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EVALUATION

of the EU pilot programme on Environmental Technology Verification (ETV)

{SWD(2020) 244 final}

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1. INTRODUCTION

1.1. Purpose of this evaluation

Environmental Technology Verification (ETV) is a service designed to help innovative environmental technologies access the market. In ETV, qualified third parties verify a technology's technical and environmental performance by assessing the results of tests of controlled quality, based on performance claims put forward by technology developers. This should help developers and sellers of the technology to document the reliability of their performance claims and help technology purchasers identify innovations that suit their needs. This is particularly helpful to SMEs in a context where there is no certification or labelling scheme applicable to the technology. A longer term objective of ETV is to help overcome technological lock-in, while ensuring that more effective and cheaper environmental protection measures can emerge.

In the context of ETV, a technology is understood as the application of scientific knowledge, tools, techniques, craft or systems to solve a problem or to achieve an objective which can result in a product or process.[1] The verification of a technology performance should be distinguished from certification:

- Certification confirms whether products meet specified standards normally established by independent organisations (e.g. a standards body such as CEN);
- Verification is the process of independently validating performance claims put forward by the owner of the technology.[2]

In line with this distinction, parameters assessed in a verification process are not pre-determined in a standard. They are defined on a case-by-case basis and can include specific features of a technology, for which the technology developer wishes an independent validation because they differentiate the technology from its competitors. The first steps of EU verification process are designed to screen innovative products for their suitability to whole process.

The EU ETV pilot programme was launched on an experimental basis through the 'Eco-AP' eco-innovation action plan in 2011. It was described in a Commission staff working document[3] explaining its objectives, organisation and scope. ETV was also part of the Green Action Plan for SMEs in 2014 and this evaluation was included as one action to be implemented as part of the first Circular Economy Action Plan in 2015[4]. In parallel to the EU pilot, two Member States (Denmark and France) launched national

[1] Definition of technology in ISO 14034:2016 – Environmental Management – Environmental Technology Verification

[2] ETV Reference document 001/2016 – Clarification on the meaning of 'verification' under ETV and differences from certification – JRC Technical Reports 2016

[3] Commission staff working paper on the Environmental Technology Verification (ETV) initiative — Helping Eco-Innovations to reach the Market, SEC(2011) 1600 final, accompanying the Communication on Innovation for a sustainable Future — The Eco-innovation Action Plan (Eco-AP), COM(2011) 899 final

[4] The new Circular Economy Action Plan (2020/98/final) adopted on 11th March 2020 refers to ETV under circularity in production processes by stating the '*need to promote the uptake of green technologies through a system of solid verification by registering the EU Environmental Technology Verification scheme as an EU certification mark*'.

ETV programmes, using the same reference document and procedures as the EU pilot, and applying it also to technology areas not covered by the EU pilot. Moreover, for environmental technologies in the agricultural sector, 3 EU Member States (Denmark, Germany and the Netherlands) have established a specific verification programme (VERA[5]) on an intergovernmental basis, sharing with the EU pilot similar objectives but different procedures.

This evaluation delivers on CEAP commitment and draws conclusions on the current programme's potential to promote environmental technology verification in Europe. The conclusions will be used to revise the ETV programme and to define new operational settings for its future, in particular the registration as EU Certification mark planned as one action under the new Circular Economy action plan[6] adopted in March 2020.

1.2. Scope of the evaluation

The evaluation covers the activity of the EU ETV pilot programme from 2013 to 2017.

Implementing the pilot programme requires the accreditation of **Verification Bodies** (VBs). These are the organisations that receive the verification requests from technology developers. They carry out the technology assessment and ensure the quality of verification results. The first ETV Verification Bodies were accredited in December 2012. We can therefore consider 2013 as the first year of operation of the pilot programme. 2017 is taken as the end date for the evaluation, for the reasons set out below.

- The 2013-2017 period covers a number of verification processes, thus providing a meaningful basis for verification. During this period, 254 **quickscans** were delivered. A quickscan is the first screening of a technology to advise on the appropriateness of conducting a full evaluation process. This led to 107 verification contracts signed between technology developers and VBs, 49 specific verification protocols fixing the details of the verification process, and 27 full reports and Statements of Verification (SoVs) published on the ETV website[7].

- The imminent end of the pilot programme, announced first for 2016 and then for 2017, lead to a decrease in communication activities and in the processing of new technologies as from 2016. The support provided by the Commission to most VBs through grant agreements ended in 2017 or 2018, depending on the organisation. Both events had an impact on how the pilot programme was implemented towards the end of its lifespan.

The EU ETV pilot programme included the participation of seven Member States and the accreditation of up to 15 VBs. Out of seven technological fields considered as possible

[5] https://www.vera-verification.eu/

[6] Communication from the Commission on 'A new Circular Economy Action Plan - For a cleaner and more competitive Europe', COM(2020) 98 final, 11.3.2020

[7] https://ec.europa.eu/environment/ecoap/etv/verified-technologies_en

initially[8], three areas were covered. These were: water treatment and monitoring; materials, waste and resources; energy technologies.

2. BACKGROUND TO THE INITIATIVE

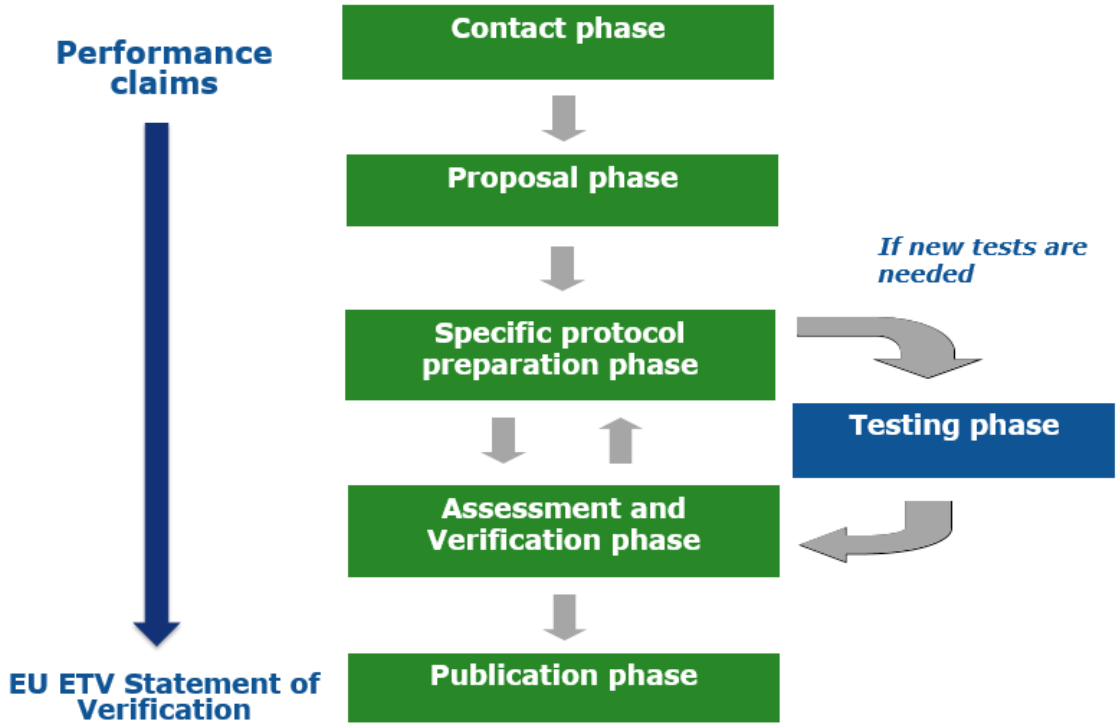
2.1. Description of the initiative and its objectives

Europe faces a range of environmental challenges that have a negative impact on future prosperity. These include resource depletion, water scarcity, air pollution, climate change and biodiversity loss. Innovation and innovative environmental technologies can provide solutions, while also contributing to sustainable growth and increasing EU competitiveness. However, breaking into the market with innovations can be a significant challenge, because by definition innovations cannot show a past successful track record. Without credible information about innovative technologies, potential buyers are unsure whether or not to trust the claims made about their performance. Small and medium-sized enterprises (SMEs) are particularly vulnerable in this context, because they often do not have the same level of recognition as larger companies on the market.

ETV addresses this need by offering technology developers a service in which their claims about the performance of their environmental technology can be verified by a third party. The end result is a Statement of Verification describing how the technology performs on a certain number of quantitative parameters, reflecting the claims and/or supplementing them. This gives a fair account of the technology, based on the results of tests performed under rigorous quality requirements and controls. The Statement also sets out the exact application of the technology and the range of uncertainty of the results. The ETV verification process can be summarised by the following figure.

Figure 1. Summary of ETV process

[8] The following technology areas were not covered by the pilot: soil and groundwater monitoring and remediation, cleaner production and processes, environmental technologies in agriculture, and air pollution monitoring and abatement.



The information provided by ETV relates mainly to the functional performance of the technology and includes only technical parameters, which can be measured through tests. The ETV process includes the consideration of impacts associated with the technology along its life cycle, compared with the main impacts of relevant (not innovative) alternative, but this does not constitute a Life Cycle Assessment, which provides another type of information and follows different processes. Also, the ETV process does not include economic or market parameters and therefore cannot be understood as a Techno Economic Assessment[9].

The ETV pilot programme provided a framework for this service in the EU. It used a common procedure agreed with the EU Member States taking part in the pilot and required the specific accreditation of the organisations that provide this service, Verification Bodies (VBs). The pilot programme contributed to the objectives of the Eco-innovation action plan (2011) and later on to the Green Action Plan for SMEs (2014) and to the Circular Economy Action Plan (2015) by helping technology developers, in particular SMEs, demonstrate the innovative features and technical performance of new environmental technologies arriving on the market. This evaluation was included as one action to be implemented as part of the first Circular Economy Action Plan in 2015.

The aim of the ETV pilot programme was to carry out a large-scale experimental application of ETV in near-real conditions, in a way that would test the main elements of the scheme. However, the pilot programme had neither full geographical coverage nor a comprehensive technological scope (i.e. it only covered a limited range of technologies).

[9] A techno-economic assessment (TEA) is an integrated evaluation of the technological performance and economic feasibility of a (new) process or value chain with the aim to identify the most important underlying parameters for its economic feasibility. (source: VITO)

The pilot programme has been run by the European Commission since its inception in 2013. The reference document laying down ETV procedures and requirements is the General Verification Protocol (GVP[10]). Verification Bodies providing this service are specifically accredited for ETV by national accreditation bodies[11]. This ensured that all verifications follow the same process and have the same meaning and value throughout Europe. VBs also participated in technical working groups, which provided guidance on implementing ETV and ensured that practices were properly harmonised. The technical groups were coordinated by the Commission's Joint Research Centre (JRC).

The pilot programme financially supported the establishment of Verification Bodies in the EU through grant agreements under the CIP (competitiveness and innovation programme) (total amount for the grant agreements: €2.62 million[12]). An additional budget of approximatively €100,000 was made available for communications and translations.

As stated in the 2011 staff working document, the pilot programme's main objectives were to provide:

- technology developers with a reliable, independent verification of the performance of their innovative environmental technologies, on a voluntary basis;

- technology users, consumers and public authorities with reliable information on innovative environmental technologies;

- a high level of recognition of the potential of new technologies within the EU, facilitating acceptance in different markets, on the basis of a single verification.

In the medium to long term, the ETV aimed to create confidence in eco-innovations verified under the scheme and promote healthy competition — based on performance — between technologies and between test bodies.

2.2. Intervention logic

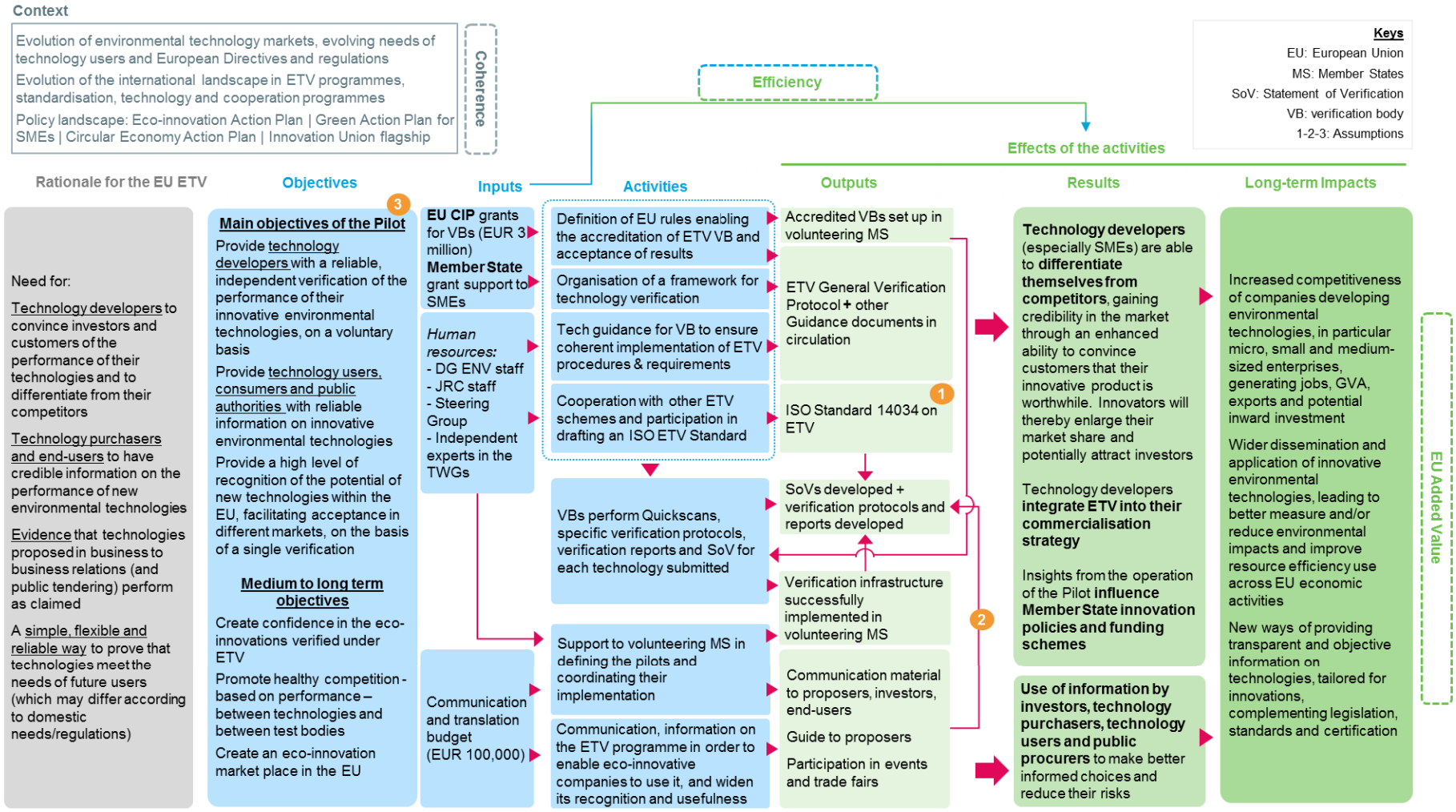
The intervention logic of the pilot programme is summarised as below.

[10] https://ec.europa.eu/environment/ecoap/etv/reference-documents_en

[11] The accreditation of VBs follows the same approach and similar procedure to the accreditation of certification bodies under EU internal market rules. For more info, see the website of the European co-operation for Accreditation: https://european-accreditation.org/accreditation/for-regulators/

[12] The budget made available for grant agreements was €3.2 million but the amount committed after the calls for projects was €2,967,000 and the amount effectively spent on grant agreements with Verification Bodies, after finalisation of the contracts, was €2,615,281

Figure 2. Intervention logic model for the EU ETV pilot programme



Underlying assumptions for the intervention: 1 Other external organisations/experts, including outside EU, committed themselves to the development of an ETV ISO standard. 2 Availability of funding to support development and marketing of technologies, e.g. under the H2020, CIP eco-innovation and LIFE programmes, and Member State support funding or specific calls. Technology proposers could find financial support through existing EU funding programmes that support eco-innovation. 3 Current landscape of standards and services of testing and certification does not fully address identified needs: innovative technologies not always or adequately covered; testing may not be of controlled quality or easy to design and interpret. Additionally, technology proposers demand verification services (i.e. they see the value of verifying their products, and are able to afford it — either through their own funds or finance).

The graph in Figure 2 should be read from left to right as a succession of logical steps, from needs (in a given context) to objectives, and from inputs to activities and outputs, leading to results and long-term impacts.

The **objectives** derive from the identified **needs**. They describe the characteristics of the service to be provided with a view to responding to those needs. The verification of technology performance, which is the service at the core of ETV, addresses the identified needs of technology developers directly, in a contractual relationship between an ETV Verification Body and a technology developer. In contrast, the identified needs of technology purchasers and users are addressed only indirectly, through: (i) the use technology developers make of the ETV report and Statement of Verification to inform their own customers; and (ii) the availability of Statements of Verification on a free-access website. The medium to long-term objectives are pursued also indirectly, through the expected long-term impact of the scheme as a whole and through its interaction with other policies supporting innovation.

On **activities** and **outputs**, we should distinguish between those related to the programme governance structure, and those related to the service provided, i.e. the verification of specific technologies.

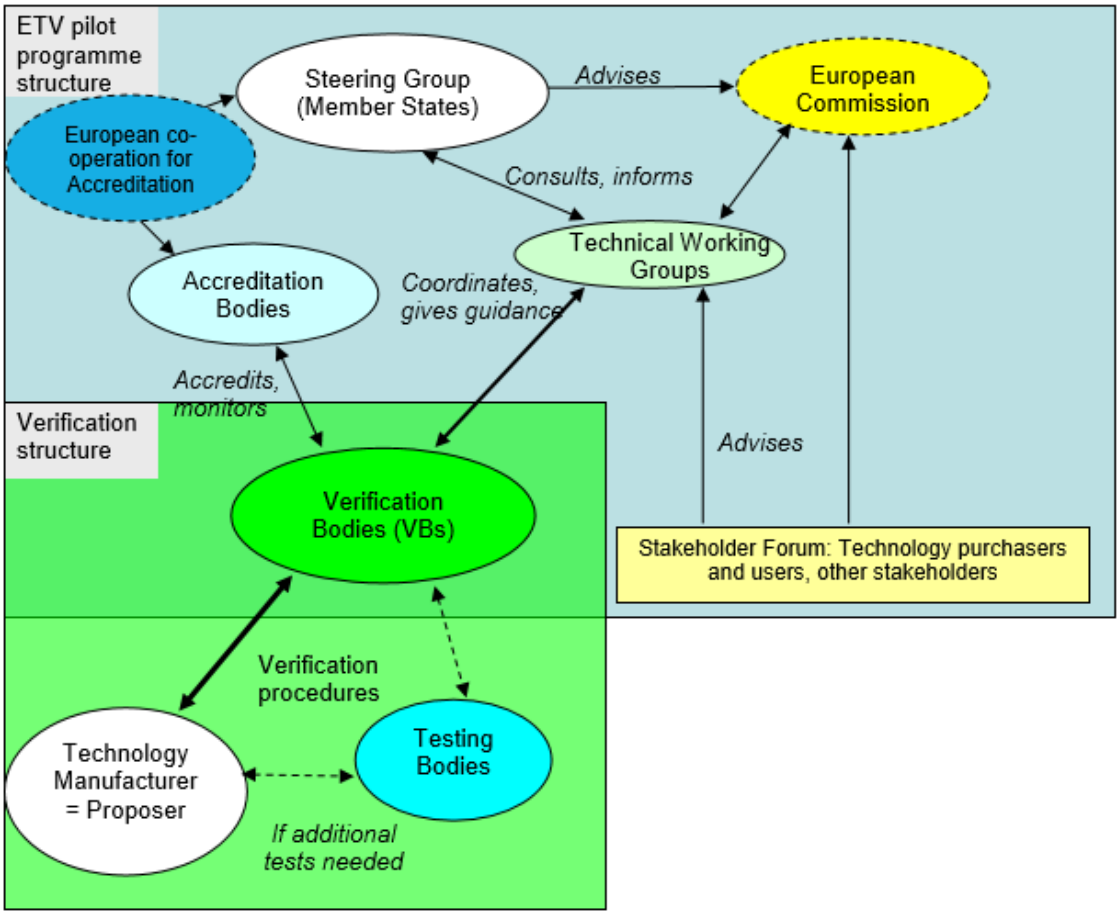
- Activities related to **programme structure** (framed by a blue line in the column 'activities' in Figure 2) include:
    - the definition of harmonised rules in an ETV '**General Verification Protocol**' and associated '**guidance documents**';
    - the accreditation of VBs by national accreditation bodies;
    - the activities of the ETV steering group, where Member States are represented, and of technical working groups, where VBs and independent experts are represented;
    - the international activities comprising the cooperation with non-EU ETV schemes; and
    - the contribution to the drafting of an ISO standard on ETV;

- Activities related to the **service** provided, i.e. the technology verification (central box in the column 'activities' in Figure 2), involve for each technology the technology developer or 'proposer', the VB chosen by the proposer, and testing bodies as appropriate. These activities follow the ETV procedure laid down in the General Verification Protocol. It is the VBs who produce the outputs of these activities: **quickscans, specific verification protocols, verification reports** and **Statements of Verification**.

Figure 3 below shows the different organisations and groups participating in the programme structure and/or involved in the verification service.

Results derive mainly from service-level activities, which themselves depend on programme-level activities. However, **longer term results and impacts** may depend significantly on the recognition and potential success of the programme as a whole and on its capacity to influence other actors in the innovation 'ecosystem' that are not directly involved in the ETV activities. These longer term results and impacts are out of the scope of this evaluation.

Figure 3. Organisations and groups participating in the ETV pilot programme



3. IMPLEMENTATION AND STATE OF PLAY

The ETV pilot programme has been implemented through the activities set out below.

Activities related to the programme structure

The Commission had overall responsibility for the programme.

The Commission's Directorate-General for the Environment (DG ENV) dedicated 0.8 full-time equivalents to preparing and running the programme until 2014, reduced to 0.25 full-time equivalents from 2015.

DG ENV chaired the meetings of the **ETV steering group**.

Under an administrative arrangement between DG ENV and the JRC's Institute for Energy, the latter ensured technical and scientific support to the scheme, running the **technical working groups** and the ETV website (until 2015), including the registry of Statements of Verification. JRC dedicated between 2 and 3 full-time equivalents to its role during the period covered by the evaluation.

The Commission supported 13 accredited Verification Bodies through grant agreements as a result of 2 calls for projects published in 2011 and 2012. The

financial support provided through the calls amounted to €2.6 million.[13]

The **ETV steering group** gathered those EU Member States interested in the pilot programme, either as members of the group (Belgium, Czech Republic, Denmark, Finland, France, Poland, United Kingdom, joined by Italy in 2015) or as observers (Germany, and occasionally Slovakia and Hungary).

The European co-operation for Accreditation (EA) and the European Centre of Norms (CEN) participated in the group to provide support in their areas of competence (accreditation and standards respectively).

The steering group met 2 to 3 times per year to prepare the pilot (2009 to 2012) and during its implementation (from 2013). During the implementation phase, the group's main tasks were to:

- advise the Commission on the progress of the pilot;
- exchange information on implementation in Member States (including links with national ETV programmes and/or national support to ETV where relevant);
- update the ETV **General Verification Protocol**; and
- exchange information on international activities relevant for ETV, in particular on the drafting of an international ISO standard on ETV.

See Annex 3 for the different versions of the ETV General Verification Protocol.

The **technical working groups** gathered representatives of all accredited VBs and independent experts selected by Commission departments among experts suggested by members of the ETV steering group. The aim was to keep a balance of competences and geographical origins in the group. Three groups were established, one for each of the technology areas covered by the programme. For all discussions concerning the programme as a whole, the three groups met altogether, in particular for the drafting of **guidance documents** to guide the VBs in implementing the General Verification Protocol in a harmonised way when verifying technologies; 10 guidance documents were drafted, plus one reference document of an illustrative nature without operational consequences.

See Annex 3 for the list of guidance and reference documents.

International activities consisted in cooperation with an international working group gathering ETV programmes that signed a Memorandum of Understanding for this purpose in 2008. The countries involved were: Canada, the Philippines and the United States (until 2012), the Republic of Korea from 2011 and Japan as an observer from 2012; 7 meetings and 21 conference calls took place between 2007 and 2014, and the main results of discussions were consolidated in a guidance document published in 2014[14]. The international working group also contributed to the preparation of a 'new

[13] The budget made available for the grant agreements with Verification Bodies was €3.2 million but the amount committed after the calls for projects was €2,967,000 and the amount effectively spent on grant agreements, after finalisation of the contracts, was €2,615,281

[14] For more information and access to the guidance document, see the dedicated page on the ETV website: https://ec.europa.eu/environment/ecoap/etv/international-activities_en

work item proposal', presented by the Standard Council of Canada to the ISO in 2013. This initiated preparations for a new international standard, ISO 14034, finally adopted in November 2016, and a guidance document adopted in 2018[15]. The ISO standard, which describes the verification process under ETV, aims to become a common reference for ETV activities globally and a basis for cooperation between ETV programmes (where relevant).

Communication activities were undertaken by VBs and, to a lesser extent, by the Commission and participating Member States. These were intended to reach out to companies, mainly technology developers, and to the innovation and technology community. VBs' communication activities included the dissemination of information materials, participation in conferences and trade fairs, and organisation of training sessions. The Commission provided approximately €100,000 to support these activities, shared between: (i) the translation of information and process documents; (ii) the publication of a newsletter; and (iii) participation in a selection of trade fairs to present ETV along with other Commission programmes. The list of information publications is in Annex 3.

Activities related to the verification service

The core activity of the ETV Verification Bodies is to verify specific technologies presented to them by technology developers. VBs produce annual reports which provide monitoring of the verifications they carry out, including indicators reflecting the main steps of the verification process:

- **quickscans** — the first screening of the technology to advise on the suitability of a full verification process;
- **proposals** — these contain performance claims and technical support documents;
- **specific verification protocols** — these are the planning documents detailing the parameters to be verified, the testing conditions to verify them and conditions to be fulfilled by test results;
- **verification reports** — reporting on the process, results and conclusions on the verified performance;
- **Statements of Verification (SoVs)** summarising the verification reports for publication.

From 2013 to 2017, a total of 254 quickscans were conducted, leading to 107 verification proposals, 49 specific protocols and 27 full SoVs published on the ETV website. Around 90% of technologies were presented by SMEs and 50% from micro-enterprises.

When considering the period from 2013 to 2019, these figures become: 278 quickscans; 123 verification contracts; 52 specific verification protocols; 37 full reports and statements of verification. However, the evaluation support study considered only the pilot phase (2013-2017) and the conclusions drawn from the assessment of this period are considered still valid.

[15] ISO/CD TR 14035 Environmental technology verification — ETV - Guidance to implement ISO 14034

See Annex 3 for summary tables of these indicators and the list of verified technologies.

National ETV programmes established in Denmark and France have closely followed and cooperated with the EU pilot programme: the same reference document (the EU General Verification Protocol16) was used by all programmes, with adaptations for national processes and technology areas not covered by the EU pilot, and the same Verification Bodies were implementing both EU and national programmes. In Denmark, the accreditation of the Verification Body to EU ETV was extended to 4 new technology areas to cover also the national ETV programme.

During the same period 2013-2017, the Danish and French ETV programmes have fully verified 5 technologies each (including the publication of Statements of Verification) in areas not covered by the EU pilot programme.

[16] https://ec.europa.eu/environment/ecoap/etv/reference-documents_en

Examples of technologies verified through ETV (see full list in Annex 3)	
AQUATRACK Early warning system with automatic sampler	This Swedish technology, verified in 2016, was designed for the monitoring and sampling for pathogen detection in drinking water, filtered lakes, source water or treated waste water. It checks for micro particles exceeding the prescribed limit and thus indicating harmful contaminants. The advantage of this technology is that it provides constant monitoring of the flow of water. This is different from other sampling methods on the market, which collect samples with predetermined frequency, which risks missing temporary peaks of contaminants in the water. To test the developer's claims, the VB had to tailor a specific in-house method to verify the technology's ability to detect contaminants in a closed loop system. To verify the accuracy of the monitoring system, the VB compared the results of the in-house test with analysis by external labs. All the proposed claims have been verified and validated.
The AgriLamp induction system	This UK technology, verified in 2016, is a 'contactless' power technology that enables LED 8 W bulbs to simply be clipped onto a cable in order to operate. This technology has been designed in particular for the poultry farming sector. Poultry is more sensitive to the red and blue parts of the light spectrum than humans, which mean they see colour differently from humans. These different wavelengths ultimately have an impact on production and behaviour. Therefore, the light spectrum of a system of LED bulbs was adjusted to emit shorter wavelength radiation, which better suits poultry vision. The unusual claim of this technology on poultry vision had no previous standard testing methodology. Alongside other tests of energy consumption and luminosity efficiency, the VB developed a poultry/human photopic ratio, following a procedure which calculated luminous flux and lighting levels for domesticated mammals and birds. The test demonstrated the spectral effectiveness of this product for the photopic response of chicken.
Aerobic biodegradation under marine conditions of Mater-Bi of third generation	This Italian technology, verified in 2017, is a family of bio-based plastic materials based on starch and polyesters derived from vegetable oils. These materials have been developed to have a high degree of aerobic biodegradation. In the absence of a test standard applicable in marine conditions, the verification body applied two different test methods: (i) an innovative test to measure the aerobic biodegradation of plastics buried in sandy marine sediment under controlled laboratory conditions; and (ii) ISO DIS 19679, a test method to measure the aerobic biodegradation of plastic materials sunk at the sea water/sandy sediment interface. The results show the aerobic average biodegradation of the two materials tested and the differences between the test methods.

ETV-related developments outside the EU ETV pilot programme

The following developments occurred during the period covered by this evaluation but are outside the remit of the EU pilot programme per se.

- Two Member States (Denmark[17] and France[18]) established national ETV programmes mirroring the EU pilot programme (using the same process and quality requirements) and complementing it in four technology areas where the programme is not active: clean technologies, air pollution abatement, underground water quality, and environmental technologies in agriculture.
- The VERA (verification of environmental technologies for agricultural production) scheme[19] is an inter-governmental collaboration between the Danish, Dutch and German environmental and agricultural authorities to test and verify environmental technologies in the agricultural sector, in support of regulatory implementation or taxation support.
- The International Standardisation Organisation (ISO), acting on a proposal by Canada and building on the EU ETV process, prepared a standard on ETV and adopted it in November 2016; a technical report advising on its implementation is also in preparation.
- An international network of verification bodies formed a new consortium, VerifiGlobal[20], to provide testing and verification services based on the new ISO ETV standard. VerifiGlobal gathers some of the EU-accredited pilot programme VBs, together with organisations involved in implementing non-EU ETV schemes.

4. METHODOLOGY

This evaluation focuses on the period from January 2013 to December 2017.

In line with the **European Commission's guidelines for evaluations**[21], the evaluation assesses the ETV pilot programme in terms of five criteria.

- **Effectiveness** — this examines how far the programme's objectives, organisation and scope, as set out in the Commission staff working document of 2011 — and also cited as a key action under the Eco-Innovation Action Plan of 2011 — have been achieved. More specifically, the effectiveness criterion looks at how far the short-term and medium-term results[22] have been achieved, particularly when set against the expectations for the programme.

- **Efficiency** — this criterion considers the extent to which the programme's desired effects are being achieved at a reasonable cost. This includes examining the ratio between outputs and results and the inputs (particularly

[17] http://www.etv-denmark.com/

[18] http://www.verification-etv.fr/

[19] http://www.vera-verification.eu/

[20] http://www.verifiglobal.com/en

[21] http://ec.europa.eu/smart-regulation/guidelines/toc_guide_en.htm

[22] Sometimes referred to in evaluations as 'outcomes'.

financial resources) used to achieve them. This also feeds into an assessment of the value for money achieved.

- **Relevance** — this looks at the extent to which there is a need for third-party verification of the performance of environmental technologies, how far the programme is relevant to fulfilling that need, and whether SMEs are particularly requesting verifications.

- **Coherence** — this looks at how far the programme is consistent with other administrative action and policy priorities at either EU or Member State level. This includes the relationship between the programme and other support influencing the development and deployment of eco-innovative technologies.
- **EU added value** — this considers how far the programme demonstrates that EU involvement has clear added value compared with other similar ETV schemes in operation in the EU.

4.1. Evaluation questions

The following questions were included in the evaluation roadmap and are the basis of this evaluation.

Effectiveness:

- To what extent has the programme delivered the intended output and results as set out in the intervention logic?
- To what extent do stakeholders knowledgeable about the pilot programme recognise ETV as a credible and scientifically sound way of assessing the performance of technologies?
- How far does the programme's verification of technologies add value to them? What evidence is there that ETV verifications contribute to opening up the market?

Efficiency:

Assessment of the programme operational settings after 2 to 3 years of actual operation:

- To what extent is the ETV pilot programme proportionate and efficient in delivering the results assessed under effectiveness?

Cost-benefit of the ETV verification procedure for technology developers:

- How do the costs involved in verifying a technology under ETV compare with the benefits for technology developers and users? Insofar as a comparison (whether qualitative or quantitative) is possible, how does this cost compare with that of certification? How proportionate/acceptable are costs vs benefits?

Cost-efficiency of the ETV pilot programme:

- How do the costs implied by the ETV programme overall compare with its added value? To the extent that a comparison is possible, how does this cost compare with other programmes or tools assessing the performance of innovative technologies in the EU and outside? This may relate to public or private initiatives, with the same or slightly different intervention logic.

Relevance:

- To what extent is there still a need for third-party verification of the performance of environmental technologies? How relevant is the programme in fulfilling this need? Particular attention should be paid to assessing the scope of environmental technology verification (functional performance, environmental aspects) and how verification parameters are set (performance claims, expert views, life-cycle aspects).
- How far should SMEs be considered specifically in relation to technology verification? In particular, how appropriate is the programme's approach to supporting SMEs?
- What role can or should the verification of technology performance play in facilitating the acceptance and transfer of technologies on international markets? How far is this reflected by ETV as implemented in the programme?

Coherence:

- (internal coherence) How consistent are the overall rationale and operational settings of the EU pilot programme with the way ETV is implemented by the different Verification Bodies and the way ETV results are understood by technology developers and users?
- (external coherence) To what extent is the ETV approach, as implemented in the pilot programme, consistent with the overall rationale of the Eco-innovation action plan? Of the Green Action Plan for SMEs? Or of the Circular Economy action plan? Or of other relevant EU policy frameworks such as Energy Union?
- (external coherence) To what extent is ETV, as implemented in the pilot programme, complementary to legislation? Or to the standardisation, certification, technology assessment? Or to other voluntary approaches such as the public procurement of innovation?

EU Added value:

- Comparison of the pilot programme with Member State programmes on ETV[23] and other programmes pursuing similar objectives: to what extent is there evidence of EU added value from the ETV pilot programme?
- Considering the recent adoption of the new ISO Standard 14034 and different options for its implementation in the EU (with or without ETV schemes, at EU or Member State level): to what extent is there an expected EU added value in implementing ISO 14034 through the EU ETV pilot programme?

4.2. Process

4.2.1. Introduction

The ETV pilot programme evaluation is based on the results of a support study commissioned for this purpose. The study included two objectives:

[23] i.e. the ETV programmes run by Denmark and France complement the EU pilot programme by covering the four technology areas not retained for the EU pilot programme (see footnote 4), while the inter-governmental VERA project, run by Denmark, Germany and the Netherlands, complements the EU pilot in the area of environmental technologies in agriculture.

- ‘Objective A’ dealt with the evaluation per se and is the basis for this evaluation report;
- ‘Objective B’ studied the feasibility of four possible evolutions of the programme and the business case for an ETV programme extending the operational settings of the pilot programme.

The study contract was awarded to a consortium led by the Institute for European Environmental Policy (IEEP), with Inner City Fund (ICF) Consulting Services as the main partner undertaking the evaluation work and Vlaamse Instelling voor Technologisch Onderzoek (VITO) contributing to the feasibility studies. The study reports are published on the Environment pages of the Commission's Europa website[24].

A formal, continuous and wide-ranging stakeholder consultation was carried out to support the evaluation, in line with the Better Regulation Guidelines[25]. The questions asked in the stakeholder consultation were based on the evaluation questions set out in the ETV evaluation roadmap[26] and subsequently presented by the study team in an evaluation framework[27]. The consultation approach was also supported by a consultation strategy, which identified all the different categories of stakeholder directly or indirectly involved in the pilot programme and set out the methods and tools used to ensure a comprehensive and well-balanced consultation. Annex 2 to this report presents a summary of all the consultations published together with the support study.

4.2.2. Online surveys

Three online surveys were designed to collect standardised data from the different stakeholder groups. The target groups included technology proposers, VBs and independent experts involved in the technical working groups.

Technology proposers[28]

The online survey was designed to capture important insights into companies’ experience of the pilot programme and to explore the potential and actual benefits to companies of taking part.

The online survey was sent to 109 technology proposers in different stages of engagement with the EU ETV at the time of the survey. The survey targeted: (i) companies with verified technologies; (ii) companies in the process of undergoing verification; and (iii) companies that had dropped out of the process. The last of these three groups was useful as a mechanism to capture counterfactual activity with respect to commercialisation and sales of firms that had not undergone EU ETV.

[24] Links available on evaluation page of the ETV website: https://ec.europa.eu/environment/ecoap/etv/evaluation_en

[25] European Commission. (2015). Better Regulation Guidelines (SWD(2015) 111 final). Available at: http://ec.europa.eu/smart-regulation/guidelines/docs/swd_br_guidelines_en.pdf

[26] http://ec.europa.eu/smart-regulation/roadmaps/docs/plan_2017_871_evaluation_environmental_technology_en.pdf

[27] For most of the evaluation questions, it was necessary to produce sub-questions to probe the subject more deeply and provide the right types of questions (i.e. questions stakeholders will relate to).

[28] Often used interchangeably with ‘technology developers’

A total of 48 technology proposers successfully completed the online survey, which represents 41% of the initial 109 contacted and 23% of the total number of technology proposers who enquired about EU ETV (254[29]). In total, among the respondents, 11 companies had been awarded a Statement of Verification[30], 19 were still undergoing the verification process at the time the survey was completed, and 17 had left the programme before achieving verification or had never applied in the first place. The distinction between the three categories of technology developers and the varying number of responses received for each question surveyed explain why the analysis presented in this report draws on multiple sample sizes. For each question explored, the exact number of responses collected has been systematically highlighted.

Verification Bodies and independent experts

Two other online surveys were also sent to VBs and independent experts. Table 1 provides a summary of overall outcomes and response rates from the three different surveys.

Table 1. Overview of online survey responses

Target group	Sample used	Response n =	Response rate	% of total population	Survey language
Technology proposers	109	51	43%	23%[31]	CZ, EN, FR, IT, PL
Independent experts	63	18	28.5%	28.5%	EN
Verification bodies	15	15	100%	100%	EN

4.2.3. Semi-structured interviews with stakeholders involved in the EU ETV pilot programme

Interviews took place with officials from relevant DGs (ENV, GROW, ENER) and from the Executive Agency for Small and Medium-sized Enterprises (EASME). Each official contacted had either helped deploy the EU ETV pilot programme, or else had taken an interest in EU ETV since its inception.

After the online surveys, semi-structured telephone interviews followed with VB representatives, independent experts involved in the technical working groups and the steering group, and with technology developers who indicated that they would be available for a discussion.

In total, 75 semi-structured interviews were planned with the key participants in the pilot programme, and 43 interviews were completed.

[29] As the quickscan stage occurs before the actual signature of a verification contract, not all technology proposers are known by the Commission and not all proposers agreed to be contacted for the survey.

[30] At the time of the consultations.

[31] The total number of application requests is 205, as per the Europa website: https://ec.europa.eu/environment/ecoap/etv/verified-technologies_en

4.2.4. Semi-structured interviews with stakeholders outside the EU ETV pilot programme

Counterfactual research and analysis in seven Member States

The aim of this type of research was to establish how far stakeholders in Member States outside the current programme area were aware of the EU ETV pilot programme and saw added value in it. This would make it possible to explore a situation that was counterfactual to the provision of EU ETV within the pilot area. Such research would also seek to understand: (i) the current innovation support provision for firms; (ii) the level of engagement that domestic firms had had with EU ETV (if known by officials); and (iii) the appetite of government officials and other stakeholders for engaging with EU ETV.

The study team contacted a representative sample of stakeholders from seven Member States that were similar in terms of parameters such as GDP and population to the seven Member States participating in the pilot programme in terms of parameters such as GDP and population. The countries selected included Germany, the Netherlands, Portugal, Romania, Slovakia, Spain and Sweden.

The overall exercise was more difficult than envisaged initially, particularly in a few Member States, where there was either limited policy interest in the eco-innovation supply side or limited support for it, and/or a reluctance on the part of officials to take part in the study. Finding companies also proved difficult. In contrast, Sweden proved to be very easy to engage with, particularly across the policy and innovation landscape. However, it should be stressed that the findings of this analysis represent the views of stakeholders interviewed only. The participants were mainly public officials, and their views do not necessarily reflect those of the wider population, for example, on the issue of the value of an EU ETV scheme in Member States currently not taking part in the pilot programme.

National Member State ETV schemes and ETV schemes outside the EU

The aim of these enquiries was to obtain key information and data on the scope of other ETV schemes, namely the costs incurred by companies to undergo verification, the level of subsidy on offer to incentivise companies and, most importantly, any evidence of results generated by companies that had an ETV verification, such as increased sales or an improved ability to raise investment. These findings would help provide comparative results and lessons which could be contrasted with the learning and results from the EU ETV pilot.

For those ETV schemes operating in the EU (i.e. in Denmark and France, and the VERA scheme[32]), scheme managers were contacted and interviewed using a structured interview topic guide.

For those ETV schemes operating outside the EU (e.g. Canada, the Philippines, Republic of Korea, USA), it took a long time to obtain responses. In Canada and the USA, the ETV schemes had recently had their funding withdrawn and key staff were no longer involved.

[32] An ETV scheme dedicated to environmental technologies in agriculture and operating across Denmark, Germany and the Netherlands.

An interview with a new private company, VerifiGlobal, was undertaken because of the interesting business model that has emerged and the manner in which VerifiGlobal is seeking to work with a number of VBs in the EU ETV scheme, including ETA Danmark.

Knowledge Innovation Communities of the European Institute of Innovation and Technology (EIT KICs)

Consultations were also conducted with senior representatives from the three Knowledge Innovation Communities (EIT KICs), covering energy, materials and climate. The aim was to determine their awareness of EU ETV and to understand their approach, if any, to verifying the performance of innovative technologies they invest in and support through their respective communities.

4.2.5. Public consultation

A public consultation was organised by DG ENV to gather information and opinions from a spectrum of stakeholders on the effectiveness and added value of the EU ETV pilot programme since its launch. The public consultation provided an opportunity to 'open up' data collection to all interested stakeholders and enable them to contribute to the study.

The total number of respondents was 53.

4.2.6. Stakeholder meeting

On 28 September 2017, stakeholders met in the EU ETV stakeholder forum to discuss preliminary findings on the EU ETV evaluation and lessons learnt to date. Speakers included two companies with technologies verified under EU ETV and a venture capitalist, along with key stakeholders and other experts who were invited to share their views on the pilot programme's results, strengths and weaknesses, feeding into the evaluation research. Around 30 stakeholders participated in total.

4.3. Limitations — robustness of findings

4.3.1. Methodological approach to demonstrate evidence of increased sales for companies

Evidence of increased sales could only be obtained from companies that had had their technology fully verified and the Statement of Verification (SoV) published. Since only 27 SoVs had been published when this evaluation was carried out, the sample size for understanding the significance of the SoV to companies is limited. However, consultations with all the major programme stakeholders provided direct evidence of increased sales for companies following the SoV.

- A small amount of evidence of increased sales of verified technologies was obtained from proposers who responded to the e-survey: 7 out of 11 technology proposers who participated in the survey recorded new sales after verification, but only 5 reported that the SoV was either a contributing (N = 4) or decisive (N = 1) factor in sales. Out of those 7 companies, 2 stressed that it was difficult to attribute the increase in sales to the SoV. EU ETV's contribution to sales and revenues was further confirmed during individual interviews with technology proposers.

Further qualitative evidence showing impact on sales of the SoV was provided.

- Two technology proposers still involved in the verification process reported that the SoV had raised the interest of prospective clients and that these 'were keen to see it when issued'. Another company with a verified technology (but no sales yet) mentioned that the SoV is 'an argument for sales' and that 'every customer will ask [for] the results'.

- One VB reported in their annual/final reports that one of their clients had recorded growth in the Czech Republic and Hungary and attributed their success to the SoV they had been awarded.

Overall, there is some evidence to conclude that: (i) the programme is helping companies commercially, either through generating increased sales or by providing wider benefits (e.g. access to new markets); and (ii) it is likely to do so for companies still engaged in the process or wishing to enquire about it.

4.3.2. Targeting end users

Despite the consultation of a large spectrum of relevant stakeholders with different perspectives on the EU ETV pilot programme, it was not possible to obtain any substantive feedback (i.e. direct surveys or interviews) on it from technology end users. Preliminary attempts to reach out to this target group did not pay off, which led the evaluation team to discontinue direct consultations with end users on the basis that additional efforts would not yield the expected feedback. However, questionnaire responses received from other existing ETV schemes have provided valuable feedback on the level of awareness among technology end users about national ETV schemes and the latest trends observed by ETV scheme managers.

It was envisaged, however, that the public consultation on the pilot programme would help to engage some technology end users; this happened to a limited extent. Only several respondents to the public consultation noted that they were buyers of environmental technology. Indirectly, the opinion of end-users was sometimes transmitted by technology proposers and VBs and reported as such in the consultation results.

5. ANSWERS TO THE EVALUATION QUESTIONS

5.1. Effectiveness

5.1.1. Delivery of expected outputs

Evaluation question: To what extent has the programme delivered the intended outputs and results, as set out in the intervention logic?

Overall response: In terms of programme outputs (the verification infrastructure and key procedures), the general opinion of stakeholders is that the intended outputs were delivered and are recognised as being of high quality. In terms of service outputs (the verification results and their use by proposers), the number of SoVs issued by the programme is modest but in line with the pilot's timescale and the achievements of non-EU ETV programmes in their first years of implementation. The overall pipeline of projects is, however, below the initial expectations of Verification Bodies and below a level which would ensure a viable,

self-financing scheme. Communication activities produced mixed results, but the view of many stakeholders is that they were not sufficient to reach the level of awareness and recognition needed for the programme to develop successfully.

Intended outputs of the programme

The intended outputs of the programme, as set out in the intervention logic, can be grouped into four main themes.

- An accredited VB infrastructure is established in the EU Member States participating in the pilot and provides adequate coverage across the three technology areas covered by the pilot.

- A number of key procedures and mechanisms — including the General Verification Protocol (GVP) and guidance documents to help put the GVP into operation — are in place to ensure that the verification infrastructure delivers EU ETV as intended in a manner that is transparent and widely understood.

- Companies, particularly SMEs, are engaged in the programme via direct contact or awareness-raising activities from VBs, Member States and the Commission, and they submit technologies for verification under the programme.

- An ISO standard on ETV is produced to ensure mutual recognition of EU ETV across global markets, giving technology proposers greater access to international markets than might otherwise be the case.

On **verification infrastructure**, the programme led to 15 accredited VBs being established across seven Member States, covering a population of about 254 million. Around half of the VBs are able to offer full coverage of the three technology areas covered by the programme, while six offer two areas. In four of the seven pilot Member States, SMEs also had a choice of two or more VBs to engage with, providing choice for firms and ensuring a degree of competition across VBs. However, in retrospect, the presence of four VBs in two of the pilot countries appears excessive given the limited volumes of technology proposers that have enquired. Conversely, having just one VB appears to have worked well in countries such as the Czech Republic and Denmark, where the domestic market is smaller. In addition, despite the uneven distribution of VBs among Member States the number of applications received and verifications completed was not particularly concentrated in Member States with the highest number of VBs. This supports the hypothesis that a low number of VBs per Member State was sufficient. Instead, the presence of a national ETV scheme in parallel to the Member State's participation in the pilot programme, as is the case in Denmark and France, seems to have encouraged companies to enquire about EU ETV, as both countries produced far greater numbers of quickscans and SoVs than other pilot Member States.

On **key procedures and mechanisms**, the general conclusion of stakeholders responding to the public consultation was that the EU ETV infrastructure and processes are well implemented and structured. At operational level, the length of the verification process varies widely, from 3 months to over 3 years, with most verifications appearing to take from 6 to 12 months. Delays in the verification process tend to occur when the verification protocol is drafted. However, comparison with feedback from other ETV

schemes, both in and outside the EU[33] shows that the EU ETV verification process is similar in length to other verification systems. Importantly, these schemes also report that there does not appear to be scope for efficiency gains to be made over time. There are various reasons for this, including the frequent need to test environmental technologies across the seasons.

Research and innovation projects solicited under several water and circular economy calls of Horizon 2020, have been also asked to support the implementation and evaluation of technology verification schemes, including the EU ETV. These calls were very useful in raising awareness on the EU ETV scheme and in understanding how it works. In addition they provided funding for the developed technologies/solutions to benefit for the verification EU ETV pilot programme, like the innovative technology for nutrient removals and reduction of GHG emissions in wastewater treatment plants developed in the context of the SMART-Plant H2020 project[34] and the innovative technology developed under the MASLOWATEN H2020 project[35], to control large-scale irrigation powered solely by solar photovoltaics with no alternative electricity source. On the other hand experiences from other projects indicated that the issue for not going to EU ETV was linked to the costs for the verification that were considered high, and to the time needed to obtain the verification. Usually the technologies are ready to be verified at the end of the projects, so the verification would require extra time. Experiences from water related projects show that although the EU ETV has been successfully tested in pilot actions and demonstration projects, the water utilities and end-users are still not aware of its credibility. In fact, EU ETV is still rarely required in public procurement processes. Finally the benefits for accessing international markets seem not very obvious.

On **awareness raising and communications**, the Commission and Member States worked to increase the visibility and recognition of the scheme in general, while VBs had the main responsibility for carrying out communication activities to attract customers and received grants for this purpose. Overall, around 30% of the grants were allocated to VBs to enable them to engage with technology proposers, with some VB dedicating up to 50% of their grant to financing promotional activities. However, absolute expenses on marketing and promotional activities show large discrepancies among VBs' promotional budgets, which ranged from €29,000 to €167,000. While larger marketing and promotional budgets often helped produce more quickscans than the average, this was not always the case, as some VBs managed to exceed the average number of quickscans on smaller promotional budgets. This may suggest that the degree of effectiveness of promotional activities depends not only on budgets, but may also stem from other factors such as promotional strategies, channels, target audience, etc.

Besides using their reputation in the market and existing client base, VBs used various awareness-raising channels to make EU ETV highly visible to innovative companies that might require such services. Such channels include VBs promoting the programme on their own websites, direct engagement with pre-existing customers, social media

[33] Other ETV schemes considered in this evaluation are the Danish and French ETV programmes, in the EU, and the Canadian, Japanese, Korean, Philippine and US EPA schemes outside the EU.

[34] SMART-Plant "Scale-up of low-carbon footprint material recovery techniques in existing wastewater treatment plants", http://www.smart-plant.eu/

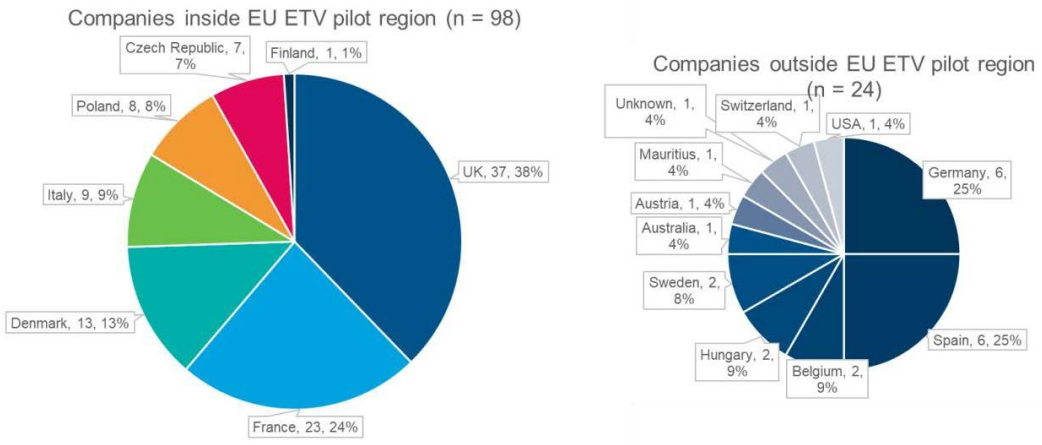
[35] MASLOWATEN "MArket uptake of an innovative irrigation Solution based on LOW WATer-ENergy consumption.", https://maslowaten.eu/?page_id=579&lang=en

campaigns and activities (LinkedIn, Twitter and Facebook), organisation of seminars, conferences and workshops, distribution of printed advertisements and newsletters. VBs also worked together to market EU ETV, including joint events held by two or more VBs to promote the programme and help achieve a common marketing message. The Commission also helped provide information on EU ETV by promoting the policy, producing flyers, brochures and guides for proposers (translated into 11 languages), and through its efforts to engage with technology proposers at trade fairs.

These efforts to market the programme, and the benefits of participation, have clearly yielded some success in terms of outputs, particularly when the timescale of the pilot (4 years) is contrasted with the long periods over which other ETV schemes outside Europe have been running (e.g. over 20 years for Canada and the U.S. schemes) and the overall market size (254 million for the EU pilot region against 325 million for the US, 127 million for Japan, 36 million for Canada, 100 million for the Philippines and 50 million for Korea).

Initial enquiries from 1,166 companies occurred between 2013 and 2017, with a total of 254 quickscans conducted, leading to 107 verification proposals, 49 specific protocols and 27 verification reports and Statements of Verification during the period evaluated. The uptake of verification services has been very different across the seven Member States in the pilot area. Countries that have a national ETV scheme in operation (Denmark, France) have seen stronger interest from domestic firms. Demand for EU ETV also originated from outside the pilot area. As shown by Figure 3 below, among companies who underwent a quickscan and responded to the support study survey, around 20% of technology developers — 23 out of the 122 identified companies — originated either in non-participating EU countries outside the pilot area (19 companies) or in non-EU countries (4 companies). This indicates a level of awareness of EU ETV across the market, generated particularly by the VBs. However, one VB reported having communication difficulties with a few European firms outside its home market and that these initial enquiries fell away.

Figure 3. Origin of companies having undertaken a quickscan (n = 122)[36]



As stated above, 27 SoVs have been published to date, while many companies' products are still being verified under the programme. However, it is interesting to contrast the

[36] Source: ETV CIRCABC group statistics, 2017.

apparent success of the 'pipeline' of companies that have gone through the EU ETV scheme with the expectations of those closely involved in the programme. For example, nearly 73% of VBs and 75% of independent experts surveyed had expected more companies to apply to the programme.

Finally, on **international cooperation**, experts from VBs and public bodies involved in the pilot programme have over several years worked with experts from other ETV schemes worldwide to improve international cooperation on ETV and to ensure its international recognition and acceptance. Experts from Europe took part in the international working group on ETV (until 2014) and subsequently in the ISO working group on ETV (2014-2016). The work culminated in the publication of the international standard on ETV, ISO 14034, which seeks to promote the mutual recognition of ETV internationally. The verification process established by the ISO ETV standard is very similar to the EU ETV process. This is a success for the European experts who took part in preparing the standard and will make it easier to align procedures and achieve wider recognition of the EU ETV process and results.

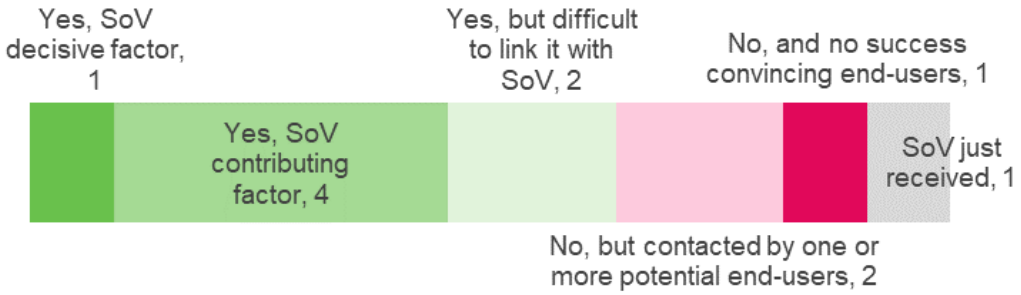
Intended versus actual results of the programme

The main intended result of the programme, as set out in the intervention logic, is that technology developers are able to use the SoV to help differentiate themselves from competitors in the market and sell their products faster and more easily to end users. A secondary result, one that is fundamental to the success of a future EU ETV, is that other stakeholders, such as technology end users, investors and public procurers, might use SoVs in their decision-making to make better informed choices and reduce their risk. This will result in greater demand for the scheme and encourage companies to have their products verified through it.

Between 2013 and 2017, SoVs were issued for 27 technologies from 20 technology proposers. Based on VBs estimates at the end of 2017, a further 40 technologies were in the pipeline and expected to be verified[37]. While this is lower than was initially envisaged by VBs, it is by no means a small number of verifications when compared to other ETV schemes, especially as the scheme is in its early stages. Given the modest number of SoVs, the overall sample size for understanding their significance to companies is limited. However, proposers who responded to the e-survey provided a small amount of evidence that sales of verified technologies had increased. Although the data are too limited to draw any definitive conclusions, they do provide an early indication of the scheme's added value. Out of 11 technology proposers who participated in the survey, 7 recorded new sales after verification, but only 5 of them reported that the SoV was either a contributing (N = 4) or decisive (N = 1) factor in sales. Another verified company reported sales increases in the order of 20% only 6 months after the SoV was issued.

[37] A further 10 SoVs were published in 2018 and 2019. This indicates that the verification pipeline is still active, but also that a further 40 SoVs (as predicted at the end of 2017) may be an overestimate.

Figure 4. Since receiving your verification have you managed to sell any of your product? (companies with an EU ETV-verified technology, n = 11)[38]

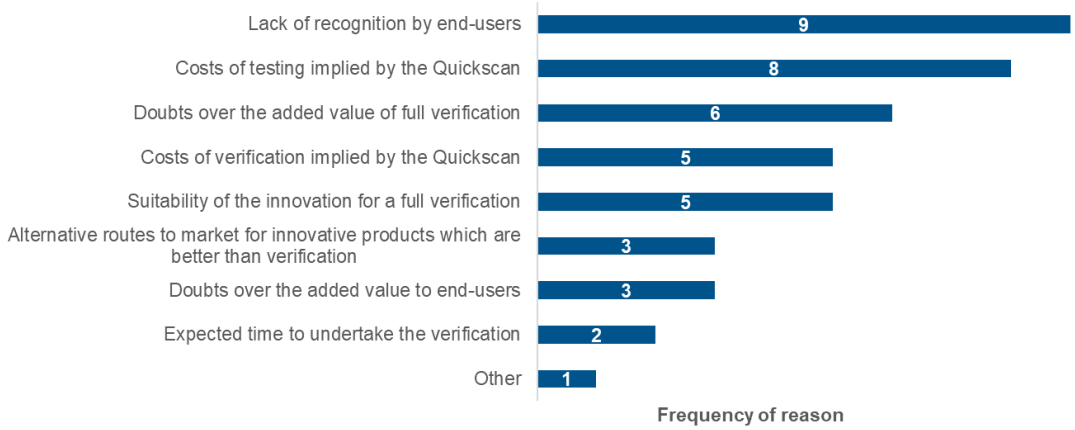


With respect to secondary results, evidence from the public consultation shed some light on end-user and investor perspectives on verified technologies. For example, of the 53 stakeholders, around a quarter (12) considered themselves a potential buyer of technologies. Of these, when asked whether they would consider a technology with an EU ETV SoV more favourably than one without, nearly all respondents (11) would 'definitely consider it more favourably'. A similar number of stakeholders (11) stated that they were potential investors in environmental technologies. Of these, around three quarters (8) would consider an ETV-verified technology more favourably than one that had not undergone ETV. Interestingly, one investor speaking at the 3rd ETV stakeholder forum felt strongly that the SoV needs to be adapted so that it provides more usable and accessible information to aid investment decisions and for it to tie in better with investors' technology due diligence process.

The most important reason why companies did not progress from a quickscan to a full verification proposal was 'a lack of recognition by end-users' of the SoV. This reason was cited by around two thirds of VBs (9 out of 15), implying that companies are sceptical about the potential benefits of verification. Stakeholders responding to the public consultation also felt that scheme promotion to the critical constituency of end users was lacking. This criticism reinforces the views of technology proposers, independent experts and VBs that marketing efforts directed at end users in the EU to help support and stimulate the market demand for ETV were insufficient.

[38] Source: ICF, 2017, Survey of Technology Proposers.

Figure 5. What are the main reasons why firms and other organisations do not progress from a quickscan to a full proposal? Please tick up to 3 of the most important factors (N = 14)[39]



It should be stressed that the EU verification process is designed to screen innovative products for their suitability to the ETV process. One ETV scheme manager noted that, besides innovations being found to be not suitable for ETV, other reasons for companies leaving their scheme early included the technology not performing as expected when tested and, in some cases, the application being started as part of funding for developing the technology but the funding not being granted. In another ETV scheme outside the EU, the manager reported that companies did not progress with verification either because they were unable to complete the required documents or else were put off by the cost of the testing involved in the verification process. The attrition rate of ETV schemes varies considerably, from 10% in Canada to 70% for the VERA scheme. The average dropout rate of companies that started the process across five non-EU ETV schemes is 41%. As these schemes do not include a step equivalent to quickscans, if we take the number of proposals as the basis for calculating the dropout rate for EU ETV by comparing it against the number of technologies actually verified, the rate jumps to around 75%. One would expect the whole process under EU ETV to become more streamlined and efficient over time as VBs become much more familiar with the process. By the same token, we would expect dropout rates to fall as the 'capture' process improves and some of the potential challenges are made clear to companies earlier on in the process.

Given that the pilot has run for just 4 years and resulted in 27 SoVs between 2013 and 2017, it is reasonable to conclude that it has yet to develop a reputation either in the EU or globally. It is also interesting to contrast the outcome of EU ETV with that of the Canadian ETV, which was established in 1997 and generated 71 verifications before having its funding cut. The Canadian scheme manager recognised that for their scheme, 'there is significantly more awareness in the market place; however, considerably more resources are required to help promote the benefits of ETV in the Canadian market place and beyond, e.g. through public funding'. This view was echoed by feedback from another European ETV scheme, which reported that 'neither public nor private technology buyers have a sufficient level of knowledge about the possibility to ask for documentation of the environmental performance in the form of an ETV'.

[39] Source: ICF, 2017, Survey of VBs.

Since both VBs and the European Commission have focused their promotion of EU ETV on the EU Member States, this feedback points to a much greater need to focus on awareness raising among end users, as well as investors and the public sector. This will help drive market demand for ETVs, both in the EU and internationally, so that market actors fully recognise the programme and the significance of the SoV in their investment decisions.

5.1.2. Credibility and robustness of ETV process

Evaluation question: To what extent do stakeholders knowledgeable about the programme recognise ETV as a credible and scientifically sound way of assessing the performance of technologies?

Overall response: A majority of stakeholders who are knowledgeable about the pilot programme indicated that EU ETV provides a robust and credible system which is acceptable to the market, thanks to its rigorous procedures and guidance, peer review and quality control. This is a strong point of the pilot programme.

A majority of stakeholders who are knowledgeable about the pilot programme — namely VBs, independent experts and Commission officials — indicated that EU ETV provides a robust and credible system which is acceptable to the market. There are various reasons for this.

Firstly, technical working groups under the aegis of the JRC, have helped to produce and refine verification guidance notes for the VBs and firms. These guidance notes have in turn enabled all parties to fully understand the verification process and helped frame the performance parameters by which firms present their products for verification. Technical working groups have also served as a platform for raising and resolving operational challenges encountered in the delivery of EU ETV. For example, in the 7th such meeting (January 2016), VBs raised concerns about the quality of work and level of staff training in some test laboratories. This claim highlights the potential risk for the quality and robustness of verifications, but justifies the emphasis given to quality requirements in ETV procedures. This approach was reflected in particular in guidance documents 5 and 9 on the acceptance of test data and the auditing of testing bodies, which were adopted in June 2016. Overall, VBs stressed the importance of technical working group meetings as an arena to discuss problems and share insights with other VBs and independent experts. As one expert noted, at the start of the process most VBs had a limited understanding of ETV and of the quality levels to be achieved. Their participation in the working group meetings provided an opportunity to learn from other VBs' approaches and processes. The exchange of knowledge through the working groups was seen as extremely useful in bringing less experienced VBs up to speed and increasing their knowledge on ETV. The additional training delivered by some VBs also helped increase the shared knowledge of ETV operators; for example, a representative from ETA-Danmark, Denmark's ETV, is understood to have helped train Polish VBs. This, coupled with the work on guidance documents and JRC providing feedback to VBs, helped ensure the robustness of the verification process within the pilot.

Secondly, independent experts attending technical working groups in their respective technology area of competence helped generate insights on specific processes (for example on quality management) and technologies which helped feed into the general

robustness of the verification procedure. Furthermore, the level of engagement of independent experts in the peer review process for individual verifications adds a level of scrutiny to the process and provides an important opportunity to challenge the parameters being proposed for verification protocols. This process appears to work well according to the experts, two thirds of whom indicated that the process of sharing and reviewing technical content is a suitable mechanism for helping the verification process to become more robust.

As for the verification process itself, the nature of ETV means that instead of simply using an agreed method to test a product's conformity with a particular standard, the parameters being tested are instead first agreed with the technology proposer; after that, independent tests are conducted to ensure that these performance claims can be met. As one European ETV scheme manager reported, 'this often requires a considerable amount of rigorous and long-term testing, since for many environmental technologies the changing climate over a year (winter, spring, summer, autumn) can influence the environmental performance of the technology'. This helps explain the long average time taken to undergo ETVs; scheme managers globally have reported that these can average from 4 months (Canada) to 12 months (Denmark, Japan), 15-18 months (VERA) and even up to 23 months (France).

The combination of rigorous guidance and procedures and peer review, coupled with accreditation of the VBs and quality control of the laboratories carrying out the testing, makes the process a credible and scientifically sound way of assessing the performance of technologies.

5.1.3. Added value for the technologies verified

Evaluation question: How far does the programme's verification of technologies add value to them?

Overall response: the main value added by ETV to the technologies verified lies in the credibility of performance claims, the enhanced reputation of the company proposing the technology, access to new markets and differentiation from competitors on these markets. These recognised benefits are only part of the route of technologies to the market and should be seen in relation to a wider planning and strategy by innovators.

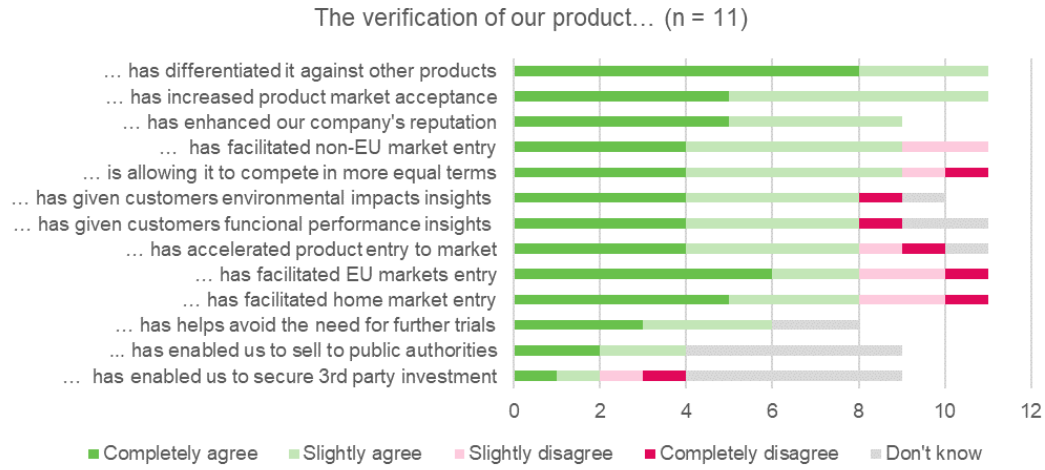
Technology verification forms a part of the sales 'toolkit' for innovators; it is by no means a panacea. The evaluation found that a variety of methods are often used by companies of all ages and sizes to prove their product's performance. These include on-site demonstration and testing by a reputable test centre, as well as certification, where it is possible to test against an agreed product standard. Company reputation also plays a role in helping to convince end users of the potential credibility and validity of a product's performance.

The ability of companies to differentiate their product from competitors is recognised as one of the key benefits of EU ETV. This was acknowledged by VBs in their annual and final reports and by all 11 surveyed technology proposers who have been awarded a SoV. One way EU ETV can achieve this differentiation is because the verification process has flexibility, i.e. it is possible to integrate several claims and parameters into one verification, creating a point of differentiation and added value in comparison with standard certification and test reports, which might otherwise limit the key selling points of a technology.

The impact on the differentiation of products is less highlighted by independent experts (approved by 7 out of 16 independent experts surveyed), who instead stressed that ETV has a role in facilitating non-EU market entry and international technology transfers (80% of experts). A hypothetical reason for this difference could be that technology developers may be more attentive to the short-term benefits of verification while independent experts favour longer term ones.

Among the potential benefits of EU ETV, access to third-party investment was the least mentioned by companies having a technology verified (see figure below). During the ETV stakeholder forum discussing the programme evaluation, the representative of an investment fund indicated that ETV results could usefully feed into the due diligence of investors before deciding to invest in a technology company, as SoVs provide some of the information typically sought by investors. However, there is no evidence that this actually happened during the pilot programme.

Figure 6. Implications of having a technology verification, according to technology proposers with a fully verified technology[40]



The added value of EU ETV compared to a standard certification or a detailed test report also lies in the benefits provided by having an EU framework at its disposal, including the accreditation of Verification Bodies and harmonisation of practices. This framework provides assurances on the competence of verifiers and that the process has strong quality control that can be recognised internationally.

5.1.4. Contribution to market opening

Evaluation question: What evidence is there that EU ETV verifications contribute to opening up the market?

Overall response: the amount of evidence on the impact of ETV verifications is limited by the sample size. The more qualitative feedback, both from companies that have had technology verified and from managers of other ETV schemes, indicated a role for ETV in opening up markets, starting with increased customer acceptance of new products, both within the EU and internationally.

All stakeholders agreed that technology verification under EU ETV can lead to increased customer product acceptance and confidence. While the sample size is very small, 7 out

[40] Source: ICF, 2017, Survey of Technology Proposers.

of 11 technology proposers surveyed recorded new sales after completing the verification process under ETV. However, only 5 reported that ETV was either a contributing (N = 4) or decisive (N = 1) factor in these sales.

It is important to note that the repository of SoVs on the programme's website is intended to allow stakeholders to check the veracity and detail of the verification, not necessarily to attract new customers. However, 3 out of 11 companies with a fully verified technology had been contacted by an end user who had seen their SoV on the EU ETV website, illustrating that this repository has potential to become more of a dissemination channel to help open up the market.

Facilitating market entry to other EU Member States is one of the prime reasons for companies enquiring about EU ETV, and there are signs that this has materialised following verification. Out of 11 companies with a verified technology surveyed, 6 completely agreed that the SoV had facilitated entry to EU markets, and 2 slightly agreed. One verified company highlighted that the ETV results convinced them to enter new markets which would certainly have been more difficult to access without them.

While the evidence gathered from EU ETV-verified technology companies is so far limited, it is useful to reflect on the experiences of other ETV schemes in Europe and globally. This can provide comparisons with EU ETV that could indicate how ETVs can open up the market, and may also provide an indication of what can be expected in the future.

Overall, a number of non-EU ETV scheme managers provided positive feedback demonstrating both factual and anecdotal evidence[41] that an ETV can help to provide credibility to the technology proposer, enable access to clients and achieve sales. For example, in Canada, several of their ETV 'graduate companies' provided testimonials which demonstrated that ETV verifications had helped them win a contract, particularly with government clients. Nevertheless, the manager also observed that there was no 'objective' or measurable data available to support these claims. Japan reported that 'several organisations said they got new client by ETV report', while in the Philippines, the manager reported that their scheme had helped verified companies 'obtain the necessary permits and certifications that are required by the DENR [Department of Environment & Natural Resources] and/or end-users, making it easier to gain market access'.

5.2. Efficiency

5.2.1. Proportionality and efficiency of the programme operations

Evaluation question: Based on an assessment of the programme's operational settings after 2 to 3 years of actual operation, to what extent is the programme proportionate and efficient in delivering the results assessed under effectiveness?

Overall response: In quantitative terms, the total budget dedicated to establishing the pilot programme (€5.22 million) is significant when considering the number of statement of verifications issued during the period assessed, but more reasonable if one assumes that the technologies still in the verification pipeline will complete the process or when considering the other products of the ETV process, such as

[41] It is important to note that none of the ETV schemes consulted had carried out a full evaluation: only the VERA scheme had undergone a partial evaluation.

quickscans. Based on the sales estimated by companies that have had technologies verified, the pilot programme seems to provide value for money, even when taking into account that ETV is only one factor among others generating sales.

Moreover, in more qualitative terms, the knowledge and experience built up in the pilot programme could provide the basis for a more efficient ETV scheme, albeit one that will probably not be economically viable immediately. However, this will require ensuring that ETV's commercial meaning and relevance is better communicated to technology developers and progressively also to technology purchasers or end-users.

EU ETV's operational settings are generally recognised as able to deliver valuable results, as shown in the previous question, but these settings come at a cost. It has costed the European Commission €4.64 million to establish a fully functioning EU ETV infrastructure that is generating verifications. This comprises €1.92 million for the JRC to administer the scheme, €2.62 million for VBs to help start up and deliver the scheme, and €100,000 on translation and communication.

Given the 27 SoVs published during the pilot phase, this investment equates to a generous subsidy of €170,000 per technology[42]. Moreover, for many companies, quickscans are valuable on their own because of the initial assessment provided on the maturity of the technology, the quality of existing test data, and the appropriateness of a full verification and/or cost estimates. Comparing the total budget with the number of technologies verified is therefore not representative of the whole service provided to companies.

For companies that have completed ETV verification, assuming that each company expects to generate sales of €1 million within a year of obtaining their SoV (estimate based on the limited feedback received from verified technologies[43]), and that 100% of these sales were attributable to EU ETV, this would generate net total sales of €27 million, equivalent to a six-fold return on investment[44].

Furthermore, there is potential for EU ETV services to continue to deliver after the pilot: the initial EU investment has created a substantial knowledge base in the form of the expertise delivering and advising on ETV and through the 107 verification proposals and 49 specific protocols developed, and this can act as valuable reference material for future verifications. In fact, assuming that the number of applicants goes up, it may be possible for such an EU ETV to rely solely on verification fees paid by companies rather than further public subsidy. However, for EU ETV to be a viable business, VBs must achieve

[42] If we consider the 37 Statements of Verification published between 2013 and 2019, as no cost was engaged by the Commission after 2017, this comes down to €125.000 per technology and many technologies are still in the process of verification.

[43] Estimates of benefits or returns based on this assumption should be considered prudently, as the amount of sales depends very much on the type of technology and market applications — sales of small equipment and of complete industrial processes follow completely different routes. The figures provided here are meant to indicate trends rather than solid estimates.

[44] The same assumption extended to the 37 technologies verified until 2019 would give net total sales of €37 million and a return on investment of 8.

a sufficient number of verifications[45]. Otherwise some form of grant support, either to VBs or firms or both parties, may be necessary.

It is also worth reflecting on the critical fact that the programme was a pilot and therefore intended to road-test a new support mechanism. As such, it could not be expected to deliver efficiently from day 1. 'Teething' issues are evident from the evaluation. For example, there has been some criticism from VBs and independent technology experts that it took too long to establish the overall verification process. Understandably, much of the time spent by VBs and independent experts in the early technical working groups was focused on ensuring that the system overall (i.e. the General Verification Protocol and the various guidance documents that complemented it on aspects raised in questions from VBs) was fit for purpose.

Another consequence of the programme being a pilot was that much time was spent 'going up the learning curve'. This was true both of the VBs, which had limited knowledge of verification and lacked experience and expertise in verification initially, and of the independent experts. The length of time that the pilot has been running also resulted in natural turnover of experts in the technical working group meetings. This again reduced scheme efficiency, as new experts had to build their understanding of ETV afresh. Therefore, the pilot programme was a learning process for all parties involved.

To the extent that this early, and very necessary, development work is now complete, the system is now working much more efficiently than when it started. The body of knowledge that resided at the start with just a few individuals has been transferred widely across organisations and geographies. System efficiencies have been generated as a result.

While recognising the programme's limited timeframe, there are still inefficiencies in the system which could be addressed. For example, verification experts could improve their responsiveness to technologies as more of the same types of technology are being proposed. This occurred in the Canadian ETV scheme where, for certain technologies such as stormwater management the verification processing time decreased 'due to greater experience/knowledge by Verification Experts conducting multiple verifications in the same field (i.e. learning curve has levelled off)'. Furthermore, there could be opportunities to apply similar parameters to the same types of technology. The Philippines ETV scheme reported this as one way they had sought to improve scheme efficiency: 'Identification of general parameters that need to be monitored for certain types of technologies has made it easier to prepare the ETV Test Plan'.

The attrition of applicants across the entire ETV process[46] is one of the distinguishing features of ETV; it is, as previously noted, a common feature of all ETV schemes globally investigated in the study forming the basis for this evaluation. One way to overcome this is to engage with more innovative technology proposers as soon as possible to generate a larger future pipeline of potential users of verification. Another way (tried during the pilot programme but certainly improvable) is to communicate better to interested companies about the process and level of requirements under ETV. This was the purpose of the 'Guide for proposers' drafted in 2013. A similar approach was adopted

[45] Tentatively estimated at 7 per VB per year in the feasibility study on expanding the current EU ETV scheme.

[46] From 254 quickscans to 107 proposals, 49 specific verification protocols and 27 SoVs during the pilot phase.

by the French ETV scheme, but the French approach focused more on explaining to companies interested in ETV that it is crucial to have good test data before applying to ETV in order to help reduce the time involved.

Finally, three stakeholders from the public consultation felt that operational efficiency could be improved by strengthening EU ETV's commercial meaning and relevance. This would mean that instead of putting the emphasis on reducing costs, the emphasis should be on increasing the value of the scheme results — both in terms of recognition and of end users' capacity to benefit from them. Such measures overall could help to generate more relevant SME throughput and deliver a relatively higher proportion of SoVs than to date, because of a better technology 'fit' with EU ETV.

Although improved knowledge of ETV among technology end-users is one of the anticipated results of the model presented in the intervention logic, it is to be expected that this will take considerable time to filter through. Evidence from ETV schemes outside Europe suggests that end-user knowledge can remain weak even when schemes have operated for over 15 years (e.g. Canada), although in the Philippines scheme awareness has 'increased over time since there are more end-users that require ETV before they enter into contracts with technology providers.

5.2.2. Cost-benefit of ETV verification

Evaluation question: With respect to the cost-benefit of the ETV verification procedure for technology proposers, how do the costs involved in verifying a technology under ETV compare with the benefits for technology developers and users?

Overall response: Looking at the sales recorded by some technology developers as a result of the verification and their sales forecasts for the next 1-3 years, we have significant indications that the programme is achieving the expected result of promoting the verified technologies. Of course, this is based on a limited sample of verified technologies. Feedback from companies also suggests that EU ETV verification is delivering wider benefits including product differentiation, facilitated access to non-EU markets, and increased product acceptance and confidence among customers.

The evaluation study quantified the cost-benefit of ETV for technology proposers, using as an indicator the sales recorded or estimated in the first years after completion of the ETV procedure. However, the notion of 'sales' may vary considerably with the technology considered — from a piece of equipment to a larger process or a service associated with a certain technology. Adding sales estimates and comparing them with costs should therefore be done with prudence, and other indicators should be used to better qualify the assessment made.

Based on a limited sample size, albeit one representing around 20% of the total number of EU ETV verifications during the pilot phase, median sales estimates in the first year for companies with a verified product (N=5) were €1 million, compared to average verification costs of around €100,000.

A comparison of costs versus benefits (in terms of forecasted sales and profit margins) shows that benefits could grow by a factor of 6 over one year and by nearly 12 after 3 years compared to costs incurred by companies in the first year.

Assuming the attribution of all additional sales to the ETV, the payback period from verification using this sample of five companies is therefore within the year (and this takes no account of potential subsidies which the firm might have received if it was located in Denmark, France or Poland). More realistically, however, the feedback from technology proposers with a SoV indicates that the ETV is one of a number of aspects which help persuade buyers to commit to a sale. Even attributing 10% of sales to the effect of ETV would generate a one-year payback period.

Feedback from companies also suggests that EU ETV is delivering wider benefits, including product differentiation of their innovative environmental technologies, facilitated access to non-EU markets, and increased customer product acceptance and confidence.

Until now, governmental financial support has been essential in attracting many companies to the scheme: technology proposers' willingness to pay is equal to only 60% of the average fee per ETV verification, as estimated based on VB annual and final reports. However, increasing the scale of verified technologies could progressively lead governments to lower their support to VBs and companies. Verification fees can also be expected to go down a little as VBs and experts gain experience in the verification process, although evidence from other ETV schemes suggests that fee reductions may not occur in practice, although some time efficiency gains may occur. Comparison with feedback from other ETV schemes, both in and outside the EU, shows that the EU ETV process is similar in length to other verification systems, some of which have been running for several years. Reaching this average time period in such a short time frame necessarily required the establishment of effective processes facilitated by knowledge transfers from other national programmes and peer learning.

5.2.3. Comparison with certification

Evaluation question: Insofar as a comparison (whether qualitative or quantitative) is possible, how does the cost implied by the verification compare with that of certification? How proportionate/acceptable are costs versus benefits?

Overall response: For companies that have successfully completed the verification, the average verification fee (without testing) was €14,583, lower than the maximum the EU ETV scheme initially set as its objective (€20,000). ETV appears overall in the same cost range, although this depends on the point of comparison taken with certification schemes for environmental technologies.

Uncertainty regarding total verification costs is an issue for scheme applicants. Test costs are difficult to estimate beforehand, and the setting of verification parameters is often not straightforward. As a result, the full costs of verification can only be identified when the verification protocol is drafted, when additional tests are decided and valued and when final agreement is made between the company and the VB in a verification contract. Determining the return on investment for the verification, vis-à-vis comparisons with certification costs, is therefore often problematic for companies. This means that cost estimates need to be more transparent and more detailed at the outset of the verification. For example, two VBs explicitly indicated they were factoring in the complexity of the technology in their fees.

Insights into the verification fees charged by VBs suggest that, for five companies that successfully completed the verification and received their SoV, the average verification fee (without testing) was €14,583. This is in line with the €14,600 reported by VBs themselves and lower than the objective initially set by the EU ETV scheme (€20,000).

In the absence of information on fees from certification bodies, the study supporting this evaluation relied on a series of certification costs across different technology categories, as reported by companies participating in the 2011 study on ETV by the European Policy Evaluation Consortium[47], which examined the potential market demand for an EU ETV scheme. Using these certification costs — the average cost of which was €18,600 (excluding testing) for six technology types — suggests that verification under EU ETV is equal to or lower than the cost of certification across different technology groups. Insights from industry experts suggest that the cost of non-accredited verification of performance claims[48] could be considerably lower, in the magnitude of €1,000 to €5,000.

However, the technologies that EU ETV targets are precisely those for which there are no existing standards and/or criteria which allow for the demonstration of that technology's main environmental benefits and functions. Therefore, most certification schemes are not suitable for the technologies the pilot programme primarily targets. Indeed, for those companies willing to show additional and credible claims to that which certification typically requires, any additional costs for an ETV verification might be considered proportionate and representing good value for money to the innovator. This assumes obviously that the companies can draw additional benefits of their innovative technology versus those of the competition, and that ETV can unlock this potential.

5.2.4. Cost-efficiency of the programme

Evaluation question: With respect to the cost-efficiency of the programme, how do its costs compare with its added value? To the extent that a comparison is possible, how does this cost compare with other programmes or tools assessing the performance of innovative technologies in the EU and outside?

Overall response: The quantification of benefits from technology verification under ETV is too limited to be able to clearly compare them with the costs of the programme. Soft benefits for technology developers are better established. The first added value of the programme is the proof of concept: the creation in Europe of a new way to assess innovative technologies and prove their performance in a robust but flexible way. Finally, it is difficult to find programmes in the EU to which the pilot programme could be compared. The following question discusses the comparison with Member State ETV programmes.

The total spent by DG ENV on funding the pilot phase of EU ETV was €4.64 million. As previously noted, this included:

- €1.76 million for JRC's delivery of the pilot programme, with a further €160,000 added to the 2017 budget;
- €2.62 million, covering 3 years, allocated to 13 VBs — a sum considered essential to enable VBs to deliver verifications at a cost technology proposers can afford;
- a small budget of €100,000 for translation and communication activities.

[47] Detailed assessment of the market potential, and demand for, an EU ETV scheme, EPEC, June 2011, available on the ETV website: https://ec.europa.eu/environment/ecoap/etv/reference-documents_en

[48] The comparison with ETV is, however, difficult, as these non-accredited verifications may range from the simple desk review of a test report to more structured assessments, albeit without the robustness and transparency provided by a verification process like ETV.

First and foremost, the programme's main added value is not quantifiable: it is the creation in Europe of a new way to assess innovative technologies and prove their performance, without the need to first establish product performance standards usable through certification, but while still providing the robustness and reliability of certification schemes. With the limitation noted already in terms of recognition and awareness of technology end users, this proof of concept should be considered as the EU ETV pilot's main achievement.

In quantitative terms, the pilot's added value could be considered in relation to the sales generated by ETV proposers after completion of the ETV process. However, as noted in the previous question on the cost-benefit of verification, the estimations of sales are based on a limited sample, which would not allow for an accurate estimate of cost versus added value for the whole programme. Alternatively, stakeholders have referred to a series of 'soft' benefits to illustrate the added value of EU ETV, claiming these would ultimately lead to increased sales. These include the capacity to foster the company reputation and product recognition across the EU, thereby opening up new markets. Also, as mentioned under the criterion 'efficiency', some proposers valued the first steps of the ETV process and did not pursue until completion, suggesting that the provision of simpler, less costly results than the Statement of Verification (albeit less reliable) could also represent added-value for the programme.

Apart from the EU Member State ETV programmes assessed in the following section, there are few comparable programmes assessing the performance of innovative technologies in the EU or elsewhere against which to compare EU ETV. One example the study team found was the Climate KIC's technology validation scheme. This is a science- and engineering-focused study, undertaken especially for small companies, with the objective of assessing whether their technology actually works and at what cost. Such assessments have to be tailored to each technology, and are undertaken by universities or labs selected as having the best expertise relevant to that particular technology. Informal feedback from the Climate KIC suggests that its technology validation scheme should be considered more as a pre-ETV assessment than as a comparable performance verification scheme.

5.3. Relevance

5.3.1. The need for third-party verification in the European context

Evaluation question: To what extent is there still a need for third-party verification of the performance of environmental technologies? How relevant is the programme in fulfilling this need? Particular attention should be paid to the scope of verification (functional performance, environmental aspects) and how verification parameters are set (performance claims, expert views, life-cycle aspects).

Overall response: There is a continuous need for third-party verification of the performance of environmental technologies, as pointed to by European policy priorities and developments on the circular economy, resource efficiency, climate goals and a continued emphasis on promoting innovation and increased competitiveness. The relevance of ETV in helping innovative companies, particularly SMEs, to differentiate their product on European and global markets remains as valid as when EU ETV was first conceived. The scope of verification in the pilot programme is consistent with the demand for a reliable and robust

process, but there are also requests to simplify it, in particular the life-cycle aspects in the verification procedure. In terms of environmental sectors covered by ETV, the scope identified by the initial market study and by stakeholders is actually larger than the scope of the EU ETV pilot programme.

The need for third-party verification in the European context

The EU ETV pilot programme was established in response to strong EU policy objectives to support the market adoption of environmental technologies, backed by evidence that European technology developers, particularly SMEs, were struggling to convince technology end users and investors about the performance of their innovative products. The need for environmental technologies was further reinforced by policy developments in the circular economy agenda. For example, the development of water reuse practices, of more material recycling and use of secondary raw materials, and of substitution materials containing fewer substances of concern all require technological developments and reliable information on the performance of new technologies. The general mistrust in manufacturers' performance claims appears to be a second factor calling for an ETV.

By providing independent proof of verifiable performance parameters, third-party verification makes it easier for suppliers of innovative environmental technologies to access their target market[49]. Technology purchasers and users require credible information on the performance of new environmental technologies; this is all the more relevant because innovative technologies are not always or adequately covered by testing methodologies and standards. Moreover, testing may not be of controlled quality or easy to design and interpret. When asked about EU ETV's usefulness as a non-financial measure targeting the commercialisation of technologies developed by SMEs, a majority of the 52 respondents to the public consultation found it either 'quite useful' (20) or 'very useful' (15).

Globally, various established ETV schemes, starting from 1995 in the USA[50], had already demonstrated that third-party verification was being used successfully to prove the performance of innovative environmental technologies, setting a precedent for this type of public-sector market intervention. Based on figures exchanged by the different ETV programmes[51], over 1,400 technologies have been verified globally, showing a clear appetite for this approach among companies.

The continued need for ETV in the European context is reflected in the demand from companies for the pilot programme, in spite of potential applicants' low awareness of it, as highlighted by all surveyed stakeholders. Initial enquiries from 1,166 companies have occurred since the programme commenced in 2013, with a total of 254 quickscans conducted to date, leading to 107 verification proposals, 49 specific protocols and 27

[49] A study to examine the market potential for an EU ETV found demand for a third-party verification scheme from European SMEs across various environmental technology product groups, as well as a clear business case for such verification for several technologies across different environmental areas. Detailed assessment of the market potential, and demand for, an EU ETV scheme, EPEC, June 2011, available on the ETV website: https://ec.europa.eu/environment/ecoap/etv/reference-documents_en.

[50] The USA ETV programme, run by the Environment Protection Agency, was discontinued in 2013. See: https://archive.epa.gov/nrmrl/archive-etv/web/html/.

[51] Last update in 2015.

verification reports and SoVs. A large proportion of initial enquiries do not lead to quickscans, but may be redirected to other services that are more appropriate to specific circumstances. ETV should ideally be seen as one tool among others supporting companies with innovative technologies on their route to market, and the first steps of the ETV process may actually be used by companies as a more general consultancy service.

Public officials in several Member States outside the pilot area also thought that EU ETV was potentially beneficial for companies that wish to export their products. Stakeholders in Germany, the Netherlands and Sweden agreed that verification can play an important role when expanding to foreign markets.

The scope of the verification process designed for EU ETV and the setting of parameters

ETV schemes globally are all designed in different ways, albeit most following a typical process whereby a performance claim is independently scrutinised and validated via specific and controlled tests if necessary. As for the scope of the verification process designed for the EU ETV pilot, the evaluation evidence shows that for the most part a very thorough and robust system has been developed, with multiple opportunities for independent expert reviewers to challenge both the performance claims and the verification parameters that seek to put the claims into operation. There is clear benefit to this approach, and it helps to add confidence and robustness; however, it also adds considerable time and a degree of complexity, which stakeholders feel could be simplified.

Interviews with VBs indicate that key cost drivers for verification are: (i) the development of the verification protocol criteria; (ii) the setting of the verification parameters; and (iii) the assessment of the life-cycle aspects. There is also potential confusion about life-cycle aspects, since it is difficult for technology proposers to distinguish between the approach followed under ETV and a full life-cycle analysis, which is considerably more complex and does not address the same objective of functional performance. VBs therefore have the responsibility to clarify the scope and expectations of verification to technology proposers in the early steps of the engagement and to guide the choice of parameters that technology proposers wish to use, while ensuring that this choice represents the technical and environmental performance of the technology credibly and fairly.

It should be stressed that the pilot programme covered only three environmental sectors out of the seven investigated in the 2011 study on market potential. A number of stakeholders, during the pilot implementation and its evaluation, requested an extension of this scope to the seven areas corresponding to the need identified. This was in particular the choice made by two Member States (Denmark and France) which opened their national ETV schemes to the seven technology areas from the beginning. This approach was broadly confirmed by the views of independent experts and the open public consultation, in which 41% of respondents considered that the pilot programme should have included additional areas, while 32% thought the selected areas were the right ones.

5.3.2. Specific needs of SMEs

Evaluation question: How far should SMEs be considered specifically in relation to technology verification? In particular, how appropriate is the programme's approach to supporting SMEs?

Overall response: the specific needs of SMEs in competing with larger companies on new technologies are widely recognised, and nearly all ETV schemes, both within and outside Europe, address SMEs in particular. The approach experimented in the pilot programme seems appropriate for SMEs, but the perceived complexity of the procedure and its cost, or lack of targeted financial support, have discouraged a number of companies from undergoing verification or led them to drop out during the process.

There is a body of evidence to suggest that SMEs find it harder to break into established markets and compete against incumbent technology providers, many of whom are large companies with powerful brands, with years of demonstrating successful technologies and with established sales track records with end users. While the programme is open to companies of all sizes, experience shows that SMEs are the primary users of it: around 90% of technologies were presented by SMEs, while micro-enterprises alone represent 50% of quickscans.

Evidence obtained from the managers of other ETV schemes in Europe and around the world reinforces this point, since it shows that they predominantly cater to SMEs, and small and micro-businesses in particular. Such companies clearly feel that verification can provide them with a competitive advantage. In the French ETV scheme, 78% of those applying are micro-businesses, with the rest being small companies; the Danish ETV also services only small companies. In Japan and the Philippines, 70% and 75% respectively of applicants are small or micro-businesses. The VERA scheme in Europe provides an interesting contrast to this global trend of ETV clients, since 30% of their applicants are large companies and 40% are medium-sized — just 25% are small or micro-businesses.

It is important to emphasise that larger companies are not excluded from EU ETV, and out of the 48 technology proposers that responded to an e-survey, 3 were non-SMEs. However, it is to be expected that larger companies are generally able to successfully use other channels to achieve product sales, including their market reputation and previous track record in selling similar types of equipment. As a result, they have less reason to obtain an ETV statement of verification.

The appropriateness of EU ETV's approach to supporting SMEs can be split into two considerations: (i) the way in which the programme is specifically designed to focus on SME needs and the process that has been developed to put EU ETV into operation; and (ii) the limitations on how SMEs can be supported financially through an EU policy instrument. With respect to the first issue, feedback from some companies and experts has confirmed that while the EU ETV verification process is robust, it can also be complex, lengthy and time-consuming for participating companies. These issues can and did discourage some SMEs from continuing the verification process.

On the second issue, the cost of undergoing an ETV plays a major role in the scheme's accessibility. The fees, the additional cost of testing and the internal cost associated with the time spent by company staff to engage with and follow the verification process mean that SMEs will find it marginally harder than larger companies to cover the costs of

bringing an innovative product to the market. In an ETV scheme outside the EU, the manager reported that 'financing is typically one of the main challenges that prospective clients face when considering ETV verifications. In many cases, [companies] simply choose not to proceed with the formal application, citing cost as a main reason for not proceeding'.

Based on VB reports to the Commission, technology proposers' willingness to pay is equal to 60% of the average verification fee charged by VBs for the service, illustrating the need for grant support to make up the difference. While the Commission did not provide any explicit funding to SMEs to exploit EU ETV, it provided the grant support instead to VBs to help them establish the verification infrastructure and facilitate communication of the process to stakeholders. The grant support to VBs was also considered essential to enable them to deliver verifications at a cost that technology proposers can afford. The Commission also helped to promote the EU ETV approach via RD&I support mechanisms such as Horizon 2020 (2014-2020), the Eco-Innovation Market Replication initiative (2007-2013) and LIFE programme grant funding.

It is fortunate that SMEs in several Member States, such as Denmark, France and Poland, have been supported by grant subsidies to undergo verifications under EU ETV. In Denmark and France, national ETV schemes covering four additional technology areas to EU ETV provide an additional reason for providing funding, which in turn has helped to attract SMEs: the grants are allocated across the entire supply side and do not favour particular sectors, therefore enabling SMEs to take part in either EU ETV or the national ETV technology areas. Only France differentiated its support level according to company size. Indeed, grant funding from national governments is often seen as a precondition for undergoing verification: in France, for example, only one SME involved in the national ETV scheme has not received state support. Furthermore, in four cases, VBs used the possibility provided in grant agreements with the Commission to dedicate some of their funding to help subsidise EU ETV verification fees they were charging to technology proposers, thus incentivising the scheme's uptake.

Conversely, several technology proposers pointed to high verification fees, the lack of financial support and excessive internal human resource as the main reasons for withdrawing from EU ETV verification. For six technology proposers, the cost of verification fees and lack of financial support to undergo verification were among the top three reasons for leaving EU ETV. According to the survey of VBs, in four Member States — the Czech Republic, Finland, Italy and the UK — there was insufficient government support for SMEs to become involved with the EU ETV programme.

Overall, therefore, the scheme appears appropriate for SMEs, and the European Commission and some Member States have helped to bring down the costs of the delivery infrastructure, thereby reducing the verification fees for many SMEs. Nevertheless, the lack of direct grant subsidy support in some of the pilot Member States made it more challenging for SMEs to take part in the scheme and progress through the verification process.

5.3.3. Acceptance and transfer of technologies on international markets

Evaluation question: What role can or should the verification of technology performance play in facilitating the acceptance and transfer of technologies on international markets? How far is this reflected by ETV as implemented in the programme?

Overall response: The view that access to international markets is facilitated by technology verification is strongly supported both by companies that have had technology verified under ETV and by independent experts. However, this was only partly reflected by the open public consultation and there is not enough evidence from verified technologies to prove that ETV effectively facilitated international sales. Access to international markets was also a major reason for the drafting of an ISO standard on ETV and for EU support to this process.

A large proportion of technology developers taking part in the survey recognised the added value of an EU system that would enable greater recognition of their technologies and open up new international markets.

Among the technology developers interviewed, almost all those with a verified technology who responded (9 of 11) acknowledged that EU ETV verification facilitates access to non-EU markets. According to interviews with companies, the primary non-EU markets they are targeting are the USA, China and the Middle East. However, the extent to which these benefits can be fully observed across all the companies receiving verification is too early to tell, since most technologies with Statements of Verification are either only in the early stages of generating sales or have yet to start them.

More than 80% of independent experts indicated that verification of technology performance plays a key role, or may have a role to play, in facilitating the acceptance and transfer of technologies to international markets. One independent expert highlighted that, for EU ETV to play a definitive role in accessing international markets, it needs to 'have a good reputation, be robust, repeatable, fair and provide a tool for comparing products'.

These views contrast somewhat with the 53 respondents to the public consultation, over 50% of which had been involved in the EU ETV pilot. For them, the 'most important' observable benefits from verifications under EU ETV were facilitating entry to EU-28 markets (7 responses) and increasing the credibility of SMEs (9 responses). Only 4 respondents thought the most important observable benefit was facilitating entry to international (non-EU) markets.

An important aspect of the programme is the process by which expertise involved in the EU ETV pilot programme supported the development of the international standard on ETV, ISO 14034. This contributed to the mutual recognition of EU ETV internationally. The impact of the new international standard on the acceptance and transfer of verified technologies on international markets will have to be assessed in due course.

5.4. Coherence

5.4.1. Internal coherence

Evaluation question: How strong is the consistency between: (i) the overall rationale and operational settings of the programme; (ii) the way ETV is implemented by the different VBs; and (iii) the way EU ETV results are understood by technology developers and users?

Overall response: There is a high degree of internal consistency. Stakeholders knowledgeable about ETV, including technology developers, share a common understanding of the rationale and potential benefits of ETV. However, this understanding should also be communicated to technology purchasers. The lack of

awareness and recognition by technology users and purchasers is the greatest limitation to the further uptake of ETV in the EU.

The overall rationale for EU ETV was to make it easier for suppliers of innovative environmental technologies to access target markets by providing independent proof of verifiable performance parameters. The way the programme was designed seeks to ensure: (i) the quality of this service; (ii) consistency and comparability of its results. It aims to achieve this while reducing verification costs, partly by allowing pre-existing data to be accepted, as long as data quality can be assured. At face value, therefore, the scheme should have been appealing to companies and to SMEs in particular. It could offer these companies an additional mechanism to help them improve their competitive position and potentially access new markets and win new customers.

Survey responses show that technology proposers have a common understanding of the potential benefits they could gain from EU ETV, and that they therefore have common expectations for ETV. The prime reasons for companies to enquire about EU ETV include: product differentiation, market acceptance, enhanced reputation, and the facilitation of market entry into other EU Member States. Interestingly, the least important driver for engagement with EU ETV was a desire to help increase investment in companies. This is perhaps explained by the relatively mature age profile of many companies participating in the pilot programme.

Furthermore, the study shows that although a number of companies of all ages had yet to engage in the sales process for their product, many established companies had made initial sales of their innovative product, or were nearly at the point of achieving a first sale, when they first engaged with the programme. This implies different expectations of benefits across different companies (from helping improve company credibility and raising the profile of younger firms, through to differentiation and a level-playing field for more established firms) although there is no clear trend. This also implies there is a broader level of demand than originally believed. EU ETV can support initial market entry for newly established companies, helping to sell innovative products to end users. But it can also improve the suite of methods that established companies are able to draw on to achieve sales with end users.

VBs seem to show a strong adherence to the EU ETV scheme and understand its benefits. Much of the effort to promote the scheme has come from VBs who have helped to attract companies and also collaborated at the national and international level to create a more effective scheme.

That being said, companies did report that the process was often lengthy, administratively burdensome and more expensive than first envisaged. There may also have been an implicit tension between the needs of companies, who wish to achieve a fast verification, and those of the VB, which must ensure the integrity of the process.

The ETV pilot has now formally ended and no decision has yet been made on the continuation of the scheme, pending the results of this evaluation. Given this context, some VBs have recognised that it is too challenging a market area to continue to provide services in and have decided to stop offering the service[52].

[52] At the time this SWD was finalised in 2019, out of 15 VBs accredited during the pilot phase, 4 had stopped renewing their accreditation and 1 new body had been accredited, bringing the total of VBs to 12.

5.4.2. *Coherence with other EU policies (external coherence)*

Evaluation question: To what extent is the ETV approach, as implemented in the programme, consistent with the overall rationale of: (i) the Eco-innovation Action Plan; (ii) the Green Action Plan for SMEs; (iii) the Circular Economy Action Plan; and (iv) other relevant EU policy frameworks such as the Energy Union?

Overall response: There are many substantial links between the ETV approach and the different EU policy frameworks for eco-innovation, environmental technologies and support to SMEs. However the links with differentiated policy objectives may lead to emphasis being put on different aspects of ETV and on potentially different priorities for ETV implementation.

The idea for an EU ETV initiative was born following the 2004 Environmental Technologies Action Plan (ETAP), and has been supported in subsequent plans and policies. Various linkages between the EU ETV objectives and those pursued by the other policy plans and frameworks can therefore be identified, the most important of which include:

- faster and easier deployment of eco-innovation;
- cost-effective environmental protection measures;
- improved resource efficiency and energy efficiency;
- promotion of investments in eco-technologies;
- competitiveness of SMEs; and
- generation of jobs.

However, ETV has a slightly different role within each EU plan, policy or framework. For example, the objectives of differentiation, credibility and increased sales aligns well with actions to help improve the competitiveness and environmental performance of SMEs under the Green Action Plan for SMEs (GAP). The opportunity to bring more resource-efficient technologies more quickly and easily to market contributes to wider resource efficiency across the European economy under the Circular Economy Action Plan (CEAP).

Of the 52 stakeholder responses in the public consultation, 37 considered the ETV approach, as implemented in the programme, to be ‘very’ or ‘fairly’ consistent with the overall rationale of key EU policies supporting eco-innovation and resource efficiency. Only one stakeholder felt it was not consistent, although a substantial minority (14) stated that they did not know. Suggestions for improvement by some stakeholders included: encouraging the public sector to use EU ETV; clarifying the relationship between ETV and other EU action plans; providing associated financing options to support EU ETV; and simplifying the process.

The ETV approach is therefore clearly one part of the ‘toolbox’ of measures which the European Commission has pursued to help fulfil the various objectives of the EIAP, GAP and CEAP. It also has the advantage of mutually reinforcing different initiatives, because of the various positive outcomes it can have, both from a supplier perspective but also across the wider European economy.

5.4.3. Coherence with legislation, certification, and voluntary approaches (external coherence)

Evaluation question: To what extent is ETV complementary to and consistent with: (i) legislation; (ii) standardisation, certification, and technology assessment; and (iii) other voluntary approaches such as the Public Procurement of Innovation?

Overall response: The consistency and complementarity of ETV with the overall infrastructure of tools to guide and assess the performance of technologies (tools that include standardisation and certification schemes), seem well recognised by stakeholders. In principle, the ETV is also consistent with legislation (in particular legislation based on technology performance) and with support policies for the public procurement of green or innovative technologies. However, links with EU legislation have not been used or implemented in practice in the EU pilot programme.

Technology verification schemes are part of the general infrastructure of establishing agreed-upon scientific and engineering information, and/or an acceptable level of product or service performance, for any given technology application. This general infrastructure is based around measuring technology performance against established standards, and certification of this performance by accredited bodies. Verification schemes (at least in the EU) also enable the technology proposer to decide — to some extent — the performance parameters they see as representative of the technology's innovative features and that they want to promote to the market. This feature helps to differentiate ETV schemes from other mechanisms, such as certification and labelling schemes. In some cases however, ETV can replace certification by integrating the particular standard in question, together with other verification parameters. Alternatively, ETV can build on certification results, not repeating tests if certification has already been obtained.

On the complementarity of ETV with other voluntary approaches, it is interesting to see that the ETV scheme of the Republic of Korea helps to promote public procurement of innovative technologies, and the attractiveness of the Korean ETV benefits from this link with public procurement. Adopting a similar approach with public procurement would also seem possible in principle for the EU ETV scheme[53], but in practice this was not tested under the pilot programme. Links between ETV and innovation or environmental technology policies were established in some Member States. For example, in the last decades, France promoted 'competitiveness poles', long-term regional thematic clusters with a potential of excellence and competitive advantage for the regional economy. ETV was integrated by some of these clusters among their innovation-support tools. In Poland, links between ETV and national policies on environment protection and water management enabled ETV projects to be funded by the dedicated national fund (NFEP&WM).

Established ETV schemes have also successfully used ETV to complement legislation, for example, by satisfying regulatory needs driven by environmental policy (e.g. USA), or by supporting performance-based environmental policy implementation (e.g. the VERA scheme). In the Philippines, the DENR requires all technology suppliers to apply for an ETV for any new environmental technology prior to issuance of an Environmental Compliance Certificate. VBs recognise the untapped potential of wider Member State adoption and integration of ETV into EU and national regulations. The fact that some

[53] This possibility is discussed in one of the feasibility studies undertaken in parallel to this evaluation.

ETV schemes outside of Europe are employing such mechanisms to complement legislation based on technology performance suggest that similar mechanisms could also be considered within EU ETV, even if this was not explored in the pilot programme.

5.5. EU added value

5.5.1. Comparison with EU Member State programmes

The evaluation question focused on comparing the EU ETV pilot programme with Member State programmes on ETV (such as the ETV programmes in Denmark or France; and the VERA scheme for environmental technologies in agriculture covering Denmark, Germany and Netherlands) and other programmes pursuing similar objectives. The question asked to what extent there was evidence of added value from the EU ETV pilot programme.

Overall response: Comparing the results of EU ETV pilot programme with national schemes in Denmark and France is difficult for two reasons. Firstly, there is a lack of quantified estimates of the impacts of national programmes. Secondly, national programmes appear to function more as a complement to the EU pilot, developing technology areas not covered by the EU pilot, and sharing — at least partly — communication efforts and financial support with the EU pilot in the Member States concerned. Nevertheless, stakeholders have a clear preference for a technology verification programme to be developed at EU level that builds on synergies with EU legislation and policies. Stakeholders involved in the different schemes favour a merger or co-operation of the different schemes rather than an increase in competition.

The added value of EU ETV can be assessed on two aspects: the way it helps technology developers commercialise verified technologies, compared with Member States programmes, and the added value of ETV harmonisation at EU level more largely, including for stakeholders other than technology developers.

On the first aspect, drawing comparisons between EU ETV and Member State programmes on ETV is difficult, not least because there is limited evidence of impact for Member State ETV programmes.

An advantage of a statement of verification under the EU ETV system is that once the SoV has been awarded in one Member State, it can be used by a technology proposer to facilitate access to 28 Member States and non-EU markets. This is the basis of the EU added value of the system. However, there are two drawbacks for the practical use of this advantage. First, the EU ETV system may not be known by the actual users of the technologies being verified. Evidence from the counterfactual analysis in countries outside the pilot area showed very different levels of awareness of the scheme among public officials and market actors. Nevertheless, as indicated under 'Effectiveness', around 20% of technology developers — 23 out of the 122 identified companies — originated either in non-participating EU countries outside the pilot area (19 companies) or in non-EU countries (4 companies), showing an interest to the EU approach beyond home markets. Second, existing national regulatory requirements may still require the technology to satisfy particular standards. This is discussed later on in this section.

When asked to identify the EU added value of the EU ETV programme, stakeholders mainly referred to the capacity of an EU-led system to institutionalise cooperation between various actors involved in ETV, and to facilitate knowledge sharing and mutual recognition of ETV. This institutionalised cooperation was further supported by the

development of key documents (GVP) which led to the harmonisation of approaches also at national level in Member States participating in EU ETV. VBs show great appreciation for the system and understand its benefits. They also recognise the untapped potential of wider Member State adoption and integration of ETV into EU and national regulations when such regulations are based on technology performance (for example, via the definition of Best Available Techniques). Such added value would never have been possible at that scale within a national scheme.

The backing of additional Member States could promote greater acceptance of ETV products. When the programme is not supported at national level, it seems more difficult for VBs to promote the programme. It is also more difficult for technology developers to use ETV results because technology users are less likely to recognise these results. It should be noted that the results of this evaluation were presented and discussed in the Commission expert groups dedicated to resource efficiency and to sustainable consumption and production. At these expert group meetings, the Commission asked those Member States not involved in the pilot programme whether they would consider participating in future. There was only a limited number of responses, split equally between those interested in participating in the future and those confirming they had no interest in participation.

For technology coverage, the French and Danish national ETV schemes chose to cover those technology areas initially planned under EU ETV but not covered in the EU pilot phase, and to use the same VBs for both schemes. Each of the two national schemes also chose to create a single, shared communication effort with the EU scheme and funding mechanism benefiting both to the national and EU schemes. The approach followed was therefore one of cooperation rather than competition. The national schemes were actually seen by governmental authorities as part of their contribution to the establishment of ETV in Europe and as a precursor to wider technology coverage by the EU scheme. Governmental authorities saw the national schemes as providing an opportunity for companies operating in national technology markets to obtain an ETV with the potential for EU-wide market access.

Another added value of EU ETV is its potential to remove regulatory barriers in Member States by providing reliable information on technology performance. However, the extent to which the verification helps to overcome regulatory barriers is unclear. In at least one Member State, a technology provider is still facing restrictions from local authorities who are not confident that the EU ETV-verified technology meets national regulations. In another Member State, a technology proposer has asked the national administration to issue a certificate attesting that, in line with the EU ETV verification, their technology complies with the national law. This suggests that involving competent national and local authorities in the early stages of the verification process may help ensure the effectiveness of ETV in overcoming regulatory barriers.

The VERA scheme is a specific case, as the three Member States concerned, namely Denmark, Germany and the Netherlands, created the scheme for regulatory purposes. The technologies verified under VERA in any of the three Member States enjoy official recognition, for example by being registered in a list of authorised technologies for end users or other forms of support from public authorities. The verification process itself is similar to that of EU ETV, although the specific protocols used by VERA include more detailed test requirements and apply to a whole product group, not to specific technologies. Since EU ETV does not cover agricultural technologies, it has happily co-existed alongside the VERA scheme. However, the extension of EU ETV to agricultural technologies was recommended by Denmark, France and the Netherlands in a joint letter

in December 2011 and the establishment of a structured co-operation between the two schemes was discussed with VERA at the ETV steering group meeting of June 2019. Such a co-operation, which would require that EU ETV cover agricultural technologies and use VERA specific protocols for technologies in this area, could be beneficial to both schemes by enabling operational savings (using the same VBs for the different approaches) and increasing the recognition and regulatory relevance of EU ETV.

5.5.2. Implementation of ISO 14034 through the programme

Evaluation question: Considering the recent adoption of the new ISO Standard 14034 and different options for its implementation in the EU (with or without ETV schemes, at EU or Member State level), to what extent is there an expected EU added value in implementing ISO 14034 through the programme?

Overall response: The ETV process in the new ISO Standard shares many common points with the ETV process in the EU pilot programme. However, the ISO Standard does not cover essential points such as requirements on and coordination of organisations implementing ETV, and quality requirements on the verification process and on the testing. Integrating the implementation of the ISO standard within an EU ETV scheme makes a lot of sense. And having a separate scheme for the ISO Standard that seeks to replace or compete with the EU pilot risks losing the key benefits of ETV on the quality and harmonisation/comparability of results.

The aims, objectives and context of ISO 14034 strongly correlate with the EU's GVP. The provisions of ISO 14034 mirror to a large extent the ETV procedures detailed in Part B of the EU GVP[54]. However, despite alignment between the EU GVP and ISO 14034, there are some key differences between both systems. For example, ISO 14034 is a technical standard focused on the verification process. It does not describe ETV schemes and does not set out requirements for: (i) the organisations taking part in ETV schemes (such as VBs accreditation), which is the objective of Part A of the EU GVP; or (ii) the quality management of the accreditation process (Part C). Statements issued under ISO 14304 may undermine the quality of EU ETV, as technologies verified under both schemes would be portrayed as being of equal value to EU ETV, when they are clearly not. This suggests the way to go would be to: (i) embed ISO 14034 within the GVP; (ii) reject the possibility to implement both schemes separately; and (iii) reject the possibility to discontinue EU ETV but keep the ISO Standard.

The added value of implementing ISO 14034 through the programme is also based on the theory that, by integrating ISO 14034, EU ETV would raise its international profile and recognition. It is believed that EU ETV would thus benefit from the international interest raised by the new ISO Standard, and that this would help advance the mutual international recognition of ETV assessments. This would also enable EU ETV to keep its differentiating features (e.g. the quality of its verification structure, and its requirements for ensuring the overall quality and robustness of the scheme).

[54] This alignment is now clearly visible in version 1.3 of the EU GVP published in April 2018, which makes systematic reference to ISO 14034 alongside the text of the GVP, and provides a table of correspondence in an appendix to facilitate the recognition of equivalence by national accreditation bodies granting accreditation.

6. CONCLUSIONS

Considering the limited scope of the evaluation undertaken, this evaluation has overall confirmed the relevance and consistency of the ETV approach and the main ways in which it was implemented in the EU pilot programme. The programme's main added value was the creation in Europe of a new way to assess innovative technologies and prove their performance, without need to first establish product performance standards, but with the robustness and reliability of certification schemes. However, the evaluation also found that there was scope for some simplification and a need for more effort to communicate the rationale and benefits of the scheme to the market, in particular to technology users and purchasers. This would increase the scheme's recognition and uptake.

The main conclusions for each of the evaluation criteria are set out below.

Effectiveness: the evaluation could only build on a limited set of quantitative evidence, therefore limiting the conclusions that can be drawn. However, a majority of stakeholders who are knowledgeable about the pilot programme indicated that **EU ETV provides a robust and credible system which is acceptable to the market, and is generally recognised for rigorous procedures and guidance, peer review and quality control.** In terms of end results, 27 statements of verification were issued under the programme between 2013 and 2017. This number is modest but in line with the pilot's timescale and the achievements of non-EU ETV programmes in their first years of implementation. The ETV's value added for the technologies verified lies chiefly in: (i) the credibility of performance claims; (ii) the reputation of the company that developed the technology; (iii) potential access to new markets and differentiation from competitors on those markets; and (iv) increased customer product acceptance and confidence. Intermediary results in the verification process (quickscans, specific protocols and testing) seem also to provide some added value. This value is more limited than the end results but sufficient for some companies. However, the number of projects in the verification pipeline limits the pilot programme's effectiveness, as until now there have not been enough projects undergoing verification to ensure wide recognition for the scheme and a viable, self-financing business plan. More effort would be needed on communication for the programme to reach the level of awareness and recognition needed for it to develop successfully.

Efficiency: The total budget to establish the pilot programme was €4.64 million. This amount is significant considering how many statements of verification were issued during the period assessed, but more reasonable if we: (i) assume that at least a part of the technologies still in the pipeline will complete the verification process and; (ii) take into account intermediary deliverables such as quickscans, which also have some value for technology developers. For companies having successfully completed the verification, the average verification fee (without testing) was €14,583. This is lower than the objective of €20,000 initially set by the EU ETV scheme and it is in the same cost range as existing certification schemes. **Based on the sales estimated by the small number of companies that have had their technology verified, the pilot programme seems to provide value for money, even when considering that ETV is only one factor among others generating sales.** Moreover, the knowledge and experience built up by the pilot programme could provide the basis for a more efficient ETV scheme in

the future. Such a scheme would probably not be immediately economically viable, but could work if ETV's commercial meaning and relevance is better communicated to technology developers and progressively also to technology purchasers.

Relevance: Policy priorities and market demand suggest that there is a continuous need for third-party environmental technology verification. **The relevance of ETV in helping innovative companies, particularly SMEs which account for 90% of applicants to ETV, to differentiate their product on European and global markets remains as valid as when the EU pilot programme was first designed.** The scope of the pilot programme is consistent with the demand for a reliable and robust process for performance verification, although there have been requests to simplify the ETV process. In terms of the environmental sectors covered by ETV, the scope corresponding to the needs identified by the initial market study and confirmed by stakeholders is larger than the scope actually implemented in the pilot programme.

Coherence: There is a high degree of internal coherence. Stakeholders knowledgeable about ETV, including technology developers, share a common understanding of the rationale of the scheme and its potential benefits. However, this understanding should also be communicated to technology purchasers as the lack of awareness and recognition among this latter group is the main obstacle to the further uptake of ETV. In terms of **external coherence**, there are many substantial links between the ETV approach and the different EU policy frameworks relevant for eco-innovation, environmental technology and support to SMEs. **There is high complementarity with the overall infrastructure of tools for assessing the performance of technologies, including standardisation and certification schemes.** Consistency with legislation and with incentives for public procurement of green or innovative technologies seems also to have been established in principle, but has not really been implemented on the ground in the pilot programme.

EU added value: national ETV schemes in Denmark and France appear to complement the EU pilot rather than compete with it. However, there is insufficient information to carry out a quantified comparison with the EU pilot programme. The added value of EU ETV compared to a standard certification or a detailed test report also lies in the benefits provided by having an EU framework, including the accreditation of Verification Bodies and harmonisation of practices. This framework provides assurances on the competence of verifiers and on quality control that can be recognised internationally. Furthermore, **technology developers, including SMEs, and the majority of interviewed experts have a clear preference for a technology verification programme developed at EU level and building on synergies with EU legislation and policies**. The new ISO standard on ETV shares many common points with the EU pilot programme when considering the ETV process but does not cover essential points such as: (i) requirements on and coordination of organisations implementing ETV; and (ii) quality requirements on the verification process and testing of technologies. **Integrating the ISO standard into an EU ETV scheme makes a lot of sense**, whereas having a separate scheme for the ISO standard to replace or compete with the EU pilot could seriously jeopardise ETV's key features on the quality and comparability of results.

Based on this evaluation, we can conclude that the EU ETV pilot programme has demonstrated the validity and applicability in the EU of the concept of environmental technology verification. The pilot programme's operational settings are satisfactory when

judged against the criteria of relevance, effectiveness, EU added value and coherence. On efficiency, the pilot programme provides value to the technologies verified, but the number of technologies assessed during the pilot is not sufficient to ensure the overall viability of the scheme or to conclude on its cost-efficiency.

Any future development of ETV in the EU should aim at addressing the needs identified in this evaluation and should in particular consider:

- simplifying the ETV process as far as possible, without endangering its quality and robustness, with particular focus on clarifying the life-cycle aspects and ensuring alignment with the ISO standard on ETV;

- protecting the independence and added value of ETV as an EU scheme, while integrating ETV within a larger framework of technology assessment tools and support tools to innovation and SMEs, making it easier to attract technology developers to the scheme and to ensure that they gain more from it;

- broadening the range of technology covered by the scheme to cover the identified market needs and expanding ETV to cover the EU as a whole;

- strengthening the provision of information and communication about ETV in order to reach out to technology users, better explain how the scheme fits their needs and increase its uptake within the EU and outside;

- developing stronger links with EU and Member State environmental legislation and policies, so that ETV can contribute both to science and to evidence-based implementation and benefit from further recognition and visibility.

ANNEX 1 – PROCEDURAL INFORMATION

1) Lead DGs and internal references

This evaluation is led by DG Environment. It was included as item PLAN/2017/871 in the Agenda Planning (AP).

2) Organisation and timing

An inter-service group (ISG) to steer and provide input for the evaluation was set up in 2016 with representatives from the Secretariat General (SG) and the Directorates-General for Internal Market, Industry, Entrepreneurship and SMEs (GROW); Agriculture and Rural Development (AGRI); Energy (ENER); Environment (ENV); Climate Action (CLIMA); Trade (TRADE); Research and Innovation (RTD); Communications Networks, Content and Technology (CNECT); Joint Research Centre (JRC) and Justice and Consumers (JUST).

The group met three times during the evaluation process. The ISG meeting dates and topics of discussion are set out in the table below.

DATE	TOPICS OF DISCUSSION
9 September 2016	1st ISG meeting: discussion of overall process, roadmap and draft terms of reference for the support study
18 May 2017	2nd ISG meeting: kick-off meeting of the support study
21 March 2018	3rd ISG meeting: discussion of the support study draft final report

3) Exceptions to the Better Regulation Guidelines

No exceptions were made to the Better Regulation Guidelines[55] during this evaluation.

4) Evidence, sources and quality

The evaluation was largely based on a support study that collected information through targeted stakeholder consultation (online and phone interviews) and through an open public consultation hosted on the Commission's Better Regulation website. Two meetings of the ETV stakeholder forum, meetings with the ETV Steering Group, meetings with the Technical Working Groups completed the consultations.

The information from stakeholder consultations is summarised in Annex 2.

[55] https://ec.europa.eu/info/better-regulation-guidelines-and-toolbox_en

ANNEX 2 – SYNOPSIS REPORT OF STAKEHOLDER CONSULTATION

1 INTRODUCTION

The stakeholder consultation for the support study for the evaluation of the EU Environmental Technology Verification (ETV) pilot programme began in August 2017 and continued until December 2017. The objective of the consultation process was to collect information, ideas, opinions and insights from a variety of stakeholders, based on a set of evaluation questions laid out in the EU ETV evaluation roadmap. It was recognised that some questions would be far more relevant to certain stakeholder groups than to others. To this end, an evaluation framework was developed to help target each evaluation question.

This synopsis report aims to inform: (i) policymaking by describing the outcome of all consultation activities; and (ii) stakeholders on how their input has been taken into account. It summarises the various contributions received and, based on the analysis of this input, identifies the main strengths and weaknesses of the EU ETV pilot programme (hereafter 'the programme') after more than three years of operation. These areas will be used to inform the evaluation of the pilot programme.

2 STAKEHOLDER GROUPS COVERED BY THE CONSULTATION ACTIVITIES

Figure 1 below provides an overview of all relevant stakeholder groups based on the published evaluation roadmap and the consultation strategy. Each of the four broad stakeholder categories can be divided into two subgroups: (i) the stakeholders directly involved in the EU ETV pilot programme (inner circle of Figure 1), either by way of oversight, delivery or as customers; and (ii) the stakeholders not involved — or only indirectly involved — in the pilot (outer circle of Figure 1). The various categories of stakeholders are described in the following sections.

2.1 Core actors and stakeholders in the EU ETV pilot programme

This stakeholder category includes the following groups:

- **the EU ETV steering group** with Member State representatives;
- **EU ETV Technical Working Groups (Verification Bodies and independent experts)** – helping to shape the overall guidance for the programme and providing peer review and challenge for verification protocols for each technology in the system;
- **other relevant EU entities (e.g. DG ENV policy leads[56], RTD, JRC[57], GROW[58], and ENER[59]);**

[56] For the ETV pilot itself and consistency with core ENV policies such as the Eco-innovation Action Plan, the Circular Economy and the Green Action Plan for SMEs (a joint ENV/GROW initiative), etc.

[57] JRC and DG ENV have a formal administrative arrangement, which sets out tasks and expected work to be delivered.

[58] With respect to scheme consistency with the Green Action Plan for SMEs (a joint ENV/GROW initiative).

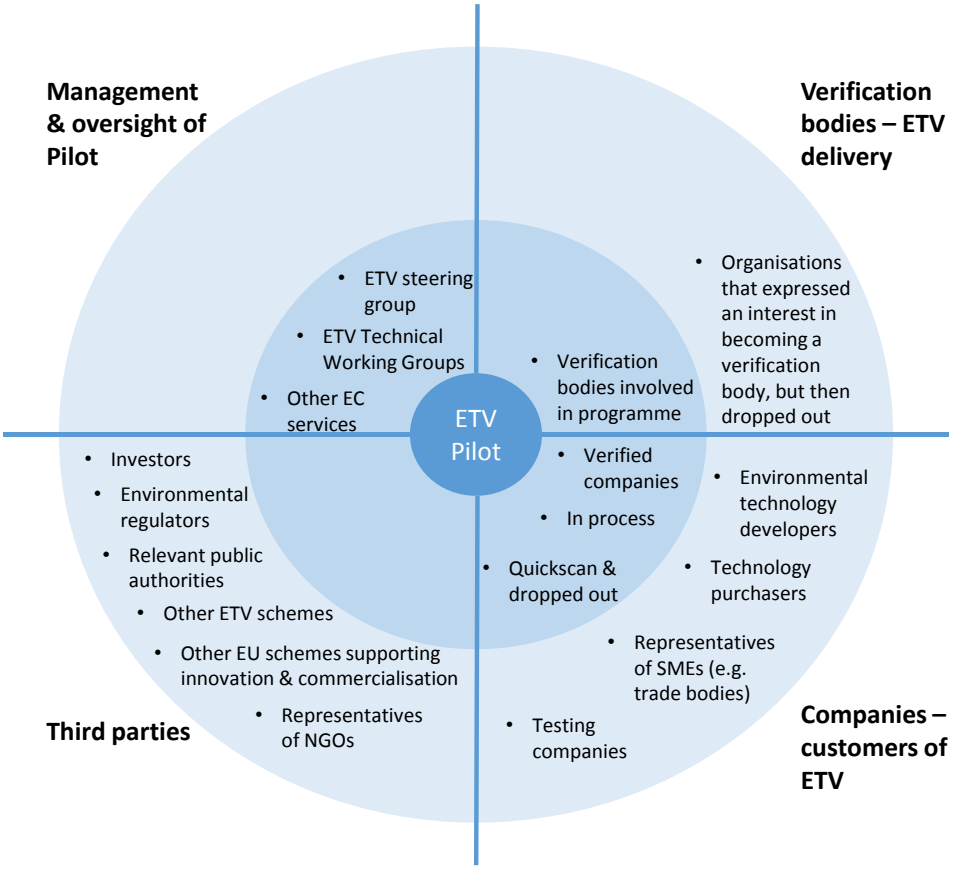
[59] With respect to scheme consistency with the Energy Union.

- **Verification Bodies (VBs)** – responsible for promoting EU ETV, delivering verifications to companies and helping to shape the overall guidance for the programme;

- **Companies directly involved in EU ETV:**

  - firms that applied and whose products were fully verified;
  - firms that applied and are currently on-boarded in the scheme;
  - firms that only applied or did a quickscan and then dropped out of the scheme.

Figure 1. EU ETV pilot programme – stakeholder mapping



Source: ICF, 2017

2.2 Stakeholders not directly involved in the EU ETV pilot programme

This stakeholder category includes the following groups:

- **organisations that either expressed an interest in becoming a VB and/or applied to become a VB, but subsequently dropped out;**

- **companies with an interest in the ETV:**

  - environmental technology developers;
  - technology purchasers (end users);
  - representatives of SMEs;
  - testing companies.

- **other ETV schemes** – both in EU Member States (France, Denmark, VERA[60]) and outside the EU (e.g. in Canada, Japan, South Korea, USA, etc.);
- **environmental permitting authorities** – such as the Irish Environmental Protection Agency, Swedish Environmental Protection Agency, and the Polish Chief Inspectorate for Environmental Protection[61];
- **investors** – for example, leading European cleantech venture capital funds;
- **relevant public authorities** (especially public purchasing authorities interested in innovation);
- **Member States with an interest in the EU ETV pilot programme** – an innovative aspect of the evaluation is to determine, via discussion mainly with public officials, whether those potential clients completely outside the EU ETV pilot area are in any way worse off from not using such a system;
- **other EU schemes supporting the commercialisation and deployment of environmental innovations** – such as Knowledge & Innovation Community (KIC) networks (part of the European Institute of Technology), European Technology Platforms, Fast Track to Innovation Pilot (within Horizon 2020), InnovFin Energy Demo Projects pilot facility (DG RTD/EIB), and NER 300 (DG CLIMA);
- **representatives of NGOs** – such as the Climate Action Network, WWF, etc.;[62]
- **the general public**.

3 CONSULTATION ACTIVITIES

3.1 Methods and tools

A variety of methods and tools were used to ensure a comprehensive and well-balanced consultation process that answered all of the evaluation questions and thematic areas set out in the evaluation roadmap. Table 2 provides an overview of the principal approaches used to consult with each stakeholder group. The choice of specific methods and tools was based on a consideration of the following factors: the size and diversity of the stakeholder group; the nature of information we expected to collect from them; and the criteria described in the stakeholder mapping section above.

[60] Verification of environmental technologies for agricultural production (VERA), an ETV scheme operating across France, Germany and the Netherlands.

[61] Further examples of environmental regulatory bodies can be found in the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) here.

[62] Further examples of environmental NGOs can be found here.

Table 2. Overview of methods used to consult with different stakeholder groups

	Online surveys	Semi-structured interviews	Public consultation	Stakeholder meeting
ETV steering group members	✓	✓	✓	✓
ETV Technical Working Group members	✓	✓	✓	✓
Other relevant EU entities (e.g. DG ENV policy leads, JRC, GROW)		✓		✓
Verification Bodies	✓	✓	✓	✓
Companies directly involved in the ETV	✓	✓	✓	✓
Organisations that expressed an interest in becoming a VB but then dropped out		✓	✓	✓
Potential verification bodies			✓	✓
Environmental permitting inspectors			✓	✓
Investors			✓	✓
Relevant public authorities			✓	✓
Technology developers with a potential interest in ETV			✓	✓
Public- and private-sector end users of environmental innovations with interest in ETV			✓	✓
Member States not involved in the ETV programme – *counterfactual dimension*		✓	✓	✓
Other ETV schemes (EU/non-EU)		✓[63]	✓	✓
Other schemes supporting the commercialisation and deployment of environmental innovations			✓	✓
Representatives of NGOs			✓	✓

[63] In the first instance a two-page survey was emailed to scheme representatives in order to gather key data and insights on schemes to complement the data and insights already prepared by the study team from a literature review. In several cases, this data required validation from a follow up interview with a scheme manager.

3.2 Participation in the various consultations

3.2.1 Online surveys

In total, three online surveys were conducted with targeted technology proposers[64] (from 11 August to 29 October 2017), VBs (from 14 August to 18 September 2017) and independent experts (from 18 September to 9 October 2017). Table 3 provides a summary of overall outcomes and response rates from these three different surveys.

Table 3. Overview of online survey responses

Target group	Sample used	Response n =	Response rate	% of total population	Survey language
Technology proposers	109	51	43%	23%[65]	CZ, EN, FR, IT, PL
Independent experts	63	18	28.5%	28.5%	EN
Verification bodies	15	15	100%	100%	EN

3.2.2 Semi-structured interviews with stakeholders involved in the EU ETV pilot programme

In total, 44 semi-structured interviews were conducted with:

- 6 officials from relevant DGs (ENV, GROW, ENER) and EASME, that had either helped deploy the EU ETV pilot programme, or else had taken an interest in EU ETV since its inception;
- 11 VB representatives, 9 independent experts involved in the Technical Working Groups (TWGs) and 3 independent experts involved in the Steering Group;
- 12 technology developers who took part in the survey and agreed to be interviewed (of which 4 had a Statement of Verification - SoV, 6 were in the process of obtaining a SoV, and 2 had dropped out during the verification process); and,
- 3 technology proposers who had been granted a SoV for their innovative technologies, but who had chosen not to respond to the online survey.

[64] Often used interchangeably with 'technology developers'.

[65] The total number of application requests is 205 as per the EC's website: https://ec.europa.eu/environment/ecoap/etv/verified-technologies_en.

3.2.3 Semi-structured interviews with stakeholders outside the EU ETV pilot programme

3.2.3.1 Knowledge Innovation Communities (KICs)

Three interviews were conducted with senior representatives from the three Knowledge Innovation Communities (KICs), covering energy, materials and climate.

3.2.3.2 Counterfactual research and analysis in seven Member States

The study team engaged with a representative sample of stakeholders from seven Member States that were similar in terms of parameters such as GDP and population to the seven Member States participating in the pilot programme. The countries selected were Germany, Netherlands, Portugal, Romania, Slovakia, Spain and Sweden. A number of semi-structured interviews were conducted with each country, organised using a sample ideally drawn from the following stakeholder groups:

- relevant ministry/agency officials (e.g. industry, innovation, environment);
- environmental technology industry/trade bodies;
- environmental technology proposers, particularly SMEs; and,
- companies and public authorities purchasing environmental technologies.

In total, 27 interviews were conducted across the seven Member State case studies.

3.2.3.3 National Member State ETV schemes and ETV schemes outside the EU

The study team obtained key information and data on the scope of other ETV schemes operating both within and outside the EU. A survey and a follow-up interview was completed for ETV schemes in Denmark, France, the VERA scheme, and Canada. Written responses were also received from the Philippines, Japan and the USA[66]. Furthermore, an interview with a new private company, VerifiGlobal, was undertaken. This interview was conducted due to the interesting business model that VerifiGlobal was pursuing, and the manner in which VerifiGlobal is seeking to work with a number of VBs in the EU ETV scheme, including ETA Denmark.

3.2.3.4 Public consultation

A public consultation was organised by DG ENV to gather information and opinions from a spectrum of stakeholders, including the general public, on the effectiveness and added value of the EU ETV pilot programme since its launch. The survey was hosted on the Commission's public consultation website. The public consultation was launched on 31 July 2017 and remained open for 20 weeks, before being closed on 20 November 2017[67]. A stand-alone write-up of the public consultation responses can be found online.

3.2.4 Stakeholder meeting

Two meetings were organised during the evaluation study. Details of these two meetings are set out below.

[66] Funding for the US ETV had stopped by the time of the survey, and staff had either retired or moved to new positions. Consequently, it proved too difficult to obtain any response.

[67] Please see Chapter 4.1.4.1 below for further details.

- On 28 September 2017, the study team organised a meeting in Brussels with relevant EU ETV stakeholders to: (i) raise awareness of the evaluation and the supporting study, including the public consultation; and (ii) obtain feedback on the EU ETV approach and lessons learnt to date. Around 30 stakeholders participated in total. The agenda, minutes and presentations of the meeting have been published on DG ENV's website.

- On 15 February 2018, the 4th stakeholder forum was held in Brussels to present the final results of the supporting study for the evaluation of the EU ETV pilot programme being carried out by the study team. A secondary objective of the forum was to present four specific feasibility studies that had been developed as part of the study to inform the Commission's work in drawing up future policy options for: (i) a possible follow-up to the pilot programme and/or (ii) other initiatives or policy tools for supporting EU environmental and innovation policies. The agenda and minutes of the meeting were published on DG ENV's website. Presentations from the meeting are also available here.

4 THE RESULTS OF STAKEHOLDER CONSULTATIONS

The first section of this chapter: (i) analyses the results from three main stakeholder groups; (ii) highlights the key concerns raised about the EU ETV pilot programme; and (iii) highlights the areas where the programme could be further improved. Where there is a degree of consistency among the views of stakeholders, and on issues of particular concern to certain groups, these have also been noted. The second section covers horizontal issues addressed mainly through the semi-structured interviews with VBs, independent experts and technology developers.

4.1 Analysis of results per stakeholder group

4.1.1 Technology proposers

The online survey and interviews were designed to: (i) capture important insights into how companies found their experience with the pilot programme; and (ii) explore potential and actual benefits to companies of taking part.

Important insights were obtained about the current needs and motivations of technology proposers that made enquiries about the pilot programme. These insights are set out below in the following seven bullet points.

- In decreasing order of importance, the main reasons for companies to inquire about EU ETV are: product differentiation, to promote market acceptance, to improve their reputation and to facilitate market entry into other EU Member States.

- The length of the verification process varies widely between technology developers taking part in the EU ETV pilot, from three months to over three years, with most appearing to take from 6-12 months.

- The total cost of a verification ranges from €25,000 to €210,000. For six companies which have completed the verification and received their SoV, the average verification fee was €14,583, with additional testing costs to satisfy the demands of EU ETV ranging from €2,500 to €40,000. Internal company labour costs also add an additional burden on companies. The total headline costs to firms undertaking an EU ETV is on average close to €80,000.

- There is a small amount of evidence of increased sales following the verification. This evidence is set out in the sub-bullet points below.

  - Out of the 11 technology proposers who participated in the survey, 7 recorded new sales after the verification, but only 5 of the 11 reported the SoV was either a contributing (N=4) or decisive (N=1) factor for sales.

  - Interviews also provided some evidence for the attribution of sales (or expected sales) to the SoV.

  - Insights into the forecast sales of technology proposers show that the median sales estimate in the first year is €1 million for companies with a verified product (N=5), versus a median sales estimate in the first year of €500,000 for companies still engaged in the verification process (N=10).

- On the added value of EU ETV, 9 out of 11 surveyed technology proposers have acknowledged that EU ETV verification facilitates access to non-EU markets. The ability of companies to differentiate their product from competitors was recognised as one of the key benefits of EU ETV. Finally, enhanced company reputation and credibility have also been stressed by technology proposers (N=9 of 11), even though this is not a benefit that was clearly evident and substantiated during interviews with firms.

- Despite the reported benefits of having a verified technology, practical examples of companies that successfully attracted new customers as a result of having their technology verified are still scarce. While the SoV serves first and foremost as a form of certification to demonstrate environmental performance claims and not as a promotional tool, it has triggered the interest of end users on various occasions. According to the technology proposers' survey, 3 out of 11 companies with a fully verified technology have been contacted by an end user who has seen their SoV on the ETV website.

- In general, it appears that EU ETV is not enabling greater access to finance, according to independent experts (no surveyed expert highlighted EU ETV as a key benefit) and technology proposers (only 2 of 11 regard it as an important benefit). One company reported that the SoV had increased its chances of getting grant funding from Horizon 2020 and financial investors through EU ETV. This company said that most financial institutions are not aware of the EU ETV pilot programme, but that they appeared to show interest when they hear about it. However, simply engaging in EU ETV is often not enough to unlock funding.

4.1.2 VBs

The online survey and interviews were designed to capture important insights into how VBs found their experience with the pilot programme and to explore areas where the programme could be further improved.

- Overall, the various frameworks and tools developed to support the EU ETV verification process, including the use of experts and the delivery of verification services by VBs, were assessed as having 'worked well' or 'worked quite well' according to VBs. VBs also stressed the importance of TWG meetings as an arena for discussing problems and sharing insights with other VBs and independent experts. While the vast majority of VBs also said that the current approach to setting parameters to cover performance claims was workable, two thirds of VBs (N=10) said that the current approach would benefit from changes.

- On the number of enquiries from technology proposers, the EU ETV 'pipeline' of potential verifications that might be undertaken was below expectations for 73% of VBs surveyed.

- According to the survey, VBs' marketing activities were the most effective tool for promoting EU ETV[68]. In joint second place for effectiveness were environmental trade fairs (i.e. those attended by VBs, which differ from the environmental trade fairs promoted by DG ENV) and the EU ETV website. The remaining DG ENV marketing activities (e.g. a dedicated EU ETV newsletter and stakeholder fora), were not deemed effective by most survey respondents. Member State governments/agencies were regarded as playing an important role in a number of cases.

- According to two thirds of VBs (N=11), the EU ETV programme developed the international recognition of EU ETV to a 'certain extent'[69].

- Survey results indicated that the average verification fees charged by VBs are €14,500, and vary between €6,850 and €28,000. The figures reported by VBs appear to be very similar to those reported by technology proposers. When asked about the main factors that drive up the verification costs incurred by companies, VBs interviewed mainly referred to staff expenses. Staff expenses are themselves driven by complexity and parameters verified; testing costs; expert costs and document writing; and the successive reviews of documents.

- According to survey results, average set-up costs for VBs were € 82,300. Interviewed VBs said that these costs included not only the fees to become accredited to ISO 17020, but also: (i) all internal costs (e.g. staff expenses, administration costs) to conduct the audit and align internal procedures to the GVP requirements; and (ii) external costs (e.g. costs derived by sourcing the required expertise). At least four interviewed VBs said that the accreditation fees accounted for most of the set-up cost. For VBs, paying the accreditation costs was

[68] Overall, the budget dedicated to promotional activities represented 25% of the grant funding received by VBs from the European Commission.

[69] No precise definition of 'international recognition' was provided in the survey. This notion was therefore subject to interpretation by each respondent.

a pre-condition for accessing EU grant funding. This explains why all except one VB were able to cover between 65% and 80% of the costs to establish themselves as a VB within the EU ETV pilot programme. When including accreditation costs in the overall set-up costs, 5 out of 12 VBs[70] were able to cover more 50% of the set-up costs. For 3 other VBs, such funding covered between 20% and 40%. For 2 VBs in Poland, who had not benefited from CIP[71] grant funding, the only set-up support received was from their national government[72]. Governments in France, Poland and the UK provided support to help with VB set-up costs. This financial support covered between 30% and 100% of total costs, ranging from €30,000 to €100,000.

- The annual operational costs linked to EU ETV, as reported by surveyed VBs, varied widely, from €2,000 to €222,000. However, the median[73] falls close to €70,000. This means that for a median[74] VB, the total operational cost through the life of the programme (i.e. 3-4 years) was approximately €250,000.

- Under the programme, revenues from VBs came from the fees charged under the quickscan process and under the actual verification (comprising the development of the verification protocol and the undertaking of the verification).

- Considering the fees charged by VBs, a comparison between the operational costs and the estimated revenue from verifications seems to indicate that EU ETV is not yet a highly profitable business for VBs. Considering that: (i) the median[75] amount of verifications undertaken by each VB during the whole programme was two, and that (ii) the median[76] verification fee was approximately €11,000[77]; then it becomes apparent that the revenues from verification fees are not sufficient to cover the operational costs of VBs.

- Interviews with VBs stressed that the programme is not financially self-sustaining. One VB affirmed that without its grant funding, it would not have been viable to deliver the verifications.

- Despite the apparently poor return on investment and low profitability resulting from levels of verification activity that have been below VB's expectations, most VBs said it was quite or very likely that they would continue to offer verification services under EU ETV. Expected cost and revenue figures provided by seven surveyed VBs help illustrate their sense of optimism with estimated expected returns on costs varying from 14% to 500%. This may be explained by VBs anticipating an increase in the uptake of EU ETV in future, and/or by the

[70] Only 12 out of 15 VBs reported their set-up costs.

[71] EU Competitiveness & Innovation Programme (2007-2013).

[72] Data was not provided for the remaining VBs.

[73] Median has been used in lieu of average due to the presence of outliers.

[74] Median has been used in lieu of average due to the presence of outliers.

[75] Median has been used in lieu of average due to the presence of outliers.

[76] Median has been used in lieu of average due to the presence of outliers.

[77] This figure is according to VBs.

synergies created with other VBs activities, if the knowledge and network created by ETV can benefit to other services provided by the VBs.

- Out of 13 VBs surveyed, 10 suggested that the GVP and ISO 14034 should be combined.

4.1.3 Independent experts

The online survey and interviews were designed to capture important insights from independent experts on: (i) the relevance and added value of the programme; and (ii) how they found their experience with the programme.

- Nearly all independent experts interviewed believe there is still a strong need for third-party verification of the performance of environmental technologies across all sectors (only two experts felt it was relevant only to particular environmental sectors) and that it is an appropriate mechanism for supporting SMEs.

- Overall, the various frameworks and tools developed to support the EU ETV verification process, including the use of experts and the delivery of verification services by VBs, are assessed as having 'worked well' or 'worked quite well' according to independent experts. While the vast majority of independent experts also said that the current approach to setting parameters to cover performance claims was workable, almost two thirds of VBs (N=9) said that the current approach would benefit from changes. Eight VBs also said that the current approach on life-cycle aspects of technologies is 'workable but would benefit from modifications' while two highlighted that 'the approach is unworkable and needs to be reassessed'. Independent experts in general agreed that the verification steps are usually considered complex. However, clear suggestions and practical solutions, as well as examples of ETV schemes which are closer to striking a good balance between simplicity and robustness, were lacking in the study consultations.

- There is a divide among experts as to whether the EU ETV pilot programme was effectively promoted. Of those arguing that it had been, six (a third of all respondents) believed that EU ETV-specific channels (such as its website and newsletters) were the most effective way to promote the programme. However, more than half of surveyed independent experts believed that the promotion of verified technologies among end users has 'not really worked', or 'not worked at all'.

- Independent expert opinion was also divided when it comes to EU ETV's international reputation. Among the opportunities for improving international recognition, experts cited several potential mechanisms: greater clarity of test protocols; obtaining greater support from national ministries and agencies; and distributing a regular newsletter to external audiences. Other suggestions included 'more communication' and 'more promotion of the system'.

- Out of 16 independent experts, 7 said that the ability of companies to differentiate their product from competitors was one of the key benefits of EU ETV. More than 80% of independent experts indicated that verification of technology performance either plays a key role or may have a role to play in facilitating the acceptance and transfer of technologies into international markets.

- The EU ETV pipeline of potential verifications was below expectations for 75% of independent experts surveyed.

4.1.4 Other consultation activities conducted

Research was conducted in three additional areas through the open public consultation (OPC), non-ETV schemes and counterfactual analysis. Together, the results of these consultations form a substantive body of evidence to: (i) corroborate and triangulate the results of the main EU ETV consultation (as highlighted in the previous sections); and (ii) assess the programme's performance overall.

4.1.4.1 Open public consultation

The OPC results involved key constituencies of the pilot programme. In total, 53 stakeholders responded to the OPC, among which were 12 technology purchasers. This helped offset the perceived lack of end-user feedback in the evaluation. A majority of respondents were actively involved in the EU ETV pilot when responding to the OPC.

The OPC results have confirmed some of the main findings of the evaluation. These OPC results are set out in the bullet points below.

- Around two thirds of respondents recognised that independent third-party verification is the only way to demonstrate the reliability of claims made by technology developers. Of technology developers, 43% said they were considering undertaking a verification as part of their commercialisation plans. And 8 out of 12 potential end users of environmental technologies argued they would 'definitely consider a product with an EU ETV SoV more favourably' than a product without an EU ETV SoV.

- Stakeholders considered that the establishment of VBs, the development of a methodological framework, and the issuance of guidance documents had all been successfully achieved by the pilot programme.

- Overall, stakeholders felt limited efforts had been made to promote the pilot programme to interested parties.

- The cost of the verification process, the lack of recognition of the pilot programme, and the uncertainty about the potential benefits of engaging in EU ETV were perceived as the main drawbacks by stakeholders. Other drawbacks raised by stakeholders included the amount of time needed to establish the EU ETV infrastructure, the amount of bureaucracy involved, the length of time taken by the verification process, and the cost of the process (a particular barrier for SMEs).

- While the vast majority of respondents felt EU ETV had prioritised the right technology, 41% indicated that the pilot programme could be expanded beyond the current three technology areas (TAs) – namely: (i) energy technologies; (ii) materials, waste & resources; and (iii) water treatment & monitoring to include additional TAs. The proposed additional TAs were: (i) environmental technologies in agriculture; (ii) air pollution monitoring and abatement; (iii) cleaner production and processes; and (iv) soil and groundwater monitoring, and soil and groundwater remediation technologies. However, there was no strong

consensus on what TAs should be added, and all four suggested TA options were popular among stakeholders.

4.1.5 Non-EU ETV schemes

Consultations with representatives from non-EU ETV schemes were important benchmarks to assess the achievements of the EU ETV pilot programme.

The analysis of non-EU ETV schemes revealed a number of interesting lessons, which are outlined in the bullet points below.

- Drawing comparisons between EU ETV and non-EU ETV schemes in terms of timescale and number of verifications, indicate that the EU ETV system has clearly yielded some success. For example, non-EU ETV schemes do not produce many verifications per year, typically less than 10. The two exceptions to this are Japan (averaging 42 per year and reaching a peak of 88 in 2008 before declining to 18 in 2015), and the US ETV scheme in its heyday (which reached 64 verifications in 2004, falling to 7 in 2014 when the scheme was closed down because of funding cuts).

- Most schemes cover the full range of environmental technologies (i.e. the seven TAs mentioned above). The exceptions are VERA (solely focused on environmental technologies in agriculture) and the Philippines (where there is an emphasis on clean production, water technologies and monitoring devices).

- Costs are mostly met by applicant companies, although a few countries provide some subsidies to offset these costs (such as France, where 70% of verification costs are met by government). In the USA, during the five-year pilot phase, costs shifted from government-funded to private-sector funding.

Furthermore, it was found that verification fees reported by five non-EU ETV schemes vary from €200 (lowest fee experienced) to €75,000 (highest fee experienced). However, more 'typical' (average) verification fees reported by four schemes range from €8,000 to €27,000. In general, the fees from the non-EU ETV schemes are lower than or equal to those reported by technology proposers under EU ETV.

4.1.6 Counterfactual analysis

The size and maturity of the eco-innovation markets (and associated suppliers), across the seven Member States targeted for this discrete research task were very diverse. Knowledge of EU ETV, and importantly its exact purpose, also varied widely among the (mostly public) stakeholders interviewed.

We assessed the nature of the support provided to SMEs, including help for eco-innovative suppliers to commercialise and deploy their innovations. This assessment showed that there were very different opinions among suppliers about the extent of latent demand for EU ETV. There were also very different opinions among suppliers about how best to take advantage of latent demand within each Member State. It is telling that in countries that are well-known for market-leading eco-innovations and that have established support channels for innovators, such as Germany and Sweden, there was no real perceived need for the ETV according to stakeholders interviewed. In the Netherlands, there was also scepticism among stakeholders about the potential demand for ETV from companies.

In some countries, based on the size of the supplier base, there may well be sufficient domestic demand to justify establishing a VB infrastructure. In other countries, the supply side was considered too small. Conversely, geographical barriers (e.g. distance to test centres or the difficulty of moving potentially large/unwieldy technologies across the EU), as well as language and cultural challenges, suggest that it would be advantageous to ensure a minimum distribution of VBs to ensure sufficient coverage across all the EU-28 countries.

4.2 Horizontal issues

4.2.1 Awareness and promotion

Most stakeholders reported that marketing efforts have not been effective enough in promoting the pilot programme. This was demonstrated by the low number of enquiries received as a direct result of the marketing efforts that were deployed.

Overall, consulted stakeholders agreed that there was a lack of end user understanding and awareness of EU ETV. This significantly diminishes the potential market for the ETV process. As already indicated, almost three quarters of surveyed VBs (and over half of surveyed independent experts) believed that the promotion of verified technologies among end users had 'not really worked', or 'not worked at all'. Only around a third of surveyed VBs have received enquiries from end users interested in how they could benefit from EU ETV, and only 2[78] out of 15 enquiries received were from end users interested in actual verifications which had been generated.

Overall, it was recognised that the EU should play a greater role in engaging technology proposers and end users with EU ETV.

4.2.2 Drawbacks and costs

The total overall cost to firms of undertaking an EU ETV is on average more than €80,000, with companies' internal costs accounting for more than half of total costs. This is considered as particularly expensive for the smaller technology proposers at which the ETV is aimed. However, most of the verified companies and companies still engaged in the process reported that they received grant funding to cover part of both the verification and testing fees (verified companies received grants covering 72% of these fees on average).

The main factors that drive up the verification costs incurred by companies include staff expenses (which are themselves driven by complexity and parameters verified); testing costs; expert costs; document writing; and successive review of documents.

EU verification costs are equal to — or somewhat lower than — verification costs in the five surveyed non-EU ETV schemes.

The verifications undertaken under the pilot programme are not yet a profitable business for VBs. Revenues from verification fees did not seem sufficient to meet VBs' operational costs, let alone their set-up costs.

Therefore, Member State support for verifications is still seen as necessary to allow VBs to deliver verifications at a cost that technology proposers can afford.

[78] Both in Eastern Europe: Poland and Czech Republic.

A greater pipeline of potential innovative technologies requiring verification would be needed to allow VBs to become more proficient at conducting verifications. Expanding the TA coverage of EU ETV would be necessary to increase the number of applicants.

4.2.3 Benefits

Participation in EU ETV has been shown to increase sales of verified environmental technologies. While most companies have attributed their increased sales to the verification, others find it hard to establish whether the increased sales are solely down to the merits of having a verification.

Overall, it was recognised that the pilot programme generates a set of wider 'soft' benefits, such as greater access to international markets and better product differentiation, which stakeholders expect will ultimately lead to increased sales.

Although costs were regarded as high, forecast sales figures indicate that the expected payback from undertaking an EU ETV verification could occur in a short time frame (i.e. within two months according to companies with a verified technology, and within six months according to those still engaged in the EU ETV process).

Whether verification is helping to overcome regulatory barriers is unclear. Some technology developers still face restrictions from public authorities who are not confident that the EU ETV-verified technology meets their national regulations. This suggests that the involvement of competent national and local authorities in the early stages of the verification may be beneficial in certain cases.

4.2.4 Programme infrastructure and process

Although the process of setting up the EU ETV pilot programme — establishing the VB infrastructure and developing the GVP — has been long and complex, the current scheme provides a good basis to deliver reliable and credible environmental technology verifications.

Overall, the various frameworks and tools (e.g. TWGs, supporting documents) developed to support the verification process have been working well or quite well. However, there are contrasting opinions on the workability of the current approach on life-cycle aspects of technologies.

The complexity (e.g. setting of parameters, life-cycle approach) of the verification process was also raised by a number of parties involved, but concrete proposals for how to simplify the process without compromising its robustness are lacking.

5 CONCLUSIONS

Stakeholders highlighted that the programme has generated a range of 'soft' benefits, such as greater access to international markets and better product differentiation. Although the consultations drew on a small sample of responses, they showed that technology developers had achieved increased sales following the delivery of an EU ETV SoV. However, the link between sales growth and the SoV is often difficult to establish.

Most stakeholders considered that the EU ETV pilot programme was successful in establishing a strong verification infrastructure backed by appropriate methodological frameworks and tools.

However, stakeholders have also called for changes to the verification process to address its complexity and the length of time it takes (e.g. setting of parameters, life-cycle approach). But stakeholders have not provided concrete proposals for how to simplify the process without compromising its robustness.

Survey respondents also emphasised that there were two areas where more work was needed: the promotion of verified technologies to potential technology users and measures to increase the credibility of ETV.

These consultations were conducted as part of the support study to the EU ETV pilot programme evaluation, which was commissioned by the Directorate-General for Environment and carried out from May 2017 to March 2018.

The responses to the consultations provide the European Commission with comprehensive evidence to help determine whether the EU ETV pilot programme has achieved its desired outcomes after more than 3 years of operation.

ANNEX 3: LIST OF MAIN OUTPUTS

EU ETV DOCUMENTS AND PUBLICATIONS			
Document title	Date of publication	Hyperlink (ETV website)	Description of content
Commission Staff Working Paper on the ETV initiative	15.12.2011	Link	The CSWP describes the objectives and the operational principles of the ETV Pilot Programme, within the frame of the Eco-Innovation Action Plan.
General Verification Protocol			
General Verification Protocol v. 1.3	01.04.2018	Link	The ETV General Verification Protocol (GVP) is the technical reference document describing the procedures guiding the verification process and the requirements for the organisations taking part in it.
General Verification Protocol v. 1.2	27.07.2016	Link	
General Verification Protocol v. 1.1	07.07.2014	-	
General Verification Protocol v. 1.0	15.12.2011	-	
Guidance and Reference Documents			
TWG Guidance Document 001	31.05.2013	Link	On confidentiality and no conflict of interest issues within the ETV scheme
TWG Guidance Document 002	15.10.2013	Link	On the workflow between the Verification Bodies, the Commission Services and the Technical Working Groups
TWG Guidance Document 003	23.04.2014	Link	On the clarification of the eligibility criteria and assessment
TWG Guidance Document 004	26.01.2016	Link	On assessing the environmental added value of an environmental technology in a life-cycle perspective at the proposal stage
TWG Guidance Document 005	07.06.2016	Link	On the Acceptance of Existing Test Data
TWG Guidance Document 006	08.04.2015	Link	On the use of the ETV logo and post-verification requirements when marketing a technology verified through the ETV scheme
TWG Guidance Document 008	08.04.2015	Link	On addressing the interfaces between Technology Areas in the context of the EU-ETV Pilot Program
TWG Guidance Document 009	06.06.2016	Link	On Auditing Test Bodies
TWG Reference document 001	07.06.2016	Link	Clarification on the meaning of 'verification' under ETV and differences from certification
Newsletter			
Newsletter Issue Number 10	11.2018	Link	ETV Public consultation – final call for contributions
Newsletter Issue Number 09	01.2017	Link	EU ETV Pilot Programme: three years of supporting innovation
Newsletter Issue Number 08	10.2016	Link	ETV: accelerator of SME market penetration
Newsletter Issue Number 07	07.2016	Link	ETV: Strengthening the water economy in the EU
Newsletter Issue Number 06	04.2016	Link	ETV: verified technologies for a more circular economy
Newsletter Issue Number 05	05.2015	Link	ETV: The Finns and the Italians betting on ETV: meet one Verification Body from each country
Newsletter Issue Number 04	01.2015	Link	ETV: ETV is active in the UK and in Poland: meet two of the ETV Verification Bodies
Newsletter Issue Number 03	09.2014	Link	ETV: Getting to know the Verification Bodies: CERTIQUALITY bringing ETV to Italy
Newsletter Issue Number 02	04.2014	Link	ETV: Strong ETV presence in France and the UK: meet 2 of the Verification Bodies
Newsletter Issue Number 01	09.2013	Link	ETV: A peek at two of the first Accredited Verification Bodies for European ETV
Videos on ETV			
ETV: clear and simple	02.09.2014	Link	What is ETV all about? Video prepared by the ETA-Danmark and DANETV.
Animated ETV	09.09.2014	Link	The Verification Body NPL explains what the EU-ETV Programme is all about.
Examples of ETV verifications from DANETV	29.10.2014	Link	DANETV has produced a short video showing how ETV has been helping some Danish companies.
Examples of ETV verifications from BRE	04.10.2017	Link	BRE Global is a UK verification body active in particular on buildings and constructions products. The video describes shortyly the verification process for PVStop.

Alberto Pozzi - Pozzi Leopoldo SRL	16.10.2015	Link	Pozzi Leopoldo SRL provides an engineering service to the textile machinery industry. In this video, Mr Pozzi explains the importance of ETV to their work.

Publications			
Flyer	01.2014	Link	Languages available: CS - DA - DE - ES - FI - FR - HU - IT - NL - PL - SV
Brochure	09.2014	Link	Languages available: CS - DA - DE - ES - FI - FR - IT - NL - PL - SK - SV
Guide for Proposers	01.2014	Link	Languages available: CS - DA - DE - ES - FI - FR - IT - NL - PL - SK - SV
ETV Flyer - International Working Group on Environmental Technology Verification	10.2015	Link	Verified once, accepted everywhere International Working Group on Environmental Technology Verification

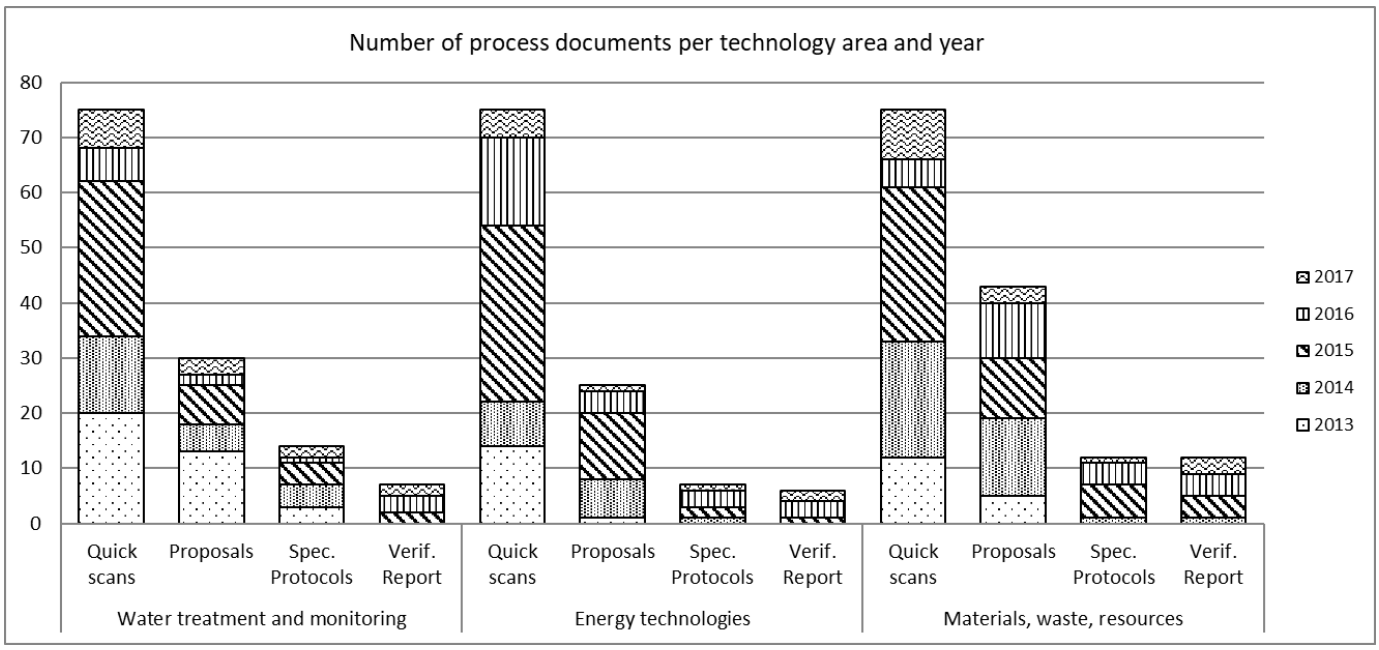
VERIFIED TECHNOLOGIES 2013-2017

Registration Number	Title	Manufacturer	Country	Verification body	Issued
Energy Technologies					
VN20170029	Energetic System Li-Mithra	Li-Mithra Engineering	France	French National Laboratory for Metrology and Testing (LNE)	18-12-2017
VN20170028	SmartCIM system	Cav. Uff. Giacomo Cimberio Spa	Italy	Certiquality	16-12-2017
VN20170024	PVStop	Solar Developments Pty Ltd	Australia	BRE Global	01-08-2017
VN20160018	Mixergy tank	Mixergy Limited	UK	National Physical Laboratory (NPL)	16-12-2016
VN20160009	AgriLamp™ Induction System	Greengage Lighting Ltd	United Kingdom	National Physical Laboratory (NPL)	21-01-2016
VN20150008	COGEN'AIR	Base sarl	France	French National Laboratory for Metrology and Testing (LNE)	20-01-2016
Materials, Waste & Resources					
VN20170025	Re-Match Artificial Turf Recycling	Re-Match	Denmark	ETA Danmark A/S	26-09-2017
VN20170022	PolyFibra® PF-PEF-04	FuturaMat	France	RESCOLL	24-03-2017
VN20170021	BioFibra® BF-LED-10	FuturaMat	France	RESCOLL	24-03-2017
VN20170019	AU-LXX-06	FuturaMat	France	RESCOLL	24-03-2017
VN20170020	BioMine® BM-LMI-03	FuturaMat	France	RESCOLL	24-03-2017
VN20160013	BioFibra® BF-LHE-01	FuturaMat	France	RESCOLL	08-09-2016
VN20160014	EWA Fermenter	AGRO-EKO Ltd.	Czech Republic	The Czech Environment Management Center (CEMC)	15-04-2016
VN20160012	GW Dryer	G3 Enterprises - Verification proposed by the Institute for Agricultural and Fischeries Research (ILVO)	United States	RINA Services	16-03-2016
VN20160011	ECOGI	Komtec Miljo af 2012 A/S	Denmark	ETA-Danmark	01-02-2016
VN2015006	PURROT	PurFil Aps	Denmark	ETA-Danmark	23-11-2015
VN20150005	Bio-Com System	SELMA sp. z o.o. sp.k	Poland	Institute of Technology and Life Sciences (ITP)	07-09-2015
VN20150004	Aerobic Biodegradation of Mater-Bi AF03A0 and Mater-Bi AF05S0 under marine condition	NOVAMONT Spa	Italy	Certiquality	09-08-2015
VN20150003	New substrate technology concept	J.S. Trading	Denmark	ETA-Danmark	08-05-2015
VN20140001	BIOMASSER® briquetting machines	ASKET Roman Długi	Poland	Institute of Technology and Life Sciences (ITP)	12-11-2014

Water Treatment & Monitoring					
VN20170023	UV Disinfection system MR4-350 SS ACN	UltraAqua A/S	Denmark	ETA Danmark A/S	11-08-2017
VN20160017	AQUATRACK	AQUA-Q AB	Sweden	EUROFINS EXPERT SERVICES OY	20-12-2016
VN20160016	BioKube Summerhouses Wastewater System	Biokube A/S	Denmark	ETA-Danmark	14-12-2016
VN20160015	Wetnet	Ingegnerie Toscane srl	Italy	RINA Services	08-08-2016
VN20160010	BacTerminator® Dental	Adept Water Technologies	Denmark	ETA-Danmark	21-01-2016
VN2015007	VRT – Vacuum Rain Tank	Pozzoli Depurazione srl	Italy	RINA Services	30-11-2015
VN20150002	Mosbaek CEV flow regulator	Mosbaek A/S	Denmark	ETA-Danmark	07-05-2015

SUMMARY TABLES OF PROCESS DOCUMENTS BY YEAR AND BY SIZE OF ENTERPRISE

Number of process documents by technology area and by year							
		2013	2014	2015	2016	2017	Total
Water treatment and monitoring	Quickscans	20	14	28	6	7	75
	Proposals	13	5	7	2	3	30
	Spec. Protocols	3	4	4	1	2	14
	Verification report	0	0	2	3	2	7
Energy technologies	Quickscans	14	8	32	16	5	75
	Proposals	1	7	12	4	1	25
	Spec. Protocols	0	1	2	3	1	7
	Verification report	0	0	1	3	2	6
Materials, waste, resources	Quickscans	12	21	28	5	9	75
	Proposals	5	14	11	10	3	43
	Spec. Protocols	0	1	6	4	1	12
	Verification report	0	1	4	4	3	12



Breakdown of quickscans by size of enterprise and by year					
	2013	2014	2015	2016	2017
Micro enterprises	31	17	51	16	13
Small enterprises	10	16	21	6	6
Medium-sized enterprises	2	6	2	4	1
Total SMEs	43	39	74	25	20
Other enterprises	3	4	14	2	1