may be technical experts, regulators or quality assurance experts from other ETV systems.	Appointed by Verification sub-body from case to case
Analytical laboratories	Analytical laboratories providing analysis of any kind as part of the verification tests, within or outside the test centre body have the responsibility for: •Maintaining an ISO 17025 accreditation with the quality management sys-tem required herein. •Application of accredited analytical methods, where available. •Application of other methods according to either international standard methods or in-house methods that are validated as required for accredited methods. The selected analytical laboratory subcontractors are listed by the test centre, test sub-body	Appointed by test sub-body from case to case
Staff	The test centre has, develops and maintains staff that is qualified for the technology verifications and	Appointed by NOWATECH and

Organisation	Role in ETV system	How to choose
	tests within the scope of the centre with the executive staff responsible for the units shown in NOWATECH/DANETV steering committee DHI (Centre host) Water Technology Test Centre Verification sub-centre Test sub-centre Staff competence management procedures	DANETV steering committee, respectively, and centre host management

3.1.5 Financing of the system

NOWATECH is financially supported by the Nordic Innovation Centre (NICe), initially until 2009. The 4 participating institutes co-finance by approx. 50% during the start-up phase.

DANETV is financially supported by the Danish Ministry for Science, Technology and Innovation, initially until end of 2009. The 4 participating institutes co-finance in 2007-2009 by 10% during the start-up phase.

The cost of producing one verificate (verification statement) is typically between €10,000 and €100,000. This verificate is based on a:

- product-specific test plan, verification report and a test report
- application-specific verification protocol
- industry-specific, independent verification centres and test centres

The initial ETV verifications in the inception phase of the Water Technology Centre have revealed that there are different ways of sharing the costs depending on the technology area, application and associated willingness to pay.

Where there are relatively few (and large) vendors and many (and smaller) purchasers, the vendor will often pay for the entire verifications to get a verificate which will differentiate them from other competitors. Examples are large international companies selling new sensor technologies to e.g. waste water treatment plants.

In markets with many (smaller) vendors and few (larger) technology purchasers, the purchaser may have an interest in buying verification protocols to use in e.g. tender materials. Examples are large international water utilities buying treatment technologies from small innovative technology development companies.

If an entire industry (in this case water technology market) is to adapt a new instrument for market regulation, a catalytic stimulation from authorities and/or industry organizations may be required. Until ETV is a well established and accepted institutional instrument in the market, it appears that external (public) funding is required. Thus, as multiple stakeholders will have different added value of such verificates, the business model for e.g. DANETV Water operates with differentiated products from ETV to different type of stake holders:

- Vendor-financed verification reports and test reports
- Purchaser-financed verification protocols and test plans
- Public funding, of establishing verification centres and test centres

The share between the three is expected to evolve as ETV develops as an accepted model by all stakeholders in the markets. The Water Technology Centre will make use of all three payment models.

3.1.6 Quality aspects of the system

The test centres work according to the principles of ISO 9001. This is done by working according to the general Quality Manuals of the participating institutes which is in compliance with the ISO 9001 and by working according to procedures prepared for the processes listed below. In the following, the DHI DANETV Water centre is used as an example.

Review of plans, protocols and reports
This procedure describes how the test centre plans the reviews required. An overview of responsibilities is given in Table 6.

Table 6 Responsibilities concerning reviews and audit.

	DHI internal		External expert
Function	Technical expert	Trained auditor QA staff	Technical expert
Tasks			
Plan document with verification protocol and test plan	Review	-	Review
Test system	-	Audit	-
Report document with test report and verification report	Review	-	Review

The test centre management recruits external and internal experts for reviewing documents. The experts are independent of the test centre and the competence is documented in CV's kept together with the lists of experts. External experts are paid for one day work per document.

Document and record control
The DHI Quality System includes a procedure which describes the process of drafting, revising and approving documentation such as the test centre manual with the aim of ensuring that all involved in the verification processes have access to and uses the latest approved version of the manual with process descriptions. A list of documents is maintained with indication of the persons authorized to draft, revise and approve the documents. The procedure in the DHI handbook: Laboratory service – laboratory data describes how records of verification and testing are stored, transferred, maintained and controlled in order to ensure data integrity for a period defined in the procedure, but not shorter than 5 years from completion of the verification.

Internal audits
The procedure in the DHI Quality System Manual – Audit and evaluation describes the process of periodic internal auditing of the verification and test activities in the test centre including audit responsibilities and planning, auditor training and competences and audit reporting. The procedure in DHI Quality System Manual – Non-conformities and corrective actions describes how deviations identified during operation and auditing are corrected (corrective actions) and how future occurrence of the same deviations is prevented by

improving the quality manual including the process descriptions and working methods (preventive actions).

Complaint management

The procedure in the DHI Project Management Manual - Complaints describes how vendor complaints are recorded, resolved, reported. If not resolved, com-plaints are referred to the DANETV steering committee or NOWATEC steering committee, respectively, for resolving.

Subcontractor management

The procedure in the DHI Quality System – Use of subcontractors describes how the test centre ensures that subcontracting of tasks such as tests, sampling, measurement or analysis to other independent bodies is done while ensuring that the subcontractor follows the quality requirements, the verification protocol and the test plan for the task, see also Section 1.2.1 for the responsibilities of an analytical laboratory working for the test centre.

The procedure in the handbook Laboratory services – Suppliers of critical ser-vices and articles furthermore describes how it is ensured that purchased items for verification and testing resemble requirements, such as those that may be specified in a verification protocol, a test plan or a working method. In particular, the procedure describes how the purchased items are controlled, accepted and calibrated (see Appendix 10 (List of sub-contractors)).

Staff competence management

The procedure: Education, Training and Knowledge of staff in the DHI Hand-book – Staff describes how the test centre ensures that verifications and tests are done by staff with adequate competences and knowledge of their responsibilities. This is done by maintaining a list of functions in the verification and test process with competence requirements and responsibilities, staff approved for the function. The list is supported by reference to staff files in the DHI CV-data base. The list of staff approved for functions within verification and test (Appendix 10) includes documentation for staff members' ETV-training.

Facility management

The procedure: Facilities in the DHI handbook: Laboratory services describe how the test centre ensures that the facilities and the equipment for verification and test of products belonging to the technology area covered by the centre are available and fit for the purposes.

Management review

The procedure Introduction to Quality System – Audit and Review of the Quality System in the DHI Quality Manual describes how the management of the organization hosting the centre is ensuring that the test centre is working ac-cording to this quality manual through mechanisms such as e.g. an annual management review process.

The quality manager is designated to be responsible for maintenance and development of the quality system and for the internal auditing of all aspects of the system – with daily reference to the Director, Group R&D and Quality Management. The DHI Quality System Manual contains rules for reviews of the quality system.

3.1.7 Market aspects

Drivers

The global trend in climate change mitigation and adaptation poses a drive towards accelerated innovation in sustainable environmental and energy technology solutions which at the same time can stimulate economic societal growth (green growth programmes).

Investments in new and innovative technologies involve risks and perhaps resistance. The risks can be reduced when the buyer have independent documentation on the efficiency of the products. Through verification, producers can prove the efficiency of their products and increase the share of the market. The independent documentation on efficiency, which the verification gives, is considerably useful for innovative companies that market new products and try to be established on new markets.

Markets
The markets for environmental technologies are quite different. However, there is a trend towards more high-tech products with cross-cutting appeal internationally and less low-tech and locally produced products for local markets. This is valid both for energy technologies, air, soil, water monitoring and treatment, waste handling etc. The implication is, there is an even bigger distance between producers, purchasers, users and regulators (authorities), and therefore a bigger need for verifications.

In NOWATEC and DANETV, vendors request verifications with international validity, such as EU-ETV or EPA-ETV co-verifications. Furthermore, DANETV has customers also from outside Denmark and Nordic countries. Larger purchasers of environmental technologies have expressed their interest in using DANETV also as a way to screen new innovative – and verified – technologies in the long run.

Barriers
For the Nordic ETV centers (and for the Nordic technology industry) the challenge is to approach the uniform phase in development of test and verification centres as soon and as much as possible in order to gain a key position globally as early as possible. From the public consultation on the first draft of an EU ETV scheme, it can be inferred that:

- ETV is most important for small and medium sized enterprises (SME)
- Low costs are mandatory, in particular for SME
- European and international recognition of verificates is of paramount importance
- Accessibility in terms of language and proximity is important

The experiences from NOWATECH operation have indeed supported these finding, in particular after the start of the current recession (2009), with respect to SME being the main type of vendors with an interest in ETV and to the importance of low costs. The current version of the proposal for an EU ETV scheme suggest that the costs of verification should not exceed 20.000 € per technology verified and suggest EU funding for the ETV infrastructure and for verification of SME owned technologies.

The lack of a normative framework for ETV operation in Europe until the EU ETV scheme has been implemented, probably some time during 2011, is indeed a barrier for recognition of verificates obtained in the Nordic countries and in Europe. As an international standard for ETV operation does not exist using the established conformity assessment routes is not possible. To overcome this challenge, one possible approach is to prepare an accepted method, such as a Nordtest method, for ETV operation and implement this method in an international organization, such as Nordtest as a first step (only) towards first a broader regional (EU) ETV scheme and later a standard based ETV process. This is a viable bridge into the future for the Nordic technology industry and the Nordic water technology test centers. The Nordic Innovation Centre (NICe) has in principle approved and agreed to

establish a Nordtest ETV scheme, NTETV, as the interim normative framework for ETV operation in the established Nordic test and verification centres.

For innovative technologies, the innovative element can itself be a barrier for acceptance in the market. The potential buyers may be cautious with new, unproven solutions, the authorities can find it hard to approve their use, and the vendor may find it difficult to substantiate their claims on superior performance of their new products.

On one side, use of pilot and demonstration plants/equipment from case to case between vendor and purchaser is the "conventional" way (although inefficient and costly) of overcoming problems with introduction of new technologies. On the other side, mature markets with existing product standards which require certifications, are conservative and by nature reluctant to adopt new technologies. ETV is positioned in between these two extremes as a valuable tool for the industries to speed up the innovation pace in regulated markets. However, it is still in its infancy –at least in Europe– thus acceptance in the industry as a valid tool is a challenge.

3.2 Technologies

The type of technologies which are accepted for verifications in NOWATECH and DANETV will generally speaking fulfill two criteria related to (1) area of expertise, and (2) comparability between alternative technologies:

- It is within defined technology or market areas, where the test centres under NOWATECH and DANETV have their core competencies, i.e. energy production and –efficiency, air- and gas emission and cleaning, water monitoring and treatment.
- It is within an application area, where there is – or is judged to be in the near future - a critical mass of other related and comparable technologies

The vendors are often found among the customers, suppliers or partners of the hosting institutes behind NOWATECH and DANETV. Thus, in the first screening, internal experts assist in defining relevant technology areas.

In a subsequent screening, defined as a so-called quick-scan, a dialogue with the vendor as well as relevant (internal and external) experts is the basis for a final decision whether the vendor can be offered a verification of his technology.

The current technology areas in NOWATECH and DANETV are depicted below.

Table 7: Test center for technology areas in NOWATECH and DANETV

Test center	**Technology area**
DHI	• Monitoring technologies and programmes • Water supply and distribution • Wastewater systems and treatment technologies • Cleaner technology • Decision support regarding water resource management
Agrotech	• Agricultural and horticultural technology • Biomasses and biomass processing technology • Environmental and energy technology • Information and communication technology, including

	sensor technology
Force Technology	• Optimisation of and consultancy for energy and environmental processes • Optimisation of production processes • Material use, protection and analyses • Inspection, testing, calibration, verification and certification
Danish Technological Institute	• Energy, climate and environmental technology. • Construction, construction components and materials. • Working environment and security. • Certification of environmental management and energy management including the verification of CO2 emissions.
IVL	• Water Treatment Technologies and Cleaner technologies. • Separation technologies like membrane filtration, evaporation, crystallisation, adsorption, ion-exchange, etc. • Evaporation and membrane technology for cutting oil treatment and for alkaline cleaning baths or degreasing baths.
Aquateam	• Biological Water Treatment Technologies (aerobic, anoxic and anaerobic processes) to treat drinking water, process water or wastewater • Removal of nutrients, readily biodegradable organic matter, slowly degradable/toxic organic compounds using adapted microorganisms. • biological removal of nutrients and removal of organic matter, using attached biomass

3.3 The system

3.3.1 Outline of the system

The principles of operation in NOWATECH as well as DANETV with the role of the verification and test documents and the different sub-bodies responsible are given in Figure 6.

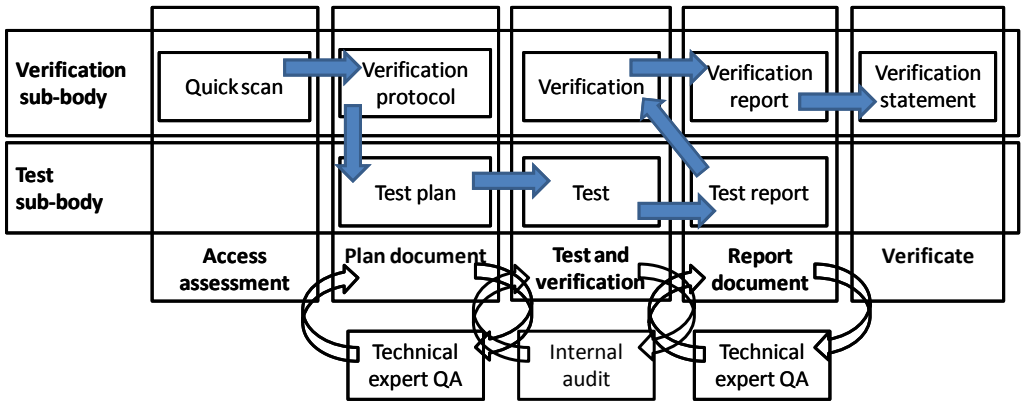


Figure 6 Principles of operation of the DANETV verification scheme.

The verification protocol and report may be prepared for one product or for a group of products aiming at the same application. Once elaborated, a verification protocol shall be used for future verifications of products aiming at the same application just substituting product specific information. The remaining documents are each prepared for one product.
A contract between the vendor and the test centre must be entered before initiating the verification. Definition of the application and of the relevant performance parameters, as well as detailed assessment of any existing test data and of the need for additional test data is done in the first phase of protocol development.

In order to facilitate the preparation of the documents, templates have been prepared. The use of the templates is outlined below. Reports are in principle protocols and plans with data and evaluations inserted.

3.3.2 Protocols and reports:

The responsibilities for preparing, reviewing and approving documents in the verification are summarized in 8.

Table 8 Verification document responsible summary.

Document	Preparation	Review	Approval	Public Avail.
Quick scan report	Verification staff	Verification sub-body responsible	Verification sub-body responsible	No
Contract	Verification staff	Test center manager	Test center manager	No
Verification protocol and report	Verification staff	Technical experts	Test center manager	Yes
Test plan and report	Test staff	Technical experts	Verification staff	Yes
Review reports	Technical experts	None	None	No
Verification statement	Verification staff	Technical experts	Test center manager	Yes

Table 9 Templates for verification and tests with the use at product, product group or test centre levels indicated, product groups may include one product only.

Template		Product group level document		Product level document		Test centre level document
Test centre quality manual		■		■		Test centre quality manual
Quick scan report		■		Quick scan report		■
Contract		■		Contract		■
Verification protocol *Test plan*		Verification protocol ■		■ Test Plan		■ ■
Test report *Verification report*		■ Verification report		Test report ■		■ ■
Verification statement with logo		■		Verification statement with logo		■

4 ETV Canada

This chapter summarises the structure of the ETV Canada system, based on information collected for the writing of the report "Environmental Technologies Verification Systems", EC, IPTS, 2007 and updated information collected from "http://www.etvcanada.ca/".

4.1 Organisation of the ETV system

Environment Canada launched the ETV program in 1997, through an agreement with OCETA (Ontario Centre for Environmental Technology Advancement[2]), an independent entity that manages the ETV program. The objectives of ETV Canada give special importance to the growth and marketability of the Canadian environmental industry by emphasising its capabilities and credibility in the environmental market, helping companies to access foreign markets and thereby increase their competitiveness. The approach is to provide the market with the assurance that a vendor's claim of performance for an environmental technology is valid, credible and supported by quality independent test data and information.

ETV Canada has developed two technology evaluation procedures, Verification and Benchmarking. Under the Verification scheme, 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. Supporting data are collected by an independent third party and analysed by an accredited laboratory. ETV Canada will scrutinize the submitted data and pronounce itself on the validity of the accompanying claims. A verified claim is only valid if the technology is operated within the operating conditions stated in the claim. Under its Verification scheme, ETV Canada does not perform tests nor develops new protocols. Other ETV systems (New Jersey, China and Bangladesh) follow ETV Canada system's way of functioning[3].

4.1.1 Type of organisations involved in the system

Table 10: Organisations in ETV Canada

Organisation	Role in ETV system	How to choose
Vendor	The vendor company submits a pre-screening application. If the technology and performance claim are eligible to apply, the applicant submits a formal application and a non-refundable application fee. The formal application should contain additional information about the technology, the claim to be verified and the data and information that is available to support the claim. If the application is not considered complete, the applicant may choose to modify and resubmit it.	Any kind of environmental technology is allowed to undergo the verification process but there are certain prerequisites, which are checked in the pre-screening phase.
ETV Canada	Collects vendors' claims and from independent laboratories, reviews the	Not applicable

[2] http://www.oceta.on.ca/
[3] http://www.etvcanada.com/

Organisation	Role in ETV system	How to choose
	applications, identifies the verification entities, transmits information to them and prepares a final verification report, a technology fact sheet and a verification certificate. Can propose an optional service to vendors, the provision of a technology market review and technical assessment, under the Environmental Technology Development Assessment Program (ETDAP)[4]. This program provides assistance and detailed advice on the required technical performance data needed to support quantifiable technology performance claims.	
Environment Canada	Is responsible for program policy and general direction. Provides quality oversight and performance review and is responsible for negotiating bilateral agreements with other countries and agencies seeking program reciprocity.	Not applicable
Verification Entities	Private or public organisations 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.	Potential ETV Canada applicants are requested NOT to contact VEs – ETV Canada and the applicant will agree on suitable VEs as part of the verification process.
Laboratories	Independent laboratories, analyse technologies and generate data that can verify the performance claims made by the vendor.	They have to be accredited by a recognized certification agency. The laboratories are directly selected by the vendor.
Stakeholders	Identify and validate acceptable performance criteria for screening, assessing and verifying performance.	Only for benchmarking, not for the "standard" ETV Canada process. Sector specific.

4.1.2 Financing of the system

The program is in principle fully funded by vendors. However, OCETA, has committed substantial internal financial resources to support the development of ETV as a means of assisting new environmental technologies to achieve commercialisation. The program is focused on emerging new technologies and these are primarily generated by young or start-up

[4] http://www.etvcanada.com/ETDAP.asp

companies with limited financial resources. Such clients pose high financial risks and have had difficulties in financing ETV participation. Nevertheless, the program often benefits from subsidies of Environment Canada, sometimes targeted at specific technologies. In 2003, the government granted CAD 5,000 per verification, irrespective of the technology.

Testing: the cost of testing (to produce the reliable data required) is usually paid directly to the testing organization and analytical laboratory by the vendor.

Verification: fees are paid by the applicant company to ETV Canada as follows:
$1,500 - formal application fee (non-refundable).
$15,000 - 20,000 - actual cost of verification (this includes the work done by the verification entity); this amount also includes the cost for the production and printing of 400 copies of the Technology Fact Sheet ($1,500); 200 of the 400 copies are kept by ETV Canada for promotion purposes.
$2,000 - renewal fee for every three year period.

For a detailed analysis of costs, including estimates for cost of testing see:
http://susproc.jrc.ec.europa.eu/activities/etap/documents/CostsofETVsystems.pdf, Annex IV, pp. 49 - 52

ETV Canada has been reported to be quick (6 months) as there is no testing required. However, the writing of the claims, for which ETV Canada can assist the vendor can take an additional 1-2 months to which has to be added the searching time for a verification agent/entity. This last step may be time consuming for innovative technologies.

4.1.3 Quality aspects of the system[5]

Under the Canadian ETV Program, it is mandatory that test data be provided by an accredited laboratory which is certified for analyzing the specific parameters of interest. In most cases, this requires accreditation by the Canadian Association for Environment and Analytical Laboratories (CAEAL), an accredited PALCAN member. The laboratory must also have related experience with similar projects and an established Quality Assurance (QA) and Quality Control (QC) plan. It is the testing laboratory's responsibility to apply and execute the appropriate analytical procedures which meet general accepted principals of good laboratory practice and quality control. Appropriate laboratory equipment must be provided for sample analysis and "chains of custody" and records of analytical procedures must be maintained throughout the process from field to lab.

In addition, although not mandatory, it is advisable that the vendor contract the services of an independent, qualified and unbiased testing organization to review the test protocol in detail prior to testing to ensure implementation of a test plan that will produce verifiable data, or is likely to. In some cases it may be necessary for the independent testing organization to operate and maintain the technology during the test procedure consistent with the test plan and in accordance with the vendor's O & M manual. If necessary, the testing organization can modify and make changes to the existing test plan. However, any changes must be documented.

[5] http://www.etvcanada.ca/faq.asp#question8

Upon completion of the test, the testing organization prepares and submits a testing report along with the test data to the owner of the technology (e.g. the applicant). For verification requirements, the analytical laboratory used to analyze the samples must be identified and recorded. This includes specifying the accreditation and capabilities of the laboratory analyzing the samples and the provisions in-place for laboratory QA/QC.

The claim must meet minimum standards and guidelines for the technology. Where a federal standard is not available, the least stringent provincial standard shall apply. The technology must meet federal, provincial, and/or municipal regulations or guidelines for discharged waters or treated effluents, soils, sediments, sludge or other solid-phase materials. ETV Canada will refer to such appropriate standards when assessing the claim. The claim must be measurable and verifiable. The claim must be measurable using acceptable test procedures and analytical techniques[6].

4.1.4 Market aspects

Benefits of ETV[7]

- Provides a specific and precise performance claim of a technology
- Provides with credibility to prospective buyers and reduces their risk in the procurement process.

Identified markets: technology[8]

- Pollution prevention
- Pollution detection and monitoring
- Environmentally-related human health protection
- Pollution control and treatment
- Instrumentation and measurement systems for environmental protection or remediation
- Energy efficiency/management
- Emergency response
- Non-hazardous and hazardous waste management
- Site remediation and restoration
- Land and natural resource management
- Greenhouse gas reduction/monitoring

Identified markets: geographical areas

The ETV Program has verified the performance of a variety of environmental technologies developed by companies located throughout Canada. Memorandums of Understanding have been signed between Environment Canada and South Korea, the state of New Jersey and California[9] (the California program is no longer running). Moreover, ETV Canada recently completed the first phase of a Canadian International Development funded project to assist China to develop an ETV program, and a program for verifying environmental technologies

[6] http://www.etvcanada.ca/procedures.asp
[7] http://www.etvcanada.ca/benefits.asp
[8] http://www.etvcanada.ca/faq.asp#question5
[9] http://www.arb.ca.gov/eqpr/eqpr.htm

for arsenic mitigation has been developed in Bangladesh. The Bangladesh initiative belongs to the ETV Canada Benchmarking scheme, described in the following paragraph.

4.2 Technologies[10]

For a technology to be eligible for the ETV program, it must be either[11]:

- an environmental technology or process that offers an environmental benefit or addresses an environmental problem, or
- an equipment-based environmental service that can make claims based solely on measurable performance of the equipment.

The basic approach to ETV in Canada is client driven (i.e. responding to client enquiries), and thus initially there were no target fields for verification. After implementing the "environmental performance benchmarking" approach, the following target fields have been identified for ETV Canada for fiscal year 2007:

- Storm water management technologies.
- Environmental sensors and monitoring technologies.
- After market technologies for vehicle emissions reductions and reduced fuel use.
- Drinking water technologies for removal of arsenic, pathogens and other contaminants.
- Remediation technologies.
- Other possible technology prospects on the horizon which might arise through initiatives such as Green Procurement.

[10] http://www.etvcanada.ca/faq.asp#question15
[11] http://www.etvcanada.ca/procedures.asp

4.3 The system

4.3.1 Outline of the system

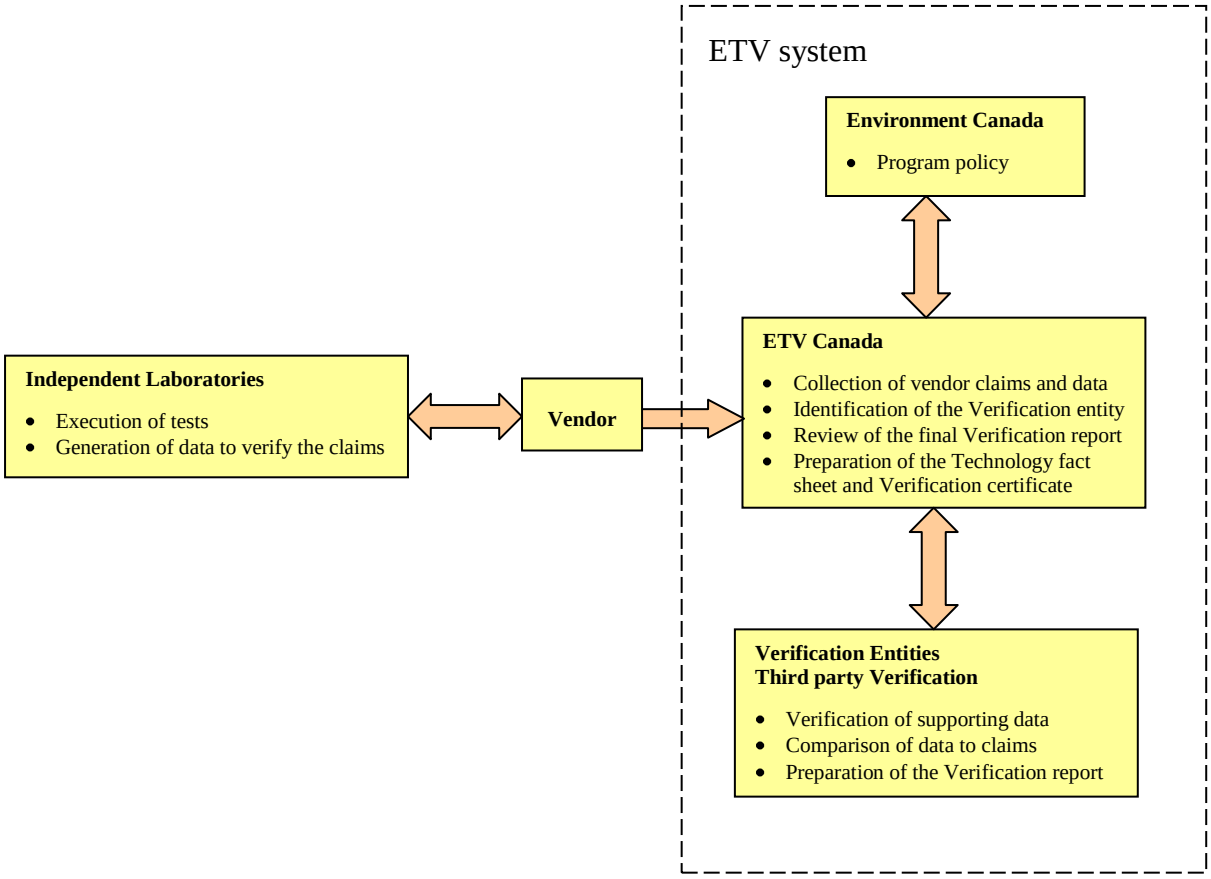


Figure 7 ETV system for ETV Canada

When the formal application is submitted, ETV Canada reviews the information and proposes a verification process for the claim, including the identification of a Verification Entity and a cost estimate. The cost will include the administration and management of the application process by ETV Canada as well as the actual validation by the Verification Entity. The cost will vary from application to application and will depend on the effort involved in the verification process. The Verification Entity analyses the data and decides if the claim is adequately substantiated or if additional testing is required, which in that case is conducted by an approved testing agency and paid by the applicant. A report is prepared with the results and submitted to ETV Canada for review, and finally the applicant is provided with a copy. Upon successful verification, the vendor is entitled to a presentation of a verification certificate (for use in marketing), a technology fact sheet which defines the performance claims, a detailed verification report and the use of the ETV logo. The verification is valid for three years after which a license renewal fee will apply should the vendor wish to continue the program.

4.3.2 Protocols and reports:

Upon successful verification the company is issued three documents[12]:

- A Verification Certificate

[12] http://www.etvcanada.ca/faq.asp#question9

- A Technology Fact Sheets
- A Final Verification Report

Only the technology fact sheet is published in the website of ETV Canada.

Performance criteria:
There are not minimum performance requirements for the verification. On the other hand the supporting data should corroborate the performance outlined in the vendor claim.

The Benchmarking scheme[13], distinct from the Verification scheme, is proposed to applicants as a different option. The Benchmarking scheme is *sector specific*. The basic difference with the ETV Canada Verification scheme is the presence of stakeholder involvement resulting to the development of protocols and test methods.

The "performance benchmarking" component of the program addresses performance parameters. The approach used is based on the development of credible stakeholder-driven performance criteria and the transparent reporting of performance information. It typically includes the following four steps:

- Review and consolidation of current experience followed by a multi-stakeholder consensus-building process to identify an initial set of acceptable performance criteria.
- Multi-stakeholder discussion of initial criteria and agreement on a final set of criteria for screening, assessing and verifying performance.
- Stakeholder validation of all criteria under review, both quantitative and qualitative.
- Implementation through the used of "acceptable" criteria and test methods for the verification of environmental performance.

It is also important to note that ETV Canada has a "General Verification Protocol" (GVP) that provides the criteria and process for doing any verification. This document was created in March 2000 by an independent contractor and was substantially revised in February 2007 by ETV Canada. The GVP is used by VEs in the verification process and offers a comprehensive and rigorous procedure so that all verifications are done in a uniform manner, which puts all applicants on a level playing field.

Accepted data[14]
Periodically, companies request whether verification can be done based solely on a review of test data only. Typically in these cases the data were not generated by an accredited testing organization or were generated by their own testing. There are strict ETV guidelines that the proponent must follow in order for ETV Canada to accept the testing results. The first and most important requirement is that the testing is carried out by an independent third party and the laboratory generating the data is accredited by CAEAL or equivalent.

ETV Canada's preferred process is to have reliable data generated by a rigorous independent testing agency, witnessed by the VE, and involving an accredited laboratory. Anything less raises questions about the validity and integrity of the program.

[13] http://www.etvcanada.ca/faq.asp#question11
[14] http://www.etvcanada.ca/faq.asp#question13

5 EURODEMO

This chapter summarises shortly the outcomes of the EU FP6 project EURODEMO, a European co-ordination action for Demonstration of Efficient Soil and Groundwater Remediation, finalized in December 2007.
EURODEMO **did not have the objective to develop and/or demonstrate the merits of an ETV-system.** As a research-project, it was however linked to a number of FP6-project related to ETV. Demonstration is a stage prior to verification and independently reviewed demonstration reports can (according to the CEN Workshop Agreement CEN/WS-32) be considered as verification

5.1 Organisation of the ETV system

5.1.1 Type of organisations involved in the system

EURODEMO is a Co-ordination Action (CA), to boost technology demonstration in the field of soil and groundwater remediation, by:

- Preparing a detailed database of remediation projects demonstrating remediation technologies;
- Creating a database of funding resources available for demonstration projects;
- Working to reduce the barriers which hamper the use of promising soil and groundwater remediation technologies;
- Promoting the harmonisation of quality criteria for the reporting of soil and groundwater remediation demonstration projects.

In EURODEMO, innovative remediation technologies were supported by providing comprehensive information through reports, directories and promotional workshops. The information provided was targeted on the defined needs of end-users: Interesting national developments and knowledge sources for individual technologies, applications and processes were identified and generated.

The Federal Environment Agency Austria (Umweltbundesamt) has co-ordinated the project. 25 Partners were involved, representing administration, technology developers, service providers and research organisations from 13 EU Member States.

Table 11: Organisations in ETV system according to EURODEMO

Organisation		**Role in (ETV) System**	**How to choose**
Contact point	CoP	Co-ordinates the project, guides the ambassadors.	Voluntary basis
Ambassadors	Am	National contact point, provides information, finds national information, disseminate information to national contacts	EU Countries
End-users		Expertise for setting criteria/needs for soil and groundwater remediation, and provide information for the database.	All End-users (voluntary)

The main activity is developing a central European Database for Demonstration that will provide an overview of ongoing and recently completed remediation demonstration and pilot projects throughout Europe. This will be continued in EURODEMO+.

5.1.2 Financing of the system

Because EURODEMO was a co-ordination action to increase and focus research for better market implementation, to set up a technology platform (Database for Demonstration) and to contribute to process development and testing procedures no research on verification systems was performed. Contractors and end-users on a voluntary base fill in cases for the database. The efforts to submit a case in the database should not take more than a few hours of filling out the data. At current the system does not receive specific funding in the market.

For the continuation of the system beyond the project lifetime of EURODEMO a technology platform EURODEMO+ has been set up. A business plan has been outlined for EURODEMO+, which strives to act as a European information platform for credible knowledge and technology transfer and support technology transfer for use within Europe and to the global market in order to increase the demonstration and implementation of sustainable and cost-effective remediation technologies across Europe. The business plan contains a proposal for a three-stage process outlining the financial structure:

1. Short-term strategy: until adequate funding can be leveraged, a self-financed phase is proposed, in which the interested organizations will keep contact with each other and investigate funding and set-up possibilities.
   Existing national organizations interested to participate may collaborate on a voluntary basis with a voluntary EURODEMO+ contact point.
2. Medium-tem strategy: EURODEMO+ and 3-4 national demonstration platforms should be (partly) financially sustained, be in place and working. For example HIP-program (NL) and Cluster (UK).
3. Long-term strategy: additional national technology platforms shall link to EURODEMO+. When NTP's gain financial benefit, they are possibly willing to pay some contribution.

At the moment the market should finance EURODEMO+, for a continuation of the technology platform. A voluntary network maintains it.

5.1.3 Quality aspects of the system

The main activity of EURODEMO is the Database for Demonstration. Listing demonstration projects is on a voluntary basis. An independent party should review data supplied to the database in order to increase the reliability of the data entries. However, due to lack of (financial) means no independent party review can be set up as a standard activity. Therefore, quality control has to be performed by other users of the database.

5.1.4 Market aspects

EURODEMO supports innovative remediation technologies by providing comprehensive information through reports, databases and promotional workshops. The aim of EURODEMO is to accelerate acceptance and market confidence in innovative soil and groundwater techniques.
A number of drivers for EURODEMO are acceptance, promoting the use of remediation techniques and supporting the expansion of field implementation of technology innovation throughout Europe.
The main barrier is that stakeholders do not trust technologies which are:
I).. recently developed and not commonly used,
II). not visible (in-situ techniques) and
III). lasting over long periods.

Technology selection relies mainly on individual expertise and experiences of all the actors involved in the decision making process. The majority of operators favour the use of already proofed techniques.

Most important factors of success are:

- Simple and fast to fill out data related to the cases
- Increased use of remediation techniques

For the database with demonstration projects, the main barriers are that the case-studies are submitted on voluntary basis and not all cases are reviewed. This leads to a result in which not many cases are added to the database and the projects that are submitted often contain limited information. Another aspect is that for each country the governmental policy for soil and groundwater remediation is different. Therefore, the information gained from the cases cannot be used everywhere.

The end-users were categorised:

- Landowners
- Problem owners
- Property developers
- Contractors
- Regulators
- Service providers
- Technology developers
- Universities
- Technology investors
- Technology verifiers.

5.2 Technologies

EURODEMO did not perform any selection.

5.3 The system

5.3.1 Outline of the system

The main outcomes of the EURODEMO project are the guidance documents for setting up, executing and verifying demonstration projects and a database for remediation projects. The section of guidelines and support for demonstration projects is focused at potential remediation practitioners, particularly vendors, and aims to loosely explain the demonstration process as a sequenced list of considerations, which should be addressed throughout the stages of a good quality remediation demonstration projects.

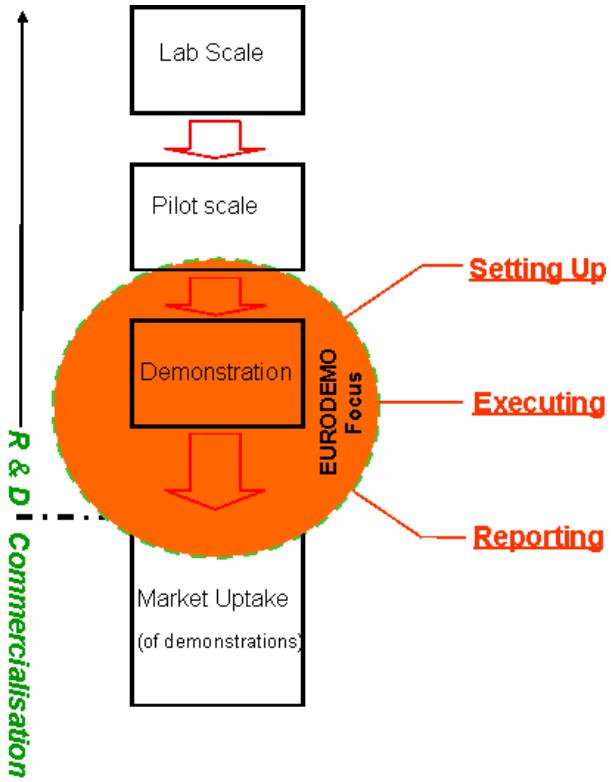


Figure 8 Focus of EURODEMO in product development and marketing

The database system is mainly a market driven system. It is dependent on the input of companies who have carried out remediation projects (pilot/demonstration/commercial). Templates should be filled in for the database on voluntary basis. Because the submitters do not have immediate benefit, it might have no (high) priority for them.

5.3.2 Protocols and reports:

The following protocols and reports are available in the public domain:

- Guidelines for setting up, Executing, and Reporting on Demonstration projects (is transposed as web-based application on the EURODEMO website) http://www.eurodemo.info/project-information-1/demonstration-project-guidance

Sustainability

- EU: Framework for sustainable land remediation and management
- EU: Model protocols and guidance for analytical sustainability assessment tools
- EU: Environmental efficiency criteria- Report on Case studies

Decision making

- EU: Final concept for a technology promotion programme
- EU: Protocols and guidance for best practice in decision making
- EU: Status report on decision making processes and criteria

Technical issues

- EU: Guideline and model protocols for checking technical reliability of selected remediation technologies
- EU: Status report on technological reliability for demonstrated soil and groundwater management technologies with special focus on the situation in Europe
- NL: In-situ bioremediation technologies- experiences in the Netherlands and future European challenges

Policy

- EU: Prioritisation plan for technology demonstration in the field of contaminated soil and groundwater management
- EU: Strategy for funding soil and groundwater technology demonstration

End user

- EU: Status report on end-used needs

6 PROMOTE

6.1 Organisation of the ETV system

6.1.1 Type of organisations involved in the system

PROMOTE developed a basic system for environmental technology verification (ETV), focusing on site characterisation, monitoring and remediation technologies for soil and groundwater. The preliminary ETV system and procedure is designed as a vendor driven system. It is meant to provide valid results on technology performance using fast, easy, and cost efficient ways. A scheme of the institutions and groups involved and their interaction is shown in figure 9.

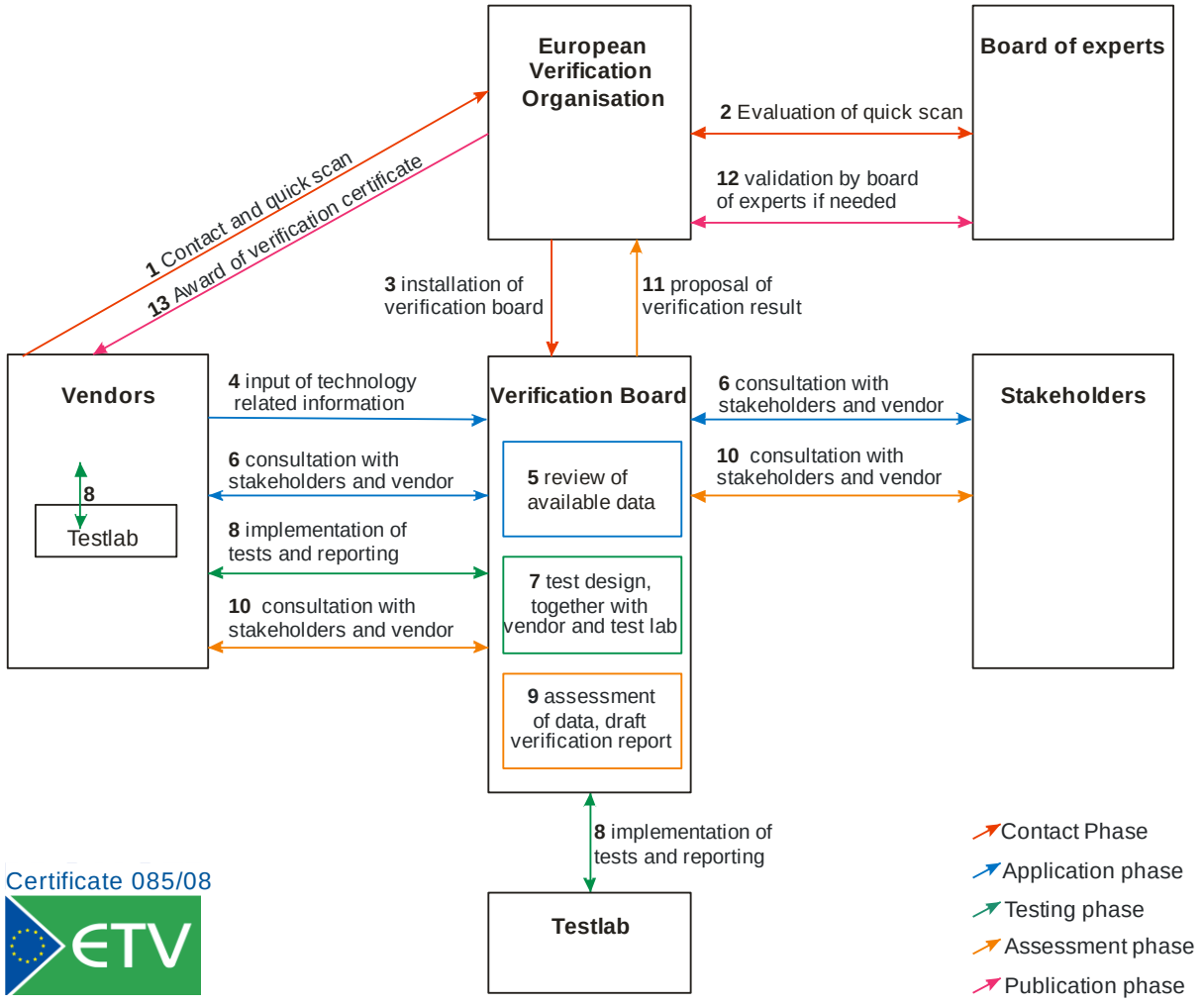


Figure 9. Proposed ETV organisation from PROMOTE

Table 12: ETV relevant organisations according to PROMOTE

Organisation		Role in ETV system	How to choose
European Verification Organisation	EVO	• Contact point for the first application of vendor / producer • Initialisation of technology specific Verification Boards, delegation of managers to VB and assigning contracts to experts for VB • Validation of verification reports • Awarding the ETV certificate	
Verification Board	VB	• Assessment of application documents and available test and data • Development of the technology specific verification procedure • Supervision of tests • Assessment of results • Compilation of the verification report • Cooperation with contracted test labs, vendors and stakeholders	Team of EVO staff for management of the board plus contracted expert(s) that is/are chosen by EVO from list of registered experts. Limited installation for one defined verification task
Vendors		• Submission of an application form for admission to ETV procedure • Provision of product related information (available data, product description) • Co-operation with the VB for developing technology specific verification tests	
Test labs		• Design of tests in consultation with VB • Conduct the tests • Presentation of test results to VB	Chosen by vendor and/or VB concordantly
Board of Experts		• Advice and expertise for EVO • Assessment of verification report upon request of the EVO	Chosen by EVO
Stakeholders		• Consultation in design and performance of verification tests • Active cooperation in workshops	Invited by VB via member states

6.1.2 Financing of the system

As a vendor driven system the technology and test specific costs, which are assessed to range from 20.000 € 100.000 € in most cases are to be covered by the vendor. Accordingly the system specific costs for the EVO and management of the VB etc. should be covered by public money. Additional funding would be a major benefit for ETV acceptance especially among SMEs.

6.1.3 Quality aspects of the system

Quality assurance and control in the PROMOTE system is built on 2 main pillars, the expertise of the entities involved and the consequent application of pre-defined protocols.

1. The selection of the most appropriate verification expert as part of the team of VB is a crucial task for the EVO in the application phase of the procedures. Test labs to be

contracted require accreditation to international standards. Stakeholder consultation process introduces further third party expertise.

2. The protocols are designed to ensure a complete input of technology data into the ETV procedure, the proper assessment of available data, consequent test design combined with a high quality but efficient test implementation, an accurate presentation of test results and a competent test evaluation.

6.1.4 Market aspects

From the supply side (vendors) the following aspects are of major concern:

- Verification should remain voluntary.
- A faster entrance of verified products into new European and international markets would be a great benefit for technology providers.
- International, mutual recognition would increase the attractiveness of a n ETV scheme.
- The benefit of verification has to exceed verification costs
- Additional funding would be of major benefit for ETV acceptance.
- National contact points are necessary to avoid access barriers to ETV

The demand side (customers, administration) clearly stated:

- Besides English national languages of the major target markets of a product have to be addressed, which is prerequisite for acceptance by public administration.
- Customer feedback on the usefulness of ETV when applying verified technologies should be possible
- A well traceable ETV logo, with an easily understandable range of validity is essential for acceptance

6.2 Technologies

Within PROMOTE, technologies in the areas of sampling and monitoring for soil and (ground) water has been in focus. Technology testing was done in two phases,

- First internally to test the workflow of the developed draft procedure, including the elaborated protocols and guidelines related to the design, implementation and interpretation of tests, thus testing the methodological concept of verification itself to constantly provide input for the ongoing system development process
- Second with external vendors for a final check of the system and related procedures

All tests were performed as role plays, in which PROMOTE partners according to their field of expertise took over the different roles in the verification process as described in the system, which ensured to proceed always close to reality.

Table 13: Overview about testing activities in PROMOTE

Aim	Verification tests during system development, project internal technologies				Final verification tests, project external technologies		
Scale	Lab and/or reference to field				Lab to field		
Technology	Photometer Slandi	Ceramic Dosimeter imw	Mini Pressure Pump imw	Fluorometer, Metal Oxide Sensor VEGAS	Direct Well, Soil Corer Eijkelkamp	BOD- Micro Biosensor Biosensores	Passive Sampler Envirogene
Verification tests	X	X	X	X			
Reference report	X		X				
Public report to external vendor					X	X	X

The external ETV system testing aimed for techniques in the area of site characterization devices for a rapid and cost effective in-situ and on-site characterization of contaminants and fit for use in a site characterization approach using dynamic work planning. A range of technologies from different vendors were identified during stake-holder consultations (developers, end users, consultants and authorities) and other dissemination activities related to the set- up of the ETV system. Based on the expressions of interest at these events and the information collected from the vendors there was no need to set-up an additional call inviting technology providers to submit innovative techniques for verification.

Technologies in the area of site characterization and monitoring of soil and groundwater were proposed as well as a limited number of remediation technologies. Based on the available information, the technical complexity and feasibility to perform the verification within the project's constraints a final selection of suitable requests was made. Because of time constraints and uncertainties related to site availability remediation technologies were not selected in the PROMOTE-project and it was decided for the external technology verification to focus on site characterization (more specific innovative sampling techniques) and innovative monitoring techniques for ground- and surface-water. Technologies were not accepted when there was a lack of availability of reference laboratory data, they were already verified or when confidentiality issues on technology specific information related to intellectual property rights resulted in limitations to data-availability.

Four technologies from vendors outside the project consortium were selected.
These technologies represented novel site characterization devices, which had not previously been verified. A major issue with verifying innovative technologies, which are complete new techniques, is to find independent experts that have e.g. not been involved in their development.
The following techniques have been verified:
SAMPLING

- A quick to install type of monitoring well: Direct Well (Eijkelkamp Agrisearch BV, NL)
- A soil sampling device aimed at sampling of volatile organic hydrocarbons: Soil Corer for volatiles (Eijkelkamp Agrisearch BV, NL)

SAMPLING - MEASUREMENT

- Field portable Slandi® LF300 Photometer (Slandi, Poland)

- A monitoring tool for biological oxygen demand in aqueous systems: BOD5 (Biosensores, Spain)

EXTRACTION (in this case colonization), MEASUREMENT, EVALUATION

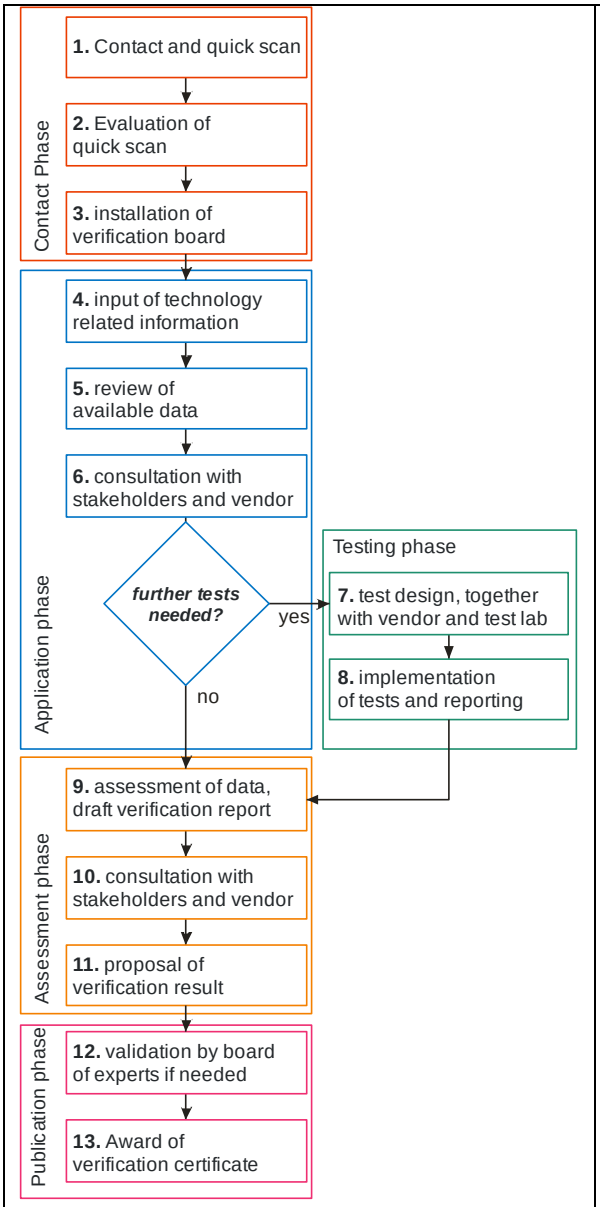
- A device for in situ ground water monitoring for detection of bacterial populations capable of degrading contaminating pollutants in groundwater: Biotrap (Envirogene, UK)

Claim specifications as well as selection of suitable reference methods are key factors in the verification process and directly linked to the test design. Since resulting time and costs are priority issues to the vendor these need a lot of consideration. The claim has to be clear, verifiable and needs to be relevant. Time and costs have to be in balance with the added value of verification results.
During the verification process claims can be revised, when tests give unexpected results that will lead to adaptations in the protocol.

6.3 The system

6.3.1 Outline of the system

The basic ETV procedure consists of max. 13 steps that are divided in five phases: contact phase, application phase, test phase if needed, assessment phase and publication phase



In the contact phase three organisational steps finally lead to the installation of the VB.

The application phase contains compilation and evaluation of all available technology specific documents. In this phase the vendor also defines the performance claims of his technology in cooperation with the VB. The application phase is divided into three steps and ends with the decision whether further test are needed.

In case a verification cannot be done based on the information provided by the vendor, additional tests are needed and a testing phase is inserted. In this testing phase the technology is tested at lab or reference scale and/or in the field.

In the assessment phase all previously available and produced data are finally assessed by the VB against the claims. This phase includes again stakeholder consultation on the assessment results.

The publication phase is the final phase of the verification. After validation the EVO awards the ETV logo to the vendor/vendors technology and publishes the award together with a fact sheet, summarising the verification and the results.

Figure 10 PROMOTE ETV scheme

The performance of the steps 2, 6, 7, 8, 10 and 12 depend on nature and scale of the verification procedure. In case of unambiguous decisions no consultation of the board of experts in step 2 and 12 is necessary. Also, the consultation of stakeholders in steps 6 and 10 might be reduced to a minimum if appropriate.

6.3.2 Protocols and reports:

The PROMOTE user's guide leads through the ETV procedure as described before. Various generic protocols, forms and checklists are available to apply the procedure step by step to specific technology verifications. The protocols refer to the verification of monitoring and site characterisation technologies for soil and groundwater. The verification of remediation technologies follows the same procedure but requires modified checklists.

The protocols are designed to ensure a complete input of technology data into the ETV procedure, the proper assessment of available data, consequent test design combined with a

high quality but efficient test implementation, an accurate presentation of test results and a competent test evaluation. The protocols are designed to be used in the different verification steps as follows:

Table 14: Documents in PROMOTE

Guidance document (Form, protocol etc.)	To be applied in step
Quick scan input form	Step 1: Contact and quick scan Step 2: Evaluation of quick scan
Requirements on product/technology description	Step 4: Input of technology related information
Application and test design protocol	Step 5: Review of available data Step 7: Test design
Test implementation protocol	
Protocol for evaluation of manual	Step 5: Review of available data Step 8: Implementation of tests and reporting Step 9: Assessment of data and draft of verification report
Protocol for evaluation of personnel qualification and strategy	Step 5: Review of available data Step 8: Implementation of tests and reporting Step 9: Assessment of data and draft of verification report
Protocol for evaluation and reporting	Step 9: Assessment of data and draft of verification report

6.3.2.1 Acceptance of existing data

The PROMOTE procedure as a vendor driven system prefers the use of existing data, as long as the data quality is assured. No specific method for quality assurance of this data has been proposed.

6.3.2.2 Reference methods

We distinguish between

1. certified reference methods: a method which is endorsed by an internationally recognised institution like DIN, ISO, and EPA….. A well defined standard internationally recognised
2. laboratory reference method: well defined method, described and published, generally accepted for certain purposes

If a certified reference method is available and its use considered appropriate, it should be the preferred option for verification. If it is not used the reasons have to be outlined and a thorough justification for the preferred use of the laboratory reference method has to be given.

7 TESTNET

This chapter summarises shortly the outcomes of the EU project TESTNET, Towards European Sectorial Testing Networks for Environmental Technology, finalised in October 2008.

7.1 Organisation of the ETV system

7.1.1 Type of organisations involved in the system

For the organisation of the proposed ETV system, public-private partnership has been the starting point. Another goal was to guarantee independency without creating a too complex bureaucratic structure.

The proposed system is shown in the figure below. The bodies acting in the primary process are demarcated in the large box, supported by organisations in the right and lower box.

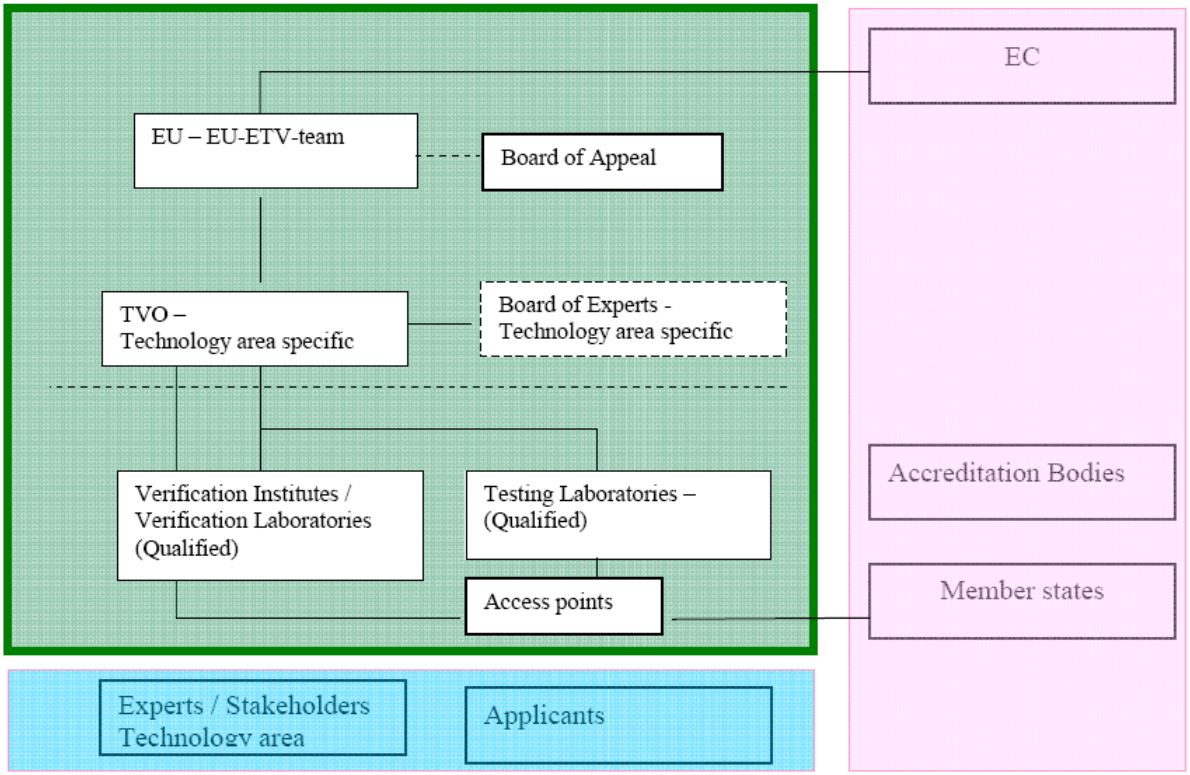


Figure 11: Proposed EU ETV structure from TESTNET

The role of the organisations is described shortly in the following table.

Table 15: Organisations in an ETV system according to TESTNET

Organisation	**Role in ETV system**
Access points	First contact with vendors, provides information, guides to appropriate Verification managers
Vendor/applicant	Has technology to be tested, knowledge about technology
EU ETV Team	Representing EU, marketing of ETV, awarding ETV logo, open calls for verification institutes and labs, running the day-to-day process of ETV
TVO Thematic Verification	Publish lists of institutes for verification and testing, register applicants, manage board of experts, collect and control test plans

Organisation	Role in ETV system
Organisations	and protocols, run and administrate financial transactions, publish verification results
Board of Appeal	Responsible for complains regarding ETV and verifications
Verification institutes	Perform verifications, project quality control, expertise for criteria, contact and advice for vendors
Testing laboratories	Expertise for data acquisition and testing, perform testing and report results.
Independent experts, stakeholders	Expertise for setting criteria for individual verification
Accreditation bodies	Responsible for accreditation of labs and verification institutes

7.1.2 Financing of the system

The costs for verification depend on the complexity of the product to be verified. In TESTNET, costs for verification varied from 5-20 k€ and costs for testing from 10-70 k€. Results from TESTNET indicate that the upper value for costs is 50k€, but a lower value is more likely to assume as a realistic average.

Acceptable total costs for verification depend on the added value of the results achieved and the logo. Additional funding has to be foreseen especially for SME.

According to TESTNET, when run efficiently, the duration for verification should be possible within 6 months, and with exceptions 9 months.

7.1.3 Quality aspects of the system

As credibility has been identified as one of the important success factors, TESTNET has put significant effort in assuring quality by the system design.

A number of independent organisations are involved in the process. The main work of practical verification is performed by verification institutes and labs. These have to fulfill quality criteria and they have to be accredited to relevant standards, e.g. ISO 17025 for laboratories. It is also important, that necessary competence is available in the organisations involved in the verification. In order to increase independency, TESTNET recommends having testing and verification done by different organisations.

EU ETV system sets up a list of eligible organisations, i.e. organisations are only allowed to participate in verification after a quality check of the organisation by EU-ETV. EU-ETV is also responsible for evaluation of the quality assurance data.

In order to achieve high quality of the protocols, stakeholders and experts are involved in the production of these.

7.1.4 Market aspects

TESTNET had the scope of water and clean production technologies with the related monitoring. The investigations have been focused on these technologies, but the findings might often be of a more general nature. Within the targeted areas, there are a number of

drivers that create opportunities for new products. A number of drivers are: Increasing water stress, balancing water supply and demand, reducing negative environmental impact.
In Testnet most important factors of success of the ETV system were mentioned:

- Credibility, reliability and transparency are essential in producing credible data
- Simple, fast and not too expensive
- Added value for the producer; worldwide recognition, at least in the member states
- Subsidising
- Accessibility

Factors of failure mentioned mostly are aspects undermining the factors of success:

- Agencies in several European countries still demanding additional tests by their own institutes
- The responsibility of each government for acceptance of products (type approval procedures) in their member state will not be denied. But duplicating tests is only expensive, causing annoyance and loss of time to market. EC should play a strong role in making the credibility of the data recognised.
- Bureaucracy, making it complicated, time consuming and expensive
- Lack of flexibility (mentioned are: also prototypes, simplified procedures)
- Lack of competence (An insufficient level of knowledge, expertise and experience)
- No preferential status in the market (this would mean a more or less mandatory submission)
- Transparency does not mean everything is public: it is up to the producer to decide what to keep confidential

7.2 Technologies

Within the project TESTNET, technologies in the following areas have been in focus:

- Water technologies
- Clean production.
- Monitoring related to the technologies mentioned above.

According to TESTNET, only ready-to market technologies should be verified.
The technologies verified as test cases have been chosen as part of the project, although they have been partly proposed already during the application process. The aim was to cover all areas mentioned above as well as having different complexity. The choice of technologies has been justified within the project, by means of a mapping of promising and relevant technologies in the areas. For all three areas, the project identified a number of types of technology that will be interesting for future verification.
Although TESTNET has been restricted to a number of technology areas, the project concluded that a running ETV system will have a broader range of technologies covered.
The following technologies have been verified:

Table 16: Test cases within TESTNET

Technology area	**Technology/product**
Water monitoring	Toxcontrol
Water monitoring	S:can spectro:lyser
Water treatment	Technologies for water disinfection in food industry
Water Treatment	Fuzzy filter
Cleaner Production (membrane technique)	Water recycling from flue gas condensate
Cleaner Production (waste)	Plasma treatment for waste

Cleaner Production (production line)	Clean pipe production
Cleaner Production (air membranes)	Membranes for hydrocarbon separation

7.3 The system

7.3.1 Outline of the system

A main outcome of the TESTNET project is the proposed scheme for verification. Two different approaches have been discussed and tested, one with a larger involvement of different organisations in production of protocols and documents, and one where several actions are taken over by the same body. This resulted in the recommendation to have two possible pathways, one when no similar protocol is available ("long track"), and one when there is a similar protocol ("short track").

The verification system is probably vendor driven. There are national contact points to enter the verification. National contact points are seen as important as many suppliers are most convenient with the national language. A first step is the decision if a similar protocol is available. This decision is made by the TVO.

If there is a similar protocol available, the short track route for verification will be followed, where the protocol adaption is managed by the testing organisation. A quick-scan is performed by the testing laboratory with data supplied by the vendor. During the quick scan it is checked, if the technology is suitable for verification, e.g. ready-to-market, and if there are data available that can be used for verification. After the quick scan a contract between the verification organisation and the vendor is signed. The verification organisation can be chosen from a list by the vendor this protocol will be adapated by a task group consisting of the vendor, the verification organisation, external expert(s) and possibly a customer. When the protocol is ready, also the test plan is adopted with regards to the current verification. Existing and testing phase data are checked and evaluated. If additional testing is needed, this is done according to the test plan. The results from the testing are reported in a test report.

If there is no similar protocol available, the procedure is still the same, but more advanced in producing the protocol. It involves both a testing laboratory and a verification institute. The verification institute is responsible for the production of the documents, the test laboratory only for testing and test report.. The protocol is developed including a stakeholder procedure with a stakeholder group of about 15- 25 persons.

The final step is the verification phase. A verification report is produced either by the verification laboratory (short track) or the verification institute (long track). The report is checked and approved by the TVO. Finally the ETV logo is awarded for a successful verification.

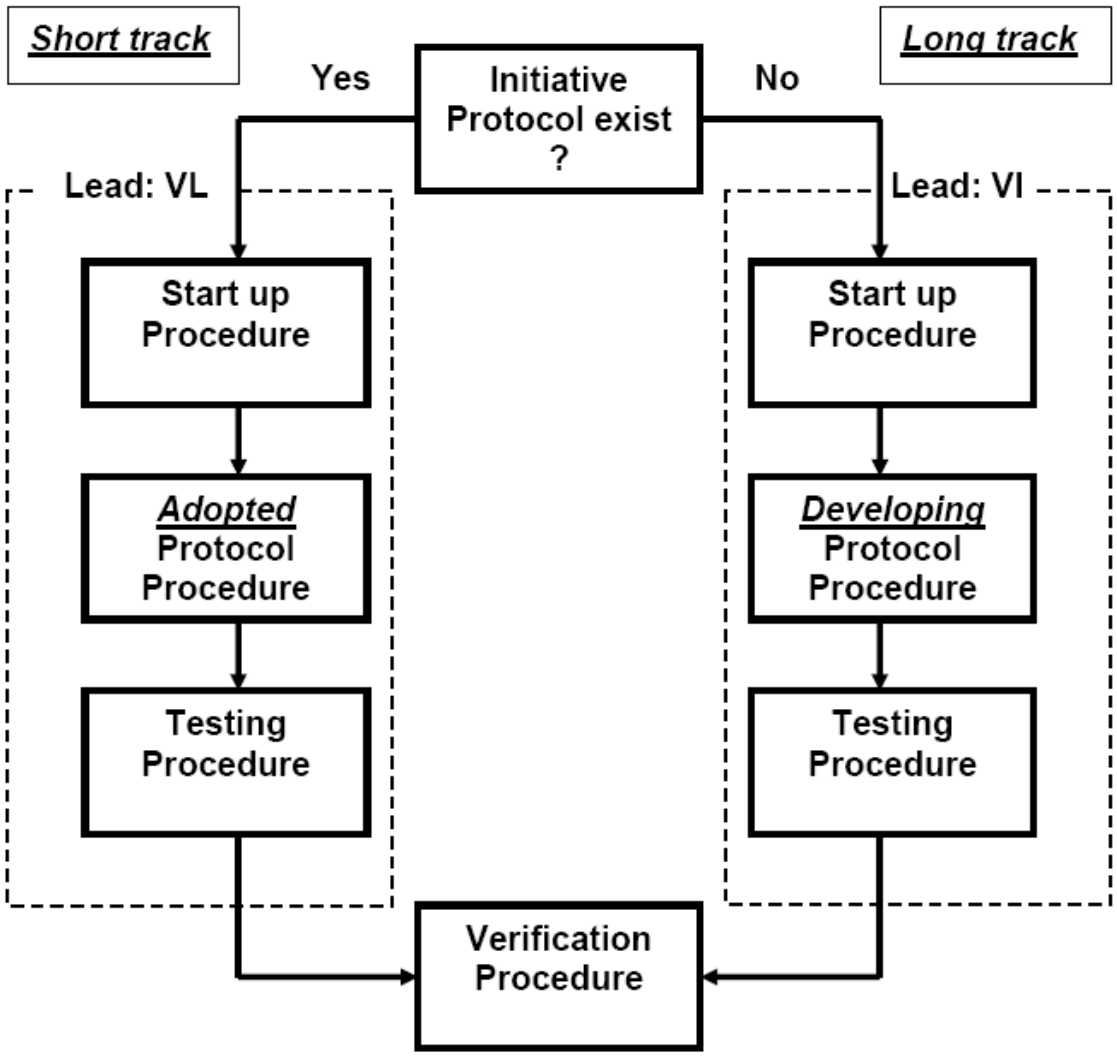


Figure 12: Verification scheme with 2 options according to TESTNET

According to TESTNET, the applicant should always have the chance to stop the verification process at each stage. If stopped before finishing no information will be published.

The discussions in TESTNET suggest that the proposed system should work for all technology areas. The protocols will be technology specific, but the system itself would be applicable for other technology areas as well. Within TESTNET a broad range of different technologies has been tested, that allowed this conclusion. TESTNET also suggested Thematic Verification Organisations, which would cover only a certain number of technology areas. As the verification institutes and laboratories have to be qualified by expertise, each one might also be restricted to certain technology areas, but there will be institutes and laboratories for all areas.

7.3.2 Protocols and reports

7.3.2.1 Documents produced during verification

The following documents are produced and their availability for the public:
Ownership TVO, in principle public

- Quick Scan report
- Verification Protocol

- Verification Statement, the right to use the logo
- Verification Report, ownership producer, publication is his competence
- Test report(s)

But, it has also been mentioned in the final TESTNET report, that the producer should have control over what is published.

7.3.2.2 Performance criteria and their definition

The performance criteria are defined in the protocol development or adaptation phase, depending on which route of verification is applicable. It is always based on the vendor claim, but a task group will decide on which parameters have to be tested. If there is an existing protocol to be adapted, this task group is limited to a number of persons. If a new protocol has to be developed, there is a larger number of persons involved, including a stakeholder process.

Parameters that are included in verification are: benefit of the technology and the corresponding operational parameters, function, and resource use for environmental impact and operational cost estimations. Also operational safety, i.e. risk for break-down can be important.
Target values have to be set based on the needs in the main target markets and on the vendor claim.

7.3.2.3 Acceptance of existing data

The TESTNET procedure allows the use of existing data, as long as the data quality is assured. No specific method for quality assurance of this data has been proposed.

7.3.2.4 Reference methods

The issue of reference methods has not been a main point of discussions in the design of the verification system.

7.4 Reference

TESTNET Final project report, October 2008.

8 TRITECH

8.1 Organisation of the ETV system

8.1.1 Type of organisations involved in the system

Table 17: Organisations in ETV according to TRITECH

Organisation		**Role in ETV system**	**How to choose**
Vendor	V	Has technology to be tested, knowledge about technology	(might be EU initiative) open access
EU ETV Team	ETV	Representing EU, system management, overall quality control, management of databases on VM and experts, information about ETV	For EU?
Verification Bodies	VB	Project manager, project quality control, expertise for criteria, contact and advice for vendors	Free to choose by vendor, from a list or by criteria, appointed by EU ETV Team
Testing centre	TC	Expertise for data acquisition and testing	Chosen by vendor from list or by criteria (with necessary experience)
Independent experts	Ex	Expertise for setting criteria for individual verification	Chosen by VM from database
Stakeholders	S	Additional expertise for criteria	Public inquiry and specifically addressed by VM and vendor

8.1.2 Financing of the system

TRITECH has investigated a possible business model for an EU ETV system. The Central Verification Organisation (EU ETV Team) will be financed publically. Verification bodies are foreseen to be financed with part public and part private financing – public financing for the general operation and overheads associated with the scheme and private financing in the form of a contribution by vendors to the costs of verification. Verification by the VBs will require the use of accredited experts in the form of Verification Panels. To ensure availability of experts, a system for compensation of their expenses should be developed.

Based on the hypothesis that the number of verifications would increase progressively up to 200 over the first five years of implementation of the EU-ETV scheme (at a settled-down rate of 60 per year), the cost for the EU budget is estimated to be around €4 million Euros per year.

Costs for verifications (based on the IPTS report) are assumed to be as an average €70,000 per verification Assuming a bedded-down run rate of 60 verifications per year, the cost per verification excluding the centre costs would be around €40,000 per verification. It would be expected that the applicants would make a contribution to these costs as a fee for the verification service. The objective is to limit this final cost to applicants to the order of €15,000 per verification.

TRITECH proposes that the EU Budget covers the administrative cost related to the EU-ETV in the Commission (through the CVO), the costs associated with meetings of the Technical Groups and the Advisory Fora, Verification Bodies' administration costs and subsidisation of verification costs, focused on facilitating the access of SMEs to the system

8.1.3 .Quality aspects of the system

Tritech identifies quality contral and assurance as important factors for success of an EU ETV system. Special focus is put on the test centres. Proficiency testing of approved test centres is regarded as the key to the successful implementation and acceptance of the future EU ETV scheme. A number of different quality aspects for test centres are identified like internal quality control, reproducability of conditions, statistical control measures etc.

8.1.4 Market aspects

Within the TRITECH Business Plan, there is a market analysis, giving an overview on the environmental technology market in Europe. The environmental technology market can be seen as a large market, with an estimated value of 227 billion EUR for 2004 for Europe. In a different study from 2007/8, the global market of low carbon environmental goods and services was investigated. The total global market is estimated to be about 3350 billion EUR, with the largest part in the emerging low carbon sector (47.5%), followed by the renewable energy sector (30.9%) and the environmental sector (21.6%).

8.2 Technologies

Three different technology areas are being studied during the project; water, soil and energy related technologies.

8.3 Water

4 technologies are being verified – the 5th dropped out of the scheme. The technologies going through the scheme are:

- SHS Sludge Dryer – Verification is complete and the report available
- Watman Bio (continuous mechan-biological-chemical domestic waste water treatment plant. Verification nearly complete.
- Atrex – Disintegration device recovery of solids from paper industry reject water
- Elävä Lähde – Nanosilver containing water purification elements

A fifth company, Chena, which is a real time water quality monitoring system is going through the ETV process, but VTT are not sure they will have time to complete it before the 31st August due to delays outside of their control (i.e. from the technology vendor)

8.4 Soil

4 technologies are being verified as listed below:

- Safer Soil Tester, Crown Bio – Verification complete and results currently being interpreted.
- 2 composting methods – verification of both of these is under way. IVL have been delayed due to Swedish law preventing them from carry out the tests within certain months of the law.
- 1 Sorbent method (‘sausages’ – in these, IVL can only verify the likelihood of the sorbant trapping contaminants because they can’t rely on a consultant putting the ‘sausage’ in the right place in the ground, and therefore the consultant could theoretically simply miss the contamination)

8.5 Energy

Five technologies have been tested. A further 3 were considered. The five are listed below:

- Fluoresave – verification complete. All aims were achieved.
- Sabien technologies M2G – intelligent boiler optimisation control.
- Wheel Right – tyre pressure and remote tyre condition monitoring. This technology is also going through the Carbon trust incubator programme therefore the Carbon Trust evaluation data is also being utilised.
- Stingray – Reflector system
- Minimise LTd – KVAR Power Factor Optimisation (optimises the power factor of inductive load)

The 3 onsidered are:

- Megafans – cooling and ventilation (BRE have been contacted to do the testing)
- Magnatech – Fuel conditioning system
- ROMAG – PV solar panels and glass

8.6 The system

8.6.1 Outline of the system

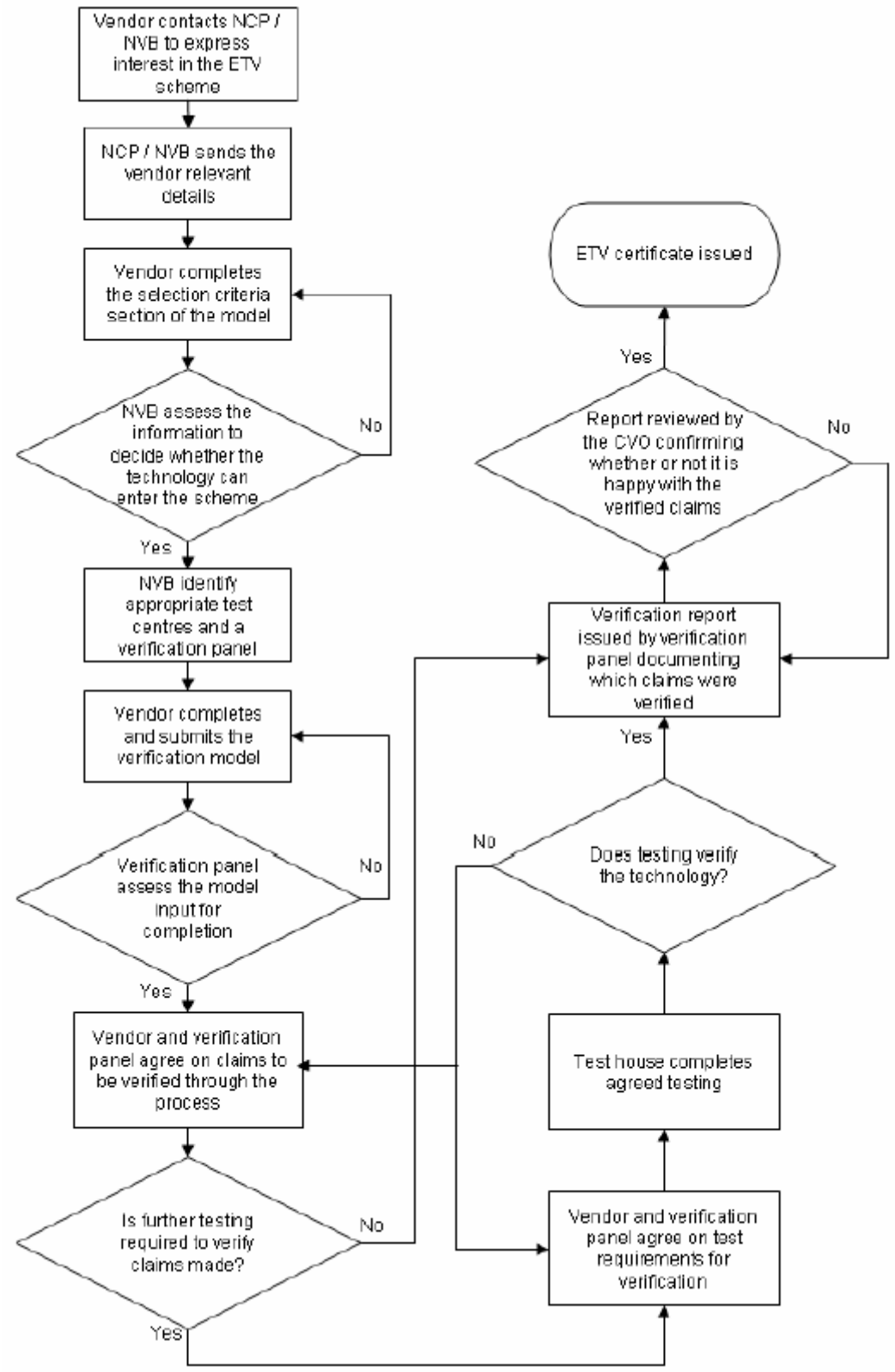


Figure 13 The ETV organization outline according the TRITECH project.

The outline in 13 was the original structure when the project started. It has stayed almost unchanged except for the fact that interaction with the vendor is needed during several occasions and that it is essential when it becomes clear how tests really can be performed. Then test designs might be subject to change.

ETV should be seen as a process. The process should be recognised ie. A 'brand' that is recognised as robust and reliable. All organisations going through ETV would then have to be published on website for example, but there is no 'approved' or 'not approved', just the fact that ETV has been implemented.

8.6.2 Protocols and reports:

Including:

- Two documents are being produced; 1) the protocol which is a generic test methodology description for a group of technologies with the same function (i.e. soil toxicity testing or ex situ soil treatment), 2) the report which is specific for every tested appliance.
- Technologies tested in full scale will be tested with respect to their intended function and the parameters that may concern the claims. Also, LCI-data will be reported that are harmonized with the EPD-reporting format. This data is normally retrieved from the vendor's journals.

Table 18: Verification actions depending on information availability

Available information	**TRITECH action**
No or very sparsely available information	Carry out a full study including a relevant pre-study.
Information available. Research conducted by the company itself or an unknown actor/not reliable actor	Use information as input to set limitation/boundaries of the design. Carry out a full study.
Information available. Research conducted by a third party trusted actor.	If materials and method is correctly described for the existing study – repeat parts of the study i.e. carry out a reduced study.
Verification study by ETV	The "verified once – accepted everywhere" principle says that verification does not have to be done unless the scope is different the second time. In that case, a completion of the first study is performed.

9 US ETV

9.1 Organisation of the ETV system

9.1.1 Type of organisations involved in the system

Table 19: Organisations in US ETV

Organisation		**Role in ETV system**	**How to choose**
Vendor	V	Provides technology to be tested, knowledge about the technology	1) Vendor approaches ETV Program or Verification Organization (VO) with interest and stakeholders concur with proceeding 2) Stakeholder suggests vendor/technology/technology category and VO solicits and identifies applicable technology vendors
EPA ETV	ETV	Overall program and quality	Chosen by US EPA management

Program Office		management; manages ETV Web site, database, and ETV brand/logo; outreach	
EPA ETV Center Project Officers and Quality Managers	Center	Center compliance with programmatic process and quality requirements/system; technical and quality assurance expertise; outreach	Chosen by US EPA management
Verification Organization	VO	The public and private sector organizations holding cooperative or interagency agreements or contracts to assist US EPA in implementing the ETV program. Responsible for planning and performing the verification tests; forming and maintaining stakeholder groups; recruiting vendors and collaborators; quality assurance; developing verification reports and statements; and outreach.	EPA ETV Center Project Officers choose VOs to manage their centers following a competitive solicitation process. Vendors choose/are directed to a center based on the type of technology they want verified.
Stakeholders	S	Prioritization of technology categories; test plan development; test collaboration; peer review; outreach	Chosen by VO
Collaborator	C	Help fund/support verification testing; technical expertise	Recruited by the VO, stakeholders, and EPA ETV staff

9.1.2 Financing of the system

Vendor and/or test collaborator funds and/or donates support for verification test (which includes test/QA plan development; testing; and reporting). Since 2006 the US EPA has provided limited funding on an as-available and as-needed basis to help cover center management costs and limited verification activities. US EPA also provides personnel and other support to manage the overall ETV program, provide technical and quality assurance input, perform outreach, and manage the ETV Web site. In fiscal years 2004 and 2007, about 50 percent of program funding (i.e., approximately half in-kind and half monetary) were received from vendors and others. In 2008, approximately 90 percent of program funding was received from vendors and others. Verification costs, which include testing, range from $50,000 to $250,000 and verification times average between 6 months and 2 and 1/2 years, including testing periods that can range from 1 or 2 weeks to over a year

9.1.3 Quality aspects of the system

US EPA maintains a program-level Quality Management Plan (QMP) for the ETV Program which meets EPA and ANSI E-4 quality system requirements. Each ETV Center (run by VO) has Center-level QMP based on US ETV QMP. Each verification test is conducted under US EPA and vendor approved test/quality assurance plan (TQAP) that complies with the requirements of the overarching quality system. Technical systems audit (TSA) and audit of data quality (ADQ) performed by VO for each verification test, and at US EPA discretion for each verification test.

9.1.4 Market aspects

Markets

Markets and target groups are:

- Risk-averse markets and decision-makers as a whole.
- Regional, national, and international markets that would benefit from the development of broadly applicable testing approaches/data sets that limit the need for duplicative testing.
- Markets with voluntary drivers for improving environmental performance (diesel retrofit programs, grants) associated with some type of economic or other incentive to encourage technology use.
- Regulated or soon-to-be regulated markets which benefit from use of data from external testing organizations/programs like ETV, particularly with respect to establishing performance of an alternative process or providing a venue to establish conformance with a new or upcoming rule.
- Dual-benefit markets, in which environmental and other benefits (energy production/reduction, water reduction, etc.) are targeted.
- Markets for which a clear economic/resource advantage can be demonstrated for the application of the technology.

Developer and Vendor Drivers

- Increases credibility of performance claims
- Provides sound science-based marketing advantage
- Reduces advertising and marketing costs
- Expands markets and business opportunities
- Spurs additional technology innovation/improvements
- Adds confidence for investors and lenders
- Enhances regulatory acceptance
- Reduces testing required for acceptance by multiple states and localities
- Increases public awareness
- Spurs the environmental technology sector
- Facilitates national and international exchange of environmental products

User, Purchaser, and Regulatory Drivers

- Access to credible, third-party, relevant performance data obtained with input from stakeholder colleagues
- Allows easier evaluation of competing technologies
- Improves ability to make informed decisions
- Promotes high quality performance testing for new technology categories
- Establishes realistic performance requirements; not limited to any single state's regulations
- Facilitates technology acceptance, permitting, and regulatory development/response at the state, local, and federal level
- Provides a technological basis for streamlining the regulatory process and/or simplifying and revising regulations
- Increases confidence in measurement and control of pollutants
- Reduces noncompliance risks
- Advances technologies that benefit human health and the environment

- Increases the availability of technologies that meet user needs and regulatory requirements
- Fosters cooperation between industrial and public interests
- Increases public confidence
- Spurs the environmental technology sector
- Facilitates national and international exchange of environmental products

9.2 Technologies

US ETV is composed of six centers. Each center verifies the performance of specific technology areas that are grouped by media, technology use, or a specific environmental issue, as shown below:

- US ETV Advanced Monitoring Systems Center
- US ETV Air Pollution Control Technology Center
- US ETV Drinking Water Systems Center
- US ETV Greenhouse Gas Technology Center - Energy efficiency, renewable energy, and greenhouse gas mitigation and monitoring technologies
- US ETV Water Quality Protection Center - Infrastructure rehabilitation, and storm and waste water control and treatment technologies
- US ETV Materials Management and Remediation Center

To date, the US ETV program has verified 408 technologies in over 75 categories (see http://www.epa.gov/etv/verifiedtechnologies.html). Technology categories are selected based on stakeholder input. In general, stakeholders apply three criteria in setting priorities among technology categories:

- Existence of an important environmental problem to be addressed
- Availability of techniques for performance testing
- Feasibility and practicality considerations.

Verification is open to any technology in a category chosen for verification, assuming resources are available to cover the cost of verification. Technologies are voluntarily committed by technology vendors for verification testing. ETV Center VO must obtain concurrence from stakeholders to proceed with verification testing to ensure relevance to meeting technology needs of user community.

US ETV also verifies technology categories that directly support an Agency information need or priority through the Environmental and Sustainable Technology Evaluations (ESTE) portion of the program. ESTE verifications are performed by VOs through contracts with US EPA. Verification categories are chosen by EPA's Office of Research and Development (ORD) with input from EPA program offices and regional offices. All environmental technology categories are considered and technologies are voluntarily committed by technology vendors for verification testing. ESTE maintains the quality assurance, stakeholder involvement, and cost-sharing those are fundamental operating principles of ETV, as described in http://www.epa.gov/nrmrl/std/etv/este.html

9.3 The system

9.3.1 Outline of the system

The EPA Environmental Technology Verification (ETV) Program is a voluntary program. The ETV verification process, illustraded in figure 14, typically includes the following steps:

- Identification of area-specific technology categories
- Identification of verification factors
- Vendor solicitation and application
- Verification protocol
- Test/quality assurance plan
- Verification testing
- Verification report and statement
- Outreach

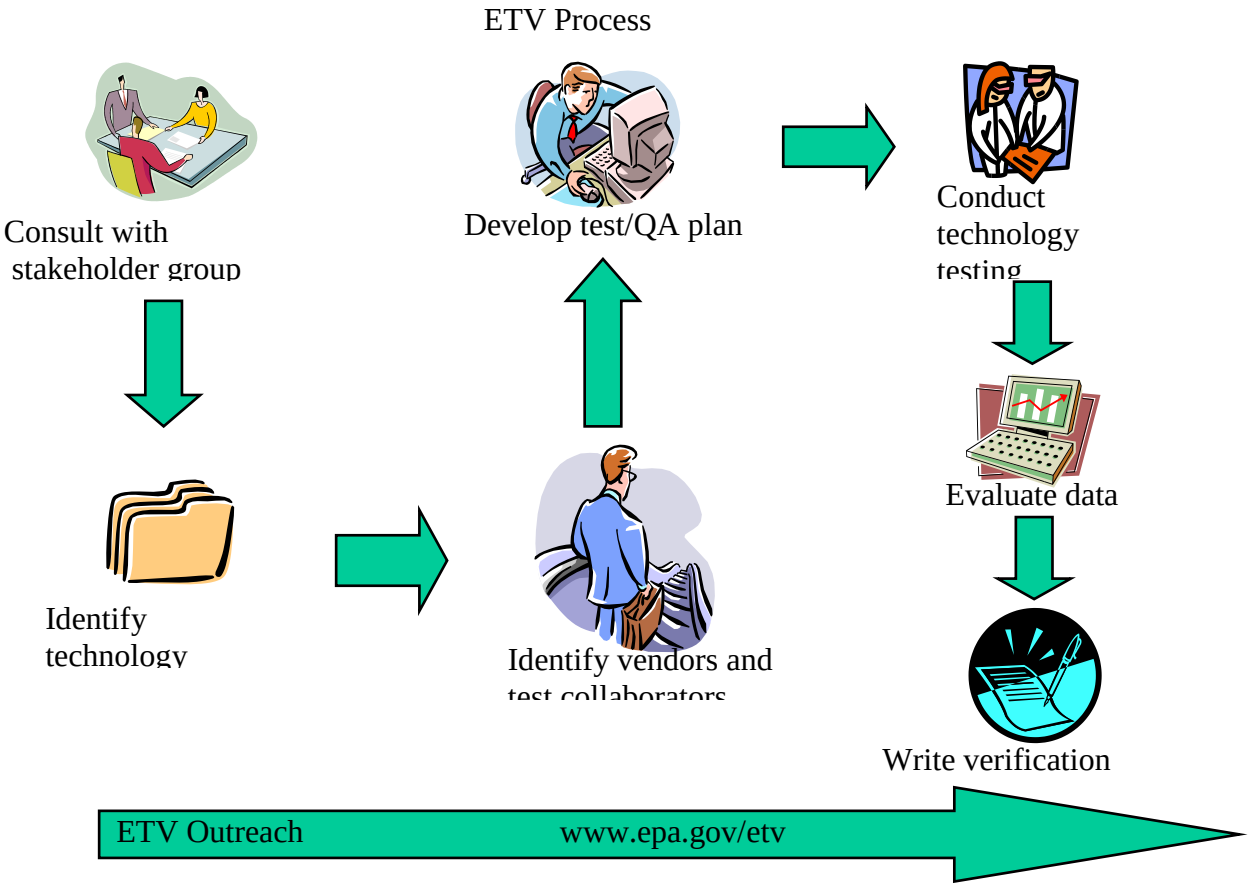


Figure 14: US ETV system

9.3.1.1 Identification of Area-Specific Technology Categories

ETV is open to any technology. However, to organize and set priorities for verification activities, ETV identify specific categories of technologies across all environmental media—air, water, and land. These area-specific technology categories are prioritized by the ETV verification centers and their stakeholders. In general, stakeholders apply three criteria in setting priorities among technology categories:

- Existence of an important environmental problem to be addressed
- Availability of techniques for performance testing
- Feasibility and practicality considerations.

Existing priority categories are regularly reviewed by the stakeholders and are frequently adjusted to reflect changes in the marketplace.

9.3.1.2 Identification of Verification Factors

Once a technology category is accepted for verification, ETV stakeholders identify the verification factors, or performance considerations, about which purchasers and permitters need information to make decisions. For example, monitoring technologies are evaluated for verification factors such as measurement precision and accuracy. In the case of field monitors, the required technical proficiency and training of the operator, the time required for setup and breakdown, and the overall ruggedness of the instrument can be very important verification factors. For other technologies, energy consumption, downtime considerations, failure rates, and multimedia impacts (e.g., air control technologies that may produce water or solid waste residuals) can also be evaluated.

9.3.1.3 Vendor Solicitation and Application

Once a technology category is identified, ETV issues vendors solicitations and the verification centers begin accepting vendor applications in that category.
ETV solicitation for vendors may occur in the following ways:

- By posting an announcement on ETV's Web site and in ETVoice (ETV's listserve and monthly electronic newsletter)
- By posting an announcement in FedBizOpps
- By inviting known vendors in the marketplace to participate
- By discussing participation in the ETV Program with individual vendors at conferences and trade shows.

9.3.1.4 Verification Protocol

When the full list of verification factors has been identified, a verification protocol is usually developed by the verification organization. The protocol is either based on existing test procedures or is newly developed. Stakeholders and panels of technical experts review the protocol to determine whether the data to be collected in the verification test will definitively address the verification factors when published in the final verification report. In some cases, the protocol is developed prior to testing. In other cases, a generic protocol is developed after the verification is complete and reflects lessons learned during the testing experience.

9.3.1.5 Test/Quality Assurance Plan

Once vendors and their products are identified for a particular test event, a test/quality assurance plan is developed by the verification organization and agreed to by EPA and the vendors. Sometimes, a generic verification protocol is developed prior to testing and the test/quality assurance plan is based on the protocol. Other times, the test/quality assurance plan is developed first, prior to testing, and a generic verification protocol is developed after verification is complete.
If the technology is tested in the field, the test site is generally identified when the test/quality assurance plan is developed so that the plan can be tailored to a particular test location.

9.3.1.6 Verification Testing

Verification testing can be conducted for one product or for a group of similar products at the same time. To conserve resources, ETV evaluates technologies within a given category in groups when there are multiple vendors.
According to the schedule specified in the test/quality assurance plan, and agreed to by all parties, the verification organization and vendors finalize the arrangements for testing. With assistance from the participating vendors, the verification organization tests the equipment using the procedures outlined in the test/quality assurance plan. Audits of the test event are

conducted by EPA and the verification organizations. Rigorous quality assurance evaluations of the resulting test data are performed in accordance with the plan, the center-specific quality management plan, and the ETV Quality Management Plan (PDF) (84 pp, 744 KB).

9.3.1.7 Verification Report and Statement

When testing and data analysis are complete, a draft verification report and a summary statement (2 to 7 pages) are developed by the verification organization for each product tested. The report and statement are reviewed by EPA, the participating vendors, and peer reviewers. EPA management approves the final report and statement, and EPA management and the verification organization sign the verification statement. The final report and statement are published on the ETV Web site.

9.3.1.8 Outreach

The technology vendor is solely responsible for outreach activities related to the performance verification of their product. However, companies and products that have been verified by ETV are posted on the ETV Web site and are included in other ETV outreach materials. EPA and ETV verification organizations also conduct on-going outreach to inform audiences about the activities of the program and the availability of performance verification information to aid in decision making.

9.3.2 Protocols and reports:

All protocols, TQAPs, verification reports, and verification statements are available publicly once in final form (see http://www.epa.gov/nrmrl/std/etv/publications.html). Outreach materials, stakeholder meeting minutes, QMPs, and other programmatic documents are also posted on the ETV web site. Performance parameters are determined through stakeholder-based process and applicable performance requirements. All test/quality assurance plans, protocols, and reports are peer reviewed. Reference methods are selected based on relevance to technology(ies) being tested. Previous data (called existing data) can also be used to supplement or replace testing (see Appendix C of the ETV QMP at http://www.epa.gov/etv/pubs/600r08009.pdf for ETV's Existing Data Policy).

Appendix 1: Collection of documents: Protocols

AIRTV: collected within the project
ETV Canada:http://www.etvcanada.ca/verifiedtechs.asp
DANETV:www.etv-denmark.com
EURODEMO: http://www.eurodemo.info/de/project-information-2/ (not ETV protocols)
NOWATECH:www.etvnord.org, partly collected within the project
PROMOTE:
TESTNET: collected within the project
TRITECH: partly collected within the project
US ETV: see http://www.epa.gov/nrmrl/std/etv/vp.html

Appendix 2: Collection of documents: Test plans

AIRTV: not available publically
ETV Canada:http://www.etvcanada.ca/verifiedtechs.asp
DANETV:www.etv-denmark.com
EURODEMO: not relevant
NOWATECH:www.etvnord.org, partly collected with the project
PROMOTE:
TESTNET: collected within the project
TRITECH: partly collected within the project
US ETV input: see http://www.epa.gov/nrmrl/std/etv/tqap.html