Project supported by the European Commission
through the „Intelligent Energy-Europe“ Programme

A European Tracking System for Electricity (E-TRACK)

http://www.e-track-project.org

Consultation document for the Advisory Group and the third round of consultation workshops

Version 1.0, 16. November 2006

Christof Timpe, Herbert Ritter, Chris Pooley, Dominik Seebach, Diane Lescot, Mike Sandford

Contents

1 Background and general approach 3

2 Features of a proposed European tracking standard 3

2.1 Tracking standard vs. tracking systems 3
2.2 Key lessons from the discussion of tracking options 4
2.3 Non-technical features of the standard 5
2.3.1 Domains 5
2.3.2 Schemes 5
2.3.3 Quality standards 7
2.3.4 Registry 7
2.3.5 Residual Mix calculation 7
2.3.6 Governance of the standard 10
2.3.7 Independency of actors 10
2.3.8 Reporting 11
2.4 Technical features of the standard 11
2.4.1 Evidence to be Tracked 12
2.4.2 Evidence within a Registry 12
2.4.3 Sources and Availability of Data 12
2.4.4 Data Collection Requirements 13
2.4.5 Registry Infrastructure 14
2.4.6 Management of Registry Data 14
2.4.7 User Requirements 14
2.4.8 Transfer of Data 14
2.4.9 Using Tracked Evidence: Compliance Procedures 15
2.4.10 Treatment of Electricity System Support Activities 16
2.4.11 Governance 16
2.4.12 Users and Providers of a Tracking System 16

3 Assessment of the cost of tracking systems 17

3.1 System borders for the cost assessment 17
3.2 Gathering of cost information 17
3.3 Costs drivers 18
3.4 Costs of existing electricity tracking systems or comparable systems 18
3.5 Implementation structure and scenarios for cost assessment 20
3.6 Assumptions and calculation procedure 21
3.7 Results of the cost assessment 23
3.8 Benefits of using the tracking standard 26
3.9 Distribution of costs 27

Annex 28

A1 Evaluation criteria for tracking options 29

A2 Discussion of selected alternative tracking options 29

A2.1 The Scenario Approach 30
A2.2 Option 0: “Contract based system” 31
A2.3 Option A: "Ex post contract tracking" 32
A2.4 Option B: “Voluntary certificate system plus residual mix” 33
A2.5 Option C: "Ambitious certificate system" 35
A2.6 Indicative illustration of the evaluation 36
A2.7 Detailed scenario matrices for the tracking options 37

1 Background and general approach

The objective of the project "A European Tracking System for Electricity (E-TRACK)" is to draft a harmonised standard for tracking of electricity generation attributes in Europe. Such a standard will help to increase market transparency and support the implementation of electricity disclosure as well as other energy policies. At the same time it will reduce transaction cost and the risk of multiple counting of electricity generation attributes.

This Consultation Document is directed at stakeholders which have already a good understanding of the issues at stake.[1] It summarises the current status of work in the project in a condensed manner and outlines a draft recommendation for a European standard for tracking of electricity. The document will be discussed in a series of Consultation workshops across Europe and in the project's Advisory Group. Based on feedback from stakeholders, the project will finalise its recommendations, which will be published before summer 2007.

The main part of this document consists of an outline of the non-technical and technical features of a proposed European tracking standard and of an assessment of the cost of tracking systems. In the Annex, a description of evaluation criteria for tracking options and descriptions and evaluations of four generic tracking options can be found.

Whereas the main part contains new results from the project, the Annex represents revised versions of contents which have been discussed during the second round of consultations, and which have been used in preparing the main part of this document. In addition to the Annex, a working draft of the report on Work Package 4 (technical specifications) is attached to this paper.

2 Features of a proposed European tracking standard

2.1 Tracking standard vs. tracking systems

Whereas the second round of consultations has discussed certain designs of tracking systems, which could be implemented in a country or region, the final recommendation which is developed in the E-TRACK project will not focus on a uniform implementation. In response to the existing variations in policies and tracking systems already in place, the project is developing a standard for tracking electricity in Europe, which will be able to accommodate a variety of individual tracking systems. The standard is defining minimum requirements which ensure a common quality standard, but which at the same time leave a certain degree of flexibility in the design of individual (national) systems.

The intention behind this standard is to develop a joint European tracking system based on the subsidiarity principle: On the European level, only those rules are defined which are necessary for a smooth operation of the joint system. Details of the implementations in individual countries or regions in Europe are left to the responsible actors. As long as the tracking systems developed by these actors comply with the standard, they will deliver a reliable and cost-efficient service to the electricity industry, consumers, governments and regulators. Existing tracking systems, which do not comply

[1] An introduction to these issues can be found in the first two background information documents from the E-TRACK project, which are available on the project website (http://www.e-track-project.org/documents.php), and in the presentations from previous consultation workshops (http://www.e-track-project.org/events.php#workshops).

with the standard, could be developed further to meet the standards in the future. It must be emphasised that the use of any tracking systems outside of the standard could lead to multiple counting.

In the following, the proposed non-technical and technical features of the standard are outlined on a high level. More details will be provided in the Work Package reports, which will be finalised after the third round of consultations. The border line between the technical and the non-technical features of the standard are not always clear to draw, and due to this overlap some redundancies might exist.

It must be noted that although we use the term “standard”, it is not clear whether the E-TRACK standard should be converted into a formal standard following the rules of international standardisation organisations like CEN and Cenelec. This question will be clarified after the third round of consultations.

2.2 Key lessons from the discussion of tracking options

Annex A2 contains a condensed discussion of different tracking options, which could be implemented in a country or region. These options were one of the subjects of the second round of E-TRACK consultations with stakeholders, and have been revised based on the results from the consultations.

In the light of the discussions in the project team and with stakeholders, the following key features of future tracking systems have been identified (see the evaluations of tracking options in Annex A2 for more details):

- It is not necessary to make a general decision regarding contract tracking vs. de-linked tracking (based on certificates). Both types of tracking can be combined, as long as the proper accounting of attributes is ensured.
- Any tracking system should feature at least two alternative options for tracking, explicit and implicit tracking. The share of implicit tracking should be minimised as far as possible, because it does not support differentiation in the market with regard to attributes.
- Explicit tracking should be based on registries, which allow the ownership of attributes to be tracked and which support transfers of ownership both within a registry and to other registries. Guarantees of Origin for RES-E and CHP should be integrated into the explicit tracking mechanism.
- Inter-registry transfers as well as provision of joint information for all registries should be provided by a centralised hub (as opposed to a peer-to peer-system with dispersed information).
- Implicit tracking should feature a Residual Mix, which corrects the generation statistics in a certain region by the attributes, which are allocated based on explicit tracking, and by exports and imports of electricity and attributes.

This list forms the basis for the proposed description of the tracking standard, which is developed in the two subsequent sections.

2.3 Non-technical features of the standard

2.3.1 Domains

- All tracking activities are organised in domains. A domain consists of a geographical area (e.g. a Member State) and one or several schemes, which make use of tracking results (e.g. disclosure or certain support schemes). A Domain is set up by one or several Scheme Authorities, which govern such schemes. All domains in the E-TRACK standard must be defined clearly.
- All domains provide facilities for explicit and, in case of disclosure, also for implicit tracking of the attributes of electricity generation episodes. Explicit tracking is based on transferable evidence (certificates), which can be issued, transferred and redeemed. Usually the Scheme Authority appoints all relevant actors which run the domain, which is at least an Issuing Body, but could also encompass certain agents for specific tasks.
- One of the major purposes of the tracking standard is to make explicit and implicit transfers between domains possible. E.g. a certificate issued in one domain can be transferred to another domain and can be redeemed there for a certain purpose. It is a principle that redemptions, which are made in order to comply with a certain scheme (e.g. a RES-E support system in a certain country) must take place in a domain which is linked directly to this scheme. Usually this means that the certificate must be transferred to the country in question and must be redeemed there.
- The services of an Issuing Body for a certain Domain, as well as meter reading services, registration of production devices etc., can be offered by single providers for each service. Alternatively, these services can be offered by several providers, which are competing against each other. However, in the case of competing Issuing Bodies, certain regulations are required to ensure that multiple counting of attributes (by the competing service providers) can be avoided. For example, there could be one single registry, which is used by several Issuing Bodies.

2.3.2 Schemes

- A scheme represents a certain policy for which results of tracking can be used (see also the definition in section 2.4). For example, electricity disclosure in a certain country can be facilitated by the redemption of (eligible) tracking certificates, or by the use of a default value.
- There are three “classic” types of schemes:
    - o Disclosure: The origin of electricity for the purposes of disclosure can be proven by results of tracking of a volume of electricity generation which matches the volume of electricity to be disclosed to customers. Any specific claims about electricity sold to final customers (e.g. green power) should be linked to the disclosure scheme and the underlying tracking system.
    - o Support: Systems for financial support of certain technologies for electricity production, e.g. from renewable energy sources (RES) or high-efficient cogeneration (HE-CHP) can be based on “support certificates”. (Note that the use of certificates for tracking purposes does not imply a certain preference in the design of support

schemes. I.e. feed-in support systems can work well with tracking based on certificates.)

- Quantitative targets: European countries have agreed on certain indicative targets for the expansion of the production and consumption of RES-E. So far, it is not fully clear how compliance with these targets will be measured. Certificate systems can help in monitoring production, cross-border trade and consumption of RES-E.

So far, disclosure is the only European scheme which requires tracking of the whole electricity market. Implicit tracking has been introduced in order to reduce the burden of tracking for those parts of the market, where explicit tracking information is not available or is not required (by consumers, legislation or regulators). Consequently, implicit tracking is currently only relevant for disclosure.

It is possible that additional types of schemes become relevant in the future, depending on the further development of the electricity market and related policies.

- The different schemes define the information content of certificates, which are eligible for this scheme. Where possible, all countries should strive to agree on common minimum information standards in order to reduce the barriers for cross-border transfers of certificates. The disclosure scheme defines the information content for implicit tracking.
- In each country participating in the E-TRACK standard, the relation of the tracking system to the different schemes must be stated clearly. This is a prerequisite for functioning markets and reliable tracking systems. For example, the following questions must be answered:
  - If there is a support scheme, how is the supported generation integrated in the disclosure scheme?
  - If there are support certificates, can they also be used for disclosure?
  - What are the conditions under which a certificate qualifies for RES-E GO or for CHP-GO? Under which conditions can the export of a RES-E GO, and a redemption of the GO in the importing country, be credited to the RES-E target of the importing country?
- Market actors who redeem certificates, which qualify for disclosure, must use the attributes from the redeemed certificates for disclosure purposes. (This regulation is necessary to avoid manipulations of the attribute market.)
- If a certificate can carry evidence which is eligible for several schemes, and the related country wishes to separate the ownership and/or the timing of redemption of such evidence, then a so-called “multi-certificate” system can be established, which introduces several transferable certificates based on the same instance of electricity generation, but carrying different associations to the individual schemes (e.g. a disclosure and a support certificate). In this case, the country in question must make sure that the individual certificates are distinguished clearly so that they can not be redeemed for other schemes than they were issued for. Other countries might require the re-bundling of such multi-certificates into a single certificate before accepting their import.

2.3.3 Quality standards

- The E-TRACK standard contains certain quality requirements for registries and the organisations which are providing the tracking system. The most relevant regulations are outlined below and in section 2.4.

2.3.4 Registry

- A registry is an electronic database which allows the recording of relevant attributes of electricity generation. The records in the databases are called certificates and have a certain minimum information content. The registry is able to track ownership of the certificates, and to facilitate transfer of certificates to any other registry within the E-TRACK standard, which supports the scheme(s) for which the certificate is eligible. The registry supports redemption of certificates, which means that the value of the certificate is realised and credited to the current owner, and that the certificate cannot be transferred any more.
- The operation of a registry is a service which can be delivered by the Issuing Body or a separate agent. Usually there is only one registry per domain, even if there are several Issuing Bodies within the domain.
- Registries are linked to a central hub, which facilitates the exchange of certificates and management of joint information for all tracking systems participating in the E-TRACK standard.
- The Guarantees of Origin for RES-E and electricity from HE-CHP, as introduced by the relevant EU Directives, should be integrated into the explicit tracking system for disclosure, i.e. the Guarantees of Origin become specific types of tracking certificates. In addition, GO for RES-E can be used as evidence for cross-border transfers of RES-E under the indicative targets for RES-E. In case that a plant can receive Guarantees of Origin for both RES-E and for HE-CHP (e.g. a biomass cogeneration plant), then it should not be possible to issue two separate Guarantees of Origin for the same instance of electricity, which both are linked to disclosure. Rather there should be only one certificate which represents both types of GO and which qualifies for disclosure purposes.
- Each registry handling certificates which are eligible for disclosure will supply input to a procedure for the calculation of a residual mix, which can be applied to electricity without explicit tracking from its origin (see 2.3.5).

2.3.5 Residual Mix calculation

- As a supplement to the explicit tracking of electricity generation attributes based on certificates, the E-TRACK standard also features the calculation of a Residual Mix as a default value (implicit tracking) for purposes of electricity disclosure. The Residual Mix represents all attributes in a certain domain, or a group of domains, which have not been allocated to final consumption of electricity within a certain accounting period. Usually the Residual Mix is calculated for disclosure in a single country or a group of countries. However, following the further integration of electricity markets in to a single market, the Residual Mix should ultimately be calculated as one mix for all countries participating in the E-TRACK standard.

- Explicit tracking should be used where possible, and implicit tracking based on the Residual Mix should only be used for electricity volumes subject to disclosure, for which no explicit tracking information is available. In these cases, the use of the Residual Mix is binding.
- The Residual Mix not only consists of the set of attributes which are necessary for disclosure. It also represents a certain volume of electricity, which is accounted for as well. In order to avoid double counting, the Residual Mix in any region should only be used for a volume of electricity which is equivalent to the volume of the Residual Mix.
- The accounting period for electricity disclosure is a calendar year. In order to maintain a coherent database, and to avoid multiple counting and loss of information, the validity of certificates for purposes of disclosure must be limited. The schedule could look like this:
    - Within year A, electricity is generated and consumed.
    - No later than X months after the end of year A, all meter data relating to electricity generation in year A must have been processed and certificates must have been issued if so ordered by the generator.
    - No later than (X+Y) months after the end of year A, all transactions with disclosure certificates relating to electricity generation in year A must have been performed (transfers and redemption). After this deadline, all disclosure certificates relating to electricity generation in year A, which are not yet redeemed, are collected without compensation for the current holder. The electricity attributes represented by these certificates will become part of the Residual Mix.
    - After (X+Y+Z) months after the end of year A, the Residual Mix is calculated and published.

    It is only after this point in time that the suppliers of electricity can use the Residual Mix information for purposes of disclosure. In order to meet the requirement of Directive 2003/54/EC that disclosure information should relate to the preceding year, it is suggested that the total of (X+Y+Z) months should be not more than nine months in all E-TRACK Domains.

    Question to stakeholders: What would be the implications of such a time restriction? Are there other options for a timely determination of an accurate Residual Mix?
- The calculation of the Residual Mix requires the cooperation of all Issuing Bodies with a central European body, which is called the European Clearing Body. It is recommended that this body also operates the central hub (see above).
- The calculation of the Residual Mix for a certain geographical region (a Residual Mix Area) is following three steps:
    1. The preliminary internal Residual Mix is calculated as follows:
        - Attributes of all electricity generation in the Residual Mix Area (based on data taken from appropriate statistics)
        - plus all attributes from disclosure certificates which have been imported into the Residual Mix Area,

- minus all attributes from disclosure certificates which have been exported from the Residual Mix Area,
- minus all attributes which have been allocated based on redeemed certificates for disclosure
- minus all attributes which have been allocated based on independent reliable tracking systems (see below for details).

2. The second stage of the Residual Mix also takes into account the balances of imports and exports of physical energy and attributes between the Residual Mix Areas and other European countries. As a simplified approach to this correction, a joint European Residual Mix is calculated for all countries participating in the E-TRACK standard.[2]
   - For this European Residual Mix, each Residual Mix Area firstly determines the volume of total electricity delivered to final consumers and the volumes of attributes available from redeemed certificates for disclosure, other reliable tracking systems and the preliminary internal Residual Mix.
   - All Residual Mix Areas notify the size of their surplus or deficit and the attributes of their preliminary internal Residual Mix to the European Clearing Body. They also notify the European Clearing Body about the balances of imports and exports of electricity and of certificates between their Residual Mix Area and countries which are not participating in the E-TRACK standard.
   - Based on this information, the European Clearing Body determines the attributes and the volume of the European Residual Mix.
3. All those Residual Mix Areas, which have a deficit of attributes compared to electricity delivered, use this European Residual Mix to fill up their preliminary internal Residual Mix to the volume required for full disclosure in their Residual Mix Area. All those Residual Mix Areas, which have a surplus of attributes compared to electricity delivered, use their preliminary internal Residual Mix for disclosure purposes.

- The calculation of the Residual Mix may require the definition of and cooperation with independent reliable tracking systems. These are systems which allocate the attributes of certain electricity generation to final consumers for purposes of disclosure, but which are independent from the certificates handled by the E-TRACK registries. A typical example of such independent reliable tracking systems would be a feed-in support system for RES-E, which allocates the attributes of supported RES-E generation on a pro-rata basis to all those final consumers, which are paying for the cost of the feed-in system.[3] In order not to compromise the reliability of the E-TRACK standard, only such mechanisms should be acknowledged as independent reliable tracking systems, which are actually reliable and prove a high degree of accuracy. Moreover, the coexistence of such systems with explicit tracking under the E-TRACK standard

---

2 A more accurate solution would require separate analysis of all bilateral relationships, which seems to be too complex; and in the case of physical exports and imports, the required data would not be available.

3 The German Erneuerbare Energien-Gesetz (EEG) is a typical example of such a support scheme with clear allocation rules for the attributes of supported generation.

must not lead to multiple counting. Usually, only systems implemented by national legislation will qualify for this status.

Existing private tracking initiatives should ideally be integrated in the E-TRACK tracking system. The organisations operating such initiatives could cooperate with the Issuing Body of the respective Domain, or they could become competing Issuing Bodies under the E-TRACK standard. However in the latter case, the use of a common registry and additional measures will be required in order to avoid multiple counting due to overlap of the Domains of several Issuing Bodies.

2.3.6 Governance of the standard

- Each E-TRACK domain will be managed by the respective Issuing Body. As stated above, the Issuing Body will usually be appointed by the Scheme Authority, the body responsible for a scheme for which tracking results are to be used. In the case of electricity disclosure, the Scheme Authority would usually be the ministry responsible for the electricity sector, or a regulator acting on behalf of it. The Scheme Authorities should continuously supervise the operations of the Issuing Bodies.
- It is certainly useful to incorporate the experience and expertise of market players in the detailed design of individual tracking schemes in the domains. The Scheme Authority will lay down rules for participation of stakeholders in the system design and further development.
- The E-TRACK standard will not be static, it will rather have to be adapted to developments in the markets for electricity and attributes and to the changing requirements from governments of countries participating in the standard, and of new members. Therefore a body on the European level is required which governs the standard and develops it further as appropriate. This could for example be a European association, in which all Scheme Authorities or their Issuing Bodies are members.[4] The European body would have to decide on its internal procedures for decision-making, handling of disputes and complaints etc.
- The admission of domains into the E-TRACK group, and the ongoing quality control of the operations in the E-TRACK domains are additional tasks which need to be fulfilled by the European body. Furthermore, the following responsibilities should be placed on the European body:
    - Operation of the central hub, which facilitates the exchange of certificates and management of joint information for all E-TRACK domains
    - Acceptance of “reliable tracking systems” and function of the European Clearing Body for the determination of the Residual Mix

2.3.7 Independency of actors

- In order to ensure the reliability and credibility of the tracking system, all Issuing Bodies and their agents should be independent from market actors and should not have any own interests in the markets for electricity and certificates.

4 The current European Energy Certificate System (EECS) is governed by the Association of Issuing Bodies. For more details, see http://www.aib-net.org.

2.3.8 Reporting

- Both the Issuing Bodies and the European body should be required to issue annual reports on their activity, including the measures taken to ensure the continuous reliability of the tracking system and any relevant problems and violations of the rules which might have occurred. Both types of bodies should also provide timely information on developments on the certificate market as appropriate for a well-functioning market. Additional reporting might be required by national schemes, such as support schemes, and for the development towards the indicative RES-E targets.

2.4 Technical features of the standard

The technical requirements for a tracking system necessarily cover a broad range of elements which are discussed in the draft report for E-TRACK Work Package 4. The following is a brief summary of the recommendations from that report, which focus on the features of registries for explicit tracking and the procedures for their operation. A working (incomplete) draft of the report is attached to this consultation paper and can be used as a source of further detail.

It should be noted that there are a number of existing tracking systems within the EU that meet many of the criteria set out below. Indeed, the standard is designed to be inclusive of existing systems where such systems meet the specification, as well as accommodating the different uses of electricity attribute tracking and their implications for systems. The standard is independent of any specific support mechanism or other use of tracked attributes.

As a technical specification, some of the terms used have a specific meaning. The table below provides a brief glossary of these terms.

Association	A scheme for which evidence is eligible. Certificates can have one or more associations.
Attributes	Information on electricity generated, including fuel source and technology, CO2 emissions and nuclear waste created, all of which are required for electricity disclosure, but more detailed information could be included
Certificate	An instance of evidence (normally in units related to 1MWh) for one or more schemes which can be transferred between different owners.
Domain	A single geographic or geopolitical region defined for the purposes of a scheme. There must be only one scheme authority in a domain.
Evidence	Proof of a set of generation attributes. Certificates are issued against evidence to facilitate transfers and aggregation within schemes.

Redemption	The realisation of the value of a certificate. The value may be monetary, or in terms of compliance with a legislative or regulatory requirement, or fulfilling a product description. On redemption, the certificate ceases to be transferable or useable for any other purpose.
Residual mix	A volume of electricity having attributes remaining after explicit redemptions by participants as part of a compliance process. This is only relevant for disclosure.
Scheme	A set of rules and procedures using attribute tracking for the purposes of e.g. complying with a Directive, supporting specific generation technologies, or evidencing an electricity label.
Scheme authority	A person appointed by legislation or by members of a voluntary scheme to control the qualification of production devices and both the issue and redemption of certificates for that scheme. Additionally, a scheme authority will manage the compliance process including the use of non-certificate information. There must be only one scheme authority for a scheme in any domain.

The recommended E-TRACK standard comprises the following technical aspects:

2.4.1 Evidence to be Tracked

- Energy and the attributes of generation are separable entities, with separate existences. It is therefore possible for a person to use the attributes even when that person has no contractual connection with the generator to which the attributes relate.
- Evidence of generation attributes collected at source are to be used wherever practical. Implicit information should be used only where explicit evidence is unavailable or impractical.

2.4.2 Evidence within a Registry

- Explicit quantitative and qualitative data represents the attributes of the production plant structured into a common grouping by fuel, process and type. The production device itself to be registered using its unique metering point identifier and the electrical system to which it is connected.
- The volume of energy (and therefore associated attribute) to be metered for a generation episode defined by start and end dates/times. The actual duration of generation episodes can be different according to practicality of data collection, but certificates must not be issued such that they may straddle a compliance period boundary of any scheme to which they relate. Therefore episodes should start/end at calendar month ends.

2.4.3 Sources and Availability of Data

- The E-TRACK standard is to use existing data sources where possible. In Member States where GO for RES-E and CHP-GO are being implemented the data availability issues are

being addressed and in a number of cases a tracking system for certificates associated with the GO is also in operation.

- The data required to extend GO to all electricity sources exists in many countries and would be feasible to collect without incurring substantial costs. However, in other countries it might be necessary to set up new data collection systems, in order to obtain consistent information.
- In some cases, data from different sources could be combined to provide a full set of evidence. Use of existing sources will avoid costs and inconvenience of duplicated data provision and collection.
- However, the project has identified a number of instances where data exists, but cannot be accessed for tracking purposes without changes in legislation. There are also issues regarding the ownership of data in some countries which would need to be addressed to facilitate implementation of a general tracking system based on explicit evidence.

2.4.4 Data Collection Requirements

- A production plant must only be allowed to register with an Issuing Body for the domain in which the plant is located. In the case of multiple Issuing Bodies for related schemes in a domain, a control mechanism is needed to prevent multiple issue (e.g. a common registry).
- Metered output data must be continuous throughout the period of registration to facilitate reasonableness checks. Producers must also warrant that their data is only presented to the tracking system at one entry point. These requirements reduce the scope for fraudulent claims by generators.
- Issuing must be based on net plant production. The metering data reference point should be such that auxiliary generator data and station consumption can be identified. Difference metering against grid connection meters should be used where necessary to achieve this.
- Data collected must be verified by an independent organisation. In the case of generation identifiable through central energy settlement, meter data from that settlement process should be acceptable as independent. Data collection should also be automated wherever economic to do so.
- Where the period between scalar meter readings straddles a potential compliance period boundary, evidence should be apportioned to the respective periods according to a suitable production profile for the device.
- Issuing should normally be based on full Megawatt-hours produced. Rounding up of part units of evidence should not be used as this discriminates in favour of small plant, any remaining part units should be carried forward into the subsequent generation episode.
- The attributes from multi-fuelled production devices should be allocated according to energy source factors calculated using the mass and calorific values of each fuel used.
- Implicitly tracked information is usually only relevant to a single scheme and therefore should be compiled by or for the relevant scheme authority on an equivalent basis to any explicitly tracked data being used in that scheme and consistent with any other domains from which evidence may be transferred into this scheme.

- Self declaration by plant operators cannot be regarded as high quality verified information and their use should be controlled. In the case of the originating plant being situated outside of the respective domain, such declarations must be regarded as double counting. Without mandatory identification of these declarations as exports of attribute in the originating domain, such declarations cannot be admissible within the standard.

2.4.5 Registry Infrastructure

- There are already a number of operational tracking systems with Issuing Bodies and registries in Member States and non EU-members, some of which are handling Guarantees of Origin and related certificates on behalf of national governments. However, almost none of them handle all forms of electricity sources. Many of those systems would satisfy most of the requirements specifications set out in this document. Therefore, whilst feasible, it would not be necessary to build an entirely new registry infrastructure, especially as most of the existing infrastructure is designed for the higher value support schemes.
- From a practical and economic implementation perspective, a standard based on a hub infrastructure for the exchange of certificates offers most flexibility, both in terms of scope and commercial enterprise, whilst maintaining a high degree of system control. This is consistent with the higher scoring tracking options from Work Package 3 (see Annex A2).

2.4.6 Management of Registry Data

- Each volume of evidence must be explicitly associated with the schemes that the evidence is known to be eligible for.
- Where evidence is potentially eligible for a set of mutually exclusive schemes, the evidence is initially allocated (certificates issued) to only one of those schemes in order to avoid double counting.
- Where evidence associated with one scheme is acceptable to another scheme that is mutually exclusive to the first, it must be possible to convert certificates from the first scheme into those for the second.
- Multiple instances of evidence can exist, but only where each instance is associated with a distinct sub-set of the schemes for which the evidence is eligible such that double counting is avoided.

2.4.7 User Requirements

- A registry should provide as much open access as possible in order to provide transparency and support user assurance in the system and the accuracy of reported information. This suggests a web-enabled registry would be the most efficient solution offering a suitably broad coverage. The technology of such a solution is already commercially proven in relation to electricity tracking.

2.4.8 Transfer of Data

- Transfers within the E-TRACK standard must be initiated by the seller, but do not need to be confirmed by the buyer prior to transfer. The trigger action that creates the need for a transfer

is outside the scope of E-TRACK, but direct interfaces with trading platforms could be established if appropriate and economic.

- Transfer between registries requires a common approach to identifiers in order to facilitate the infrastructure and to ensure uniqueness. As evidence is held in the form of electronic records, electronic transfer should be the standard method of transferring records between registries. The transfer process should be conducted using a common transfer protocol to ensure safe operation.
- For reasons of cost and availability, the transfer medium should be the internet using a commonly available XML based file format.
- Transfer security should be achieved using a commonly available security method.

2.4.9 Using Tracked Evidence: Compliance Procedures

- The period of eligibility of evidence for a scheme should be limited in order to make the scheme finite. This is set by the scheme itself and is critical to disclosure and target uses. Managing the redemption of evidence is fundamental to the compliance process and applies equally to the allocation of implicitly tracked information.
- The tracking system should provide a controlled environment for participants to demonstrate their compliance with any obligation and to realise the value of their evidence. The process for demonstrating compliance should respect an information and value precedence of claims, starting with explicitly tracked evidence as having the highest quality of information and normally carrying the highest value.
- Redemption of certificates within a registry should be the transfer of certificates into specific redemption accounts for a scheme and should only be done by the participant who is realising the value or claiming compliance. For national issues such as taxation or legal jurisdiction, redemption accounts should be within the country of the scheme authority. On redemption, the certificates must be retired from circulation.
- For disclosure, the volume of explicitly tracked evidence and generator declarations claimed should be deducted from the totals of implicitly tracked information. Similarly with imports and exports, attribute transfers should be netted off against energy transfers to derive a residual mix (see the previous section for details).
- A residual mix can be calculated for a region or the whole EU, but all domains within the area of that mix must use a common approach and timing.
- The residual mix volume should be allocated to the electricity suppliers where redemptions of certificates from explicitly tracked data or other forms of declaration are insufficient. However, in some circumstances there may be a lower volume of residual mix than required.
- The potentially adverse impact of the residual mix can be reduced by increasing the proportion of explicit tracking. In terms of accuracy and compatibility with the single market, the recommendation would be to use a high proportion of explicit tracking, which in the long run should be combined with a single residual mix within those Member States operating tracking systems compatible with the E-TRACK standard. However, this requires considerable alignment between Member States.

2.4.10 Treatment of Electricity System Support Activities

- The definition of metering points is such that network losses could be identified and would enable either assignment under a residual mix allocation or active participation in disclosure by network operators.

2.4.11 Governance

(see also the respective recommendations in the previous section)

- Management of the standard should be through an independent not for profit umbrella organisation under a code of practice recognised by national electricity regulators and governments.
- Procedures for the maintenance of standards will need to be established. These will need to include the terms for accreditation of service providers. Additionally, the terms for de-accreditation should be established.
- Periodic audit of service providers may be used to ensure operational standards are maintained.
- The relationship between the governance organisation and the Commission, national governments, regulator and industry trade associations should be established as part of the implementation of the E-TRACK standard.
- Possible funding arrangements for the organisation will need to be equitable and have some relationship to the volume of use.
- Funding of service providers can be on an enterprise basis (paid by the users of the service) and not necessarily through the governance organisation.

2.4.12 Users and Providers of a Tracking System

A number of functions have been identified in providing a tracking system. These are:

- Scheme Authority – responsible for scheme definition and so controls eligibility for a scheme as well as determining compliance with that scheme. Co-ordinates Issuing Bodies and registry operators.
- Issuing Body – responsible for examining the evidence collected and controlling the issuing of certificates for schemes for which it has been appointed.
- Accreditation Body – performs the verification of the plant registration details on behalf of a scheme authority.
- Registry Operator – maintains a registry and the data contained within it. He is also responsible for ensuring the secure and timely transfer of data into and out of that registry.
- Data Collector – responsible for obtaining the evidence for populating a registry.
- European Governance Organisation – responsible for maintaining a robust and reliable infrastructure for electricity tracking through ensuring consistent standards in issuing, registry operation and data collection.

3 Assessment of the cost of tracking systems

The aim of work package 5 of the E-TRACK project is to develop a detailed cost assessment for tracking systems which could be implemented based on the E-TRACK standard. This assessment is based on discussions with potential implementers, operators and users of tracking systems, which will make use of the proposed tracking standard. Thus, all relevant cost drivers were identified and the costs associated with the proposed tracking standard were assessed for an European wide implementation.

Furthermore the work package aims to develop recommendations on the distribution of costs to the parties involved. Thereby it is taken into account where the costs actually incur and who receives the benefits, aiming at a balanced cost sharing standard. Finally a short qualitative summary of the benefits associated with the proposed tracking standard is given, describing the benefits and their implementation.

3.1 System borders for the cost assessment

The cost assessment considers all relevant aspects associated directly with implementation and operation of the proposed tracking systems. This includes the costs required for development, implementation and operation of software systems and data acquisition as well as the costs for system users (electricity generators, traders and suppliers). All expenditures related to the political decision process and legal implementation process are not considered in the cost assessment.

3.2 Gathering of cost information

The main source of cost information are organizations, which already have experience and work with existing tracking systems or comparable systems, because it can be assumed that the proposed tracking standard will have similar features. The experiences and know-how of these organizations is therefore the key information for obtaining robust results for the cost assessment based on practical examples.

As the first step of the cost assessment the main cost drivers were identified. The list of cost drivers was the basis for a questionnaire, which was sent to organisations that already operate and work directly with existing tracking systems. The data collected through the questionnaire were summarized and analysed. Supplementary desktop research and discussions with various parties potentially involved in the implementation and operation of tracking systems were contributing further cost information.

Based on the first results and the discussions about the key design elements of a tracking standard (WP3) an interview guideline was developed in order to improve and refine the cost information basis. This interview guideline mainly addressed organisations that are potential “users” (electricity generators, electricity suppliers, electricity traders) of tracking systems. The interview guideline was used by the project team to gather information from selected stakeholders in all participating countries.

All this information was considered in the costs assessment of a European tracking standard. The tasks and results of WP5 are summarized in the following sections.

3.3 Costs drivers

The main cost drivers reflect the principle tasks, processes and procedures of electricity tracking. In principle, two main cost areas can be distinguished: 1) costs related to the development and implementation of a tracking system, which are one-off costs and 2) costs related to the operation, maintenance and usage of a tracking system, which are annual running costs.

The following main cost drivers have been identified:

Cost drivers for system development and implementation:

- setting up of organisational structures
- composing detailed system specifications
- software development/development of a registry
- collection of initial data input
- testing of registry
- organisation of data input
- development of interfaces between registries
- composing information material for users
- training of market actors

Cost drivers for system operation and adaptation:

- governance of the overall system
- operation and maintenance of the system:
    - hardware maintenance
    - software maintenance
    - data handling
- user support
- further development of the system due to user needs and policy development

Cost drivers for system operation - issuing aspects:

- certification and auditing of plants
- collection of plant master data
- collection of generation data
- verification of input data

Cost drivers for system operation - transfer aspects:

- handling of information (certificate) transfer

Cost drivers for system operation - usage and redemption aspects:

- conversion of data into format for final use (e.g. for disclosure)
- verification of output data
- calculation of residual mix

3.4 Costs of existing electricity tracking systems or comparable systems

Based on questionnaire information, on the additional desktop research and on discussions with various parties potentially involved in the implementation and operation the costs of existing electricity tracking systems and comparable systems have been analysed. All tracking systems considered in this analysis are based on registries.

The results are summarized in Figure 1, in which costs of existing tracking systems in Austria, Belgium, Netherlands, Norway, Finland, Sweden and Switzerland are given; in addition the costs of a registry for the European "Renewable Energy Certificate System" (RECS), of national registries for the "EU Emission Trading Scheme" (ETS) and of the European hub within the ETS are illustrated.

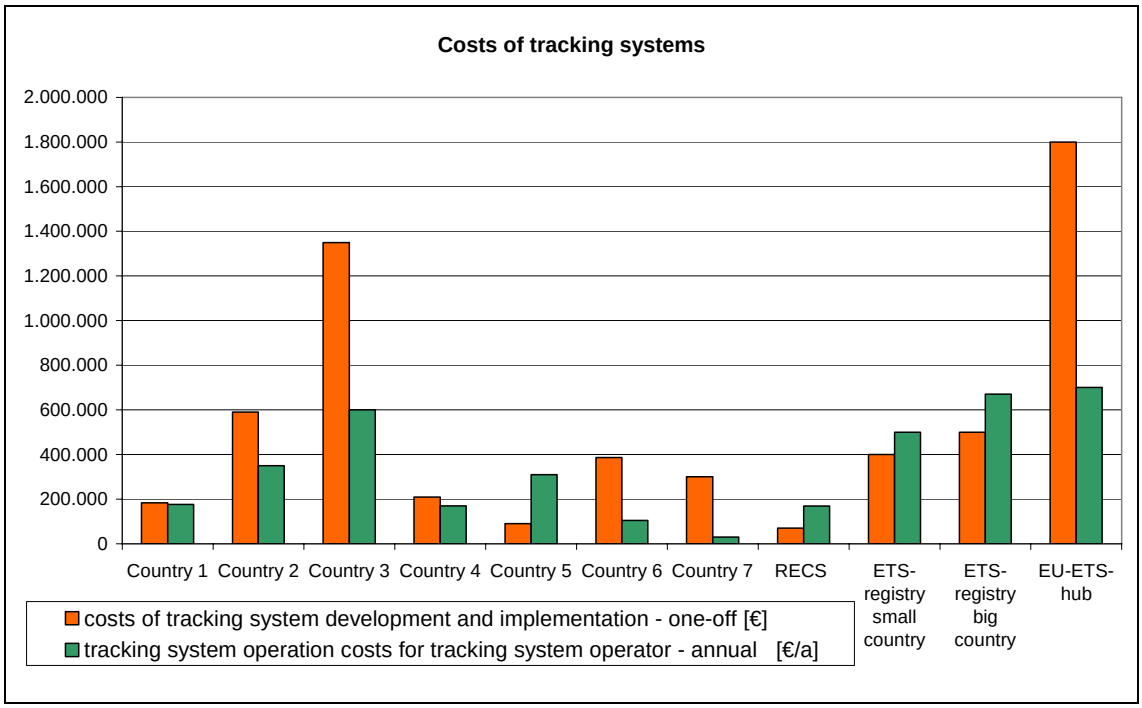


Figure 1: Costs of existing tracking systems

The costs of existing tracking systems/registries vary in a rather big range. The costs for tracking system development and implementation amount from 100.000 € to 200.000 € at the low range, from 300.000 € to 600.000 € at the medium range and to 1.300.000 € at the high range. The situation is similar for the operation costs of tracking systems which are effective for the registry operator; at the low range they are between 50.000 €/a to 200.000 €/a, at the medium range between 300.000 €/a to 400.000 €/a and at high range up to 600.000 €/a.

Reasons for the big differences in costs are the different levels of policy integration of the tracking systems and the different requirements resulting from it. Some tracking systems are on a voluntary basis, addressing a small market segment (e.g. renewable certificate market etc.), some are voluntary but providing a relevant service to the electricity market (e.g. information evidence for electricity disclosure) and some are fully integrated, which means that mandatory market instrument(s) of high financial relevance (e.g. evidence of quota obligation, emission trading scheme) are built on the tracking system.

Operational costs of tracking systems are mainly depending on how the procedures are set up and how the system is used. If there are already procedures (for auditing, data acquisition etc.) in place that can be used directly for tracking, low operation costs can be the consequence.

3.5 Implementation structure and scenarios for cost assessment

The E-TRACK project defines a standard for electricity tracking (E-TRACK standard); but not its detailed implementation. The core element of the tracking standard are “dispersed local” registries which are able to record and track ownership of certificates for electricity from all fuel sources and which are linked to a common hub. The common hub has the function to transfer attribute information from one “local” registry to another.

It is assumed here that all member states of the European Union, Norway and Switzerland will each run one registry on the “local” level, and a common hub will be implemented for the exchange of certificates. This means that 27 registries and one European hub have to be developed, implemented and operated, as the structural backbone of a common electricity tracking system in Europe. Thus, the structure outlined in Figure 2 is the basis of all upcoming scenarios for cost assessment.

In order to assess the maximum range of costs (costs of development and implementation, cost of operation) of tracking systems based on the E-TRACK standard - and its basic design criteria - three different scenarios for the potential implementation of the standard in actual tracking systems have been developed. Thereby experiences of existing tracking systems were taken into account when setting up the scenarios, because a lot of the features of the E-TRACK standard are already anticipated in existing tracking systems.

Lower scenario:
The lower scenario is seen as a basic implementation of the E-TRACK standard. In this scenario existing organizations (e.g. regulators, TSO) are foreseen to implement and to operate the “local” tracking system in all countries. And there are already procedures in place which are coherent with procedures for electricity tracking: auditing procedures for RES-E and HE-CHP power plants, and automated issuing at least for these two types of plants.

Advanced scenario:
The advanced scenario represents an extension of the lower scenario. In the advanced scenarios it is assumed that in all countries new organizations for the implementation and operation of the “local” tracking system have to be set up. This leads to more expenditures for establishing communication procedures to electricity market actors. Similar to the lower scenario already introduced procedures can be used directly for electricity tracking.

Upper scenario:
The upper scenario is also characterised by a foundation of new organizations for the implementation and operation of “local” tracking systems as well as by the introduction of new communication procedures. But it is assumed that the system is fully integrated in the policy framework and is the authorised tool to handle/administrate national RES-E support schemes. So the system requirements for reliability, accuracy and security are very high in this scenario. Again existing procedures can be used for tracking.

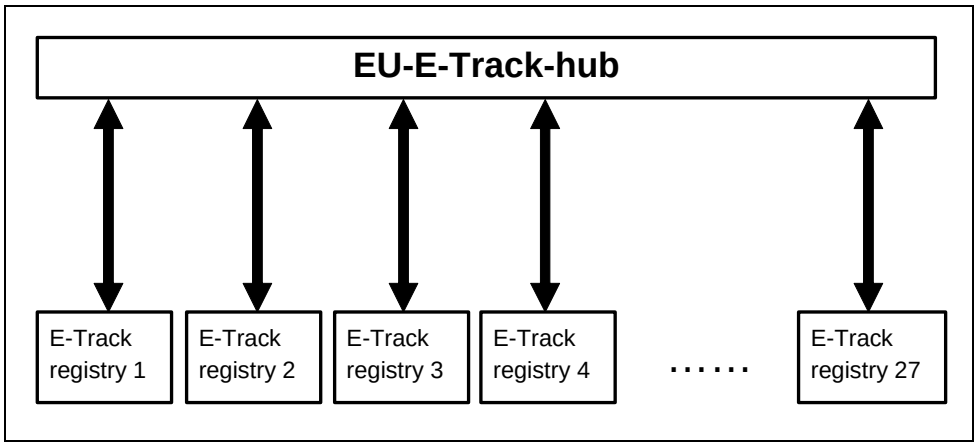


Figure 2: Implementation structure of the tracking system according the E-TRACK standards in the EU member states (EU25) plus Norway and Switzerland

3.6 Assumptions and calculation procedure

As a first step the costs of development and implementation of a single "local" tracking system and its operational costs for the system operator are determined according to the scenarios. As the scenarios are developed in accordance with existing tracking systems characterised by similar features, similar costs can be assumed. Based on the cost information of existing systems and on an analogy approach, the costs of one "local" tracking system for the different scenarios are summarized in Table 1.

one tracking system		lower scenario	advanced scenario	upper scenario
costs of tracking system development and implementation	[€]	**210.000**	**650.000**	**1.490.000**
tracking system operation costs for tracking system operator	[€/a]	**195.000**	**400.000**	**660.000**

Table 1: Costs for a single "local" tracking system in an average country according the different scenarios

In a further step the costs of the single "local" registry are scaled up to the European level, assuming a similar implementation of tracking system in all 27 considered countries (EU25, Norway, Switzerland). All countries are assumed to implement a tracking system as outlined in the "lower scenario" or in the "advanced scenario" or in the "upper scenario". Different cost levels of countries and higher expenditures for big countries were taken into account to scale up the costs to 27 countries level. Costs or investments for already existing systems are not deducted, because the cost assessment is aiming to display the maximal possible range of costs of a tracking system according the E-TRACK standard.

The costs of the common hub are assessed based on cost information of the European hub within the ETS and on information given by the "Association of Issuing Bodies" (AIB) experiences. Again the detailed implementation of the hub and its underlying procedures influence the costs significantly. As it is expected that the common hub has to perform the same functions in all scenarios (secure and correct transaction of attributes between "local" registries, calculation of a trans-national residual mix), the

same cost are assumed for the hub in all scenarios (see Table 2). The definite costs for the hub are deduced from the ETS-hub costs.

hub		lower scenario	advanced scenario	upper scenario
costs for tracking system development and implementation	[€]	**2.000.000**	**2.000.000**	**2.000.000**
tracking system operation costs for tracking system operator	[€/a]	**800.000**	**800.000**	**800.000**

Table 2: Costs for a common hub

Costs for plant certification and auditing is considered to be a relevant factor. Certification and auditing procedures are already established in many countries for most of the small plants - particularly for those covered by support schemes. These procedures can be used directly for the tracking system.

Around 10.000 larger plants[5] exist in Europe and it is assumed that this number of plants has to be audited every five years. This means that about 2000 plants/year have to be audited in all scenarios. The costs for plant auditing given by market actors vary from 300 €/plant (lower scenario) to 2.500 €/plant (higher scenario). The assumptions for cost calculations for plant certification/auditing are summarized in Table 3.

		lower scenario	advanced scenario	upper scenario
audited plants per anno		**2.000**	**2.000**	**2.000**
auditing costs per plant	[€/plant]	**300**	**1.000**	**2.500**

Table 3: Assumptions for cost calculations for plant certification /auditing

On the European level 3000 electricity suppliers are registered[6], which are seen as potential "external" users of a tracking system. But it is rather unlikely that all users will actively use the tracking system; some could cooperate with others or delegate this task to external parties and some will remain passive. So it is assumed that only a part of users is actively using the tracking system (600 users in the "lower scenario", 1.200 users in the "advanced scenario", 1.800 users in the "upper scenario"). Moreover the operating expenses (working days/anno) are judged differently by the market actors depending on the complexity of the systems and the number of transactions involved. So in the lower scenario" 12 working days/anno respectively 36 working days/anno in the "upper scenario" are assumed for the cost assessment. The labour costs are assumed to be 600 €/day for all of Europe.

5 Source: UCTE

6 Source: Commissions Staff Working Document "Evaluation of the Performance of Network Industries Providing Services of General Interest", 2005 p28

		lower scenario	advanced scenario	upper scenario
"external" users actively using the tracking system		**600**	**1.200**	**1.800**
operating expenses for one "external" user	[days/a]	**12**	**24**	**36**
labour costs for one external user	[€/day]	**600**	**600**	**600**

Table 4: Assumptions for cost assessment for "external" users

3.7 Results of the cost assessment

The cost assessment does not claim to assess the costs for a realistic implementation scenario but it aims at showing the cost range for a European wide implementation of electricity tracking system according the E-TRACK standard. The "lower scenario" represents the lower bound of costs, whereas the "upper scenario" is seen to be the cost maximum. Particularly the "upper scenario" might represent an overestimation of the total costs, because it is quite unlikely that all countries will implement a fully integrated tracking system.

Moreover no learning effects and synergies are considered in the cost assessment. First of all it is safe to assume that the more tracking systems are developed and implemented, the cheaper is the development of new ones. It is also possible that one registry software developed for a specific country may be used in other countries, too. This fact can lower the implementation costs significantly. It is also possible that some countries share a common tracking registry, which decreases costs as well.

The total costs of the development and implementation of an European tracking system – 27 registries plus hub - are illustrated in Figure 3. For the "lower scenario" the costs result in 7,3 m€ and for the "upper scenario" in 39,6 m€. These costs are one-off costs and the costs accrue mostly at the organisations that are responsible for the system introduction and operation.

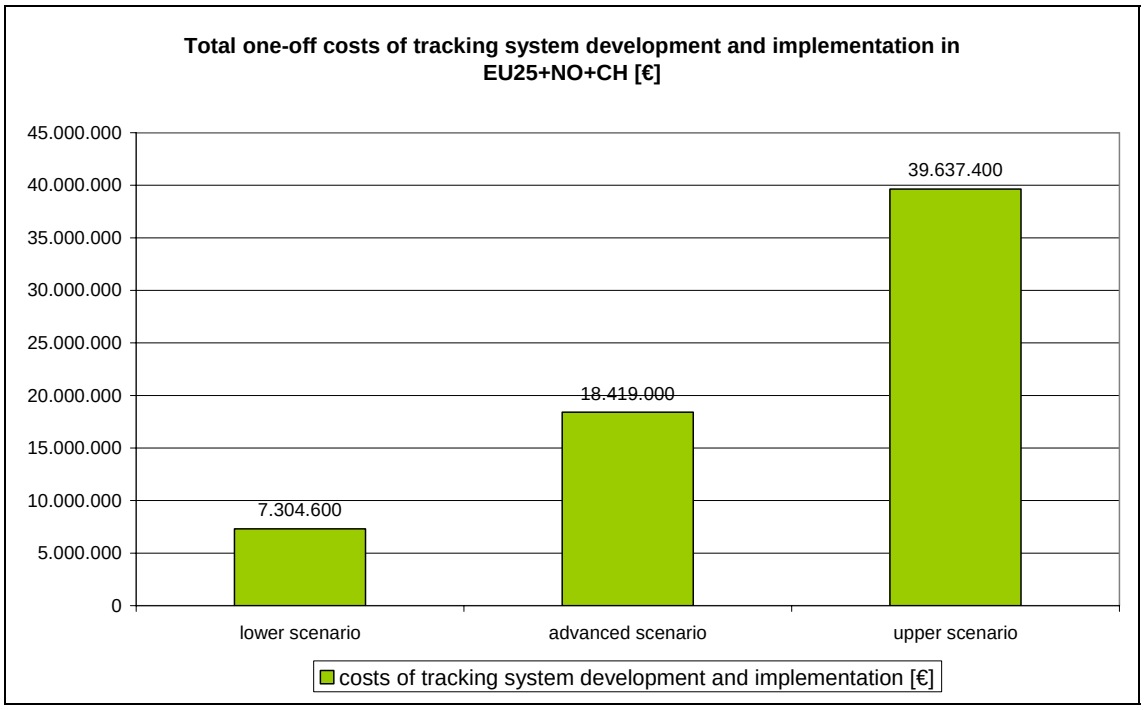


Figure 3: Total one-off costs for the development and implementation of tracking systems according to the E-TRACK standard in the EU Member States (EU25) plus Norway and Switzerland in the different scenarios

The total annual operational costs of the full European tracking system including the annualised costs for system development and implementation are illustrated in Figure 4. The costs add up at 12,5 m€/a in the “lower scenario” and at 71 m€/a in the “upper “scenario”. The operational costs are mainly driven by the costs of “external” users and the operational costs of the tracking system operator.

A significant share of the operational costs accounting for the “external” users is depending on their expected involvement and amount of work when using the tracking system. But “external” users of the tracking system also benefit through facilitation of market instruments (e.g. electricity disclosure) and additional marketing possibilities (e.g. electricity product management). Costs for auditing of power plants are not so relevant compared to the other cost categories.

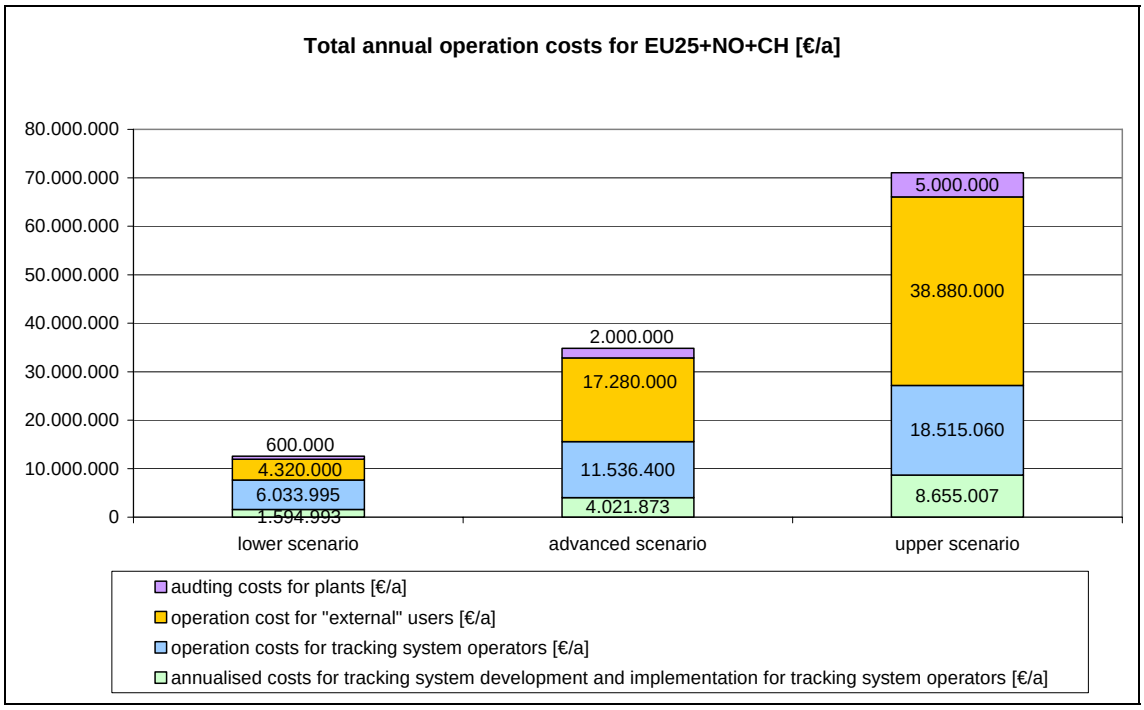


Figure 4: Total annual operations costs (including annualised costs for development and implementation) of tracking systems according to the E-TRACK standard in the EU Member States (EU25) plus Norway and Switzerland in the different scenarios

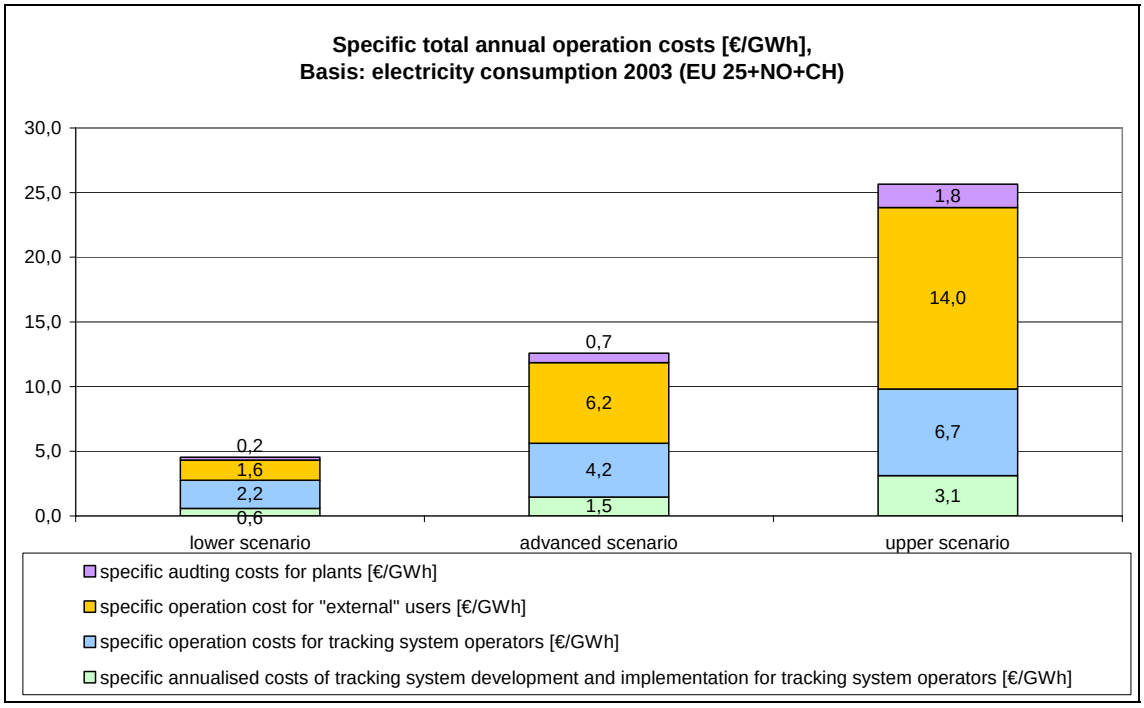


Figure 5: Specific total annual operation costs (including annualised costs for development and implementation) of tracking systems according to the E-TRACK standard in the EU-Member States (EU25) plus Norway and Switzerland in the different scenarios

The specific costs for tracking - total system costs divided by the electricity consumption in Europe[7] - are illustrated in Figure 5. The electricity market price for baseload is currently around 50 €/MWh, with distinct increasing tendency. In the "lower scenario" the specific operation costs for tracking amount to 4,5 €/GWh which corresponds to 0,009% of the current market price, in the "upper scenario" the specific operation costs 25,7 €/GWh which corresponds to 0,05 % of the market price. This means that the implementation and operation of a tracking system would have very low impact on the market prices for electricity.

Additional costs for final consumers caused by the European tracking system are given in Figure 6. Assuming that the total operation costs are shifted to the consumers, for a consumer with an electricity consumption of 5.000 kWh/a the additional costs amount to 2,3 Cent/a in the "lower scenario" and to 12,8 Cent/a in the "upper scenario". For an electricity consumption of 10.000 kWh/a the additional costs for the final consumers are doubled. To sum up the impact caused by electricity tracking on the consumer price of electricity would be very low.

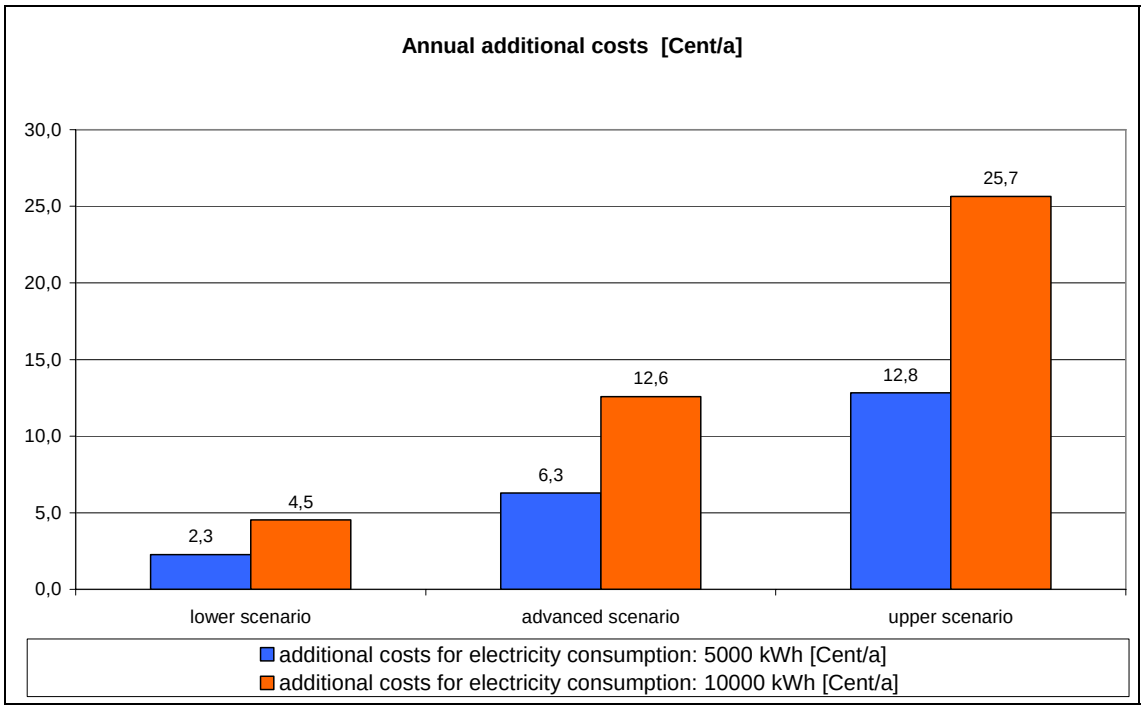


Figure 6: Annual additional costs for electricity consumption of 5.000 kWh and 1.000 kWh, Calculation basis for electricity price: 15 Cent/kWh

3.8 Benefits of using the tracking standard

It is not possible to assess the benefits of the E-TRACK standard in monetary terms because a tracking standard is the backbone and infrastructure for "uses" (e.g. electricity disclosure, special power products, target and quotas etc.). The benefits are directly linked to the "uses" and how the "uses" are implemented. The main purpose of the tracking system is to enable and facilitate the implementation of "uses" for the market.

[7] Electricity consumption of EU25+Norway+Switzerland: 2.770 TWh for 2003.

Nevertheless a qualitative description of the benefits is intended. Based on information from the questionnaires and discussions with market actors the benefits are identified and outlined.

List of benefits:

- securing and forcing the attribute market for RES-E
- increasing market transparency, delivering reliable and high quality information
- supporting electricity disclosure and green power products
- contributing to an active electricity product management
- avoiding of double counting
- potential synergies with internal accountancy systems and trading systems
- automatic procedures, e.g. simple cross border exchange
- synergies with existing support mechanisms
- basis for new policy instruments

3.9 Distribution of costs

Recommendations on the distribution of cost to the parties involved take into account where the costs actually incur and who receives the benefits.

The following general rules for cost distribution are recommended:

- Costs related to the development/implementation and to the direct operation of the tracking system should be socialized through the electricity tariffs because every electricity consumer benefits from tracking by an increased market transparency.
- Costs for “external” users should be covered by themselves, because they can gain benefits by doing tracking (e.g. marketing benefits, fulfilling disclosure obligations).
- Costs for auditing plants should be covered by the plant operator.

Annex

A1 Evaluation criteria for tracking options

A2 Discussion of selected alternative tracking options

A2.1 The Scenario Approach

A2.2 Option 0: “Contract based system”

A2.3 Option A: "Ex post contract tracking"

A2.4 Option B: “Voluntary certificate system plus residual mix”

A2.5 Option C: "Ambitious certificate system"

A2.6 Indicative illustration of the evaluation

A2.7 Detailed scenario matrices for the tracking options

Scenario matrix – Template

Scenario matrix – Option 0

Scenario matrix – Option A

Scenario matrix – Option B

Scenario matrix – Option C

A1 Evaluation criteria for tracking options

The project team has selected six major criteria for the evaluation of tracking system designs, which are explained below. Most of them summarise several sub-aspects. For example: While accuracy is a relatively straightforward criteria, the (expected) acceptance by stakeholders is summarised together with other aspects in the criterion "feasibility". For each tracking option outlined in section 0, a short textual description of the evaluation based on the criteria is given. A comparison of graphs showing a rough numeric assessment of each option is shown in Annex A2.6. Here, each option is ranked between 0 and 5 points for each of the five criteria. The contribution of different sub-aspects to the ranking for each criteria is also indicated in Annex A2.6.

The set of criteria takes into account discussions from previous studies and comments from stakeholders during the consultation process.

Informational value describes qualitative aspects of the tracked information in terms of added value for different stakeholders. This includes mainly to which extent stakeholders can base decisions or verification processes on the data provided, like choice of a particular supplier by a customer or facilitation of national support schemes by governments and regulators.

Accuracy focuses on quantitative aspects of the tracked information. Tracking data should be collected and processed in a correct and objective way, and the results delivered by the tracking system should be free of systematic errors such as multiple counting (which includes multiple issuing, multiple sale and unintended multiple benefit/use of electricity generation attributes).

Robustness of a tracking scheme is mainly affected by the degree of traceability of attributes within a particular scheme and its resistance against "distortions" of information due to errors and fraud by the actors involved in the operation. Thus, the criterion "robustness" strongly influences the presumed credibility of a system.

Feasibility includes various aspects in terms of practical implementation of a tracking system. Thus, this criterion describes to which extent the system accords to the existing economic, socioeconomic, regulatory and legislative framework.

Cost describes implementation and operation cost of a tracking scheme for all market participants concerned.

Flexibility describes the ability of the system to adapt to different framework conditions both in terms of national or regional frameworks and their changes over time.

A2 Discussion of selected alternative tracking options

In the following, four options for the design of electricity tracking systems are outlined, which allow for an orientation about the range of possibilities for the implementation of tracking in a certain domain. These options have been selected by the project team and were refined during the consultation process, taking into account comments from stakeholders. Obviously, there are many more options of how tracking can be implemented than just these four, but the selection presented here should be sufficient to discuss the major implications of the design of tracking systems and, together with their evaluation, allow for the development of the draft tracking standard as presented in section 2. For each of the options, a corresponding scenario matrix is included in Annex A2.7. These might allow a more struc-

tured comparison between the options than the textual description. (For a description of the scenario approach used, see the next section.)

A significant distortion in terms of accuracy and informational value can occur when an individual tracking option like the ones described below is not the exclusive source of information for disclosure. As soon as suppliers are free to use other tools for accounting for their disclosure portfolios which are not harmonised with the standard procedure, it is not possible to evaluate the overall reliability and informational value of disclosure information. Certainly, the coexistence of several parallel tracking systems opens up possibilities for multiple counting of attributes. In order to be able to evaluate and to compare the different tracking options, all options are supposed to be applied on a mandatory basis for the uses indicated, at least for disclosure.

The cost evaluations outlined in this section have been adjusted with the results from the cost analysis as outlined in section 3 of this document.

A2.1 The Scenario Approach

In order to allow for a structured discussion on the complex issues at stake, the project team has chosen a scenario approach to describe the possible overall design of tracking systems. Under the scenario approach, the individual features of a tracking system are described by so-called “descriptors”, which can take on different states.

Example:

One of the descriptors is called: “Use of explicit tracking for electricity from renewable energy sources (RES-E) and from high-efficiency cogeneration (HE-CHP)”[8]

This descriptor can take on one of the following states:

A. Explicit tracking is mandatory for RES-E and HE-CHP

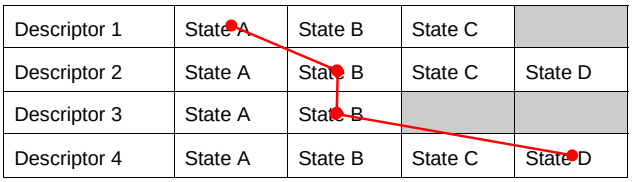
B. Explicit tracking is mandatory for part of RES-E and CHP (e.g. if RES-E or CHP are used for disclosure or if they are supported)

C. Explicit tracking of RES-E and HE-CHP is voluntary

D. Explicit tracking of RES-E and HE-CHP is not possible

In total, the project team has determined more than 40 descriptors which can take on between one and five different states. However, the most important aspects of a specific tracking approach can be described by around ten descriptors.

Any specific tracking system design can be described as a combination of appropriate states of the descriptors, see the following illustration.



8 Note that explicit tracking means tracking of electricity attributes using certificates or contract-based methods, as opposed to implicit tracking, which is based on default data, e.g. statistical averages.

A matrix template for this scenario approach and illustration of the individual options for the system design are included in Annex A2.7.

A2.2 Option 0: “Contract based system”

This option has been inserted after the second round of consultations. As this is a “true” contract tracking approach, it must be placed first in the sequence of options. In order to not confuse the readers of the previous consultation document, the names of the other options have been maintained, and this new option has been called “Option 0”.

Description of the tracking scheme

Option 0 describes a contract based system, which means that attributes can not be de-linked from electricity contracts. There is no central registry, the market actors are rather obliged to manage their attribute portfolios based on internal accounting systems. Guarantees of Origin are not integrated in the contract-based system.

Explicit tracking is generally mandatory for all kinds of generation and contracts, with the exemption of purchases from power exchanges, undisclosed imports and other electricity of unknown origin. For these types of contracts, statistical default values must be used. For power exchange transactions, sellers to the exchange must notify their attributes to the operator of the exchange. This allows to calculate monthly averages of an internal power exchange mix, which is applied for all purchases form the exchange during this period. For undisclosed imports and other electricity of unknown origin, the default value is based on overall generation statistics (like the UCTE mix). As explicit tracking is not facilitated by a central registry, it is not possible to correct these statistics into a residual mix.

A basic set of information to be tracked is mandatory. Standard clusters for energy sources and standards for other attributes where applicable are introduced in order to limit the impact of the tracking system on market liquidity. Major support information has to be indicated within the contracts. The system provides basic regulations for the handling of attributes in case of international transactions, but is limited in this respect due to the lack of centralised handling of data.

Usability of the tracking system is mainly restricted to disclosure, though it can be used for the green power market as well. Specific information for quality labels can be defined within bilateral contracts. There is no interaction with support and target accounting.

Independent verification by regulators takes place on a random basis, enhancing the motivation of market players for correct data handling.

Evaluation of Option 0

Option 0 provides for information mainly for disclosure purposes and the green power market. Based on the requirements concerning tracked information, product differentiation can be supported.

A major potential shortfall of this option is that it can reduce the liquidity of electricity markets significantly, which could be a substantial problem and make the option not acceptable to market players. In well-developed electricity markets, liquidity of electricity markets is a key requirement. However, due to the regulations on the monthly average mixes to be determined by the power exchange, the impact on trading on the exchange could be acceptable. OTC trading and long-term bilateral contracts would have to incorporate attributes, and these markets would therefore become much more complex and less liquid.

This could result in an incentive for market players to “hide” the origin of electricity and to declare it as unknown, even if the seller is known internally. In this case, the default attribute mix must be used, and market liquidity would not be affected. However, any increase of the share of the market, for which the default mix is applied, would reduce the informational value of the tracking system. This is because an increased application of the default mix levels out the differences between the disclosure portfolios of suppliers. In addition to this, the default mix also reduces the accuracy of tracking, because it is based on pure generation statistics and can not be corrected for the attributes which have been allocated based on bilateral contracts or the exchange averages. Therefore, multiple counting will always occur if the default mix is used, and this problem becomes the more severe, the higher the share of the default mix is in the total market. So Option 0 leads to a conflict between the criteria of feasibility (including compatibility with market requirements) and informational value and accuracy. If the Guarantees of Origin are not integrated in the contract tracking system, additional options for multiple counting are created.

The contract-based option will be more acceptable for those stakeholders, which argue that any de-linking of attributes and the introduction of transferable certificates would make the tracking system more vulnerable to manipulation. Depending on the share of trading on power exchanges, the disclosure portfolios of vertically integrated utilities might reflect their actual generation portfolio more directly in the case of contract-based tracking compared to the de-linked options B and C. For stakeholders and consumers who consider this aspect, Option 0 provides a higher informational value.

The contract-based system is relatively easy to set up, but if a high level of reliability is to be achieved based on independent verification, the operating costs can be significant. The system is not tailored for the needs of support schemes and target accounting. The flexibility of the system is relatively high, as there are only few fixed structures in the beginning, and no procedures are included which could not be easily changed with reasonable effort.

A2.3 Option A: "Ex post contract tracking"

Description of the tracking scheme

Under this option, tracking of electricity is generally based on contracts as well. Explicit tracking options such as electricity contracts with ex ante specification of the attributes (e.g. green power contracts) and even the use of de-linked certificates are optional and are used for a small part of the market. In order not to compromise the liquidity of electricity markets, the tracking information for the bulk of the market is based on the bilateral balances of electricity trading between market participants, which are determined ex post, e.g. after the end of each calendar year. This procedure requires iterative steps of calculation due to the complexity of the market, where electricity is likely to be traded several times. Even suppliers with a high share of own production might use the power exchange for part of their generation, thus preventing a straightforward calculation of electricity balances. For electricity of unknown origin a default value based on generation statistics is used (no correction into a residual mix). The system is designed with a national focus and there are no specific rules for the handling of attributes in case of international trade.

There are not many specific regulations on the information which is conveyed by the tracking scheme. Environmental indicators are based on average emission factors by fuel type. The tracking scheme does not integrate Guarantees of Origin for electricity from RES or HE-CHP, nor does it report whether a support mechanism has been used.

If certificates are used for disclosure purposes, then their redemption is mandatory. There are no binding requirements for independent verification of the tracking system and its results.

Evaluation of Option A

The coexistence of several options for tracking attributes (the standard ex post procedure plus optional explicit contract tracking and certificates) and their combination with default values based on generation statistics, which are not corrected into a residual mix, opens up possibilities for multiple counting of attributes and correspondingly the loss of other attribute information. This systematic shortcoming is further increased by the lack of integrating Guarantees of Origin in the tracking scheme, which again might lead to multiple counting. The actual effects of these shortcomings in terms of informational value and accuracy of the overall system depend on the share of the market, for which other tracking information than those from the ex post contract procedure is used. If this share is small in relation to the overall market, then the absolute error margin will be low. In this case, the ex post tracking system will deliver a good informational value by making the disclosure portfolios of suppliers different.

However, if for example ex-ante contract-based tracking, certificates and Guarantees of Origin are used to a significant extent in the “green” part of the market, then the informational value and accuracy of tracking in this part of the market can be distorted significantly. Due to non-integration of Guarantees of Origin, the system will not be able to convey RES-E target accounting information across national borders. The requirement to redeem certificates in order to use their information content for disclosure provides for protection against multiple use of certificates. Still, the overall robustness of the tracking scheme is limited, because errors and fraud can more easily occur and are more difficult to detect because several independent tracking mechanisms can be used.

On the other hand, the system is relatively easy to implement, as no direct implications arise for the bulk of electricity trading processes. The implementation cost of the system are relatively low, while operational cost may become considerable due to the low degree of standardisation and associated transaction cost when handling different information sources for tracking. Clearly, the potential shortfalls of this option in terms of accuracy and informational value will reduce its acceptance by some stakeholders. The flexibility of this option is quite high, as it combines several tracking options, which could be applied as appropriate.

A2.4 Option B: “Voluntary certificate system plus residual mix”

Description of the tracking scheme

Similar to option A, explicit tracking of electricity is generally performed on a voluntary basis. A certificate system is established and is the only accepted source of information for explicit tracking. Guarantees of Origin for RES-E and HE-CHP are fully integrated into the certificate system, and the tracking system includes a scheme for international accounting for national RES-E targets.

Due to the specific interests of consumers in RES-E and HE-CHP, these two types of generation may only be disclosed to consumers if they are tracked by certificates. A residual mix is calculated on a national basis (or jointly for several countries in a region) by subtracting all explicitly tracked attributes (based on redeemed certificates). The residual mix is used as default value for implicit tracking. In

case of international trade, regulations are set up in order to enhance reliable allocation of attributes between the countries involved.

Governments might decide to introduce a cap on the share of each market player's portfolio which is covered by statistical data (implicit tracking). Such a cap is possible because all market participants are able to use certificates for explicit tracking, which can be issued for all kinds of power generation. Therefore tracking information can be acquired even for electricity of unknown contractual origin.

The tracking information includes a detailed, standardised list of energy sources for electricity generation and respective environmental indicators. Furthermore, certificates record the production period and the issuing date. If support for RES-E or CHP has been granted, this is indicated on the certificate in the form of an earmark. Additional information on eligibility for green power or other quality labels can be included on the certificates on a voluntary basis. The support systems for RES-E and HE-CHP are not linked to the tracking scheme.

Obligatory redemption of used certificates and regulations on the residual mix are included in order to prevent multiple counting of attributes. In addition to this, the regulator performs verification audits of tracking results on a random basis.

Evaluation of Option B

This tracking option represents a compromise between a certain degree of reliability on one side and feasibility and flexibility on the other side. Due to the fact that a residual mix is provided, which significantly reduces the risk of multiple counting, the degree of accuracy of tracking results does not depend on the market share of implicit tracking. This is a major advantage compared to options 0 and A, and can only be achieved because there is a central registry for explicit tracking.

The informational value is high with regard to green electricity and CHP due to the mandatory use of certificates for these energy sources. For conventional energy the informational value of this approach depends on the share of implicit tracking used by suppliers. This is the reason why governments might want to restrict the share of implicit tracking, if the residual mix is used too much.

Option B performs well on feasibility and flexibility, because certificates do not impose restrictions on the liquidity of electricity markets and suppliers generally have a choice between explicit and implicit tracking (which might be restricted by a cap on implicit tracking). Explicit tracking is only required for shares of green electricity and CHP in portfolios and products, and these shares have a higher market value which justifies the effort of explicit tracking.

These regulations could also increase the acceptance of the system among energy industry stakeholders. Option B could also be a good starting point for a tracking system which evolves over time, including improved harmonisation on the European level. Cost for implementation is somewhat higher than in options 0 and A, as in many countries, new registries and institutions have to be set up for the certificate system and market participants have to get used to the application of this system. However, due to the high degree of standardisation and centralised handling of data in the registry operational cost for market participants are limited while maintaining a high degree of reliability and easy verification by regulators or independent auditors.

In terms of robustness, some uncertainty lies in the fact that support systems for RES-E and HE-CHP are not linked to the tracking scheme. This depends on the detailed regulations for coordination of both systems.

A2.5 Option C: "Ambitious certificate system"

Description of the tracking scheme

This option is a comprehensive certificate system including automatic issuing of certificates for all kind of production and mandatory redemption for disclosure. Default disclosure data based on a a residual mix is only accepted in very limited cases. Guarantees of Origin for RES-E and HE-CHP are fully integrated in the tracking scheme. Different to the other options, in this case the certificates from all countries are managed in a central European database. For both exports and imports, explicit tracking information is required as a standard.

After the end of a calendar year, there is a limited period for collecting meter data, issuing and transferring certificates, and certificate redemption for fulfilling the disclosure requirements by suppliers. Following this remaining certificates will be collected from trader accounts and become part of the residual mix.

The tracking system provides all information required for disclosure purposes. This includes a detailed, standardised list of energy sources for electricity generation. Both for CO_2 emissions and for nuclear waste production the system is able to track plant-specific production factors. The certificates include a detailed list of support granted for the generation of the underlying electricity. Due to the integration of GO and a comprehensive registry setting, the system can be used for target accounting for RES-E (and for HE-CHP, if required). Other standard certificate information includes the issuing date and the production period. In addition to this, the system can also handle specific information for quality labels, e.g. for green power, on the request of generators.

Support schemes for RES-E and CHP can be facilitated by the tracking system. If the support schemes allocate both the cost of the scheme and the attributes of supported electricity to consumers, then a single-certificate system can be used. In case of different allocation regulations, the certificates can be split up into disclosure, support and target certificates as required (so-called “multi-certificate”-system).

In addition to these features, strict requirements apply in order to enhance reliability and verification of the tracking process and its results.

Evaluation of Option C

The informational value of the tracking result is high, because the use of default mixes for disclosure is minimised. Furthermore, Option C is very suitable for handling of support schemes and target accounting. The combination of a large share of explicit tracking based on a single European registry and a small residual mix, the accounting of attributes is very reliable and the accuracy of this option is very high. Inconsistencies due to international trade can largely be avoided. However, the ability of the tracking system to adapt to national framework conditions is certainly lower than in the other options.

Moreover, the feasibility of this rather strict tracking option is only moderate. Although end consumers and national authorities might appreciate the informational value and accuracy of the scheme, many market participants will see it as a very strict regulation which forces them to use certificates even in cases when they do not represent a relevant market value. In the case of a multi-certificate system, it is very important that the different types of certificates are clearly distinguished, in order to prevent their misuse.

The cost of Option C can be relatively high. This is due to mandatory implementation of the registry and nearly full coverage of the market by certificates, which requires data capture and auditing for all plants. All market players need to be able to handle certificates. With regards to flexibility, Option C also ranks relatively low. This is because the system is quite advanced and forces all participating countries to make a big step into a comprehensive certificate system. One of the key advantages of this option is that there are no other mechanisms for tracking, whose coexistence with the certificate system could undermine the accuracy of the tracking results.

A2.6 Indicative illustration of the evaluation

In order to visualise the evaluation of the different tracking options, a very rough numeric assessment of each option was performed by the project team. For this, each option has been ranked between 0 and 5 points for each of the criteria. It has to be stressed that this numeric evaluation does not fully reflect the complexity of the evaluation, but shall help in order to gain a quick overview over the strengths and weaknesses of the different approaches. The results should only be used in combination with the textual explanations above.

The following table provides a rough overview over the assessment, including the qualitative contributions of different sub-aspects of the criteria for the numeric evaluation. For the sub-aspects, three levels have been applied: Negative (–), neutral (O) and positive (+).

Criterion		**Option O**	**Option A**	**Option B**	**Option C**
	Sub-aspect	Contract	Ex post	Certificates + RM	Ambitious Certificates
Informational value		**3**	**3**	**4**	**5**
	product differentiation/distinction of products	O	O	**+**	**+**
	generally usable for support and target accounting	–	–	O	**+**
Accuracy		**2**	**2**	**4**	**5**
	avoiding multiple counting	O	–	**+**	**+**
	correct data input	–	O	**+**	**+**
Robustness		**2**	**1**	**3**	**4**
	resistance against distortions (intended or unintended by market actors)	–	–	O	**+**
Feasibility		**2**	**4**	**4**	**2**
	accordance to regulatory and legislative framework	**+**	**+**	**+**	–
	accordance to market principles	–	**+**	**+**	–
	effects on liquidity of markets	–	**+**	**+**	**+**
	fair participation of all market players	O	O	O	–
Cost		**2**	**4**	**3**	**1**
	Cost for implementation	**+**	**+**	O	–
	Cost for operation	–	O	O	–
Flexibility		**4**	**4**	**3**	**1**
	ability to adapt to different national or regional frameworks	**+**	**+**	**+**	–
	ability to adapt to changes over time	**+**	**+**	O	O

Table 5: Rough numeric assessment of tracking options

The following graphs show the condensed results of the numeric assessment of the four tracking options.

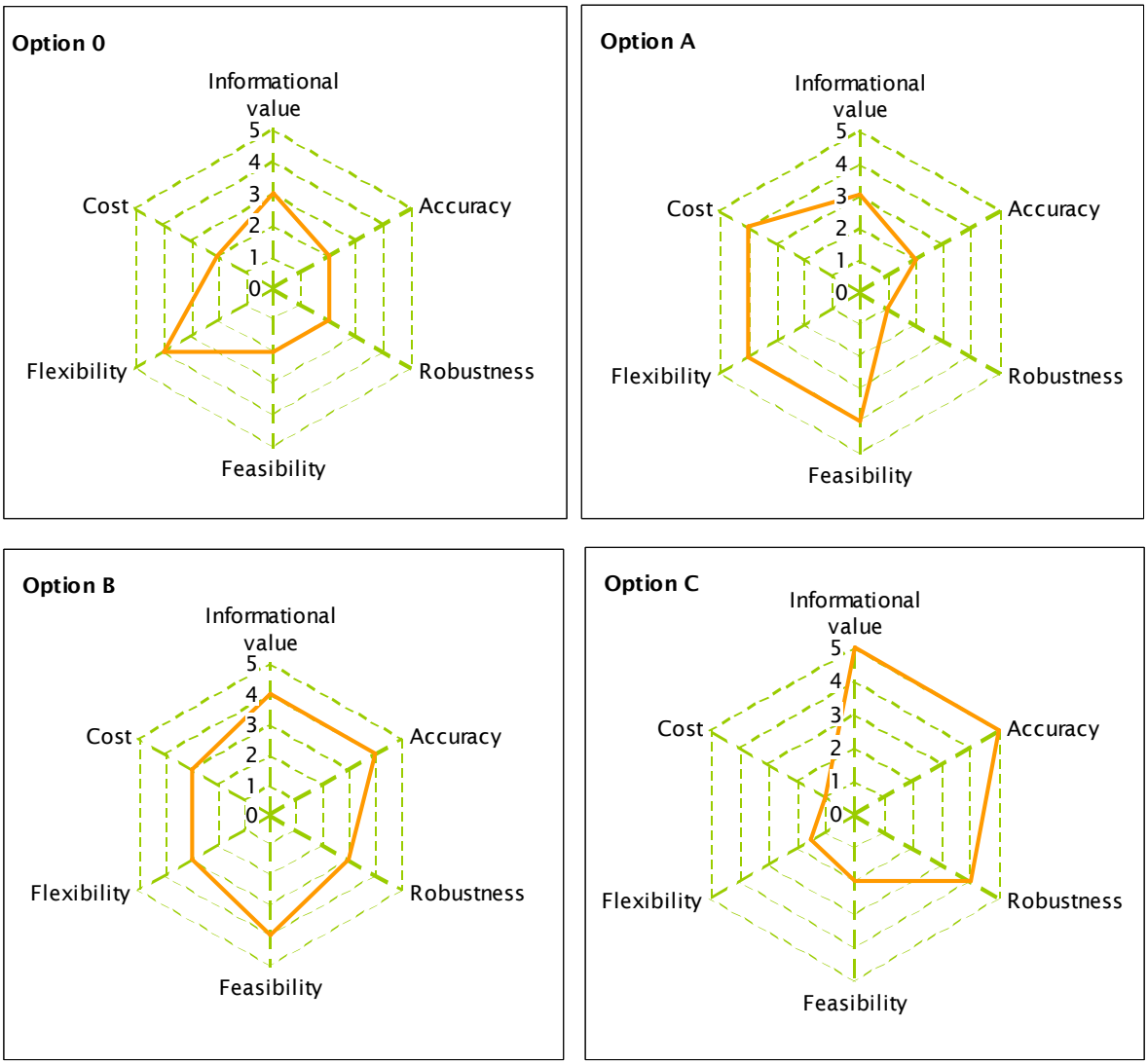


Figure 7: Graphical display of the numeric assessment of the four tracking options

A2.7 Detailed scenario matrices for the tracking options

In the following, a template for the systematic discussion of the design of tracking options based on a scenario matrix and the illustration of the four selected options for the design of tracking systems as outlined above are provided. (See section A2.1 for a brief introduction to the scenario approach.)

(These matrices are contained in a separate file.)